Pastoral Settlement, Farming, and Hierarchy in Norse Vatnahverfi, South Greenland

Ph.D.-Dissertation
Submitted to the University of Copenhagen
09.07.2014
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ACKNOWDLEGEMENTS

I would like to thank the Northern Worlds research initiative at the National Museum of Denmark for funding this Ph.D., and the Department of Middle Ages and Renaissance for providing a peaceful workplace and good everyday company.

I heartily thank my supervisors Ulla Lund Hansen and Jette Arneborg, for their insightful comments, patience, and the cake brought to the meetings. And to Jette Arneborg especially, I wish to convey my deepest gratitude for bringing my onboard the project, for trusting and encouraging me, for showing that you should never stop learning or reaching out!

I thank the researchers of North Atlantic Biocultural Organization, especially Thomas H. McGovern, Andrew J. Dugmore, and Ian Simpson, for welcoming me into the North Atlantic family, and not at least for introducing me to a host of good researchers, many of which are now also good friends. These I want to thank for many good hours spent in, and out of, the field: Seth Brewington, Aron Kendal, Ramona Harrison, Norrie Manigault, Laura Comeau, Richard Streeter, Michael Nielsen, and many more.

I also wish to convey very special thanks to those colleagues and trusted friends with whom I have spent so many good, and wet, hours in the landscapes of Greenland: to Niels. A. Møller, thanks for teaching me about ruins and zodiacs; to Konrad Smiarowski, thanks for long days of hard work and long nights of good talks; to Poul B. Heide, thanks for the long discussions about landscape and for demonstrating how one should always take adversity with good spirit and humor.

Finally, I want to most gratefully thank my girlfriend Kirstine E. Møller, for all her help and patience, and for putting up with me and keeping me going to the end.

ABSTRACT

Around AD 1000 two settlements were founded in Greenland by Norse hunter-farmers: the larger *Eastern Settlement* in South Greenland and the *Western Settlement* ca. 500 km north in the inner parts of the Nuuk fjord region. The Norse settlers had a two stringed economy that combined pastoral livestock farming with cattle, sheep, goats, pigs, and horses with extensive hunting, the latter also to sustain trade in wildlife luxury exports to Europe. This economy was based on a settlement pattern of dispersed farmsteads occupying the most fertile niches of the fjords, but extending the entire range of the landscape from the Ice Sheet to outer coast, and from lowland to highland, through specialized sites and shielings. This Norse settlement system lasted for around 450 years, the Western Settlement being abandoned in the mid- to late 14th century, the Eastern Settlement a century later.

In 2005, the Vatnahverfi Project was initiated, a research project under the National Museum of Denmark and coordinated by senior researcher Jette Arneborg, aimed at investigating regional level Norse settlement-, economic, and cultural patterns in a core area of the Norse Eastern Settlement: the Vatnahverfi. From 2005-2011 and in 2013, archaeological ruin group surveys were carried out in the Vatnahverfi, gradually expanding the research area to include the entire peninsula between the fjords of Igaliku Kangerlua and Alluitsup Kangerlua, an area of some 1560 km^2. In these archaeological surveys, 129 Norse ruin groups – among them 18 newly discovered – and 798 individual ruins were DGPS-surveyed and uniformly documented. In 2010, a Ph.D.-scholarship was set up as part of the Northern Worlds initiative at the National Museum of Denmark to investigate this new Norse ruin group survey evidence.

The dissertation *Pastoral Settlement, Farming, and Hierarchy in Norse Vatnahverfi, South Greenland* concludes on these investigations and part of the Vatnahverfi-Project: the dissertation presents a detailed analysis of the Vatnahverfi survey evidence, as well as of comparative sites from elsewhere in the Eastern Settlement, a total of 1308 ruins divided on 157 ruin groups, abort one third of all the ruin groups registered in the Eastern Settlement. This evidence implies that the Vatnahverfi constituted a small community of an average ca. 225-533 people, inhabiting some 47 farmsteads and 86 shielings, some of the latter likely being small farmsteads at the peak of settlement. Most of these farmsteads seem to have been organized around eight evenly distributed larger farms or manors, the remainder probably being subsidiary farms belonging to cotters and tenants. Overall, analysis of population numbers, settlement- and land use patterns suggest a pastoral farming system heavily dependent on extensive landscape resources and intensive herding strategies.

New dates generated through the Vatnahverfi Project suggest that this community expanded in to stages: first settlement occurred just around AD 1000 in the inner and middle fjords, but only at locations near the fjords; the second state of expansion occurred around AD1050-1100, during which time the outer fjord, inland and highland areas were occupied. The new dates also suggest that settlement contraction began already from the mid-13th century AD. The contraction first involved abandonment of the outer fjord farmsteads, as well as closing down of small churches. From the late-14th century AD, shieling activities appear to have disintensified, and during the 14th century AD many farmsteads were apparently abandoned, although a few sites in primary farmlands continued into the 15th century AD.

As an explanatory model for this settlement development, the comparative case study of pre-modern Inuit farming has been used. Combined with ice core climate proxy evidence, the analysis suggests that a change towards a more intensive mode of farming was forced by climatic deterioration after AD 1250. Such a change was likely problematic for cottagers and tenants, which may have become more dependent on the large farms and manors. An analysis of food- and environmental securities within different societal strata at different times of settlement, coupled with a resilience theory perspective, suggests such deprivation in lower societal strata caused by poor access to labor and continued environmental stress could eventually have cascaded up through the system to seriously affect large farms and manors. If the Norse settlements in Greenland had one major problem, it was apparently shortage of people.

ABSTRACT

Omkring år 1000 e.kr. grundlagde norrøne jæger-landmænd to bosættelser i Grønland: den større Østerbygd i Sydgrønland samt Vesterbygden ca. 500 km nordligere i den indre Nuuk fjord. De norrøne kolonister havde en tostrenget subsistens økonomi, der kombinerede pastoralt husdyrlandbrug (kvæg, får, geder, svin og heste) med ekstensivt jagt, hvilket også muliggjorde eksporten af grønlandske luksusvarer til Europa. Denne økonomi var baseret på et bosættelsesmønster af spredtliggende gårde placeret på de mest fertile områder i fjordene, dækkende fra Indlandsisen til den ydre kyst, samt fra lavland til højland gennem specialiserede pladser og sætere. Dette norrøne bosættelsesmønster varede ved i omkring 450 år: Vesterbygden blev forladt i midten til det sene 14. århundrede, Østerbygden et århundrede senere.

I 2005 blev Vatnahverfi projektet, et forsknings projekt under Danmarks Nationalmuseum og koordineret af senior forsker Jette Arneborg, iværksat for at undersøge de regionale norrøne bosættelses-, økonomiske og kulturelle mønstre i et kerneområde af den norrøne Østerbygd: Vatnahverfi. Fra 2005-2011 og i 2013 blev arkæologiske ruingruppe surveys udført i Vatnahverfi, gradvist udvidende undersøgelsesområdet til at inkludere hele halvøen mellem fjordene Igaliku Kangerlua og Alluitsup Kangerlua, et område på omkring 1560 km^2. Gennem disse arkæologiske undersøgelser blev 129 norrøne ruingrupper, heraf 18 nye, og 798 individuelle ruiner DGPS-indmålt og ensartet dokumenteret. I 2010 blev et Ph.d.-stipendium slået op, som del af Nordlige Verdener ved Danmarks Nationalmuseum, til at undersøge og gennemgå denne nye norrøne ruingruppe materiale.

Denne afhandling *Pastoral Settlement, Farming, and Hierarchy in Norse Vatnahverfi, South Greenland* konkluderer på disse undersøgelser og en del af Vatnahverfi projektet: afhandlingen præsenterer en detaljeret analyse af Vatnahverfi opmålingerne og andre komparative lokaliteter i Østerbygden, i alt 1308 ruiner fordelt på 157 ruingrupper bliver behandlet, hvilket svarer til ca. 1/3 af samtlige ruingrupper registreret i Østerbygden. Undersøgelsen antyder at Vatnahverfi udgjordes af et lille samfund bestående af gennemsnitligt ca. 225-533 mennesker, fordelt på 47 gårde og 86 sætere, hvoraf nogle af de sidstnævnte muligvis har fungeret som små gårdsanlæg under bosættelsens højdepunkt. De fleste af disse gårdsanlæg synes at have været organiseret omkring otte større gårde og stormandsgårde. De resterende gårdsanlæg har formentlig fungeret som subsidiære gårde tilhørende husmænd og lejere. Analyser af befolkningstal, bosættelses- og landbrugsmønstre indikerer at det pastorale landbrugssystem var yderst afhængigt af ekstensive landskabsressourcer og intensive hyrde strategier.

Nye dateringer foretaget under Vatnahverfi projektet antyder at dette samfund ekspanderede over to faser: bosætningen den indre- og mellemfjorden fandt sted omkring 1000 e.kr., men kun på lokaliteter nær fjordene; den anden ekspansion skete omkring 1050-1100 e.kr., hvor bosættelsen udvidedes til den ydre fjord, indlandet samt højlandet. De nye dateringer antyder endvidere at en sammentrækning af bosættelsen allerede begyndte omkring midten af det 13. århundrede e.kr. Til at begynde med involverede denne sammentrækning at gårdene i den ydre fjord blev forladt, samt at de små kirker blev lukket ned. Aktiviteter omkring sæterne bliver mindre intensive fra slutningen af det 14. århundrede og i løbet af dette århundrede bliver mange gårde tilsyneladende forladt, enkelt lokaliteter i primære landbrugsområder forblev dog fortsat bosat ind i det 15. århundrede e.kr.

Et komparativt casestudy af præ-moderne Inuit landbrug er blevet brugt som en forklaringsmodel for denne bosættelsesudvikling, Kombineret med iskerne klima proxy data antyder analysen at en klimaforværring efter ca. 1250 e.Kr. fordrede en mere intensive landbrugspraksis. En sådan forandring var formentlig problematisk for husmænd og lejere, hvorfor de kan være blevet mere afhængige af de store gårde og stormandsgårde. En analyse, af *food-* og *environmental securities* hos forskellige sociale strata på forskellige tidspunkter i løbet af bosættelsen, parret med et *resilience* teoretisk perspektiv, indikerer at forarmelse i lavere sociale strata forårsaget af ringe adgang til arbejdskraft og fortsat miljømæssige stress kan have vandret op igennem systemet og i sidste ende have haft kraftig indvirkning også på de store gårde og stormandsgårdenes virkemuligheder. Hvis den norrøne bosættelse i Grønland have ét stort problem, var det tilsyneladende mangel af arbejdskraft.

CONTENTS:

1. INTRODUCTION

'(…) those who have visited Greenland testify that there the cold has received its greatest strength. Moreover, both sea and land bear testimony (…) for both are frozen and covered with ice in summer as well as in winter. It has been stated as a fact that Greenland lies on the outermost edge of the earth toward the north (…)'.

'(…) the land has beautiful sunshine and is said to have a rather pleasant climate. When the sun rises highest, it has abundant power to shine and give light, but very little to give warmth and heat; still, it has sufficient strength, where the ground is free from ice, to warm the soil so that the earth yields good and fragrant grass. Consequently, people may easily till the land where the frost leaves, but that is a very small part'.

'(…) I shall tell you something about the nature of the land. When storms do come, they are more severe than in most other places, both with respect to keen winds and vast masses of ice and snow. But usually these spells of rough weather last only a short while and come at long intervals only. In the meantime the weather is fair, the cold is intense'.

King's Mirror (royal didactic text, mid-13th cen. A.D.)

The above are excerpt from the King's Mirror, one of the few medieval accounts on the geographical and natural setting of the Norse settlements in Greenland. Although written more than 750 years ago, the account resounds with perceptual imagery similar invoked by mention of *Greenland* even today: as a place of great and wild expanses, of majestic landscapes wrought in stone, ice, and water; of remoteness and isolation, and of dangers, freezing whiteness, and lost souls. This was the Greenland that was "conquered" by 19th and early-20th century European arctic explorers and forged the cultural perceptions – visions *ab extra* – that last to this day as a "paradigm of arctic marginality".

However, the King's Mirror also hints at another and very contrasting perspective; it refers to those small and lush niches in the landscapes of Greenland that compare to parts of Scandinavia and the North Atlantic, and which never cease to surprise first visitors with their, in summer, luxuriantly vegetated slopes. In fact, these niches are where the name *Green*land itself originated, given to it by the Norse settlers – *the grænlendinga* – who founded two small colonies around AD 1000 and survived of its lands until the mid-15th century AD. Academic and popular accounts of the livelihood in these Norse communities on the '*outermost edge of the world*' seems always to have been caught somewhere in between these paradoxical perspectives, although the mysterious end of Norse settlement in Greenland has clearly become part of the narrative of arctic marginality.

In 2005, the National Museum of Denmark initiated the Vatnahverfi-Project to reinvestigate one of these niches of Norse settlement, the Vatnahverfi region in South Greenland. From 2005 to 2011, 129 Norse sites in this region – including 18 newly discovered – and some 798 individual ruins were precision surveyed, providing a digital archaeological survey dataset of hitherto unprecedented precision and uniformity. In addition to the surveys, excavations were carried out at 22 sites as part of collaborating research projects or with the specific aim of providing a chronological framework for the interpretation of the survey evidence. In 2010, a 3-year Ph.D.-scholarship was generously put up by the National Museum of Denmark's 'Northern Worlds' research initiative to investigate the new survey dataset. This Ph.D.-dissertation thus concludes on the survey-archaeological part of the Vatnahverfi-Project.

During the prolonged field surveys in the Vatnahverfi region, my perspective on this landscape has changed dramatically: from a preconception of arctic marginality of an isolated "wilderness" full of daunting obstacles and threats, environmental experience and familiarity gained through extended travels and interaction with local Inuit sheep farmers has transformed the Vatnahverfi into a familiar and rural landscape little different from other sparsely populated parts of Scandinavia. This, in turn, has influenced the themes of this dissertation to focus more on Norse pastoral livelihood rather than simply issues of Norse pastoral marginality:

1.1 Dissertation Research Questions and Progression

The archaeological survey evidence from the Vatnahverfi region is used to address four main research questions:

What was the functional layout of the medieval Norse farmsteads in the Vatnahverfi region?

What was the specific nature and layout of pastoral settlement and farming in the Vatnahverfi region?

What does this settlement pattern evidence imply in terms of regional organization and social hierarchies?

What changes did the pastoral farming community go through during the settlement period; who were affected the most, how, and when?

To answer these research questions, the dissertation addresses related themes in following progression:

Chapter 2 – *Greenland in the North Atlantic* – provides an introduction to the historical and archaeological context for the colonization of Greenland with focus on population size, overall economic conditions, basic farm and animal husbandry strategies. The topics are presented in a comparative North Atlantic settlement perspective to establish a socio-economic baseline for Norse settlement in Greenland.

Chapter 3 – *The Fjords of the Farmers – The Eystribyggð and Vatnahverfi* – provides a detailed description of the geographical, topographical, and environmental setting of the Norse Eastern Settlement with particular focus on the Vatnahverfi region. The description is specifically aimed at establishing the nature of these landscapes in terms of their potential for pastoral farming, but overall observed weather and paleo-climatic patterns are also discussed. Chapter 3 establishes an environmental baseline for discussing Norse settlement and farming in Greenland.

Chapter 4 – *The Archaeology of Norse Greenland and the Vatnahverfi* – provides a literary review of archaeological research in the Norse settlement areas of Greenland. The first part of chapter 4 outlines and summarizes archaeological investigations up to the beginning of the Vatnahverfi-Project, where the second section describes and discusses the field investigations of the project and issues relating to the survey record.

Chapter 5 – *The Archaeology of Norse Farmsteads and Shielings* – presents a summary *stand der forschung* and archaeological framework for the interpretation and classification of Norse architectural features in the survey evidence from the Vatnahverfi region.

Chapter 6 – *The Archaeological Features of Norse Farmsteads and Shielings in the Vatnahverfi* **–** presents, analyses, and functionally classifies the archaeological ruin survey evidence from the Vatnahverfi region. The empirical data is listed and summarized in Appendix 1: the Ruin Database (referred to as the RD in the below). The RD is attached as an access database.

Chapter 7 – *Medieval Norse Settlement and Organization in the Vatnahverfi* **–** presents a functional classification and settlement pattern analysis of the ruin group evidence from in the Vatnahverfi region. The empirical data is listed and summarized in Appendix 2: the Ruin Group Database (referred to as the RGD in the below) and site plans of the individual ruin groups are found in Appendix 3. The first part of chapter 7 analyses the Vatnahverfi archaeological record in terms of the functional layout of pastoral settlement and farming in the region, whereas the second part discusses patterns of community-level hierarchical organization.

Chapter 8 – *Pastures Found – Farming in Greenland (Re)introduced* – discusses the broader implications of the settlement and hierarchy patterns established in chapter 7. In the first part of chapter 8, historic Inuit farming is used as a comparative case study to explore and discuss Norse settlement and farming development and change with focus on the new dates from the ruin groups in the region. The last part of chapter 8 draws on findings of all the above chapters to discuss Norse settlement and farming in terms of *human securities* and *resilience theory*

Chapter 9 – *Conclusion* **–** Summarizes the main findings and implications of the dissertation and stakes out some future research issues and agendas.

Note that the ruin and settlement analysis includes survey evidence of 24 comparative ruin groups from elsewhere in the Norse Eastern Settlement. This data is listed in both the RD and RGD, but only the ruin groups surveyed by the author are included in appendix 3. Otherwise I refer to the references in the RD.

1.2 On Some Categories of (Norse) Landscape

An archaeological settlement pattern study such as this dissertation is by default also a landscape study. Over the last couple of decades, the multifariousness of landscape approaches has exploded, one simple explanation for the miscellany of 'landscape' being that it has been adopted both as term and distinct research area within multiple academic disciplines: from its introduction through Renaissance art (Barrel 1972;1, Cosgrove 1985;46), *landscape* has grown to range equally freely across such academic fields such as planetary geology (Tanaka and Leonard 1995), geography (e.g., Sauer 1925, Coones 1985, Berg *et al.* 2006), ecology (e.g., Forman and Godron 1986, Burel and Baury 2003), sociology (e.g., Greider and Garkovich 1994, Glenna 1996), and social anthropology (e.g., Ingold 1993, Hirsch and O'Hanlon 1995). Not at least in archaeology and history has landscape developed as a full-fletched independent research area with its own vast corpus of theoretical and practical literature (e.g., Muir 2000, Anschuetz *et al.* 2001, Whyte 2002, Thomas and David 2008).

However, as this dissertation concerns landscape only as perceived on settlement, or at most community, level, I will not engage in any lengthy theoretical discussion of the nature and extent of landscape experience by the individual. Also, since historic records in fact allow for distinguishing some basic categories of Norse landscape distinction, this section will only briefly clarify the meaning behind some key terms and concepts used throughout the dissertation:

Social-ecological systems (SES's): was a concept introduced in 1998 to abolish artificial distinction between the social and ecological dimensions of delineated ecosystems with both human and ecological components, and to stress the complex interaction between these components on multiple spatial and temporal scales (Fig.1.1) (Berkes and Folke 1998, Ostrom 2009). SES's were at first used in sociology to discuss related aspects of cultural- and resource management and was adopted as the main framework for resilience theory (e.g., Gunderson and Holling 2001, Walker *et al.* 2004, Folke 2006). The settlement evidence from the Vatnahverfi region is discussed in a resilience theory perspective in chapter 8, but here it sufficient to clarify that when applied in the below chapters, SES refers to the entire delineated system of the Norse Settlements in their Greenland setting.

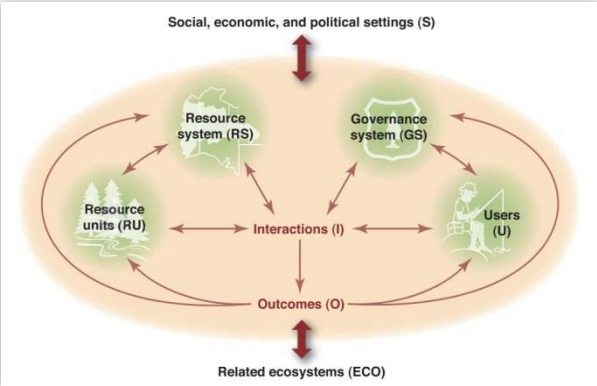


Fig.1.1 Simplified examples of subsystems within a Social-Ecological System (SES) (after Ostrom et al. 2009:Fig.1).

Traditional Ecological Knowledge (TEK): also referred to as '*Traditional Environmental Knowledge*', is a concept originally introduced by human ecologists and anthropologists to refer the way indigenous people accumulate, organize, apply, and transmit experiential practice, and belief based knowledge of their surrounding environment (Berkes *et al.* 2000, Dugmore *et al.* 2012:3660). In other words, TEK is an interface between the social and ecological components of the SES's. In the dissertation, I apply the concept just as broadly to signify a similar kind of pooled knowledge base that existed, and expanded or contracted, in the Greenland Norse communities. However, TEK also had certain significant limits, for instance how long the memory of a rare event was stored in the "common knowledge bank" and how to cope with events that were unprecedented.

Farming systems: In some recent articles, Ingvild Øye has argued that North Atlantic farming should be examined in terms of *farming systems*, i.e. not only the structural features of the farmsteads, shielings, fields etc., but include related components such as available labor and technology, land use patterns and organization, ownership rights and management practices etc. (Øye 2003, 2005b, 2005a, 2009, 2013). Although I. Øey has herself not coupled this idea of farming systems to the concept of SES's and TEK, it is clear that it feeds perfectly into that model: the farming system can simply be considered a subsystem to the larger SES (cf. Fig. 1.1), governed and directed by the TEK associated with farming in that system.

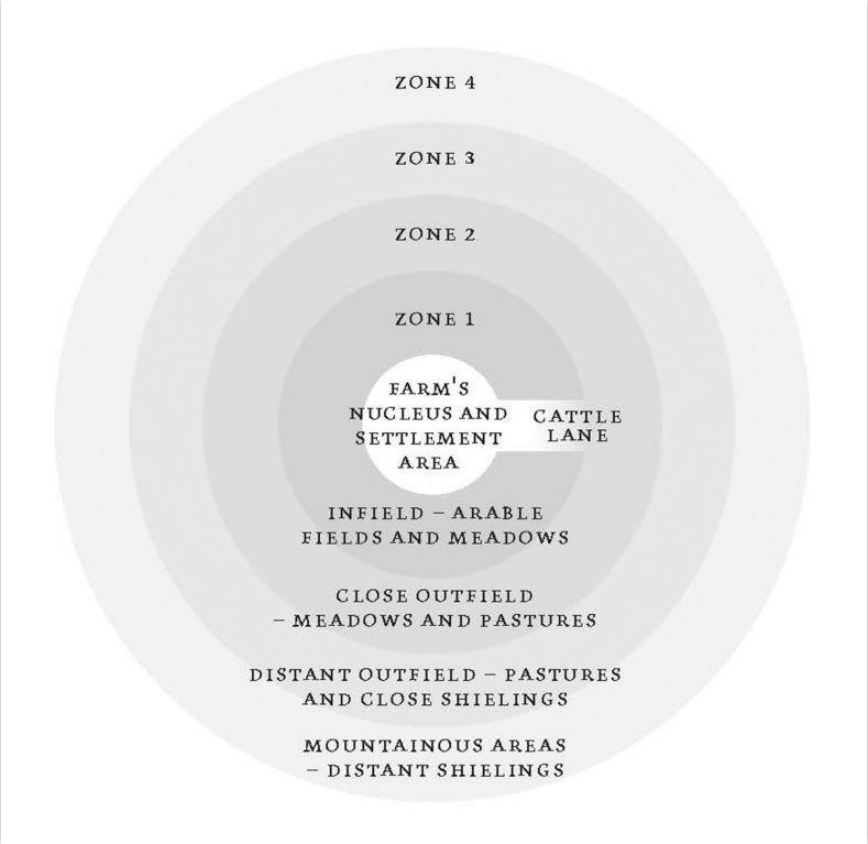


Fig.1.2 A conceptual model for different and legally regulated use areas of a medieval farm in Norway. This land use model can be almost directly transferred to the Norse settlements in Greenland, the only difference being the absence of 'cattle lanes' and occasionally varying placing of 'distant shielings' (see the text) (*after Øye 2013:Fig.4*).

The concept of a farm: in continuation of her ideas on farming systems, I. Øey has argued (Ibid.) that the concept of a North Atlantic, or at least Norwegian, medieval farm should also be shifted towards a more embracive view. Based on Norwegian medieval written accounts, she has stressed that the farms consisted of more than the central cluster of buildings and farmyard, but extended into the surrounding territory with different use and use rights to different areas (Fig.1.2). Here, I extended her model to the Norse settlements in Greenland with minor modification, mainly that her zone 3 and 4 (cf. Fig.1.2) in the outer fjords of Greenland included shielings at horizontal distance from the home farmsteads, i.e. a type of horizontal shieling that I return to in chapter 8.

When I below refer to 'farm' I thus mean to signify not only the central buildings and infield of an agricultural unit – I refer to this as a *farmstead* – but to all of the adjoining lands and resource areas belonging to the farm, e.g. outfield meadows, woodlands, shielings, fishing grounds etc., and to which the farm had particular legal use rights. After Norwegian historical parallel (Hougen 1947:96, Myhre and Øye 2002:3622p), I occasionally refer to Øye's zone 2 as the *heimrast*, a fertile pasture area very near to the farmsteads and which in Greenland appears to have been of great importance.

The ruin groups and ruin group numbers: in the context of Norse Greenland archaeology, sites are referred to as 'ruin groups'. As I return to in chapter 4, ruin groups were earlier numbered consecutively and labeled after their location in the Eastern-, Western, or Middle Settlements. Here, I retain this numbering system because of its simplicity, but stress that I have replaced the original 'Ø' for 'Østerbygden' by 'E' for the Eastern Settlement. Also, when specific ruin groups are referred to in the below, I do not normally supply an explicit appendix reference, because both appendices are listed by their 'E' number.

2. Norse Greenland in The North Atlantic

'So say wise men, that in the same summer, when Eric the Red set out to settle Greenland, then three tens and a half ships (35) *sailed out of Breidafirth and Borgarfirth, and fourteen came out thither ; some were driven back and some cast away. That was XV winters, before Christianity was fixed by law in Iceland (…)'.*

Eiriks saga Rauða, HB 27-36, late 14 c. AD

'But in Greenland it is this way, as you probably know, that whatever comes from other lands is high in price, for this land lies so distant from other countries that men seldom visit it. And everything that is needed to improve the land must be purchased abroad, both iron and all the timber used in building houses. In return for their wares the merchants bring back the following products: buckskin, or hides, sealskins, and rope of the kind that we talked about earlier which is called "leather rope" and is cut from the fish called walrus, and also the teeth of the walrus'.

King's Mirror (142), ca. AD 1250.

In retrospect, Norse settlement of Greenland around AD 1000 marked an important transition point in the greater history of Scandinavia: it was the last of the Viking Age migrations, which over the last two centuries had introduced Scandinavian culture to most of Europe and to all the islands of the North Atlantic (Fig.2.1). In Greenland – on the new arctic frontier of Europe – the migration ground to a halt, the ensuing Norse excursions to North America being only of a provisional character. Yet, in such travels by the Greenland Norse they came into contact with peoples of North American origin, i.e. Indian-, Late Dorset-, or Thule-cultures (Gulløv 2000b, Sutherland 2000, Jakobsson 2001, Gulløv 2008b). Through these exchanges between continents – and almost in a testament to the celebrated Viking thirst for exploration and travel – the colonization of Greenland came to signify something even more profound: the first contact in the full circumnavigation of planet earth by mankind since its parting in Africa.

However, the fate of the Greenland Norse was tied to the east and the notable changes that unfolded across Scandinavia. There, the turn of the first millennium A.D. heralded the end of the Viking Age and was impelled by two major changes: the formation of the Scandinavian political and economic kingdoms and their conversion to Christianity. In that sense, the *landnám* in Greenland also coincided with the transition of the Scandinavian and North Atlantic Iron Age societies to – historically recognized – integrated political, economic, and religious parts of medieval Europe.

While the Greenland colonies constituted the extreme westernmost node in this network – essentially tying the arctic to the Papal States in Italy and beyond – the settlements came to be directly influenced by societal, political, and economic developments on the continent; and although these developments might have been as experientially distant to the *grænlendinga* as their origins were geographically, some changes would cascade down through the network to impact the Norse farmers in the North Atlantic and Greenland.

Chapter 2 sets a brief historic stage for Norse settlement of and in Greenland, but only as needed to contextualize those particular aspects and conditions of settlement and pastoral farming in the Vatnahverfi region to be investigated in the following chapters: section 2.1 outlines and discusses some overall economic and demographic settings for the Greenland colonies; section 2.2 outlines the basic layout of the settlement- and farming system and its functional units; and section 2.3 outlines the basic layout and development of the livestock economy. In other words, chapter 2 traces the cultural and socio-economic starting point from which the Greenland Norse were directed along a particular historical trajectory, as well as such regional developments that continued to influence, and limit, pathways open to the Norse *grænlendinga*. This also involves looking to developments in the wider North Atlantic and Scandinavia. Note that unless otherwise stated, all dates given below refer to years AD.

2.1 Green, White, and Soft Gold – North Atlantic Hunter-Farmers

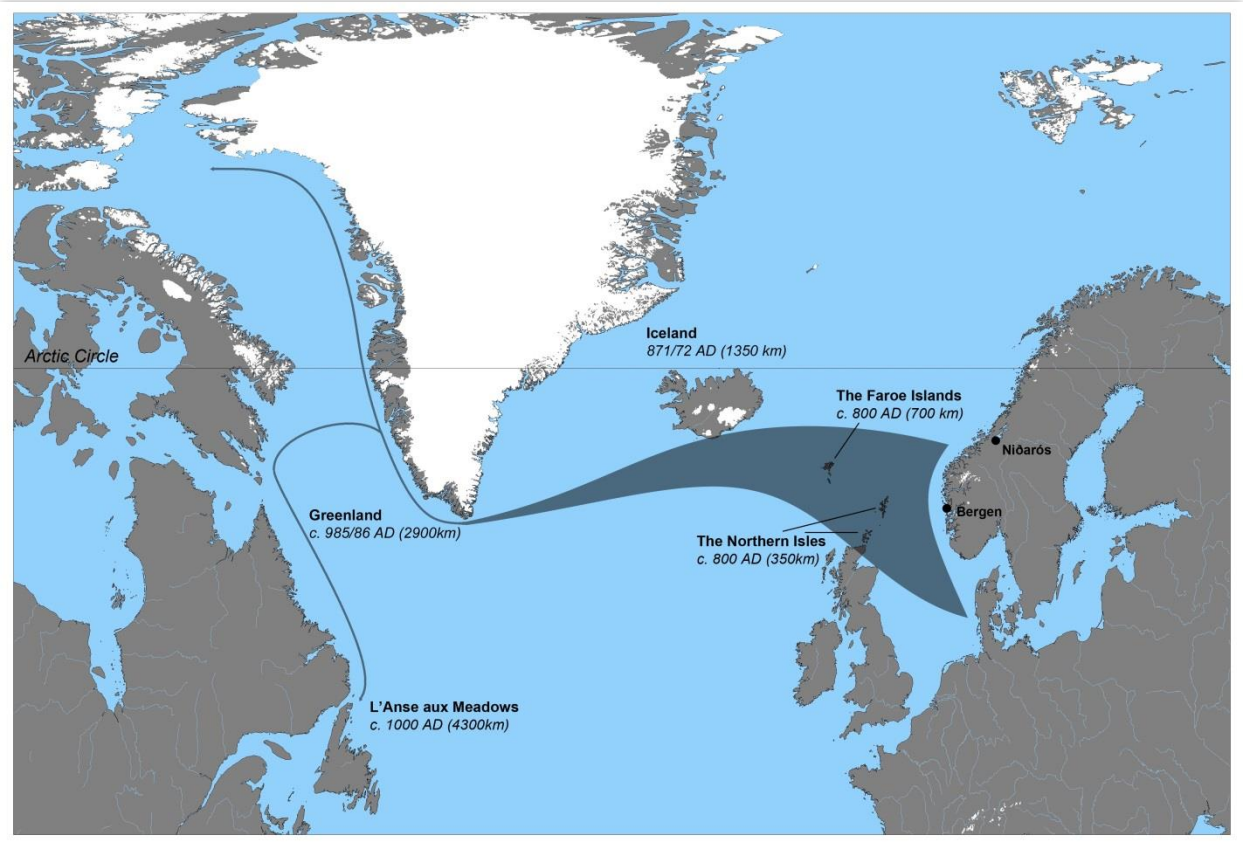


Fig.2.1 Overview map showing the general route and timing of the late Viking Age migrations from Scandinavia across the North Atlantic. The thickness of the "arrow" indicates relative population numbers involved. Kilometers set in parenthesis gives the accumulated distance from the medieval trade capital of Bergen, Norway.

Landnám – 'the taking of land' – in the North Atlantic was by any measure a remarkable feat of the Scandinavian Viking Age: facilitated by an apex in maritime technology – the Viking ship – parts of Ireland, the Hebrides and northern Scotland, the Northern Isles, the Faroe Islands, Iceland and, finally, Greenland was colonized by people of Scandinavian descent from ca. AD 800-1000 (cf. Fig.2.1) (Smith 1995, Ólafsson 2000, Arneborg 2004, Arge *et al.* 2005, McGovern *et al.* 2007, Harrison 2013). Apart from small populations in the Faroe Islands and, perhaps, Iceland (Church *et al.* 2013) (e..g, Smith 1995:320, Vésteinsson and McGovern 2012:207), the islands of the western North Atlantic offered virgin territory; in Greenland, the areas settled by the Norse were completely depopulated by the Dorset-culture for up to 1000 years prior to their arrival (Park 2000, Appelt 2004).

Push-pull factors traditionally offered to explain the Viking Age migrations include: perfection in ship technology; a shortage of young females; the hunt for plunder; favorable environmental conditions (see section 3.1.3); population pressure and lack of land; external political weakness and internal political centralization; and religion based Viking ideologies of honor, fatalism, and masculinity (for an overview and critical discussion see: Barret 2008). Some of these factors can obviously be ruled out in the North Atlantic migrations, while others seem more credible. Political upheaval and lack of land in Norway has been common explanatory models for the settlement of Iceland, but recently some authors have proposed a new narrative involving cash-crop hunting organized and directed by societal elites (see below), a model that perhaps also better explains *landnám* in distant Greenland.

2.1.1 Exiles or Entrepreneurs?

Lack of arable land – the "green gold" – could seem a likely reason for the migrations to both Iceland and Greenland. However, this is partly contradicted by continued population growth in both Norway and Iceland into the 13th-14th centuries, i.e. well after the migrations had ceased (Thorláksson 2000:176, Myhre and Øye 2002:252, Þórhallsson 2012:27). Clearly, these social-ecological systems could – either by a reallocation or expansion of the existing resource base – adjust to accommodate larger populations (for a discussion, see also Dugmore *et al.* 2007b:16). In addition, compared to Iceland the areas of arable land in Greenland are negligible and marginal (see section 3.2.1., 7.2.4). In short, the "green gold" was in short supply in Greenland and could at best have attracted a few *landnámsmen* (as it essentially seems to have, see below).

Recent investigations into *landnám* in Iceland from AD 971/72 have outlined a new narrative with possible implications also for the colonization of Greenland: first, walrus bone found in early settlement contexts as well as place name evidence has established the existence of small walrus colonies in Iceland around *landnám* (Dugmore *et al.* 2007b:16, Perdikaris and McGovern 2008:192, Pierce 2009:56p). Walrus ivory – "the white gold" – and skin used to make ropes for ships' riggings were low-bulk high-price commodities in increasing demand on European markets (Roesdahl 1995:10p, 2005:185p, Dugmore *et al.* 2009:105, Pierce 2009:58, Keller 2010:3). Second, based on new archaeological settlement evidence and a high-resolution tephra-chronology from Mývatnssveit, north Iceland, it has been projected that a minimum population of 24,000 had to be relocated from Norway to Iceland over a timespan of only 20 years to "fill out" the settlement landscape (Vésteinsson and McGovern 2012). Third, Orri Vésteinsson (2005) has observed that signs of wealth and nobility in Iceland, when compared to Scandinavia, appear very modest until at least the mid-13th century, which makes him suggest that the initial profits of *landnám* were at first not imbedded locally, but returned to investors in Scandinavia. In combination, this new evidence suggests that: A) *landnám* was driven – or at least spearheaded – by systematic resource exploitation; which B) was followed by rapid relocation of a large number of people; that C) still answered to manorial centers in Scandinavia.

Fig.2.2 Before recent over-hunting, walrus was found on large part of Greenland's west coast. Greatly treasured by the Norse for their tusks – the "white gold" – and hides, the hunt for walrus could have been a main incentive for early Norse excursions to both Iceland and Greenland (*photo: courtesy of the National Museum of Denmark*).

Whereas walrus populations in Iceland were quickly extinct (Dugmore *et al.* 2007b:105, Perdikaris and McGovern 2008:192), Greenland had more viable populations, the largest of which was found in the Disco Bay region, where they survive to this day despite centuries of overhunting (Witting and Born 2005:282). Suggestively, the Disco Bay is usually identified as the northern hunting grounds – the *Norðrseta* – of the Greenland Norse (Seaver 1996:28p, Arneborg 2004:268, Perdikaris and McGovern 2007:209). In addition, Greenland had plentiful other wildlife that could supply furs and skins: from fox, hare, seal, caribou, and polar bear – the "soft gold" – as well as the tooth of narwhal, all of which was also in high demand on European markets (Roesdahl 1995:7p, Arneborg 2003b:170, Dugmore *et al.* 2007b:16). Exploitation of walrus tusk, at least, from onset to end of settlement in Greenland is amply demonstrated by zooarchaeological evidence (Fig.2.3) (e.g, McGovern 1985:89p, Perdikaris and McGovern 2007:210, Dugmore *et al.* 2009:99).

Combined with signs of early expert tusk extraction techniques, this has led some authors to suggest that *landnám* in both Iceland and Greenland was preceded by an initial phase of exploration for resources, e.g. the hunt for walrus (Dugmore *et al.* 2007b:16, Perdikaris and McGovern 2008:192, Keller 2010:3). Importantly, early exploration would have equipped settlers with the TEK needed for the secondary full-scale and explosive phase *landnám*. Such a process of first probing a niche, next occupying and consolidating it, seems a more likely

landnám scenario than farmers setting out headlong across the North Atlantic with all their possessions for unknown territory, not at least to distant Greenland. Such a *landnám* model has more direct implications for the themes of this dissertation: because if, as pointed out by Dugmore *et al*. (2007:17), a hunt for luxury trade goods was a main impetus for settling in Greenland and remained its' link to the outside world – needed also for the import of everyday goods such as iron, building timber etc. (cf. the opening quote) – then farming was, in a sense, subsidiary, i.e. sustained mainly to support hunting (?). While this may be exaggerating, the need to ensure a steady supply of wildlife exports would have affected the farming system in terms of its access to labor, but this depended on the available workforce.

2.1.2 A Small Community Divided?

Questions of population size and available labor are reoccurring themes in the later chapters, addressed through archaeological evidence from the Vatnahverfi region. However, they are to a large extent also questions of 'when' and for 'how long', aspects which may be explored in a comparative regional perspective:

The peopling of the western North Atlantic after the new narrative of *landnám* may be described as a 'probe-burst-trickle' model, i.e. initial exploration and resource extraction by fairly few people, rapid and vast relocation of fairly many people, and subsequent minor population inflow. Clearly, labor would have been in relatively short supply during the first critical phase of *landnám*, which was perhaps a reason for the ensuing rapid and vast relocation of many people. But what was the rate and extent of the following population development?:

In Norway, it is estimated that the population doubled, in some areas tripled, since the Viking Age reaching a maximum of some 530,000 people around AD 1300 (Tab.2.1) (Øye 2013:298). After *landnám* in Iceland involving ca. 8,000-24,000 people (Vésteinsson and McGovern 2012:217), population growth appears to have peaked during the Commonwealth Period ca. 930-1262 with estimated population maxima usually ranging between 40.000-70.000 people from around AD 1100 (Tab.2.1) (Karlsson 2000:44p, Thorláksson 2000:176), i.e. again a doubling or close to a tripling of the Viking Age population.

Fig.2.3 Drill- or awl handle made of walrus molar (length ca. 8 cm) and found in early midden context at ruin group E172 (left). Incised on one side is a depiction of a walrus (middle), recognizable from its "beard", bulking eyes, and the wrinkles at the neck. The walrus is shown in a bird's eye perspective, which explains why the tusks are not portrayed (cf. Fig.2.2). The likeness to a later 16th century AD depiction is striking (right: modified after Seaver 2009:Fig.1).

Tab.2.1 – North Atlantic Population Densities 13th Century AD

Region:	Estimated max. Population	Area in km^2	Population Density per km^2	Reference:
Greenland, East. Settlement	1,120 - 4,800	12,300[1]	0.09 - 0.39	(Keller 1986:145p, Lynnerup 1998:100p)
Greenland, West. Settlement	280 - 1,200	7,900[1]	0.04 - 0.15	(Keller 1986:145p, Lynnerup 1998:100p)
Iceland	40,000 - 70,000	91,500	0.44 - 0.77	(Karlsson 2000:44)
Faroe Islands	4,000 - 5,000	1,400	2.86 - 3.57	(Arge *et al.* 2005:601)
Norway	400,000 - 530,000	381,220	1.05 - 1.39	(Myhre and Øye 2002:252)
Shetland (AD 1755)[2]	5,000 - 15,000	1,468	3.41 – 10.22	(Fenton 1997:Fig.4)
Orkney (AD 1755)[2]	5,000 - 24,000	990	5.95 - 24.24	(Fenton 1997:Fig.4)
Denmark	1.326 million	78,000	17.00	(Hybel and Poulsen 2007:124)
England	2.00-2.45 million	130,395	15.34 - 18.79	(Hybel and Poulsen 2007:124)

Tab.2.1 Ranges of estimated population maxima, areas in square kilometers (omitting glaciated areas), and population densities per square kilometers of Scandinavian and North Atlantic regions c. AD 1200-1300. Clearly visible from the table is the trend that population densities decrease with distance from Northern Europe and the extremely low population densities in Norse Greenland, especially the Western Settlement. [1] : The estimated areas of the Norse Eastern and Western Settlements are shown in Fig.3.2. [2] : As medieval population maxima for Shetland and Orkney are lacking to the authors knowledge, the suggested ranges refer to the maximum population in the Faroe Islands and the first actual population census in AD 1755).

We know less of population developments in Greenland: written evidence is limited to anecdotal saga accounts, which name only some 8-10 settlers (cf. the opening quote, ES ch.1, GS ch.1), at best only 1/100 the number of named *landnámsmenn* involved in the settlement of Iceland. Based on the number of ships mentioned in the sagas, authors have suggested that the founding population in Greenland consisted of c. 300-800 people (Meldgaard 1965:43, Keller 1986:146, Lynnerup 1998:115), i.e. only about 1/10 of the founding population in Iceland. As to medieval population growth – based either on the estimated number of farmsteads in Greenland or population modelling – maxima range between 1400-6000 people (Nørlund 1934:22, Krogh 1982b:65, Keller 1986, Lynnerup 1998:100). The lower estimates may seem extremely low. Yet, if the founding population was 300-800 people – as most authors seem to agree on – then the largest population peak estimates would require an almost tenfold population increase from the late Viking Age, which seems very unrealistic compared to Norway and Iceland. From this perspective, at least, maximum population in Greenland of 1400-2000 seems more believable. Based on comparison with the other regions, this maximum was probably reached before 1300.

That this would make for a very different settlement setting in Greenland is indicated by Tab.2.1 which shows estimated peak population sizes per square kilometers for the North Atlantic (and comparative European regions). As visible from the table, even with the highest and most unlikely peak population estimates, population densities in Greenland appear astoundingly low – especially in the Norse Western Settlement – when compared to the other regions.

Tab.2.1 thus highlights what is implied in Fig.2.1, i.e. that the farther removed from economic and political centers of mainland Scandinavia, the smaller the populations and -densities. This pattern implies a subsistence-economic baseline of North Atlantic settlement: i.e. neither in Iceland or Greenland could the economies be intensified to sustain development of urban centers, which were accordingly absent. In turn, their only means absorbing medieval population increase was – like in Norway - by subdivision of old settlements or by expansion into more marginal agricultural areas. In either case, it likely elicited an increase in the number of smalltime farmers, cottagers, and tenants, whom with their small livestock herds and marginal farmsteads were far more susceptible to climatic variability and to the ambitions and governance of societal elites.

Recent studies suggest that such societal elites were established from the beginning and that *landnám*, did not, as often held before, flow from an egalitarian and democratic society. Rather, it flowed from a societal setup with few chieftains or magnate landowners and many dependent farmers or serfs, meaning that a system of manorial organization and land tenure was in place from day one (Vésteinsson 2005b:8, 2007:117, Júlíusson 2010, Skre 2011:201). If manorial organization in the hands of a small societal elite was the norm in the rest of the North Atlantic, then it surely also was in Greenland. Part of this manorial organization involved control over religious institutions, i.e. the complex proprietary church system that was the model for early Catholicism in all of Northern Europe (e.g., Skovgaard-Petersen 1960, Krogh 1982a:274, Arneborg 1991b, Vésteinsson 2000b, Arneborg 2002, Gjerland and Keller 2009:166p). I will not go into further discussions of these systems here, but refer to the above authors and conclude that centralized manorial and religious organization is considered a baseline also for the societal setup in Norse Greenland in the below discussions (e.g., Gad 1964, Arneborg 1991b, Seaver 1996:61pp, Arneborg 2002, 2004:247pp).

2.1.3 A Medieval Bloom and Bust Cycle?

Since this dissertation is on livelihood, I will not discuss causes for the abandonment of the settlements in Greenland, but rather focus on the workings of the pastoral farming- and settlement system. Instead, I here briefly outline a few central points of political and economic change:

The Middle Ages saw North Atlantic economic systems based on household production and minor trade in luxury items change into a full-blown marked oriented system, which was organized around mass produced goods – primarily of stockfish and *vaðmál* (homespun cloth) – and shipping in the hands of professional merchants operating on behalf of the king or the Church (Helle 1982:398p, Magerøy 1993:225p, Arneborg 2000:308, 2004:268, Perdikaris and McGovern 2007:200, 2008:199, Þórhallsson 2012:14pp). Although some authors have held that the *grænlendinga* must also have traded in mass goods (e.g., Ingstad 1960:261, Gad 1965:89, Seaver 1996:48, Østergård 2003:146), there is presently little evidence to support this. However, there is evidence of continued trade in the traditional luxury items of walrus ivory, and probably skins and furs, the prices and demands were in decline on European markets (Roesdahl 1995:33, Keller 2010). Overall, this has led to the suggestion that the continued Greenlandic emphasis on luxury exports was a 'dinosaur' that left them exposed to economic stagnation and, eventually, collapse (Dugmore *et al.* 2007b:18, Perdikaris and McGovern 2007:211p, Keller 2010:16p).

Stagnation may also have been a cause for the free submission of the *grænlendinga* to the crown of Norway in AD 1261 (Gad 1964). Through this "alliance" Greenland became a tax country to Norway, but possibly secured that the King's trade ships would visit regularly or, at least, that trade goods were not impounded upon reaching Norwegian markets (Arneborg 2004:268). Iceland made a similar move the year after and it has recently been argued (Þórhallsson 2012) that this regional centralization reflected active policy of the small North Atlantic colonies in seeking economic, political, and societal shelter of the kingdom of Norway. Even so, merchant's ships only appear to have arrived in Greenland infrequently, often years apart (Gad 1965:86, Fyllingsnes 1990:95p, Magerøy 1993:81). In short, the Greenland Norse communication and trade networks were weak, and it directly affected that trade goods had to be stored for up to several years before they could be shipped off.

The Greenland Norse networks became even more exposed in later stages of the Middle Ages: first, in AD 1350 the plague swept over Norway, in AD 1402-04 Iceland, causing major disruption to the established systems of organization and commerce (Øye 2004:100p, Keller 2010:17). Second, in AD 1397 the Scandinavian kingdoms were unified under the Kalmar Union after which the political and economic interests of the old sea empire of Norway shifted to northern Europe (Roesdahl 2004:46). At the same time, the German Hansa Merchants had gained complete dominance of the trade in bulk goods in Scandinavia and their medieval ships were ill-fitted for transatlantic voyages (Þórhallsson 2012:16). English traders may have offered an alternative trading partner for the Icelanders', but since the *grænlendinga* were not engaged in mass stockfish production, they could perhaps not attract them either. In short, Greenland was growing increasingly isolated by regional events outside their control.

2.2 Farms and Shielings in the North Atlantic

Fig.2.4 View of the late-medieval *Hvalseyjarfjörður* church (E83); in Norse Greenland, the wealth and status of the societal elite seems mainly to have been signaled through the construction of special architecture, primarily the churches. Considering the labor and materials involved in the construction and maintenance of the churches they undoubtedly constituted a major investment on part of the magnate farmers (*photo: C.K. Madsen 2009*).

While the sea increasingly became the main source of North Atlantic medieval prosperity, the profits were imbedded and invested in the traditional Scandinavian farming system that was based on land tenure. The nature, layouts, and complexity of these systems varied from region to region, although it is beyond both the scope and purpose of this chapter to provide any extensive account. Rather, I here offer a brief description of some fundamental traits of the North Atlantic farms to contextualize the archaeological survey evidence presented and discussed in the below, but also to expand on and clarify some of the terms relating to North Atlantic farming systems outlined in the introduction. The section is divided on those two farm units that formed the core North Atlantic farming: the farmsteads and the shielings.

2.2.1 Medieval Farmsteads

The hubs of North Atlantic farms were, naturally, the farmsteads themselves. Generalizing, they were laid out after a rather similar and simple plan: the occupation-, livestock-, and storage buildings were situated in the middle or edge of the *infield* – the most productive plot of arable land – all of which was enclosed by an *infield dyke* (Fig.2.5). Besides keeping animals from raiding or trampling the infield, the division inside – *innangarðs* – and outside – *utangarðs* – the infield dyke has been suggested as a fundamental religious and legal dichotomy of the Norse worldview (Hastrup 1985:147, Myhre and Øye 2002:296p, Øye 2003:402, 2005b:10, 2005a:365).

In the traditional view of rural North Atlantic settlement, it was dominated by such *separate* or *single farmstead* units more or less evenly dispersed in the landscape (Øye 2000:12, Vésteinsson 2007:128p). However, more recently some authors have exposed a rural settlement patterns of greater complexity:

In rural Norway, the early Middle Ages saw the development of *multiple*, *nucleated*, or *agglomerate farms* and hamlets, i.e. two or more farmsteads sharing and lying within the same infield, and often without any physical demarcation of ownership boundaries (Skre 1996:64, Øye 2000:17p, 2009:41p). Multiple farms have also been noted in Iceland, although there they are mostly considered a *landnám* feature (Vésteinsson 1998:16, 2000a:168p). Also in Iceland, systems of multiple infield enclosures have been noted (Lárusdóttir 2006), as well as equally complex earthworks in the outfield (Vésteinsson 2005b). This "division" of farms and outfields echoed a similar change and division in the farmhouses, referred to as the *'functional fragmentation'* of the longhouse (see section 5.1.2 and: Skre 1996:64). In broader perspective, one might instead refer to overall 'settlement fragmentation' since it also extended to the splitting of single farms on *multiple*, *nucleated*, or *agglomerate farms* and hamlets (Skre 1996:64, Øye 2000:17p, 2009:41p), and to division of the longhouse and animal housing on functionally specified rooms and buildings (Myhre and Øye 2002:356).

In short, the complexity and regional variation in medieval farmsteads layouts and settlement patterns is, unsurprisingly, far greater than the simple model. In chapter 7 I propose that double-farms also existed in the Greenland Norse settlements (although contemporaneity is at times difficult to establish archaeologically). In chapter 6, on the other hand, I demonstrate that infield dykes were very rare in Greenland, which is strongly suggestive of another, less intensive type of farming system. However, concluding this brief section, it is sufficient to note that the North Atlantic farming system allowed for significant regional adjustments and variation.

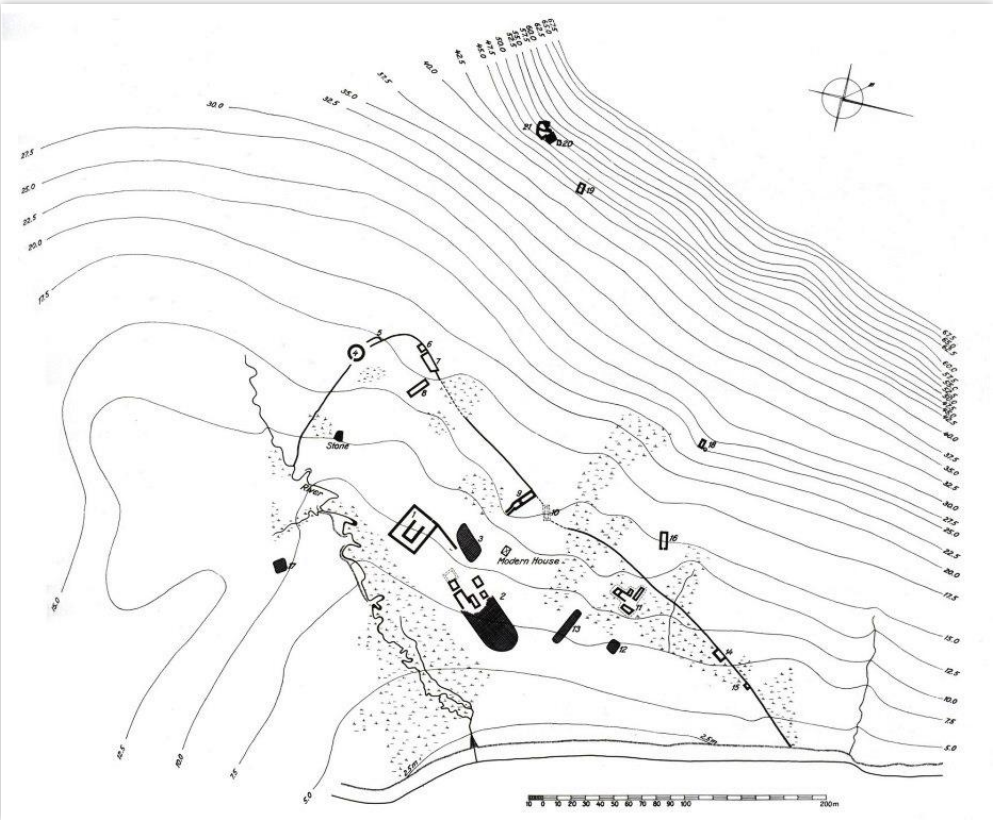


Fig.2.5 Survey plan of ruin group E149 in the Uunartoq fjord, South Greenland, a supposed nunnery. It also one of the few Norse Greenland farmsteads to display a traditional layout with an infield dyke (after Vebæk 1991).

2.2.2 Medieval Shielings

The other core unit of the medieval farms – at least for a period – was the shielings. Although shielings have recently come under increased archaeological scrutiny, they still present a more problematic type of site, partly because of their much varied nature, partly because scholars do not always agree on the definition. Again, any full disclosure of the subject in beyond the present section and for further discussions I refer to the earlier investigations (e.g., Hougen 1947, Reinton 1955, 1957, 1961, 1969, Albrethsen and Keller 1986, Mahler 1991, Sveinbjarnardóttir 1991, Borthwick *et al.* 2006, Mahler 2007, Lucas 2008).

'Shieling' is also often referred to as 'transhumance' to indicate the movement of people and animals from summer to winter activity (pasture) areas. However, in the North Atlantic version, shieling activities were often more wide-ranging than that. Some of the functional variation was enveloped in L. Reinton's (1961) tripartite division of shieling types based on Norwegian historic and ethnological evidence, with:

A) *Dairy shielings* the main purpose of which was continued milk production; such shielings were often situated relatively close to the home farmstead and their time occupation therefore varied.

B) Haymaking shielings the main purpose of which was production of winter fodder, although not always – as suggested by the name – related to the production of hay-fodder, but also of other fodder types, e.g. leafy-fodder.

C) *Full shielings* that combined the functions of the two former types, but where most or the entire household took up residence during the entire summer, or in some areas even in the winter (e.g. Hougen 1947:87).

As I will return to in chapter 8, all of these shieling types seem present in the archaeological survey evidence from the Vatnahverfi region. There are, however, some shielings that do not fit very neatly in any of these three historically types, which has also been the experience elsewhere (e.g., Sveinbjarnardóttir 1991:98) For the purpose of classifying the archaeological material under scrutiny here, I therefore suggest a simpler definition:

A shieling is a site (with structural features) related to a specific and temporary outfield activity.

Two main points of this definition are the temporary character of the activities on, or occupation of, shielings, and that these activities – whatever their nature – were situated in the outfield. 'Structural features' is bracketed because the documentary mention of the *Norðrseta* – translating directly as 'the Northern Shieling' (see above) – implies that whole areas, rather than only some particular buildings, could constitute a shieling. When 'structural features' is included in the definition, it is because shieling activity is nearly impossible to identify archaeologically if without any physical remains. Based on the historic record of shieling use and activities, there were several legal implications to the term, but as we have no idea of such legislation in the context of Norse Greenland, I will not discuss this aspect here.

The above definition is admittedly very open, but it does through this quality allow exactly for the variation evident in the Vatnahverfi survey record (see section 7.1.4). In addition to Reinton's types, shieling activities may more broadly include:

1) Exploitation of extensive terrestrial or marine resources, either located distant enough from the home farmstead to make daily transport of products, materials, or movement of animals inconvenient or impossible, or where location of a structural facility at some distance from the home farmstead would greatly eased a particular task or resource use.

2) To save on the fodder and vegetation reserve of infields and *heimrast* by keeping animals from trampling or grazing them.

3) To continue milk production throughout the period where the animals were lactating (as opposed to winter stalling periods).

4) Shieling activity was – like many other farming activities – predominantly the women's domain (Hastrup 1989:74, Myhre and Øye 2002:402p), freeing the men to fish, hunt, seal etc.

Finally, to this variation must be added the dynamic character of the shielings in that they could, depending on conditions and need, change from shieling to farmstead and back again, from one type of shieling to another, or any other possible combination. In general, however, shielings were related to extensive land use in more marginal resource areas, i.e. fitting very neatly the overall settlement setting outlined for Norse Greenland in section 2.1.2.

2.3 Norse Animal Husbandry and Livestock Economy

Fig.2.6 Cattle herd grazing at the foot of a mountain in the north Vatnahverfi near ruin group E60. In Greenland cattle can only graze outside during the summer, making the associated facilities – byres, barns, cattle pens, hay infields etc. – defining characteristic features of wealthy farmsteads (*photo: C.K. Madsen 2013*).

At the time of the North Atlantic *landnám*, the emphasis on animal husbandry – especially cattle husbandry – was in Northern Europe being replaced by production of bread cereals to sustain the growing populations and urban centers (Hamerow 2002:134, Myhre and Øye 2002:315p, Vésteinsson 2005b:22). Mixed farming with barley crop also featured in the North Atlantic, but environmental confines greatly restricted this production (Nørlund and Roussell 1929:140p, Simpson *et al.* 2002, Edwards 2005:591pp, Edwards *et al.* 2005:77p). In Greenland, mixed farming was probably attempted during earliest settlement: it is evidenced by historic mention (KS:142), the finds of quern stones in excavated farmsteads (Holm 1883:83, 87, Nørlund and Roussell 1929:141, Nørlund and Stenberger 1934:131), macro-fossil evidence (Henriksen 2012, pers. comm.), and patterns of dental caries in Norse skeletons (Lynnerup *et al.* 2008:375). However, in most of the North Atlantic and certainly in Greenland, the cultivation of barley was at best supplemental and confined to early settlement, meaning that they were primarily *pastoral farming systems* based on livestock.

Detailed zooarchaeological records on subsistence economies and livestock strategies from the across North Atlantic have virtually exploded over the last decades. This denies any prospect of presenting the new results in the full here and neither is it necessary because of the many local and regional overviews (see below). Here, I provide the review needed to discuss the setup of the Greenlandic farming system and the related settlement evidence. However, because the Norse depended heavily on various wild resources, this is where I begin the review.

2.3.1 Arctic *Hunter*-Farmers

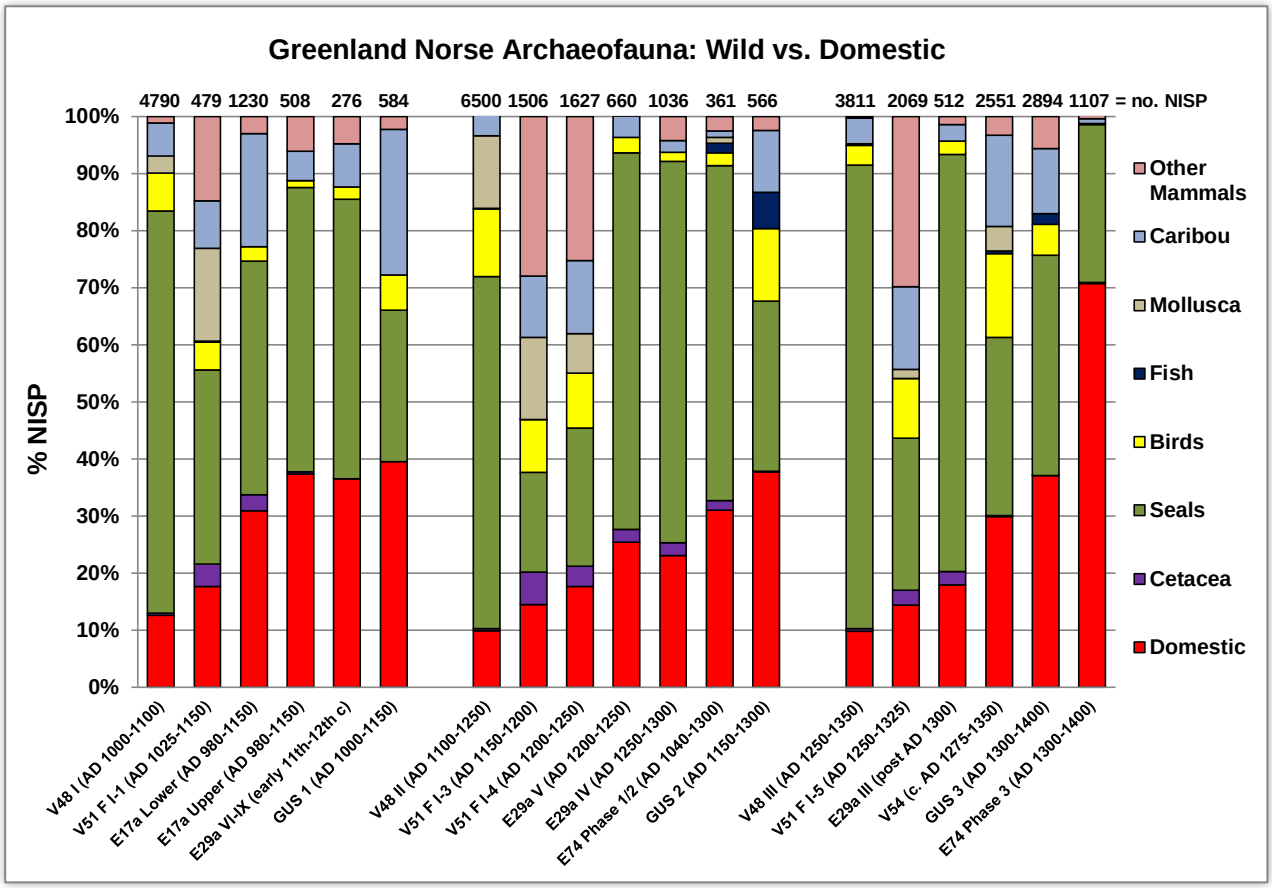


Fig.2.7 NISP (*Number of Identified Specimens*) percentages from seven Greenland Norse stratified archaeofaunal assemblages divided upon main species categories and rough site sub-phasing. The notable Norse emphasis on wildlife resource – especially seals – is noted. Except for a moderate gradual increase in the proportion of wildlife species over time, there is overall little change (data after: McGovern *et al.* 1983:Tab.2-5, McGovern 1993:Tab.1-2, McGovern *et al.* 1996:Tab.3, Enghoff 2003: Tab.2-4, Edvardsson 2007a:Tab2, E74 unpubl. data of Konrad Smiarowski).

Fig.2.7 displays the relative proportions of various categories of wildlife species against the total proportion of domesticates from a selection of Greenland Norse sites and divided on a rough three-period division (for a critical evaluation and discussion of the individual archaeofaunal datasets refer to the cited literature). Two patterns instantly strike the eye: first, that domesticates constitute a minor proportion of the total archaeofauna, emphasizing a great reliance on wildlife species from the beginning (e.g., McGovern 1985, Dugmore *et al.* 2005, Perdikaris and McGovern 2008). Second, that seal proportionally was the most important of the wildlife species and, in fact, of all of the species. A stable isotope study found that 15-50% of the Greenland Norse diet consisted of marine protein, most of it probably seal (Arneborg *et al.* 2012a:128).

Although the archaeofaunal assemblages overlap somewhat chronologically, the overall pattern is quite consistent: the *grænlendinga* became increasingly reliant on wildlife species, which on average changed from constituting some 70.9% in the early period, to 73.4% in the middle, and 78.1% in the late period. The only deviation from this pattern is E74 phase III (not included in the latter average), which by this time likely had transformed from a small farmstead to a shieling (see section 5.1.3), leading to a quite atypical refuse pattern. There are many implications to Fig.2.7, but I refer to the cited authors for a discussion of the wider implications. The point to make here is that the Greenland Norse were far from entirely dependent on their livestock, but were from the start of *landnám* geared towards on exploitation of other resources.

2.3.2 Arctic Hunter-*Farmers*

The North Atlantic late Viking Age "*landnám* package" included cattle, pigs, sheep, goats (the latter two grouped as *caprines*), horses, dogs, and cats. In terms of the first four domesticates, zooarchaeological analysis have implied that *landnám* farmers attempted to adhere to an "ideal livestock model" as it was found at chiefly manors in the Scandinavian homelands, i.e. maintaining a cattle to caprine ratio of ca. 2:1 (Vésteinsson *et al.* 2002:108, Dugmore *et al.* 2005:27p, Perdikaris and McGovern 2007:198). From this shared starting point, however, livestock strategies across the North Atlantic began increasingly to part ways:

Beginning with cattle, which was a primary rural currency and measure of status, their numbers in Norway appear to have remained fairly high from the Viking Age into the Middle Ages: based on historic evidence, small farms –cottagers and tenants – would have kept a stock of around 6 heads of cattle, average farms the double, and magnate farms up to as many as 200 heads of cattle; there were, however, large regional differences (Myhre and Øye 2002:350p, 406)

In Iceland and the Faroe Islands, the number of cattle husbandry began to decline shortly after *landnám* and by the later Middle Ages a cattle to caprine ration of ca. 1:4 was the norm in Iceland (Vésteinsson *et al.* 2002:110, Arge *et al.* 2009:19). Based on zooarchaeological evidence and byres areas, T.H. McGovern *et al*. (1988: Tab.1) have estimated that early medieval middle to high status farms in south Iceland kept around 20 heads of cattle and 100 sheep (1:5 ratio), whereas smaller farms kept around 12 heads of cattle and 72 sheep (1:6 ratio). However, again there were large status-related and -regional differences: e.g. some manorial farms upheld cattle to sheep ratios of c. 1:1.5-3.5 throughout the Middle Ages and cattle was in general more frequent in south Iceland than in the north. (Amorosi *et al.* 1992:Tab.1, Vésteinsson 2004:Tab.1, McGovern 2009: Tab.4.3, McGovern *et al.* 2013:12) The steady decline in cattle has been attributed to climatic and environmental deterioration slowly setting in from the beginning of the Middle Ages (Dugmore *et al.* 2005:27p, McGovern *et al.* 2007:39p, Dugmore *et al.* 2012:3659).

The other animal husbandry also went through changes during the Middle Ages: in Norway, pigs remained fairly common on the farms and especially in the urban centers; so too did goats, which in some coastal and inland areas were so numerous that they were referred to as 'goat-settlements' ('*geitebygder*'), where goat and buck skins constituted the main natural currency (Myhre and Øye 2002:359). Conversely, in Iceland pigs rapidly declined and totally disappeared by the 13th century (Dugmore *et al.* 2005:28, McGovern *et al.* 2007:40). Goats also became rarer, although never disappeared completely: from a sheep to goat ratio of ca. 2:1 in the Viking Age and early Middle Ages, average ratios declined to around 10:1 in later assemblages (e.g., Amorosi 1992:Tab.3, McGovern and Perdikaris 2003:Tab.3, Brewington *et al.* 2004:8, McGovern 2009:Tab.4.3, McGovern *et al.* 2013:13). The decline in both pig and goat husbandry has been linked to depletion of scrub wood or intensified wool-production (Vésteinsson 2005b:22, McGovern *et al.* 2013:20). .

Based on the scarce available evidence, also sheep numbers remained stable in medieval Norway (Myhre and Øye 2002:353). In Iceland, sheep numbers increased steadily as the other livestock declined and part of this latter trend was the 13th century AD emergence in north and northeast Iceland of specialized sheep farms with only < 10% cattle and the rest sheep, i.e. cattle to sheep ratios of some 1:20-25. These farms also relied heavily on fishing and sealing, i.e. subsistence economies similar to those recorded of early modern Iceland (e.g, Amorosi 1991:Tab.2, Amorosi 1992:Fig.10, Brewington *et al.* 2004:Fig.3, McGovern *et al.* 2007:40, Harrison *et al.* 2008:Fig.6, Hambrecht 2009:Fig.7).

Revising the zooarchaeological and historic evidence for medieval livestock farming strategies from across the North Atlantic, it appears clear that not only climatic deterioration, but also economic change influenced local practices: the change to less labor intensive sheep farming in, especially northern, Iceland corresponded well with the emergence of trade in bulk products such as *vaðmál* and stockfish. In Norway, the high proportion of goats in some marginal areas, and in the cities, reflected an intentional focus on milk, cheese, and skin production currency (Bratrein 1996:18, Myhre and Øye 2002:359). It is not unreasonable to suspect that similar economic motivations could have been part in shaping the layout of the Greenland Norse husbandry:

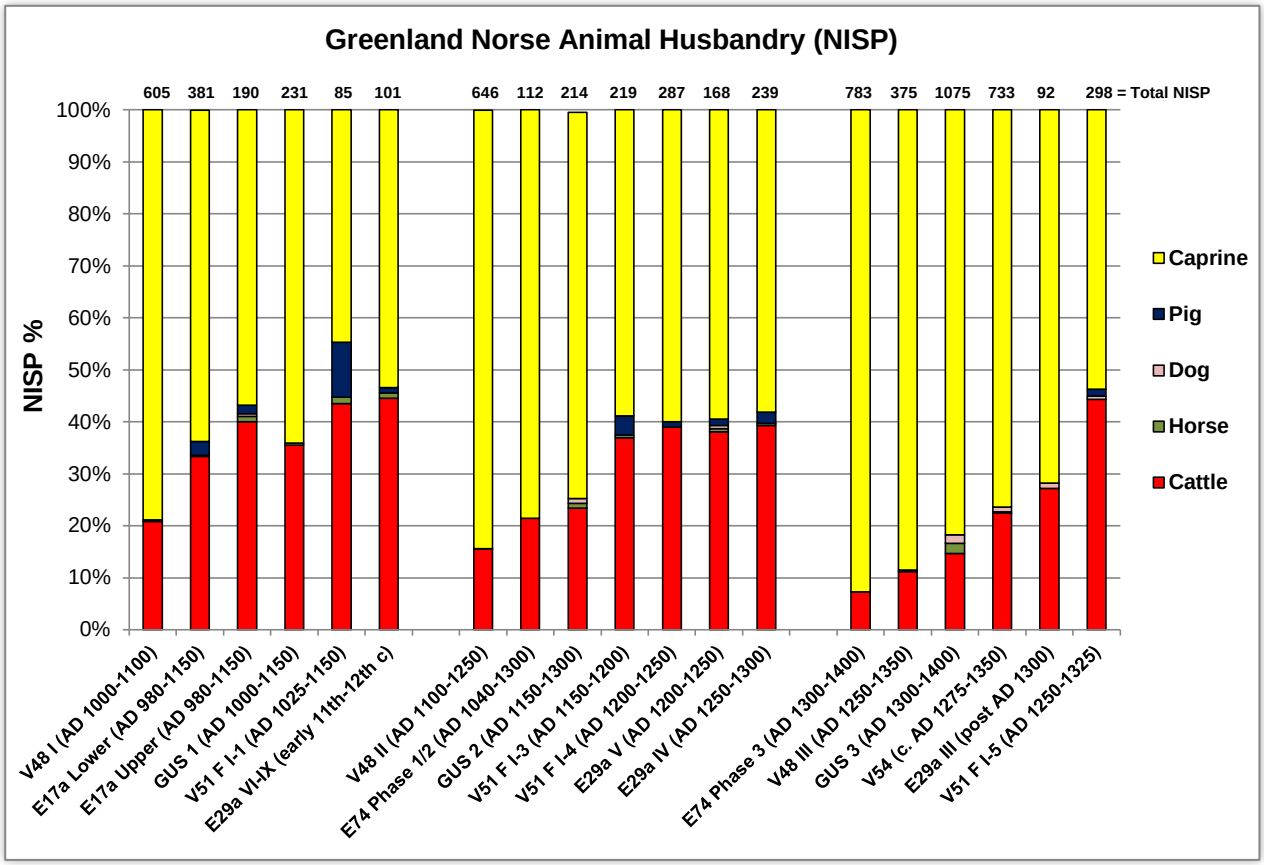


Fig.2.8 NISP (*Number of Identified Specimens*) percentages from seven Greenland Norse stratified archaeofaunal assemblages divided upon domestic species and site sub-phasing. Overall, there is only moderate change in the proportion of domesticates, although a trend towards keeping more caprines is noticeable (data after: McGovern *et al.* 1983:Tab.2-5, McGovern 1993Tab.1-2, McGovern *et al.* 1996:Tab.3, Enghoff 2003Tab.2-4, Edvardsson 2007a:Tab.2, E74 unpubl. data by Konrad Smiarowski).

Fig.2.8 displays the phased subsamples of domestic animals of the Greenland Norse archaeofauna displayed in Fig.2.7, again divided on three main periods with some temporal overlap between the bone collections (for a critical evaluation and discussion of the individual archaeofaunal datasets refer to the cited literature). Overall, the zooarchaeological data suggests continuity with gradual change in the layout of the animal husbandry. However, there were noticeable changes, especially towards the latest settlement phase:

The earliest period Greenland archaeofaunal assemblages display likeness with 10th century northern Iceland: ratios of cattle to other domesticate vary between c. 1:1.5 at the chiefly estate of V51/Sandnes to c. 1:4.8 at the very small farmstead or shieling of E74 (McGovern *et al.* 1996:fig.14, Vésteinsson *et al.* 2002:fig.4); on average, cattle bones comprise ca. 36.3% of the early assemblages. This is a somewhat higher proportion than even in contemporary Iceland (see above), which has made authors suggest that the *grænlendinga* were still trying to adhere to the Scandinavian "ideal model" (Dugmore *et al.* 2005:28).

Sheep and goats constituted the other 2/3 of the livestock (Fig.2.8)(McGovern 1985:Tab.7, Vésteinsson *et al.* 2002:fig.4, Dugmore *et al.* 2005:fig.4). Whereas goats were in decline in Iceland, they still featured frequently on contemporary Greenlandic farmsteads at ratios of between 1.5 sheep to 1 goat (McGovern *et al.* 1996:fig.15, Enghoff 2003:fig.37). The high proportion of goats in Greenland could relate to the richly available shrub- and heathland resources and pollen analysis of Norse sheep/goat pellets from one farm in the Western Settlement indicate that they had indeed been feeding on such vegetation (Ross and Zutter 2007:82). Pigs were generally fairly uncommon and mainly an early settlement feature (McGovern 1985:86, Dugmore *et al.*

2005:28, Edvardsson 2007a:26). However, at a few farmsteads – some of them chiefly estates – pigs were kept at least into the 13-14th centuries. Although there were plenty of shrub areas in Greenland for pannage, isotopic analysis have shown that the pigs were feeding on substantial quantities of marine protein, most likely seal offal (Nelson *et al.* 2012:83). This, and the presence of quantities of pigs' dung in Western Settlement byres (Roussell 1936b:43, 89) suggest that pigs in Greenland were not – as has been suggested for Iceland, see above – managed by pannage in scrub forests, but were kept and fed near the farmsteads and stabled over the winter. Although caprines were better suited to graze outside even in harsh weather, tethering pegs, and sheep/goat coprolites found in several excavated farmsteads suggest that – at least in a later stage of settlement – some caprines were periodically stalled (e.g., Roussell 1936b:47, 89, 1941:185).

In Greenland's middle settlement period, the average proportion of cattle bones in the archaeofauna had decline to ca. 30.5%. Although this ca. 6% decline from the early period is perhaps statistically negligible, it does correlate with the contemporary decline in cattle in Iceland and the Faroe Islands (see above). However, the upper cattle bone percentages in Greenland – found at church farmsteads E29a and V51 – are actually within range of high-status sites in later medieval and early-modern Iceland (c.f., Harrison *et al.* 2008:Fig.6, Hambrecht 2009:App.1, McGovern *et al.* 2013:Fig.12). Thus, the overall proportion – undoubtedly not actual numbers – of cattle in Greenland appears on average to have been higher than in contemporary Iceland, and in the middle period Greenland archaeofauna (Fig.2.8), only V48 comes near the low cattle proportions seen on the late-medieval to early-modern specialized sheep farms in Iceland (see above).

As visible in Fig.2.8, the proportion of caprines in Greenland correspondingly increased from an average c. 61% in the early assemblage to c. 69% in the late, a trend less distinct, but otherwise comparable to the other North Atlantic areas (see above). In contrast to Iceland and the Faroes, however, goats remained frequent – at some sites even increased and became more frequent – relative to sheep on some Greenlandic farmsteads (McGovern 1985:Tab.7, McGovern 1992b:Fig.138), and new species identification methods suggest that that goat proportions may have been 5-18% higher than implied by the older zooarchaeological analyses (Mainland and Halstead 2005:116). This notable emphasis on goat husbandry in Greenland has been explained by their high milk yields, which meant that they could have replaced cattle as milk producers in marginal agricultural areas (McGovern 1992a:199p, McGovern 1992b:99). This is strongly corroborated by the ruin evidence from the Vatnahverfi region (see section 6.2.3).

In the latest assemblages, most of the overall trends of the previous periods continued, but with increased severity: cattle bones dropped to constitute an average ca. 21.2% of the archaeofauna, with a corresponding increase in caprine husbandry, some sites (E78 and V48) now approaching the same type of livestock composition as on the medieval Icelandic "specialized" sheep farms of the later medieval and early modern period (see above). Pigs disappeared even on the largest farmsteads (when they still appear at V51 in Fig.2.8 it is undoubtedly because the assemblage chronologically inclines towards the previous period). Goat remained frequent, or even increased in relative proportion. As emphasized elsewhere, most of these changes were likely related to climatic deterioration (e.g., McGovern 1985, 1991, Vésteinsson *et al.* 2002). The timing of this most marked change in the Greenland animal husbandry also corresponds with an abrupt change in climatic conditions from around AD 1250 (see section 4.3.1).

The overall continuity of this system of pastoral livestock farming is also echoed in the production from various livestock throughout the settlement period: cattle butchery patterns suggest that in Greenland – as in Iceland – they were kept primarily for a dairy produce, whereas beef production was mainly a feature of large farms and manors (e.g., McGovern 1985:102, Enghoff 2003:71pp, Dugmore *et al.* 2005:28, Edvardsson 2007a:27, McGovern *et al.* 2007:32, Lucas and McGovern 2008:20, Zori *et al.* 2013:159). Norse farmers in Greenland seems to have managed caprines for a household-economic produce of meat, milk, and wool in respective order, i.e. there is no sign of specialization (McGovern 1985:103, McGovern 1992b:101, Enghoff 2003:54p, Mainland and Halstead 2005:117).

In conclusion, pastoral livestock farming in Norse Greenland appears to have been a largely household-economic system of notable stability, although there was a general and clear trend of gradual adjustment of the animal husbandry, probably to local and changing environmental settings. Still, some manors in Greenland

were, at least for the first 200 years or so, able to rear cattle herds proportionally similar to contemporary Icelandic medieval estates. The question is, however, whether it was only, or primarily, environmental factors that determined the layout of the animal husbandry, or if other economic considerations were in play?

This is evidently a question beyond the scope of this section, but a single highly pertinent ethno-historic parallel from northern arctic Norway – which appears to have a number of other similarities to the Greenland Norse economic system settlement – may provide some clues, or at least an interesting comparative perspective:

H.D. Bratrein (1996) has provided an excellent account of this farming system in Karlsøy, North-Troms, bordering the Finnmark in northernmost Norway, where an AD 1723 livestock census provides detailed insights into the animal husbandry layout: these arctic farmers relied heavily on marine resources and livestock farming was of limited scale; there were an average of 3,5 cows per farm, although large farmsteads would boast as many 20-30 heads (Bratrein 1996:12). However, even smalltime farmers went far to maintain a full range, but small stock, of animal husbandry, mainly for a household production of dairy and meats, but also for a limited surplus production of butter and (goat) skins for trade; pigs were very few. This highly intentional strategy was reflected in an average cattle to sheep to goat ratio of 1 : 1.4 : 0.86, where the fairly high proportion of goats was explained by their replacement of cows as milk animals and by the purposeful production of goat and buck skins for commerce (Bratrein 1996:12, 18). Average actual livestock numbers were small, but a few large farms reared substantial herds, enabling a surplus production which was not only traded, but also invested in extra labor for the increased exploitation of tradable marine resources (stockfish and blubber), whereby large farms also became natural centers of wealth and trade.

Agrarian farming was limited to grass cultivation of small coast-near, and normally unfenced, land strips, which saw little amendment (plowing, fertilizing etc.). Instead, the livestock was maintained by nearby summer pasturing and the foraging of naturally available terrestrial and marine resources for winter fodder; pigs especially fed on marine offal. The production of farming, especially dairying, was limited to the summer half of the year and demanded constant herding and milking of the livestock. However, apart from milking stations ('støl') in the *utmark* and the use of islands as naturally delimited grazing areas (see section 6.2.3), most herding activities took place near the farmsteads and use of more distant shieling was uncommon. All in all, the farming strategies practiced in northern Norway were highly extensive, demanded little capital input, but were very labor intensive; since fishing was practiced by the men, farming – e.g. field work, herding, milking etc. – was predominantly carried out by the women.

The similarity of this north Norwegian fisher-farmer economic system with conditions in Norse Greenland, or at least in the setup of the animal husbandry, is obvious, but so are a few differences. Clearly, such an ethno-historic record cannot – regardless of the assumed age and origin of the farming system – automatically be extended to medieval conditions. However, the fact that the Karsøy farmers managed to continue this farming system at least through a later part of the 'Little Ice Age' (see section 3.1.3) on an almost just as marginal arctic frontier suggest that environmental impacts were not alone in determining the layout of the animal husbandry. Could not, for instance, the observed focus on goat husbandry in Norse Greenland have served similar economic interests rather than reflecting environmental stress? Goat skins and hides would store and stack easily in the periods between the infrequent arrival of foreign merchants' ships (see section 2.1.3), and would fetch a decent price on the medieval Norwegian markets (Helle 1982:305). Perhaps the specific mention in the King's Mirror (see opening quite) of 'buckskins' as a Greenland main trade commodity is valid? Drawing a parallel between the Greenland Norse and the north Norwegian farming system is clearly tempting, but it precedes the actual analysis of the detailed settings and functions of Norse pastoral farming and settlement in Greenland.

3. THE FJORDS OF THE FARMERS – THE EYSTRIBYGGĐ AND VATNAHVERFI

Fig.3.1 The Vatnahverfi region is characterized by notable and very local variability in landscape and vegetation, as seen for instance in this photo from the north Vatnahverfi. This part of the Vatnahverfi is highly impacted by its proximity to the Ice Cap and a large glacial out wash plain to the north; a completely scoured and barren *sandur* separates the north Vatnahverfi in two parts, on either sites of which is very lush vegetation. Here in the picture, taken near the Norse farmstead E64C, thick aeolian deposits from the out wash plain have led to the creation of lush meadows around the half-buried rocky knolls (*photo: C.K. Madsen 2005*).

Chapter 3 presents a description of the geographical and environmental setting of the Norse Eastern Settlement – the *Eystribyggð* – with particular focus on its central and most densely settled area, of which the Vatnahverfi region constitutes a substantial part. The chapter opens with a broad geographical outline and moves to the description more particular settings:

First, to approach an understanding of the Norse settlement areas in terms of pastoral farming landscape, the climatic setting of the *Eystribyggð* fjords is in section 3.1 discussed in terms of observed weather patterns and paleoclimatic proxy evidence. In relation to the latter, I present and compare two models and accentuate issues relating to the interpretation of their climatic and environmental implications. In section 3.2, aspects of regional to local level environmental conditions and settings in the central Eastern Settlement and the Vatnahverfi region are outlined; they form the basis for the later discussions of the archaeological survey evidence and observed settlement patterns. The final part of section 3.2 presents a summary outline of the topographical and vegetational settings local to the Vatnahverfi region, discussed mostly from the pastoral farming perspective of pasture distribution and quality.

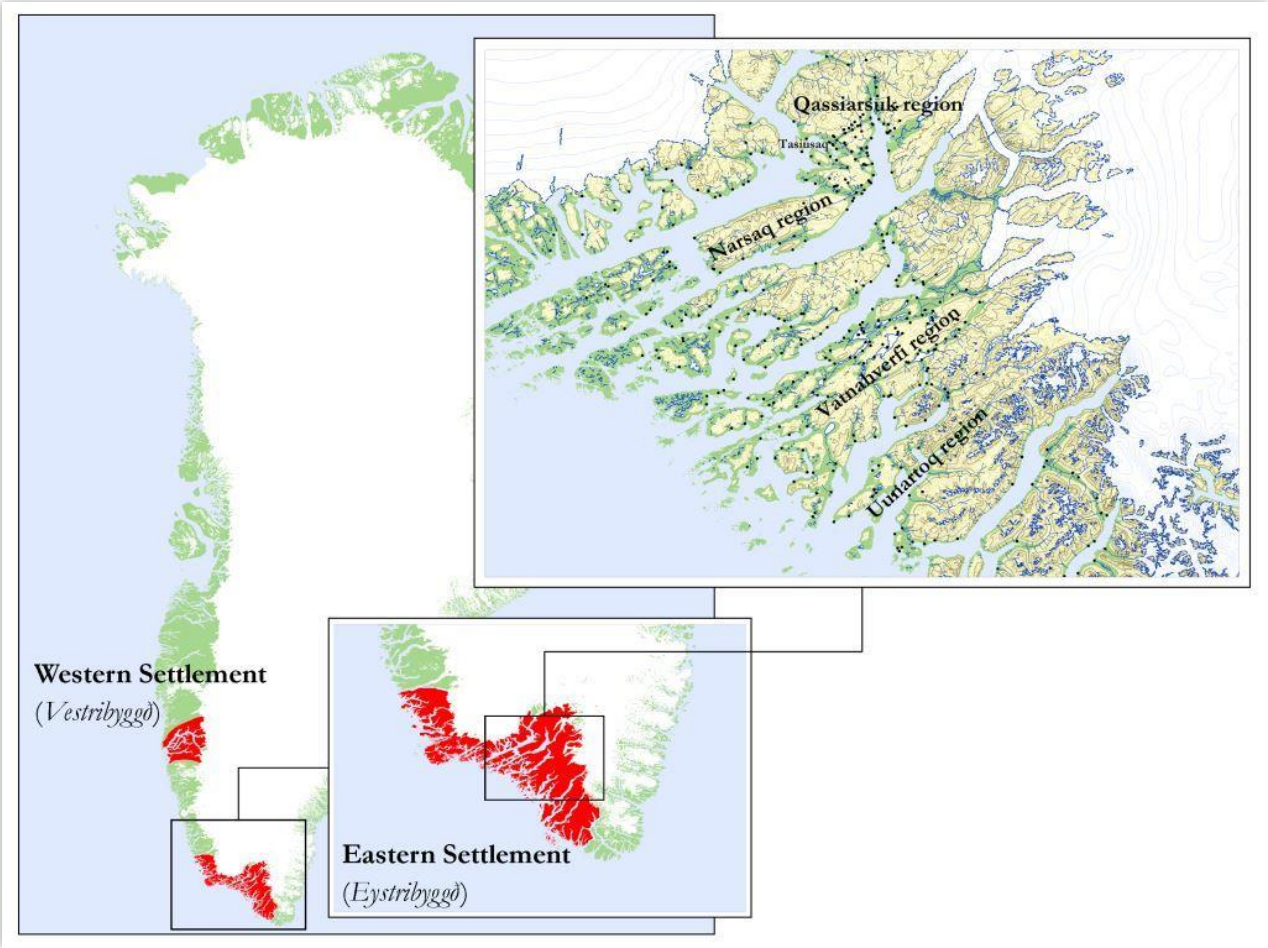


Fig.3.2 Overview map of the approximate areas (red) of the Norse Settlements in Greenland and details of the Eastern Settlement and its central and most densely settled part with indication of ruin group (black dots). Regional areas frequently referred to throughout the dissertation are also indicated.

The *Eystribyggð* was located between ca. 59-61° north, i.e. about the same latitude as between Stavanger and Bergen in Norway. The region is today referred to as South Greenland, as it will be throughout the text. The *Vestribyggð* – the Western Settlement – was located some 500 km north between ca. 63-65° north, i.e. about the latitude as Trondheim in Norway. The total area of *Eystribyggð* is some 12,300 km^2 – i.e. an area only a little larger than Scania – the *Vestribyggð* only ca. 7,900 km^2 (extent of red areas in Fig.3.2). The northwestern part of the Eastern Settlement near todays Ivittuit is sometimes referred to as the *Middle Settlement*. This is an archaeological distinction, however, and the Middle Settlement undoubtedly formed a peripheral part of the Eastern Settlement. Since the case study explored here is the central Eastern Settlement and the Vatnahverfi region (Fig.3.2), I will only occasionally refer to the other two Norse settlement areas.

As visible from the detailed map of the central Eastern Settlement (upper right Fig.3.2), South Greenland is characterized by its deep fjords – between 40-100 km long – that cut into the land separated by mountainous peninsulas. The highest mountains reach some 1400-2000 m, but generally they rarely ascend to more than 1000 m; the mountains are lowest in the outer fjord and gain altitude as one travels inland. Besides latitude and supra-regional weather systems, local weather patterns are determined by proximity to either the Ice Sheet or the open Atlantic, and the fjords consequently display notable climatic and environmental variation on what may be designated the *horizontal axis*. As also seen in Fig.3.2, the Norse ruin groups are found from the edge of the glaciers and all the way out into the outer fjords, resulting that their particular environmental settings vary equally (see below).

3.1 The Weather and Climate of South Greenland

There are probably few places on the earth, where climate has been ascribed a greater role in the fate of cultures and lives of peoples than in Greenland. Not at least has the total depopulation of the Norse settlements tempted scientists to see a direct link between climatic and societal change, or collapse (e.g., Dansgaard *et al.* 1975, McGovern 1991, Barlow *et al.* 1997, Diamond 2005, Andersen *et al.* 2006, Ribiero *et al.* 2012). That climate is a key, if not the key, element in understanding what it is, and was, like to inhabit the fjords of South Greenland is beyond doubt. Yet, anyone who has spent a reasonable amount time in those landscapes will know that they can really be "green" and lush lands and far from the frozen wilderness so often reiterated. On the other hand, archaeology is, as most other field sciences, a summer activity, which can equally distort our experience and perspectives of setting of the Norse settlements. What I attempt here, then, is simply to find some reasonable foothold somewhere in between the archaeologist's land of '*perpetual summer*' (Olsen 2012:13) and the climatologist's, and the 'paradigm of artic marginality's' land of *perpetual winter*'.

This section opens with a description of meteorological records from the Norse settlement areas in South Greenland. It does so not only because it must have been critical to the farmers, but also because it provides the context for interpreting the paleoclimatic record. Accentuated elsewhere, what people living "in an environment" are really concerned with – whether in the past of the present – is weather, whereas climate is more the domain of scientists; or, in other words: '*climate is recorded, weather is experienced'* (Ingold and Kurtilla 2000:187).

This is followed by a brief overview and discussion of the large set of increasingly detailed paleoclimatic proxy records available from Greenland or nearby regions. I began comparing such proxy records in the hope of identifying short-term regional climatic events – which to an extent succeeded – but in reality perhaps learned more about the proxy records than of the climate, or weather, in the medieval Norse fjords in Greenland. Concluding, I present the climate model that is used as a baseline in discussions throughout the dissertation.

Fig.3.3 Early May view of lake Qorlortorsuup Tasia in the Qorlotorsuaq region and the location of ruin group E74. There was no infield to this small farmstead, only the dense, but in spring leafless, willow shrub covering the lacustrine plain in the northeast end of the lake. Surely, spring must have been a critical time on such a marginal farm and it is unsurprising that it changed into a shieling 13th century AD (cf. Tab.8.2)(*photo: C.K. Madsen 2006*).

Tab.3.1 North Atlantic Observed Weather Means

Mean:	Inner Fjord (Narsarsuaq)	Outer Fjord (Qaqortoq)	Outer Fjord (Paamiut)	Outer Fjord (Nuuk)	Iceland South (Reykjavík)	Faroe Islands (Thorshavn)
Ann. Temp.	0,9°C	0,6°C	-0,8°C	-1,4°C	5,0°C	6,5°C
Jan. Temp.	-6,8°C	-5,5°C	-6,6°C	-7,4°C	-0,4°C	3,5°C
July Temp.	10,3°C	7,2°C	5,6°C	6,5°C	11,2°C	10,5°C
Days w. frost	194,8	213,3	233,8	237,5	115	-
Days w. frost, May	9,5	16,9	21,6	23,0	4	-
Frost free days	115	68	61	80	143	-
Acc. Hours of bright sunshine	1431	-	-	-	1249	840
Annual Precipitation	615mm	858mm	874mm	752mm	805mm	1284mm
Days w. snow cover (> 50% covered)	154,2	178,9	219,0	222,9	157	38
Days w. snow cover (> 50% covered), Jan	27,2	30,3	30,7	30,9	-	9
Days w. snow cover (> 50% covered), May	3,4	8,7	24,6	21,4	-	0

Tab.3.1 Displays selected meteorological mean data from observation stations in Greenland and the North Atlantic (data after: Einarsson 1984, Cappelen *et al.* 2001, Cappelen 2012).

3.1.1 Some Observed Weather Patterns

Tab.3.1 displays observed mean weather patterns at four meteorological observation stations in Greenland located at varying proximity to the inland or coast (indicated over the observation station name), as well as one in Iceland and one on the Faroe Islands. Tab.3.1 displays several obvious and significant differences between inner and outer fjord weather: as visible from the table, there are marked differences between observation stations located at different latitudes (Paamiut is located just north of the Eastern Settlement and Nuuk by the Western Settlement); they clearly imply the overall more favorable weather conditions in the *Eystribyggð*.

Focusing on the two observation stations in the latter area – Narsarsuaq in the inner fjord and Qaqortoq in the outer – they also display significant local differences (the middle fjords are transitional): overall, the inner fjords are drier and warmer in the summer, while the outer fjords are colder and get more precipitation. In the winter, temperatures are slightly milder in the outer fjords, but they still have longer snow cover. From a farmer's perspective, the most important difference is revealed in the May weather: days with frost and snow are on average fewer than in the outer fjord, which essentially means that spring starts a month earlier in the inner fjord than in the outer. This was essential because spring was the most critical time in the farmers' yearly round: at this time, fodder supplies were expend or at a critical low, the fat reserves of the livestock was minimal from nutrition deficiency, pasture vegetation was negible and poor in nutrients (cf. Fig.3.3), and sheep/goats were lambing/kidding. Clearly, farmers settled in the inner fjords were better situated to cope with these problems.

The observation stations in Tab.3.1 are all located down to the fjord and do thus not only describe weather variation on a *vertical axis*, i.e. going upland where some Norse farms were also located. However, with increasing altitude, farmers' also had to face overall poorer (colder) weather conditions. I will not go into comparative exploration here, but it is nonetheless worth noting that summer weather in the South Greenland inner fjords was – at least historically – fairly similar to elsewhere in the North Atlantic.

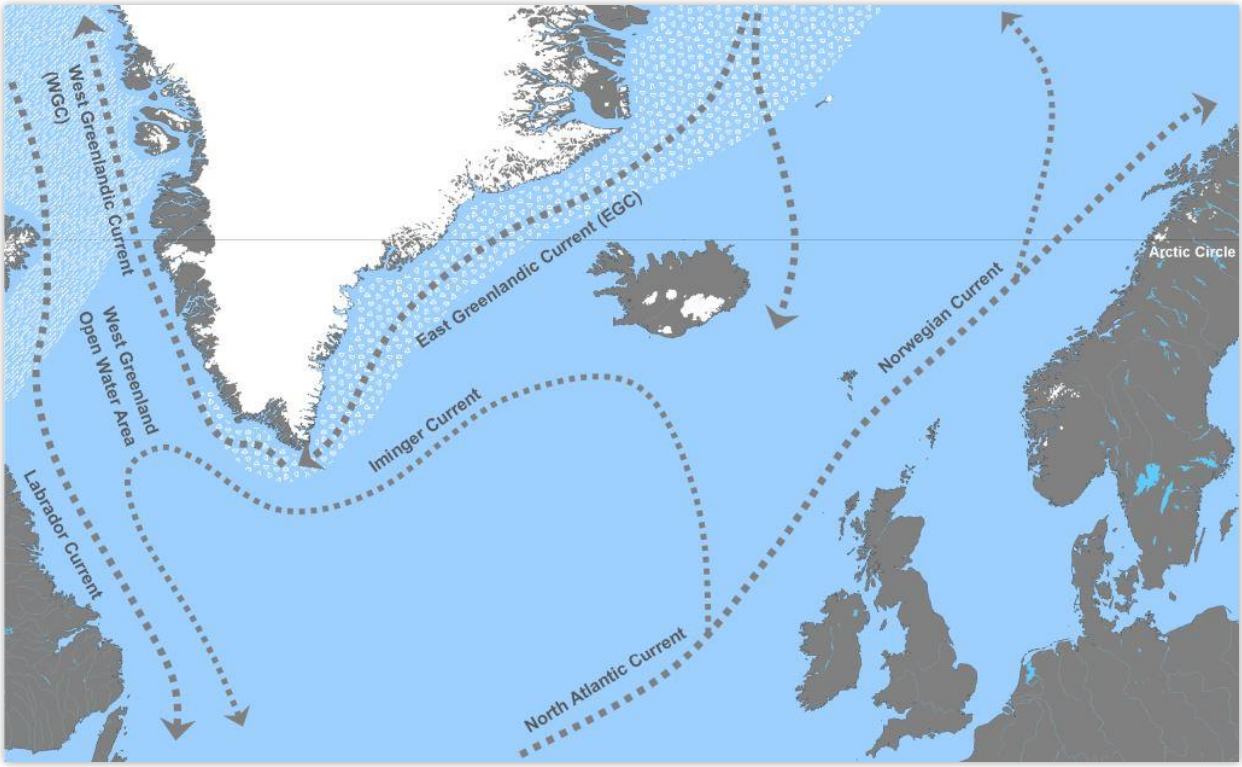


Fig.3.4 The m**ain sea currents of the North Atlantic and normal sea-ice conditions around Greenland at its maximum extent in April-May: triangles indicate the summer drift ice ('storis'), cross-hatching the west ice ('vestis') (*modified after Born and Böcher 2001:Fig.5.2, 5.5*).**

3.1.2 Regional Weather and Drift Ice

The main drivers behind local weather and environmental variation in South Greenland were regional level atmospheric and sea-current circulation systems, primarily the *North Atlantic Oscillation* (NAO), sea currents, and the summer drift ice:

The NAO refers to the development and position of two opposite northern hemisphere sea-level pressure systems that have been found to explain up to 60% of North Atlantic winter temperature, storminess, and precipitation variability – to a lesser extent summer variability – although exactly how large an extent is still disputed (Hurrel 1995:677, Cappelen *et al.* 2001:24, Wanner *et al.* 2001:351p, Vinther *et al.* 2003:40, Rimbu and Lohmann 2010:4616). The relative position of the NAO results in colder and stormier winters in the North Atlantic and milder and wetter winter weather in Northern Europe and Scandinavia, or vice versa, why it is also referred to as the '*temperature seesaw*'. Changes in the NAO are annual, but decadal trends also occur.

However, a more directly perceptible environmental factor in South Greenland is ice, either in the shape of *fast ice* or *summer drift* or '*storisen*', the 'great ice' (Fig.3.4): today, the winter extent of fast ice is limited to the innermost parts of the fjords, but earlier in the 20th century many *Eystribyggð* fjords were covered by fast ice from October to May (Bendixen and Bobé 1921:384). Sediment cores from the fjords suggest that fast ice, or sea ice, in the fjords only became more extensive from the mid-15th century AD (Jensen *et al.* 2004, Kuijpers *et al.* 2014). In any case, winter fast ice in the fjords may not have been fully disadvantageous to the Norse, since they offered easy routes of transport.

More problematic is the summer drift ice – and cold water – which is transported from the Arctic Ocean to South Greenland with the *East and West Greenlandic Currents* (EGC/ WGC, Fig.3.4). The 'storis' normally rounds the Cape Farewell from around January-February and reaches its maximum extent off the mouths of the South Greenlandic fjords in May-June (Born and Böcher 2001:114). The drift ice packs in the outer fjords with several negative consequences for the Norse farmers settled there: it impeded sea travel, seal hunting, and lowered surface air temperatures (Fig.3.8), effecting the delayed spring seen at the weather data of the outer fjord

observation stations in Tab.3.1. The increased presence of sea ice off the coast after ca. AD 1250 and its cumulative negative effects on the Norse settlements has been discussed elsewhere (e.g., Dugmore *et al.* 2009, Ogilvie *et al.* 2009, Kuijpers *et al.* 2014). In addition to these adversities caused by the '*storis*', it probably also meant that hunting voyages from the Eastern Settlement to the *Norðrseta* had to set off already by April-May as to avoid being blocked by 'storisen'.

North of the Western Settlement was the 'vestis' ('west ice'), which in the winter forms in the Baffin Bay and Davis Strait and has its maximum extent in January-February, at which time it normally reaches just south of the Disco Bay (Fig.3.4). The stretch of open ocean from this ice edge and south to around Paamiut – approximately the stretch of Greenland's west coast that separates the Eastern and Western Norse settlements – is ice-free all year round and is referred to as the *West Greenland Open Water Area* (Fig.3.4). This could have allowed sea travel between the two settlement areas throughout the winter and until the arrival of 'storisen'.

3.1.3 Some Paleoclimatic Observations

Although the above described weather and environmental patterns may outline general settings in the fjords of South Greenland, they can evidently not be extended directly to the medieval settlement period. Over the last 25 years the number of high resolution paleoclimatic proxy records from Greenland and neighboring areas have been accumulating to such an extent that it is today difficult to get an overview of overlapping trends and patterns. To achieve some kind of overview, and possibly identify short-term intermediate climatic events that could more observably have influenced pastoral farming in the Eastern Settlement, I compared proxy records from 30 locations in Greenland and Iceland:

The sampling locations of the investigated proxy records are shown in Fig.3.5, whereas sampling types and references are listed in Tab.3.2 (note that some sites were sampled for multiple proxy evidence). Reviewing the findings from these investigations, I noted when authors described a relative change in temperature, storminess, precipitation, and overall environmental stability in the proxy records in the period from ca. AD 800-1500, as well as if this change was described "abrupt". This information is shown in Fig.3.6a-d.

Revising Fig.3.6a-d, the proxy evidence for change in overall climatic and environmental regimes has many implications as well as a good deal of problematic issues. Most noticeable in Fig.3.6a-d is the precise antiphasing of some proxy records, which has been noted before, but not explained (e.g., Meeker and Mayewski 2002, Kuijpers *et al.* 2014). To my mind the precise antiphasing of some proxy records would suggest their joint correctness on some level. However, as I am not a climatologist it is beyond me to clarify or discuss these issues. It does, however, seem fair to state that just about any past climate scenario can be backed by at least two or three proxy records, which serves as a warning not to take the accuracy of single, at times even multiple agreeing proxy records, for granted. However, some overall patterns in Fig.3.6a do appear very consistent:

Most obvious is the prevalence of the Medieval Warm Period (MWP) during the first part of settlement. The notion of a MWP with generally warmer conditions prevailing across the northern hemisphere from ca. AD 900-1300 was introduced by climatologist H.H. Lamb, who also suggested that it could have been a driver in the Viking Age *landnám* in the North Atlantic (Lamb 1995:158, Xoplaki *et al.* 2011). Other authors have since argued that "optimal" *landnám* conditions experienced by colonists during the MWP could even have promoted over-optimistic expectations and strategies that would prove unsustainable in ensuing centuries of deteriorating climate (Keller 1986:152, Amorosi *et al.* 1997:495p, Ogilvie and McGovern 2000:392, Dugmore *et al.* 2006:340p, Dugmore *et al.* 2007b:14). The general prevalence of the MWP is clearly displayed by the "warm" (red) cells in Fig.3.6a.

Equally clear in Fig,3.6a is the transition from the MWP to the 'Little Ice Age' (LIA) c. AD 1550-1850. Since the proxy records are listed roughly according to latitude, it is quite interesting to observe how the LIA sets in with different timing; in the northernmost proxy records the LIA appears to set in already around AD 1100-1150, whereas in the more southern latitudes, and including sample sites near the Eastern Settlement, it appears to set in fairly abruptly around AD 1250. This is concomitant with new evidence of climate change related to the violently explosive eruption of the Samalas Vulcano on the island of Lombok, Indonesia, in AD 1257 or 1258 (Oppenheimer 2003, Miller *et al.* 2012, Lavigne *et al.* 2013). In sum, the fact that so many of the proxy records agree on the early onset of the LIA, and the convincing evidence that it could have been connected to volcanic activity, lends credibility to the notion that the MWP-LIA transition in the North Atlantic ca. AD 1250 may have set in as an abrupt climate event, or even shock (Dugmore *et al.* 2012).

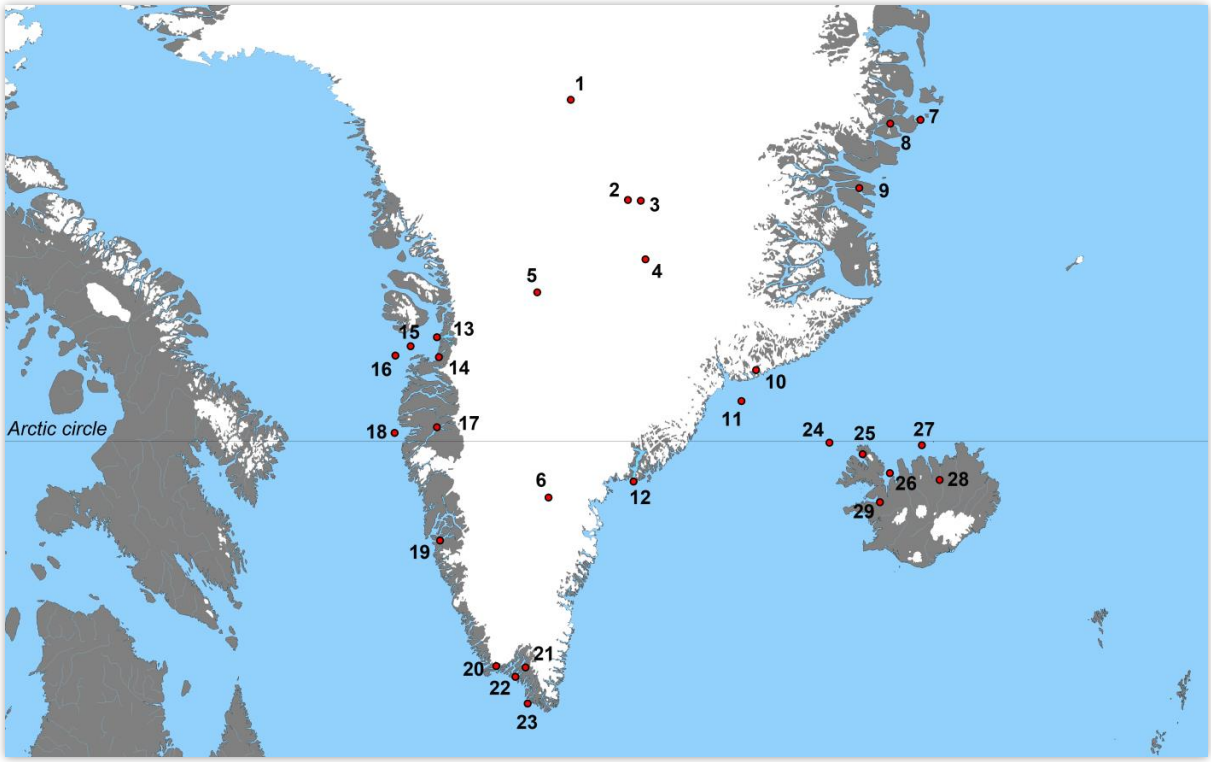


Fig.3.5 Overview map showing sample locations of the climatic records shown in Fig.3.6a-d and discussed in the text. References and site names are listed in Tab.3.2. Note that some locations include more than one sample or sample type.

Table 3.2 – North Atlantic Climate- and Environmental Proxy Evidence

	Reference:	Sample type:	Location name:
1	(Dahl-Jensen *et al.* 1998, Fischer *et al.* 1998, Vinther *et al.* 2010). 1a: (Andersen *et al.* 2006)	Ice core	NGRIP, Greenland Ice Sheet
2	(Dahl-Jensen *et al.* 1998, Fischer *et al.* 1998, Andersen *et al.* 2006, Vinther *et al.* 2010); 2a: (Stuiver *et al.* 1995); 2b: (O'Brien *et al.* 1995); 2c: (Meeker and Mayewski 2002); 2d: (Alastair *et al.* 2003); 2e:(Kobashi *et al.* 2011).	Ice core	GISP2, Greenland Ice Sheet
3	(Dahl-Jensen *et al.* 1998, Fischer *et al.* 1998, Vinther *et al.* 2010, 3a: Andersen *et al.* 2006)	Ice core	GRIP, Greenland Ice Sheet
4	(Dahl-Jensen *et al.* 1998, Fischer *et al.* 1998, Vinther *et al.* 2010, 4a: Andersen *et al.* 2006)	Ice core	Crete, Greenland Ice Sheet
5	(Dahl-Jensen *et al.* 1998, Fischer *et al.* 1998, Vinther *et al.* 2010, 5a: Andersen *et al.* 2006)	Ice core	Milcent, Greenland Ice Sheet
6	(Dahl-Jensen *et al.* 1998, Fischer *et al.* 1998, Vinther *et al.* 2010); 6a: (Andersen *et al.* 2006); 6b: (Miller *et al.* 2012).	Ice core	Dye3, Greenland Ice Sheet
7	(Grønnow *et al.* 2011)	Lake sediments	Sabine Island, NE Greenland
8	(Christiansen *et al.* 2002)	Terrestrial sediments	Zackenberg Delta, NE Greenland
9	(Wagner *et al.* 2000)	Lacustrine sediments	Geographical Society Island, NE Greenland
10	(Jennings and Weiner 1996)Jennings&Weiner 1996	Marine sediments	Nansen Fjord, E Greenland
11	(Moros *et al.* 2006a)	Marine sediments	North Atlantic
12	12a: (Mernild *et al.* 2012); 12b: (Andresen *et al.* 2013)	Marine sediments, glaciers	Sermilik Fjord, SE Greenland
13	(Lloyd 2006)	Marine sediments	Jaobshavn Isfjord, W Greenland
14	(Moros *et al.* 2006b)	Marine sediments	Kangersuneq, W Greenland
15	15a: (Moros *et al.* 2006b); 15b: (Krawczyk *et al.* 2010)	Marine sediments	Disko Bay, W Greenland
16	(Ribiero *et al.* 2012)	Marine sediments	Outer Disko Bay, W Greenland
17	(D'Andrea *et al.* 2011)D'Andrea *et al.* 2011	Lacustrine sediments	Kangerlussuaq, W Greenland
18	(Sha *et al.* 2011)	Marine sediments	Holsteinburg Dyb, W Greenland
19	19a: (Møller *et al.* 2006); 19b: (Seidenkrantz *et al.* 2007)	Marine sediments	Ameralik Fjord, outer, SW Greenland
20	(Kaplan *et al.* 2002)	Lacustrine sediments	Qipisarqo Lake, S Greenland
21	21a: (Jensen *et al.* 2004), 21b: (Kuijpers and Mikkelsen 2009)	Marine sediments	Igaliku fjord, inner, S Greenland
22	22a: (Jensen *et al.* 2004); 22b: (Lassen *et al.* 2004); 22c: (Roncaglia and Kuijpers 2004)	Marine sediments	Igaliku fjord, outer, S Greenland
23	(Andresen *et al.* 2004)	Lacustrine sediments	Angissoq Island, S Greenland
24	24a: (Andresen *et al.* 2005), 24b: (Andrews *et al.* 2009)	Marine sediments	Djüpall, NW Iceland
25	(Patterson *et al.* 2010)	Mollusks	Vestfjords, NW Iceland
26	26a: (Andrews *et al.* 2001); 26b: (Casteñeda *et al.* 2004)	Marine sediments	N Iceland
27	27a: (Jiang *et al.* 2001); 27b: (Casteñeda *et al.* 2004); 27c: (Miller *et al.* 2012)	Marine sediments	N Iceland
28	(Ólafsdóttir and Guðmundsson 2002)	Terrestrial sedimentss	Mývatnshedi, N Iceland
29	(Geirsdóttir *et al.* 2009)	Lacustrine sediments	Haukadalsvatn, W Iceland
30	(Ogilvie 1991, Ogilvie *et al.* 2000, Ogilvie and Jónsson 2001, Ogilvie *et al.* 2009)	Historical records	Iceland

Tab.3.2 Site location (in Fig.3.5), references, sample type, and location name of the climatic or environmental proxy records illustrated in Fig.3.5; number with letter refers to the individual samples in Fig.3.6a-d.

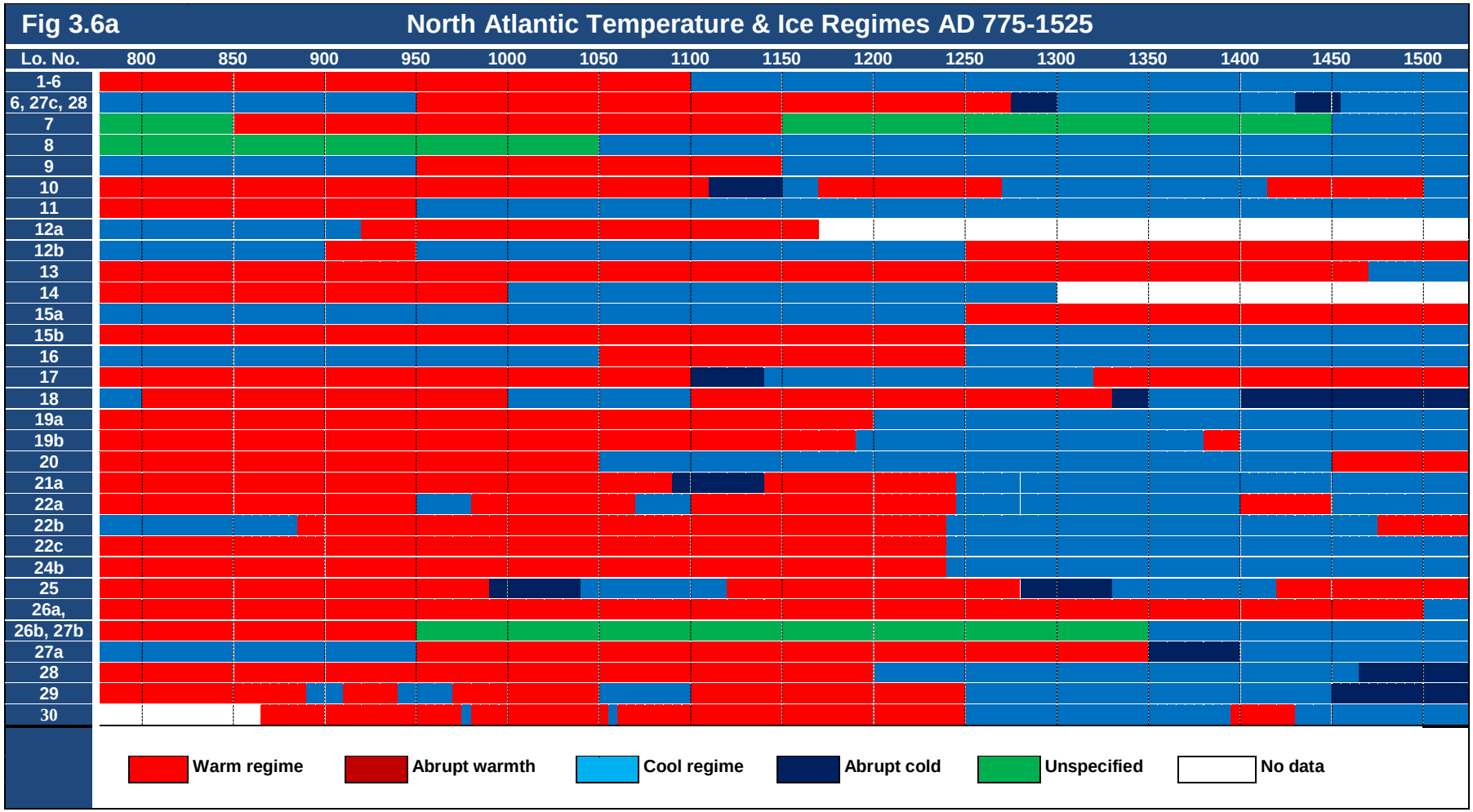


Fig.3.6a Displays the timing of climatic and environmental proxy record evidence from 30 locations across Greenland and Iceland (shown in Fig.3.5 and listed in Tab.3.2). Note that record no. 30 is based in historic evidence from Iceland. Most apparent in the figure is the prevalence of a Medieval Warm Period and its fairly synchronous termination across the North Atlantic already around AD 1250, and overall climate variability in the following centuries.

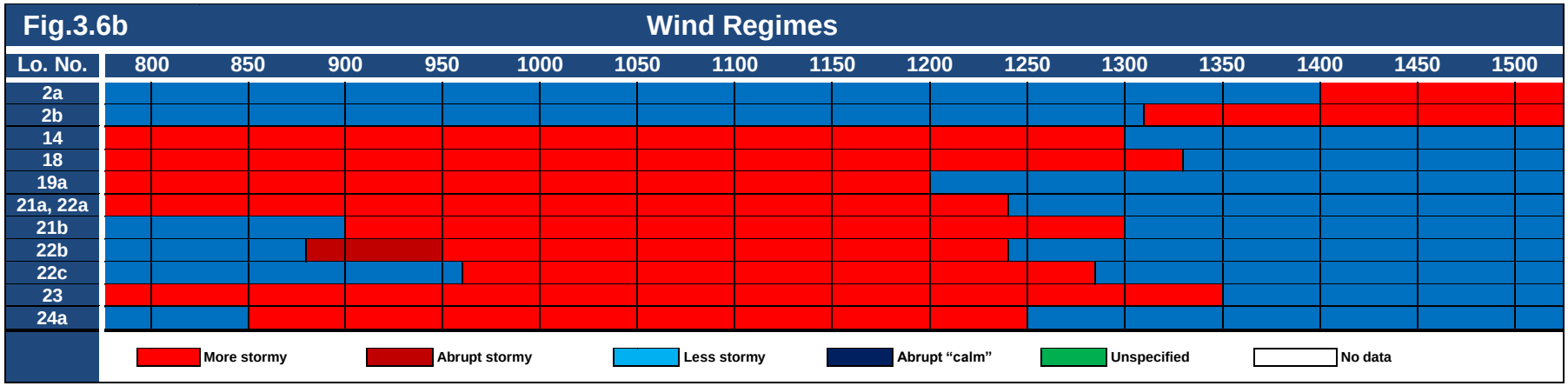


Fig.3.6b Same as Fig.3.6a, but showing recorded changes in overall wind regimes in the proxy record evidence.

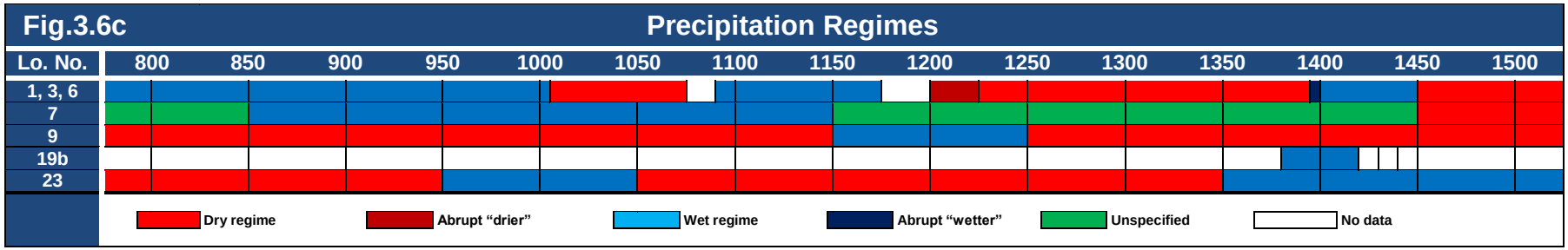


Fig.3.6c Same as Fig.3.6a, but showing recorded changes in overall precipitation regimes in the proxy record evidence.

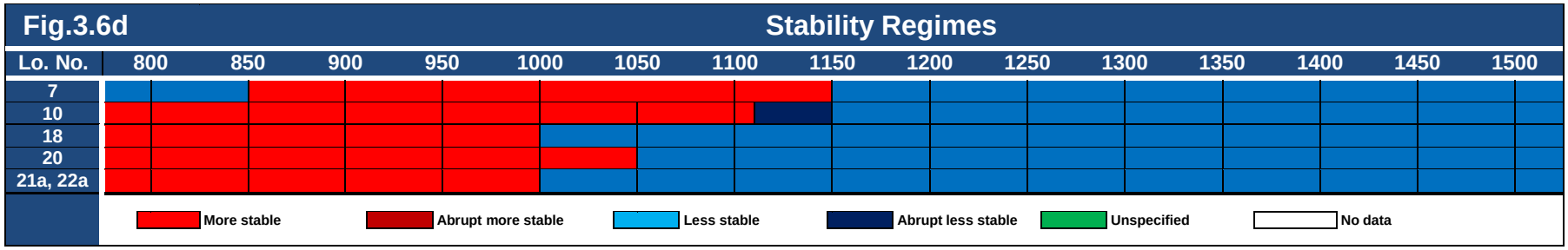


Fig.3.6d Same as Fig.3.6a, but showing recorded changes in overall precipitation regimes in the proxy record evidence.

A third consistent pattern visible in Fig.3.6a is, paradoxically, the general inconsistency of the climatic proxy records AD after ca. AD 1250, which seems to point to overall increased climatic and environmental variability. In terms of weather experienced such unpredictability in weather patterns would have been a major problem for the *grænlendinga*, not at least for their pastoral farming system – and especially if the weather changes were of unprecedented and magnitude, i.e. exceeded the TEK capacity of Norse farmers'. Overall environmental variability has been attributed a major critical element in the demise of the Norse settlements (e.g., Dugmore *et al.* 2009, Dugmore *et al.* 2012:3661).

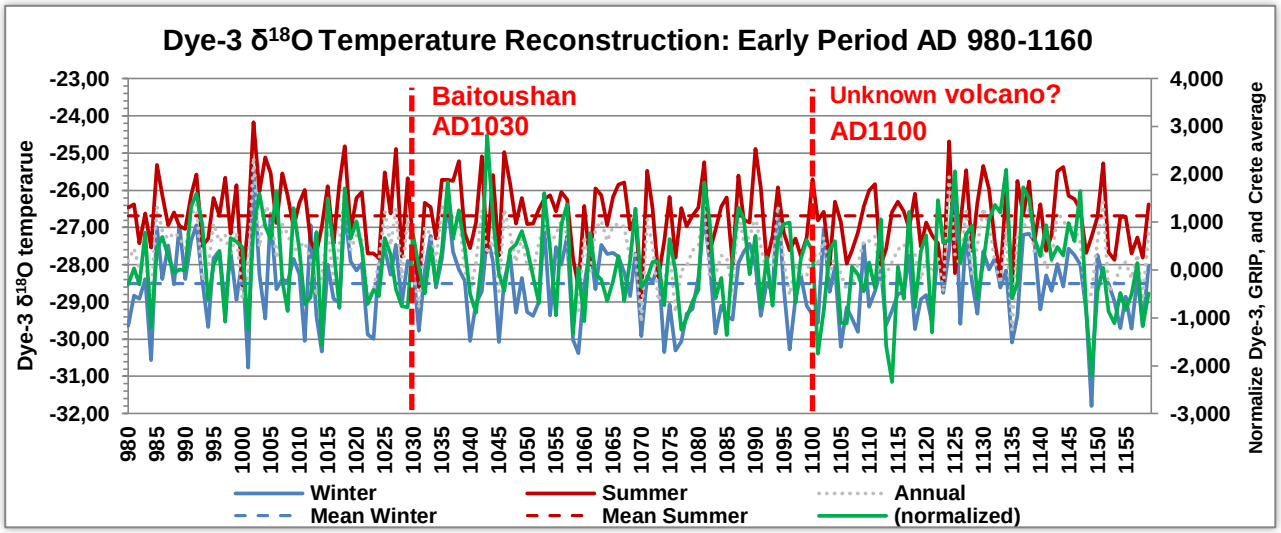
The other proxy records of changing environmental regimes (Fig.3.6b-d) are fewer and thus less robust. Nonetheless, the changes in overall wind regimes (Fig.3.6b) display great conformity, including the precise antiphasing of some proxy records: the ice core proxies for storminess indicates an increase ca. AD 1300-1400, whereas proxies from sediment cores – several of them from the fjords of South and West Greenland – agree on a stormier regime from up until ca. AD 1250-1300. Issues of storminess proxy record antiphasing has been noted and discussed elsewhere (Meeker and Mayewski 2002, Alastair *et al.* 2003, Kuijpers *et al.* 2014), and some authors have suggested that the pattern is perhaps explainable by fewer, but more violent storms during the LIA (Trouet *et al.* 2012). Again, I will not venture into such discussion here. Changes in overall precipitation regimes (cf. Fig.3.6c) are unclear and uninformative, whereas 'stability' regimes – i.e. authors referring simply to transition from more to less, or vice versa, "stable conditions" – display a fairly uniform pattern of increased instability even a little earlier than the AD 1250 onset of the LIA indicated in Fig.3.6a.

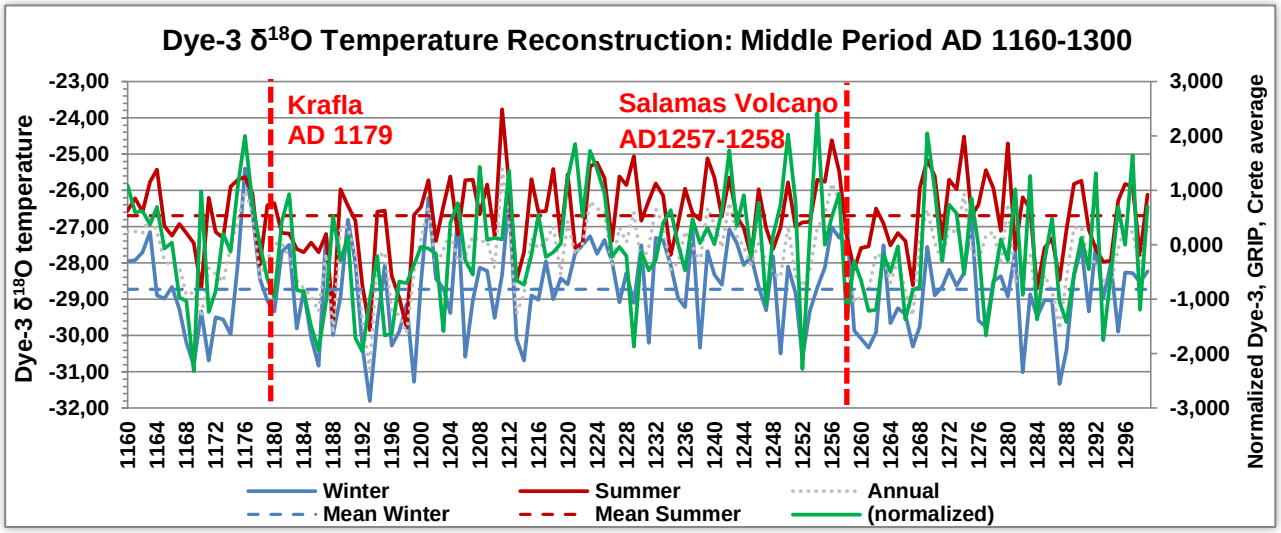
Reiterating, the aim of detecting minor and discrete climatic events from paleoclimatic proxy records have largely failed, since there are few visible and consistent correlations of short-term climatic and environmental changes (Fig.3.6a-d). This failure has likely more to do with the chronological resolution of the different proxies than the actual absence of such climatic events: it can be noted of Fig.3.6a that even the MWP was characterized by several very intermittent colder intervals, of which an abrupt cooling between AD 1100-1150 noted in proxy samples nos.10, 17, and 21a appear the most conspicuous. Other similarly brief cold breaks are well within the range of chronological error, but can for now not be positively matched.

In conclusion, the intermittent intervals of cold spells during the MWP – regardless of their exact timing – would imply that Norse farmers from an early point had to adjust to fairly rapid climatic and environmental change. Although the paleoclimatic proxies do not translate directly into weather experienced, it must be expected that climatic deterioration occurred across the entire setting, e.g. the means observed in Tab.3.1 would simultaneously have been moved to averagely cooler or warmer temperatures, longer and earlier snow cover etc. Attempting to convert the "relative" cold breaks of Fig.3.6a into actual medieval "weather experienced", a study of $\delta^{18}O$ values in mollusks in the Westfjords, northwest Iceland, has suggested that this area over the 120 years between AD 960 and 1080 experienced an average drop in summer temperatures of ca. 4.5°C (Patterson *et al.* 2010:5803). A similar abruptness of climatic deterioration – ca. 4°C in the 80 years after AD 1100 – was reported from Kangerlussuaq, West Greenland (D'Andrea *et al.* 2011:4, Fig.3.6a no.17). In other words, already before the onset of the LIA, intermittent climatic events would have equipped Greenland Norse farmer with sufficient TEK to cope with some extent of climatic variability. On the other hand, the abrupt onset of highly variable and prolonged LIA climatic conditions from ca. AD 1250 was clearly unprecedented (cf. Fig.3.6a); it could have effected major change in the Greenland Norse farming system.

3.1.4 A Climate Model

Ice core $\delta^{18}O$ climate records provide some of the most high-resolution climatic proxy records presently available. In a recent study (Vinther *et al.* 2010) were able to evaluate the correlation of several Greenlandic ice cores with the observed weather by extending climatological records back into the 19th century (Box 2002). They found the winter temperature reconstruction from the Dye-3, GRIP, and Crete ice cores to correlate significantly with observed winter temperatures in southwest Greenland, whereas constructed summer temperatures showed less correlation (Vinther *et al.* 2010:537). Since the winter was the most critical period of the Norse farmers' seasonal round, I, in this study, use the Dye-3 temperature reconstruction as a climatic baseline for the discussion of climate related aspects of farming, past and present, in South Greenland, although I refer to the other proxy evidence as well. The Dye-3 climate record for the three main settlement periods – AD 980-1160, AD1160-1300, and AD 1300-1350 – are shown in Fig.3.7.





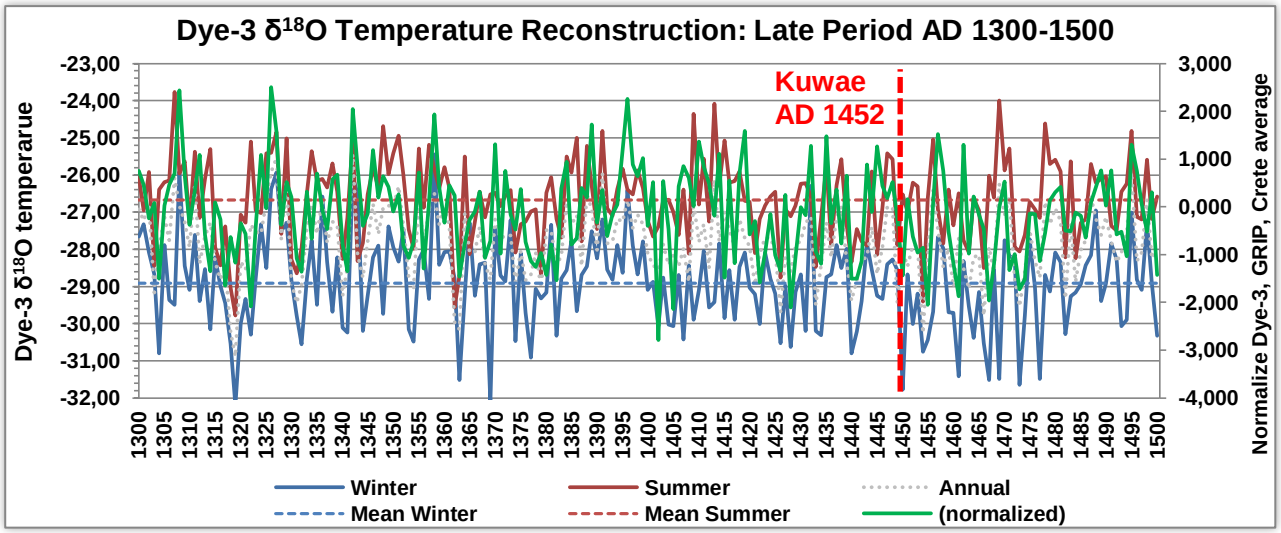


Fig.3.7 Dye-3 $\delta^{18}O$ reconstructed temperature for the period AD 980-1500 (separated upon the periodic division used throughout the dissertation) with indication of mean summer and winter temperature, and of volcanic eruptions identified from GISP2-suphate records (data after: Oppenheimer 2003, Vinther *et al.* 2010).

Arguably, any single ice core temperature proxy recorded cannot be trusted any further than any other single proxies and I mainly use the Dye-3 climate model to discuss overall trends. The Dye-3 climate model unsurprisingly conforms to the outlined transition from a warmer MWP to a colder LIA (cf. winter- and summer means in Fig.3.7). Both winter and summer temperatures were apparently affected, although in the final settlement period especially the winter. Fig.3.7 also indicates volcanic eruptions recorded in the GISP2 ice core (Oppenheimer 2003). An abrupt and distinct both summer and winter cooling following the AD 1257-1258 Salamas eruption is clearly evident, which again corresponds with the onset of the LIA in most of the climatic proxy records (cf., Fig.3.6).

However, additional "blips" in the Dye-3 climate curve are noticeable: the AD 1030 Baitoushan was followed by a single year of extremely cold summer temperature and colder than average winter temperature; the AD 1100 eruption of an unknown volcano appears to have caused lower than average summer temperatures, but had little effect on winter temperatures. The effects of this eruption may perhaps also be linked to the ca. AD 1100-1150 cooler interval that was implied by several other proxies (cf. Fig.3.6). This could have been a minor "climate event", but as it involved little decrease in winter temperature, it may not have affected the Norse farming system significantly. However, already in AD 1179 the Krafla eruption caused another and more significant blip in the curve, which appears to have impacted both summer and winter temperatures over a small decade. Chronologically, the Krafla eruption is not further offset from the multiproxy evidence for an AD 1100-1150 cooling (see above) than they might reflect the AD 1179 event rather than an AD 1100-1150 event.

Concluding, the latter two eruptions and the subsequent temperature cooling is the closest I have come to identifying potential minor, but abrupt climatic events that could directly have influenced Norse pastoral farming. Since the farmers', as discussed above, were undoubtedly capable of coping with single- or multiyear unfavorable seasons, the latter decadal episode seems the most likely candidate for a minor climate event up until the AD 1257-1258 extreme event. However, simply establishing "that it got colder at times" is clearly not enough to understand the direct impacts on the Norse farming- or social-ecological system. I will return to a more lengthy discussion of this issue in chapter 9 after having presented and discussed the settlement evidence from the Vatnahverfi.

Fig.3.8 Remains of moored summer drift ice off the shore of Qaarsuatsiaq, the location of ruin group E190. At such outer fjord Norse settlement sites drift ice can completely pack and block access to the site for months. Besides its negative effect on transport and communication, the drift ice lowers surface air temperatures, both delaying and shortening the growing season. In recent times, sheep farming was attempted here, but is now abandoned, which is a testimony to the marginal setting of the site (*photo: C.K. Madsen 2009*).

Fig.3.9 Greenland Norse settlement patterns, to a large, extent appears to be about occupying niches in the landscape that offer rich vegetation: here, in small southern faced valley deep inland from the Sioralik; ruin group E304 is located on a level plain of old fluvial deposits (indicated by the arrow), which have been vegetated by fairly rich meadow hay; the surrounding slopes are covered in dwarf-shrub heath. Undoubtedly, exploitation of these resources was the main reasons for the location of this and many shielings (*photo: C.K. Madsen 2006*).

3.2 Vegetational Patterns in the Fjords

However, the Norse farmers might not have been as directly affected by adverse climatic conditions in the form of cold, storminess, or precipitation as they were by the effect of deterioration on the vegetation surrounding their farmsteads: it lowered the productivity of infields and outfields alike; it simultaneously depraved them of, and set higher requirements for needed, winter fodder; and farmers could do little actively to mitigate such deficiencies. As I will demonstrate below, large and well-managed infields was a feature mainly reserved for the largest Norse farmsteads, whereas the more regular farmsteads probably relied more on natural resources both for winter fodder and pasture (Fig.3.9).

Norse land use patterns have been in focus since J. Iversen discovered the first presumed *landnám* layer in Greenland, i.e. a thin charcoal-rich horizon related to initial clearing of shrub by fire to establish infield areas (Iversen 1934). For a long time, palynologists addressed Norse land use in terms of the, mostly negative, effects of introduced farming and grazing livestock on the Greenlandic landscapes, i.e. overgrazing leading to erosion (e.g., Jacobsen and Jacobsen 1986, Fredskild 1988, Jacobsen 1991, Fredskild 1992). The decline in natural shrub vegetation and plant species following Norse *landnám* is richly documented from a list of sites (Fredskild 1988, Edwards *et al.* 2007, Perren *et al.* 2012). However, recently some investigators have begun to reinterpret this evidence: for instance, several authors have pointed to changes in storminess rather than overgrazing as an explanation for increased erosion in a later part of the settlement (e.g, Kuijpers and Mikkelsen 2009, Kuijpers *et al.* 2014); others scholars have even suggested some extent of Norse shrub management (Schofield and Edwards 2011, Ledger *et al.* 2014b).

However, just as the paleoclimate proxy evidence, the palynological proxies only provides a relative range – i.e. more or less shrub, grassland – and the vast majority of the investigations have been carried out very near to the Norse farmsteads, in many cases large farmsteads. In order to better understand the highly dispersed settlement pattern in the Norse *Eystribyggð* (cf. Fig.3.2), I here explore outfield resources based on present vegetation patterns:

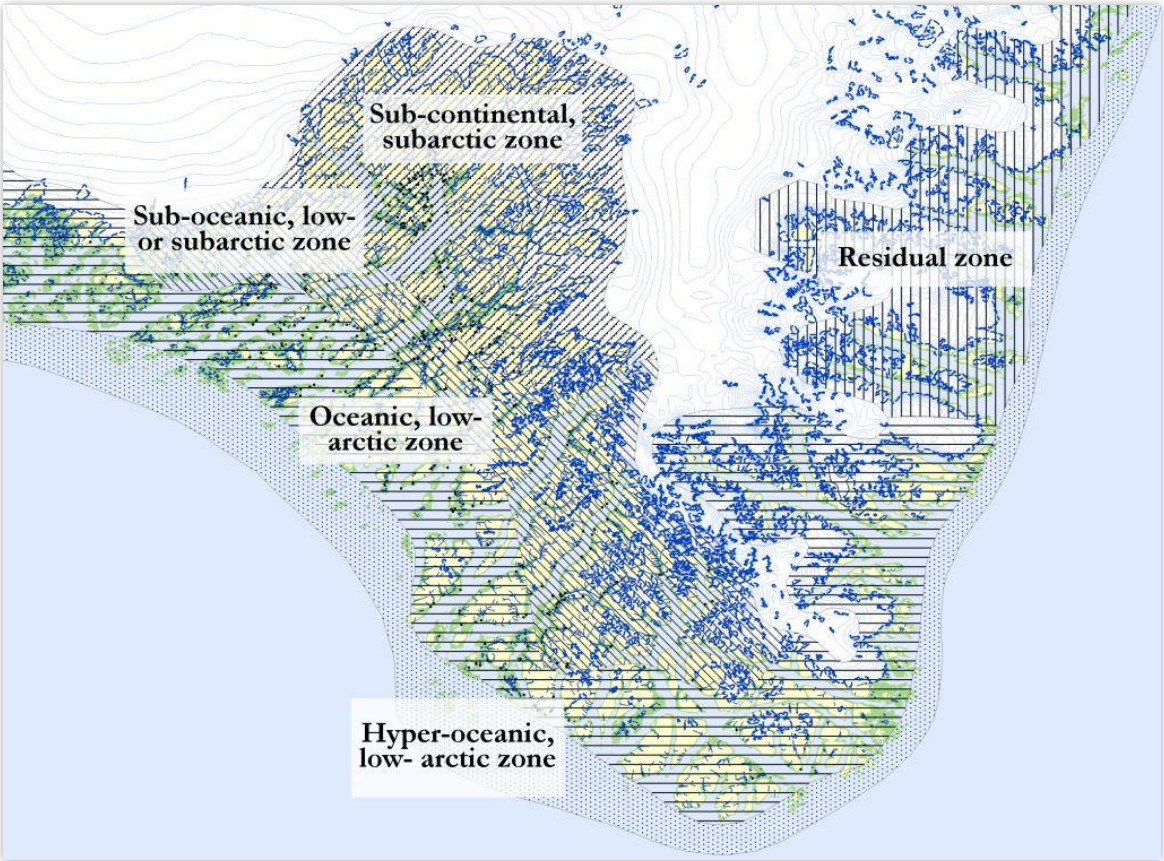


Fig.3.10 The regional vegetational zones in the fjords of South Greenland. The inner fjords of this region is the only place in Greenland where one finds a sub-continental, subarctic environmental niche and this was, unsurprisingly, where Norse settlement was most densely concentrated (vegetational zones after: Feilberg 1984a)

3.2.1 Subregional Vegetation Patterns

The fjords of South Greenland can be divided on four vegetational zones (Fig.3.10) which reflect their relative proximity to the Ice Cap or the North Atlantic (Feilberg 1984a). Each zone is characterized by certain dominating plant communities (see below). The inner fjords of the central Eastern Settlement can be described as a sub-continental, subarctic zone (> +10°C in the warmest summer months, cf. Tab.3.1); the middle fjords constitute a transitional sub-oceanic, low- or subarctic zone; the outer fjords a oceanic, low-arctic zone (July mean temperature < +10 °C, cf. Tab.3.1); and the coast a Hyper-oceanic, low arctic zone. The vegetational zones only describe very general patterns on the horizontal axis and there is much variability within each zone. Some of this variability can be approximated by satellite based vegetation mapping: Fig.3.11 displays a 25x25 m vegetation mapping, generously provided by the DMU (Tamstorf 2001). This mapping distinguishes seven vegetation types (and six non-vegetation surfaces):

Dwarf shrub heath; a varied plant community, but dominated by shrub of northern willow and glandular birch; in the inner fjords the dwarf shrub heaths include sizable patches of grassland, sedges and herbs, whereas in the outer fjord the shrub is broken by patches of crowberry and bilberry dominate in the latter.

Lichen heath; is a lichen dominated heath type mostly found at higher altitudes.

Copse; is a varied plant community, but dominated by large expands of continuous willow and birch shrub and thickets of up to 2m (occasionally up to 4-5m) with an undergrowth of grasses, sedges, and mosses (inland), or dwarf shrub heath (coast).

Fen/meadow; is dominated by sedges, grasses, and mosses.

Grassland; is dominated by different species of natural grasses and sedges; in South Greenland, it is normally found on somewhat inundated land.

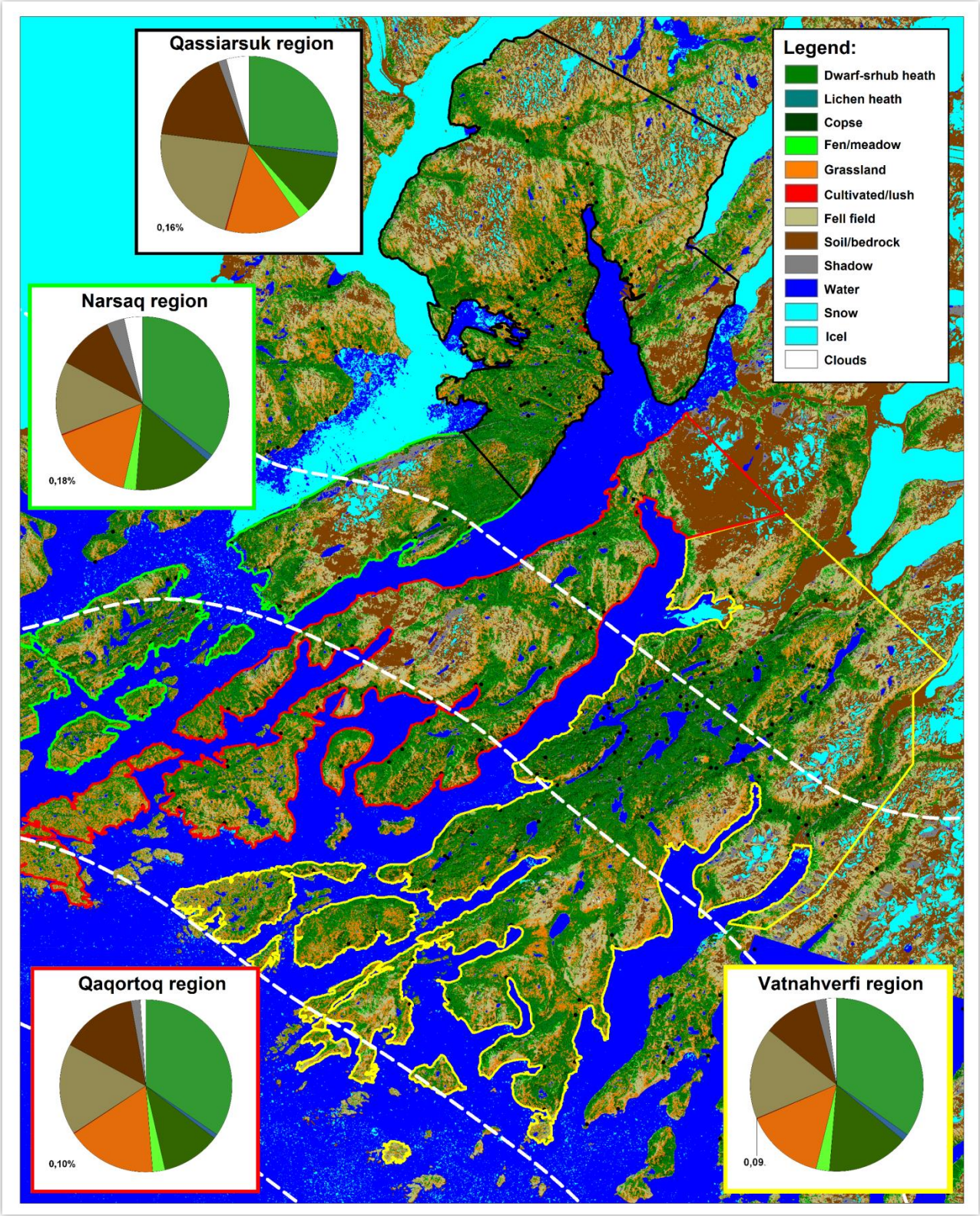


Fig.3.11 Satellite based vegetation mapping of the central Norse settlement area in South Greenland. Relative proportions of the most common plant communities in each region are shown with percentages of cultivated/lush land. The white dashed lines indicate the larger vegetational zones. There are few vegetational differences between these core Norse settlement regions.

Cultivated/lush; if not actually cultivated fields, these are areas dominated by lush natural grassland.

Fell-field; is a poor plant community where only the hardiest plants can survive, e.g. dispersed and low growing patches of lichens, grasses, and dwarf shrubs.

The six non-vegetation surfaces are: soil/bedrock, water (lakes and fjords), and snow or ice, clouds, and shade where no monitoring is possible.

Reviewing Fig.3.11, there are overall no differences in the proportional regional distribution of the most common plant communities that cannot be attributed to local geological and topographical differences: all the central fjords of South Greenland are heavily dominated by dwarf-shrub heath and copses. Grassland is also fairly prevalent, whereas the other vegetation types are poorly represented, not at least the cultivated land that does not in any region exceeds more than 0.20% of the total vegetated area. In chapter 8, I argue that meadows especially were targeted by the Norse farmers, but as seen in Fig.3.11 such areas were very small. It should be noted that fen/meadow areas are expected to be somewhat underrepresented in the satellite vegetation mapping: they are mostly found in narrow bands along lake shores, streams, and rivers, which means that they are "swallowed up" by the neighboring larger plant communities in the weighing of 25x25 m cells.

As noted above, *landnám* was followed by a rapid decline in natural plant communities, at least nearest to the farmsteads. Thus present vegetation patterns cannot be directly transposed on a medieval setting. Although most palynological studies imply that the vegetation never fully recovered from Norse farming activities (e.g., Fredskild 1988, Edwards *et al.* 2007, Gauthier *et al.* 2010), the fact that dwarf-shrub heath and copse is so dominant, even after ca. 100 years of renewed farming, must certainly suggest that this resource was never close to being depleted. On this level, at least, present vegetation patterns appear to provide a reasonable analogue. One exception, however, may be fjord near cultivated/lush areas: recent bathy-metric soundings and sediment cores at in the South Greenlandic fjords have implied that relative sea-level rise may have claimed large extents of the most productive low-land grasslands and meadows near the farmsteads (Mikkelsen *et al.* 2001, Mikkelsen and Kuijpers 2008).

While there are few vegetation differences on sub-regional scale, local variations are more obvious: Fig. 3.12 displays the aggregate areas (in km^2) of the most common plant communities (and soil/bedrock) in the Vatnahverfi region divided on the vegetational zones. Whereas the inner- and middle ford appear reasonably similar, the outer fjords seem to have far greater areas of dwarf-shrub heath and grassland. This is quite at odds with settlement densities in the area (see section 7.1.2) and serves as a warning that this vegetation mapping displays only vegetation type, not its quality in terms of pasture or fodder. This could be mitigated by introducing further gradients, but here I only mean to highlight the richness of shrub vegetation.

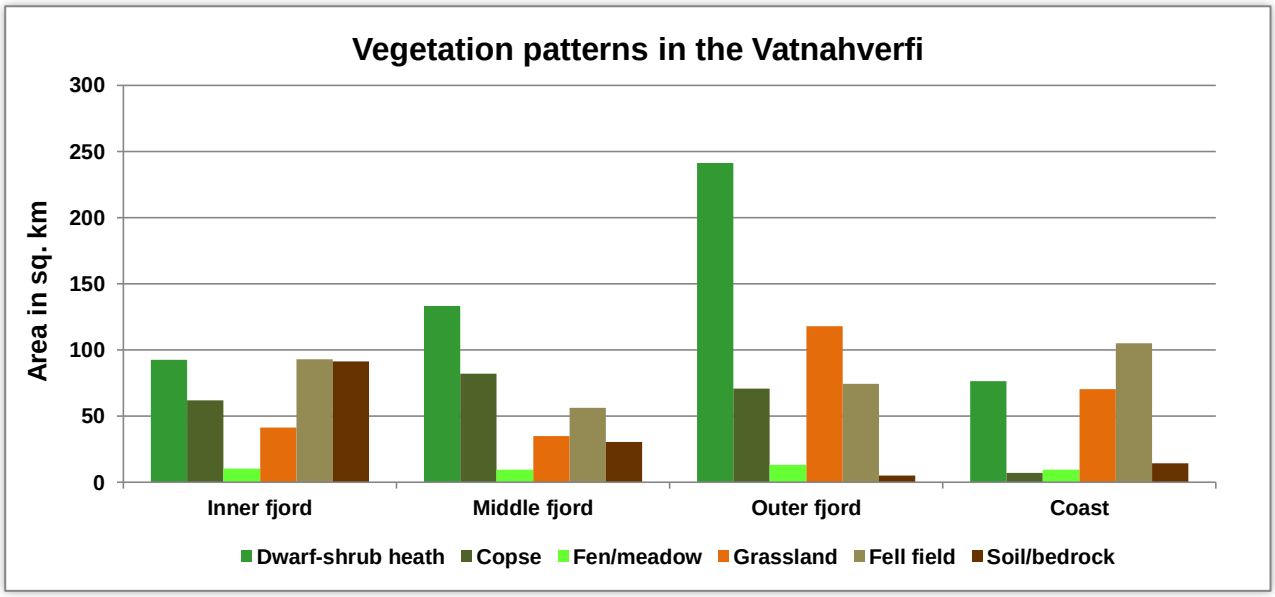


Fig.3.12 Displays the distribution of aggregate areas in km^2 of the most common plant communities in the Vatnahverfi region as they divide on sub regional vegetational zones. The figure is discussed in the text.

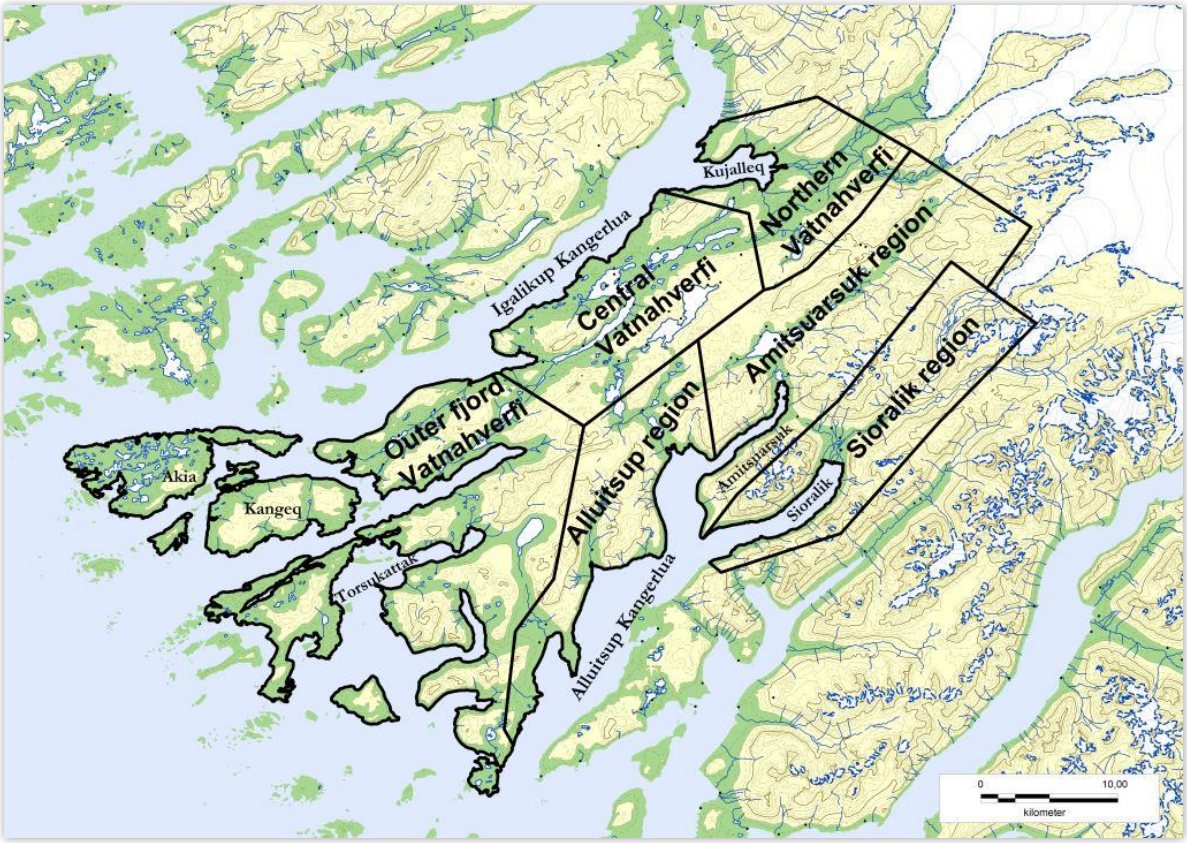


Fig.3.13 Overview map of the Vatnahverfi region and sub-regions separated in the analysis.

3.2.2 Landscapes of The Vatnahverfi

The case study area designated the 'Vatnahverfi region' comprises the peninsula between the fjords of Igaliku Kangerlua and Alluitsup Kangerlua (see section 4.2, Fig.3.13, Fig.4.20). The distance from coastal islands to the inner fjord is some 65 km; there are some 16-18 km across the main peninsula. Including all of its islands, the region has an area of some 1560 km, i.e. just a little larger than the Faroe Islands. The background for the archaeological surveys and definition of this case study area is described in section 4.2 and this section only presents a short description of the six sub-regions distinguished in this study (Fig.3.13). It should be noted that these sub-regions are arbitrary and do not reflect delineated medieval or even geographical regions. However, comparing Fig.3.10-3.11, 3.13 it is clear that the subdivision corresponds roughly to the vegetational zones; without design, the sub-regions also largely correlate with a pasture quality survey of 1977-1988 and I refer to this work for the below description of sub-region farming/pasture quality (Thorsteinsson 1983).

Northern Vatnahverfi:

Northern Vatnahverfi is split into three areas by natural features: the fjord of Kujalleq divides the area in a northern and southern part, whereas a sandur (Fig.3.1) divides it on a western and eastern half. The mountains north of the Kujalleq are high (1660 m) and steep, confining the settled area to a strip of land along the fjord (Fig.3.14). A single valley offers access to some grassland areas closer to the glaciers; otherwise the area is dominated by dwarf-shrub heath (cf. Fig.3.11).

At the head of the Kujalleq fjord is a small plain – Igaliku Kujalleq (Fig.3.14) – which opens into the sandur and inland part of the Vatnahverfi region. This is one of the most fertile areas in the entire region and the location of major church farmstead E66. Igaliku Kujalleq is also where sheep farming was first reintroduced to the region and the vegetation near the farms, along the entire south coast of the Kujalleq, and the nearby upland area is heavily marked by grazing. However, travelling east and inland from Igaliku Kujalleq, the shrub vegetation is less affected and fairly rich. The pasture quality is described as good (Ibid.Tab.76).

Fig.3.14 View across the head of the Kujalleq fjord. As visible in the photo, the mountains ascend rather abruptly from the fjord, confining the settlement area to a narrow gravel terrace along the fjord. Ruin groups E64 and E209 are located on the terrace on the far right (*photo: C.K. Madsen 2010*).

Fig.3.15 View of the plain and farm at Igaliku Kujalleq at the head of the Kujalleq Fjord. The ruins and church of E66 are clearly visible in the front of the picture; the edge of the sandur can be seen in the upper right corner (*photo: C.K. Madsen 2005*).

Fig.3.16 View of the central Vatnahverfi lake basin. Besides the dominant dwarf-shrub vegetation, sizable areas of wetland sedges can be found on many of the lakes shores (*photo: C.K. Madsen 2011*).

As described above, katabatic winds and aeolian deposits have created a 1.2-1.5 km wide and almost completely barren sandur that parts the northern Vatnahverfi in two; once on the other side of the sandur, however, the vegetation immediately becomes rich and lush, especially in copse and dwarf shrub heath, but also with sizable meadows along the edge of the sandur (Fig.3.1).

Central Vatnahverfi:

Travelling south along the sandur, it ends rather abruptly as the terrain lowers into a northeast-southwest oriented elongated valley basin (10-20m.a.s.l.) with a series of connected lakes that extent the full length of the central Vatnahverfi region (Fig.3.16) . The slopes on the sides of the lake basin are richly vegetated by copse and dwarf-shrub heath. On lacustrine plains at the edges of the lakes are considerable patches of meadowland or mire, most of it today cultivated, and rich sedge communities are found on the banks of many of the lakes. Ascending up into the adjoining mountains – here referred to as the *central Vatnahverfi highland* – the copse vegetation is replaced by dwarf-shrub heath and, at first, sizable tracks of grassland (Fig.3.17). Deeper into the highlands, however, poorer dwarf-shrub heath is completely dominant (Fig.3.18). The pasture quality in the central Vatnahverfi is described as good (Ibid.Tab. 73-74).

Fig.3.17 Rolling fells on the western edge of the central Vatnahverfi highland – just a few hundred meters from ruin group E167 – where considerable extents of natural grassland pastures are found among the dominant dwarf-shrub heath vegetation

Fig.3.18 View of lakes in the inner part of the central Vatnahverfi highland, where even grass vegetation becomes limited and is completely replaced by dwarf-shrub heath. Only a few Norse farmsteads – or shielings – are located on the edge of this vegetation poor landscape (*photo: C.K. Madsen 2008*).

Fig.3.19 View of outer fjord landscape – the Torsukattak – with its many small islets and skerrie. In sheltered valleys in the inner part of the fjords, such as here at ruin group E339 – some shrub-vegetation and grass vegetation is found, but otherwise the outer fjords are completely dominated by crowberry heaths (*photo: P.B. Heide 2009*).

Fig.3.20 In the most exposed parts of the outer fjords, the vegetation is completely dominated by crow-berry heaths and swampy mires, such as here by Torsukattak and close to ruin group E95b (photo: C.K. Madsen 2009).

Outer fjord Vatnahverfi:

The outer fjords are generally dominated by crow-berry and blueberry heaths (Born and Böcher 2001). However, at the transition from middle to outer fjord, as well in the most sheltered places of the outer fjord (Fig.3.19), some reasonable shrub land pasture can be found. However, on the exposed stretches of low coast, even dwarf-shrubs heaths are exceedingly poor (Fig.3.8, 3.20). This is reflected in Thorsteinsson's pasture quality survey (1983: Tab.60-62, 68-79), where the vegetation in the "inner belt" of the outer fjord – including the Island of Kangeq – is described as average, whereas pasture quality in "outer belt" ranges from poor to very poor, such as on the island of Akia (Fig.3.13).

Alluitsup region:

In terms of settlement and farming landscapes, the first two thirds of the Alluitsup Kangerlua gives off a poor first impression: the fjord is much more exposed to the Atlantic and the mountains ascend steeply from the fjord, so that settlement areas are confined to intermittent valleys or narrow land strips (Fig.3.21). The vegetation is dominated by dwarf-shrub heath, but with sheltered niches with lush copse. The pasture quality ranges from poor to average (Ibid.Tab.80.81).

Amitsuarsuk and Sioralik regions:

Towards the head of the Alluitsup Kangerlua, it splits on two fjord arms, the Amitsuarsuk and the Sioralik. These are treated separately in the settlement pattern analysis (see chapter 7), but can be treated collectively since they share topographical and vegetational characteristics: they are both narrow fjord arms with steep mountain slopes on either side; however, where sheltered, the shrub vegetation is lush. At the heads of both fjords are plains that sustain rich copse and dwarf-shrub heath vegetation (cf. Fig.3.22). The pasture quality is described as good (Ibid.Tab.78-79), mostly because of the dense copse that deeper into the mountains changes to regular subarctic scrub forest, especially in the valley that runs parallel with the fjord above Amitsuarsuk.

With this concluding description, the basic environmental setting for the farming settlements, past and present, in the Vatnahverfi region should have been clearly established. It should also be clear that a key to understanding Norse settlement lies in recognizing such landscape niches that enable pastoral farming. Although I have not attempted systematic analysis here, I stress that the agro-ecological field surveys carried out in the years after 1976 provide highly detailed and quantified datasets that may be fed into future landscape models.

Fig.3.21 View of narrow and poorly vegetated strip of coastal land along the Alluitsup Kangerlua, where ruin group E180 is located. Generally, the Alluitsup Kangerlua presents a poorer settlement landscape than Igaliku Kangerlua, not only because of the vegetation, but also because of the steeply sloped mountains bordering the fjord (*photo: C.K. Madsen 2006*).

Fig.3.22 View from the (former) waterfall of Qorlortorsuaq towards the head of the Ameralik, where ruin group E91 is located. As seen in the photo, the central part of the plain is today farmed, but the mountain slopes are still vegetated by dense willow scrub (photo: C.K: Madsen 2006).

4. THE ARCHAEOLOGY OF GREENLAND AND THE VATNAHVERFI

'It is known (…) that Julianehaab District is the most fertile place in the Western Settlement, that grass grows everywhere in the fjords, extensive scrub forest by Greenlandic measure, that salmon is found in every river and also all kinds of other fish (…). Thus, no one can deny that as favorable as these places must have been to the Norsemen of old, as favorable they are still. Anyone who visits these pleasing meadows and sees everywhere grass and scrub forest in such an abundance that many families could it not reduce, less consume, must equally wonder, why the old Europeans did abandon them (…) and why none after have availed themselves of the profusion that is here brought forth year after year'.

(au. trans. after Thorhallesen 1776;53p)

In 1767-1773 Icelandic priest Eigill Thorhallesen travelled a large part of Greenland's West Coast to evaluate the potentials of the land for resettling it with Icelandic farmers;the above excerpt is a closing remark on this journey. E. Thorhallesen's evaluation stands in notable contrast to perspectives of the 'paradigm of arctic marginality' (see chapter 1). Moreover, the quote touches upon another aspect of Norse culture in Greenland: its archaeological exploration was tied to prospects of renewed farming, just as renewed farming was – when it eventually initiated – tied to the lands and tradition of Norse farming. Chapter 4 describes the archaeological aspect of, and background for, this cultural-historical interaction (the reverse is explored in chapter 8).

Where chapter 2 outlined the wider North Atlantic cultural and historical context for Norse settlement in Greenland, and chapter 3 concerned environmental settings and their changes, chapter 4's first main section deals specifically with the development of archaeology in Norse Greenland: it is a literary review and discussion of archaeological investigations carried out in Greenland and the Vatnahverfi in the period 1723-2005 with special focus on activities in the latter region. In short, the first section of chapter 4 is the archaeological introduction to chapters 5. The second section of chapter 4 introduces and summarizes the archaeological field activities of the Vatnahverfi-Project 2005-2011 with special focus on the ruin group surveys, i.e. the settlement survey evidence that is presented and analyzed in the following chapters. In short, the second section of chapter 4 is the archaeological introduction to chapters 7-8.

Fig.4.1 View of Norse (E69) and modern farm at Timerliit in the central Vatnahverfi, South Greenland. Today, all the Inuit sheep farms are located right next to once larger Norse farmsteads, clearly signaling an overlap in farming and land use traditions (*photo: C.K. Madsen 2005*).

4.1 THE ARCHAEOLOGY OF NORSE GREENLAND 1723-2005

'(…) We have the outmost confidence in him, that he (Maj. Paars) will spare no diligence or effort, neither will be deterred by any danger or difficulty, but will seek in any possible way, by some route across the country, to reach the aforementioned Eastern Settlement; there to learn whether the descendants of the old Norwegians does there still reside, what language they speak, whether they yet are Christian or heathen, and under what law and livelihood they subsist'.

Royal instruction of 1728 (au. trans. after Stenstrup 1885:130)

The above is an extract from a royal instruction of 1728 concerning one of the earliest colonial expeditions to Greenland: that year, Major C.E. Paars – the first and last governor of Greenland – was to cross over the Ice Cap from west to east by the aid of 11 Icelandic horses (Nansen 1890:392, Ryder 1891:68). Naturally, the attempt was quickly abandoned, but it reveals how little was known of Greenland's geography and environment at that time, a confusion also noted of E. Thorhallesen's report. However, the instruction proves another point: that the colonization of Greenland was greatly motivated by the wish to reestablish contact with the old Norse colonists; by creed of their Norwegian ancestry and historical links, they were subjects to the Danish-Norwegian king. For while interest in Greenland faded, and contact was eventually lost, in the late-medieval vacuum that followed the joining of the former kingdoms of Norway and Denmark after the Kalmar Union (see section 2.1.3), the Norse settlements in Greenland were never forgotten. In fact, already from AD 1472 expeditions meant to reestablish contact with the *grænlendinga* had been planned, and some even carried out, with more following from the late 16th century onwards (Madsen 1907:35, Etting 2010:151).

The cultural-historical links between the Kingdoms of Scandinavia and the Norse settlements in Greenland were thus never completely severed; and they came to influence historical and archaeological research for more than a century. Unravelling the full extent of these links is beyond the scope of chapter 4. However, a review of even the earliest studies and field campaigns is needed to understand the development of the research area as a whole, not at least because the early surveys, and even excavations, helped form subsequent research strategies and methodologies, and are of significant research value even today.

Section 4.1 presents a literary review and discussion of the archaeology of Norse Greenland up to the start of the Vatnahverfi-Project in 2005, focusing in particular on the Norse Eastern Settlement and the Vatnahverfi. The review begins with the very earliest investigations and progresses over more or less defined research epochs – each characterized by particular research questions and methodologies – concluding with a summary discussion. Key research questions pertaining to each research epoch were regularly published by leading scholars in Norse Greenland archaeology; these overviews are presented for each research epoch, as are the popular or pseudo-academic monographs that indirectly communicated contemporary research themes.

For obvious reasons, a review of close to 300 years of antiquarian or archaeological investigations cannot be all-inclusive; it is a multifarious record that consists of imagery covering everything from artistic paintings, sketch drawings, photographs, to precession survey- and excavation plans; and documentary records ranging from newspaper clips, field notes and –reports, to final academic or popular publications. However, most of these records have never been published, but are only found in the archives of the national museums of Denmark and Greenland. With Greenland's repatriation of cultural heritage from 1984-2001, all such records should – either in original or copied form – be represented in the archives of both museums. Although this is far from always the case, throughout the text and appendices I simply refer jointly to such records as NMA (*National Museum Archives*) + author and year on the assumption that the records are found in both archives. The below review mainly includes reference to such published works and unpublished NMA records that relate specifically to archaeological and antiquarian investigations in the Vatnahverfi region.

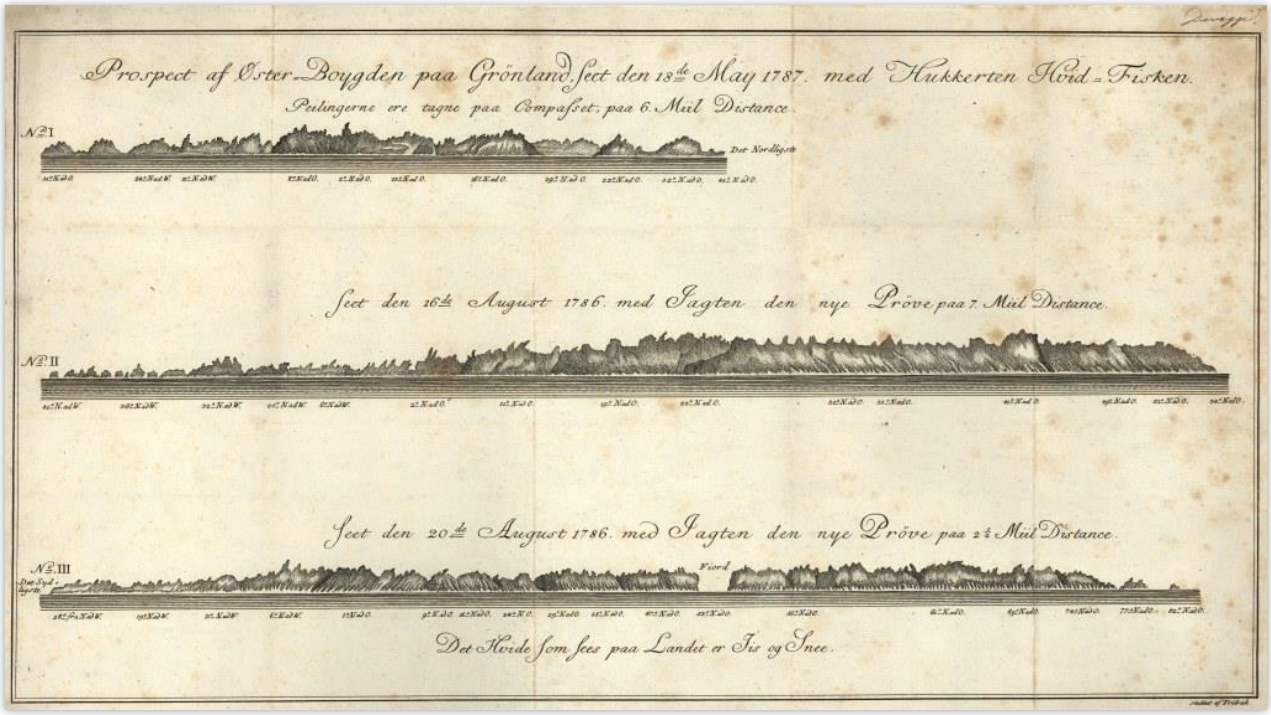


Fig.4.2 The image is titled '*Prospect of the Eastern Settlement in Greenland seen 18. May 1787*'. However, what the image depicts is the jagged coastline of Greenland's East Coast with a belt of drift ice in front. Not before this ice barrier had been breached, either from the east or the west, could mistaken notions as to the location of the Norse Eastern Settlement with potentially surviving *grænlendinga* be conclusively resolved *(image: Fridrich 1787, courtesy of the National Museum of Denmark).*

4.1.1 Settlement Discovery – 1721-1832

Because the colonization of Greenland was greatly motivated by the prospect of reuniting the Norse *grænlendinga* with their sovereign and church, it is unsurprising that the two paramount questions of the earliest research epoch concerned whether any of the Norse were still alive?; and where their settlements – known from the written sources – were to be found? That this was a very serious and sincere objective is attested not only by documentary sources such as the introductory excerpt, but also by the fervor with which Greenland's first new colonist, Danish-Norwegian priest Hans Egede, went about resolving the matter:

Immediately after his arrival in the Nuuk Fjord area – i.e. the former Western Settlement – in 1721, H. Egede began questioning the local Inuit, only to learn that the Norse must had long abandoned the region (Egede 1925:56). However, the Inuit were knowledgeable of ruins left behind by a different people – *qablunaaq* – which at that time referred to any foreign or non-Inuit person (Thorhallesen 1776:87, Egede 1925:56). Not only were the local Inuit intricately familiar with the whole Nuuk Fjord system from their annual settlement cycle, they had effectively, and fairly systematically, been mining Norse ruins and middens for metal artifacts for at least a century (Pingel 1832a:335, 1839:250, Gulløv 1997:395) The local Inuit could therefore direct H. Egede to the Norse ruins in the Nuuk Fjord, some of which he already visited in 1723 (Egede 1925:75). The short description provided by H. Egede from this voyage into the inner Nuuk fjord is, in fact, the first documented survey of Norse ruins carried out in Greenland.

Although H. Egede had found the Norse farmsteads abandoned, chances are that he was not too disconcerted: according to prevailing notions, the Norse Eastern Settlement was to be located on Greenland's East Coast (Fig.4.2); and since H. Egede was surely well-versed in the description of *Ívarr Bárðarsson* that the Western Settlement had been abandoned already during the Middle Ages (IB:123), he probably never expected to find a surviving Norse population in the Nuuk Fjord region or anywhere on the west coast of Greenland.

As persuasively argued by K.J.V. Steenstrup (1885, see below), the origin of the prevailing faulty notion of the location of the Norse Eastern Settlement owed to misinterpretation of medieval sailing directions coupled with the continued reproduction of an early 17th century cartographic error (Ibid.125pp). Combined these errors had the unfortunate effects of not only displacing the Eastern Settlement to Greenland's East Coast, but also of locating it 100-500 km up the coast between 61-65° N. This proved to have lasting impact on the study of the Norse settlements in Greenland: as long as barren terrain, treacherous waters, and drift ice kept explorers from reaching that far north – either from the west inside the drift ice or from the east from outside (Fig.4.2) – archaeological attention stayed fixed on Greenland's East Coast, and the surveys that were carried out in the Eastern Settlement in South Greenland, a chance result of their being located on the way.

First to try to reach Greenland's East Coast from the west via the Cape Farewell was H. Egede himself: in 1723 – the same year he inspected the Norse ruins in the Nuuk fjord – H. Egede headed south along the coast and managed to reach as far as Nanortalik – less than a 100 km from the Cape Farewell – before being forced to turn back (Egede 1741:19, Madsen 1907:38, Albrethsen 1971:291). On his way back to the Nuuk Fjord, he made a stop by the *Hvalseyjarfjörður* church (E83), inside which he trenched about, but unearthing only bits of charcoal and bone (Albrethsen 1971:292). H. Egede did thus not resolve the question of location of the Norse Eastern Settlement and to his death in 1758 he still believed it was found on Greenland's East Coast (Arneborg 1989:121). However, his contribution was significant: besides providing the first detailed ethnographic and cartographic records (Fig.4.2), he was – in deed at least – the first archaeologist in Greenland.

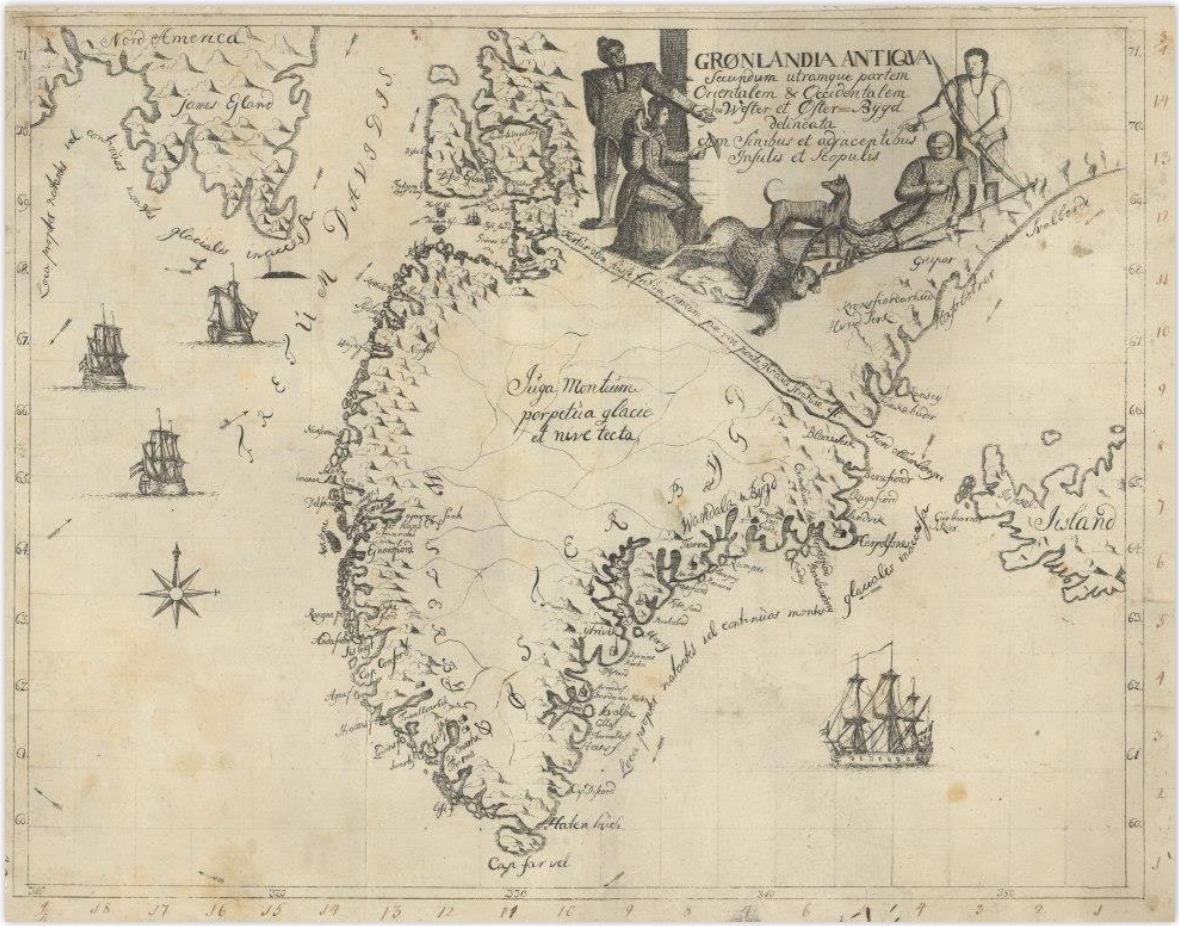


Fig.4.3 H. Egede's '*Grønlandia Antiqva*', a map appendix to his 1741 proto-encyclopedia on Greenland. As was commonly believed at the time, and for more than a 100 years, the Norse Eastern Settlement was allocated to Greenland's East Coast between 61-65° northern latitude (*map: after Egede 1741*).

It would be more than 100 years after H. Egede before the question of the location of the Norse Eastern Settlement would be laid to rest. During this time, a number of early explorers – several of which are deserving of specific mention – gradually expanded the knowledge of the geography and cultural landscapes of Greenland, their combined efforts pushing towards the conclusive clarification of the question:

First to succeed in rounding the Cape Farewell from the west was Peder Olsen Walløe, Danish trader and hunter. Prudently relying on the native *Umiak* for transport, using Inuit guides, and being a skilled hunter himself, Walløe in the years 1751-53 managed to make it some 100 km up Greenland's East Coast to ca. 60°56 N (Ryder 1891, Walløe 1927:69, 100, Gad 1969:390). Moreover, on his way to the East Coast, P.O. Walløe also travelled up the Sermilik, Tunulliarfik, Igaliku, and, Alluitsup Fjords in South Greenland, providing some of the first descriptions of the central Norse Eastern Settlement (Walløe 1927:68pp). Walløe's travel account is rich in details on geographical-, topo-graphical-, weather-, and hunting-conditions. His reports on the Norse sites are, however, much less detailed. Still, Walløe's voyage was an astonishing feat and deserving of recognition. But because he had not made it far enough up Greenland's East Coast to resolve the question of the location of the Norse settlements, and because his accounts were published as late as in 1787, Walløe undeservingly died poor and unrecognized (Bobé 1927:11, Albrethsen 1971:292).

Walløe's expedition also reflected a new wave of colonization activity: besides ascertaining the location of the Eastern Settlement and the fate of the Norsemen, the expeditions increasingly came to embrace economic interests of Danish trading companies: first *'Det almindelige Handelskompagni*' ('the Ordinary Trading Department') established 1747, in 1774 converted into the state-owned *'Den Kongelige Grønlandske Handel*' (KGH) ('the Royal Greenland Trading Department' (Sveistrup 1943). A key economic interest of the trading companies was the prospect of resettling the old Norse farmlands in Greenland with Icelanders or Faroese (de Muckadell 1929:100, Gad 1969:438). This had two favorable effect: first, that expeditions to both Norse settlements areas on Greenland's West Coast continued, even though the Norse were still believed to reside somewhere on the East Coast. Second, that detailed reports of environmental conditions became a norm of survey descriptions. Traditions of Norse and later farming, as well as archaeological methodologies, stayed patently linked.

Two of the new double-motive land surveyors stand out: the first was Norwegian tradesman and pioneer Anders Olsen: in 1773 he had surveyed central parts of South Greenland on behalf of the 'Ordinary Trade Company' to locate a suitable spot for a new colony in that region; and by 1776 the new colony of Julianehaab (Qaqortoq) was officially recognized (Gad 1969:552). Olsen was keenly interested in the Norse ruins and sites in the region and in his capacity of colony supervisor, he continued conducting surveys and, in 1776 or 1777, he even made it around the Cape Farewell and up the East Coast to about the same latitude, where Walløe had been forced to turn back (Ibid.554). Such was Olsen's familiarity with the land that when he in 1780 resigned as colony supervisor to set up the first new farm in Greenland, he did so at present Igaliku (Ibid.557), the Norse episcopal see of *Garðar*/E47, and the richest farmland in all of the settlements.

However, the results of Olsen's surveys were not published by himself, but by the second prominent double-motive explorer of the epoch, Icelandic priest explorer Eigill Thorhallesen: he spend the years 1767-1773 surveying large parts of the West Coast, including Norse sites in the Nuuk fjord system, for the best places to repopulate Greenland with Icelandic farmers. In (1776) Thorhallesen published a small study on his findings, which is remarkable in more than one way: combining Olsen's surveys from South Greenland with his own, and introducing a more systematic method for environmental site description, Thorhallesen can be accredited with publishing the first monograph on the Norse settlements in Greenland: it came complete with a chapter discussing the failure of the Western Settlement and the fate of the *grænlendinga* (Ibid.:58p). As far as I have been able to learn, he was also the first to formally compare the ruins with historic Icelandic architecture (Ibid.:31), to accompany his argument with a rudimentary house plan (Fig.4.4), and to introduce the idea that some of the sites in Greenland were so small or poorly situated that they must have functioned as shielings, not farms (Ibid.:32). In several respects, Thorhallesen's small book was a forerunner for modern publications.

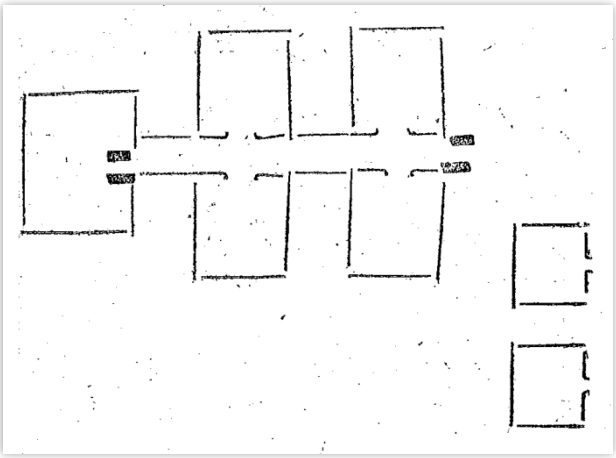


Fig.4.4 In his 1776 publication of a survey in the Nuuk Fjord, E. Thorhallesen for the first time presented a survey plan (of ruin group V36?) of a Norse dwelling based on comparison with contemporary Icelandic architecture. Note the dwelling layout plan with rooms on each sides and end of a central passage and with a few buildings front. It is a farmstead layout scheme close to that presented by much later archaeologists (cf. Fig.5.9) (*image: after Thorhallsen 1776:31*).

However, it was the third and final of the double-motive land surveyors that introduced a more stringent ruin description methodology: in 1777-1779, Norwegian tradesmen and explorers Aron Arctander and Andreas Bruhn carried out a survey on behalf of the KGH which was again aimed at exploring the prospects of reintroducing farming, this time in South Greenland (Ostermann 1944:I). Bruhn was to describe environmental conditions, while Arctander was oversee the description of Norse sites and ruins. This labor division may explain how he was able to describe in great detail some 57 ruin groups and 135 ruins in South Greenland between Nunarsuit to Cape Farewell, i.e. practically all of the Eastern Settlement (Arctander 1793, Bruun and Arctander 1944:59pp). Besides providing descriptions of individual sites and ruins that are valuable even today, Arctander was the first to hint – based on the observed richness of the vegetation and sites – that South Greenland must have been the location of the Norse Eastern Settlement (Wormskiold 1814:309, 314).

However, it was historical-geographical commentator Heinrich Peter von Eggers, who went on to press this claim: having published Arctander's ruin descriptions in 1793 (Arctander 1793), von Eggers later the same year used this survey evidence to argue for the verity of the latter's supposition (von Eggers 1793): South Greenland was really the Norse Eastern Settlement. But von Eggers went even further: although the maps available to him at the time were deficient and imprecise he tried, and to an impressive extent succeeded in, allocating the medieval place names to the fjords of South Greenland (Fig.4.5). In short, the survey evidence compiled by early land surveyors allowed von Eggers to introduce the type of historical archaeology that would gain momentum in the following research epochs.

However, as long as no one succeeded in penetrating further up Greenland's East Coast than the 61° latitude that Walløe and Olsen had reached, von Egger's claim remained disputable. This even though surveys – although of more random nature - kept adding new sites to the map: the most significant contribution was surveys made by German author, actor, and mineralogist Carl Ludwig Giesecke in 1806-1813 (Giesecke 1910), but also Danish botanist Morten Wormskjold would on a 1812-1814 expedition (Jessen 1987:7p) embrace the question of the Norse and was the first of three early 19th century scholars to oppose von Eggers' claim:

In addition to a list of other arguments, Wormskjold (1814) contested von Eggers' claim that there were by that time close to more recorded farmsteads in the Western Settlement than the 90 implied by the medieval written record (Ibid.309). Wormskjold opposed this (Ibid.311) by suggesting that a number of Norse sites were shielings, not farms, thereby being the first to academically raise this difficult debate (see also section 2.2.2). Next to oppose von Eggers was Danish historian Hector Frederik Janson Estrup (1824), who launched an array of historical contra-arguments, provokingly concluding that the day was near when explorers on Greenland's East Coast might be greeted by the Norse inhabitants themselves shouting '*this was the place!*' (au. trans. after Estrup 1824:267). The final opponent to von Eggers was Giesecke, who in 1824 published his own treatise on the question, where he took a more moderate stand by implying that the Eastern Settlement was partly situated on the Eastern Coast, only not as high a latitude as previously suggested (Giesecke 1925:57). It was an interesting change of mind, because Giesecke – who had himself visited more than 50 Norse sites in both settlement areas – apparently sided with von Eggers during his surveys (Johnstrup 1878:21).

Fig.4.5 Map appendix to von Egger's 1793 treatise on the location of the Norse Settlements in Greenland, which for the first time correctly placed the Eastern Settlement in South Greenland. In addition to this novel claim, and in spite of very imprecise maps, von Eggers also succeeded in correctly allocating several place names of the medieval topographies (*map: after von Eggers 1793*).

However, in 1828-1831, at the same time as this academic debate was raging, Danish naval lieutenant Wilhelm August Graah was making his way towards, and finally up, Greenland's East Coast. The success of this expedition was a critical response to successful foreign explorations in North East Greenland (Ryder 1891:82pp). Besides looking for the *grænlendinga*, the aim of Graah's expedition was also to press Danish sovereignty over Greenland, the first time, but not the last, that cultural historical research was influenced by state politics (see below). Drawing on the experiences from Walløe's partial success in 1753, Graah used the native umiak to make his way up the East Coast and reached as far as 65°20 N (Graah 1832b, Ryder 1891:85). In his voyage up the coast, W.A. Graah had seen neither Norse ruins or people, and when he published his findings in 1832, they all but closed the debate on the location of the Norse Eastern Settlement, placing it confidently in South Greenland (Arneborg 1989:121). Even so, some quietly voiced the potential existence of the settlement beyond 66° N (Steenstrup 1885:131), a contention that would not be definitely silenced for another 50 years (see section 4.1.2).

Although early explorers had both logistically and methodologically paved the way for later investigations, their surveys are to some extent spoiled by the condition that they were carried out "on the way" to the Eastern Settlement, by the "double-motives" of the surveys, and by the lack of proper geographical maps. Often, only the best preserved ruins were recognized and their relative placing roughly approximated. As a result, the early ruin descriptions are inconsistent and hard to compare with more recent surveys; only where ruins have distinct preservation or location can they be aligned with newer

surveys. For the same reason, it is difficult to ascertain how many sites that were known at the time of Graah's expedition. There were, however, definitely somewhat more than the some 57 sites in the Eastern Settlement, hereof ca. 23 in the Vatnahverfi, and 16 in the Western listed by von Eggers and Thorhallesen (Tab.4.1).

Discovery epoch investigations in the Vatnahverfi were fairly limited: Walløe visited the Igaliku and Alluitsup Fjords, but only reported that '*remains of the old European dwellings are found by almost every bay or inlet, especially in the inner part of the fjord, but they have now all turned into mounds of stone and are overgrown with grass*' (au. trans. after Walløe 1927:80). Arctander, however, located and described some 23 sites and 108 ruins in the Vatnahverfi region and rightly identified one of them, E66/Igaliku Kujalleq, as a church farm (Bruun and Arctander 1944:109p). In 1809 Giesecke seems to also have made a brief inspection of Igaliku Kujalleq/E66 (Giesecke 1910:218) and in 1828 Graah visited the island of Akia in the outer fjords of the Vatnahverfi region (Fig.3.13) (Graah 1832b:37p); however, neither of them provided any detailed descriptions.

4.1.2 Localities – 1832-1921

After Graah's expedition to the East Coast had validated that South Greenland was the location of the Norse Eastern Settlement and that none of the *grænlendinga* were alive, antiquarian and archaeological research perspectives shifted: investigations instead became concerned with gathering information on the existing ruins and sites in order to establish the medieval topography of the Norse settlements and to explain their abandonment:

It is no coincidence that the prominent Danish scientific society *'Det Kongelige Nordiske Oldskrift-Selskab*' in the same year began publishing reports on archaeological surveys and excavations in Greenland on regular interval (Pingel 1832b:94). While the field investigations were carried out by a number different people in Greenland – colony managers, tradesmen, missionaries etc. – they were prompted and sponsored by the society and the findings were edited and summarized in the society's periodical by Danish natural historian and geologist Christian Pingel (Pingel 1832b, 1832a, 1833, 1835, 1837, 1839, 1842). These archaeological surveys were methodologically similar to ones carried out by prior investigators. However, to my knowledge, the first more accurate and scaled ruin and ruin group plans were published in these reports (e.g. Fig.4.6-4.7).

Also, excavations – or more appropriately various test trenching – quickly began to supplement the surveys. In fact, Graah had already in 1828 carried out a larger and fairly well-documented excavation of the *Hvalseyjarfjörður* church (E83, Tab.4.1) (Graah 1832a). This was the first larger excavation of a Norse church site, which for the next some 150 years became a prime focus of archaeological activity (e.g., Pingel 1832b:99, 102, 1832a:319, 1833:219, 1837:122p, 1839:229, 231, 1842:330, 341p). Graah did not find much in his excavation except for a few pieces of bone and charcoal, which was enough to make him suggest that the church had been destroyed by fire (Graah 1832a:154). In the excavations that followed, similar charcoal finds were often reported and led to the same interpretation (e.g., Pingel 1832a:319, 1833:213, 1837:130, 1839:234), clearly showing that the investigators were now looking for explanations for the abandonment of the Norse settlements.

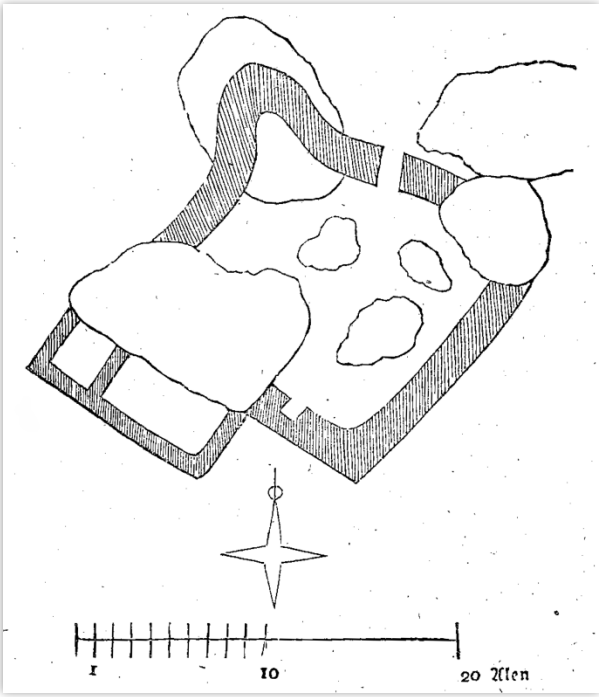


Fig.4.6 One of the first – if not *the* first – published accurate and scaled survey plan of a ruin (of enclosure at ruin group E112) *(after Pingel 1833:315).*

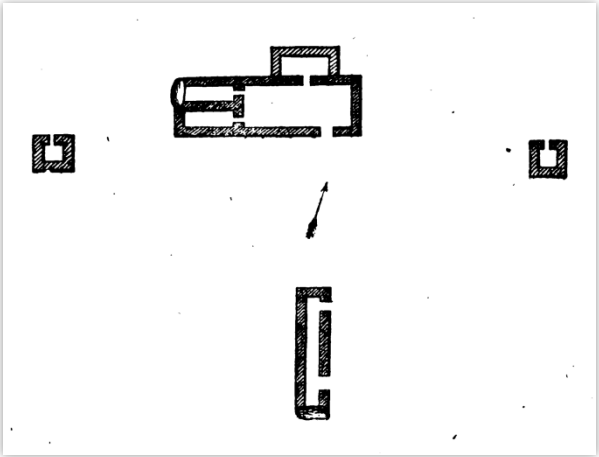


Fig.4.7 Early published survey plan of site M20, which was also one of the places to see very early excavations (*after Pingel 1837:137*).

The publication of archaeological reports from Greenland summarized by Pingel ceased in 1842 (Pingel 1842:346). At this point, all existing archaeological evidence was included in the third and last volume of the monumental '*Grønlands Historiske Mindesmærker*' (GHM I-III) ('Historic Monuments of Greenland') published by The *'Det Kongelige Nordiske Oldskrift-Selskab*'. In the first two volumes of GHM – published in 1838 – all the documentary evidence on the Greenland Norse had been compiled and discussed academically by a list of the most prominent scholars of the time; and in 1845 the archaeological evidence was included in the last volume (GHM III). Although evidently outmoded in some respects, the GHM is – with its over 2500 pages –a most impressive monograph, or rather something akin to an encyclopedia of Norse Greenland. The archaeological evidence was edited and summarized by Jens Jacob Asmussen Worsaae (GHM III:795pp), one of Denmark's most celebrated early archaeologists: the evidence now included reference to, or description of, some 115 sites in the Eastern Settlement, hereof 17 in the Vatnhverfi region, 7 in the later recognized Middle Settlement (see below), as well as some 14 in the Western Settlement (Fig.4.19, GHM III:795pp).

After the publication of GHM, there was a ca. 30 year hiatus in archaeological investigations. However, in 1875 Johannes Frederik Johnstrup requested the Danish state to establish a central organ for the purpose of organizing and funding various scientific investigations in Greenland; his request for funding was met in 1876 and in 1878 the organ – 'Commisionen for Ledelelsen af de geologiske og geografiske Undersøgelser i Grønland' (in the below simply referred to as 'the commission') – was set up (Johnstrup *et al.* 1878). 'The commission' would direct, or influence, practically all scientific investigations in Greenland up to World War II. In 1876-1878 the first field studies were carried out and although these surveys mostly concerned geology and geography, '*Depiction of Norse ruins with measurements*' were listed among the main results of the surveys (Ibid.15). It referred to the fact that Danish geologist Knud Johannes Vogelius Steenstrup and illustrator Andreas Nicolaus Kornerup in 1876 had surveyed and depicted ruins at five sites in the Eastern Settlement (Fig.4.8, Steenstrup and Kornerup 1881), while Danish naval officer Jens Arnold Diderich Jensen in 1878 had inspected an unknown number of ruins in the Ameralik Fjord in the Western Settlement, producing simplified, but scaled plans of 8 ruins (Jensen 1879:26p, Fig.2). Although still rather cursory and published in the brief, these surveys – and the 1878 establishment of 'the commission' –heralded a new epoch of archaeological research and methodological advance in Greenland.

Fig.4.8 One of the first Norse ruins surveyed and recorded in detail was the storehouse (ruin no. 36) of Igaliku/*Garðar* (E47), a ruin that would later spark the first scientific debate on sea-level rise since the occupation of the Norse Settlements (*after Steenstrup and Kornerup 1881:Fig.6*).

First to further this development was another Danish naval officer, Gustav Frederik Holm, who in 1880 was charged by 'the commission' with the task of carrying out “topographical-archaeological” investigations in South Greenland with the specific aim excavating Norse ruins to elucidate the character of the Norse settlement, as well as to plan in detail as many sites and their natural surroundings as possible (Holm 1883:63p). Essentially, this was the first explicitly formulated research agenda on the Greenland Norse. G.F. Holm went to the task with systematic fervor, surveying or visiting some 39 sites in the Eastern Settlement, 6 of them in Vatnahverfi, as well excavating 10 sites (Tab.4.1), among them Igaliku Kujalleq/E66, Qallimiut/E77, and Qorlortorsuup Tasia/ E73 in the Vatnahverfi region (Ibid. 113, 123, 125). The results of G.F. Holm was published in (1883) accompanied by meticulous survey and excavation plans; it was a comprehensive study that set a new standard for archaeological surveys in Greenland and has to a large extent been followed ever since (cf. Fig.4.9). Additionally, G.F. Holm introduced a more interpretive archaeology, where he combined environmental description – similar to Thorhallesen and Arctander – with ethnological parallels to describe the details of the livelihood on the Norse farms. Finally, G.F. Holm in 1883-1885 carried out the celebrated 'den danske konebådsekspedition' ('The Danish Umiaq Expedition'), in which he reached just beyond 65° latitude on Greenland’s East Coast (Holm and Garde 1887). Thereby any remaining doubt as to the survival of the Norsemen was irrefutably quenched.

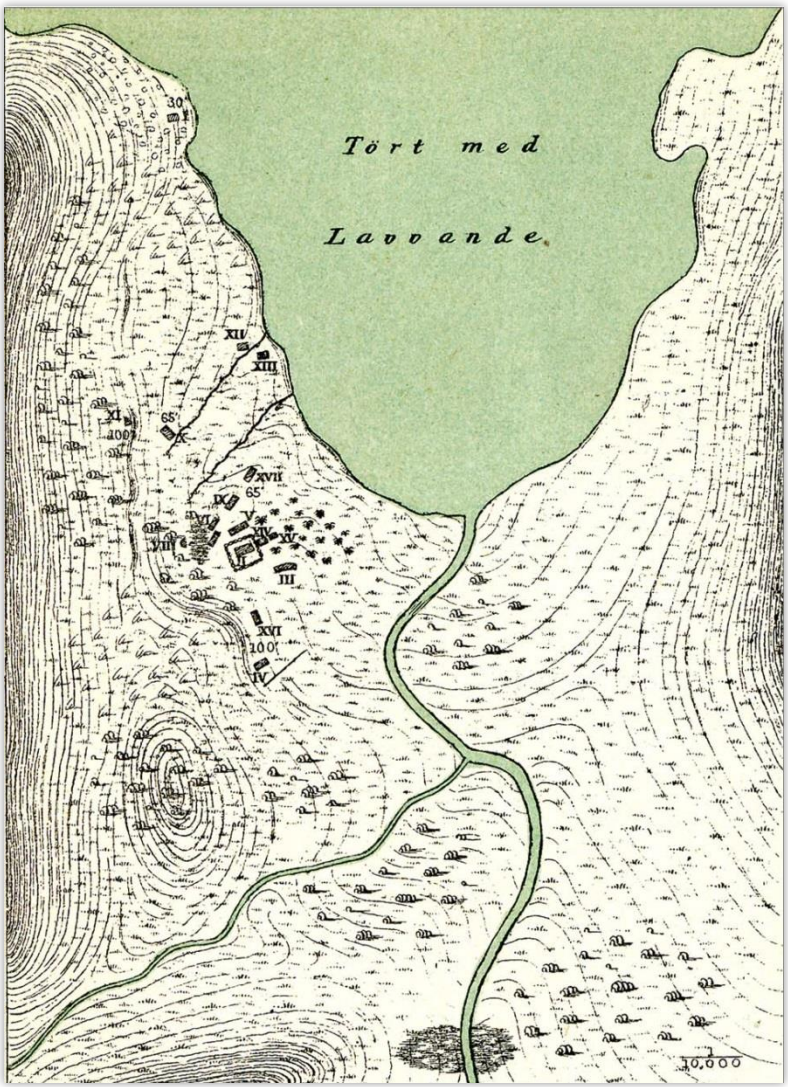


Fig.4.9 G.F. Holms 1883 survey plan of the church farm at Igaliku Kujalleq/E66 (at that time known as 'Qassiarsuk in Igaliku Fjord'). During an 1880 expedition to South Greenland, G.F. Holm was the first to systematically produce fairly accurate site survey plans of the Norse sites he inspected. In these survey plans, which also included the immediate surroundings of the sites and individual ruin numbering, the basis of a modern archaeological survey methodology is clearly apparent (cf. Fig.5.15-5.16) (*after Holm 1883:Tav.XXVIII*).

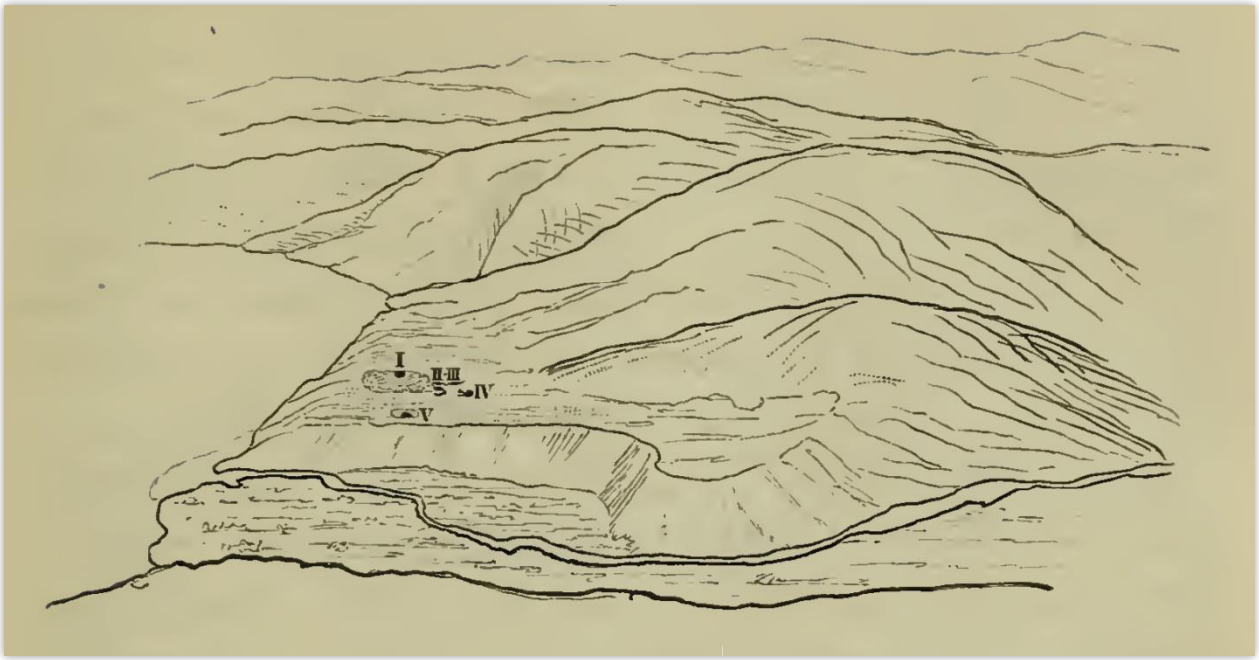


Fig.4.10 In the Western Settlement area in the Nuuk Fjord system, J.A.D. Jensen were carrying out ruin sites surveys in the mid-1880's, here a bird's eye view of Ujarassuit/*Anavik* (V7). Besides numbering of individual ruins, J.A.D. Jensen also introduced a similar consecutive numbering system to the sites themselves (after J.A.D. Jensen 1889:Fig.7).

In the meantime, J.A.D. Jensen continued the surveys of Greenland's West Coast in 1884-1885, in the last year concentrating on mapping the geography of, and Norse sites in, the Nuuk Fjord system (Fig.4.10, Jensen 1889:85). Besides inspecting – and in a few instances mapping or depicting – 14 sites, the most important contribution of Jensen was the introduction of a systematic successive numbering system (ruin site no.1, next no.2 etc.)(Ibid.100pp). This numbering system has often been attributed to D. Bruun (see below).

Thus a basic systematic survey methodology was in place when officer Daniel Bruun in 1894 was asked by 'the commission' to lead another archaeological expedition to South Greenland and there to survey and excavate as many Norse ruins as possible (Bruun 1895b, 1895a:181). The main aim was to learn about the character of the Greenland Norse buildings, especially the farmhouses. In (1889), Dr. phil. Valtýr Guðmundsson had published a cornerstone study on the Icelandic dwellings in the Saga time, which provided sort of a baseline for Bruun's interpretation of the Norse farmhouses in Greenland. Assisted by naval officer Frode Pedersen, they in 1894 between them managed to survey a staggering 83 ruin groups – a technical term which seems to have introduced by Bruun – 25 of them in the Vatnahverfi. Bruun and Petersen also did large-scale excavations of both structures and middens at E2, E20, E29, E47, and E66 (Bruun 1895a:434pp), as well as test excavation at E7, E14, E53, E90, E92, E93 (Tab.4.1).

Considering that Bruun was autodidact and had little archaeological experience when he came to Greenland in 1894, it is impressive that his (1895) publication of the investigations should become a cornerstone in the Norse Greenland archaeology: the descriptions included precise or estimated measurements of almost all the individual ruins at each ruin group, which were supplemented by sketch survey plans including the immediate natural environs. Bruun also introduced a new by descriptive methodology by offering functional interpretation of most individual ruins – most significantly the dwellings – as well as of the ruin groups as a whole. His excavations were no less pioneering and are very informative even today. In the years following 1894 he would take his experiences from Greenland to do equally pioneering archaeological and ethnographic studies in Iceland (e.g., Bruun 1897, 1901, 1903b) and the Faroe Islands (e.g., Bruun 1896, 1907, Bruun 1929).

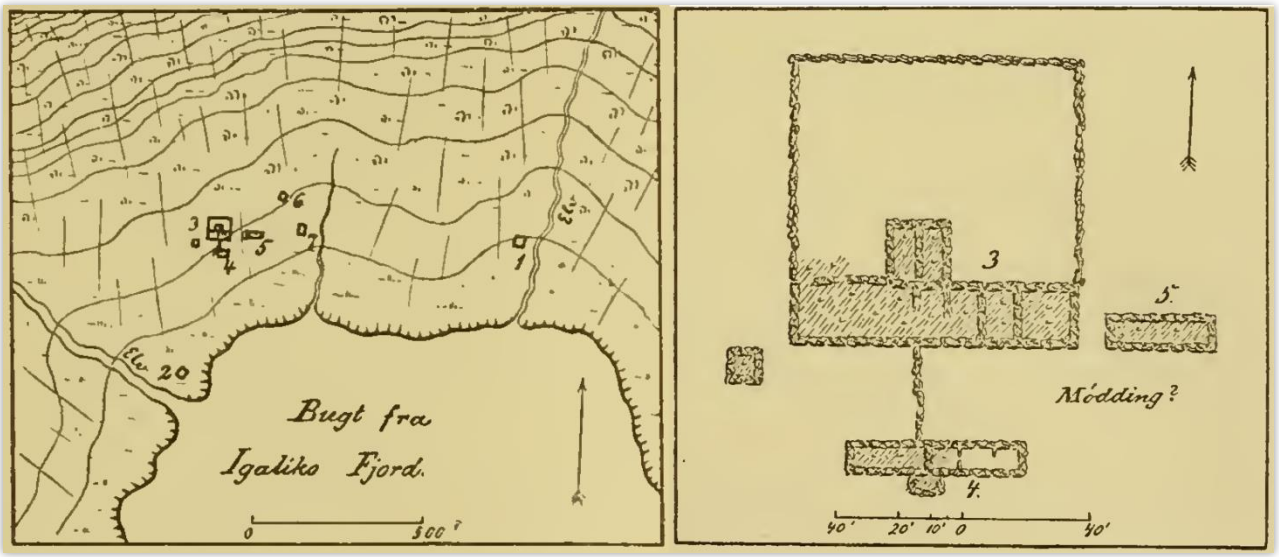


Fig.4.11 Left: Sketch survey plan of ruin group E63 and surroundings in the Vatnahverfi, South Greenland. Right: detail survey plan of the main cluster of ruins (nos. 3-5). During his 1894 expedition to South Greenland, D. Bruun made such plans of the majority of the ruin groups he inspected, most of which was in included in his 1895 publication; thereby, he introduced a new level of systematic to the ruin group documentation to Norse Greenland archaeology (*modified after Bruun 1895:364-365*).

In 1903, Bruun attempted to do a similar survey of the Western Settlement, but the shortness of the field season made these surveys more rudimentary (Bruun 1903a, 1917:58): he visited "only" some 22 ruin groups, but compiled information from earlier surveys on a total of 88 ruin groups in the Western Settlement. However, in 1903 he also managed to survey 19 ruin groups, and was later informed of another 2, on the coast between the Eastern and Western Settlements (Ibid. 109p), an area which previously had received limited archaeological attention (cf. Fig.4.19). This area – comprising the Arsuk and Ivittut regions – has since been referred to as the *Middle Settlement*. Here Bruun restarted the numbering of ruin groups (with 'M' for Middle Settlement as prefix). In addition to these archaeological ground works, Bruun should also be credited with introducig a new form of publication: synthesizing the archaeological record with medieval written records and ethnological observations from his field work in the North Atlantic, he produced (Bruun 1915, 1928) the first truly overarching cultural-historical research monographs on the Greenland Norse – also in popular form – a genre which has since been reproduced on regular interval (see below).

While D. Bruun may have defined Norse Greenland archaeology around the turn of the 19th century, it was Icelandic Dr. Phil. Finnur Jónsson who defined historical research perspectives: in (1898) he published his influential study on the medieval topography of the Norse Settlements. Greatly aided by the now inclusive settlement evidence produced by Holm, Bruun, and other early surveyors, as well as by a more precise geographical record, he was able to identify the location of many of the topographical place names known from the medieval accounts; and with the names of the Norse fjords in place, the search for specifically mentioned Norse churches and farms could begin. With Jónsson's study historical archaeology gained new momentum that would influence research the next half a century. In fact, even though Jónsson's study has not been critically revised since – except for his own later addendum (Jónsson 1930) – the historical archaeological agenda of identifying historically mentioned sites have been in focus ever since (e.g., Clemmensen 1911, Bjørgmose 1964, 1965, Bjørgmose 1967, Andersen 1982, Bergersen 1997, Guldager 1997, 2000, 2002, Gulløv 2008a).

The reinvigorated agenda of historical archaeology initiated when Mogens Becker Clemmensen in 1910 was tasked by 'the commission' with carrying out new investigations of the churches in the Eastern Settlement (Clemmensen 1911). Clemmensen was a forerunner for the new agendas in Greenland Norse archaeology: his 1910 investigations focused mainly on the architectural history and detail of the churches (Ibid.288, 326, 341), as well as on locating the churches missing according to

Jónsson's medieval topography. The historical archaeological approach is also visible from Clemmensen's identification of a group of ruins north of the episcopal farmstead (E47) as the main assembly site ('*thing*') of the *grænlendinga* mentioned in the written sources (Ibid. 334p) (but was later rejected by Nørlund and Roussell 1929:126p). Clemmensen test excavated middens at Igaliku (E47) and Igaliku Kujalleq (E66) (Tab.4.1), visited some 20 ruin groups in the region between Narsaq, Tunnuliarfik, and Sermilik, and located four new ruin groups (Ibid.354p), three of them (E118, E119, E120) in the outer fjord Vatnahverfi region. However, as the aim of M.B. Clemmensen's surveys was to identify new churches and none of the new ruin groups seemed to have one, he provided little detailed information.

The same year Clemmensen reported on his surveys, Norwegian explorer and scientist Fridtjof Nansen published his classic '*Into Northern Mists*' (Nansen 1911), of which chapter seven concerned Norse settlement in the North Atlantic. It was essentially the same kind of popular cultural-historical synthesis that Bruun had introduced, only with an emphasis on Norway's part in the history of the North Atlantic. With '*Into Northern Mists*' F. Nansen had introduced a, somewhat overlooked, parallel narrative on Greenland Norse settlement stressing Norwegian perspectives.

It was during the research epoch 1832-1921 that the main foundation for subsequent historical and archaeological investigations in Norse Greenland was laid. The site discoveries and descriptions provided by early explorers – compiled in the monumental GHM (III) – as well as improved maps, allowed Holm, Jensen, Bruun, and other surveyors to advance ruin group and settlement investigations methodologically: anyone who has tried using – as we did during our surveys in the Vatnahverfi region – these surveys will know of their continued high level of applicability, reflecting a robust and systematic archaeological methodology. These investigations were, however, not aimed at locating new sites and when Clemmensen (1911) and Bruun (1917) published the last surveys of the research epoch, some 120 groups were recorded in the Eastern Settlement, hereof 31 in the Vatnahverfi, 19 in the Middle Settlement, and 88 in the Western Settlement, i.e. in the Eastern Settlement not significantly more than in the 1845 GHM (III) (cf. Fig.4.19) (although a number of uncertain sites in GHM were removed and replaced by new ones, not at least in the inland of the Vatnahverfi).

Archaeological investigations in the Vatnahverfi region were also advanced during this research epoch: excavations began with a small test excavation inside the church at Igaliku Kujalleq/E66 conducted by Hinrich Rink in 1854 (unpub. fields notes, the National Museum of Denmark); in 1837, reverend J.F. Jørgensen carried out a small test excavation at E120 (Pingel 1839:234) and in 1839 went on to clear most of the inside of the church and test excavate the churchyard at E66 (Pingel 1842:345); in 1880, Holm also excavated in several of the ruins at E66 (Holm 1883:115p), at E73 (Ibid.:126p), and E77 (Ibid.123); in 1894, Bruun again excavated at Igaliku Kujalleq/E66, this time mostly in the churchyard and dwelling (Bruun 1895a:373pp), while Petersen made small test pits at E90 (Ibid.413), E92 (Ibid.419), E93 (Ibid.).

Of ruin group surveys in the Vatnahverfi region, the 1831-1921 epoch included: the discovery in 1832 of a new ruin group by botanist J. Vahl in the 'sandur' area southeast of E66 (Pingel 1835:222), which according to his description seems to match to the newly registered ruin group 0502 (App.?) which we located and surveyed in 2005 on information from local sheep farmers (Møller and Madsen 2006:31); In 1832-1833, V. Müller – head of the mission at Friedrichstahl – visited and described in brief seven of the Norse ruin groups by the Alluitsup Kangerlua (Pingel 1839:230p), and in 1839 Moravian Brothers discovered another ruin by Amitsuarsuk (E91) (Pingel 1842:329), which later seems to have been destroyed; in between them, Holm, Bruun, and Petersen described and mapped 31 of the ruins groups in the Vatnahverfi region in 1880 and 1894, respectively. Finally, in addition to the three new ruin groups. Clemmensen added to the Vatnahverfi region in 1910), reverend Erik Jespersen in 1911 located, and provided description and plans of, two new ruin groups (E64a, E64b) in the northern Vatnahverfi region, the former excavated by C.L. Vebæk in 1939 (see below).

4.1.3 Excavations – 1921-1962

That large-scale archaeological activity initiated in 1921 – on the 200 year anniversary of H. Egede's landing in Greenland – was not a coincidence: it coincided with the year that Denmark internationally laid claim to all of Greenland's territory, opposed only by Norway (Blom 1973). This started a feud between Denmark and Norway over the territorial rights in eastern Greenland and in 1933 the Norwegians went on

to occupy parts of the East Coast. One of the occupied parts was referred to as 'Erik Raudes Land' ('the Land of Erik the Red'), a historical linkage that was also invoked in the political debate (Ibid.13), showing that cultural-history and politics had once again become intertwined. In 1933, the dispute was brought before the Hague Tribunal, which ruled in in favor of Denmark's territorial right to all of Greenland.

More importantly, perhaps, in 1921 the National Museum of Denmark was delegated the responsibility of overseeing the continued investigations in the Norse settlements in Greenland, although still under the direction of 'the commission' (Arneborg 1989:123). It was a compromise to calm mounting frustration among scientists from different disciplines with the old setup of 'the commission' headed by a narrow group of geologists and geographers (Arneborg and Secher 2005:15). How, and to which extent, these changes in 1921 influenced the archaeology of Norse Greenland is beyond this section to discuss, but their convergence was hardly chance. At any rate, the research epoch 1921-1962 was a pinnacle for excavations in Greenland, the results of which still form the backbone of our archaeological record on the architecture and layout of the Norse farmsteads, dwellings, and outbuildings. Many results from these excavations are discussed in relation to particular topics throughout the dissertation and here I only list key scholars involved, their investigations, and associated published research overviews:

The epoch began with historian Poul Nørlund's 1921 excavation at Ikigaat/*Herjólfsnes* (E111), where he unearthed the extremely well-preserved medieval burials with garments in the churchyard, as well as the church, part of the dwelling, and the byre/barn (Nørlund 1924). Thereby Nørlund had initiated what would be the hallmark of the epoch's excavations: methodologically simple, but large-scale excavation of many farmstead buildings, although with principal focus on the churches, dwellings, and byres. Nonetheless, this was the epoch when most outbuildings were excavated (cf. Tab.4.1). It was also the 1921 excavation that for the first time brought attention to the issue of climatic deterioration as a cause of settlement decline (Nørlund 1924:237p, 1934:57). In 1926 Nørlund took the new excavation methodology to the episcopal see of Igaliku/*Garðar* (E47) (Fig.4.12, Tab.4.1) (Nørlund and Roussell 1929). In 1930, Nørlund was in charge of the first large excavation in the Western Settlement at Kilaarsarfik/ *Sandnes* (V51), but eventually left the investigations to his protégé Aa. Roussell (see below). In 1932, Nørlund, assisted by Dr. Phil. Marten Stenberger, carried out his last large excavation in Greenland at Qassiasuk/ *Brattahlið* (E28, E28a, E29, E29a), where he excavated church, churchyard, three dwellings, two byres and a sheep/goat shed (Nørlund and Stenberger 1934).

Besides his excavations, Nørlund also did a large number of surveys in the Eastern Settlement area, the details of which, however, are mostly recorded only in field notes kept in the NMA. Like Clemmensen before him, Nørlund was working explicitly to clarify the medieval topography by identifying the churches that were missing according to the medieval church lists, an agenda which was explicitly formulated in his research overview (Nørlund 1928). He was quite successful in achieving this goal, identifying – and test excavating the churchyards of – two churches in 1926 (E105 and E140) (Nørlund 1928:52p) and four in 1932 (E18, E33, E35, E149) (Nørlund and Stenberger 1934:9p). In 1934, Nørlund published his popular historical-archaeological synthesis on the Norse Settlements (Nørlund 1934). At this time, 148 ruin groups were recorded in the Eastern Settlement – most of them added during his own surveys – while the number of ruin groups in the other settlement areas remained largely unchanged (Fig.4.19).

During Nørlund's 1926 excavation at Igaliku/ *Garðar* (E47), architect Aage Roussell had worked as his assistant, but from 1932 the latter took over the National Museum of Denmark's large-scale excavations in Greenland, first concentrated in the Western Settlement: in 1930 and 1932, Roussell finished and published the excavations of Kilaarsarfik/ *Sandnes* (V51) (Roussell 1936b); in 1932, he also conducted a major large-scale excavation at V7 and V16 (Roussell 1941:32, 78), and prepared V52a for excavation in 1934 (Roussell 1936b:61p, 1936a); in the same year, he excavated the small shieling site V53 (Roussell 1936b:60, 1941:228p), as well as the dwelling of V8 (Roussell 1941:75, 108); in 1937, he carried out excavations of the dwellings at the inlands farms of V35, V53c, and V53d (Roussell 1938, 1941). These excavations allowed him to later present a typology on the development of the Norse Greenland farmhouses and the of the 'centralized farm' (see section 5.1.2).

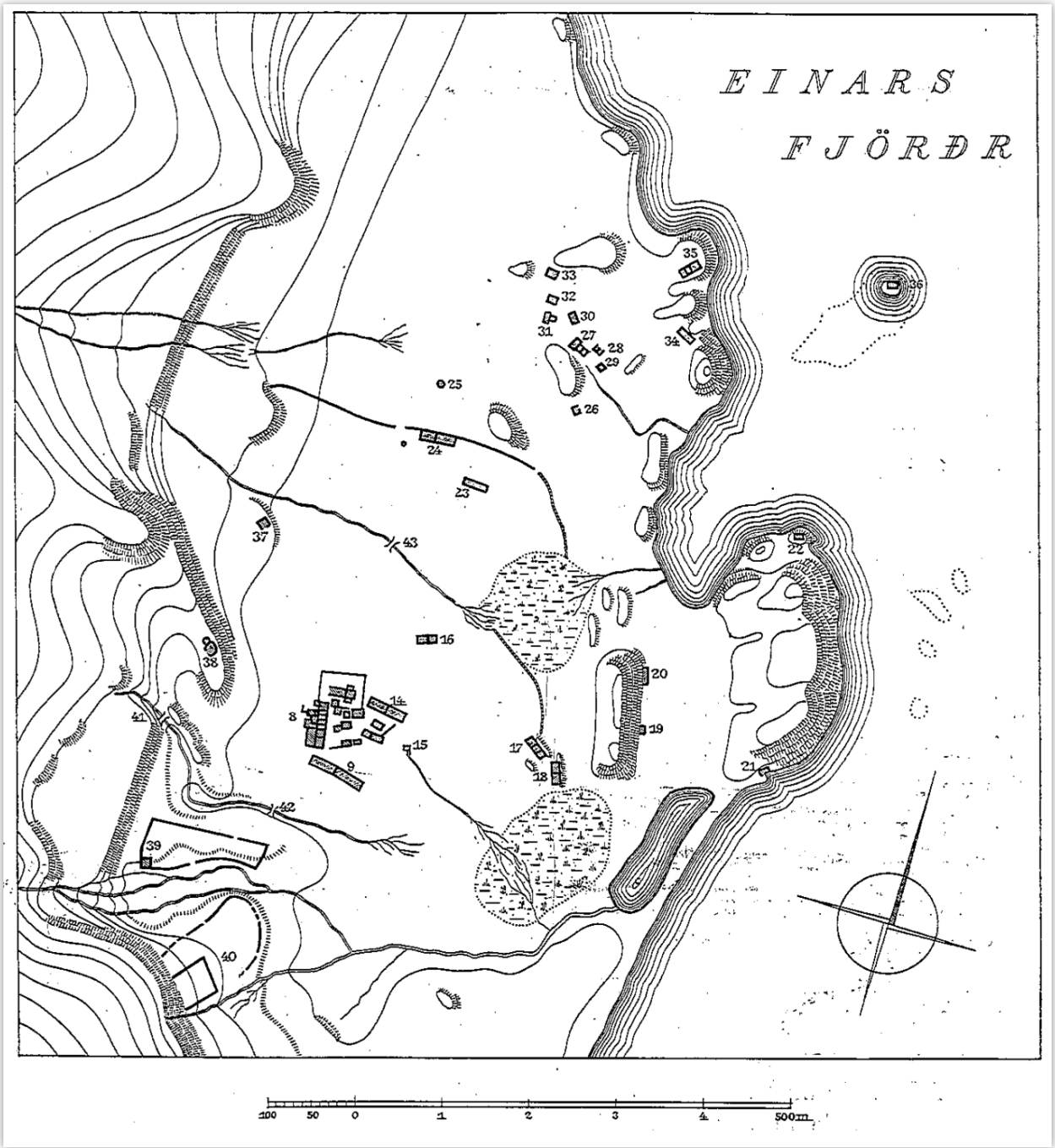


Fig.4.12 Nørlund's site survey plan of Igaliku/ *Garðar* (E47) from his 1926 excavation at the ruin group. Whereas earlier investigators had mapped the church and the immediately surrounding ruins several times, P. Nørlund was the first to map the entire farmstead, a methodology undoubtedly owing much to G.F. Holm and D. Bruun, but at *Garðar* advanced to a new standard (after Nørlund 1921:Fig.2).

Roussell was also a very active excavator in the Eastern Settlement: in 1935 he excavated the dwelling and several outbuildings at the *Hvalseyjarfjörður* church (E83) (Roussell 1941:34p), as well as a couple of ruins at the neighboring "dairy farm" E83a (Ibid.37p); in the same year, he excavated in the church, churchyard and byre at Igaliku Kujalleq/*undir Höfða* (E66). In between these large-scale excavations, he also carried out a

number of smaller test excavations, as well as surveys in both settlement areas. Some records from these investigations are only available as field notes, descriptions, and plans in the NMA, while others were published by count Eigill Knuth, who worked as Aa. Roussell's assistant in 1932 and 1934 (Knuth 1944).

However, most findings from Roussell's impressive archaeological campaigns were included or condensed in his (1941) doctoral dissertation, perhaps the single most important publication in Norse Greenland archaeology since Holm's and Bruun's landmark studies (see above), and in general. In addition to detailed reviews of prior archaeological investigations, which he compared with the results of his own surveys and excavations – most of it accompanied by detailed survey and excavation plans – Roussell in his study also carried out the first truly systematic analysis of the archaeological settlement evidence, e.g. his classical farmhouse typology (see section 5.1.2). Roussell's dissertation promoted comparative perspectives and included observations of building customs in the rest of the North Atlantic. It also included a fairly detailed description and discussion of the farmstead outbuildings (Ibid.214pp), which had not been done since Bruun's 1895 publication. With this addendum – and his excavations of a number of "ordinary" farmsteads in the Western Settlement – Roussell had moved Norse Greenland research a step away from the traditional agenda of historical archaeology and towards a more balanced settlement archaeology; it now included some 176 ruin groups in the Eastern Settlement, hereof 41 in the Vatnahverfi region, 24 in the Middle Settlement, and 77 in the Western Settlement (cf. Fig.4.19).

This new archaeological agenda was at the same time being advanced by the last important scholar of the 1921-1962 research epoch, archaeologist Christian Leif Vebæk: in 1939, he carried out excavations of three farmsteads (E64a, E64c, E78a) in the Vatnhaverfi region, one of them the first truly "centralized farm" in the Eastern Settlement (Vebæk 1941, 1943); in 1945-1946 and 1948, he did large-scale excavation of the church, churchyard, dwelling and most outbuildings at the supposed Benedictine convent at Narsarsuaq (E149, Fig.2.5) (Vebæk 1991:21pp); in 1946 he test excavated the churchyard of the newly discovered church at Narsaq/*Vagar* (E162) (Ibid.18p). In 1949-1950, Vebæk returned to the Vatnahverfi, where he oversaw excavations of three more farmsteads (E70, E71, E167) (Vebæk 1952:107p, 1958:110p, 1992:23pp); in 1954, he carried out the first larger excavation in the Middle Settlement at ruin group M15, as well as smaller excavations at two other sites (M10 and M21) (Vebæk 1956, 65, 74, Albrethsen and Arneborg 2004); finally, in 1954, 1958, and 1962, C.L. Vebæk excavated the '*landnáma* farm' (E17a) by Narsaq (Vebæk 1965, 1993), his last large-scale excavation in Greenland. With this excavation, C.L. Vebæk should be credited with carrying out the first phased excavation of a Norse dwelling.

While Vebæk's choice of sites excavated show that the livelihood on "ordinary" Norse farmsteads were increasingly in archaeological focus, he was himself still highly preoccupied with the traditional historical-archaeological questions of the medieval topography and church lists. This is clear from a research review published by him in (1943), and from a number of subsequent publications (Vebæk 1953a, 1953b, 1966, 1991), as well as, unfortunately, from his very summary publication of his many surveys of the ordinary farms (Vebæk 1952, 1953c, 1956, 1982, 1992:14p). Still, Vebæk's contribution was tremendous: after World War II, 'the commission' was disbanded as a central research organ (Arneborg and Secher 17) and it was mainly by Vebæk's efforts that excavations continued and the number of ruin groups kept increasing: in a later research overview Vebæk could list some 215 in the Eastern Settlement, hereof ca. 60 in the Vatnahverfi region, as well as 28 in the Middle Settlement, and 79 in the Western Settlement (cf. Fig.4.19. A few of these new ruin groups had been added by Norwegian explorer Helge Ingstad during a 1953 expedition to Greenland, an account of which he had published in his 1959 classic the 'Land under the Polar Star' (Ingstad 1960); this was the last historical-archaeological synthesis on the Norse settlements of the research epoch and, suggestively, the last to draw primarily on the medieval written evidence.

Reviewing the excavations of the 1921-1962 research epoch, one could easily accuse them of being methodologically simplistic and inadequate in the sense that they failed to identify and clarify the multiple and complex building histories of the excavated structures. However, it is equally clear that the excavators were aware of this issue (e.g., Roussell 1941:181, 188, Vebæk 1943:47, 1992:47), and already in 1929 Nørlund, for instance, attempted to provide a building history of the church and dwelling at Igaliku/Garðar (E47) (Nørlund and Roussell 1929:42p, 77p) (although his phasing has

since been reevaluated, see Høegsberg 2008). Rather, the excavations of epoch were simply more concerned with form and function, i.e. establishing the overall layout of farmsteads, dwellings, and outbuildings in comparison to customs elsewhere in the North Atlantic; with identifying the functional layout of the dwellings; and retrieving artefacts for illuminating the livelihood of the *grænlendinga*. In this concern, the importance of the 1921-1962 excavations cannot be exaggerated. And although traditional agendas of historical archaeology remained highly influential throughout the research epoch, Roussel's and Vebæk's investigations did move Norse Greenland archaeology significantly towards a more balanced and embracive settlement archaeology.

Not at least in the Vatnahverfi region was the 1921-1962 research epoch one of major advance: Roussell (re)excavated the church, parts of the churchyard, and byre at Igaliku Kujalleq/*undir Höfða* (E66) in 1926 and 1935 (Roussell 1941:99). In 1932, eskimologist Erik Holtved test excavated around E91 (NMA: Holtved 1932:6) However, it was Vebæk's investigations from 1939 onwards that most significantly developed research in the region.

Vebæk's surveys were equally important: over some 20 years of field work, he added ca. 20 new ruin groups to the 41 known in the Vatnahverfi region around the time of Roussell's 1941 publication, as well as two more churches (E78 and E64), in 1951 and 1962 respectively, and test excavated their churchyards (Vebæk 1953b, 1966, 1991). Unfortunately, most of Vebæk's surveys were only hastily recorded in photography, in sketch surveys, or field notes (kept in the NMA), although he did publish several overview accounts (Vebæk 1952, 1953c, 1982, 1992). He was, like his contemporaries, focused on the medieval topography. On the other hand, his investigations heralded new trends in the archaeology of Norse Greenland, which would, eventually, emerge.

4.1.4 Hiatus – 1962-1976

Compared to the previous period, the research epoch 1962-1976 must be considered a hiatus in Norse Greenland archaeology: the only larger excavation of the epoch was the investigation of *Þjóðhildarkirkja* at Qassiasuk/*Brattahlið* (29a ruin no.59) in 1962 and 1964-1965, which was a discovered by chance (Meldgaard 1964, Krogh 1965, Meldgaard 1982). The very first excavation season at *Þjóðhildarkirkja* was directed by archaeologist Jørgen Meldgaard, who also published the first historical-archaeological synthesis of the epoch (Meldgaard 1965); in spite of its popular style, this publication clearly hinted at themes of a more developed archaeology.

However, an even clearer archaeological emphasis was apparent in the next historical-archaeological synthesis, which was published just two years later by another architect-archaeologist from the National Museum of Denmark, Knud Jepsen Krogh. Krogh had taken over the excavation of *Þjóðhildarkirkja* after Meldgaard, and for the next many years he would oversee most of the museum's investigations in Greenland, including a number of test excavations, as well a vast number of ruin groups surveys in connection with the intensification of sheep farming in South Greenland (see section 9.1.3). Although Krogh was a highly active and skilled surveyor, only his church investigations were published and his developmental typology for small and large churches is still used today (see section 5.2) (Krogh 1976, 1982a). Of his many other detailed surveys, only a part are found in the NMA, the remaining records still being largely unpublished or in private ownership. Krogh also brought attention to the irrigation systems on the Greenland Norse farms (Krogh 1974), although it was H. Ingstad who had first noticed them (Ingstad 1960:78).

On the excavation team at *Þjóðhildarkirkja* were two archaeology students, Svend Erik Albrethsen and Jette Arneborg, both of which would have a great importance for investigations in Greenland to come. Already during the research epoch 1962-1976. Albrethsen took part in archaeological investigations related to intensified sheep farming (Tab.4.1, field reports in the NMA), and in 1971 he presented the research epochs' first more academic research overview (Albrethsen 1971).

However, the perhaps most important contribution to Norse Greenland archaeology in the 1962-1976 epoch came from unexpected side: in 1965, local school teacher in Alluitsup Paa (Sydprøven) Ove Bak began to search and record Norse ruin groups in the vicinity of his home settlement, over the next years gradually extending his surveys to a large part of the Eastern Settlement. Paying out of his own pocket, or by modest funding, travelling by foot or small dingy, Bak. in the period 1965-1972 visited and described no less than 305 ruin groups, 142 of them new (Bak 1969, 1970b, 1971, 1972b, 1972a). His earliest surveys were admittedly

basic, but over the years his sketch survey plans and descriptions improved significantly (Fig.4.13, the originals are now kept in the NMA). In any case, Bak must be recognized as one of the great contributors to Norse settlement archaeology, especially as the one who extended Norse settlement into formerly blank areas on the maps, i.e. into the "wilderness" of the outer fjord and deep inland. Bak was thus the main reason for the great number of new ruin groups that K.J. Krogh could include in his 1982 updated research overview (see below).

The research epoch 1962-1976 was in most concerns a rather lull phase in Norse Greenland archaeology: methodologically, and in terms of research questions, investigations were largely comparable to those of the previous epoch. On other hand, new research agendas and trends were emerging and would erupt during the next research epoch.

In the Vatnahverfi region, the period 1962-1976 was also one of relative few investigations. Apart from a 1969 test excavation in the midden of E120 (NMA:Albrethsen 1971), it consisted of archaeological surveys: in 1964 Knud Thorvildsen visited and described eight ruin groups (E63, E64, E66, E78, E78a, E119, E184, E196) in the region (NMA:Thorvildsen 1964). Bak's 1965-1972 surveys also extended to the Vatnahverfi region, where he visited and described some 33 ruins, 26 of them new. Also, follow-up surveys were carried out in the region by Krogh and Albrethsen in connection with intensified sheep farming: in 1968 of E63, E64, E66, E76 (NMA: Krogh& Albrethsen 1968), in 1969 of E119, E120 (NMA: Krogh &Albrethsen 1969), in 1971 of E66, E76, E78, E95b, E169, E172, E178, E179, E190, E184, E188 (NMA: Albrethsen 1971).

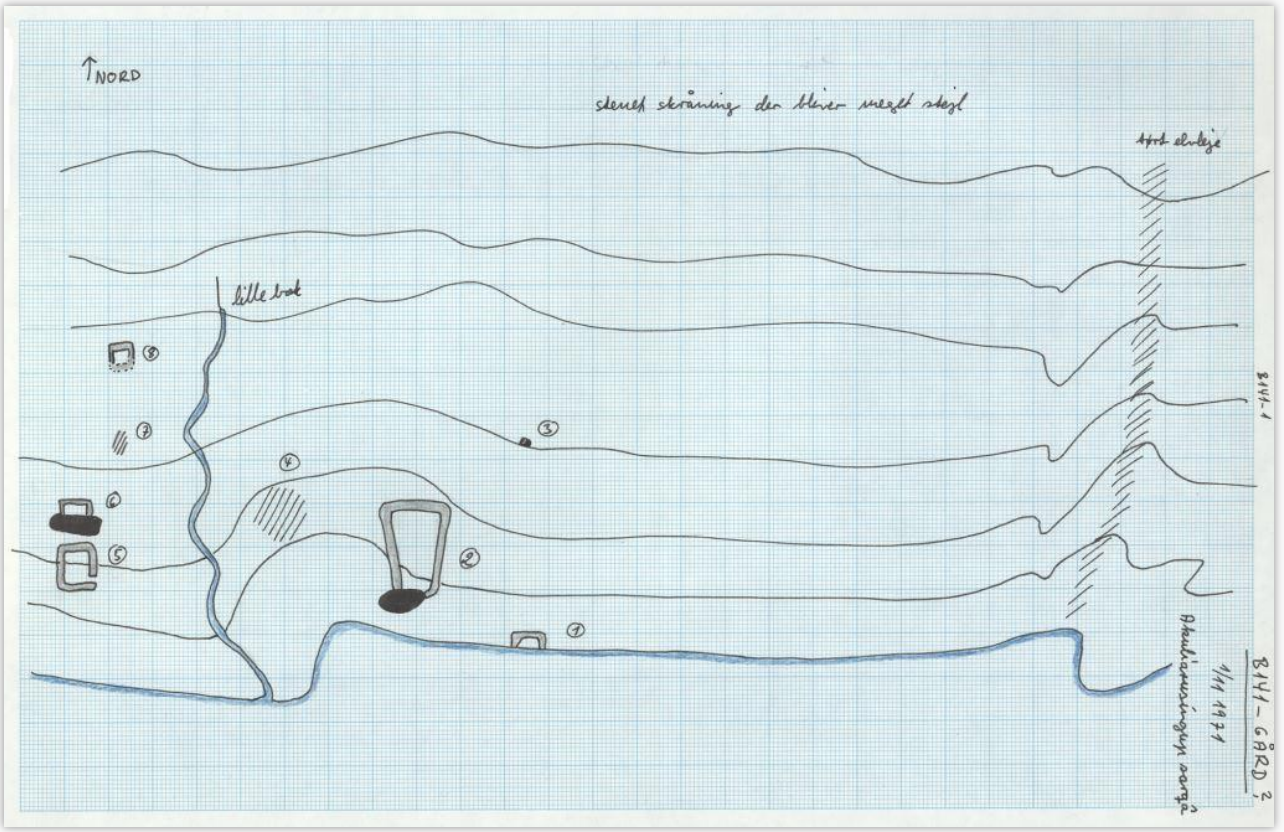


Fig. 4.13 One of O. Bak's later (1971) sketch survey plans of ruin group E313 (B141 after his numbering system) in the Sioralik in the Vatnahverfi region. Although less detailed than the survey plans of G.F. Holm (cf. Fig.5.9) and D. Bruun (cf. Fig.5.11), O. Bak's survey plans are precise enough to be a highly valuable tool during ruin group revisits and were frequently used during the Vatnahverfi surveys (*after NMA: Bruun 1971:B141*).

4.1.5 Cultural Heritage Management and Research Projects – 1976-2005

Following the 1962-1976 hiatus, the research epoch 1976-2005 saw Norse Greenland archaeology finally emerge as a fully modern discipline, e.g. shedding off most of the agendas of historical-archaeology (see above). However, the archaeological investigations were increasingly divided upon two different spheres of activity: research projects (initially introduced mainly from Denmark) and cultural heritage management, the latter especially related to intensified sheep farming after 1976/1977 (see section 8.2.3) and transfer of archaeological supervision and responsibility to Greenland's Home Rule in 1981 (Arneborg 1989:128). The number and scale of archaeological investigations in this epoch preclude any full review, not at least because a number of research- or heritage management projects concerned with non-Norse cultures opportunistically, or summarily, included Norse ruin groups. The below review is limited to the major archaeological investigations, presenting in detail only activities in the Vatnahverfi region.

Although cultural heritage management increasingly came to constitute an important sphere of archaeological activity, the research epoch 1976-2005 initiated with two research projects headed by the National Museum of Denmark, but collaborating internationally: one was the 'Inuit/Norse Project' in 1976-1977 in the Western Settlement (Meldgaard 1976, 1977). The aim of this project was to investigate the interaction between Norse and Inuit in the Nuuk fjord system. In addition to investigations at two Thule-culture sites, the Inuit/Norse Project included excavation of the midden at V48/ Niaquusat, most of the dwelling and part of the midden at Nipaatsoq/V54, and test excavation of the dwelling at 59/Eqaluit (Meldgaard 1976, 1977, Andreasen 1982, Møhl 1982, McGovern *et al.* 1983, McGovern 1985, Arneborg 1991a). Although the Inuit/Norse Project failed to clarify the question of Inuit and Norse interaction, it had several other research repercussions:

First, it introduced modern excavation techniques to Norse Greenland archaeology, i.e. separation and sieving of stratigraphic sequences. Second, this excavation technique was applied to both buildings and middens. This completely revived the research niche of zoo-archaeology in Greenland, advanced especially through the studies of Thomas H. McGovern (e.g., McGovern 1980, 1985, 1991, 1992a). In turn, this niche was part of a larger environmental and land use research agenda, which was also introduced through Inuit/Norse Project (e.g., Meldgaard 1977, McGovern and Jordan 1982, McGovern *et al.* 1983, McGovern *et al.* 1988, Barlow *et al.* 1997). Climate related and environmental research approaches to Norse settlement in Greenland have grown in importance ever since.

Parallel to the Inuit/Norse Project was the 'Nordisk Arkæologisk Expedition 1976' ('Nordic Archaeological Expedition' or 'NAE') around Tasiusaq and Qorlortup Itinnera in the central Eastern Settlement. The aim of this project was reinvestigate settlement evidence to address issues of depopulation, also by Nordic comparative perspective. The project therefore included scholars from all of the North Atlantic and Scandinavia (Edgren 2002:2p). In 1976, field investigations included detailed surveys of seven ruin groups in the valley of Qorlortup Itinnera (E4, E33-E38) – covering some 200 of the then 230 registered ruins – as well as a test trench in the midden of E38 (Ibid.7), a cut in an irrigation ditch and phosphate sampling at E4 (Hasselmo 1985:59p). The project was to run for several years, but for various reasons ended with a smaller field season in 1977 (Keller 1983:59). Both the Swedish and Finish field teams handed in interim reports (Hasselmo 1985, Edgren 2002), but otherwise the project did not come together as planned. On the other hand, the NAE did establish the foundation – and provided ruin group records – for later studies by Norwegian archaeologist Christian Keller and Albrethsen (Keller 1983, Albrethsen and Keller 1986, Keller 1986, Albrethsen 1991), some of the research epochs' most important settlement pattern studies. As with the research "offshoots" from the Inuit/Norse Project, C. Keller's and S.E. Albrethsen's had a notable focus on environmental conditions and land use patterns.

Following these projects, there was a pause in larger archaeological research projects until the Vatnahverfi Project initiated in 2005 (see section 4.2.1). However, renewed archaeological investigations at Kilaarsarfik/ *Sandnes* (V51) in 1984 were to a large extent project oriented, although they were partly carried out in response to erosion threat of the ruin group's midden: in 1981, T.H. McGovern and Richard H. Jordan surveyed part of the Ameralik to assess erosion threats and midden preservation (McGovern and Jordan 1982:63), which led to the excavation by an international team of specialists of V51's midden and coast near structures in 1984 (Arneborg 1985, McGovern *et al.* 1996).

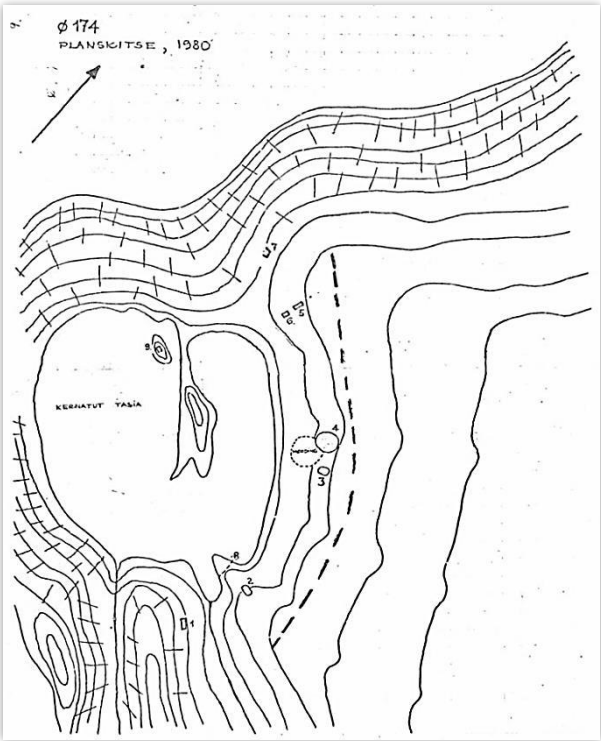


Fig.4.14 Example of a 1980 sketch survey plan of ruin group E174 in the southern Vatnahverfi region (cf. appendix ?.?). In terms of method and accuracy, this type of archaeological survey carried out in connection to the development of sheep farming was comparable to the surveys of G.F. Holm and D. Bruun and hundred years earlier (cf. Fig.4.9, 4.11). However, the surveys are still highly valuable for the location of ruins (*after NMA: Krogh og Berglund 1980:168*).

Also, towards the end of the research epoch two smaller archaeological projects in the Eastern Settlement were carried out: one was a Ph.D.-project by Dorte Veien Christiansen, which involved test trenching of one ruin and a midden at E221 by the supposed Norse *Sandhavn* in 2001-2002 (Tab.4.1) (Christiansen 2002:15, 2004:32). This Ph.D.-project was associated with a project on the early Thule-culture in South Greenland, which involved a number of surveys and minor test excavations (E47, E80, E221) of Norse ruins (Gulløv 2000a, Raahauge *et al.* 2002, Raahauge *et al.* 2003, Gulløv 2008a). The other project was Arneborg's study on the smaller types of Norse churches (Arneborg 2002) and isotopic levels of buried Norsemen (Arneborg *et al.* 1999, Arneborg *et al.* 2008, Arneborg *et al.* 2012a), which since its beginning in 2001 has involved test trenching or excavation of five (E33, E35, E48, E64, E78) churchyards in the Eastern Settlement (Arneborg *et al.* 2002, Møller *et al.* 2007:22p, 25p, Arneborg *et al.* 2009a:9pp). Related to Arneborgs church project was also a test excavation in 2002 at E39 (Arneborg 2010, Edwards *et al.* 2010), which disproved the identification of a ruin as a church (Guldager 2000, 2002); and a follow-up excavation at E83a in 2004 – which identified a possible early type dwelling (Arneborg *et al.* 2009b).

However, while the research projects were renewing the agendas of the archaeology of Norse Greenland, cultural heritage management accounted for a larger part of the research epoch's field investigations: most of the archaeological surveys were related to the development of intensive sheep farming, which entailed enlarging cultivated areas and building large modern sheep stables (see section 5.2.3), improvements that were preceded by archaeological inspection. The surveys, and surveyors, are too many to list and the survey evidence, predictably of much varying detail and quality (e.g. Fig.4.14), most of it available only in reports in the NMA. However, it was these surveys that kept the number of ruin groups, and not at least ruins, growing throughout the epoch: when Krogh in (1982) published his updated edition of his 1967 popular synthesis, the map included some 408 ruin groups in the Eastern Settlement, hereof 143 in the Vatnahverfi region, as well as 28 in the Middle Settlement, and 78 in the Western Settlement. (Fig.4.19). Academic research overviews were published in 1982 and 1989 (Olsen 1982, Arneborg 1989).

Towards the end of the 1976-2005 research epoch, two more research based archaeological surveys set new, or in the least revived the old, standards for systematic archaeological surveys and their publishing: one was the survey of Albrethsen and Arneborg of the ruin groups in the Middle Settlement (Albrethsen and Arneborg 2004); the other the survey of Ole Guldager, Steffen Stummann Hansen, and Simon Gleie in the region between the Tunnulliarfik and Sermilik fjords in the central Eastern Settlement (Guldager *et al.* 2002). Both these benchmark surveys are as systematic and thorough as those of Holm and Bruun (Fig.4.15, see section 4.1.2). Unfortunately, they are essentially also methodologically similar: most ruins were only roughly measured or "paced off", and overview ruin group survey plans sketched. This makes direct comparison with later DGPS-surveyed sites somewhat problematical. Still, the two recent surveys have set the standard for the methods and visualization used in the surveys of the Vatnahverfi Project (cf. Fig.4.15-4.16).

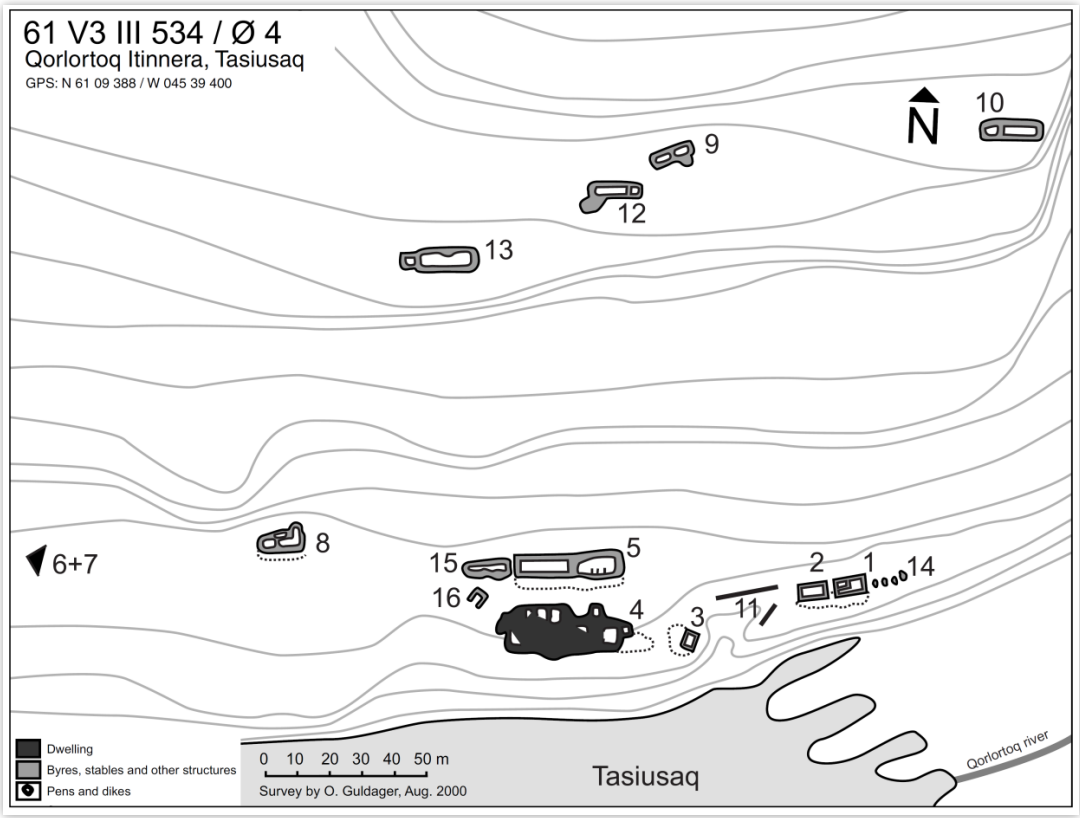


Fig.4.15 Example of 2002 sketch survey plan of ruin group E4 by the Tasiusaq in the central Eastern Settlement. Although still based on estimated measurements and placing, archaeological surveys have from the late 1990's become increasingly detailed, systematic, and precise (cf. Fig.5.16), a methodological improvement especially advanced by O. Guldager *et al.* (2002) (*after Guldager et al. 2002: Fig.82*).

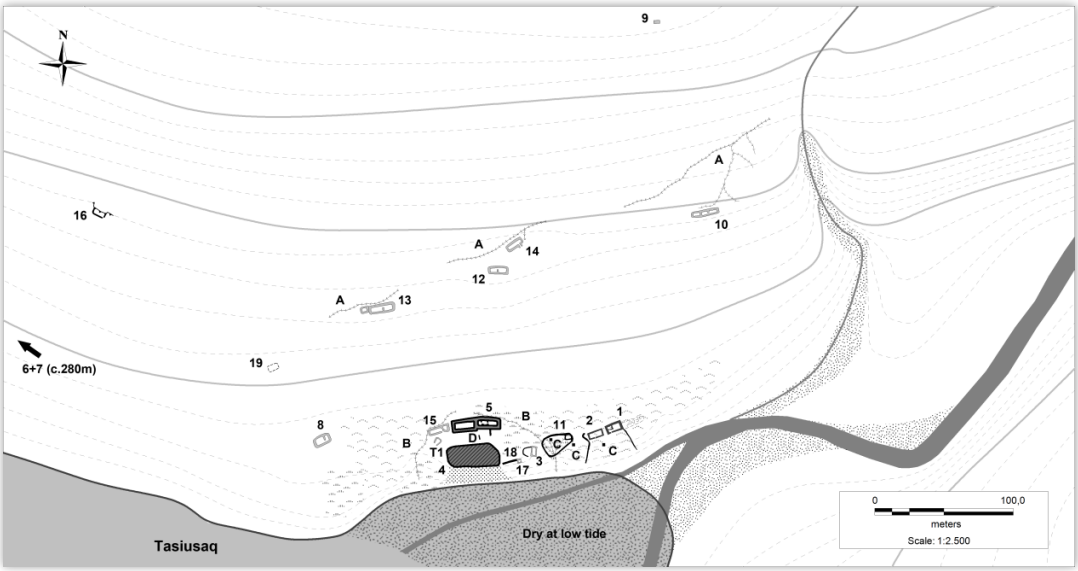


Fig.4.16 Example of 2011 DGPS-survey plan of ruin group E4 by the Tasiusaq in the central Eastern Settlement. Apart from a greater number of buildings and features, the precision plan is comparable to the sketch survey plan (cf. Fig.4.15), attesting to the skill of the surveyors of the former. However, while some sketch may provide comparative survey evidence, others may be more imprecise, and there is no way of ascertain this (*plan made by C.K. Madsen 2011*).

Cultural heritage management also accounted for several excavations during the 1976-2005 research epoch: one was related to the development of sheep farming, e.g. test excavation in 1994-1995 of the midden of E34, which had been discovered in 1993 by a sheep farmer cutting drainage channels (NMA: Nyegaard 1996). However, the most important excavation of the period was carried out due to erosion threat: in 1990, local caribou hunters reported seeing large pieces of wood being washed out of the brink of a melt-water river in an unnamed inland area south of the Naajat Kuuat in the Western Settlement. An inspection by the National Museum of Greenland the same year confirmed the presence of an unknown and eroding Norse ruin with astounding preservation conditions due to sedimentation and permafrost. Actual excavations of this 'Farm beneath the Sand' (GUS) were carried out in 1991-1996 and it is to date the most comprehensively excavated Norse ruin. However, besides zoo-archaeological evidence (Enghoff 2003), specialist studies (e.g., Panagiotakopulu *et al.* 2007, Hebsgaard *et al.* 2009), and several preliminary reports (e.g., Andreasen and Arneborg 1992, Arneborg and Berglund 1993, Albrethsen and Ólafsson 1998, Berglund 1998a, 2000, 2001), the final publication of GUS is in progress.

Two other excavations of the research epoch related to industrial development: in connection with the establishment of a gold mine in 'Kirkespirsdalen' in the peninsula between the Southern Semilik and Tasermiut fjords, a presumed Norse shieling site (60V2-II-574) was excavated in 1997 (see section 5.1.3 and: Berglund 1998b); in 2004, a test excavation was carried out at the dwelling and byre/staple at E74 and outbuildings at E73 by lake Qorlortorsuup Tasia in the eastern Vatnahverfi region in connection with the establishment of a hydro-electrical plant (see section 5.1.3 and: Kapel 2004).

Apart from a number of brief research reviews presented by Arneborg (e.g., Arneborg 1993, 1999, 2003a, 2003b), it was more than a decade before Krogh's 1982 historical-archaeological synthesis was replaced: first, by a very thorough and critical, but also very historically oriented monograph by Kirsten Seaver (1996), latest by an archeologically oriented synthesis by Arneborg (2004). In this latest study, some 460 sites were recorded in the Eastern Settlement, hereof ca. 145 in the Vatnahverfi region, as well as ca. 39 in the Middle Settlement, and ca. 95 in the Western Settlement (Fig.4.19).

In summary, the 1976-2005 research epoch saw some of the most important modern excavations in Norse Greenland to date. Especially midden excavations have provided detailed information on economic patterns and -changes on the farmsteads (e.g. see section 2.2). The significance of the ruin excavations, however, is somewhat reduced: first, by the circumstance the larger excavations (V54, GUS) concerned only Western Settlement centralized dwellings, which were almost, but not completely, excavated (no outbuildings were investigated); second, by the – as yet – rather preliminary and summary publication of the excavations. More significant, perhaps, was the introduction to the archaeology of Norse Greenland of modern excavation methods and environmental research aspects. Although archaeological activities related to cultural heritage management did not advance the scope or established methodologies of ruin group surveys, they did continue to add ruins and ruin group evidence, much of which has been invaluable to the surveys of the Vatnahverfi region. Also, the combined survey records gained from research projects and cultural heritage management encouraged and enabled the first regional-level detailed settlement pattern studies in Norse Greenland archaeology.

Beyond ruin group surveys associated with the development of intensified sheep farming (e.g. Fig.4.14), the 1976-2005 research epoch saw few archaeological investigations in the Vatnahverfi region: in 2004 small-scale rescue-excavations were carried out at E73 and E74 Kapel *et al.* (see above), an investigation that also involved the first surveys in the Vatnahverfi by Niels Algreen Møller (Kapel 2004).

4.1.6 Specialized Research Projects and Ecodynamics after 2005

In 2005-2006, a substantial part of the midden at Qassiasuk/*Brattahlið* (E29a) was excavated by an international team in order to secure a stratified faunal material from the Eastern Settlement (Edvardsson 2007a); also in 2006, most of the dwelling and midden of ruin group E74 by lake Qorlortorsuup Tasia in the central Vatnhaverfi region was excavated in connection with the establishment of a hydro-electrical plant (Edvardsson 2007b). Otherwise, the bulk of archaeological activity after 2005 relating to Norse settlement in Greenland has been by part of, or affiliated with, the Vatnahverfi-Project, which is described in detail in section 4.2.

Otherwise, smaller and specialized research projects addressing climatic, environmental, and land use aspects of Norse settlement have been the trademarks of the research of the last decade. Since many such studies are presented throughout the dissertation, they will not be listed here. However, of special interest to the themes explored in the dissertation are the new palynological studies in the Vatnahverfi region (Ledger *et al.* 2013a, 2014b), and elsewhere in the Eastern Settlement (Edwards *et al.* 2007, Schofield *et al.* 2007, Buckland *et al.* 2009, Golding *et al.* 2011, Schofield and Edwards 2011, Panagiotakopulu *et al.* 2012, Schofield *et al.* 2013). The French research project 'Groenland Vert' ('Green Greenland') has since 2010 worked on sediment cores from lakes in the central Eastern Settlement (Gauthier *et al.* 2010, Massa *et al.* 2012a, Massa *et al.* 2012b, Perren *et al.* 2012), latest in the Vatnahverfi (unpublished).

Also of special value to the dissertation have been the ruin group surveys by Niels Christian Clemmensen and Hans Kapel, who since 2008 have been DGPS-surveying Norse ruin groups (E18, E59, E66, E111) for the National Museum of Greenland as part of their cultural heritage management strategy (Clemmensen and Kapel 2008, 2010a, 2010b, Kapel and Clemmensen 2013). They have kindly provided me with the precision surveys that constitute most of the comparative Eastern Settlement survey evidence. Archaeo-agronomist Peter Steen Henriksen from the National Museum of Denmark have since 2010 conducted specialized studies of farming and fertilizing at farmsteads in the central Eastern Settlement, including E64 in the Vatnahverfi region; some of his findings are already published (Henriksen 2012), others are in press. Finally, Icelandic historian Orri Vésteinsson (2010) have used the prior survey evidence and interim reports from the Vatnahverfi Project to carry out a parish-level study of settlement patterns in the Eastern Settlement (see also section 7.3.1)

A major research trend since around 2005 has been a move towards increasingly overarching and comparative perspectives on North Atlantic settlement and land use: in these studies of ecodynamics in the North Atlantic, changes in settlement- and economic patterns across the North Atlantic are jointly weighed against human impacts on, and management of, landscapes and resources, and not at least the impact of natural climatic and environ-mental changes. It is especially scholars working with the research network of the 'North Atlantic Biocultural Organization' (NABO) that have promoted these new perspectives, not at least by very rich publication activity (e.g., Dugmore *et al.* 2005, Dugmore *et al.* 2007b, Dugmore *et al.* 2009, Dugmore *et al.* 2012, Dugmore *et al.* 2013). These studies have been highly inspirational to the themes investigated and discussed in the dissertation.

At present, no monograph on Norse Greenland has been published to update J. Arneborg's (2004) overview and to synthesize and summarize all of these new findings and approaches. However, two historical-archaeological popular narratives have been presented, one with a fairly discursive perspective (Seaver 2010), the other stressing Norwegian perspectives on settlement in Greenland (Lindval 2011).

4.1.7 Summary Discussion

Reviewing the research history of the archaeology of Norse Greenland and the Vatnahverfi it developed – as most scientific disciplines – through steadily advancing and accelerating research, spearheaded by archaeological pioneers all the way back to H. Egede's first 1723 exploration: the surveys of the Vatnahverfi-Project were only possible because of the prior surveys of Holm, Bruun, Bak, Krogh, Albrethsen etc., who in turn were indebted to earlier surveyors Walløe, Olsen, Arctander etc. I have been able to list far from all contributors to this development, neither all investigations. However, although I believe I have outlined the most important contributors and their investigations, and having thus provided a *stand der forschung* over near 300 years of archaeology in Greenland, a few concluding comments and perspectives seem in order:

Tab.4.1 and Fig.4.17-4.18 shows most archaeological excavations carried out on Norse ruins in the settlements of Greenland, listed after the first year of investigation. This list of a total of 94 ruin groups is not exhaustive, but it does include all the investigations described in the above, as well as others not described. I predict that at least 90% of the excavations carried out in Greenland, or at least in the Eastern Settlement, are listed in Tab.4.1; it indicates what type of ruin or feature was investigated, whether it was a comprehensive or test excavation, and references to primary related publications.

There are few striking patterns to Tab.4.1, except for the most apparent observation that more than two thirds

of the excavations were carried out between 1832 and 1962, i.e. prior to the introduction of ^{14}C-dating (except for the excavation of E17a: Vebæk 1993). Thus, for two-thirds of the excavations, there is no chronological framework. Obviously, this has problematic implications for tracing building developments and the surface interpretation of ruins. This issue is aggravated by the observation in Tab. 4.1 that comprehensive excavations of ruin groups in the Eastern Settlement has recently only been carried out at two ruin groups (E74 and 60V2-II-574), hereof one dwelling (E74 ruin no.4).

Apart from the obvious, but unrealistic, suggestion that we need to excavate more Norse ruins in Greenland, I would suggest that several of the previously excavated buildings could expediently be reinvestigated: the early excavations were seldom carried through, so floor layers, deposits, buildings sequences are often preserved; and since early excavators rarely backfilled excavations, trenches or larger excavation areas can easily be opened, sampled, and dated. We have tried this, or test-excavating naturally eroding ruins, with success during the Vatnahverfi Project (e.g., Heide and Madsen 2011). On their own such investigations are of limited value, but compiled they constitute a valuable chronological supplement to more detailed stratigraphic records from larger excavations (see section 8.2.1-8.2.2).

Another clear implication from Tab.4.1 relates to the excavation of outbuildings: in fact, only at the Norse shieling site in Kirkespirsdalen has other, and in that case rather atypical, ruins rather than dwellings been excavated since the 1921-1962 epoch. The effect is unmistakable: apart from the byre/barns, we know next to nothing of chronology, development, or function of the various types of outbuildings. This is, by my accord, one of the most problematic issues in regard to the interpretation of the survey evidence. Finally, the historical-archaeological agenda relating to the medieval topography and church lists is also clear from the large frequency of church excavations visible in Tab.4.1.

Fig.4.19 displays the estimated number of identified ruin groups in the different settlement areas in Greenland – with the specified proportion made up by ruin groups in the Vatnahverfi region – from 1794 and up till today. Besides notable and expected increases in the first research epochs, the number of registered ruin groups in the Eastern Settlement has been growing rather steadily over the last 250 years, while the numbers of ruin groups in the Middle and Western Settlement have remained relative steady and even decreased since the 1903 survey of Bruun (see above). The reason for the stagnant ruin group numbers in the Western Settlement is that Bruun relied on rather vague written or verbal information for his description of a considerable part of the ruin groups, many of which later proved to be natural-, Thule-culture-, or later features; or were simple misplaced on the maps. The latter was also to some extent the case in the Eastern Settlement, only there the number of newly discovered ruin groups kept up with the ones cancelled or replaced.

The circumstance that the number of ruin groups in the Eastern Settlement – and in the Vatnahverfi region – has continued to grows raises the question of how many of the Norse sites that have been discovered? Will ruin group numbers keep growing? I address issues of ruin group representativity in relation to the Vatnahverfi region evidence in section 4.2.4. Here, it is adequate to note that as long as there are archaeological surveys in the Norse settlement areas, ruin group numbers will surely incresase, even in the Eastern Settlement and the Vatnahverfi. Most of the ruin groups to be discovered, however, will in all probability be smaller shieling sites of the type that Bak was so adept at localizing (see above), and to which type also the 18 new ruin groups discovered during the Vatnahverfi Project belongs.

In terms of ruin groups waiting to be discovered in the Middle- and Western Settlements, I have little idea. However, considering that the surveys in the Middle Settlement have always been carried out from boat, it seems likely that upland and inland areas could still hide a number of shielings sites of the same type as found in the outer fjords of the Eastern Settlement? During a 2012 in the Western Settlement, we located such a new small shieling site ca. 2 km inland from farmstead V15 near the fjord (field report under preparation), clearly showing that in the remote areas of the Nuuk fjord, smaller sites are still undiscovered. However, that ruin group numbers have increased continually in the Eastern Settlement, while they have remained stable in both the Middle and Western Settlement areas (Fig.4.19), undoubtedly also owes to Inuit sheep farming: it was never reintroduced on any significant scale the latter areas (see section 8.1.2). Many new ruin groups, including most of those found during the Vatnahverfi Project, was located by sheep farmers tending to their flocks.

Tab.4.1 – Excavations of Norse Sites in Greenland 1723-2011

Eastern Settlement:

Ruin Group No.	Exc. Dwel-ling	Exc. Mid-den	Exc. Struc-ture	Exc. Church /-yard	Test Dwel-ling	Test Mid-den	Test struc-ture.	Test church /-yard	Year	Primary references:
E83			●	●	●	●		●	1723, 1828, 1831, 1839, 1880, 1935	Egede 1925, Graah 1932:151, Pingel 1837:128p, Pingel 1842:342p, Holm 1883:97, Clemmensen 1911:289, Roussell 1941:34p
E323					●		●		1824	Pingel 1836:212
E47	●		●	●	●	●	●	●	1828, 1830, 1832, 1837, 1839, 1910, 1924, 2000	Pingel 1832:99, 1833:318, 1837:126p, 1839:234p, 1843:340p, Bruun 1895:331pp, Clemmensen 1911:326p, Nørlund and Roussell 1929, NMA: Gulløv 2000:24p, Gulløv 2008:95p
E111			●	●	●		●	●	1829, 1839-40, 1853, 1880, 1900, 1911, 1921	Pingel 1843:330p, Holm 1880:136p, NMA: Meldorf 1911,Nørlund 1924:40pp, NMA: Kapel&Clemmensen 2013:15
E112							●		1832	Pingel 1833:316p
E159			●						1832	Pingel 1837:129
E87							●		1832	Pingel 1837:130
E106							●		1832, 1833	Pingel 1833:317, 1836:217
E29a	●	●	●	●			●	●	1832, 1839-40, 1880, 1894, 1932, 1962, 1964-65, 2005-2006	Pingel 1833:323, Pingel 1842:343, Holm 1883:79, Bruun 1985:294, Nørlund&Stenberger 1934, Meldgaard 1964, 1982, Nørlund and Stenberger 1936, Albrethsen 1982:274, Edvardsson 2007
E120						●	●		1837, 1969	Pingel 1839:234, GHM III:809, NMA: Albrethsen 1969
E66	●	●		●		●	●	●	1839, 1855, 1880, 1894, 1910, 1926, 1935, 2008	Pingel 1843:341p, Holm 1883:115pp, Bruun 1895:373p, Clemmensen 1911:341p, Roussell 1941:99p, Arneborg et al. 2008:27p
E32			●						1880	Holm 1883:82
E59			●			●			1880	Holm 1883:108
E77			●						1880	Holm 1883:123p
E73	●		●				●		1880, 2004	Holm 1883:126p, Kapel et al. 2004:10p
E14					●				1894	Bruun 1895:247
E2	●					●			1894	Bruun 1895:215pp, 225
E20	●					●			1894	Bruun 1895:264p
E31						●			1894	Bruun 1895:302
E53							●		1894	Bruun 1895:353
E7							●		1894	Bruun 1895:238
E90			●						1894	Bruun 1895:413
E92					●	●			1894	Bruun 1896:419
E93						●			1894	Bruun 1896:419
E3						●			1910	Clemmensen 1911:323, Madsen&Smiarowski 2011 (under prepartation)
E105								●	1926	NMA: Nørlund 1926, 1928:52
E140								●	1926	Nørlund 1928:52p
E18								●	1932	Nørlund 1934:11
E28	●					●			1932	Nørlund&Stenberger 1934:92pp
E29	●					●			1932	Nørlund&Stenberger 1934:72pp
E40b						●			1932	Hansen 1999:68
E91							●		1932	NMA:Holtved 1932:6
E149	●		●	●			●		1932, 1945-46, 1948	Nørlund and Stenberger 1934:9p, Vebæk 1953a, 1958:111, 1991:21
E33								●	1932, 2001	Nørlund & Stenberger 1934:9p, Arneborg et al. 2001:10
E35								●	1932, 2001	Nørlund&Stenberger 1934:15p, Arnborg et al. 2001:15
E83a							●		1935, 2004	Roussell 1941:37p, Arneborg et al. 2009
E64a	●		●						1939	Vebæk 1943:18
E64c	●		●						1939	Vebæk 1943:55
E78a	●		●			●			1939	Roussell 1935, Vebæk 1943
E162								●	1946	Vebæk 1991:18
E71	●		●			●			1949	Vebæk 1992:23
E167	●	●	●						1949-50	Vebæk 1992:45
E70	●					●			1950	Vebæk 1992:70
E188					●				1950, 2010	Vebæk 1950:22, Heide&Madsen 2010
E78						●		●	1951, 2007	NMA:Vebæk 1951:39, Møller et al. 2007:25
E17a	●		●				●		1954, 1958, 1962, 2001	Vebæk 1961, 1965, 1993, 52.20/03
E64		●		●				●	1962, 2007, 2008, 2010	Vebæk 1966:203, Møller et al. 2007:22p, Arneborg et al. 2009:9p,
E137							●		1969	NMA: Krogh&Albrethsen 1969:18, bilag 4
E23								●		NMA: Vebæk 1969
E24			●						1969	NMA: Albrethsen 1969
E1						●	●	●	1971	NMA: Albrethsen 1971

Ruin Group No.	Exc. Dwel-ling	Exc. Mid-den	Exc. Struc-ture	Exc. Church /-yard	Test Dwel-ling	Test Mid-den	Test struc-ture.	Test church /-yard	Year	Primary references:
E39								●	1971, 2002	NMA:Albrethsen 1971:bilag I:30, Arneborg 2010:325p, Edwards et al. 2010:91p
E227							●		1976	NMA: C. Keller 1976
E38						●			1976	Edgren 2002:7
E4							●		1976	Hasselmo 1985:52
E34		●				●			1994-1995	NMA: Nyegaard 1996
60V2-II-574			●						1997	Berlund 1991
E80							●		2000	NMA: Gulløv 2000:24
E48								●	2001	NMA_Krogh 1968, Arnborg et al. 1001:5
E221							●		2001, 2002	NMA: Raahauge et al. 2003:46, NMA: Christiansen 2002:15, Christiansen 2004:32
E74	●	●					●		2004, 2006	Kapel et al. 2004:15p, Edvardsson (ed.) 2006
E60									2007	Møller et al. 2007:19
E172		●							2007, 2009, 2010	Smiarowski 2007, 2013
E165							●		2008	Arneborg et al. 2008:47
E169							●		2008	Arneborg et al.2008:47
E68						●			2008	Arneborg et al. 2008:29
E95						●			2009	Madsen 2009:30å
E329					●				2010	Heide&Madsen 2010:24
00-2						●			2011	Madsen et al. (under preparation)
E168						●			2011	Madsen et al. (under preparation)
E171						●			2011	Madsen et al. (under preparation)

Middle Settlement:

Ruin Group No.	Exc. Dwel-ling	Exc. Mid-den	Exc. Struc-ture	Exc. Church /-yard	Test Dwel-ling	Test Mid-den	Test struc-ture.	Test church /-yard	Year	Primary references:
M20					●		●		1830	Pingel 1832a:103, 1837:139
M11			●						1832	Pingel 1833:326
M19					●				1832	Pingel 1833:330
M26/27									1832	Pingel 1832a:101
M10					●				1954	Vebæk 1956:94, 1958:111, Albrethsen&Arneborg 2004:50p
M15	●		●						1954	Vebæk 1956:95, 1958:111, Albrethsen&Arneborg 2004:65p
M21							●		1954	Vebæk 1956:96, 1958:111, Albrethsen&Arneborg 2004:74p

Western Settlement

Ruin Group No.	Exc. Dwel-ling	Exc. Mid-den	Exc. Struc-ture	Exc. Church /-yard	Test Dwel-ling	Test Mid-den	Test struc-ture.	Test church /-yard	Year	Primary references:
V51	●	●	●	●				●	1903, 1930, 1932, 1984	Bruun 1917:98p, Roussell 1936:11pp, Arneborg 1985, McGovern et. Al 1996
V16	●								1932	Roussell 1941:78p, 162p
V7			●	●	●			●	1932	Roussell 1941:32
V8	●								1934	Roussell 1941:75p, 167p
V53			●						1934	Roussell 1936:60pp, 1941;228p
V55					●				1934	Knuth 1944:107p
V52						●	●		1934	Roussell 1936:59
V53a			●						1934	Roussell 1936:348
V52a	●	●	●			●			1934	Roussell 1936:61pp
V54	●	●			●	●			1934, 1952, 1976	Meldgaard 1965;90, 1976;41, 1977;165, 2001, Andreasen 1982; Møhl 1982;293
V53c	●	●							1937	Roussell 1941:64p, 171p
V35	●	●							1937	Roussell 1941:73p, 164p
V53d	●	●							1937	Roussell 1941:66p, 179p
V59					●				1976	Møhl 1982:290, NMA:J.nr.161
V48		●							1976	Møhl 1982:290p, McGovern et al. 1983:93, Arneborg 1991
64V2-0IV-529							●		1991	NMA: Kapel 1991
GUS	●		●						1992-1996	Andreasen and Arneborg 1992, Arneborg and Berglund 1993, Albrethsen and Ólafsson 1998, Berglund 1998a, 2000, 2001

Tab.4.1 List of excavated Norse ruin group in the Eastern-, Middle-. and Western Settlement areas in Greenland in the period 1723-2011, listed after the first year of excavation. 'Exc.' - dwelling, midden, structure, church/-yard signifies more comprehensive or complete excavations; 'Test' - dwelling, midden, structure, church/-yard signifies anything from cutting a small pit to carefully laid out test trenches or pits. Note that for the excavation of M25/26 there is no record or description of which type of ruin was excavated. See Fig.4.17-4.18 for the location of the listed excavations.

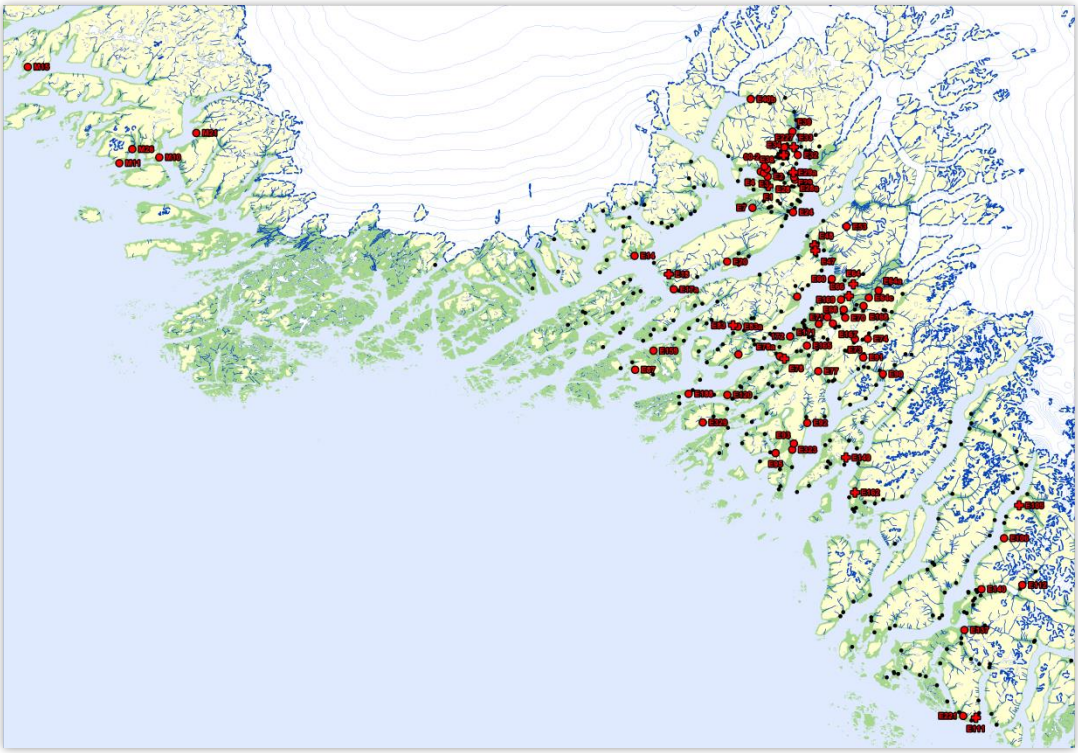


Fig.4.17 Ruin groups in the Norse Eastern and Middle Settlements excavated between 1723 and 2011 (refer to Tab.5.1 for detailed information on the excavations).

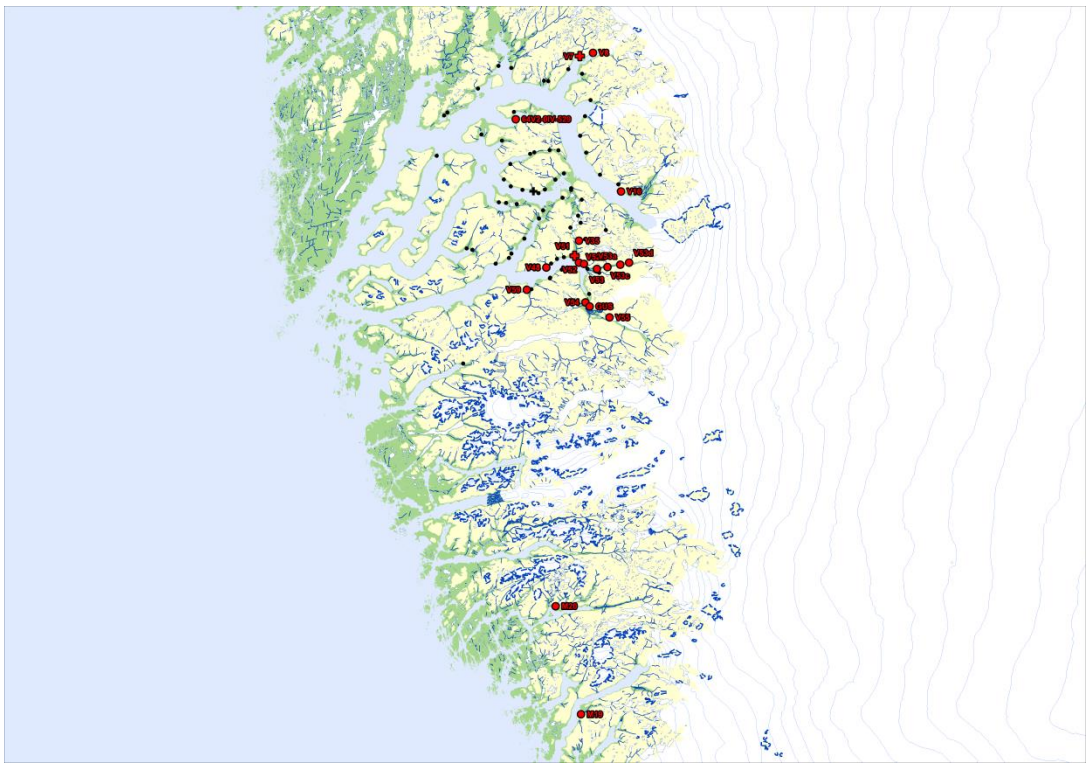


Fig.4.18 Ruin groups in the Norse Eastern and Middle Settlements excavated between 1723 and 2011 (refer to Tab.5.1 for detailed information on the excavations).

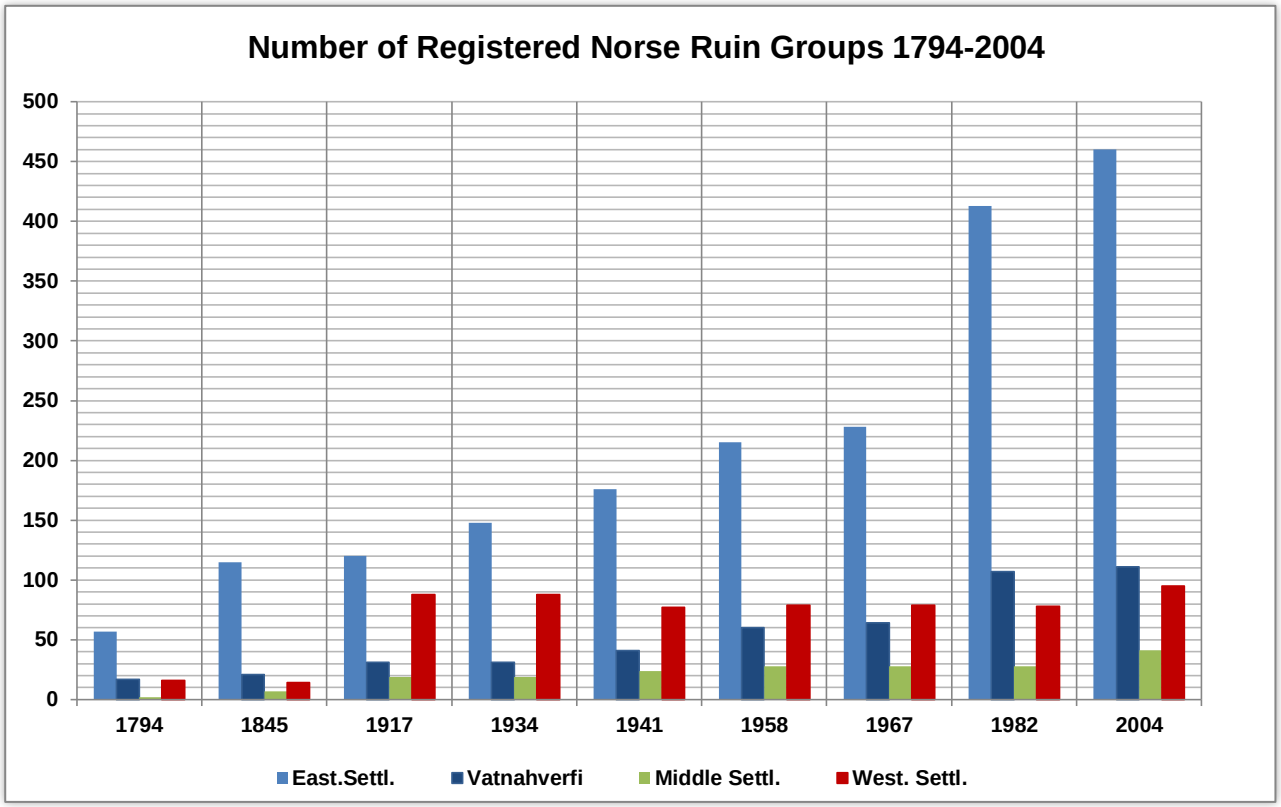


Fig.4.19 Approximate number of registered ruin groups: total number in the Eastern Settlement (blue columns); number in the Vatnahverfi region (dark blue columns); number in the Middle Settlement (green columns); and numbers in the Western Settlement (red columns) (data after: E. Thorhallesen 1776, von Eggers 1793, GHM III, Clemmensen 1911, Bruun 1917, Nørlund 1934, Roussell 1941, Vebæk 1958, Krogh 1967, 1982, Arneborg 2004).

4.2 THE VATNAHVERFI-PROJECT 2005-2011

'These men took land in Greenland, who went out with Eric : Heriulf Heriulfsfirth, he dwelt at Heriulfsness ; Ketil Ketilsfirth ; Rafn Rafnsfirth ; Sölve Sölvedal ; Helge Thorbrandsson Alptafirth ; Thorbiorn Glora Siglefirth ; Einar Einarsfirth ; Hafgrim Hafgrimsfirth and Vatnahverf ; Arnlög Arnlögsfirth ; but some went to the Western Settlement'.

***Eiríks Saga Rauða* (Flateyjarbók, 31-36), late-14th c. AD**

'Next lies Eijnerfiord, and between it and Rampnessefiord there is a large farm which belongs to the king; the farm is called Foss, and there stands also a costly church dedicated to Saint Nicholas, which the king holds to rent. Nearby is a large island with huge fish, and near it a great lake. When rains come water flows in and out; there are countless fish lying on the sand.

When one sails into Eijnerfiord there lies on the left a bay which is called Tordzualsviigh, and further into the fjord on the same side is the little promontory which is called Kleinengh, and further still a bay called Grauevigh. Further still is a large farm called Daler which belongs to the cathedral, and on the right side, as one sails into the fjord to the cathedral, which is at the end, there is a large forest that belongs to the cathedral, and that provides all of its income, both large and small. The cathedral owns all of Eijnersfiord, and also the large island which lies off the fjord and is called Renøe, so-called because in autumn countless reindeer run there; hunting is by common rights, but not without the bishop's permission. On this island there is the best soapstone, which in Greenland is of such good quality that it is used to make pots and pans. It is so consistent that fire does not damage it, and it is made into vessels large enough to hold ten or twelve tuns. Further from land lies an island called Langhøø, and on this island are eight large farms; the cathedral owns all of the islands except the tenth, which belongs to Hualzør church'.

***Ivárr Bárðarson's Description of Greenland* (75-97), mid-late 14th c. AD**

'Gest stayed at a farm called Vik in Einarsfjord on Longunes (…). Thorgrim Troll, the son of Einar, lived in Einarsfjord on Longunes. He was a godi, a great and powerful chieftain and excellent champion who had many men under his command (…). Thorgrim Troll had another sister, Thorunn, who also lived in Einarsfjord at a farm called Langanes (…). A woman named Sigrid lived at a farm called Hamar, which was a good a profitable homestead (…)'.

***Fóstbræðra Saga* (373p), 13th c. AD**

The Norse place name '*Vatnahverfi*' occurs first in the Icelandic *Landnámabók's* ('Book of Settlements') list of named men who were to have sailed out with Eirik the Red to colonize Greenland in the year AD 985/986 (LB: 92). From *Landnámabók*, this list was copied into other medieval texts, for instance *Flateyjarbók's* above version of *Eiríks Saga Rauða* (Halldórsson 1978:449). The first part of the place name – '*vatna-*' –refers to 'water', or more specifically 'lakes', whereas '*-hverfi*' is a common Icelandic place name which can refer either to a 'cluster' of farms, to a valley, or some form of natural depression (Lárusdóttir 2006:50p). Whatever reading one chooses, the place name is highly appropriate and, one could hardly have found a more suitable name for this settlement region that most accurately translates as from Icelandic as '*the Lake District*'.

With F. Jónssons (1898) pinpointing of *Einarsfjörðr* as present day Igaliku Fjord and the few existing Norse farmsteads located on the western side of the fjord (Fig. 4.20), a few other medieval place- and farm names must also be attributed to the Vatnahverfi (e.g., the above excerpts). However, it is only the church *undir Höfða í Austfirði* – ruin group E66 at Igaliku Kujalleq – that has been identified with any certainty (Ibid.291). Therefore the medieval Norse settlement in the Vatnahverfi must mainly be interpreted from the archaeological evidence.

Section 4.1 outlined the archaeological investigations carried out in the Vatnahverfi region in the context of research activities in the Norse Greenland, from 1723-2005. Section 4.2 presents a review of archaeological activities carried out as part of the Vatnahverfi-Project –

2005-2011 – an inter-disciplinary research project focused on settlement, societal organization, and pastoral farming this core area of the Norse Eastern Settlement, South Greenland.

Over its course, the Vatnahverfi-Project developed multilaterally: geographically, to include the entire peninsula between the Igaliku Kangerlua (*Einarsfjörðr*) and the Alluitsup Kangerlua (*Siglufjörðr*) – including the latter's off-branching fjord arm Sioralik – an area of some 1560 sq. km (Fig.4.20); archaeologically, to include both surveys and excavations of churchyards and middens; interdisciplinarily, to involve a range of paleo-environmental sciences by collaborating international research institutions; topically, to concern not only regional level settlement and socio-economic layouts, but also to address aspects of human eco-dynamics and diverting historic trajectories in the North Atlantic, the latter advanced through collaboration and data sharing within the *North Atlantic Biocultural Organization* (NABO: http://www.nabohome.org/).

Several studies relating explicitly to the Vatnahverfi or addressing wider comparative themes are already published (e.g., Møller and Madsen 2007b, Dugmore *et al.* 2009, Vésteinsson 2010, Madsen 2011, Arneborg 2012, Arneborg and Madsen 2012, Dugmore *et al.* 2012, Madsen 2012, Dugmore *et al.* 2013, Ledger *et al.* 2013a, Schofield *et al.* 2013, Heide 2014, Kuijpers *et al.* 2014, Ledger *et al.* 2014a, 2014b); several more are under preparation or in press. Also, interim field reports for each year of the Vatnahverfi investigations (Møller and Madsen 2006, Møller *et al.* 2007, Møller and Madsen 2007a, Arneborg *et al.* 2009a, Madsen 2009, Smiarowski 2010) can be downloaded from National Museum of Denmark's webpeage (http://natmus.dk/).

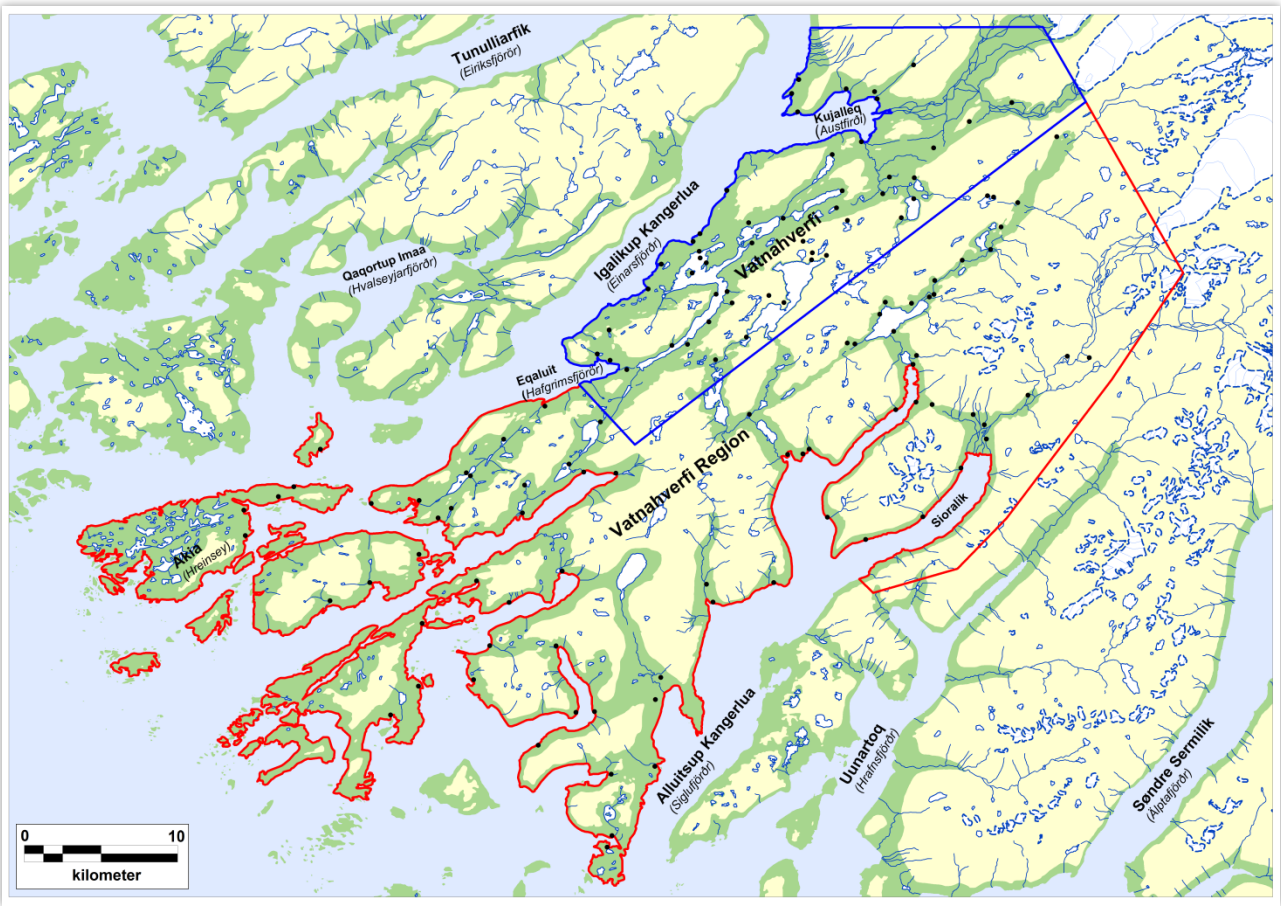


Fig.4.20 Map of the peninsula and ruin groups between the fjords of Igaliku Kangerlua and Alluitsup Kangerlua (with corresponding Norse place names given italic). The Vatnahverfi-Project began in the area traditionally interpreted as the Vatnahverfi (outlined in blue), but over the years expanded to cover the entire peninsula (outlined in red), an area of some 1560 sq. km and including 129 Norse ruin groups.

In other words, by its conclusion in 2011, the Vatnahverfi-Project had expanded to such a scope that I will not attempt to summarize the project in its entirety here. Many of the studies relating specifically to the Vatnahverfi-Project have been presented and discussed in the above, or will be so in the following, and I refer to the cited references for details on the individual affiliated projects. Section 5.2 instead presents the more regular archaeological investigations with primary focus on the many new precision ruin group surveys that have constituted a core of the Vatnahverfi-project (Fig.4.21), as well as on the test- and larger excavations that has been carried out to lend some chronological resolution to the surface survey evidence (see section 8.2.2-8.2.3). This survey evidence of Norse farmsteads and settlement is explored and discussed in detail in chapters 6 and 7.

Section 4.2.1 opens with a summary the Vatnahverfi-Project surveys as they progressed and developed from 2005-2011 (including a survey in 2013 used here as comparative evidence). Overall results of the project surveys are summarized and discussed in section 4.2.2. In the next section 4.2.3, I outline the methodologies involved in, directing, and limiting the surveys; from prior preparation and planning, over the actual field surveys, and to the final archival, digital processing and classification of the survey dataset that constitutes the empirical core data of the dissertation. In conclusion, section 4.2.4 comments on issues of archaeological representativity of the Vatnahverfi Project survey evidence. Thus, the conclusion of chapter 4 sets the scene for the analysis of the archaeological settlement evidence in the following chapters 7-8.

Fig.4.21 DGPS-survey of ruin group E325's ruin no.4 by the fjord of Akulleq in the southernmost and outer fjord zone of the Vatnahverfi region. The primary element of the Vatnahverfi-Project 2005-2011 was to revisit and precision survey all the registered Norse sites in the region, which the seven years the project was running led to the investigation of 124 ruin groups, hereof 15 of them new (*photo: K.S. Smiarowski 2009*).

4.2.1 Project Background and Development

The Vatnahverfi-Project had very modest beginnings: the idea for the project grew out of initial discussions in 1998 between Georg Nyegaard – then head of the local museum in Qaqortoq in South Greenland – and Jette Arneborg – senior researcher and curator at the National Museum of Denmark. However, the project only gained its first concrete form at a small informal meeting on the island of Bornholm in the spring of 2005: attending this meeting was project owner and coordinator J. Arneborg, geologist Carsten Secher, Hans Kapel, N.A. Møller and myself, both the latter of us at the time students in prehistoric archaeology at the University of Copenhagen. The plan decided upon at that spring meeting on Bornholm was that N. A. Møller was to lead an archaeological field survey in the traditionally identified Vatnahverfi area (Fig.4.20), where he and I would uniformly and precisely survey as many of the known ruin groups as possible. Although in itself a simple project goal, it would in fact be the first research-based and systematic regional Norse settlement analysis since 1976 (see section 4.1.5).

2005 Field Season:

We were to achieve the first survey with minimal logistic costs: in the field season of 2005 we relied on our feet, a small zodiac equipped with a 25hp outboard engine (Fig.4.22), and the aid and helpfulness of local sheep farmers, while working out from, and logistically aided by, the local museum in Qaqortoq through G. Nyegaard. Over one month in the summer of 2005 we managed to survey a total of 32 ruin groups – including three newly discovered – and some 189 individual ruins (Tab.4.2, Fig.4.25-4.26). Already in that first year, the Vatnahverfi-Project was branching out as we were joined for a week by geomorphologist Andrew J. Dugmore, Prof. at the University of Edinburg, the first of many interactions with scholars in the *North Atlantic Biocultural Organization* (for a description of the 2005 field season, see Møller and Madsen 2006).

2006 Field Season:

The 2006 field season of the Vatnahverfi-Project was preceded by an April-May rescue excavation of ruin group E74's ruin no.4 (see above, and Fig.5.14) (Edvardsson 2007b). After having joined this excavation for just under a month – and after conducting a brief survey at Qassiasuk/*Brattahlið* (E29a) – N.A. Møller and I set out on what was to be one of the main hauls of the Vatnahverfi surveys: over two hectic summer months we managed to survey some 42 ruin groups – including five newly discovered – and some 259 individual ruins (Tab.4.2, Fig.4.25-4.26). Still our primary means of transport was hiking or the small zodiac, and still we depended heavily on the aid of local sheep farmers and G. Nyegaard. The summer 2006 we extended the project survey area to include the southern part of the Vatnahverfi region – i.e. the northern coast of Alluitsup Kangerlua and the Sioralik fjord (Fig.4.20) – thereby defining what was going to become the final research area comprising the entire peninsula (for a description of the 2006 field seaso, see: Møller and Madsen 2007a). Finally, during the 2006 excavation at E74 we came into contact with two students participating at the excavation of E74 through the NABO research network, who would prove invaluable in the future field work in the Vatnahverfi region: Konrad Smiarowski, Ph.D.-student in zooarchaeology at City University of New York, and Poul Baltzer Heide, then Ph.D.-student at Aarhus Univesity and specializing in landscape studies.

Fig.4.22 Through the years 2005-2006 of the Vatnahverfi-Project, our primary means of transport for visiting ruin groups was a 25hp zodiac (*photo: C.K. Madsen 2006*).

2007 Field Season:

2007 was the first year of the *International Polar Year* (IPY). Our participation in the IPY with KVUG funding allowed us to expand the Vatnahverfi-Project; and it financed the purchase of a larger zodiac with a 90hp outboard engine (Fig.4.23). This zodiac provided a logistical basis for more wide-ranging archaeological activities, the first of which were carried out in just over one summer month of 2007: a first, brief part of the 2007 field season involved surveys of 5 outer fjord ruin groups – including one newly discovered – and 46 single ruins (Tab.4.2, Fig.4.25-4.26). On this survey, Møller and I were joined by Smiarowski, who oversaw the test coring and - excavation of middens for preservation. Test coring since became a standard practice at all sites visited and led to the discovery of an extremely well-preserved midden at the farmstead E172/Tatsip Ataa Killeq that was excavated over the next years (see below). However, the focus of the 2007 field season was not surveys, but excavations of the two small, early type church yards – E78/Eqaluit and E64/Kujalliup Kuua – in the central Vatnahverfi in order to secure samples for dating and isotopic analysis, the latter part of a study coordinated by Arneborg (Arneborg *et al.* 2012a). Also that year, the middens at E60, E78, and E172 were test excavated. The new zodiac allowed us to have two small teams of archaeologists at several sites at the time (for a description of the 2007 field season, see: Møller *et al.* 2007).

2008 Field Season:

Although the churchyards had provided skeletal sample material, not all of it was of sufficient quality for the analysis. Also, the churchyard at E64/Inoqquassaaq had revealed features worth exploring further. Thus, the one and half month 2008 field season focused on the excavation of part of the E64 churchyard by a team of archaeologists from the National Museum of Denmark under the direction of Arneborg. However, equipped with a new zodiac and joined by a group of graduate students from City University of New York (CUNY) under the direction of K. Smiarowski, we were also able to include smaller test excavations in the middens at E64, Igaliku Kujalleq/E66 and Itilleq/E68. In contrast, the ruin group surveys in 2008 were limited to follow-up surveys of 11 ruins at already visited sites (for a description of the 2008 field season, see: Arneborg *et al.* 2009a) (Tab.4.2, Fig.4.25-4.26).

Fig.4.23 In 2007, a larger zodiac with a 90hp outboard engine. This significantly increased our range of archaeological activity and made possible the many investigations until 2011 (*photo: C.K. Madsen 2013*).

2009 Field Season:

The summer of 2009 saw the next major haul of archaeological surveys in the Vatnahverfi: over the first month of the field season, Smiarowiski, Heide, and I visited ruin groups in the outer fjords in the southwest Vatnahverfi region (Fig.4.20). We managed to survey 30 ruin groups – including 2 newly discovered – and 188 individual ruins. During this survey, middens were systematically cored where present and a small test excavation was carried out of the midden at E95a/ Kujalleq (Tab.4.2, Fig.4.25-4.26). This summer, Heide began systematically surveying for cairns on the mountain ridges above the ruin groups in order to collect data for his Ph.D.-project (Heide 2014). Besides yielding many cairns of possible Norse origin, this extended surveys some ways beyond the main cluster of ruins also led to the discovery of ruins we would otherwise have overlooked. Following the survey in the outer fjord, Smiarowski and I carried out about one month of excavation at E172/Tatsip Ataa Killeq, the first of two major excavation seasons at that site (Smiarowski 2010).

Fig.4.24 Evening processing of the days survey evidence under makeshift shelter (left: P.B. Heide; right: T.B. Jensen). Because of the limited storage capacity of the zodiac used for transport, we always tried to minimize the equipment brought with us in the field, relying rather on a bit of opportunistic ingenuity (*photo: C.K. Madsen 2009*).

2010 Field Season:

Although 2009 officially was the last year of the IPY, efficient planning, low-coast logistics, and collaboration with NABO allowed the continuation of the Vatnahverfi-Project in the summer 2010. This field season had three main side-projects: first, surveys of remaining outer fjord and coastal sites, as well as test excavations at sites where erosion or earlier archaeological work allowed for minimally intrusive investigations. In 2010, we surveyed five ruin groups – one of them newly discovered – and 33 individual ruins; and conducted test excavation at three sites (E182/Kangerluarsorujuk, E188, and E329/ Eqalugaarsuit) (Tab.4.2, Fig.4.25-4.26). Simultaneously with the survey, excavation of the midden at 172/Tatsip Ataa Killeq was carried out by a team of CUNY graduate students under direction of Smiarowski. Having finished our survey, Heide and I then joined the excavation for the closing-up of the site. Thereafter, the team was moved to E64, where we continued the excavation of the churchyard under the direction of Arneborg. At that point we were joined by a team of American surveyors from Boston and Berkeley, who were to try new geophysical survey methods and who we helped carry out investigations at E64, E66, and E172 (for a description of the 2010 field season, see: Bolender *et al.* 2010, Smiarowski 2010, Heide and Madsen 2011).

2011 Field Season:

The 2011 field season in the Vatnahverfi was made possible by collaboration with the 'Northern Worlds' research agenda at the National Museum of Denmark and the NABO collaboration. Having carried out surveys and test trenching in the Tasiusaq area (E3, E4, and 00-2), the small 2011 field team of five people continued on to Vatnahverfi, where we made a test trench at 171/ Tasilikulooq, only the second midden in the entire region to display good preservation. We also dug a small test trench at E168 for the purpose of dating the settlement and use of that site. Subsequently, both Smiarowski and I participated as instructors at a Nordic field school near Narsaq, which included surveys of five Norse ruin groups (E125, E126, E195, E262, and 60V1_00I_543). All in all, 11 ruin groups and some 78 ruins were surveyed, hereof three newly discovered ruin groups and

four individual ruins in the Vatnahverfi (Tab.4.2, Fig.4.25-4.26), including a follow-up survey at E168. With 2011, the Vatnahverfi-Project was officially concluded (2011 field report is under preparation).

2013 Field Season:

In 2013, Arneborg and I – as representatives for the National Museum of Denmark – became part of the National Science Foundation funded research project *Comparative Island Ecodynamics in the North Atlantic* (CIE), which allowed us to conduct field work also in that year. Although no longer focusing specifically on the Vatnahverfi region, but rather a series of case study areas across the Eastern Settlement, the 2013 short field season included surveys of six new ruin groups, two of them (E333 and the newly discovered 1301) in the Vatnahverfi region; and some 70 individual ruins, hereof 18 ruins in the Vatnahverfi (including follow-up surveys at E60 and E184) (Tab.4.2, Fig.4.25-4.26). Test-trenching and sampling of datable material was carried out in five locations (E60, E80, E89a, E96, E149).

4.2.2 Vatnahverfi-Project 2005-2007 -Field Work Summary

To conclude, at the end of the Vatnahverfi-Project (2013), some 11 months and 2 weeks of field work had been carried out (hereof ca. six months of surveys, Tab.4.2). Over this time period, 129 ruin groups – 18 of them newly discovered – and some 798 individual ruins had been precision surveyed in the Vatnahverfi region (note that these ruin group- and ruin numbers do not reflect the grouping of farmsteads in the analysis and varies a little from numbers stated in the annual field reports); another 13 ruin groups and some 156 ruins had been precision surveyed on minor excursions to other Eastern Settlement areas (Tab.4.2, Fig.4.25).

In addition, a larger excavation was carried out in the churchyard of E64 and a smaller in the churchyard at E78. Larger midden excavations were carried out at two ruin groups (E64 and E172), and test trenches dug at another eight middens (E60, E66, E68, E71a, E78, E95, E171, and E168) (Tab.4.1). Finally, judgmental coring for assessment of midden preservation was carried out at more than 60 ruin groups (K. Smiarowski 2014, pers. comm.). The latter examination has had the disturbing implication that midden deposits with good preservation of organic material are today virtually nonexistent, even in places where preservation was noted around World War II. This unfortunate condition is primarily an effect of climatic warming, secondarily of midden deposits being drained of water as sheep farmers cut draining trenches to expand their fields.

Tab.4.2 The Vatnahverfi-Project Surveys and Excavations

Year	Field Season Duration	Ruin Groups Surveyed	New Ruin Groups	Ruins Surveyed	Excavations/ Trenches	Report
2004[1]	20.07. – 24.08. 2004	9	2	50	2	Kapel *et al.* 2004
2005	20.07. – 24.08. 2005	32	3	189	None	Møller&Madsen 2006
2006	26.04. – 26.07. 2006	42	5	259	1	Møller&Madsen 2007
2007	14.07. – 22.08. 2007	5	1	46	4	Møller *et al.* 2007
2008	15.07. – 25.08. 2008	-	-	11	5	Arneborg *et al.* 2008
2009	24.06. – 19.08. 2009	31	2	188	2	Madsen 2009
2010	07.07. – 24.08.2010	5	1	33	5	Heide&Madsen 2011
2011	29.06. – 26.07. 2011	3 (9)	3	4 (86)	2 (1)	Report under prepartion
2013	16.07. – 30.07. 2013	2 (4)	1	18 (70)	1 (4)	Madsen *et al.* 2014
Total:		129 (13)	18	798 (156)	22 (5)	

Tab.4.2 Vatnahverfi-Project overview chart displaying annual: duration of field season; no. of new ruin groups surveyed (i.e. not including revisits at ruin groups); no. of new ruin groups located; no. of individual ruins surveyed; no. of excavations or test trenches; and primary reference to the associated field report. Nos. in bracket indicates surveys of ruin groups, ruins, and excavations in Eastern Settlement areas outside the Vatnahverfi region. Additionally: [1] Ruin groups/ruins surveyed and excavated in connection the establishment of the hydro-electrical plan at Qorlortorsuaq prior to the Vatnahverfi-Project.

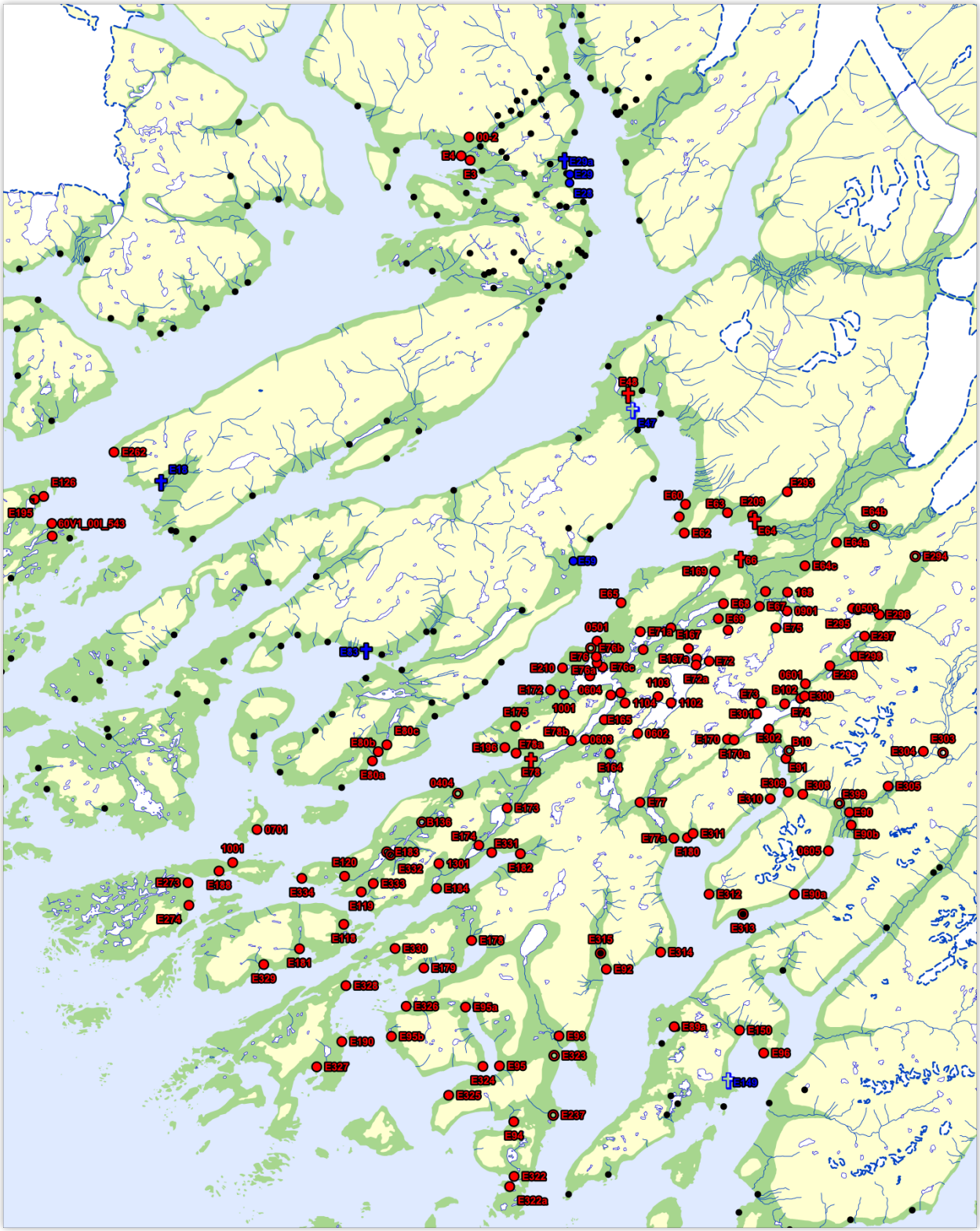


Fig.4.25 Overview map of the ruin groups surveyed throughout the Vatnahverfi Project (including 2004 and 2013) and additional comparative sites treated here: full red circles or crosses signify sites surveyed during the Vatnahverfi-Project; open red circles signify sites in the Vatnahverfi region we could locate or get to, but are included only as sketch surveys; full blue circles indicate ruin groups DGPS-surveyed by N.C. Clemmensen and H. Kapel (see section 5.1.6); open blue crosses signify ruin groups, where only old survey- or excavation plans exist.

When including ruin groups in the Vatnahverfi region that we not did not have time to visit, could not locate, or get to because of natural obstacles (14 ruin groups, Fig.4.25), as well as comparative ruin group evidence (9 ruin groups), the entire survey dataset analyzed in the below amounts to 157 ruin groups and some 1308 individual ruins. That is more than one quarter of all the ruin groups registered in the Eastern Settlement to date (excluding the 18 new ruin groups discovered in the Vatnahverfi region). This dataset on Norse sites in the Eastern Settlement is unique and unmatched in terms of its precision, uniformity, and magnitude; not at least, is it the first dataset of this size to be processed digitally, i.e. can easily be distributed between and analyzed by other scholars. The dataset is also comparable to recent cultural heritage management DGPS-surveys in Greenland (section 4.1.6). However, considering the number of ruin groups and ruins surveyed, there has naturally been some practical and methodological limits in regard to how the surveys were designed and carried out, which in turn has bearing on the interpretation of the survey dataset.

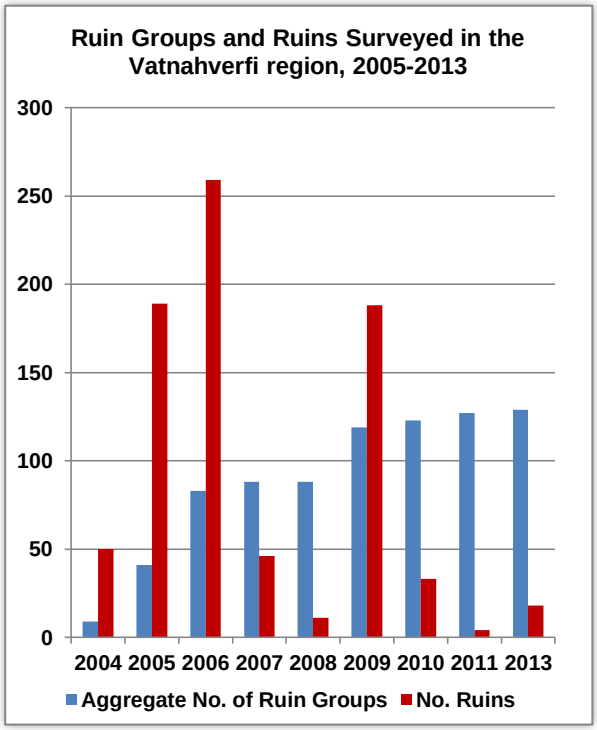


Fig.4.26 Blue columns display the aggregate number of ruin groups year for year of the surveys in the Vatnahverfi region; red columns display the number of ruins surveyed the individual year. Noticeable are the 'excavation years' with few added ruin groups or ruins.

4.2.3 Survey Methodology

Again, the surveys carried out during the course of the Vatnahverfi-Project were not designed to involve any form of complete survey or systematic sampling strategy over the entire region, but to revisit and resurvey already registered ruin groups. In effect, it was only because of prior surveys carried out by archaeologists over close to 300 years that we were able to revisit so many sites. These prior surveys allowed us to focus on the ruin groups and ruins without having to spend too much time locating them, which even equipped with prior survey maps and plans can be a difficult task. The imposing scope of prior research also accounts for the three-step method systematically used in the surveys:

Archival Preparation:

Prior to going into the field we searched publications and unpublished (NMA) records for all information on earlier investigations on the ruin groups we meant to visit the same year. This archivalia consists of everything from hastily scribbled notes or page-long accurate descriptions, over pencil drawings and aquarelles, to sketch- and, a few, precise survey plans. Accumulated over close to 300 years, these ruin group records are of course of highly varying quality and usage. Those records we deemed useable for surveys were photocopied and brought with us into the field. Prior ruin group records were also used to plan the field work, i.e. how long we were to spend at different sites and basecamps throughout the season.

The Field Surveys:

The logistical setup for the field surveys is outlined above and this section refers only to the specific on-site survey methodology: moving out from well-positioned basecamps – either over land or fjord – we would travel to designated ruin groups, looking for new features and speaking to sheep farmers along the way. As the Vatnahverfi-Project progressed, recording resource areas surrounding the ruin groups and travel times in between them also became a standard (although most of this information is presently only found in the field notes and – reports) (Fig.4.27). Whenever possible, we would try to plan travel routes between ruin groups and basecamps so that new areas were surveyed along the way.

Fig.4.27 N.A. Møller in the hills close to E64c in the northeastern Vatnahverfi. Many of the ruin groups in the region are situated inland or on the central highland plateau, where the only way of reaching them is by foot (or horse!). During such hikes, we would increasingly log travel-times and resource areas on the way between ruin groups (*photo: C.K. Madsen 2006*).

Reaching a ruin group, the surveys followed a fairly regular scheme: one person would use the prior records to begin to identify the individual ruins, while the other began setting up the DGPS-equipment. As soon as a proper DGPS-signal was established, one person would then begin to survey and describe the ruins, as far as possible numbering them according to prior surveys. Meanwhile, the other person kept on searching for any remaining or new ruins, thereafter began to photograph each ruin, in the end catching up with surveyor. This scheme meant that the survey of a ruin group could be done by two persons over 2-5 hours, depending upon the size of the site, which in turn meant that 2-3 ruin groups could be surveyed per day if located in some proximity.

The survey equipment included handheld GPS's for smaller isolated features (fox traps, cairns, shooting blinds etc.), while larger Norse ruins and features were surveyed with a Leica SR20 differential GPS, which under normal conditions provides an accuracy of < 40 cm (after post-processing, see below). However, the SR20 being an older model DGPS only able to receive a GPS-satellite signal, working in a northern latitude, and in a mountainous terrain, multipath signal interference, shadow, and abscuration were common issues, resulting in lower survey precession at some ruin groups. Some inaccuracies could be corrected or decreased through various forms of post-processing (see below). However, for the measurement of smaller details – e.g. thickness and heights of walls, entrances etc. – we instead used measure tapes or ranging rods. Based on the experience from post-processing the survey data, ruin groups were found to float with up to 2-4 meters relative to geographical coordinate systems, but mostly < 50 cm within the "local system", i.e. inaccuracies insignificant to spatial observation and analysis of ruin group layouts.

Post-Processing and Analysis:

Once back in the National Museum in Copenhagen, the survey data was post-processed in Leica GeoOffice v.7.0. Subsequently, the survey data was "cleaned up" (correcting clearly floating points) in MapInfo v.11.0, at first only as needed for rough visualization in yearly interim field reports. Also in these reports, field notes were transcribed, photographs registered, and, along with written descriptions, assigned to individual ruins.

One planned outcome of the Vatnahverfi-Project was the funding of a three-year Ph.D.-scholarship under the *Northern Worlds* research agenda at the National Museum of Denmark, set up to process and analyze the archaeological surveys data. I applied for, and was admitted, this Ph.D.-scholarship, which I started in Sept. 2010. Thereafter began a lengthy secondary process of revisiting, post-processing, analyzing, and visualizing the survey data of each of the 129 ruin groups, which were in turn being submitted to:

Archival crosschecking: through the summers 2009-2012 I was periodically leased out from my Ph.D.-scholarship to do project- and rescue archaeology for National Museum of Greenland (NKA). This gave me time to go through the Norse archives there, the records of which have since largely been digitalized. Following the 1981 repatriation of Greenland's archeological obligations to

the NKA (see section 5.1.5), all archival records and reports were to be transferred from the National Museum of Denmark to the NKA, so that they could be found – either in original or copy – at both museums. However, having gone through both archives, it is clear that this is not the case and many records, both old and new, are only found in one or the other museum. I therefore photocopied all un-digitalized archaeological ruin group records and reports regarding Norse sites in the NKA archive and send them to the National Museum in Denmark for cross-reference.

Back in the National Museum of Denmark, I went through the combined archival records on each ruin group to certify that as much information and as many ruins as possible were included and rightly numbered (see below). Once certain that I had retrieved all available information, I then started going through the survey data of each ruin group again:

Secondary Post-Processing: using the combined survey and museum archival records, I went through the description of each individual ruin, correlating the new descriptions and photographs with old ruin records, where needed making adjustments in terms of ruin dimensions, wall-thicknesses, and building material, and adjusting the ruin visualization in MapInfo accordingly. Also, because ruin outlines were surveyed as a polylines with a minimal number of points – most minimally one point in each outside corner of the building – the original raw surveys often had a somewhat angular and squared appearance. The walls and corners of such ruins were smoothed and rounded in MapInfo to have more realistic appearance and dimensions. Finally, ruin that where not correctly numbered during survey – which was at times problematic in the field because of inaccuracy of prior sketch surveys – were renumbered serially and according to the oldest existing numbering. Correct numbering of ruins is essential to the identification of specific ruins at sites where some features have been disturbed or totally removed subsequent to earlier surveys. However, it also means that ruin numbering in the survey plans and appendix (1-3) does not always correspond to the ruin numbering in the interim field reports (which is noted in the appendices). Ruins overlooked by us, but recorded earlier were sketched into the survey plans where possible. The number of such unnoticed ruins during the Vatnahverfi surveys account for the discrepancy between Tab.4.2, Fig.4.27 and appendix 1-2.

Once all the individual ruins had been post-processed in this manner, I used GoogleEarth satellite imagery and aerial photography to double-check intra-site accuracy of the individual ruin group surveys: because the Norse ruins are visible on the surface, even poorly preserved examples can often be discerned in the higher quality satellite imagery and aerial photography, once their shape and position relative to each other have been established. At ruin groups where poor GPS-signal had caused significant displacement of singular ruins, these were, if plausible, moved to correspond to the satellite imagery and aerial photography. Otherwise, or when in doubt, I relied on the original survey data.

Detailed digital maps on Greenland's topography are deficient, imprecise, or very costly. Since we most often did not have time to survey the natural features and recent buildings in the field, such features were added to the digital ruin group survey plans from GoogleEarth satellite imagery and aerial photography: e.g. dimensions and extent of coast- and lake shores, rivers and streams, roads and dirt tracks, recent or present sheep farmers' houses and stables, drainage trenches, cultivated fields, and relict Norse infields. In a few areas, however, the GoogleEarth satellite imagery and aerial photography is still too coarse to allow for observation of smaller topographical features, in which cases they were omitted, or drawn from aerial photography generously provided by the Geological Survey of Denmark and Greenland (GEUS) towards the end of the project.

The high quality DEM's used for landscape analysis and reconstruction throughout the dissertation was also only acquired towards the end of the project. Thus the solid 25 m contour lines shown in the ruin group survey plans, as well as the size and location of smaller lakes, ponds, and mires, were redrawn from georeferenced hiking maps (Greenland Tourism a/s 2001). The dashed 5 m contour lines were sketched from a combination of the 25 m fixed contour lines, GoogleEarth satellite imagery or aerial photography, overview photographs, and topographical memory of specific distinct landscape features. Thus, the sketched 5 m contour lines are not accurate, but serve only to give an impression of the local micro-level topography, which often accounts for the placing of the ruins.

Ruin Group Visualization: all this information was finally aggregated and visualized systematically in the ruin group survey plans in appendix 3. For purposes of consistency and ease of interpretation, the appearance of

the ruin group survey plans borrow much from earlier archaeological sketch or precision examples (see section 4.1), adding only a few new symbols or features (see legend to App.3). In their digital original, these final ruin group survey plans were also used for the measurement of most of the quantitative analytical parameters (see App.2-3).

4.2.4 Survey Data Representativity

Some issues regarding ruin group representativity in the Norse Eastern Settlement were discussed in section 4.1.7 Similar issues clearly also pertain to the survey evidence generated during Vatnahverfi-Project, not at least because the principal aim of the project – as outlined above – was to revisit already known ruin groups in the region, rather than to systematically search for new ones. Issues of ruin group representativity falls on to main questions: how many of the total Norse ruin groups in the region have been located and surveyed? ; And how many of the total number of buildings have been located and recorded on the individual ruin groups? Both questions are evidently difficult to answer, but must addressed as they are essential to the interpretation of the ruin groups and regional-level settlement patterns.

Ruin Group Representativity:

In terms of the number of Norse sites once present in the Vatnahverfi, the 18 new ruin groups discovered during the project clearly demonstrate that far from all the existing sites have been located. Besides ruin groups still waiting to be discovered in remote or inland mountain areas (see section 4.1.7), it must also be expected that some ruin groups have been completely removed by marine transgression or various forms of erosion: Coastal erosion is ongoing and today presents the largest threat to Greenland's cultural landscapes. Estimating how many ruin groups or ruins could have been destroyed by natural erosion is near to impossible, apart from observing that outer fjord and coastal sites are more likely to have completely disappeared, since this is where marine transgression and erosion is historically, and today, most severe and rapid.

In terms of estimating how many of the existing ruin groups have been located in the Vatnahverfi, we are fortunately somewhat better informed: for although 18 new ruin groups were discovered during the project, these were all – as also observed elsewhere (Vésteinsson 2010:144) – small sites with few ruins, i.e. shielings with a remote or marginal location rather than farmsteads lying in favorable agricultural lands. Such small sites seem to account for most new ruin groups discovered after 1962 (see section 4.1.4 and the following). Also, we have regularly questioned local sheep farmers as to their knowledge of undiscovered ruins, which has led to the discovery of about 90% of the new ruin groups in the Vatnahverfi. Considering that these Inuit sheep farmers are extremely familiar with the landscapes used formerly and presently by their farms, combined with more than 200 years of archaeological surveys in the Vatnahverfi, and the observation that no regular farmsteads have been found throughout the project, and it is a fair to assume that by far the most, perhaps even all, of the still existing low-land Norse farmsteads have been located. Certainly, there is still a considerable number of smaller ruin groups to be found in the Vatnahverfi highland plateau and in the remote inland, since archaeological and sheep farming activities there have been far less. In fact, our attention has already been directed to a few such sites as yet unrecorded. However, such shielings sites do not significantly influence interpretations of overall settlement patterns and hierarchies, only the functions and resource areas of specific farms.

The same pattern of representativity holds true even for the middle- and outer fjord areas, where some 80% of the larger and low-lying ruin groups is expectedly identified. However, the representativity of smaller shieling sites must be assumed to be poorer: first, because sheep farming has always – as especially today - been less intense in the middle- and outer fjords, and mostly absent in the coastal region, so there have been few informants to back up our site-focused Vatnahverfi surveys; second, prior archaeological surveys have always been less frequent in the outer fjord and coastal areas, and have methodologically been carried out as coast near surveys from boats. Thus, it is to be expected that a considerable number of shieling sites, perhaps even larger examples, remain undiscovered in the outer fjords and coastal areas, especially deeper inland or perhaps at some elevation? However, again, the expected lack of such sites only affect the interpretation of specific farmstead functions with little impact on the interpretation of overall regional settlement patterns.

Ruin representativity:

Regarding individual ruins, estimating how many of an unknown total we have identified is impossible. Certainly, we have found many new ruins, often noticeably increasing, in some cases more than doubling, numbers at individual sites. However, the number of new ruins located depended both upon the thoroughness of prior investigators and the time we spent surveying a site, both these factors being highly variable. However, at almost every ruin group we revisited during the Vatnahverfi-Project, we found further unregistered ruins. This attests that our surveys are not in any way complete and that still more ruins remain undiscovered at most sites, especially where dense shrub vegetation makes surface identification challenging, or at greater distance from the main cluster of farm buildings. In other words, there is no way of assessing the percentage of existing ruins located during the project. However, since only few new ruins turned up upon more than one visit at a ruin group, it is fair to assume that we actually have identified a great majority of the ruins that are visible on the surface, especially those closest to the main dwelling.

As to the contemporaneity and date of these ruins we are, except for to some extent the dwellings, at a complete loss because very few outbuildings have been dated (see section 4.1, Tab.4.2). Thus *the surveyed ruins should be considered to represent up to 450 years of accumulated settlement* at each site. The lack of outbuilding phasing could in part explain why there are apparently on average a greater number of outbuildings on the medieval farmsteads in Greenland than in the rest of the North Atlantic (see section 5.1.2). Comparative examples are, however, too few to truly verify this claim. However, as argued in section 5.1.2 it should also be noted that certain more easily identifiable ruin types – i.e. byre/barn and storehouses – are most often only represented by a single or a few ruins on the farmsteads, suggesting that outbuildings – like the dwellings – could occupy the same location for generations, rather than being built anew in a different location. I will return to this discussion in the conclusion on the analysis of the farmstead survey evidence.

Fig.4.28 View looking out of the Igaliku Kangerlua/*Einarsfjörður* from the gently rolling slopes over the coast in the northeast Vatnahverfi region (ruin group E63 is located on the first closer headland along the coast). Being located close to Igaliku Kujalleq/*undir Höfða í Austfirði* (E66), where sheep farming was first reintroduced to the region in 1930's and where it has been most intense ever since, the vegetation has a noticeable "ovegenic" appearance (Simpson *et al.* 2001:177), i.e. heavy grazing pressure has transformed much of the dwarf-shrub vegetation into grass cover (*photo: C.K. Madsen 2005*).

5. The Archaeology of Norse Farmsteads and Shielings

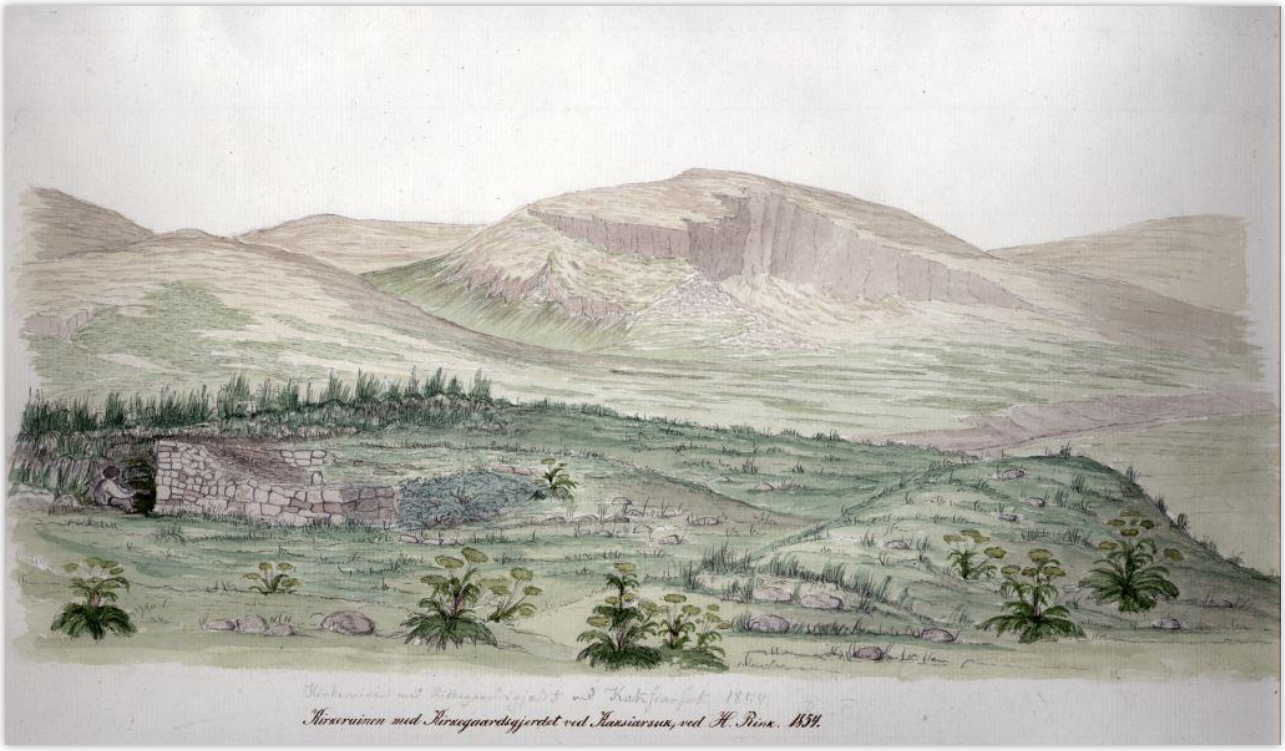


Fig.5.1 The church and farm mound at E66 in the Vatnahverfi prior to any excavation. While the stone built church building itself was distinct, the churchyard and nearby building (elevation on the right) were visible on the surface as nothing more than an uneven terrain of grass covered mounds and depressions, in this case exaggerated by later aeolian deposits. Many ruins look just the same today and for their functional interpretation we rely on the few excavated examples (*after H.J Rink 1854, courtesy of the National Museum of Denmark*).

In chapter 4, the development of Norse Greenland archaeology as a discipline was outlined. However, all the named, and unnamed, archaeologists presented there should not only be accredited with advancing the discipline in general, by locating hundreds of sites, and establishing the framework for a medieval Norse topography in Greenland, they also carried out the excavations which allow us today to trace more precisely the functional layout of the Norse farmsteads and shielings. Although many of the earlier excavations may appear methodologically outdated today, they, nonetheless, form the base on which we are able to functionally interpret the archaeological surface remains with reasonable confidence.

Chapter 5 summarizes and discusses the findings of these prior excavations and other investigations such as relating to the functional interpretation and classification of farmhouses, shieling lodges, and outbuildings of the survey evidence presented and analyzed in chapters 6 and 7. Although it would be advantageous if a review could be separated on developments within a developmental chronological framework, this is unfortunately impossible: as shown in Tab.4.1, the majority of excavations were carried out before the introduction of ^{14}C-dating and excavators were largely not preoccupied with phasing of buildings. Thus, in as a sense, the excavated Norse architecture also presents at an “accumulated” record.

Chapter 5 is divided on three main sections, each reviewing a distinct category of Greenland Norse architecture: the farmhouses and shielings lodges, the churches, and the outbuildings. Since the churches have been treated extensively elsewhere (see below) and are here mainly used as a well-established indicator of farmstead status, they are treated less extensively than the other building categories. Comparative perspectives to the rest of the North Atlantic are drawn continually to contextualize the Greenlandic archaeological evidence.

5.1 The Archaology of Norse Farmhouses and Shieling Lodges

Some general traits in the layout schemes of North Atlantic farmsteads and shielings were presented in section 2.2. At the core of these farmstead layouts were of course the farmhouses, or dwellings, why they unsurprisingly are the buildings to have received far most archaeological attention in most parts of the North Atlantic. Not at least the earliest type of farmhouses – the *skálar* or longhouses common to all of Viking Age Scandinavia – have been keenly investigated. The same is not true in Greenland, however, where only a few early type longhouses have been identified and even fewer excavated. This is not because they have not been sought after, but likely because their remains lie beneath the later building phases of farmhouses.

Nonetheless, I begin section 5.1 with a brief outline of the Greenlandic longhouses in a comparative North Atlantic perspective. I do so not because they are directly significant to the surface survey evidence analyzed in chapters 6 and 7, but first because the traditional rectangular shape of the farmhouses may – as I will discuss in section 6.2.1 – have remained an "ideal" layout model for the later farmhouses, and second because longhouses were central in formulating the development from more simple to more complex farmhouses in Greenland. I treat these more complex, later medieval farmhouses in the next part of section 5.1. In the final part, I summarize those few excavations that have been carried out on shielings in Norse Greenland.

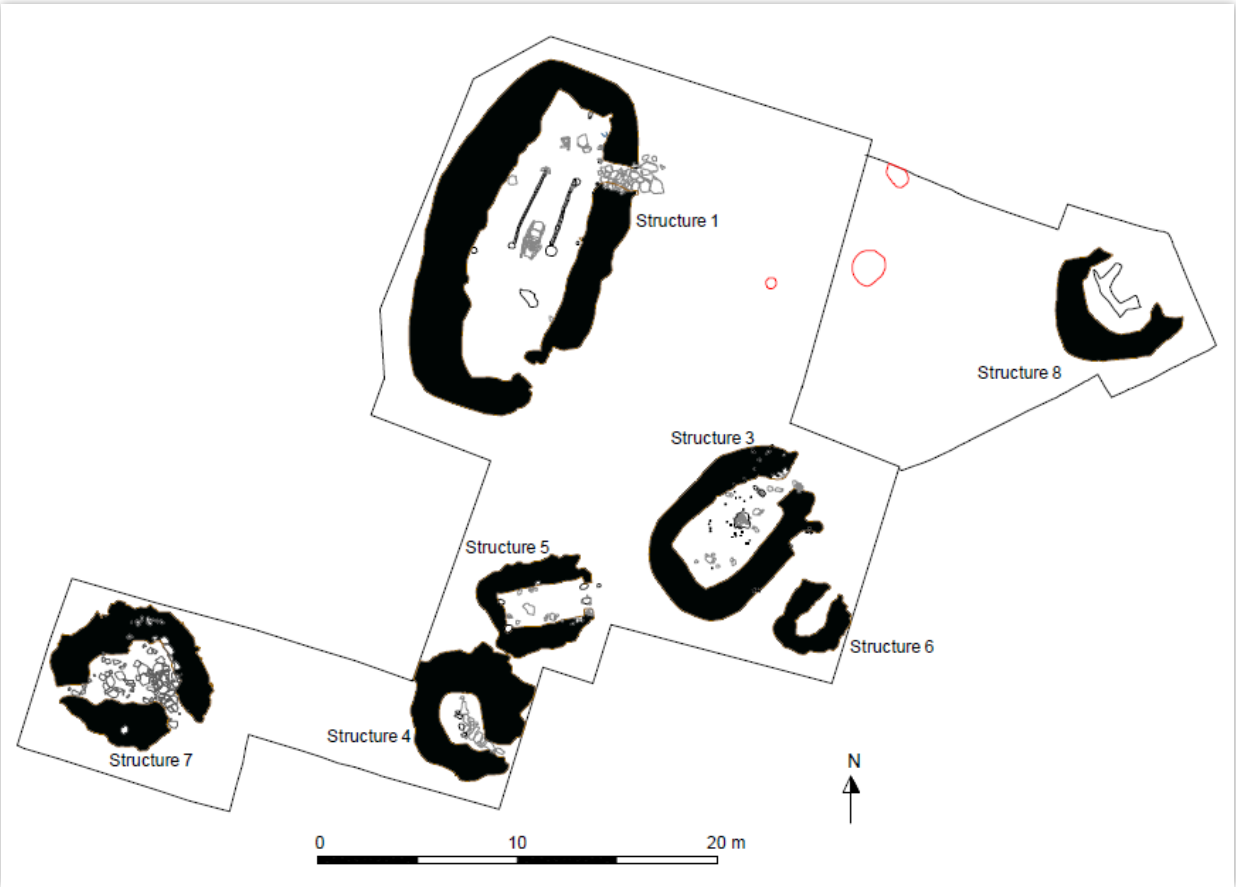


Fig.5.2 Viking Age Icelandic type *skáli* and associated outbuildings excavated at Vatnsfjörður, NW Iceland, from 2003-2010. Interpretation of the structures: no.1 earliest phase *skáli*, no.3 smithy, no.4 unknown, no.5 workroom/storeroom, no.6 storage (?), and no.7 sheep house or small byre. Red circles outline cooking pits (modified after Milek 2009:fig.3).

5.1.1 The North Atlantic Longhouses

To avoid terminological confusion it should be noted that I in the below refer to 'longhouses' or '*skálar*' (pl.) as farmhouses with the main function of a residence for a household, not to be confused with similar shaped, but larger 'hall' type structures known also from all of Scandinavia and North Atlantic, but which also clearly served representational functions (see also:Albrethsen and Ólafsson 1998:note 1).

Briefly summarized, the "classical" North Atlantic longhouse was a rectangular building with slightly curved long walls and straight gables; at its' center was a long-fire bordered by benches (Fig.5.1) (e.g., Larsen and Stummann Hansen 2001:117, Vésteinsson 2005b:22). Usually *skálar* were partitioned on different functional sections, i.e. kitchen, pantry, storage etc. (e.g., Ritchie 1993:67, Kaland and Martens 2000:44p, Bond *et al.* 2008:16p, Zori *et al.* 2013:155). Often in Scandinavia, but more rarely in the North Atlantic, the longhouse included a byre/barn section in one end of the building (e.g., Hermanns-Auðadóttir 1992:91, Skre 1996:65, Munch 2007:102, Griffiths and Harrison 2011:16).

Skáli sizes, building techniques, and architectural details varied greatly from region to region: in the tree-less North Atlantic, walls were normally built in turf and stone. In the Northern Isles and the Faroe Islands, box-walls with stone or stone/turf faces and soil filling was common (e.g., Cruden 1965:26p, Small 1967:237, Arge 1989:112, Stummann Hansen 1991:47, Matras 2005:101, Bond *et al.* 2007:18, Griffiths and Harrison 2011:16). In Iceland, walls were primarily built in turf, alternatively turf and stone, on a foundation of stone (e.g., Hermanns-Auðadóttir 1992:92, Ólafsson 2001:149, Edvardsson 2004:6, Roberts 2004:14p, Lucas 2008:85). Initially roofing was supported by buried posts (e.g., Small 1967:268, Thorsteinsson 1982:149p, Magnússon 1983:106, Stummann Hansen 1991:47, Kaland and Martens 2000:44, Herschend and Mikkelsen 2003:43, Roberts 2004:18, Vésteinsson 2005a:8p, Larsen and Turner 2010:268, Zori *et al.* 2013:Fig.2).

However, *Landnám* in Greenland ca. AD 980 coincided with diversification from the uniformity of the Viking Age (Vésteinsson 2005b:22), which also extended to the farmhouses that eventually came to include whole new house types (Skre 1996:96, Myhre and Øye 2002:281p, Vésteinsson 2005b, Høegsberg 2009:87), as well as some new shared architectural traits:

First, from the mid-9th-10th centuries, the curved longhouses were made straight-walled and narrower – and roof-bearing posts were moved closer to the walls to create space - perhaps as a result of more limited access to building timbers and a new custom of adding annexes to the sides of the buildings (Fig.5.2) (see below and: Small 1967:238, Vésteinsson 2005b:22, Larsen and Turner 2010:167). Second, at the same time or only a little later, roof-supporting buried posts were raised up on post pads or sills (e.g., Petersen 1933:82p, Myhre 1982b:112p, Magnússon 1983:106, Skre 1996:63, Myhre and Øye 2002:277); this new building technique gave buildings a longer lifespan and could thus also be interpreted as a response to timber shortage. However, the change also occurred in tree-rich Norway. Third, during the ca. 11-12th centuries AD farmhouses became more nucleated through the adding of annexes to the gables or long walls (e.g., Thorsteinsson 1982:154, Ritchie 1993:54, Vésteinsson 2005b:22, Bond *et al.* 2007:21). The latter development has been referred to by D. Skre (1996:64) as the *functional fragmentation of the longhouse* and which continued into the Middle Ages.

A fifth and major change was the separation of byre/barn from the farmhouse, which in Norway began about AD 800 (Myhre 1982a:206, Skre 1996:65, Myhre and Øye 2002:277). While there are examples of North Atlantic longhouses with byre in one end (Hamilton 1956:108, Small 1967:238, Bigelow 1989:187, Hermanns-Auðadóttir 1992:91, Griffiths and Harrison 2011:16), the norm from beginning of *landnám* seems to have been to separate farmhouse and byre. They were often closely situated and aligned (Hamilton 1956:63p, e.g., Cruden 1965:Fig.3, 26p, Hermanns-Auðadóttir 1992:Fig.2, 91p, Kaland 1993:Fig.17.2, 309, Berson 2002:59, Matras 2005:Fig.9, 106), a layout which signals both economic and social significance of the byre. Conversely, *skálar* connected byre could represent a poorer class of farmsteads (Myhre 1982a:296).

Only some 11 *skálar* type farmhouses have been wholly or test-excavated in Greenland (cf. Tab.5.1). Still, they establish that building customs there followed the rest of the North Atlantic: Aa. Roussell early identified a development from 'simple longhouse' (type I) to 'fully developed longhouse' (type Ia) with straight walls and gables, and partition – i.e. functional fragmentation – of the building including annexes added to the long walls (Roussell 1941:138p, 149p). S.E. Albrethsen added to this that the earliest *skálar* had walls built mainly of turf on a stone foundation, and that partition walls were made in perishable material (Albrethsen 1982:284).

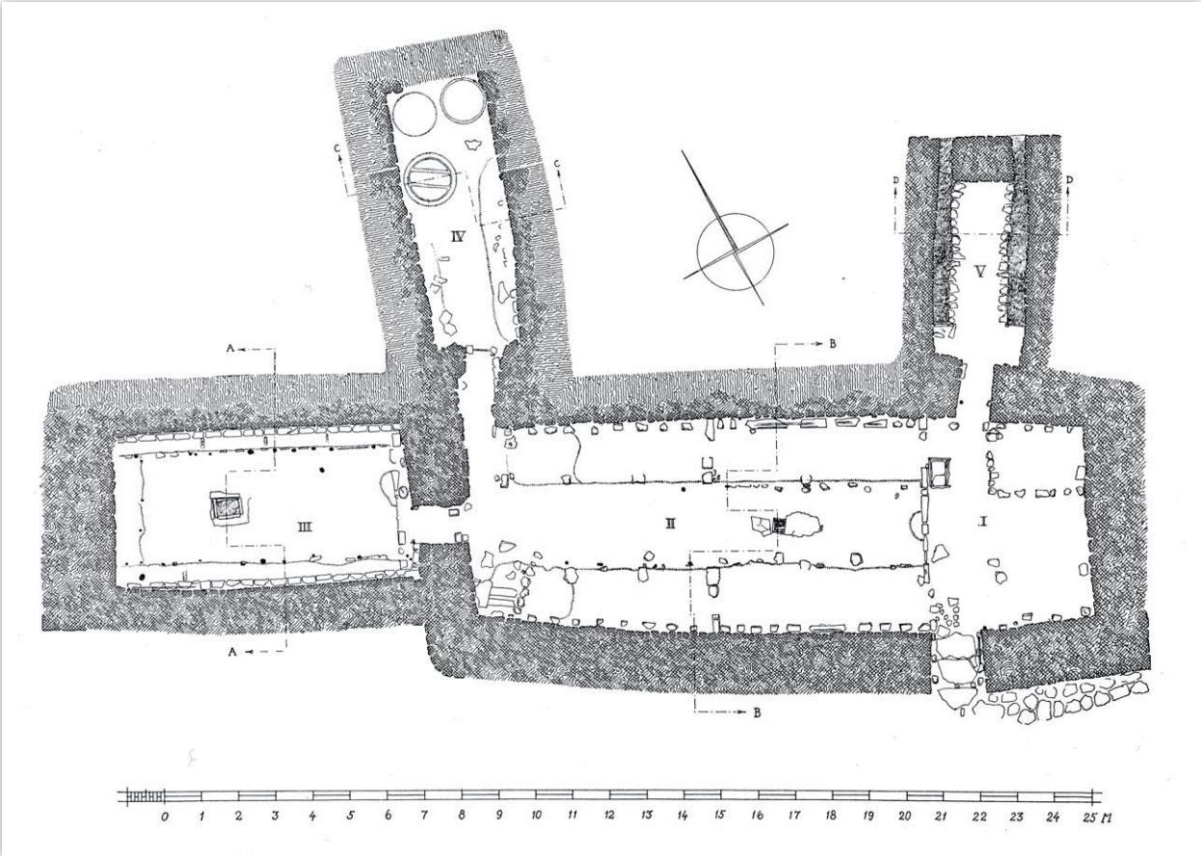


Fig.5.3 Stöng in Þjórsárdalur, SW Iceland. Excavated in 1939 and its abandonment now, debatedly, dated to AD 1104 by tephra deposits, Stöng has long been considered the prime example of an early medieval farmhouse in Iceland. At this time, the farmhouse still had at its core a central rectangular room, but also annexes with specialed function (sitting room (i.e. *stofa*), pantry, and meathouse/lavetory). Note also that room seperations are build in heavy turf wall, compared to the earlier wooden partition walls (after Stenberger *et al.* 1943:Fig.37).

To this there is only to add that some Greenlandic *skálar* examples included roof-bearing posts raised up on post pads and moved out towards the walls (Albrethsen and Ólafsson 1998:19pp, Edvardsson 2007b:plan 8), and all the developmental architectural traits of the North Atlantic are represented in Greenland. In a recent layout based discussion of the Greenland farmhouses, M.S Høegsberg (2009) also emphasized association with Scandinavian farmhouse layout developments. In addition, he suggested that early medieval farmhouses constituted a new house type – 'row houses' – and a break with the *skálar* tradition (Ibid.89), perhaps inspired by urban Norwegian architecture through interaction with town-based merchants (Ibid.94). While certainly an interesting notion, the excavations of the *landnám* era farmhouse at Narsaq (E17a) (Vebæk 1993) and E74 (see below) demonstrate that, at some farms at least, the development was a continuation of the old *skálar* tradition.

For brief comparative overview, Tab.5.1 presents the internal length/width and estimated floor areas of 74 ca. 9th to mid-12th century longhouses from Greenland and the North Atlantic, as well as a few select examples of representational halls from Scandinavia. Note that the Greenland subsample tentatively includes the longhouses excavated at L'Anse aux Meadows, Newfoundland (Ingstad 1977, Wallace 1983, 1991, 2009); although the origin of the settlers is disputable (Smith 2000:217, Wallace 2009:121) the buildings must certainly be dated to the period in question. A note of caution: Tab.5.1 lists longhouses over the period during which they underwent the above outlined changes, i.e. it does not discriminate between the earliest type of "one-room" long-houses (e.g. Vatnsfjörður, Fig.5.2) and later partitioned types with added end- and side rooms (e.g. Stöng, Fig.5.3); length/ width and floor measurements in Tab.5.1 only reflect the "central longhouse building", which may or may not have been partitioned in specific functional rooms.

Tab.5.1 – North Atlantic Longhouses, ca. AD 850-1150.

	Site name:	Internal length (m)	Internal width (m)	Estimated floor area (m^2)	Reference:
	Greenland				
1	E83a, ruin no.20[1]	47.6	3.6	171.4	(Arneborg *et al.* 2009b:25)
2	E17a ruin no.04, phase 2	34.2	5.3	181.3	Vebæk 1993:14
3	E252 ruin no.10[2]	22.8	4.8	109.4	Guldager et al. 2002:Fig.132
4	L'Anse aux Meadows Hall F	22.7	5.4	122.6	Wallace 1991:Fig.9
5	E59 ruin no. 17[2]	18.7	5.6	104.7	Clemmensen & Kapel 2010:15
6	L'Anse aux Meadows Hall D	17.7	5.9	104.4	Wallace 1991:Fig.8
7	E29a ruin no. 60	17.6	5.6	98.6	Albrethsen 1982:274
8	E74 R04, phase 2	16.9	2.9	49.0	Edvardsson *et al.* 2006:92
9	E209 ruin no. 13[2]	14.4	5.8	83.5	This volume
10	L'Anse aux Meadows Hall A, I[3]	14.3	5.1	72.9	Wallace 1991:Fig.6
11	E83, ruin no.6, room IX	14.0	4.0	56.0	Roussell 1941:141p
12	GUS hall phase 1[1]	12.0	5.0	60.0	Albrethsen & Ólafsson 1998:19
13	E17a ruin no.04, phase 1	12.0	5.5	66.0	Vebæk 1993:14
14	L'Anse aux Meadows Hall A, II[3]	11.4	4.6	52.4	Wallace 1991:Fig.6
15	E29a ruin no. A[1]	11.0	6.0	66.0	Albrethsen 1982:273
16	V52a ruin no 1, earlier phase[2]	7.5	3.2	24.0	Roussell 1941:65p
	Subset Mean	18.4	4.9	88.9	
	Subset standard deviation (s)	10.0	0.98	43.09	
	Iceland:				
17	Hofstaðir	35.9	7.7	276.4	Zori et al. 2013:Tab.1
18	Skallakot	26.0	5.4	140.4	Zori et al. 2013:Tab.1
19	Stöng	25.6	5.7	145.9	Ágústsson 1982:Fig.4
20	Hrísbrú	25.2	5.1	113.2	Zori et al. 2013:Tab1
21	Glaumbær	23.5	5.3	124.6	Bolender 2005:5, Fig.7
22	Sámsstaðir	22.6	4.0	90.4	Rafnsson 1977:59p
23	Bær í Gjáskógum	21.7	4.1	89.0	Eldjárn 1961:Fig.9
24	Hvítárholt III	20.0	6.3	126.0	Zori et al. 2013:Tab.1
25	Ísleifsstaðir	19.8	5.6	110.9	Zori et al. 2013:Tab.1
26	Hvítárholt VIII	18.0	5.0	90.0	Zori et al. 2013:Tab.1
27	Aðalstræti	16.7	5.8	96.9	Zori et al. 2013:Tab.1
28	Hvítárholt IX	16.3	5.0	81.5	Zori et al. 2013:Tab.1
29	Snjáleifartóttir	16.3	5.5	89.7	Zori et al. 2013:Tab.1
30	Granastaðir	14.7	5.4	79.4	Zori et al. 2013:Tab.1
31	Vatnsfjörður	14.3	4.9	70.1	Zori et al. 2013:Tab.1
32	Herjólfsdalur II	13.5	3.5	47.3	Zori et al. 2013:Tab.1
33	Grelutóttir	13.4	5.4	72.4	Zori et al. 2013:Tab.1
34	Eiríksstaðir	12.3	4.7	46.7	Zori et al. 2013:Tab.1
35	Herjólfsdalur V	10.0	3.5	35.0	Zori et al. 2013:Tab.1
36	Herjólfsdalur V	10.0	3.5	35.0	Hermanns-Auðadóttir 1992:91
37	Herjólfsdalur VIII	9.8	3.4	33.0	Hermanns-Auðadóttir 1992:91
38	Herjólfsdalur I	8.0	3.5	28.0	Hermanns-Auðadóttir 1992:90
39	Herjólfsdalur III	7.5	2.8	21.0	Hermanns-Auðadóttir 1992:90
40	Sveigakot[3]	-	4.7	-	Zori et al. 2013:Tab.1
	Subset Mean	17.4	4.8	88.8	
	Subset standard deviation (s)	6.98	1.12	54.93	
	Faroe Islands				
41	Kvívík phase 1	21.5	5.8	123.6	Matras 2005:101
42	Toftanes II	20.0	5.0	100.0	Stummann Hansen 1991:47
43	Seyrvági	17.6	4.6	80.3	Thorsteinsson 1982:Fig.2
44	Norðuri í Forna[3]	10.7	3.5	37.5	Thorsteinsson 1982:Fig.4
45	Fuglafirði[3]	-	4.7	-	Thorsteinsson 1982:Fig.3
	Subset mean	17.5	4.7	85.3	
	Subset standard deviation (s)	4.78	0.81	36.49	

	Site name:	2Internal length (m)	Internal width (m)	Estimated floor area (m^2)	Reference:
	Northern Isles				
46	Westness	34.0	6.0	204.0	Kaland 1993:308
47	Bay of Skaill	26.4	4.9	129.4	Griffiths & Harrison 2011:16
48	Jarlshof phase V, house 1	21.5	5.2	111.8	Small 1982:248, Fig.7
49	Hamar (house 1, phase 1)	20.6	4.6	94.8	Bond et al. 2007:Fig.2.1
50	Jarlshof phase I, house 1	20.4	5.6	114.2	Small 1982:248, Fig.6
51	Underhoull, lower	17.0	4.6	78.2	Small 1967:237
52	Belmont house I	20.0	5.0	100.0	Larsen&Turner 2009:167
53	Stoora Toft	16.0	4.0	64.0	Stummann Hansen 2000:94
54	Watlee, house I	14.0	4.5	63.0	Stummann Hansen 2000:94
55	Gardie I	14.0	4.5	63.0	Stummann Hansen 2000:93
56	Jarlshof phase V, house 6	11.4	4.6	52.4	Small 1982:248, Fig.7
57	Jarlshof phase V, house 7	10.9	4.9	53.4	Small 1982:248, Fig.7
58	Underhoull, upper	10.4	2.5	26.0	Bond et al. 2008:Fig.2.4
	Subset mean	18.2	4.7	88.79	
	Subset standard deviation (s)	6.73	0.83	45.49	
	Norway				
59	Borg I:1a	80.0	9.0	720.0	Herschend & Mikkelsen 2003:51
60	Åker[1]	40.0	7.9	316.0	Skre 1996:Fig.4
61	Storrsheien av Vigeså, tuft 4	32.5	5.8	188.5	Petersen 1933:PL. XLIX
62	Ytre Moa A-B	22.0	5.1	112.2	Petersen 1933:PL. LIII
63	Oma	21.0	5.0	105.0	Myhre 1982a:Fig.22, 1982b:Fig.5
64	Måkskitmyro	17.5	4.0	70.0	Myhre 1982a:Fig.22, 1982b:Fig.5
65	Søndre Nygård[1]	15.8	5.2	82.2	Skre 1996:Fig.4
66	Storrsheien av Vigeså, tuft 2	15.5	3.9	60.5	Petersen 1933:PL. XLVIII
67	Rapstad	13.4	3.9	52.3	Petersen 1933:PL. XLV
68	Tjora 1	12.5	3.0	37.5	Myhre 1982a:Fig.22, 1982b:Fig.5
69	Birkelandsstølen 1	10.0	4.5	45.0	Myhre 1982a:Fig.22, 1982b:Fig.5
70	Krågeland 2	9.0	4.0	36.0	Myhre 1982a:Fig.22, 1982b:Fig.5
71	Grødeim	9.0	3.6	32.4	Myhre 1982a:Fig.22, 1982b:Fig.5
72	Tranheim	9,0	3.7	33.3	Myhre 1982a:Fig.22, 1982b:Fig.5
	Subset mean	21.9	4.9	126.7	
	Subset standard deviation (s)	19.06	1.69	49.56	
	Denmark				
73	Gl. Lejre IV	47.5	10.5	498.8	Christensen 2010:243, Fig.9
74	Tissø IV	47.0	11.5	540.5	Jørgensen 2003:Fig.15.23
	Dataset Descriptive Statistics				
	Dataset mean	19.5	5.0	108.0	
	Dataset standard deviation (s)	11.67	1.51	114.82	

Tab.5.1 List of dimensions and estimated floor areas of 74 hall-. *skáli*-, and traditional type longhouses from late Viking Age/early medieval North Atlantic and Scandinavia, some of them in multiple phases. The longhouses are divided upon regional subsets with means and standard deviations included for each subset, as well as for the entire batch (lowest). The implications of the table are discussed in section 6.1. Note that longhouse dimensions are based both on descriptions and measurements from published house plans (see references). Additional notes: [1] Measurement considers the ruin one single building, although it is likely consisted of two-three separate buildings; [2] ruins are unexcavated and their interpretation as early longhouses is based on shape and typology only; [3] building dimensions are only approximate as the building is not completely excavated or partially eroded.

In terms of interpreting Tab.5.1, it should also be noted that the sample includes longhouses excavated over close to a century and which likely effects variability due to different excavation methods and research aims. The Iceland longhouses are well-represented, because they have been the main focus of excavation activity (Vésteinsson 2004:73pp). The Norwegian longhouses are very broadly dated to the late Viking Age/early Medieval period (Myhre 1982a:98p) and may represent rather atypical examples, i.e. either unusually marginal longhouses (e.g., Myhre 2000:39). The latter may perhaps also apply to the Greenlandic examples. Finally, Tab.5.1 does not make any temporal or functional distinctions.

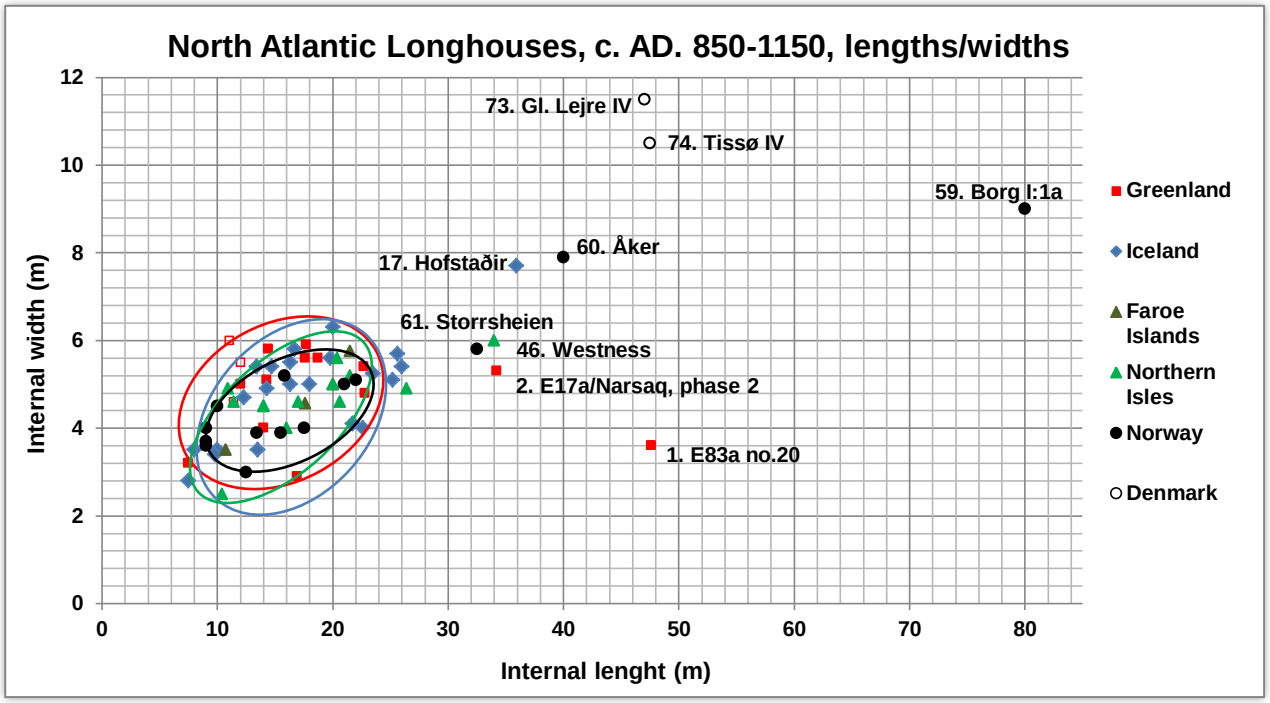


Fig.5.4 Length/width scatterplot of 72 late Viking Age/Early Medieval longhouses and chiefly halls from the North Atlantic and Scandinavia (cf. Tab.5.1). Open red squares indicate Greenland ruins tentatively suggested as longhouses. Colored circles approximate the "normal length/width range" for the regional subsample of longhouses (82% cluster within this range). Longhouses numbered and named are outliers described in the text. Data and patterns are discussion in the text.

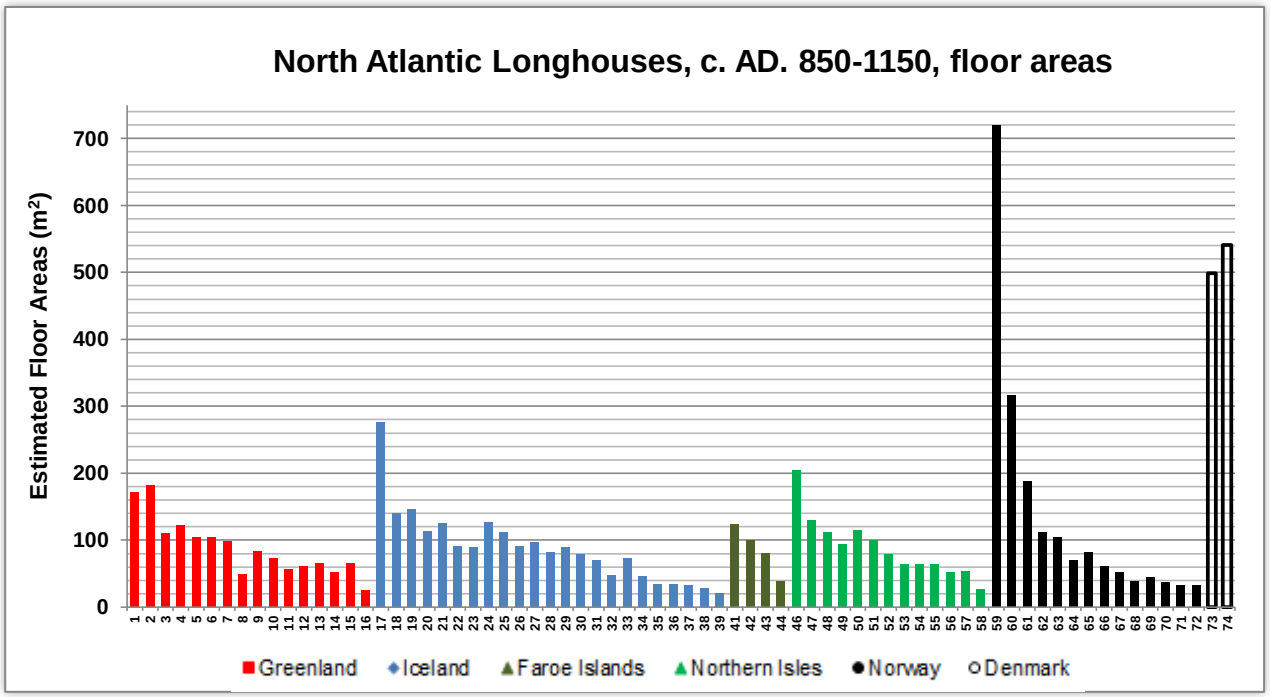


Fig.5.5 Estimated floor areas of 72 late Viking Age/Early Medieval longhouses and chiefly halls from the North Atlantic and Scandinavia (cf. Tab.5.1). Horizontal numbers refer to individual longhouses in Tab.5.1. Note how the "normal range" longhouses appear very similar across the regional subsets, dwarfed by the examples of chieftain's or royal halls in Scandinavia. Data and patterns are discussion in the text.

Fig.5.4 displays a length/width scatterplot of the longhouses listed in Tab.5.1, Fig.5.5 their estimated floor areas. There are many implications to the table and figures, and many ways they could be critically assailed. Thus, for the purpose of this discussion I will limit inferences to some overall and apparently robust trends:

Reviewing longhouse length/widths in Fig.5.4, there are some notable outliers: in the Greenlandic subsample, the uniqueness of E83a's ruin no.20 is undoubtedly erroneous; a 1935 excavation of the ruin revealed a single stall stone, which led to its interpretation as a byre (Roussell 1941:141). A 2004 follow-up excavation reinterpreted the building a *skáli* type farmhouse on the basis of the finds, but also noted that the building was probaly divided on dwelling and byre, i.e. consisted of two separate buildings (Arneborg *et al.* 2009b), which would account for its extreme length in Fig.5.4. The Bay of Skaill longhouse (Tab.5.1 no.47) also included a byre in one end of the farmhouse. The measurements of the remaining longhouses appear more credible.

The most significant trend of Figs.5.4 which I accentuate here, is the overall uniformity of the *skálar* type farmhouses in this sample. A comparison (single factor ANOVA-test) of regional variance (grouping the Faroes and the Northern Isles longhouse and excluding the Danish examples) in A) lengths, B) widths, and C) estimate floor areas between the sample longhouses show them to be statistically insignificant (A) $F = 0.54$, $p = 0.66$, B) $F = 0.12$, $p = 0.95$, and C) $F = 0.93$, $p = 0.42$). In other words, statistically speaking the long-houses could all come from a single parent population, culturally speaking the same pan-Scandinavian tradition. Thus, there is no indication that the Greenland *skálar* were dimensionally different than elsewhere in this cultural sphere (accepting that the sample is very small).

The second trend to accentuate form this sample of longhouses (cf. Fig.5.5) is somewhat at odds with the former observation: there does seem to be a small cluster of slightly larger than average longhouses in the Icelandic sample – most prominently the famous hall of Hofstaðir – which are all interpreted as large farmsteads or chieftain's residences, also on the basis of patterning in the zooarchaeology and artifacts (Vésteinsson 2004, Lucas and McGovern 2008, Lucas 2009, Zori *et al.* 2013). In short, there does appear to be some correlation between farmhouse size and status.

On the other hand, Fig.5.4-5.5 also clearly demonstrate O. Vésteinsson's (2005:11) observation that chiefly longhouses in Iceland were all minor when compared to the greatest Viking Age halls in Scandinavia (No.59, Borg, No. 73. Gl. Lejre, and No.74 Tissø). In other words, if the sizes of longhouse indicate status, then the Icelandic chieftains could not compete with their Scandinavian counterparts and, as Vésteinsson continues (Ibid.13), this could suggest that the initial profits of *landnám* were going back to mainland Scandinavia. If E83a's ruin no.20 is discounted as an unrepresentative outlier, only E17a's ruin no.4 (in its second phase) in the Greenlandic subsample compare with the chiefly farmhouses in Iceland, which of course would prompt the same parallel interpretation that the profits of *landnám* in Greenland were not, at least at this early stage of settlement, locally imbedded. However, as Vésteinsson has also noted of the chiefly farmhouses in Iceland (Ibid.11), they all date from the mid-10th century AD (Stummann Hansen and Vésteinsson 2002:15, Bolender 2005:10, Zori *et al.* 2013:415), perhaps implying that some 100 years after *landnám* a more distinct local elite was emerging. The question is, then, whether same can be argued for Greenland?

5.1.2 Medieval Farmhouses

In general, later medieval farmhouses have received far less archaeological attention in the North Atlantic than the longhouses, while quite the opposite is the situation in Greenland. This makes the type of direct comparison carried out on the longhouses in the above unfeasible. Nonetheless, I here include some parallels from elsewhere in the North Atlantic to contextualize the Greenlandic architectural evidence and to underline the observation that they essentially were little different:

In Norway, later medieval farmhouse development was mainly characterized by the completion of the *'functional fragmentation'* of the longhouse, which was noted above (see section 2.2.1 and: Skre 1996:64). As discussed in section 2.2.1, this development underlay what I generally termed "*settlement fragmentation*", since it also included the splitting of outbuildings in to more specific functions and the dividing of infield areas between multiple farmsteads, as well as increased regional variation (for an overview see: Skre 1996:63p, Myhre and Øye 2002:281, Øye 2009:38p). Fig.5.6a-d displays some of the best examples of excavated late medieval rural farmhouses and farmsteads from Norway:

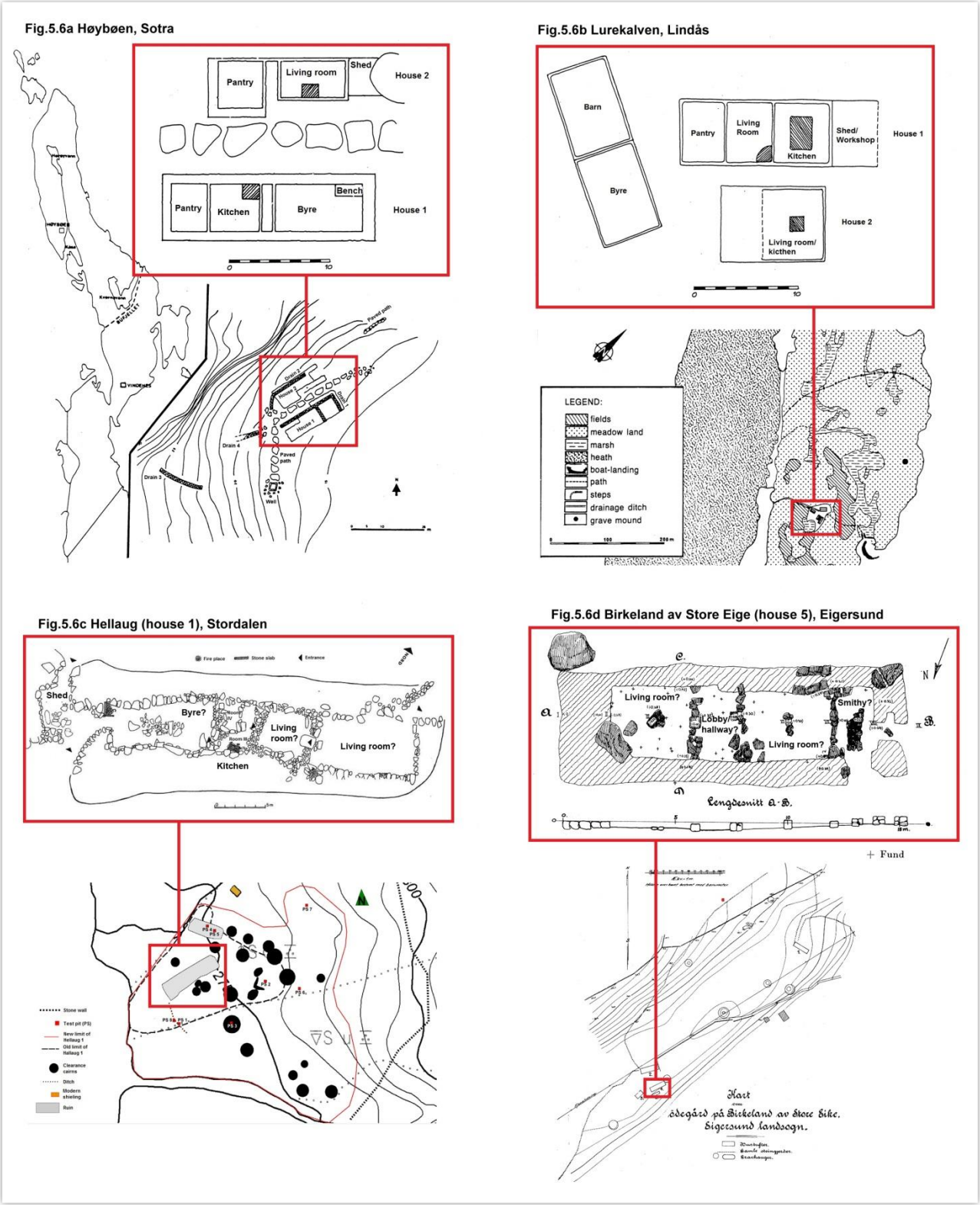


Fig.5.6 Examples of later medieval Norwegian farmsteads and farmhouses discussed in detail in the text. Note the very similar layout of the farmhouses (*modified and room interpretation after: Høybøen and Lurekalven: Kaland 1987: Fig. 2, Fig.4-5, Hellaug: Nesset 2013:Fig.1, Kart 6, Birkeland av Store Eige: Petersen 1933:Pl. XLIII, LVI*).

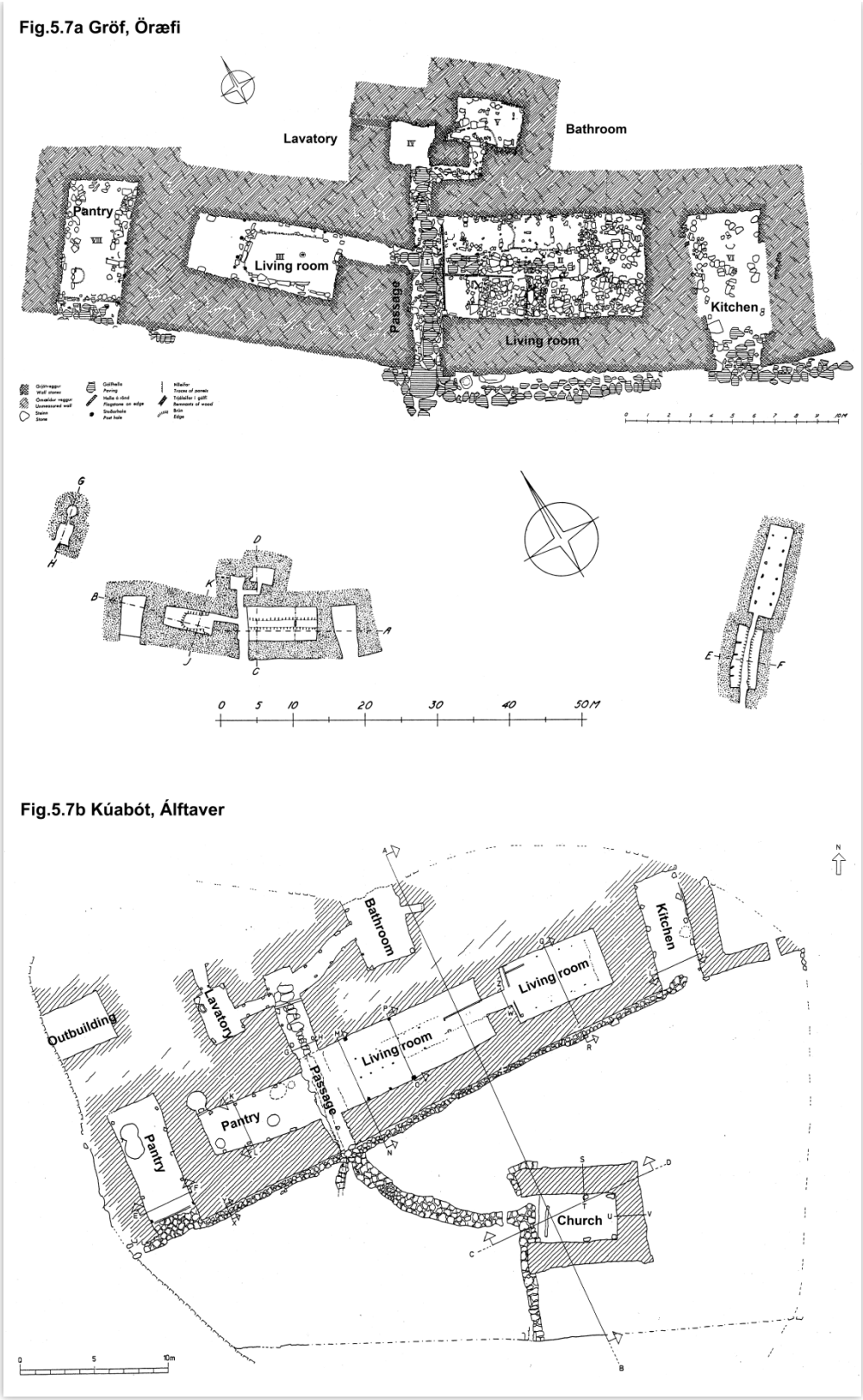


Fig.5.7 Two later medieval Icelandic farmsteads and farmhouses discussed in the text. Note the very similar layout of the farmhouses, as well as their similarity with the Norwegian farmhouses in Fig.3.42 (*plans and room interpretation after: Gröf: Gestsson 1959, Kúabót: Gestsson 1987).*

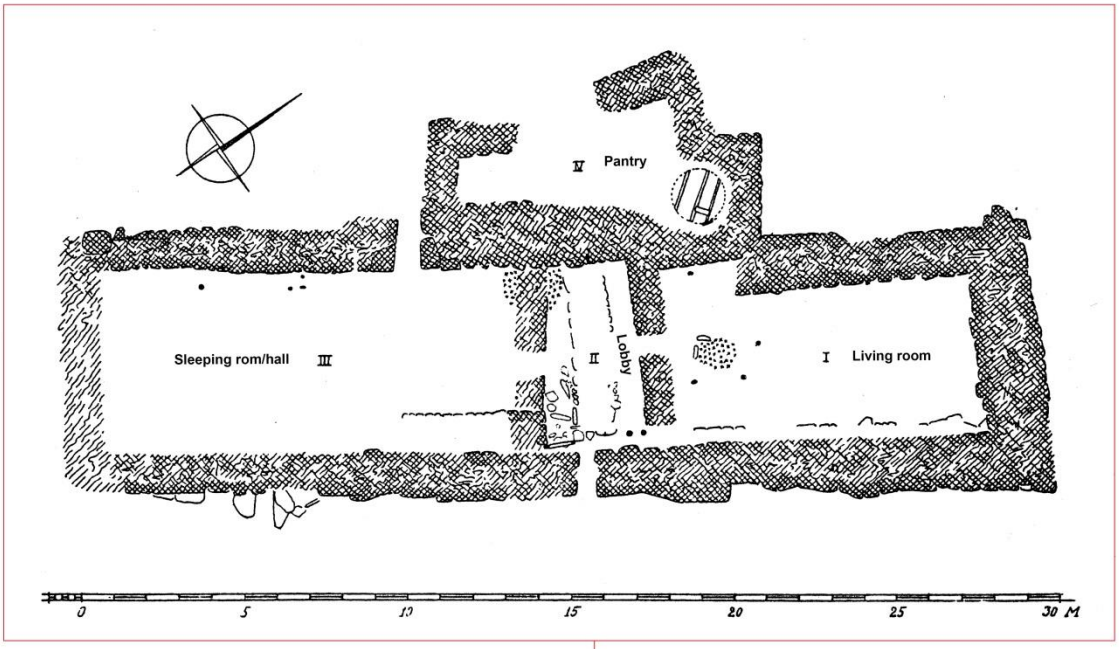
The farmsteads in Fig.5.6 Høybøen (Fig.5.6a), Sotra, and Lurekaven (Fig.5.6b), Lindås, both in the coastal Nordhordland region west of Bergen and both timber-built houses (Kaland 1987). The two other examples are Hellaug, Stordalen (Fig.5.6c) (Myhre 1982a, Nesset 2013), and Birkeland av Store Eige (Fig.5.6d) (Petersen 1933, Myhre 1982a), Eigersund, both in SW Norway and built mostly in turf and stone. They were all founded in the Viking Age, but deserted by the 14th-15th centuries and were all located in marginal agricultural areas (Ibid.). This undoubtedly partly explains their similar modest character and layout schemes: they all consisted of a few (1-3) tightly clustered buildings, one of which was a rectangular farmhouse partitioned on specific functional rooms, and in three of the cases with a separate byre/barn. Thus this type of dwelling – whether rural or urban – was common to most of Norway (Myhre 1982a:206p, Christophersen 2009:186). A new building type in medieval Norway was wooden two-storied houses, mostly in form of the '*loft*', where the lower storey served as a storage for meat and cereals, while the upper facilitated housing of guests and representational purposes (Skre 1996:67, Myhre and Øye 2002:281p).

In Iceland, only some 13 medieval farmsteads and farmhouses have been excavated (for an overview see: Vésteinsson 2004): 11 date to the 11th-13th centuries AD, one to the 14th century AD, and one to the 15th century AD. Like in Norway, all of these were derelict farms, but may represent more normal or even large farmhouses since most were abandoned following volcanic eruption (Stenberger 1943:28p, Gestsson 1959:84, Dugmore *et al.* 2007a). Fig.5.7 displays the layout plans of the two latest farmhouses, Gröf in Öræfum (Fig.5.7a), southeast Iceland, and Kúabót in Álftaveri (5.7b), south Iceland. Apart from differences owing to building materials, the Icelandic farmhouses are generally similar to the Norwegian examples: they display the same functional fragmentation of the farmhouse into more specialized rooms, only in Iceland this fragmentation entailed adding annexes to the rectangular dwelling part. One possible difference in the Icelandic farmsteads that may reflect their more normal size or status is that their layouts appear more dispersed than the Norwegian examples, i.e. the outbuildings lie further removed from the farmhouse (e.g., Stenberger 1943:Fig.35, 57, 166, Berson 2002:Fig.11, 13), but this is presently a poorly substantiated observation.

Summarizing medieval farmhouse and farmstead changes in Norway and Iceland from this admittedly scarce sample, four points can tentatively be made (for later comparison with the Greenlandic examples): first, the farmsteads were characterized by having very few outbuildings, i.e. at most a byre/barn and 1-3 other buildings, which probably owes to these being smaller farmsteads, although not necessarily in the case of the Icelandic farmhouses (Vésteinsson 2004:Tab.1). Medieval documentary records show that more buildings on the farmsteads were becoming the norm in Norway at least, and the largest could boast as many as 20-30 houses (Skre 1996:64, Myhre and Øye 2002:284, 316, 356). Also, even a "modest" farm like Lurekalven (Fig.5.6b) is estimated to have kept some 16 heads of cattle and 26 sheep and goats (Kaland 1987:181pp). Second, in later medieval Norway farmhouses were generally getting smaller (Myhre and Øye 2002:277p), which is suggestive of economic centralization with a growing stratum of small-scale farmers, some of which had to share quarters with the livestock (Fig.5.6c) (Myhre 1982a). Third, a rectangular layout with several rooms lying in a row seems to have remained the ideal for farmhouses across the North Atlantic (cf. Fig.5.6-5.7). If the *grænlendinga* kept up with developments, their farmhouses and farmsteads should display similar characteristics:

The first outline of farmhouse developments in Greenland was presented Aa. Roussel (1941:136pp), who suggested a tripartite model, where the Viking Age *skáli* was to have developed into a fully developed longhouse (type Ia, Fig.5.8), a *passage house* (Fig.5.9), and finally the *centralized farm* (Fig.5.10). In the *passage house* the rooms of the farmhouse – which did not include livestock facilities – lay on each site a central passage forming rectangular block of functionally specified rooms. This type was mostly based on Icelandic historic parallels (Nørlund and Roussell 1929:94, Roussell 1941:207). In the *centralized farm* most rooms of the farm – including livestock facilities – were clustered into one united block of connected single buildings after an apparently rather random scheme (Fig.5.10-5.11). Roussell held that the *centralized farm* was a unique adaptation to the Norse *Vestribyggð*, i.e. a measure for keeping animals and people warm during long cold winters (Roussell 1941:212p, 225). Only few years later C.L. Vebæk (1943) proved their presence also in the *Eystribyggð* , in fact in the Vatnahverfi.

Fig.5.8 V51 / Kilaarsarfik (Sandnes)



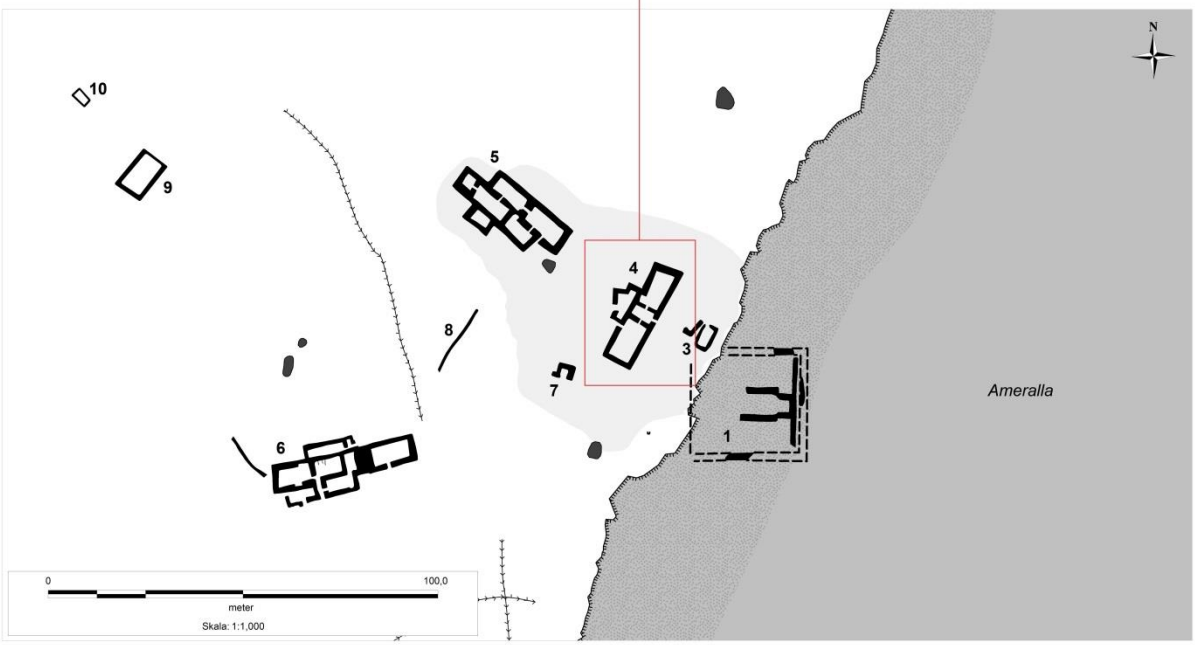


Fig.5.8 Plan of farmstead V51 (lower) and its excavated dwelling, ruin no.4 (upper). Roussell (1941) held that ruin no.4 was the archetypical example a '*fully developed longhouse*', the type of farmhouse that replaced the Viking Age longhouse and preceded the later Greenlandic (and Icelandic) '*passage house*'. However, ruin no.4. is the only farmhouse at the site and the latest dates from both midden (McGovern *et al.* 1996:Tab.2) and churchyard (Arneborg *et al.* 2012:Tab.12) fall in 14th century AD, meaning that this dwelling type is also medieval. The layout of farmhouse and outbuildings at V51 has been referred to by Arneborg (2004) as a '*longhouse farm*' or '*dispersed farm*'. The ruins are identified as: (no. 1) church and churchyard, (nos. 3) earlier building remains, (no. 4) dwelling, (nos. 5-6) stable complexes, (no. 7) smithy, (no. 8) infield dyke, (no. 9) enclosure, and (no. 10) sheep/goat shed; arrowed lines indicate possible irrigation channels (after McGovern *et al.* 1996:Fig.4), one of which has later proven to be a caribou trail (room and ruin identification after: Roussell 1936, survey plan after Madsen 2014).

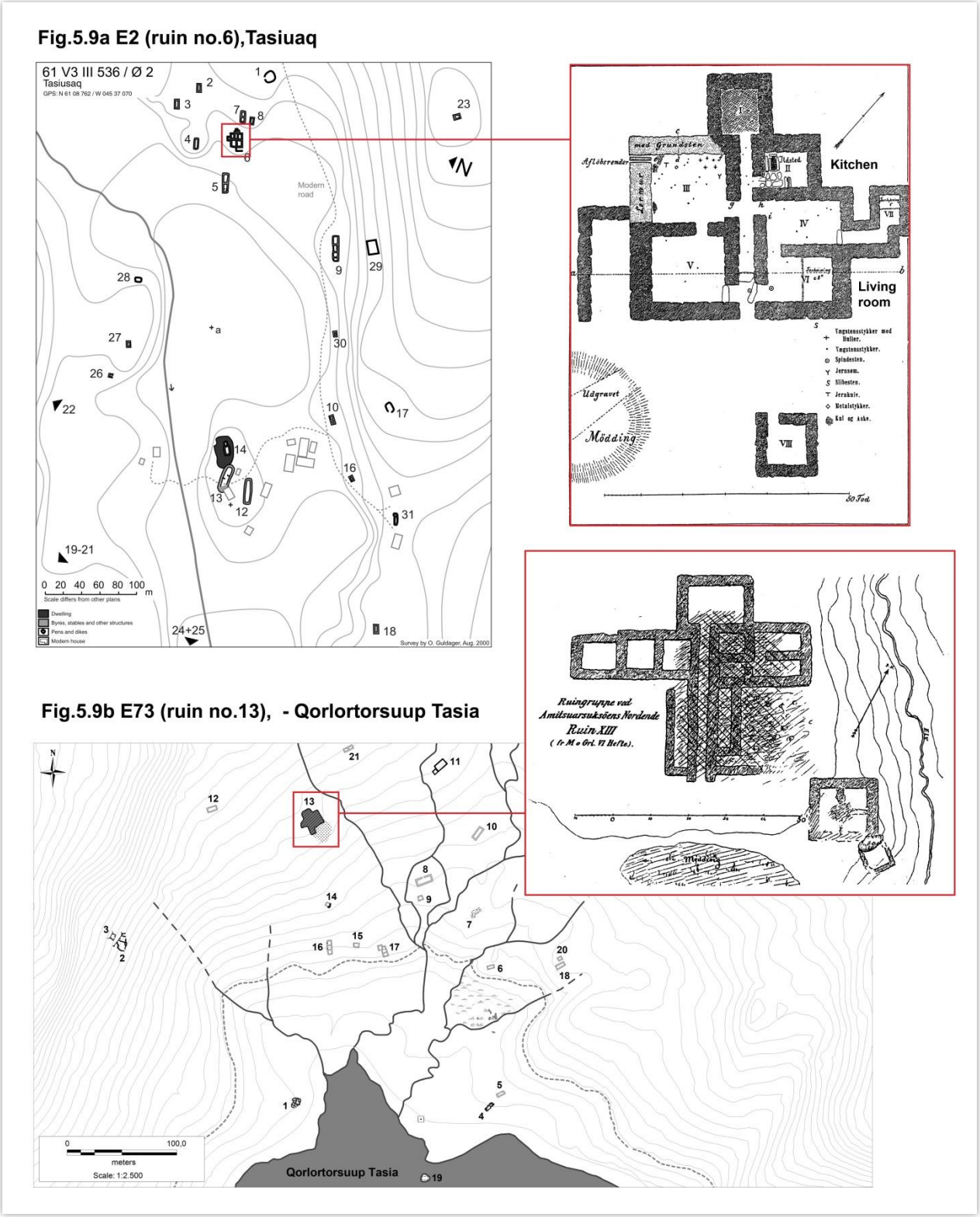


Fig.5.9 Eastern Settlement ruin groups nos. E2, Tasiusaq, and E73, Amitsuarsuk region, as well as their associated dwellings excavated in 1894 (Bruun 1895:215p) and 1880 (Holm 1883:127), respectively. Ruin group E2's dwelling (ruin no.6) was Roussell's (1941:151p) (only) prime example of a Greenlandic *'passage farm'*. Although Roussell did not refer to the poorly excavated dwelling (ruin no.13) at ruin group E73 as a *'passage farm'*, the similarity with E2's ruin no.6 is striking (*modified after: E2: Bruun 1895:216 (right), Guldager et al. 2002:Fig.88 (left); E73: Bruun 1895:396 (right)*).

Roussell interpreted these farmhouse types in terms a gradual chronological development (Ibid.211p), but his model was troubled by limited insights into construction phases and the lack of absolute dates. Nonetheless, his typology constitutes one of the most significant contributions to Greenland Norse building archaeology and many of his observations are still valid.

However, the excavation of farmhouses during the Inuit/Norse Project (see section 4.1.5) provided the first absolute dates for the "centralized farms", which proved to span the entire period AD 1000-1400 (Andreasen 1981:182). This made C. Andreasen propose (Ibid.) that the centralized farms reflected different function rather than chronology: he suggested that Roussell's *fully developed longhouse* with large separate byres was a feature of the wealthy church farms, whereas the *centralized farms* were inhabited by small-time farmers, either occupying the inland and having some cattle (byre included in the nucleated farmhouse); or situated in coastal niches and having very little cattle (byre not included in the nucleated farmhouse). In a contemporary review of early longhouses, Albrethsen (1982: 271) hinted at the same ideas, both authors thereby anticipating many of the research themes to be taken up by later research, including this dissertation.

The excavations of the '*Farm beneath the Sand*' (GUS) 1991-96 proved all of the above authors to be partially right: this excavation demonstrated a complete building history from *landnám skáli* from shortly after AD 1000 to centralized farm in the 14th century AD (Arneborg and Berglund 1993, Berglund 1998a:9, 2001:269). The final publication of GUS is still under preparation, but the initial phasing has already revealed a highly significant observation, i.e. that several of the massive centralized farm complexes excavated by Roussell in the Western Settlement (Roussell 1936b, 1941) were partly an artifact of excavation methods lumping multiple building phases into one massive complex (cf. Fig.5.11).The final publication of GUS will show whether the centralized layout of the farmhouse trace back to the 13th century AD or earlier, or if it is only contemporary with the latest phase of the site dated to ca. AD 1300-1400 (J. Arneborg, unpubl. data).

Lastly, J. Arneborg have presented comprehensive overviews of the excavated farmhouses in Greenland (e.g., Arneborg 2004:8pp, 2006:18pp, Arneborg *et al.* 2012b:238pp), although largely avoiding to discuss dwelling typologies and focusing instead on the churches and other buildings relating to farm status. However, in two of these overviews (Arneborg 2004:240p, 2012:8), she has introduced terms such as '*longhouse farm*' or the '*dispersed farm*', both signifying a farmstead layout, where the outbuildings were dispersed around the infield. Although Arneborg's definition for their differentiation is based only on building counts, the concepts are highly useful and are implemented in the analysis in chapter 8. Finally, M.S. Høegsberg (2009) has revived the discussion of Greenlandic farmhouse types, but it is unnecessary to go further into this discussion here.

To summarize some key points from these farmhouse investigations: first, the ^{14}C-dates from excavated dwellings of various type (e.g., Andreasen 1981, Andreasen 1982, McGovern *et al.* 1983, Arneborg and Berglund 1993, McGovern *et al.* 1996, Arneborg *et al.* 1998, Berglund 2001, Edvardsson 2007a) adamantly demonstrate that Roussell's farmhouse types were contemporary, or at least greatly overlapping in time; this implies that particular farmhouse and farmstead layouts have more to do with the function, economy, and thereby status, of the farms than with typology. Second, medieval Greenlandic farmhouses clearly continued to follow developments in the North Atlantic and Scandinavia, at least the functional fragmentation of the farm. While a parallel to Icelandic farmhouses may perhaps appear most obvious, the Norwegian examples presented here (Fig.5.6) are little different: "shove" the farmhouses of either Lurekalven (Fig.5.6a) or Høybøen (Fig.5.6b) closer together and you essentially have a centralized farm!

If such nucleated farms in Norway, and perhaps also in Iceland, reflected a lower societal stratum of farmers, then they most probably also did in Greenland. This is important to the interpretation of unexcavated ruin surface remains, since it implies that nucleated farmstead layouts – as opposed to the dispersed layouts suggested by Arneborg as a feature of the largest farms – may help identify site economy and the status of the site; only in medieval Greenland, this kind of small farm came in a variant with a massive dwelling complex with few other outbuildings, i.e. the centralized farm (cf. Fig.5.10). I return to explore this potential in chapter 6. Finally, the increased architectural differentiation implies that in Greenland – just as in Iceland a little earlier - wealthy farmers were at least by the 13th century AD able to display social standing through particular architecture.

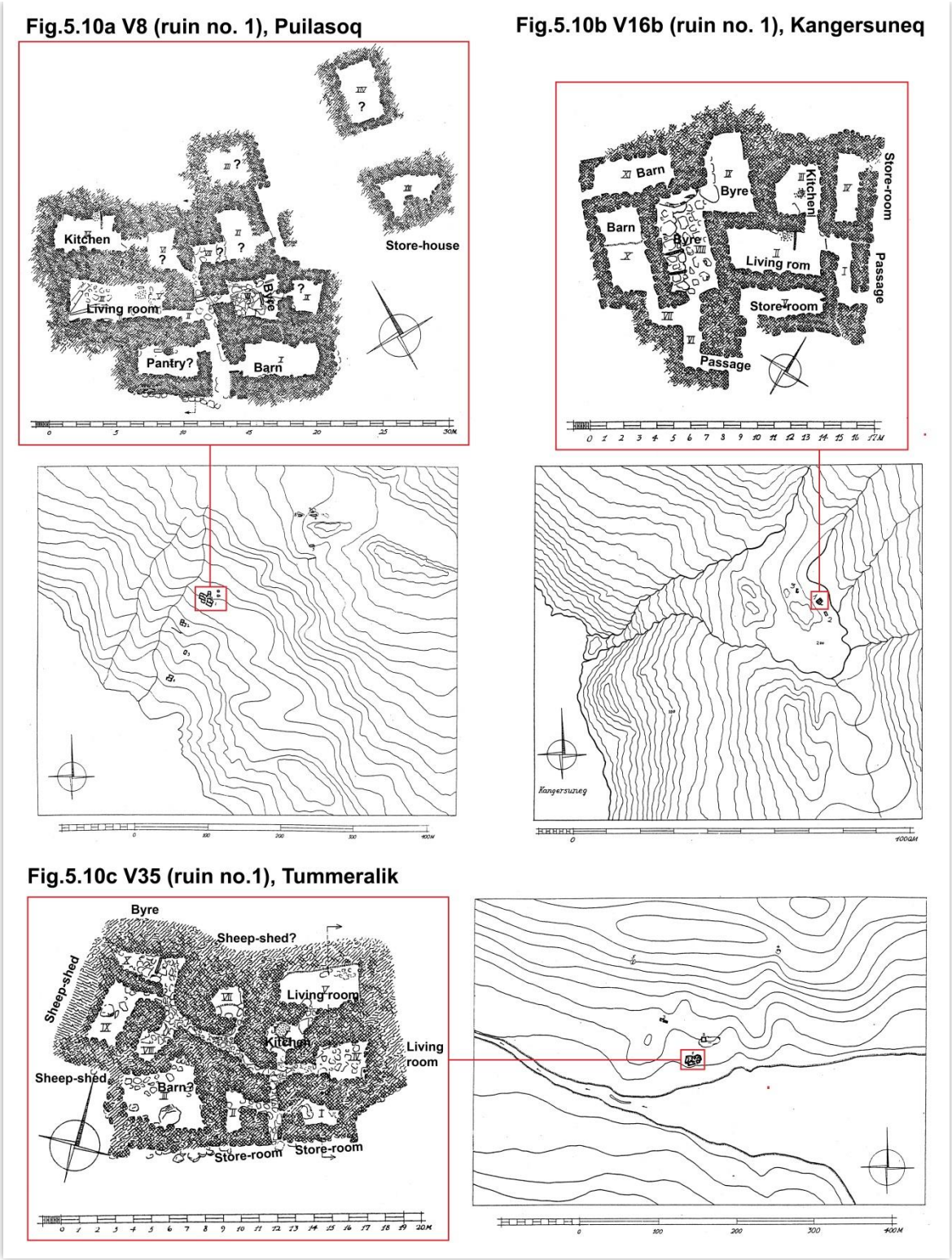


Fig.5.10 Examples of excavated small '*centralized farms*' with combined housing and livestock quarters in one farmhouse and few additional outbuildings. As most farm functions are represented by a single room, the rooms/buildings were probably in contemporary use (contrary to the large '*centralized farms*', cf. Fig.3.47) (*modified and room identification after Roussell 1941: V8: Fig.53, Fig. 102, V16: Fig.54, Fig.99, V58: Fig.51, Fig.100*).

Fig.5.11a V52a (ruin no. 1)

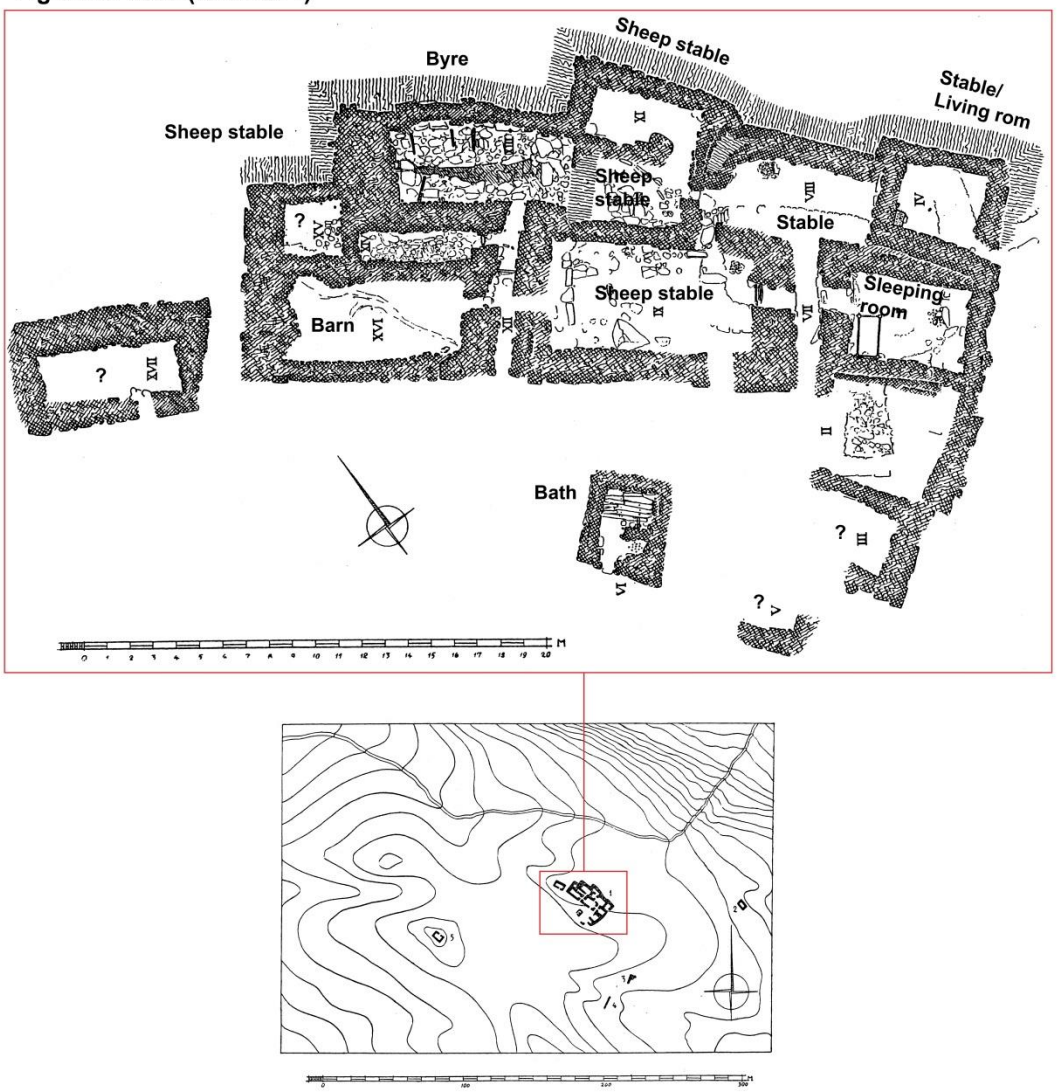


Fig.5.11b, GUS ('the Farm beneath the Sand')

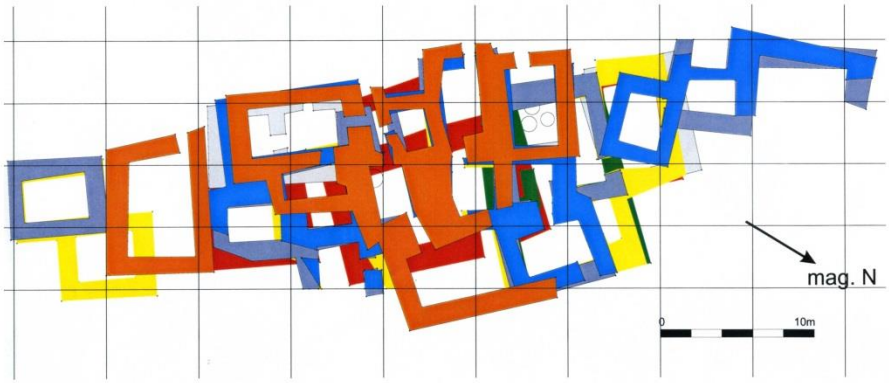


Fig.5.11 Above: plan of the partially excavated V52a ruin no. 1 – a large centralized farm – and nearby outbuildings. Below: GUS with indication of preliminary phasing (different colors). When the GUS's phases are juxtaposed, the plan shows notable resemblance to plans of Roussell's large '*centralized farms*', strongly suggesting that these complexes are, in part, a product of excavation methods (*modified and room interpretation after: V52a: Roussell 1943:Fig.46, Fig.47, GUS: Courtesy of Jette Arneborg*).

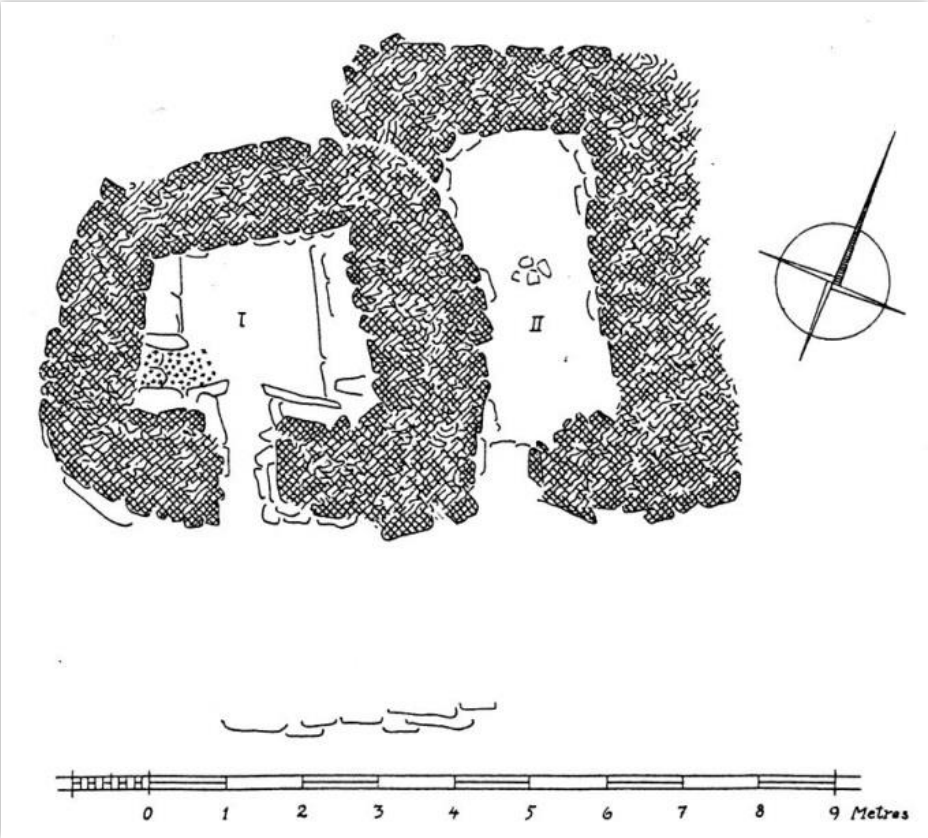


Fig.5.12 V53 in the Austmannadal in the Western Settlement. Excavated in 1934 by Aa. Roussell, he believed this ruin to be a shieling (*after Roussell 1941:Fig.143*).

5.1.3 Medieval Shieling Lodges

The basic functions and layouts of shielings in a North Atlantic context was outlined chapter 2.2.2 and this section is limited to a presentation of the three excavated examples of shielings in Norse Greenland. The term "lodge" is not normally used in the context of shielings and I do so here mainly to imply their more temporary character and thereby to distinguish them functionally from the farmhouses, or dwellings, that served year round occupation. Although only three examples have been excavated, they in fact seem to represent three different shielings types:

The first, possible, shieling is V53 in the Austmannadal in the Western Settlement, which was excavated by Roussell in 1934 (Fig.5.12)(Roussell 1941:229): it was a single building of ca. 9x7 m and consisting of two adjoining rooms, of which one was a later addition. Each room had a small fire place, but one room (Fig.5.12 no. I) also had benches and appears to have been the main occupation room. It should be noted that the ruin was found on the edge of a gravel terrace and Roussell speculated that there might have been other ruins, perhaps a whole farmstead, later eroded by the nearby river (Ibid.). V53 is an equivalent to ruins classified as "herders' huts/shelters" shelters chapter 7.

The next more certain shieling was excavated in the "Kirkespirsdalen" ("Church Spire Valley") – 60V2-II-574 – in 1997 in connection with the establishment of a goldmine in a valley near the Southern Sermilik (Fig.5.13) (Berglund 1998b). It consisted of small stretches of wall built among boulders creating five small compartments, one of them under a boulder. First thought to be an Inuit hunter's shelter/camp, the excavation unearthed a piece of woven textile – later dated to AD 1390-1450 – and Igaliku sandstone, which made the excavators reinterpret the site as a Norse shieling. The small compartment under the stone was suggested to be a herders' shelter, the other compartments as pens for sheep/goats. Although one of the more rudimentary examples, this type of shieling corresponds to the types classified as dairy shielings in chapter 7, or possibly only a milking station.

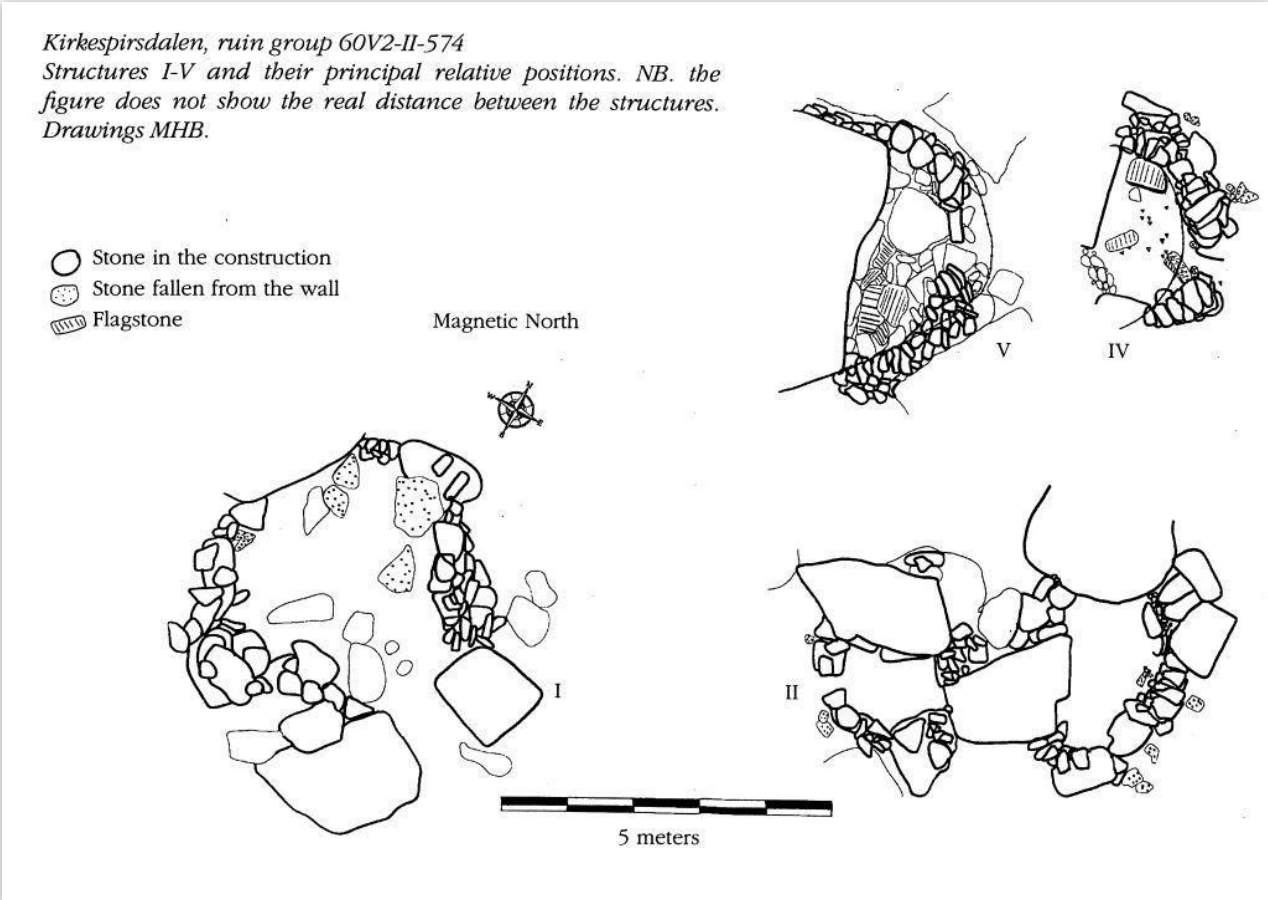


Fig.5.13 Plan of presumed Norse shieling 60V2-II-574 excavated in 1997 in Kirkespisdalen by Southern Sermilik in the Norse Eastern Settlement. First believed to be an Inuit herding shelter, excavation of the structure unearthed a single piece of woven textile dated to AD 1390-1450 and Igaliku sandstone, one of the most typical sandstones used for whetstones by the *grænlendinga*. This made the excavators reinterpret the sites as a Norse shieling, presumable for milking sheep/goat husbandry (after Berglund 1998:161).

The final shieling and the perhaps most interesting one was the dwelling of E74 excavated in the valley of Qorlortorsuup Tasia in the Vatnahverfi region in 2004 and 2006 (Fig.5.14) (Kapel 2004, Edvardsson 2007b). Although the excavation was never satisfactorily finished because of unforeseen events, it still provides an excellent example of both farmstead and shieling developments in Norse Greenland:

During the 2004 preliminary investigation the ruin appeared like a typical small farm mound with visible outlines of several rooms (Fig.5.14 top left and right). The 2006 excavation showed the surface contours to be partially right, but that the building had a more complex history (Fig.5.14 bottom): it appears to have started out as a simple longhouse (phase 1), which at some point was partitioned into two or three rooms by heavily built walls (phase 2), i.e. it exemplifies the medieval functional fragmentation of the farmhouses discussed in section 5.1.1. Later, annexes were added to the sides (phase 3) giving the building its surface appearance of a small centralized farm. However, this residence (phase 4) was taken out of use by the mid-13th century (cf. Tab.8.2) and a small building resembling a herder's hut was instead built against one wall of the old dwelling. Dating of midden remains show this hut continued in use for another some 100 years before also being abandoned. Thus, E74 presents an excellent example of both the change and continuity in farmhouse development, as well as the transformation of farm to shieling that was discussed in chapter 3. In the classification in chapter 8, E74 falls out as a large complex shieling, i.e. exactly the types of shielings expected to have been small farmsteads at some point.

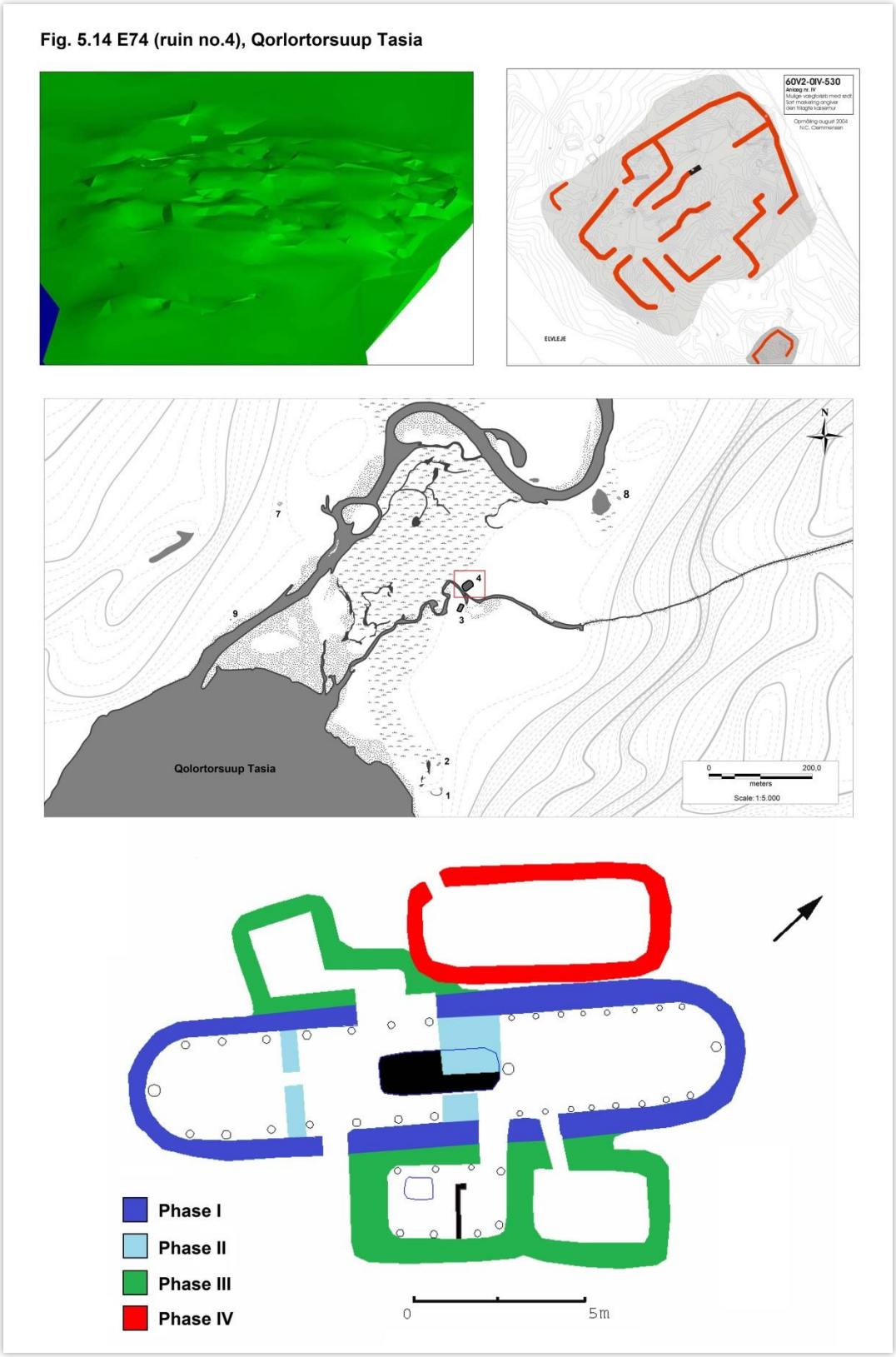


Fig.5.14 Different stages of ruin documentation of E74's dwelling (ruin no.4): Top left: surface contour survey prior to excavation (after Kapel *et al.* 2004:24). Top right: ruin and room surface outlines prior to excavation (after Kapel *et al.* 2004:23). Middle: site overview plan. Bottom: simplified building plan of ruin no. 4 after excavation and divided on phases (modified after Edvardsson 2007:Plan 8.). The figure is discussed in detail in the text.

5.2 Medieval Churhes in Norse Greenland

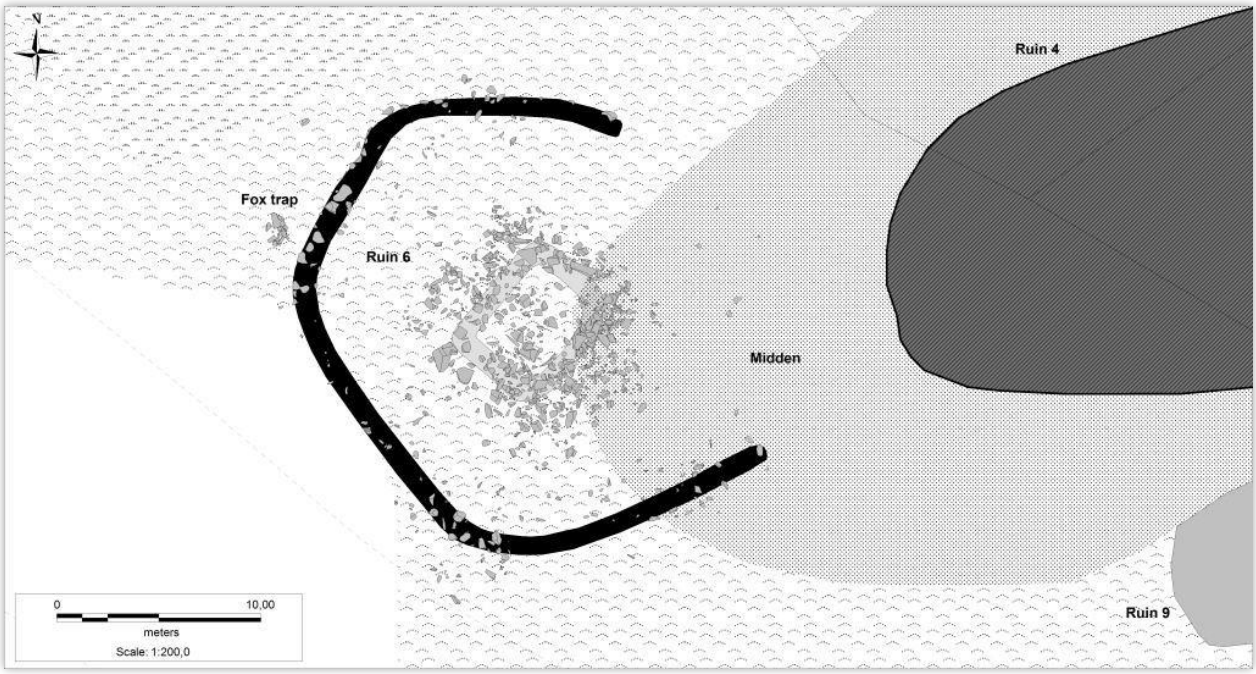


Fig.5.15 Detail survey plan of the small church at ruin group E64 in the North Vatnahverfi region. The churchyard and church has been partially excavated in 2007-2008 and 2010 as part of the Vatnahverfi Project. The interred Norsemen were dated to between ca. AD 980-1200, suggesting the church was taken out of use by then. Another interesting feature of this church is the midden in front of the dwelling (ruin no.4) seems to have spilled into the churchyard, probably during the occupation of the site since the ground is level.

At present time some 18 or 19 medieval churches have been identified in the Norse settlements, 16 in the Eastern Settlement and two or three in the Western, and all of them closely associated with farmsteads (e.g., Fig.2.5) (Krogh 1976:297p, 1982a:266p, Arneborg 2002:21, 2004:248p). The churches and the medieval church topography has – as outlined in chapter 5 – been so extensively treated that there is no cause to reiterate here (e.g., Clemmensen 1911, Roussell 1941, Vebæk 1953a, 1953b, Krogh 1965, Vebæk 1966, Krogh 1976, 1982a, Vebæk 1991, Arneborg 2002, 2006, Vésteinsson 2010, Arneborg *et al.* 2012b).The main importance of the churches in this study is as indicators of site status and, with their gradual abandonment, as indicators of political and religious centralization. The churches fall in two distinct groups, the small and the large:

5.2.1 Small Medieval Churches

The small churches were built with an inner wooden structure and outer protection walls in stone or stone/ turf; the gable was however without protection and displayed the bare wood (Krogh 1976:306, 1982a:272). All but two of the small churches have circular or rounded churchyard enclosure walls (Fig.5.16), which made C. Keller (1989:215) suggest that they should date to the 11th century. While ^{14}C-dates have since verified that interments in the churchyards began around AD 1000, the dates also show that they in several places continued up into the 12th to mid-13th centuries (J. Arneborg, unpubl. data, Tab.8.1). Two such small churches are found in the Vatnahverfi region E64 and E78 (Fig.5.15, 5.17).

The small churches have caused the greatest interpretational problems: when Norse archaeologists in the first half of the 20th century began locating more churches than mentioned in the medieval church lists, and some of them in oddly close proximity, they tried to explain them either as churches that had been moved or closed down, or that the smaller churches were annexes or chapels to the main parish churches, which became a necessity as Norse settlement and population expanded (Vebæk 1952:104p, 1953b:300p, 1966:203p).

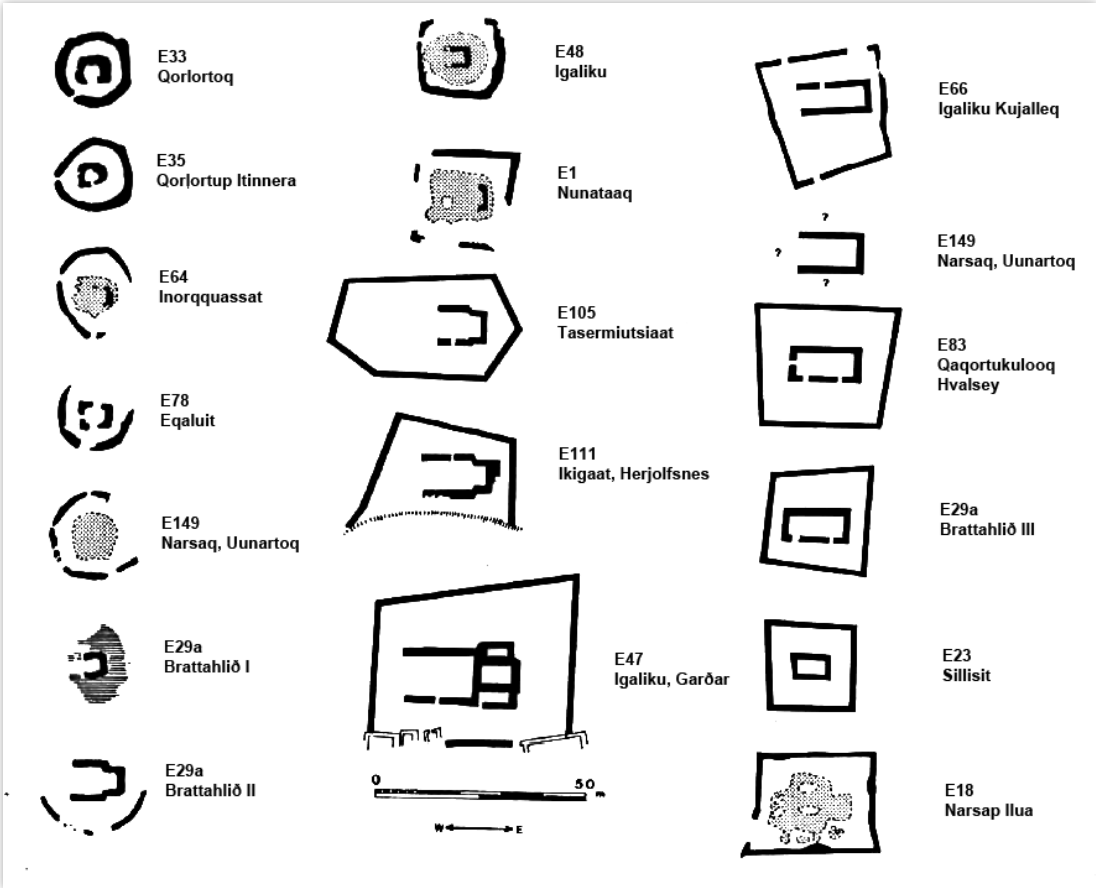


Fig.5.16 Plans of the medieval churches in the Norse Eastern settlement. Left: the group of small early churches. Right: the group of larger presumed parish churches. Left (lowest) and Middle (lower): the group of large Romanesque type churches with nave and choir. Right: the group of later (post AD 1300) Gothic type churches (modified after Keller 1989:Plate 27).

With the excavation of '*Þjóðhildar's* church' at Qassiarsuk/*Brattahlið* (E29a) the early date of the small churches was established definitely (Krogh 1965:15, Vebæk 1966:205, Keller 1989:188). However, this did not resolve the question of their function, which is still debated. Some authors have kept to the interpretation that they were annexes or chapels – *bænhús* – a kind farmstead churches without a permanent priest or tithe revenues known historically from Iceland (Krogh 1976:310, Vésteinsson 2010:143). As these authors point out, this would explain why the small churches are not mentioned in the medieval church lists. Neither does it exclude that all the churches in Greenland could have started out as the small type, some later having developed into parish churches of the larger type (see below). However, it is certain that some of the small churches for a period continued to be used parallelly with the building of the large group of churches.

5.2.2 Large Medieval Churches

The group of larger churches has caused less interpretational issues: one group of large churches is of Romanesque type with nave and smaller choir (Fig.5.16 E29a, E105, E111, E47), which are typologically dated to ca. AD 1000-1200 (Krogh 1976:307, Arneborg 2004:251). These were like the small churches built with a wooden inner structure or at least wooden gable (Ibid.). The second group of larger churches (Fig.5.16 E66, E149, E83, E29a, E23, and E18) is dated to ca. AD 1300 or later. These churches had walls completely built in stone and it was noted early that they seem influenced by Norwegian church building traditions (Roussell 1941:122p). The large group of churches undoubtedly functioned as parish churches. One example of the latest type – E66/*undir Höfða* – is located in the north Vatnahverfi region.

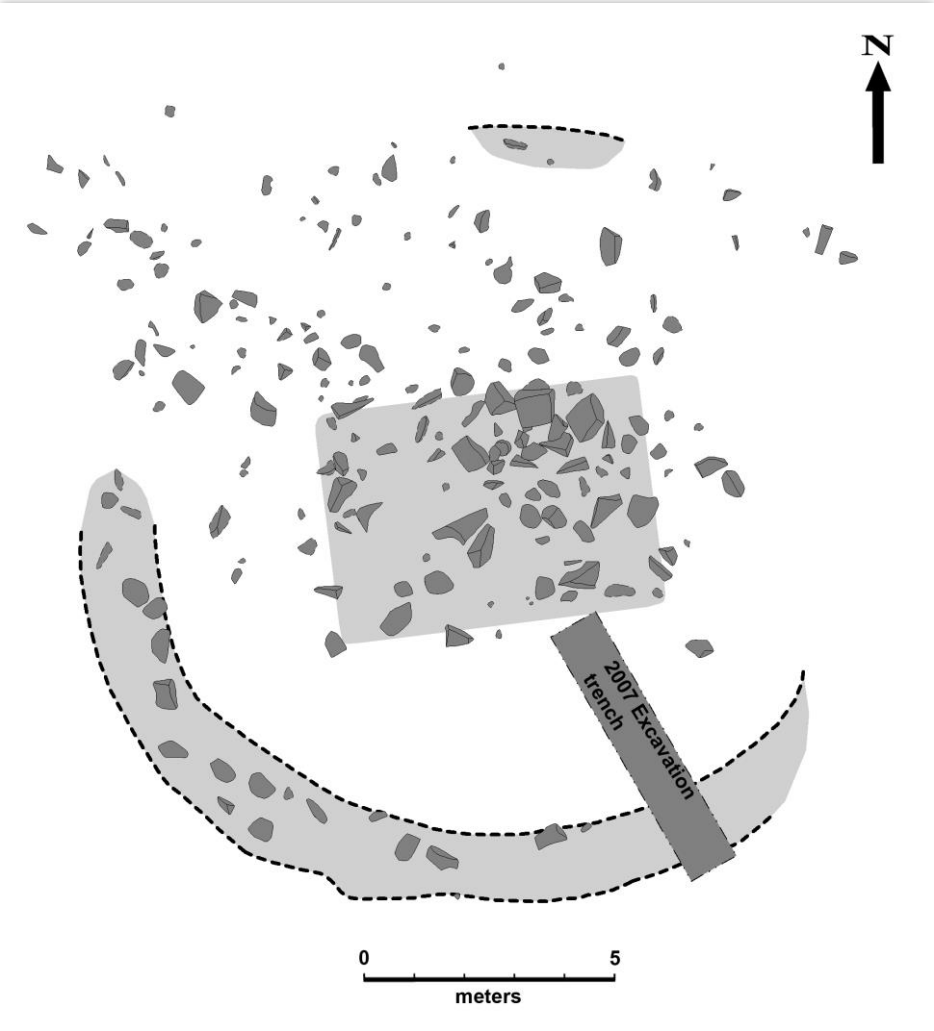


Fig.5.17 Detail survey plan of the small and rather poorly preserved church with circular churchyard enclosure wall at ruin group E78 in the central Vatnahverfi region. The placing of a 2007 excavation trench is indicated. Although probably built around AD1000, dates on the latest interments suggest that the church remained in use until ca. 1250 (cf. Tab.8.1).

Although the functions of the different types of Greenland Norse churches have been remarked on in the above, there are still many unresolved issues as to their precise use as well as to their chronology; it is, however, beyond this section to discuss. What I emphasize in conclusion is that the churches – especially the later and larger types – undoubtedly reflected a considerable investment of labor and economic means for the farmers who built them: besides the actual work put into the construction and maintenance, the materials needed – large building timbers, church bell, glass for windows, religious furnishings and paraphernalia etc. – all had to be imported. Thus the medieval churches are the most explicit and undisputed architectural mark of economic wealth and status on the Norse farmsteads and are throughout the analysis used as an upper benchmark differentiation of the largest farmsteads (note that representational halls have also been accentuated as similar signs of status and wealth (Berglund 1982, Arneborg 2006), but because they are difficult to identify in the survey evidence I omit further description of them here). Perhaps, the lack in Greenland of traditional Viking Age chiefly halls (see section 5.1.1) is explainable by the condition that by the time the *grænlendinga* were able to invest the profits of the *Norðrseta* hunt locally, they did so in the new medieval symbols of grandeur, the churches.

5.3 The Archaology of Outbuildings

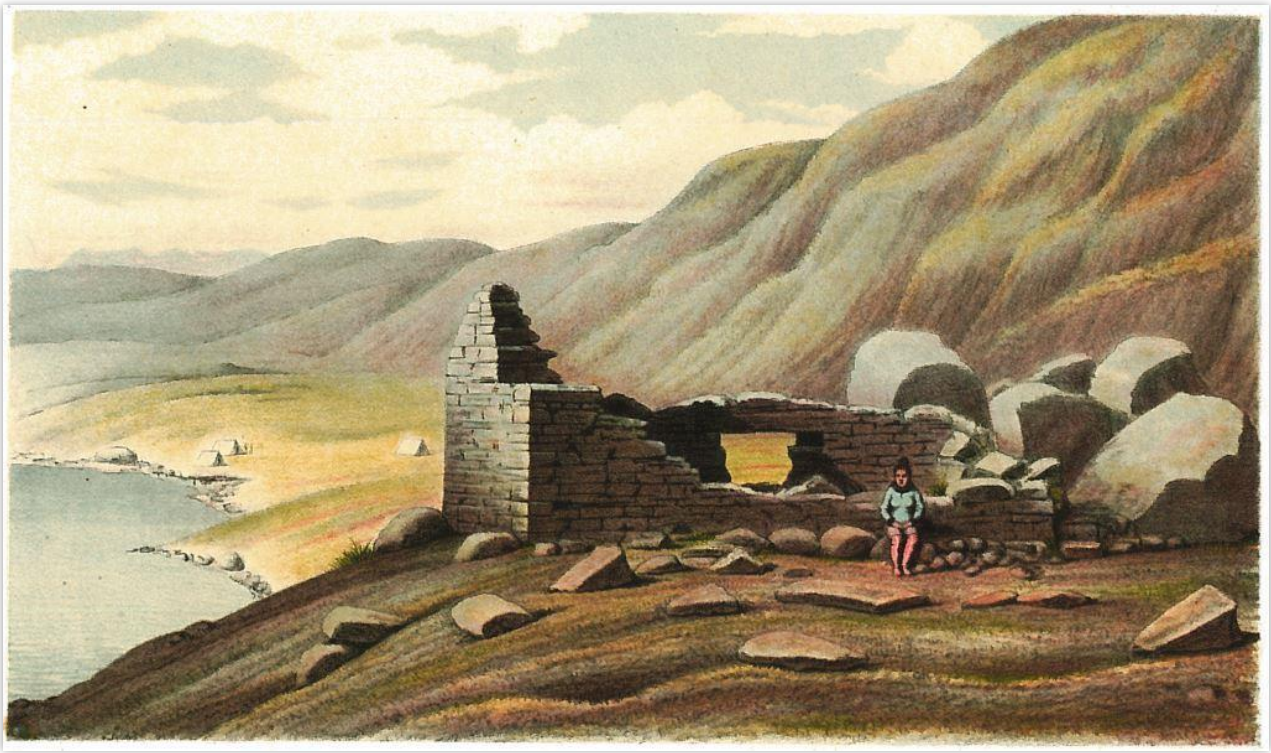


Fig.5.18 Ruin no. 1 at ruin group E66 in the Vatnahverfi, South Greenland, as it was preserved in the late 19th century; today only a few of the lower courses are left. It is an example of a stone-built store- or warehouse of the type often associated with external trade in Norse Greenland. Because of their frequently excellent preservation, the basic built and function of the storehouses was quickly established. Note also the elevation on the "terrace" in the background; it is the farm mound of E66 (cf. Fig.5.1) (*after Holm 1883*).

Outbuildings were the only of the farmstead buildings that were not – at least specifically – meant for the housing of people. Although they greatly outnumber farmhouses and churches, outbuildings have received far less archaeological attention and, to my knowledge, there exists no systematic overview of outbuildings from any part of the North Atlantic (although Roussell (1941:21pp) has provided a summary overview). Except for a selection of cattle byres (see below), this makes a comparative approach unfeasible and this section focuses principally on the Greenlandic outbuildings. Some general traits of the outbuildings should first be outlined:

Because early investigators regularly excavated all or most of farmstead buildings (see section 4.1.3) quite a few outbuildings have been excavated in Greenland (cf. Tab.4.1). However, just as the dwellings, none of these outbuildings were dated. As far as I have been able to establish, only the supposed byre or livestock building to E74 has been dated (to ca. AD 1160-1215, one sigma range, i.e. corresponding to the abandonment of phase III in Fig.5.14). This makes archaeological interpretations of outbuilding developments, uses, and contemporaneity highly problematic. In short, the outbuildings – like the survey evidence and to an extent the dwellings – also constitute an accumulated record, i.e. a "maximum" of farm activity.

However, in terms of outbuilding contemporaneity it can be observed that at many of the excavated farmsteads specific outbuildings – e.g. storehouses, smithies, bathhouses – are only represented by a single, or at maximum a few, examples at each site. If this does not reflect very short life of the farmstead – which seems improbable in many cases – then these "few" outbuildings should reflect several hundred years of activity. This would either imply that they were a later settlement feature, or that outbuildings were repaired or rebuilt on the same spot rather than left and built anew elsewhere.

5.3.1 Medieval Byre/Barns

Of all the outbuildings, the cow byre/barns are the type most frequently investigated archaeologically. One explanation for this is their obvious relation to farmstead wealth, i.e. as a mark of status in the medieval socio-economic context. Another explanation is that byre/barns are fairly easily identifiable from three conditions: first, from their large size, i.e. they are often the second largest building on a farmstead; second, from partition of the building on two sizable rooms, i.e. a byre and a barn part of which it was early observed that the former was built mainly in turf for insulation and the other in stone for ventilation (Holm 1883:73p, Bruun 1895a:209p); third, from the stall stones that separated the cows and are occasionally visible even on the surface. Thus, already by 1941 (217pp), Roussell could outline three basic types of byres in Greenland:

Simple byre/barns, rectangular buildings partitioned into a byre- and barn-part (Fig.5.19), at times with a smaller room added to one gable; *stable complexes*, rectangular blocks of adjoining rooms of which at least one was a byre and one a barn with additional rooms for other livestock and fodder storage (e.g., Fig.5.8 no.5-6); *integral byre/barns* which were included in a dwelling complex (Fig.5.11) – i.e. the centralized farms. In addition to stall stones, normal features of byres were stone flagging of the floor, at times with a central gutter for mucking out the byre, and very thick walls, at times with additional outer turf padding; some byres had a "passage-entrance" or small lobby for heat conservation (cf. Fig.5.19). Roussel recognized that these byre/barn types reflected a development similar to the dwellings, i.e. that the simple byre/barns were a precursor to the stable complexes, but that they existed simultaneously (1941:218). The categories simple byre/barns and stable complexes are used in the classification of outbuildings in chapter 6 (cf. App. I); the integral are not because they are virtually impossible to identify from other rooms of the dwellings in surface surveys.

For comparison, Tab.5.2 lists internal lengths/widths, and estimated floor areas of 40 Greenlandic byres/barns – 20 of the simple type and 10 of each of the two other types – as well as of 14 byre/barns from Iceland and three from Norway. Tab.5.2 also lists the presence of stalls, floor paving, the position of the entrances, the distance of the byre/barn to the main associated dwelling (DMD), and the presumed date of the site (Viking Age to Middle Ages). The list is obviously not exhaustive; however, it does include most of excavated examples from Greenland and Iceland (Berson 2002).

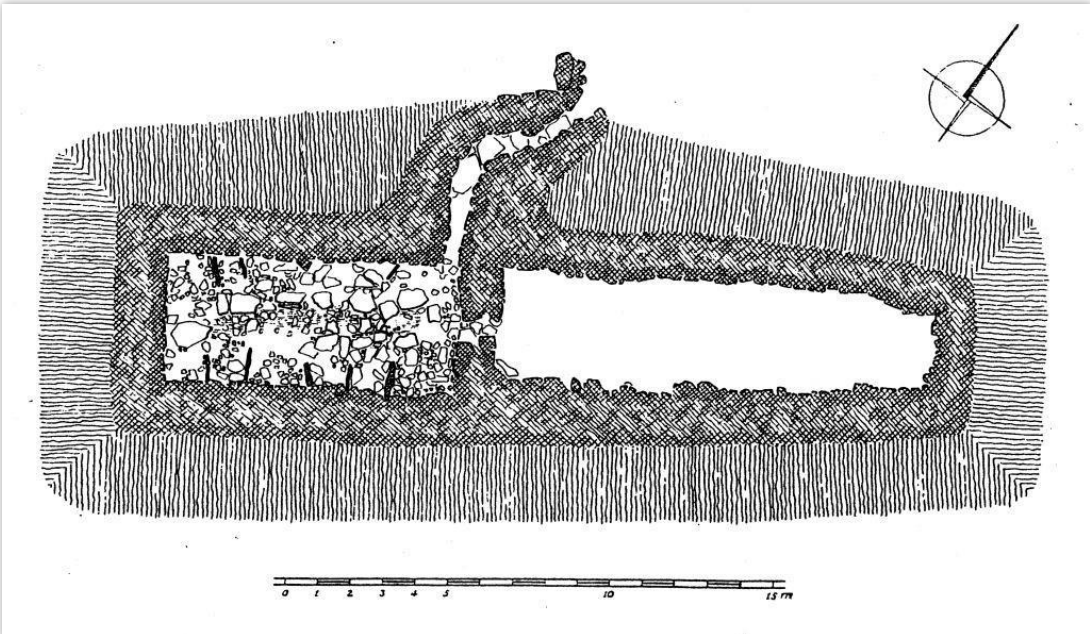


Fig.5.19 Ruin group E29's ruin no. 19, Qassiarsuk region, an example of a simple byre/barn with its particular features: a byre end with stall stones and paving, and a barn end without, thick turf walls with outer turf padding, and a passage entrance for conservation of heat (after Nørlund and Stenberger 1934:Fig.56).

Tab.5.2 – North Atlantic byre/barns

Location:	Site no.	Ruin no.	Byre length	Byre width	Byre area (m^2)	Barn length	Barn width	Barn area (m^2)	Stalls	Pave	Add. rooms	Gable entrance	DMD	Date	Reference:
Greenland *simple byre/barns:*															
Nunataaq	E1	Ruin 3	6.6	4.1	26.9	8.6	4.1	35.0	Yes	?	No	Yes	5	Med.	Bruun 1895:208
Nunataaq	E1	Ruin 5	5.2	3.1	16.4	8.4	3.1	26.4	Yes	?	No	No	119	Med.	Bruun 1895:211, Guldager et al. 2002:Fig.112
Tasiusaq	E2	Ruin 5	7.5	3.5	26.3	8.2	3.8	31.2	Yes	?	No	No	25	Med.	Holm 1883:Tavle XIV
Tasiusaq	E2	Ruin 13	9.8	3.9	38.2	11.1	3.9	43.3	Yes	?	No	?	1	Med.	Holm 1883:Tavle XIV
Tasiusaq	E4	Ruin 5	13.9	3.8	52.1	14.1	4.7	65.3	Yes	?	No	No	10	Med.	Madsen ????
Eqaluit	E9	Ruin 5	3.6	3.1	11.3	?	?	?	Yes	?	No	?	5	Med.	Bruun 1895:241
Sillisit	E23	Ruin 6	9.0	3.7	33.3	9.6	3.7	35.5	Yes	?	Yes	?	194	Med.	NMA:Albrethsen 1970, bilag I:15, Krogh&Berglund 1980:134
Issormiut	E24	Ruin 3	6.1	3.5	21.4	6.6	3.5	23.1	Yes	No	No	No	69	Med.	NMA:Albrethsen 1969
Narsap Ilua	E18	Ruin 4	10.5	3.4	35.7	14.1	3.7	52.2	Yes	?	?	No	15	Med.	Clemmensen&Kapel 2008:22
Qassiarsuk	E29	Ruin 19	8.8	3.7	32.7	13.1	3.3	43.2	Yes	Yes	No	No	39	Med.	Nørlund&Stenberger 1934:89p
Qinngua	E39	Ruin 8	9.3	3.3	30.1	9.5	3.4	32.3	Yes	?	No	No	35	Med.	NMA:Albrethsen 1970:bilag I:18, Krogh&Berglund 1980:105
Igaliku	E47	Ruin 9	33.3	4.2	138.4	26.4	4.8	126.3	Yes	No	No	?	12	Med.	Nørlund 1929:115
Igaliku	E47	Ruin 14	21.2	3.9	83.4	18.7	4.6	86.0	Yes	No	No	?	35	Med.	Nørlund 1929:115
Iterlak	E63	Ruin 4	9.4	2.0	18.4	6.8	2.0	13.6	Yes	?	Yes	?	9	Med.	Bruun 1895:366
Igaliku Kujalleq	E66	Ruin 3	10.9	3.8	40.8	7.4	3.5	25.8	Yes	Yes	Yes	No	10	Med.	Roussell 1941:219
Russip Kuua	E71S	Ruin 3	7.0	2.3	15.8	4.0	2.0	8.0	Yes	Yes	Yes	No	9	Med.	Vebæk 1993:43
Russip Kuua	E71N	Ruin 12 (X, IX)	12.0	2.5	29.4	7.5	2.4	18.0	Yes	Yes	No	No	0	Med.	Vebæk 1993:36
Kanassut	E80	Ruin 2	6.6	2.5	16.5	7.7	3.3	25.1	Yes	?	Yes	No	18	Med.	Simpson *et al.* in press
Hvalsey	E83	Ruin 7	12.1	2.9	35.4	9.4	4.4	41.5	Yes	Yes	No	No	1	Med.	Roussell 1941:218
Narsarsuaq	E149	Ruin 9	8.0	3.3	26.0	11.0	3.0	33.0	Yes	Yes	No	Yes	48	Med.	Vebæk 1991:55
Subset mean:			**10.5**	**3.3**	**36.4**	**10.6**	**3.5**	**40.2**	**-**	**-**	**-**	**-**	**33.0**	**-**	**-**
Subset standard deviation (s):			**6.5**	**0.6**	**28.7**	**5.1**	**0.8**	**27.6**					**47.5**		
Greenland *stable complexes:*															
Tasiusaq	E2	Ruin 9	7.2	2.1	15.1	8.0	3.9	31.2	Yes	?	Yes	No	135	Med.	Holm 1883:IXV
Qassiarsuk	E29a	Ruin 5 (I-II)	7.5	3.7	27.4	9.8	3.4	32.8	Yes	Yes	Yes	No	39	Med.	Nørlund&Stenberger 1934:83
Qassiarsuk	E29a	Ruin 5 (IV-V)	4.8	3.2	15.2	7.0	2.8	29.4	Yes	Yes	Yes	No	59	Med.	Nørlund&Stenberger 1934:83
Qinngua	E39	Ruin 22	10.5	3.3	34.1	?	?	?	Yes	?	Yes	?	34	Med.	NMA:Albrethsen 1970:bilag I:18, Krogh&Berglund 1980:105
Igaliku	E48	Ruin 1	9.7	4.0	38.3	9.2	4.6	42.4	Yes	?	Yes	Yes	16	Med.	Simpson *et al.* in press
Vatnahverfi	E64c	Ruin 2 (III, V)	6.0	1.8	10.5	6.0	2.9	17.4	Yes	Yes	Yes	No	6	Med.	Vebæk 1943:71
Hvalsey	E83	Ruin 1	6.8	2.7	17.9	6.8	2.7	17.9	Yes	Yes	Yes	Yes	150	Med.	Roussell 1941:217
Anavik	V7	Ruin 7	8.6	3.3	28.2	12.2	4.5	54.3	Yes	Yes	Yes	?	5	Med.	Roussell 1941:221
Sandnes	V51	Ruin 5 (I, III)	9.7	4.5	43.7	9.7	3.8	36.4	Yes	Yes	Yes	No	16	Med.	Roussell 1936:36
Sandnes	V51	Ruin 6 (I, VI)	10.5	3.9	41.0	9.5	4.4	41.1	Yes	Yes	Yes	No	52	Med.	Roussell 1936:49
Subset mean:			**8.1**	**3.2**	**27.1**	**8.7**	**3.6**	**33.7**	**-**	**-**	**-**	**-**	**51.2**	**-**	**-**
Subset standard deviation (s):			**2.0**	**0.8**	**12.0**	**1.9**	**0.8**	**11.7**					**51.6**		

Location:	Site no.	Ruin no.	Byre length	Byre width	Byre area (m^2)	Barn length	Barn width	Barn area (m^2)	Stalls	Pave	Add. rooms	Gable entrance	DMD	Date	Reference:
Greenland *Integral byre/barns:*															
Vatnaverfi	E64c	Ruin 1 (I-II)	5.5	1.8	9.6	4.8	2.0	9.5	No	Yes	-	-	-	Med.	Vebæk 1943:26
Vatnaverfi	E167	Ruin 7 (X)	4.8	2.2	10.5	?	?	?	Yes	No	-	-	-	Med.	Vebæk 1993:60
Vatnaverfi	E167	Ruin 7 (XIII)	4.6	1.8	8.1	?	?	?	Yes	No	-	-	-	Med.	Vebæk 1993:60
Puilasoq	V8	Ruin 1 (VII, XI)	3.4	3.0	10.2	3.9	3.6	13.7	Yes	Yes	-	-	-	Med.	Roussell 1941:171
Kangersuneq	V16	Ruin 1 (VIII, X)	5.7	2.8	16.0	4.8	2.4	11.4	Yes	Yes	-	-	-	Med.	Roussell 1941:163
-	V35	Ruin 1 (III, X)	3.6	1.2	4.2	4.1	2.7	11.0	Yes	Yes	-	-	-	Med.	Roussell 1941:167
Tummeralik	V52a	Ruin 1 (XIII, XVI)	7.4	3.2	23.7	7.5	3.5	25.9	Yes	Yes	-	-	-	Med.	Roussell 1936:81
Austmannadal	V53c	Ruin 1 (IX, X)	6.6	3.0	19.7	8.4	3.6	30.0	Yes	Yes	-	-	-	Med.	Roussell 1941:178
Austmannadal	V53d	Ruin 1 (IV, X)	3.6	3.1	11.0	5.9	2.8	16.6	No	Yes	-	-	-	Med.	Roussell 1941:188
Nipaatsoq	V54	Ruin 1 (II)	6.2	3.0	18.6	?	?	?	Yes	?	-	-	-	Med.	Andreasen 1982:180
Subset mean:			5.1	2.5	13.2	5.6	2.9	16.9	-	-	-	-	-	-	--
Subset standard deviation (s):			1.4	0.7	6.1	1.7	0.6	8.0							
Greenland total mean:			8.6	3.1	28.8	9.0	3.4	38.5	-	-	-	-	38.5	-	-
Greenland total standard deviation (s):			5.2	0.8	24.6	4.4	0.8	23.0					48.8		
Iceland byre/barns:															
Lundur	Ruin 3		9.0	3.5	31.5	9.8	3.0	29,3	No	Yes	Yes	Yes	?	Med.	Berson 2002:37p, Fig.2
Þórarinstaðir	Ruin C		8.0	3.8	30.4	6.2	2.2	13,6	Yes	Yes	Yes	No	46	11th c.	Berson 2002:42, Fig.4
Bergþórshvoll	-		14.2	4.2	59.6	4.0	3.3	13,2	Yes	No	No	Yes	?	-	Berson 2002:44p, Fig.6
Gröf	Ruin E-F		8.0	3.7	29.6	12.6	3.8	47,9	Yes	Yes	No	Yes	42	13th - 14th c.	Berson 2002:46, Fig.8
Gjáskógar	-		6.3	3.0	18.9	3.9	3.0	11,7	Yes	Yes	No	Yes	10	11th c.	Berson 2002:46, Fig.9
Hvítarholt	Ruin VI		10.0	5.0	50.0	14.0	5.0	70,0	Yes	Yes	No	?	30	VA	Berson 2002:50, Fig.12
Sámsstaðir	-		9.0	3.6	32.4	4.2	3.0	12,6	Yes	Yes	No	Yes	80	VA	Berson 2002:52, Fig.14
Goðatættur	Ruin 2		?	?	?	?	?	?	No	Yes	No	Yes	17	VA	Berson 2002:52, Fig.15
Herjólfsdalur	Ruin VIII		4.5	3.4	15.3	No	No	-	Yes	Yes	No	Yes	0		Berson 2002:54p, Fig.17
Herjólfsdalur	Ruin IV		8.0	4.0	32.0	No	No	-	Yes	Yes	No	Yes	2		Berson 2002:55p, Fig.17
Stöng	Ruin 6		?	4.0	?	?	?	?	Yes	Yes	?	?	34	11th c.	Berson 2002:56p, Fig.18
Laugar	-		12.5	4.0	50.0	No	No	-	Yes	?	?	?	0	Med.(?)	Berson 2002:57
Áslákstunga	-		14.0	4.0	56.0	?	?	?	Yes	Yes	Yes	No	45	Med.(?)	Berson 2002:57
Undir Lambhöfða	-		10.0	4.0	40.0	?	?	?	Yes	?	Yes	Yes	40	Med.(?)	Berson 2002:57
Iceland mean:			9.5	3.9	37.1	7.8	3.3	28.3	-	-	-	-	29	-	-
Iceland standard deviation (s):			2.8	0.5	13.5	4.0	0.8	21.0					23.5		
Norway byre/barns:															
Lurekalven	House 3		7.6	4.9	36.9	7.2	4.9	35.3	-	-	-	?	3	Med.	Kaland 1987:Fig.5
Høybøen	House 1		8.6	4.7	40.2	-	-	-	-	-	-	?	6	Med.	Kaland 1987:Fig.5
Hellaug	House 1		10.0	4.8	47.6	-	-	-	No	Yes	-	Yes	0	Med.	Nesset 2013:Fig.1
Norway mean:			8.7	4.8	41.6	7.2	4.9	35.3	-	-	-	-	3	-	-
Norway standard deviation (s):			-	-	-	-	-	-	-	-	-	-	-	-	-

Tab.5.2: Displays North Atlantic byre/barns from Greeland, Iceland, and Norway. All measuremetns are internal. Stalls = are stalls present?; Pave. = is the byre is paved?; Add. rooms = are there additional rooms besides byre/barn?; Gable entrance = is the main entrance to the building from the gable?; DMD = distance to the associated farmhouse (dwelling. The table is discussed in the tect.

The clear association between byre sizes and farmstead has been clearly established elsewhere and need not be repeated here (McGovern: 1985:91pp, 1992a:210pp) and the discussion of Tab.5.2 will be limited to overall trends:

The Greenlandic simple byre/barns were on average slightly longer and wider than byre/barns in stable complexes; and were on average over double the size of the integral byre/barns, even when excluding the massive byres of *Garðar* (Igaliko/E47). This of course conforms perfectly to the generally accepted picture that large-scale cattle farming was a prerogative and mark of the largest farms. In contrast, and in accord with the above interpretation of the centralized farms as the homes of small-time farmers, some perhaps even shielings, their byre/barns were of very limited size.

As expected, barn floor areas in Tab.5.2 correspond perfectly to the associated byre floor areas in the sense that they increase relative to the byre floor area. Stable complexes have larger barn areas than the integral byre/barns. Barn floor areas are consistently larger than associated byre floor areas, which is significant for the interpretation of rooms in byres with no visible stall stones. A general trend of uncertain significance is the relative increase in barn areas from a near equal 1:1.10 byre to barn ratio in simple byre/barns, to a 1:1.24 ratio in stable complexes, and a 1:1.28 ratio in integral byre/barns. The difference could relate to the two latter byre/barn types housing other livestock than cattle, the former requiring other fodder (e.g. leafy fodder), which could have taken up more space than hay?

Since stall stones and paving are defining parameters of the byre/barn (see above) their occurrence in Tab.5.2 need not be discussed. More interestingly, only four of the byre/barns had access through the gable (although the placing of the entrance were not recorded for the integral byre/barns), which is in stark contrast to the Icelandic sample. While perhaps a signal of regional diversification, one may note that Greenlandic byre/barns with entrance through gable are all found at church manors with later types of churches (see section 5.2.2), which could indicate that gable entrances were a late feature. Another feature of regional diversification not listed in Tab.5.2, but noted by Roussell (1941:220) is the presence of *passage-entrances* (cf. Fig.5.19). Similar passages are known from dwellings in Norway and Iceland, but not from byre/barns. The existence of single row byres also seems unique to Greenland.

The mean distance of the Greenlandic byre/barns to their associated dwellings (Tab.5.2 DMD) was 38.5 m, with the simple byre/barns on average lying closer to the dwelling than the staple complexes. Two distinct outliers of both types skew average distances somewhat. These four byre/barns are secondary, however, i.e. there is another byre/barn at the site. Thus, a more reasonable mean distance between byre/barn and associated dwellings is 19.22 m for the simple byre/barns and 28.38 for the staple complexes. This is comparable to the Icelandic sample. In short, the prestigious byre/barns lay close to the dwellings, probably both for convenience and status display: large or multiple byre/barns signaled many cows, as well as amble access to building materials and labor, whereas byres hidden inside centralized farms – for warmth and conservation of building materials – clearly signaled the direct opposite; an argument that may of course be extended to all the livestock houses.

In North Atlantic cross comparison, the mean byre area (28.8 m^2) of all the Greenlandic byre/barns is somewhat smaller than in both the Icelandic (37.1 m^2) and Norwegian sample means (41.6m^2), which suggests that the latter farmers were on average rearing higher actual cattle numbers. This trend would surely be much clearer if the Greenland sample was not so heavily biased towards larger sites and church manors and the Icelandic sample not biased to towards low to medium status sites. However, even when only comparing a subsample of relatively large Greenlandic simple byre/barns – which most resemble the Icelandic and Norwegian examples – mean byre floor areas are lower. In short, only few of the farmsteads in Greenland could compete with their North Atlantic cousins and most *grænlendinga* apparently keept modest cattle stocks.

In contrast, Greenlandic mean barn floor areas of 38.5 m^2 – i.e. including the small integral byre/barns – significantly outsizes the 28.3 m^2 mean area for the Icelandic barns, and to lesser extent also the Norwegian barns. T. McGovern (1985:93) observed the same pattern in a comparison of Eastern and Western Settlement barns, suggesting that it could reflect longer stalling periods in the latter area. This would seem to be a valid explanation for the North Atlantic differences in barn areas as well, although reliance on other fodder types – as discussed above – could also partly explain the relatively larger barns in Greenland. Otherwise the North Atlantic byre/barns are very similar and appear to have changed very little over the 500 years of settlement.

5.3.2 Other Roofed Outbuildings

The other types of roofed outbuildings on the Greenlandic farmsteads – as well as in the rest of the North Atlantic – are archaeologically far less explored than the byres, affecting that no cross comparison is possible and here I only outline a few of the Greenlandic types that have been discussed and are included in the analysis in chapter 5:

Because of their often frequent excellent preservation (cf. Fig.5.18), the layout and function of the stone built *storehouses* was early established: as summarized by D. Bruun (1895:430), they were typically square and built in unsealed dry-stone masonry allowing for a free flow of air through the building, and placed in the terrain so as to ensure wind-exposure and thereby ventilation and drying of stored food, fodder, or goods. Although buildings of similar function, but different build were known from historic Iceland – why the Greenlandic storehouses are frequently referred to as *skemmúr* (pl.) in the literature – Bruun noted a clearer parallel to Norwegian storehouses (Ibid.), which Roussell also accentuated (1941:236).

Roussell also pointed to the obvious fact that the different size and placing of the storehouses reflected different functions (Ibid.231). With little specification, Roussell differentiated between *milk-* and *food-stores* closely associated with the dwellings, *ship-stores* lying close to the fjords and relating to boating and hunting, and larger *warehouses* that facilitated storing and preservation of skins, textiles, and trade goods; in the case of the bishop's seat of Igaliku/ *Garðar* (E47), one storehouse (ruin no.5) has even been proposed to have been a 'tithe-barn', where levies, taxes, and tithes in form of natural products from the diocese were amassed (Nørlund and Roussell 1929:56, 112). Although latter suggestion is hard to substantiate, the infrequent arrival of merchant ships (discussed in section 2.1.3) meant that trade goods had to be stored for up to several years. The point that large warehouses were a feature notable of the largest farms has also recently been made by J. Arnborg (2004:242). McGovern (1985, 1991, 1992a) has also included storehouses in his model of hierarchical site rankings in Greenland, but has done so purely quantitatively and without distinction of different types. Neither do I differentiate between types in the analysis in chapter 6.

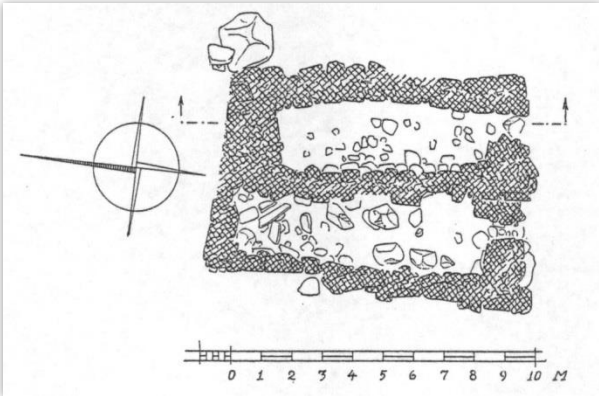


Fig.5.20 A double sheep/goat shed excavated at E83, a very rare outbuilding type mostly found on the church manors or largest farmsteads (after Roussell 1941:Fig.140).

Norwegian medieval documentary records point to the presence on the farms of a number of dedicated outbuildings for the various types of livestock, including separate sheep and goat buildings (*sauða-* and *geitahús*) (Myhre and Øye 2002:356). The ethnographic record from Iceland also point to a meticulous dividing, stalling and feeding of different livestock of different ages (e.g., Bruun 1897:80pp, 1928:269p). This was part of the above mentioned 'functional fragmentation' of the medieval farms. In Greenland, the older archaeological literature especially often refers similar sheep/goat sheds without much specification. Bruun (1895:429) summarized that they were small and narrow (ca. 2.5-3.1 m inside width) rectangular buildings, built in turf and stone, and often consisting only of a single room. Roussell (1941;226pp) elaborated somewhat on the layout and build of sheep/goat sheds, and introduced the double-sheep goat sheds (Fig.5.20, section 6.2.1). I have been unable to find other systematic reviews of medieval sheep/goat houses from Greenland or elsewhere in the North Atlantic.

However, summarizing the observations of Bruun and Roussell, sheep/goats were generally narrow, more poorly built in turf/stone or stone/turf. The walls were only ca. 60-100 cm wide, so that the total width of the sheep/goat shed was no greater than 3.5-4.1m. Sheep and goats were less sensitive to cold effects and consequently required less insolation in their housing. The sheds were mostly single-roomed, but examples with two to four also occurred. I use these general characteristics for the classification of sheep/goat related outbuildings in chapter 6.2.

A number of other roofed outbuildings – bathhouses, smithies etc. – have been identified on the Norse farmsteads through excavation, but since they are mostly impossible to verify during surface surveys, I have in chapter 6 grouped them in a residue category of other roofed outbuildings. For the same reason, I will not treat these types of outbuildings further here. In terms of tentatively identifying and classifying other livestock outbuildings in chapter 6, I have relied on "the outer architectural limits" set by the excavated examples of byres and the sheep/goat sheds – i.e. wall thickness, wall building material, ruin widths, and ruin placing – to identify buildings that were more suited for cattle or more suited for sheep/goat husbandry, although definite verification of such interpretation is lacking.

5.3.3 Medieal Unroofed Outbuildings

The final category to be discussed here are what I term unroofed outbuildings, i.e. dykes, walls, fences, pens, folds etc. This group of farmstead buildings is even less described than the outbuildings – again in all of the North Atlantic – and has mostly been treated in a matter-of-fact way, probably because of their obvious function. However, summary overviews have been provided by Nørlund and Stenberger (1934) and Roussell (1941). Most prior authors seem to agree on the use of the large cattle enclosures, i.e. the type referred to in chapter 6 as 'grazing enclosures'. The use of the smaller pens and folds for herding and management of sheep/goat husbandry is obvious, but can be nuanced through the ethnological observations of Bruun from late 19th century Iceland (1897:43pp, 1928:278pp), who also pointed to direct parallels in the Greenland Norse archaeological record (Ibid.400). From Bruun's description five types of enclosures can be outlined:

Rétt (*réttir*, pl.) were enclosures located either just outside the infield or somewhere in the outfield, which were mainly used for the seasonal rounding up the sheep. *Kvíar* were smaller enclosures used for daily sheep herding and milking near the farmsteads; this type of enclosure was narrow to ease handling of the animals and was located just inside or outside the infield. *Nátthagi* were larger and more substantially built enclosures that essentially served the same purpose, but their larger size meant that the sheep could graze and stay inside the enclosure after being milked. The final type was a *stekkr* and *lambakró*, which were used for milking the sheep: in the evening ewes and lambs were driven to the enclosure to spend the night. The ewes would be places in the *stekkr*, the lambs in the *lambakró*, so that the former could be milked in the morning before they were let out to graze another day. As will be demonstrated in chapter 6, this type of milking pen is very well represented in Greenland Norse architectural record.

Concluding on the above outline of the various Norse farmstead and shieling architecture, it is clear that even after more than 200 years of archaeological surveys and investigations, there are notable gaps in the record, especially in terms of the outbuildings and enclosures, and more generally in terms the chronology and phasing of all the buildings. As stated above, the excavated record is in a sense just as "accumulated" as the survey record. Such issues cannot be resolved in the present analysis of survey evidence and confirmation of surface ruin identification must in many cases rely on future investigations. Nonetheless, at present stage, drawing on this accumulated architectural, and ethnological, record seems the best way of advancing perspectives on Greenland Norse settlement and pastoral farming, approaches that will be explored and tested in chapters 6 and 7.

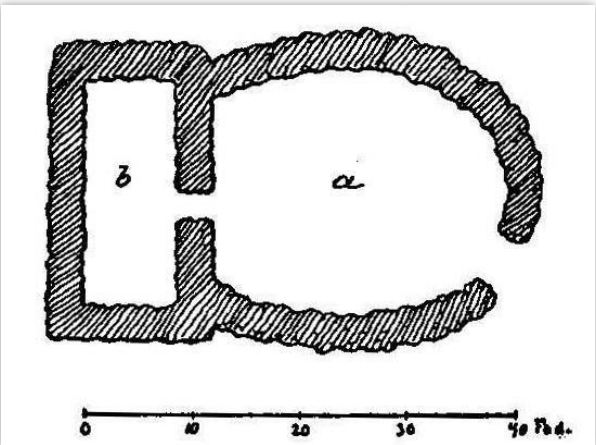


Fig.5.21 Historic example of an Icelandic enclosure layout with *stekkr* (a) and *lambakró*, i.e. a herding facility used for the milking of sheep (after Bruun 1928:Fig.34).

6. The Archeological Features of Norse Farmsteads and Shielings in the Vatnahverfi

In chapter 4, the development of the archaeology of Norse Greenland and the Vatnahverfi-Project 2005-2011 was outlined; in chapter 5, prior interpretations of this archaeological evidence on the character and layout of Norse farmsteads, shielings, and their related buildings and features were reviewed. Drawing on these findings, chapter 6 presents and interprets the survey evidence of 1308 ruins and other features in the Vatnahverfi region and the set of comparative Eastern Settlement sites: Chapter 6 concludes on one part of the Vatnahverfi - Project, i.e. presentation and identification of particular Norse building types and functions in the survey dataset. Thus chapter 6 forms the basis for the second concluding part of the Vatnahverfi-Project surveys, i.e. chapter 6's analysis of the functional and hierarchical layout of the farmsteads and shielings on settlement- and community level.

As reviewed in chapters 4 and 5, archaeological investigations in Norse Greenland have tended to focus on the dwellings and churches, the layout and development of which are consequently fairly well understood. The outbuildings, on the other hand, have received far less attention, especially after 1962 (cf. Tab.4.1); except for the byre/barns and stable-complexes (see section 5.3.3), we have a very limited understanding of their development, functions, and chronology. Add to this the condition that an analysis of survey evidence in terms of building identification involves interpretation from much dilapidated and partial surface remains and it is a very difficult exercise. Moreover, it is also an exercise that cannot be directly verified without excavation of a large number of ruins.

The first part of chapter 6 concerns source critical issues relating to the surface interpretation of the Norse ruins: it initiates with some brief considerations as to ruin preservation and taphonomy. The second part of chapter 6 presents a classification of the 1308 features included in the total survey dataset upon 25 functional building types (and 3 residue categories), each presented and discussed in turn. I conclude chapter 6 by summarizing overall patterns in relation to the functional layout of the farmsteads and shielings in the Vatnahverfi region to be presented in chapter 7.

Fig.6.1 Ruin group E168's ruin no.7, a storehouse or *skemma* (left in the photo), situated on an outcrop at some distance from the other ruins, but where it was more wind exposed. Apart from building materials, the identification of certain types of buildings often rests such qualitative assessment (*photo: C.K. Madsen 2008*).

6.1 The Identification and Description of Ruins as Functional Buildings

The exceptional preservation of Greenland's cultural landscapes has been stressed several times in the above, not at least the fossilized medieval Norse settlement evidence that remains visible as ruins in the terrain to this today. However, it should equally be stressed that this unique state of preservation does far from extent to all of the ruins. In fact, preservation varies greatly: from the rare ruins standing several meters high and almost intact (e.g., Fig.6.4) to those that are nothing more than indistinct stone heaps or low turf mounds (e.g., Fig.6.2-6.3). Ruin preservation may vary between sites, but also within the individual site. Even to the trained eye, interpretation of much dilapidated ruins is challenging, as affirmed by the frequent use of denotations such as "*possible ruin?*" or "*building of unknown function*" in archaeological survey reports. Certain identification of such poorly preserved ruins always relies on excavation. Since, however, excavation of even a fraction of the existing ruins is unfeasible, we primarily have to deal with them based on what is visible on the surface.

Chapter 7 offers an interpretational framework that combines qualitative and quantitative observations for systematic and explicit identification and interpretation of such surface evidence – the 1308 ruins of the total survey dataset – as functional features. However, in light of the ambiguous nature of the surface evidence, this framework must be weighed against a number of source critical considerations. Methodological issues relating to the Vatnahverfi-Project surveys and the resulting both ruin group and ruin representativity was discussed in detail in section 4.2. Instead, section 6.1 opens with a brief and more general discussion of what can and should be observed on the surface, which is discussed in terms of building materials, their preservation, and remains, i.e. offering what one might call a *building taphonomy*. Based on these survey archaeological potentials and limits, section 6.1 concludes with a presentation and discussion of the parameters used in the analysis of the ruins in the total survey dataset, i.e. the parameters listed in appendix ???.

Fig.6.2 View of ruin group E71a's – central Vatnahverfi region – massive dwelling complex (ruin no.1), which stands out in the terrain as a low farm mound with different vegetation, many depressions (i.e. room outlines), and protruding stones. The farm mound is of such a size that it undoubtedly covers more than one single building, but it is too dilapidated and collapsed to make such a distinction. Note also the largely stone built circular enclosure in the front and to the right of the dwelling (*photo: C.K. Madsen 2006*).

6.1.1 Building Materials and Taphonomy

Like elsewhere in treeless parts of the North Atlantic, the Greenland Norse built their houses and outbuildings in turf, stone, and wood, each material having certain qualities that related to, and even in a severe state of collapse reflect, the specific function of the building independently of particular building techniques:

The main quality of turf or sod blocks was to *insulate* buildings; or alternatively, but with similar functional result, to bind together irregular courses of stone wall. Stone had two main qualities, either working as durable and stable protection walls for the more degradable turf walls, or for ventilation of rooms by allowing a free flow of air through the cracks between the stones. The best examples of this function are the often well-preserved store-houses built completely in dry stone masonry (Fig.6.1, 6.4), i.e. walls built entirely in neatly fitted, but largely unworked, stones without mortar or any other means of cohesion. Wood was mainly used for the support of roofing, as well as for thresholds, frames, panels, and other architectural details. However, some buildings – for instance some of the churches (see section 5.2) and seemingly store-houses (see section 6.2.2) – seem to have incorporated wooden walls or gables for ventilation or decoration. While there is considerable architectural variation over the use and combination of these building materials, the basic distinction between '*all or mostly turf walls*' for the purpose of insulation versus '*all or mostly stone walls*' for the purpose of ventilation are key in identifying building functions, also in a ruined state. Once the buildings were abandoned, these materials would wither and decay in varying, but fairly regular order, although depending upon a number of external conditions:

Although wood has been found preserved in many excavated Norse buildings, the first part of the buildings to fall into ruin seems to have been the wooden posts that supported the heavy turf-covered roof (eg., Roussell 1936b:41, 1941:173). This roof cave-in would cover the inside rooms of the building, with a layer of wooden beams and wattle superimposed by the turf cover. On one hand, this cave-in protected and stabilized inside features and lower walls, on the other hand put pressure on, especially higher parts, of inside walls. This in part explains why the course of inside wall lines are often discernible even where ruins are in a severe state of decomposition and standing no more than 10-20 cm above ground, while their outside is surrounded by substantial amounts of collapse stone: even a slight amount of pressure on the inside of the walls would have caused most of the wall material to collapse outwards, while lower wall causes were at the same time stabilized by caved-in roof material.

Next, the turf component of the buildings would decay; whether walls built purely in turf on a stone sill, intermittent turf and stone layers, box walls with faces of stone and a core of turf, or turf super-structure on stone wall or foundation, the gradual decomposition of turf components caused destabilization of the entire building. Anyone who has excavated turf buildings with some preservation will have experienced how a turf wall will collapse in a very organic, at times almost fluid, manner: turf mats or blocks of walls will slump, slide, set, and even flow over and in between each other, sweeping with them any intermittent stones. This process of collapse was rather prolonged, occurring over a number of events as turfs gradually decomposed and collapsed to expose underlying layers, which would then start to wither and decompose etc.

Stones do normally not wither or decompose over the timespan involved since the abandonment of the Norse ruins. However, as just outlined, any stone building including wall components of turf would quickly have destabilized and collapsed, either sliding along with the turfs or tumbling over. Buildings made in dry stone masonry were obviously sturdier and some have survived almost intact until this day (Fig.6.4). However, even the majority of stone-built store-houses are collapsed to some extent, an unavoidable result of frequent violent storms and general weathering. Still, even where collapsed to a mere pile of stones and ruble, the sheer volume of collapsed stone implies the original built of store-houses (see also section 6.2.2).

At some point, however, the processes of gradual collapse slowed to a more or less complete halt. In case of the turf-, turf/stone-, and stone/turf buildings, either when the slopes of collapsed walls were gentle enough to stabilize and vegetate; or the turf had disintegrated to such an extent that only stones were left (Fig.6.3). Most ruins with a turf component are preserved in one of these two states. If not already entirely collapsed, dry stone masonry buildings are still in the process of collapsing, although comparison with earlier records from the last 200 years shows that the process must have slowed significantly.

Final phases in the building taphonomy are natural attrition (erosion, precipitation, frost-thaw cycles etc.) or human disturbance (reuse (e.g., Fig.6.3), looting, farming, industry etc.). These latter processes are still on-going, but to much varying extent at different ruin groups. Fortunately, Inuit sheep farmers reoccupying old Norse farmsteads have, to a great extent, respected the ruins that are protected by law, although the farming intensification from the end of the 1970's (see section 8.1.3) has increased the disturbance, especially of the middens and re-cultivated Norse infields.

In short, functional interpretation of Norse ruins from archaeological surface survey evidence is to a large extent an exercise of identifying the basic functional qualities – i.e. insulation versus ventilation – of the original building and assessing them against the visible taphonomy of the building. While this would seem fairly straightforward, prior surveys have most often applied building material descriptions in a largely unspecified manner, for instance referring to 'turf/stone or turf building' without defining what this description actually entails. Of course, earlier surveyors should not be harshly criticized for using such a vague mode of description, since it was sufficient for the surveys involved with the cultural heritage management that has dominated archaeological survey activities over the last 50 years (see section 4.1.5). However, for the more specified identification of ruins as functional buildings attempted here, a more formal and systematic description key is needed.

Fig.6.3 Ruin group E178's massive dwelling complex (ruin no.5), outer fjord Vatnahverfi region. At E178, most turf components of the dwelling have almost completely withered away, leaving only a massive area of stone collapse (all the stones visible centrally in the photograph). Additionally, some stone beams originally incorporated in the Norse dwelling have been reused for making a Thule-culture Umiaq support (vertical stone beams to the right) (*photo: K. Smiarowski 2009*).

Fig.6.4 Ruin group E80's ruin no. 4 (left) and 24 (right). No.4 is one of the best preserved ruins in the Eastern Settlement with dry-stone walls standing more than 2 m high. Clearly, if it had fallen into complete collapse, it would still be preserved as a sizable pile of stones. Thus, although ruin no. 24 was functionally similar to ruin no. 4 – i.e. a storehouse/*skemma* – the former was either earlier than, and the stones removed for building, ruin no. 4; or ruin no. 24 was not built in stone at all. If not originally built in stone, the primary ventilation function of the storehouse would preclude that it was built in turf, but probably rather in wood (*photo: C.K. Madsen 2013*).

6.2 A Classification of Ruins as Farmhouses, Lodges, and Outbuildings

Appendix 1 lists the above parameters for 1308 Norse ruins and other features, hereof 1068 ruins in the Vatnahverfi region and 236 ruins in the comparative set of Eastern Settlement sites (note that discrepancy between this number and Tab.4.2 result from ruins being added by archival post-reference (see section 4.2.3) and from ruins with clear multiple being split on separate numbers (see App.1). Section 6.2 presents a classification of the 1308 ruins upon 26 functional types of buildings (as well as three residue categories). Some types are exemplified by several hundred buildings, others only by a handful. Nonetheless, each type is defined and discussed in terms of archaeological surface identification, interpretive issues, functionality, as well as supplemented by summary descriptive statistics and patterns within the survey dataset. Overall, the 26 types can be split on three main groups of buildings: those that were roofed, those that were not, and features other than buildings. The building types are presented in this order.

Several of the presented building types borrow from existing terminology and interpretations of earlier studies outlined in section 5. Yet, as noted there, outbuildings in particular have not been treated systematically and there is no defined framework for their identification. As a consequence, the below classification will to some extent introduce a new and slightly different terminology. Finally, as also discussed in section 5 and visible in Tab.4.1, few farmhouses and hardly any outbuildings have been excavated since 1962. Thus, we have little knowledge as to their contemporaneity and date, except for the dwellings and churches. In a few cases a limited extent of building phasing can be inferred from architectural details visible through surface survey (e.g., Fig.6.4), but it is rarely possible to date or even assert such building histories. In consequence, *the classified buildings are considered to represent up to 450 years of accumulated settlement* at each ruin group. Note that all cited ruin and ruin group numbers refer to the ruin and ruin group databases (App.1&2 and will not be described further). Statistical analyses were performed in PAST v.3.01.

6.2.1 Roofed Buildings

Dwellings (Tab.6.1):

***Definition*:**

A dwelling is the main habitation building of a farmstead or shieling, i.e. the main farmhouse or shieling lodge.

Surface interpretation and issues:

Although dwellings are fairly easy to identify in ruin surface survey (e.g., Fig.6.2-6.3), it is difficult to provide any defining metrical parameters for their identification, because they come in such varied layouts and sizes: for instance, the areas of the dwellings of centralized farms can be extremely large, whereas the dwelling areas of shieling lodges are small, both building types however facilitate human habitation. Moreover, their substantial turf component – for insulation – effects that dwellings are among the most dilapidated ruins, often appearing as nothing more than a slightly elevated grassy mound littered with collapse stone (Fig.6.2-6.3). This makes room, wall, and even ruin outline delineation very difficult, especially towards the adjoining midden that always lie down slope from the dwelling and where collapse material tends to slide down and mix with midden material. In the Vatnahverfi-Project surveys, we have systematically tried to survey the outline of the dwelling structure proper, i.e. ignoring the surrounding spread of collapse material. However, comparing with other surveys, it is clear that some surveyors have included the entire area of dwelling collapse material, which account for notable difference is dwelling size estimates and makes metrical comparison impracticable.

The presence of midden is one parameter that makes the identification of dwellings feasible despite of their frequent severe state of collapse. However, some smaller dwellings – e.g. shieling lodges – have no midden (substantial enough to be visible on the surface, although sheet-midden could be detected through test-trenching). Thus a key defining parameter of all types of dwellings, including those with no midden, is that they are always the largest ruin of a site (although excavations have shown that stable-complexes may, in fact, be larger (e.g. Fig.5.8). Additionally, dwellings tend to occupy a central and sheltered location among the buildings.

At a few sites, more than one ruin has the appearance of a dwelling, suggesting the presence of multiple farms (see section 2.2.1). Excavations of ruin groups E71 and E167 in the Vatnahverfi (Vebæk 1992:23p) and E28, E29, and E29a (Nørlund and Stenberger 1934) have shown that such sites existed in Norse Greenland. However, identifying multiple farms from ruin surface evidence is difficult: unless the dwellings are well-preserved, clearly separated by natural features, or each accompanied by distinct byre/barns or stable-complexes, it is almost impossible to distinguish the latter from the dwellings. Again, there is no way of establishing if multiple dwellings were contemporary or replaced each other over time, although arguments for contemporaneity can be based on their relative locations and associated outbuildings.

Archaeological definition/surface identification:

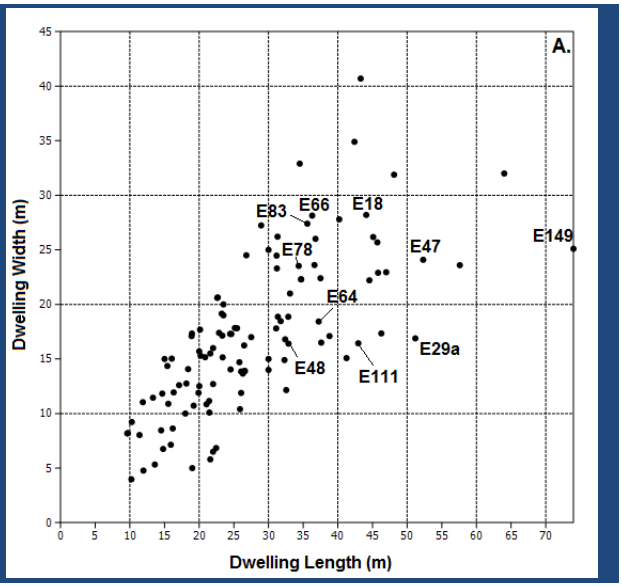
Archaeological surface identification of dwellings is based on a combination of quantitative and qualitative observation: it must be the largest roofed building in a ruin group (only in two instances < 50m^2 in area); it must be built in turf/stone, visible on the surface either as a grass-covered farm mound or slight elevation (e.g., Fig.6.2); or where the turf has completely disintegrated, as a substantial area of stone debris (e.g., Fig.6.3). Often, outlines of multiple walls rooms are discernable. A visible midden contiguous to the dwelling indicates a more permanently occupied farmhouse, while the lack of midden indicates either a shieling lodge or a briefly occupied farmhouse.

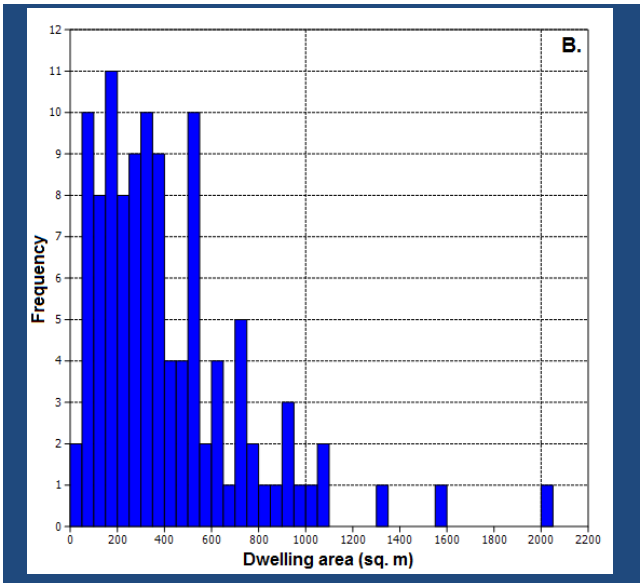
Dwelling descriptive statistics:

Tab.6.1 displays descriptive statistics for the 111 dwellings in this sample, which show great variation in shape and size (58 of the smallest dwelling fit inside the area of the single largest!). The length/width scatterplot (Tab.6.1A) reveals no distinct clustering or patterns, except that ruin lengths and widths tend to correlate. However, the inter-quartile range and area distribution histogram (Tab.6.1B) shows that the majority of the dwellings are smaller examples. There are three extreme outliers – E28 ruin no. 46, E65 ruin no. 1, and E149 ruin no. 2 – which are all artifacts of preservation conditions, i.e. ruin outlines interpreted as dwellings, but that encompass other buildings (Vebæk 1991).

Tab.6.1 – Dwelling Descriptive Statistics

N = 111	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	74.0	9.6	27.0	25.8	19.9 - 37.4	11.0
Width in m	40.7	4.0	17.0	16.4	11.9 - 22.3	7.0
Area in m^2	2048.0	35.0	421.9	336.8	190.4 - 541.2	332.0
L/W-index	3.80	1.00	1.73	1.60	1.30 - 2.0	0.58





Tab.6.1 Above: summary descriptive statistics for the sample of dwellings (all measurements area external). Below: A) XY-plot of dwelling lengths and widths in meters with indication of church farms. B) Histogram of showing the frequency of different sized dwelling in square meters.

Dwelling Discussion:

Considering the dynamic building histories of the dwellings and the above noted issues relating to their interpretation, the visible "fuzziness" is unsurprising. The distinctly positive skeweness of the distribution of dwelling areas (Tab.6.1A) disfavors a range of statistical analysis. Various cluster analysis (e.g., Fig.6.5) suggest 4-6 classes of dwellings, but are liable to bias of random data mining. Other statistical analysis could turn up patterns, but will not be attempted here. Clearly, dwelling dimensions alone clearly cannot provide a convincing classification of farmsteads. This is best achieved by combining dwelling characteristics with observation of other farmstead buildings and features.

Despite sample ambiguity, a few notable patterns are implied: first, it can be seen from Tab.6.1A that the 10 church farms included in the survey dataset all lie in the higher end of dwelling length/width plots, which denotes that dwelling size does to some extent imply the status and class of a site. Interesting in this regard is that the ruin groups with early small churches (E48, E64, and E78) all plot towards the lowest length/width range for the church farms resemble the examples of slightly-larger-than-average dwellings. This correlates well with the observation (see section 8.2.2) that the small churches were taken out of use before AD 1250's and that these farmsteads never grew into later medieval large parish centers. In turn, this would indicate that the church farms kept expanding in a gradual process of centralization, a finding that is in general agreement with prior site classification attempts based on hall area estimates (McGovern 1985:93p, 1992a:210p). However, using the total dwelling area as a proxy for farmstead size and status has the advantage that it can be applied to ruins not excavated. Still, it should be stressed again that dwelling area estimates cannot stand alone in such classification.

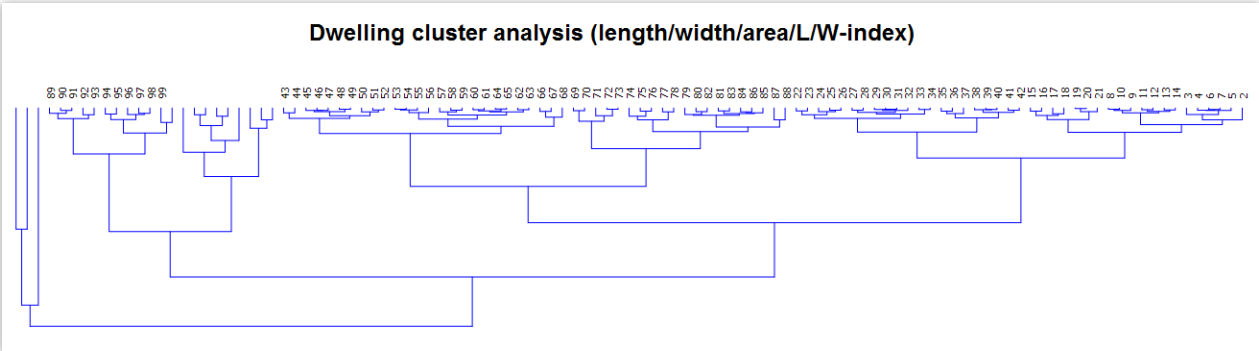


Fig.6.5 Example of a multivariate (length/width/area/L/W-index cluster analysis (classical paired group) of the dwellings in the sample. Various types of cluster analysis was run on the sample, generally turning up 4-6 clusters dwellings, which would be roughly consistent with the number of identified farmstead types (cf. section ?.?). However, this is liable to random data mining, since it is implied that farmstead dimensions cannot stand alone in such classification.

A significant observation from the sample dwellings is that 26 have no recorded associated midden (although at least in the three cases of E95a, E96, and E183 this could to owe to lacking registration). When furthermore noting that these dwellings without midden all belong to the range < 350 m^2, it can reasonable be stated that combined small dwelling size and lacking midden are likely characteristics of the smallest sites, i.e. shieling lodges (see section 8.1.4). Lacking surface evidence of midden can either be interpreted in terms of limited occupation intensity or short term site use. In any case, it is a key parameter for distinguishing between larger permanently and small temporarily occupied sites.

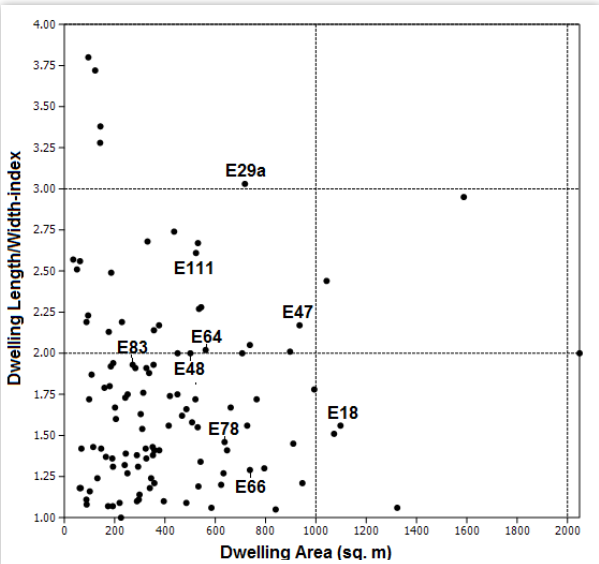


Fig.6.6 Scatterplot of the 111 dwellings with areas on the horizontal axis and length/width-indexes on the vertical axis (an index on 1 implies an almost completely round dwelling, while the higher the index, the more oblong the dwelling). Fig.6.6 is discussed in the text.

Finally, Fig.6.6 displays dwelling areas (horizontal axis) plotted against dwelling length/width-indexes (L/W -index) (vertical axis; the higher the index the more elongated the ruin). Again, there are few clear patterns to the scatterplot. However, a group of very small (< 400 m^2) and rounded (L/W-index < 1.5) dwellings is visible, i.e. the farmhouses and shieling lodges without inbuilt livestock housing. The dwellings associated with church farms do not display the same kind of clear pattern as in Tab.6.1A. However, Fig.6.6 does reveal the clear trend that – as discussed in section 5.1.1 – a rectangular shape was the "ideal" dwelling layout (i.e. higher up the vertical axis in Fig.6.6). This is, of course, also implied by the medians and means of the sample (Tab.6.1).

Simple Byre/Barns (Tab.6.2):

***Definition*:**

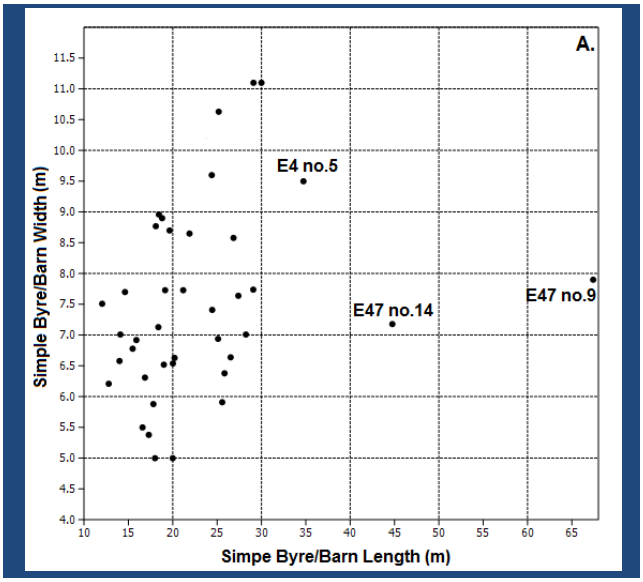
A simple byre/barn is livestock outbuilding intended primarily for the winter stalling of cattle and storage of winter fodder.

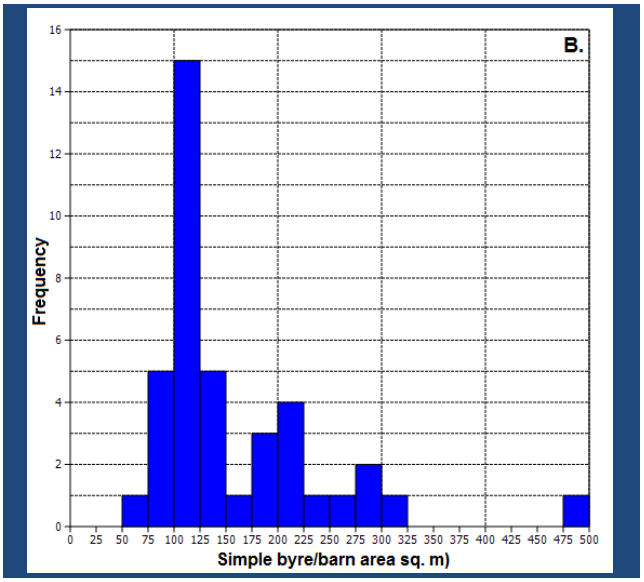
Surface interpretation and issues:

The simple byre/barns (Fig.5.19) were described in detail by Aa. Roussell (1941: 217p) and presented in detail in section 5.3.1. Because of their larger component of turf building material (at least in one end), the simple byre/barns are liable to the same issues of surface preservation and identification as described for the dwellings in the above. In effect, only when excavated

Tab.6.2 – Simple Byre/Barn Descriptive Statistics

N = 41	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	67.4	12.4	22.9	20.0	17.6 – 26.2	9.7
Width in m	11.1	5.0	7.5	7.2	6.5 – 8.6	1.5
Area in m^2	69.1	498.5	159.5	123.9	106.6 – 208.0	84.2
L/W-index	8.53	1.60	3.10	2.83	2.29 – 3.62	1.24
Dis_MD in m	400.0	0.0	71.3	38.8	10.4 – 97.1	92.2





Tab.6.2 Above: summary descriptive statistics for the sample of *simple byre/barns* (all measurements area external). Below: A) XY-plot of simple byre/barn lengths and widths in meters with indication of the extreme outliers of ruin group E47. B) Histogram of showing the frequency of different sized simple byre/barns in square meters.

or where stall stones are still in place can a ruin be certainly identified as a simple byre/barn. However, some surface settings aid in the identification of simple/byre barns: their high turf component, their frequent proximity to their associated dwellings, and their spatial layout (cf. section 5.3.1).

Archaeological definition/surface identification:

Being visible on the surface as a an elevated grass-covered mound or area with many collapse stones, simple byre/barns are always one of the largest roofed buildings in a ruin group (often the second- or third-largest) and are always built in turf or turf/stone (at least in the byre half). The walls of the byre part are no less than 1.5m thick (without outer turf padding, see Fig. 5.19). As a result, simple byre/barns are generally wider (> 5 m, external dimensions) than other oblong livestock houses. The simple byre/barns are always rectangular (L/W-index > 1.6) and divided on two, maximum three, rooms. Two of these rooms are of roughly the same size, the barn part normally being slightly larger. In situ or turned over stall stones and wall materials may imply the byre part of building. Primary simple byre/barns are usually situated in proximity (< 60 m) of their associated dwelling, although secondary simple byre/barns may be located at further distance from the dwelling.

Simple byre/barn descriptive statistics:

Tab.6.2 displays descriptive statistics for 41 simple byre/barns identified in this sample of ruins. A length/ width scatterplot (Tab.6.2A) visualizes what is apparent from the summary statistics (Tab.6.2), i.e. that they form a fairly homogenous group. This is especially true if ignoring the outliers: most distinctive and representing true difference are the two massive byre/barns of the episcopal see of Igaliku/*Garðar* (E47), as well as E4's ruin no.5. The other simple byre/barns wider than 9 m are examples where poor preservation makes accurate surface delineation and measurement of rooms uncertain. As visible in Tab.6.2B, the sample of simple byre/barns

is positively skewed, although less so than the dwellings (cf. Tab.6.2A), suggesting that the sample represents a more clearly defined group of buildings, which is also implied by the small standard deviations for the listed parameters (Tab.6.2).

As implied by the IQR, the distances of the simple byre/barns to their associated dwellings (Dis_MD) cover a large span and is somewhat at odds with what has been claimed above and in section 5.3.1, i.e. that they should lie in proximity to the dwellings. However, if excluding the simple byre/barns that are secondary (i.e. where another byre/barn or stable complex is found in closer proximity to the dwelling: E4 no.13, E18 no.2, E29a no.12&14, E47 no.16, E59 no.19&16, E78 no.12, E149 no.7, E171 no.2, E172 no.1), the distance ranges only between 0.5-65.9 m with an average distance of 24.4m. Whether proximity of byre/barns to the dwellings was a practical measure (i.e. for ease of access to and supervision of the cattle during their winter stalling), a matter of prestige (after the churches, the byres were probably the most prestigious architecture), or both, distance to associated dwelling is an important parameter for identifying primary simple byre/barns.

Simple byre/barn discussion:

The 41 simple byre/barns identified in this sample may seem a small number, especially when compared to the 111 identified dwellings. The discrepancy between the number of dwellings and simple/byre barns is partly explainable by the fact that many classified dwellings – i.e. mostly the shieling houses and lodges – had no associated simple byre/barn (or other cattle housing). At other farmsteads, the housing of cattle was facilitated by stable-complexes (see below). Finally, the fairly narrow definition proposed here for the simple byre/barns effects that quite a few smaller byre/barns are probably instead included in the category of bipartite livestock buildings (see below).

Still, there is reason for staying with the above distinction: among the 41 simple byre/barns in the sample, no less than 16 are associated with church farmsteads. Admittedly, 11 of these simple byre/barns have been excavated (E29 no. 19, E29a no. 12&14, E47 no.9&14, E66 no. 3, E83 no.7, E111 no.3&6, E149 no.7&9) and may therefore to an extent constitute a sample bias. Still, the fact the simple byre/ barns are generally associated with larger farmsteads (cf. Tab.7.1) supports the notion that these large and heavily built livestock quarters – situated close to the dwellings – were a trademark of wealth and status. This function has also ben accentuated elsewhere (Nørlund and Roussell 1929:117, Roussell 1941:217p, McGovern 1985:93p, 1992a:210p).

Stable-complexes (Tab.6.3):

***Definition*:**

A stable-complex is livestock outbuilding intended primarily for the winter stalling of cattle and storage of winter fodder, but with annexes added for other breeds of livestock.

Surface interpretation and issues:

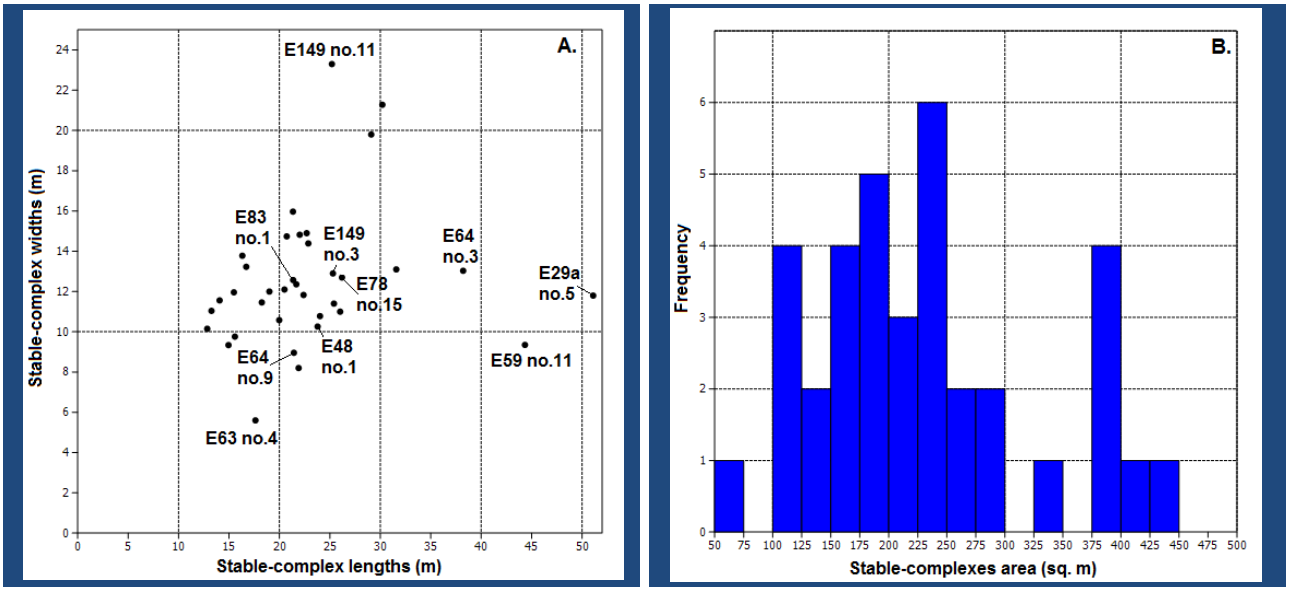
The stable-complexes were also discussed in detail by Roussell (1941:222p) and presented in section 5.2.1. In terms of surface remains, the stable-complexes are quite similar to the two previous building types. However, due to the added annexes they have a more rounded shape than the simple byre/barns (cf. Tab.6.3). This, on the other hand, can make surface differentiation of stable-complexes from the dwellings extremely difficult. When in doubt, this classification assumes that stable-complexes are smaller than the dwellings (although the V51 stable-complexes show that the opposite may be the case, cf. Fig.5.8). Also, stable-complexes tend be less substantial built than the dwellings (i.e. making for less distinct collapse mounds) and only rarely have an associated midden. Still, because their main purpose was for the insulation of the livestock – including the more susceptible cattle - their walls are just as wide (1.67 m on average) as those of the simple byre/barns.

Archaeological definition/surface identification:

Stable-complexes are – like the former two building types – visible on the surface as a slightly elevated grass-covered mound or, where the turf has disintegrated, as an area covered by collapse stone; this ruin area is almost always rounded of shape. Stable-complexes tend to be fairly large, i.e. are almost always the second or third largest roofed building in a site. If room outlines are visible, there must be at least 4 rooms lying in a row or, more commonly, the stable complexes appear rounded due to annexes being added to on one or both sides of central room(s). Where wall thickness can be measured, they are at least 1 m wide and always built in turf or turf/

Tab.6.3 – Stable-Complex Descriptive Statistics

N = 37	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	51.1	12.8	23.0	21.7	18.4 – 25.9	8.1
Width in m	21.3	8.2 (5.6)	12.6	12.0	10.2 – 13.4	3.4
Area in m^2	436.1	67.4	226.9	208.7	158.3 – 286.7	96.0
L/W-index	4.74	1.08	1.94	1.65	1.42 – 2.38	0.82
Dis_MD in m	295.7	1.0	49.4	27.9	9.5 -71.7	60.1



Tab.6.3 Above: summary descriptive statistics for the sample of stable-complexes (all measurements area external). Below: A) XY-plot of stable-complex lengths and widths in meters with indication of church farms and outliers discussed in the text. B) Histogram of showing the frequency of different sized stable complexes in square meters.

/stone. Primary stable-complexes are usually situated in proximity (< 60 m) of the associated dwellings, although secondary stable-complexes may be located at up to several hundred meters distance from the main dwelling.

Stable-complex descriptive statistics:

Tab.6.3 shows descriptive statistics for the 37 stable-complexes identified in the sample. A length/width scatterplot reinforces what can be deduced from the listed parameter descriptive statistics, i.e. that stable-complexes form a fairly homogenous group of ruins. This is somewhat surprising when compared to the dwellings (cf. Tab.6.1A), because both types are liable to the same difficulties of surface survey identification and delineation. All in all, this would suggest that the sample of classified stable-complexes in fact represent a more clearly defined group of buildings. The outliers in the sample are either very long stable-complexes (E29a no.5 and E59 no.11) associated with major farmsteads; ruins that likely consisted of several buildings, but are to poorly preserved to identify; or in the case of E63 no.4 based on georeference of an old and somewhat uncertain survey (Bruun 1895a:365), which cannot be validated because the ruin has since been disturbed (width shown in bracket in Tab.6.3). As expected, stable-complexes are averagely larger (Tab. 6.1B) and more rounded in shape than the simple byre/barns (Tab.6.1)

The stable-complexes are located at distances of 1-295.7 m from their associated dwellings (Tab.6.3). However, excluding the stable-complexes that are secondary (i.e. where another stable complex or simple byre/barn is found in closer proximity to the dwelling: E83 no.1, E91 no.7, E171 no.1, and E182 no.8), and the atypical example from E188 (no.6, Fig.6.7), the distance ranges only between 0.5-98.5 m with an average distance of 28.8 m, or about the same as the simple byre/barns.

Fig.6.7 Ruin group E188's ruin no.6 in the outer fjord of the Vatnahverfi region. Although one of the best preserved examples of a stable-complex type building in the region, the high component of turf building material effects that the ruin is much collapsed and somewhat difficult to delineate (*photo: C.K. Madsen 2010*).

Stable-complexes discussion:

With 37 examples, the stable-complexes form a small group within the total sample. However, combined with the 41 simple byre/barns, the total 78 buildings related specifically to cattle winter stalling is not too far from the 111 identified dwellings, particularly since not all dwellings had an associated byre. On the other hand, several farmsteads had more than one stable-complex or simple/byre barns. For instance, of the 37 stable-complexes 8 (Tab.6.3A, only three of them fully or partially excavated: E29a no.5, E83 no.1, E149 no.11) belonged to church farmsteads which all had additional cattle housing facilities. Although stable-complexes associated with church farmsteads comprise just under one-fifth of the entire sample, this type of cattle housing facility in general appears more regularly associated also with moderate sized farmsteads.

The overall similiarity of the stable-complexes with the simple byre/barns both in terms of relative frequency on larger farmsteads (including church farmsteads) and distance to their associated dwelling is unsurprising: as pointed out by Aa. Roussell (1941:222p) and discussed in section 5.3.1, the stable-complexes were in fact later phases of the simple byre/barns, where annexes had been added to the original building as the needs for livestock housing demanded. Therefore, the stable-complexes can also be ascribed the same significance in the surface survey identification and classification of farmsteads.

Sheep/goat sheds (Tab.6.4):

***Definition*:**

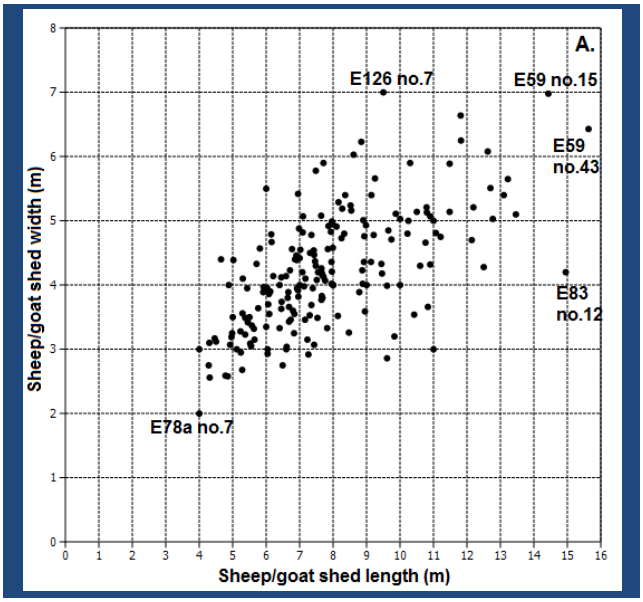
A sheep/goat stable is livestock outbuilding intended for temporary stalling or sheltering of select sheep/ goats.

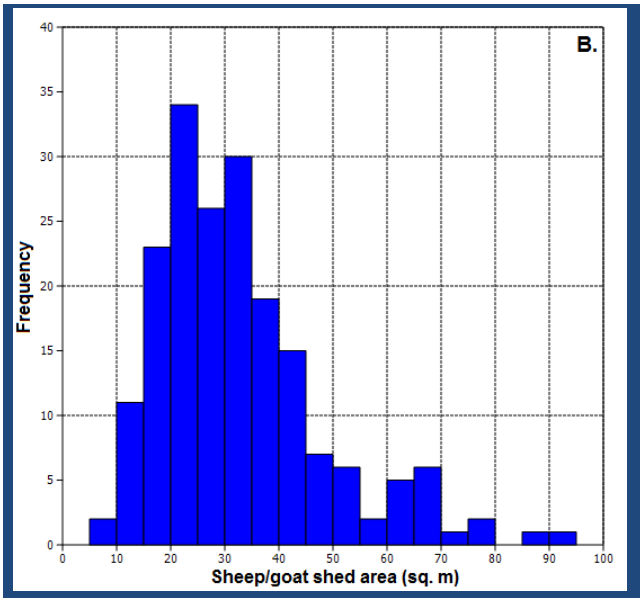
Surface interpretation and issues:

Consistent use of the building category of sheep and goat sheds was introduced, and rather liberally applied, by D. Bruun (1895) and since him a number of other authors (see section 5.3.2). These authors provided few formal guidelines for the identification for this type of building; and since very few of these proposed sheep/goat sheds have been excavated (Tab. 4.1), it is difficult to authenticate their interpretations.

Tab.6.4 – Sheep/goat Sheds Descriptive Statistics

N = 199	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	15.6	4.0	7.8	7.5	6.2 – 9.0	2.2
Width in m	2.0	7.0	4.2	4.1	3.5 – 4.8	0.9
Area in m^2	91.0	8.0	32.6	29.5	21.8 – 39.0	15.4
L/W-index	3.67	1.06	1.87	1.79	1.58 – 2.07	0.43
Dis_MD in m	567.1	2.3	114.2	81.3	35.4 – 156.3	115.2





Tab.6.4 Above: summary descriptive statistics for the sample of *sheep/goat sheds* (all measurements area external). Below: A) XY-plot of shep/goat shed lengths and widths in meters with indication of outliers discussed in the text. B) Histogram of showing the frequency of different sized sheep/goat sheds in square meters.

Undoubtedly, a number of ruins classified as sheep/goat sheds in this sample could have had other functions and I have not found any stronger argument for my interpretation than the prior investigators.

Nonetheless, it is difficult to find a more plausible explanation for the small single-roomed buildings that are present on all farmsteads and occur very abundantly at some. Of the roofed buildings, the sheep/goat sheds are among the easiest to identify from surface survey evidence (e.g., Fig.6.8-6.9), partly because of their simple construction, partly because of the limited amount of turf involved in their construction, which effects that details can be discerned even when the ruins are very dilapidated. Their small size and simple construction, however, does not mean that the sheep/goat sheds are uniform in their surface appearance. Rather, they were built in much variable materials and sizes.

Archaeological definition/surface identification:

Sheep/goat sheds are always visible on the surface as singled-room rectangular ruins of limited dimensions, i.e. normally less than 12 m in length and 6 m in width (see below). They can be built in turf, turf/stone, stone/turf, or, where the turf component has completely disintegrated, be preserved only as a stone foundation. They can be located at any distance from dwellings and various other livestock buildings, but some examples at individual farmsteads are often found in proximity to enclosures or at the edge of the infield area. Besides their fairly small size, the most distinctive feature of the sheep/goat sheds is their fairly thin walls: sheep and goats are more resilient to cold temperatures than the cattle (or pigs) and their housing did not need to be so heavily insulated.

Sheep/goat sheds descriptive statistics

With 199 ruin classified as sheep/goat sheds, they are the most numerous group assigned to a specific building function. Visible from Tab.6.4 displaying their summary descriptive statistics, the sheep/goat sheds form a uniform group with a distribution showing slight positive skeweness and few extreme outliers (Tab. 6.4A): most noticeable of the outliers are two sheep/goat sheds at ruin group E59, as well as a single example from the *Hvalseyfjörður* church (E83 no.7). The outliers E78a no.7 and E126 no.6 are explainable by poor preservation or survey description. Interestingly, of the 20 largest sheep/goat sheds, five belong to ruin group E59 and another nine to church farmsteads. Besides indicating the special character of the E59 farmstead (see section 7.1.5) This observation would support the rational contention that sheep/goat sheds – like the other livestock housing – were larger than average on the wealthiest farmsteads. However, the other statistics and especially the IQR imply that the majority of sheep/goat sheds were far more modest.

For the sample of 199 sheep/goat sheds, mean wall thickness is 0.87 m, clearly showing that the insulation of these buildings was much less substantial than in the winter housing for humans or cattle. This is also implied by the general narrowness of the sheep/goat sheds (Tab.6.4). Of the 177 sheep/goat sheds where building material is described (96%), 3 % were built in pure turf, 42% in turf/stone, 31% in turf/stone, and 24% preserved only as a stone foundation for turf walls. The distance of the sheep/goat sheds to their associated dwelling (Tab. 6.4) clearly show that they were much more dispersed than the former livestock buildings related to the stalling of cattle.

Fig.6.8 Ruin group E80a's ruin no. 11, a typical example of a single-roomed type of ruin here classified as a sheep/goat shed. Although much collapsed, the outline of the walls and internal room are clearly discernible. Building material is here described as stone/turf: while there are many collapse stone, there are clearly not enough for the building to have been built entirely in dry stone masonry. Rather, the turf building component has simply withered away. Finally, noticeable is also how the ruin is dug somewhat into the slope, so that the floor of the inside building appears slightly sunk into the ground (*photo: C.K. Madsen 2013*).

Fig.6.9 Ruin group E4's ruin nos. 14 (front) and 12 (back), interpreted as a sheep/goat shed and a bipartite livestock building, respectively, with the Tasiusaq in the background. They are among the best preserved examples recorded in the survey evidence with substantial amounts of both stone and turf preserved on the surface. Running down slope just right of the sheep/goat shed is a well-preserved irrigation trench (*photo: C.K. Madsen 2011*).

Sheep/goat shed discussion:

The large number of sheep/goat sheds implies the latters' importance of the Norse livestock economy, which is also corroborated by the zooarchaeological evidence (see section 2.3.2). However, it must be recalled that the ruins classified as sheep/goat sheds undoubtedly include a number of other outbuildings functions, since the sheds show considerable variation over a very basic layout. In any case, their small size, thin walls, and single and narrow room with no defined or obvious room for storage of fodder imply that they were only intended for fairly temporary stalling of sheep/goats, i.e. functioning just as much as shelters as stables proper. This is also implied by the larger distances to their associated dwellings, i.e. the sheep/goat sheds were located were convenient and often on the edge of the cultivated infield. Although farmstead status also to some extent seems expressed also in the size of the sheep/goat sheds, they generally appear the most common type of farm building and especially suited for the surface survey identification of smaller farmsteads and shielings, and principally those that emphasized sheep/goat herding.

Bipartite livestock building (Tab.6.5):

***Definition*:**

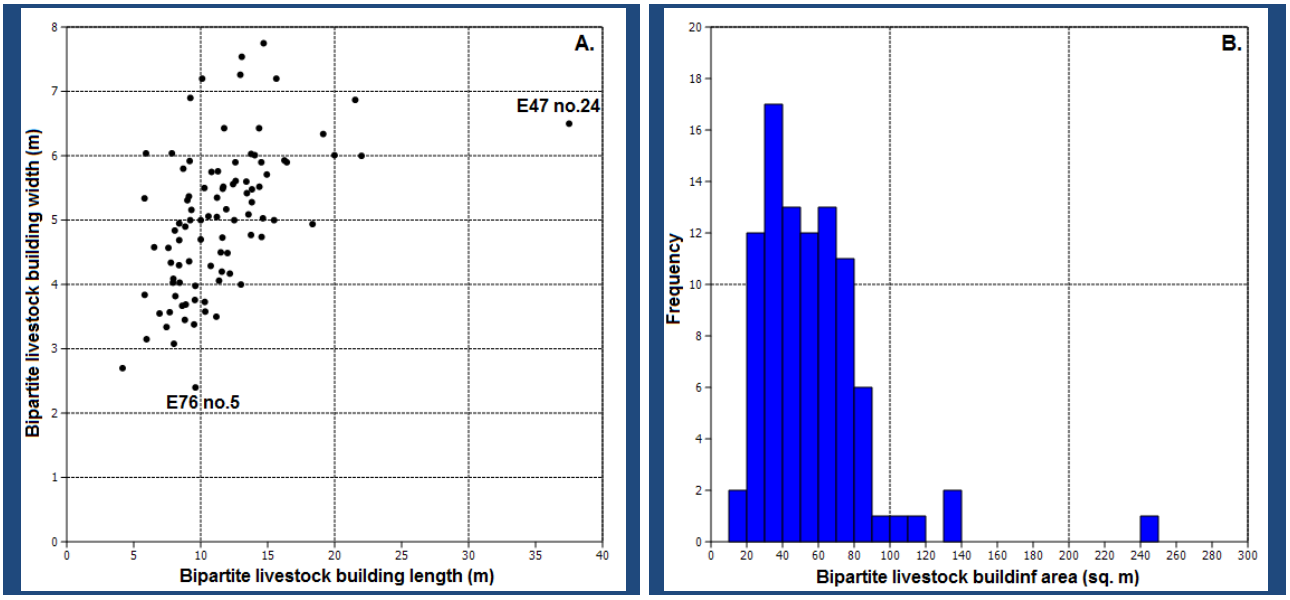
A bipartite livestock stable is a building intended for the winter stalling of a select part of the, mostly smaller, animal husbandry, as well as storage of the needed winter fodder.

Surface interpretation and issues:

The term "bipartite livestock building" has not, to my knowledge, been used before in the description of Norse architecture. The term signifies a livestock building divided on two parts, one being a stable, the other a barn or storage area. This could seem to make the bipartite livestock buildings equivalent to the simple byre/barns (see above), and certainly some examples could have housed cattle as well as other livestock (e.g., Fig.6.8). Still, several surface survey observations suggest that bipartite livestock buildings constitute a different type of outbuilding: they are generally smaller and seem less substantially built than the simple byre/barns and stable-complexes, and they very rarely appear as large grass-covered mounds. They are generally narrower than the

Tab.6.5 – Bipartite Livestock Building Descriptive Statistics

N = 199	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	37.5	4.2	11.5	11.0	8.1. – 11.9	4.4
Width in m	7.8	2.4	5.0	5.0	4.3 – 5.5	1.1
Area in m^2	243.8	11.2	56.3	50.7	33.0 – 62.5	31.3
L/W-index	5.8	1.0	2.3	2.2	1.74 – 2.47	0.68
Dis_MD in m	567.5	1.5	109.2	82.0	36.4 – 145.3	103.6



Tab.6.5 Above: summary descriptive statistics for the sample of bipartite livestock buildings (all measurements area external). Below: A) XY-plot of bipartite livestock building lengths and widths in meters with indication of outliers discussed in the text. B) Histogram of showing the frequency of different sized bipartite livestock building in square meters.

simple byre/barns, which is partly a result of their thinner walls. Their less substantial build is also implied by the condition that their basic two-room partition can be distinguished on the surface, i.e. there is less collapse material to obscure room- and wall lines. Basically, the bipartite livestock buildings seem to be extended sheep/ goat sheds.

Archaeological definition/surface identification:

Bipartite livestock buildings are always visible on the surface as fairly narrow building partitioned into two sections, which can be of any relative size. The walls are always less than 1.5 m thick and can be built in turf, turf/ stone, or be preserved only as a foundation for pure turf wall. They can be located at any distance from their associated dwelling, but generally lie closer to the dwelling than the sheep/goat sheds, but farther removed than the other cattle housing facilities (cf. Tab.6.2-6.3).

Bipartite livestock building descriptive statistics:

With 94 identified examples, the bipartite livestock buildings are well-represented in the sample. Their summary descriptive statistics dislayed in Tab.6.5 show how they constute a more varied group of outbuildins than the sheep/goat sheds (cf. Tab.6.4). Still, the bipartite livestock buildings cluster nicely with only a few extreme outliers, of which the most distinct is ruin no.24 at Igaliku (E47), again attesting to the singularity of the bishop's farm (Tab.6.5A). Another, but less distinct outlier in the smaller end of the range, is ruin group E76 no.6, which can be explained by uncertain ruin survey description. Else, histogram Tab. 6.5B displays a sample of bipartite livestock buildings that is only slightly positively skewed. 8 of the 20 longest bipartite livestock buildings are associated with the atypical ruin group E59 (nos.2 & 25), or with church farmsteads (E29a no.7, E47 nos.24&45, E48 no.4, E66 nos.5&19), again suggesting

some correlation between site status and the dimensions of outbuildings.

Comparing the simple byre/barns (Tab.6.2) and the bipartite livestock buildings (Tab.6.5), it is clear that there is a considerable overlap in ruin dimensions. However, if reviewing averages of the two samples, the latter clearly stands out as generally shorter (11.5m to 22.9m), narrower (5.0m to 7.5m), and thus smaller in area (56.3m^2 to 159.5m^2). Other differences between the simple byre/barns and the bipartite livestock buildings include the latter's thinner walls (never > 1.5 m and 1.04 in average, compared to walls never < 1.5m and 1.7 m in average at the simple byre/barns); more varied building materials (of the 89 described examples, 6% were built in turf, 61% in turf/stone, 24% in stone/turf, and 9% preserved only as a stone foundation); and the bipartite livestock buildings' greater average distances to their associated dwellings (cf. Tab.6.2 and 6.5).

Bipartite livestock building discussion:

Unquestionably, several of the bipartite livestock buildings also housed cattle, perhaps mostly in the form of the apparently particular version of Greenland Norse byres, where the cattle were only stalled along one of the long-walls (see section 5.3.1). At least, this would be implied by the bipartite livestock building generally being narrower than the regular simple/byre barns. However, with their thinner walls built in varying materials and thus less insulating, the bipartite livestock buildings probably more frequently housed other livestock, perhaps in combination with a few heads of cattle. Although several of the largest bipartite livestock buildings are associated with large farmsteads (e.g., Fig.6.8), the latter always also had larger and primary and secondary simple byre/barns or stable-complexes. Thus, there is no strong correlation between bipartite livestock buildings and farmstead status; rather, they seem a regularly featured outbuilding also on the more modest farmsteads and shielings.

Livestock stable (Tab.6.6):

***Definition*:**

A livestock stable partitioned into three rooms or more and intended for the winter stalling of a select part of the, mostly smaller, animal husbandry, as well as storage of the needed winter fodder.

Surface interpretation and issues:

Like the bipartite livestock outbuilding, the category of livestock stables has not before been singled out and defined formally by former investigators. Apart from its additional sections, the buildings interpreted as livestock stables here are in all respects similar to the bipartite livestock buildings. In consequence, all conditions and issues regarding their function, surface appearance, and construction are the same (see above).

Archaeological definition/surface identification:

Livestock stables are always visible on the surface as fairly narrow buildings partitioned into three or more sections, which can be of any relative size. The walls are always less than 1.5 m thick (excluding outer turf cladding) and can be built in turf, turf/ stone, or be preserved only as a foundation for pure turf walls. They can be located at any distance from their associated dwelling.

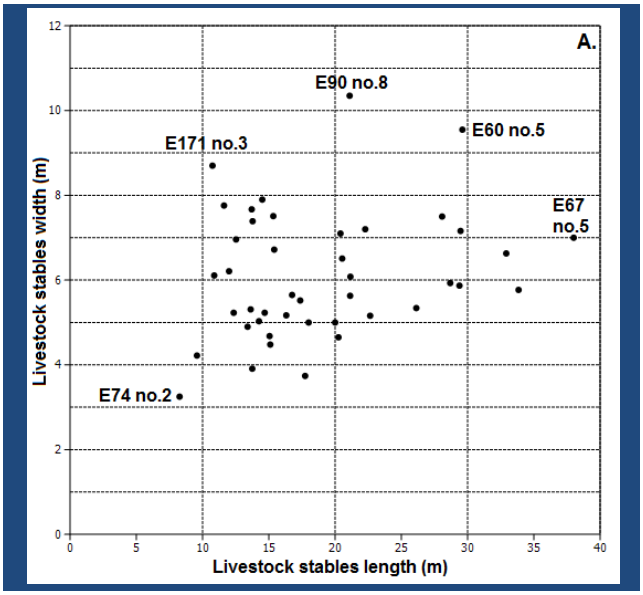
Livestock stable descriptive statistics:

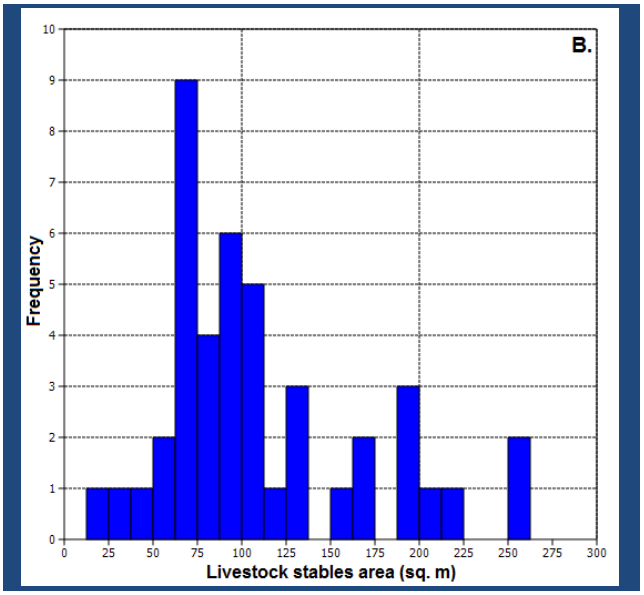
With 43 identified examples, livestock stables are only moderately represented in the sample. 70% (30) are partionioned into three sections and 23% (10) into four sections (for the remaining 7% (3) partions have been described, but not in number or size). Because of their changing number of sections, it is unsurprising that the livestock stables display a good deal of variation in dimensions and size (Tab.6.6). Although they overlap dimensionally with some of the simple byre/barns, the stable complexes are, however, on average shorter and narrower than the former (cf. Tab.6.2 and 6.6). The sample includes a few outliers (Tab.6.6A) of which E67 no.5 and E90 no.8 are explainable by sketch survey description, whereas the others E60 no.5, E74 no.3, and E171 no.3 are geneuine atypical examples.

The livestock stables separate from the simple byre/ barns on two accounts: first, the are on average located 144.4 m from their associated dwelling, i.e. considerably more than both the simple byre barns and the stable-complexes (see above). Even when taking out two outliers (E47 no.27 and E78 no.8) that are located at extraodinary distance from their associated dwellings, the livestock stables are on average located 126.2m from their associated dwelling. Second, the average wall-thickness of the livestock stables is 1.2 m and a few examples with walls wider than 1.5 m can be explained

Tab.6.6 – Livestock Stable Descriptive Statistics

N = 43	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	38.0	8.3	18.9	16.6	8.9 – 14.4	7.2
Width in m	10.4	3.3	6.1	5.9	4.5 – 5.9	1.5
Area in m^2	260.6	24.7	110.7	91.4	38.1 – 76.0	57.7
L/W-index	5.86	1.23	3.18	3.1	1.8 – 2.8	1.16
Dis_MD in m	657.2	2.3	120.8	88.8	36.5 -156.0	122.2





Tab.6.6 Above: summary descriptive statistics for the sample of *livestock stables* (all measurements area external). Below: A) XY-plot of livestock stable lengths and widths in meters with indication of outliers discussed in the text. B) Histogram of showing the frequency of different sized livestock stables in square meters.

by the ruins being covered in aeolian sediments or including outer turf cladding. Finally, of the 42 cases where wall-material is described, 57% (24) are built in turf/stone, 33% (14) in stone/turf, and only 7% in pure turf or preserved as a foundation for pure turf walls, i.e. also significantly more varied than in the simple byre/barns and stable-complexes.

Livestock stable discussion:

Similar to the bipartite livestock buildings, some of the livestock stables undoubtedly also functioned as housing for cattle, again probably most in the form where cattle was only stalled along one long-wall. However, with their thinner walls, varying, and less substantial and thus insulating building materials, the livestock stables were probably predominantly used for stalling of other livestock, i.e. housing and specialized feeding of select parts of the sheep/goat animal husbandry. Of the 10 largest livestock stables in the sample, six are associated with church farmsteads (the rest are the outliers indicated in Tab7.6A), which suggests that they to some extent reflect the status of farmsteads and can be used for survey evidence ruin group classification. On the other hand, livestock stables were also found on normal-sized farmstead.

Fig.6.10 Ruin group E66's ruin no.10, Kujalleq Fjord, an example of a ruin identified as a double sheep/ goat shed. Similar to the other sheep/goat sheds identified in the survey evidence, the ruin is fairly distinct even though built predominantly in turf (photo: C.K. Madsen 2008).

Double sheep/goat shed (Tab.6.7):

***Definition*:**

A double sheep/goat shed is a livestock building comprised of two rectangular and narrow rooms joined parallelly and which is intended for the stalling of sheep and goats.

Surface interpretation and issues:

The double sheep/goat sheds were described by Roussell, who excavated one at *Hvalseyarfjördur*/E83 in 1935 (1941:226). They are among the more distinctive ruins identifiable during surface survey with two parallel rectangular rooms (Fig.6.10). All the listed examples are fairly distinct, which is surprising since they were built predominantly in turf. In most other concerns, they seem to have much in common with the sheep/goat sheds, effectively being nothing more than two of the latter built together. The fact that they appear so well-preserved and resemble the surface remains of the sheep/ goat sheds would suggest that a limited amount of turf went into building the walls (which would otherwise have been more obscured by collapse material).

Archaeological definition/surface identification:

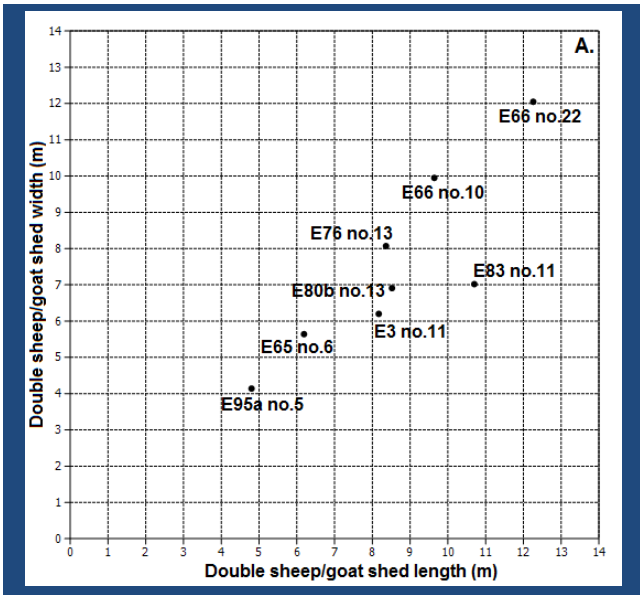
Double sheep/goat sheds are visible on the surface as two rectangular, narrow, and parallel rooms with entrance to both rooms via one or two entrances in the gable. They are always built in turf/stone (or preserved as a stone foundation for a turf wall) with wall less than 1.5m thick.

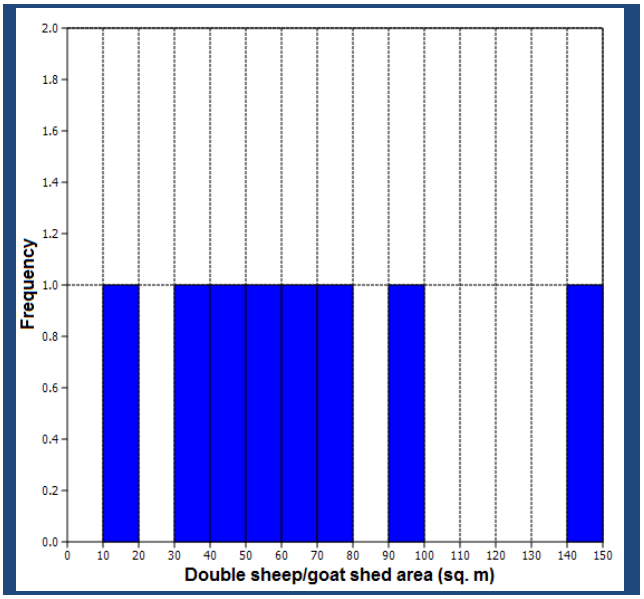
Double sheep/goat shed descriptive statistics:

The double sheep/goat sheds are only exemplified by eight identified ruins, which limits the significance of any statistical observations from their observed parameters. Tab.6.7A-B shows that the double sheep/ goat differ somewhat in sice. Otherwise, the only relavant information visible from the summary statistics in Tab.6.7A is the strong affinitiy of double sheep/goat sheds to the church and largest farmsteads. Wall thickeness of the double sheep/goat sheds vary between 0.65-1.45m with a mean wall thickness of 1.05m, implying that their insulation purpose was limited. They could apparantly be located at any distance from their associated dwelling.

Tab.6.7 – Double Sheep/Goat shed Descriptive Statistics

N = 8	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	12.3	4.8	8.6	8.4	6.7 – 10.4	2.4
Width in m	12.1	4.1	7.5	7.0	5.9 – 9.5	2.5
Area in m^2	145.1	19.8	65.8	58.3	34-7 – 88.0	39.4
L/W-index	1.52	0.97	1.17	1.13	1.03 – 1.30	0.18
Dis_MD in m	149.0	17.7	91.9	106.5	31.8 – 136.9	52.5





Tab.6.7 Above: summary descriptive statistics for the sample of double sheep/goat sheds (all measurements area external). Below: A) XY-plot of double sheep/goat shed lengths and widths in meters with indication of specific ruin numbers. B) Histogram of showing the frequency of different sized double sheep/goat sheds in square meters.

Double sheep/goat shed discussion:

The similarity of the double sheep/goat sheds with a type of outbuilding used for the same purpose in Iceland up until recent years (Bruun 1897:109p, 1928:392p) is striking. The narrowness of the parallel rooms and the fairly thin walls – like the sheep/ goat sheds – imply that the double sheep/goat sheds served as housing for this livestock, although we cannot be certain. However, a more interesting aspect relating to of the double sheep/goat sheds is that they are strongly associated with large or church farmsteads, E95a no.5 being the only, and smallest (Tab.6.7A), exception. Since it is hard to imagine that the building of a certain type of sheep/goat housing was restricted to dominant farms, the double sheep/goat sheds' rareness and association with larger farmsteads more likely reflects chronology, i.e. that they are a later type of building.

Sheep/goat shelter/pens (Tab.6.8):

***Definition*:**

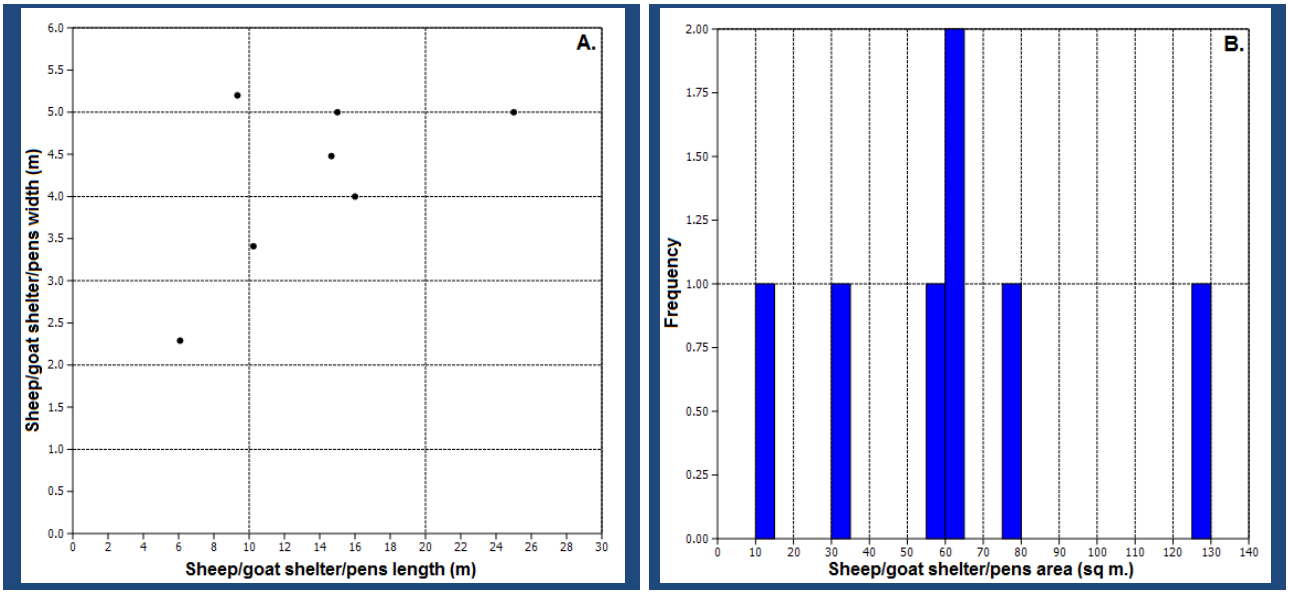
A sheep/goat shelter/pens is a livestock building comprised of several small rooms or compartments built again a vertical cliff and intended for temporary stalling of sheep/goats; the building may, or may not, have been roofed.

Surface interpretation and issues:

The sheep/goat shelter/pens have not before been singled out as particular type of functional outbuilding, perhaps because they do not appear much different from other shelters or pens, but from surface appearance seems to be something in between the two (Fig.6.11). It is difficult to establish if the sheep/goat shelter/pens were originally roofed or not. In any case, they were fairly simple and insubstantial outbuildings.

Tab.6.8 – Sheep/Goat Shelter/Pens Descriptive Statistics

N = 7	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	25.0	6.1	13.8	14.7	9.3 – 16.0	6.1
Width in m	5.2	2.3	2.5	4.5	3.4 – 5.0	1.1
Area in m^2	125.0	13.9	61.1	62.9	31.5 – 75.0	37.2
L/W-index	5.00	1.79	3.25	3.00	2.66 – 4.00	1.02
Dis_MD in m	370.3	41.7	250.8	326.6	143.4 - 339.1	124.0



Tab.6.8 Above: summary descriptive statistics for the sample of sheep/goat shelter/pens (all measurements area external). Below: A) XY-plot of sheep/goat shelter/pens lengths and widths in meters. B) Histogram of showing the frequency of different sized sheep/goat shelter/pens in square meters.

Archaeological definition/surface identification:

The sheep/goat shelter/pens are visible on the surface as two or more smallish rooms placed along a vertical cliff face or slope, which constitutes one of the long walls. Building materials and size vary.

Sheep/goat shelter/pens descriptive statistics:

Since recorded sheep/goat shelter/pens in the sample of ruins number only 7, few statistic observations can be applied with any level of significance. As shown by Tab.6.8, the small group of sheep/goat shelter/pens seem to display a fair deal of variation in their dimensions. Five examples were built in stone/turf, two preserved as a stone foundation for a turf wall; the number of rooms vary from two to four. The only consistent oberservation relating to the sheep/goat shelter/pens is that they lay at considerable distance from the associated dwellings, i.e. towards the edge of the infield similar to many of the enclosure types (see below).

Sheep/goat shelter/pens discussion:

In view of their low number and variation in size, built, and partitioning, it might be inapt to even separate sheep/goat shelter/pens as a certain type of outbuilding. They could simply be a variation of the enclosures partially delimited by a cliff face with which they share several traits (see below). The sheep/goat shelter/pens are mainly separated here because they appear to have been roofed, or at least some of their sections may have been. Also, unlike the similar enclosures (see below), the sheep/goat shelter/pens seem to be randomly oriented, which suggests that heat absorption was not a major concern in the function of these outbuildings, which of course is also explains why they could be built up against heat-draining cliff faces. This, and the fairly large distances to their associated farmsteads, strongly implies that the sheep/goat shelter/pens related to fairly temporary stalling and herding at the edge of the infield.

Fig.6.11 Ruin group E209's ruin no. 3 north of the Kujalleq fjord arm in the northeast Vatnahverfi region. It is a rare example of a ruin classified as a sheep/goat pens/shelter, i.e. a livestock building for sheep and goats portioned into several smaller compartments built up against a vertical cliff face. In this case, at least some of the rooms could have been roofed, while the compartments in each end were likely unroofed enclosures (*photo: C.K. Madsen 2005*).

Storehouses (Tab.6.9):

***Definition*:**

A storehouse is a ventilated building intended for the drying and/or storage foodstuffs or organic wares.

Surface interpretation and issues:

Because many storehouses were constructed in dry stone masonry and therefore among the best-preserved ruins (e.g., Fig.6.4), they were – as discussed in section 5.3) – some of first ruins first to be described and functionally identified by early investigators (e.g., Holm 1883:73p, Bruun 1895a:430, Roussell 1941:230p). After Icelandic example the storehouses have long and often been referred to as '*skemmur*' (sing. '*skemma*'). There is little reason to debate the storehouses' similar basic function of drying and storing foods and other perishable products since the dry stone masonry construction served to allow a free flow of air through the building, i.e. the primary building function was ventilation.

For the same reason, the storehouses are also always located so as to ensure wind exposure, which seems to have been more important than placing them close to the farmsteads' main cluster of buildings. Besides placing the storehouses up slope or on top of rocky outcrops or knolls, maximized ventilation was achieved by, for instance, locating the storehouses at mouths of valleys or in open terrain so that the wind could play freely through the building from multiple directions; on coast near farms, the storehouses seems to have been placed so as to exploit the 'fjord-wind', a strong and cool breeze from the outer fjord that blows incessantly throughout the summer as long as high-pressure conditions prevail. The drying-function of the storehouses is also clear from their placing: they are always being built on drained foundation, preferably exposed bedrock, or alternatively on stony, gravelly, and well-drained soils. The latter two qualitative, but also very obvious, observations are key to the identification of all types of storehouses.

Fig.6.12 Ruin group E72's ruin no.3 in central highland Vatnahverfi, an example of a storehouse that must have been built predominantly in wood on a stone foundation (*photo: C.K. Madsen 2006*).

As outline in section 5.3.2, there does indeed seem to be different types of storehouses: authors has referred to some especially large dry stone masonry buildings as *warehouses* (Nørlund and Roussell 1929:130, Arneborg 2006:13, Arneborg *et al.* 2012b:6) meaning to signify buildings used for the storage of other goods than foods, i.e. the organic commodities for export. Considering the irregular sailings to Greenland discussed in section 2.1.3, this would be a reasonable interpretation. There is no reason to doubt prior investigators that there were different types of storehouses, and that some were associated with the largest farmsteads and used for storing of export commodities. But since no one has tried to define the difference between store- and warehouses, they are somewhat ambiguous categories. Here I refer to them both simply as storehouses.

However, besides size and function storehouses also seem to have differed in terms of building materials: based on architectural details and rough estimation of collapse material, Roussell convincingly argued (1941:231p) that storehouse no.7 of church farmstead V7 /*Ánavík* could have had an uppermost storey built partly in wood. The idea that a larger wood component could have been part of Norse buildings has otherwise only been suggested for the churches (see section 5.2). To suggest that other less prestigious buildings could have included a substantial wood component is somewhat at odds with general impressions of wood accessibility in Greenland. However, the extent of wood shortage may have been overemphasized and partly forged within a 'paradigm of arctic marginality'.

Whereas the latter claim may be conjectural, Roussell's idea of rough quantification of collapse material quantity lends to a more tangible approach for the surface identification of mostly wooden storehouses: if relying on a drained and wind-exposed location in the terrain as the key parameter for storehouse identification, even brief surface inspection of ruins with such a placing in many cases reveals that there is not enough collapse material for the building to have been constructed in pure dry stone masonry. In some cases, only a stone foundation is visible (e.g., Fig.6.12), in other cases the pile of collapse stone is too small to have comprised an entire building (e.g., Fig.6.13). In such cases, I suggest that the main corpus of the storehouse was built in wood, resting on and supported by courses of stone (and turf?) wall (e.g., Fig.6.13-6.14).

Fig.6.13 Ruin group E4's ruin no.4 (cf. Fig.5.16), Tasiusaq. Being placed on exposed bedrock on a ridge overlooking the farmstead by the fjord, there can be little doubt that the ruin was a storehouse. However, as visible in the photo there is not enough surrounding collapse material for the building to have been built completely in dry stone masonry, i.e. it was likely a wooden storehouse on a stone foundation (photo: C.K. Madsen 2011).

Archaeological definition/surface identification:

Storehouses are visible on the surface as buildings either erected in dry stone masonry or in wood (perished) on a stone sill or foundation (preserved). They tend to be square or slightly rectangular in form and walls are fairly thin. Storehouses always occupy a wind-exposed and drained location in the terrain.

Storehouse descriptive statistics:

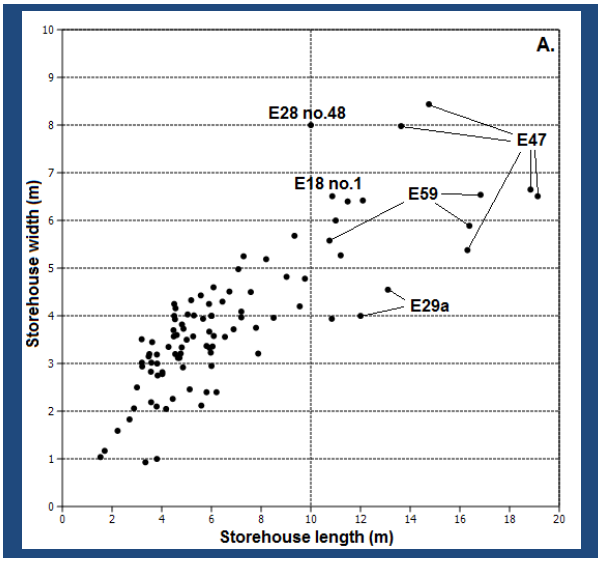
With 99 identified examples, the storehouses are among the most common outbuildings. As visible in Tab. 6.9, they display a good deal of variability in dimensions and sizes. However, there is clearly a cluster of more ordinary storehouses (Tab.6.9A-B) as summarized by interquartile ranges, medians and means of the listed ruin parameters (Tab.6.9). As shown in the histogram of storehouse areas (Tab.6.9B), their distribution displays a markedly positive skewness, although without the outliers, the cluster of regular storehouses would have an almost normal distribution. This suggests that this cluster reflects a distinct group of outbuildings, i.e. Roussell's milk- and food stores (see section 5.3.2).

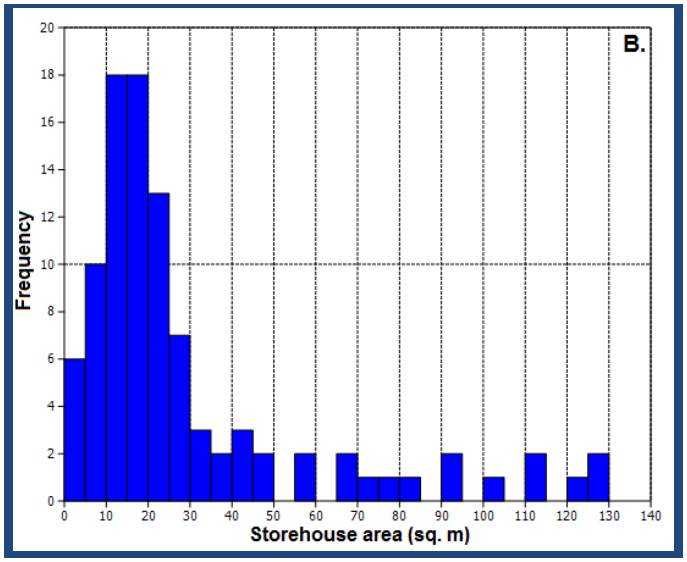
Among the extreme outliers in the sample of storehouses (Tab.6.9A) those belonging to ruin groups E18, E29a, E47, E59 are most obvious (the dimensions storehouse no.48 at ruin group 28 is based on rough description and are somewhat uncertain). In fact, of the 20 largest storehouses in the sample, no less than six are associated with the episcopal manor at Igaliku/*Garðar* (E47), two with the church farmstead of Qassiasuk/ *Brattahlið* (E29a) (five if ruin groups E28-29 were part of the *Brattahlið* church manor), one with church farmstead of Narsaq/ *Dýrnes* (E18), as well as three with singular ruin group E59. This very strong correlation between the largest storehouses – i.e. the proposed warehouses – and the largest farmsteads clearly shows that the surface survey evidence of storehouses is highly indicative of farmsteads size and function.

The storehouses are located between 3.0-825.9 m – on average 185 m – from their associated dwellings (Tab.6.9), clearly attesting to the above contention that wind-exposure, not proximity to the farmhouse, was the decisive factor in placing the storehouses; some of them were likely placed close to the fjord for easy access from arriving ships boats, i.e. the warehouses. Of the 99 recorded storehouses, 72 are described as built in dry

Tab.6.9 – Storehouses Descriptive Statistics

N = 99	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	19.1	1.5	6.7	5.6	4.2 – 7.8	3.8
Width in m	0.9	8.4	3.9	3.8	3.0 – 4.5	1.5
Area in m^2	125.8	1.6	29.9	19.0	11.4 – 32.7	29.7
L/W-index	3.80	0.91	1.72	1.50	1.30 – 1.91	0.58
Dis_MD in m	825.9	3.0	185.0	131.5	78.9 – 255.5	159.9





Tab.6.9 Above: summary descriptive statistics for the sample of storehouses (all measurements area external). Below: A) XY-plot of storehouse lengths and widths in meters with indication of specific ruins mentioned in the text. B) Histogram of showing the frequency of different sized storehouses in square meters.

stone masonry and 26 preserved as a stone foundation (1 example is not described). Interestingly, the latter supposedly wood-built storehouses almost all belong to the cluster of more moderate storehouses; their average size is 15.0 m^2, i.e. just about half of the mean for the entire sample and even less when compared exclusively to the sample of stone built storehouses (mean size = 35.6m^2). This is unsurprising, for although limited access to building timber may have been overemphasized, it was probably neither an overabundant resource. Wall thicknesses for the storehouses vary between 0.25-1.75 m, again implying notable variation. However, the average wall thickness for the entire sample is only 0.83 m, suggestive for the primary ventilation purpose of the storehouses' stone built walls.

Storehouses discussion:

Based on their general abundance, the storehouses were among the most common of functional outbuildings, which were certainly to be found on all farmsteads – on the larger manors represented by several examples – as well as on various types of shielings. The correlation between storage area and farmstead size and status is obvious and has been emphasized before (McGovern 1985:93p, 1992a:212p), an observation that conforms to the reasonable notion that larger farmsteads had more foodstuffs and wares to process and store, whereas storehouses on smaller farmsteads and shielings probably only served for the processing and storage of household food provisions. It is clear from the above that this condition is well-reflected in the surface survey evidence and a key parameter in ruin group functional and hierarchical classification. Also, the above statistics agrees well with my supposition that some (smaller) storehouses were in fact made in wood rather than stone.

Fig.6.14 In the text, it has been substantiated that a considerable number of the Norse storehouses could have resembled this wooden-built store- and drying house at Narsarsuaq (?), 1962 (although not necessarily this large or tall). If the wooden part decomposed, only a small heap of stone (and possible turf) would be left (*photo: C.L. Vebæk 1962*).

Boathouses (Tab.6.10):

***Definition*:**

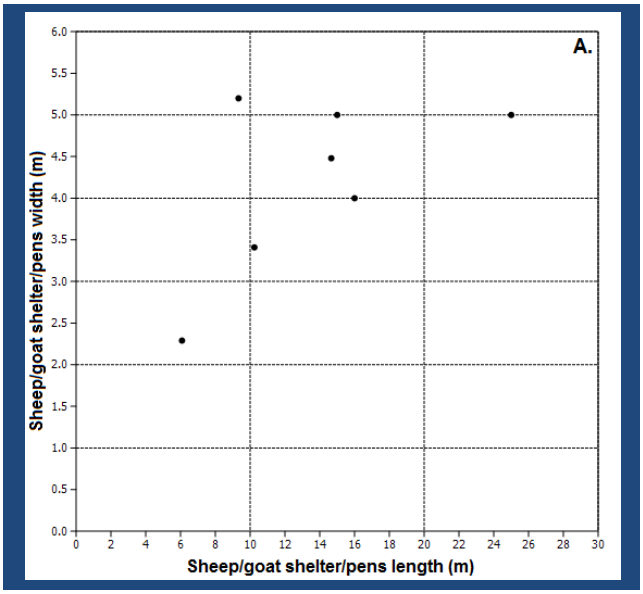
A boathouse is a building intended for the storage of a boat and/or associated tackle and fishing gear. Boathouses may or may not have been roofed.

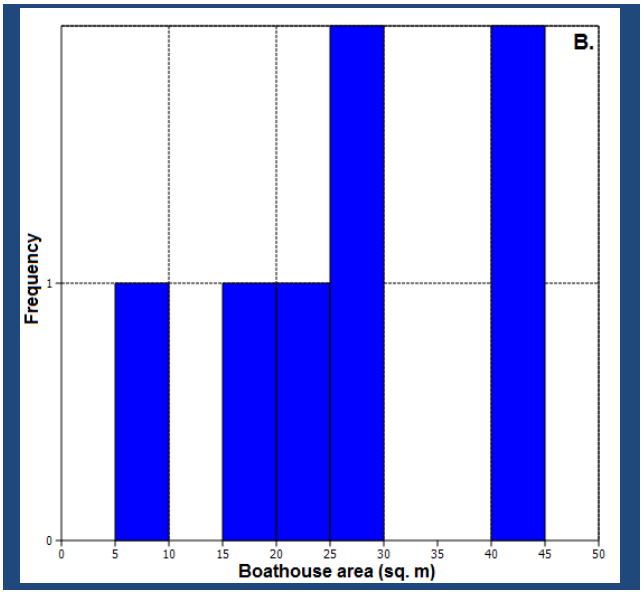
Surface interpretation and issues:

Although boathouses or (noosts) have been referred to by several authors (e.g., Bruun 1895a:430, Nørlund and Roussell 1929:130, Kapel 2004:8), they constitute a very ambiguous category of outbuildings. In fact, the only key defining parameter for their surface identification seems to be their proximity to water or a good landing place. While boathouses are sure to exist among the Greenland Norse ruins, no example has ever been identified through excavation and we thus have little idea of exactly what they should look like; and while the argument of water or land place proximity appears valid, the general proximity of so many farmsteads to the fjords, as well as unclarified effects of eustasy and isostasy, renders this argument just as ambiguous. Still, a few ruins in the sample described as boathouses have been included as a separate category, since they were interpreted as such. Surely, other boathouses could hide in the sample.

Tab.6.10 – Boathouses Descriptive Statistics

N = 7	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	10.3	3.6	7.5	7.0	5.3 – 10.0	2.5
Width in m	5.2	2.1	3.9	4.1	3.2 – 4.6	1.0
Area in m^2	45.0	7.2	27.2	26.2	18.2 – 42.6	13.3
L/W-index	2.5	1.0	1.8	1.8	1.64 – 2.22	0.47
Dis_MD in m	979.8	101.6	479.3	415.6	158.1 – 864.2	373.55





Tab.6.10 Above: summary descriptive statistics for the sample of boathouses (all measurements area external). Below: A) XY-plot of boathouses lengths and widths in meters with indication of specific ruin numbers. B) Histogram of showing the frequency of different sized boathouses in square meters.

Boathouses descriptive statistics:

The boathouses identified in this sample only amount to seven examples, which disqualify their statistical scrutiny on any level of significance. Although Tab.6.10 points to a fairly diverse group of ruins, the boathouses recorded in this sample are fairly all small and narrow. In five of the six cases where building material is decribed, the boathouses are preserved only as a stone foundation, the single remaining example being built in stone/turf; in the three cases where wall thickness is recorded it is 0.8m, implying limited building insulation, which is of course in accord with the functional interpretation (although this wall thickness overlaps with the very similar looking sheep/goat sheds). Especially noticeable of the boatsheds is the great distance to their associated dwellings if present (in four cases).

Boathouses discussion:

The small and varied sample of possible boathouses included here has few implications for our understanding of this type of outbuilding. If boathouses or noosts at all (at least one seems too short to accommodate a boat), they only seem to suggest that the boats were very short and fairly narrow. Excavated examples of this building are needed to identify the layout and built of the Greenland Norse boathouses.

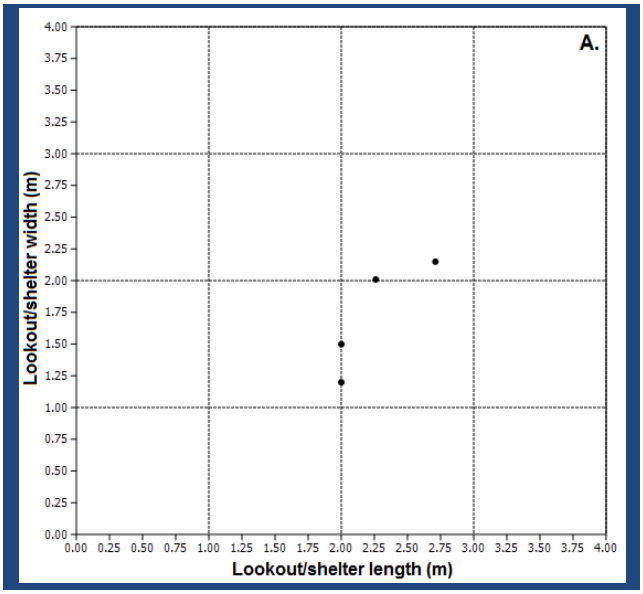
Lookouts/shelters (Tab.6.11):

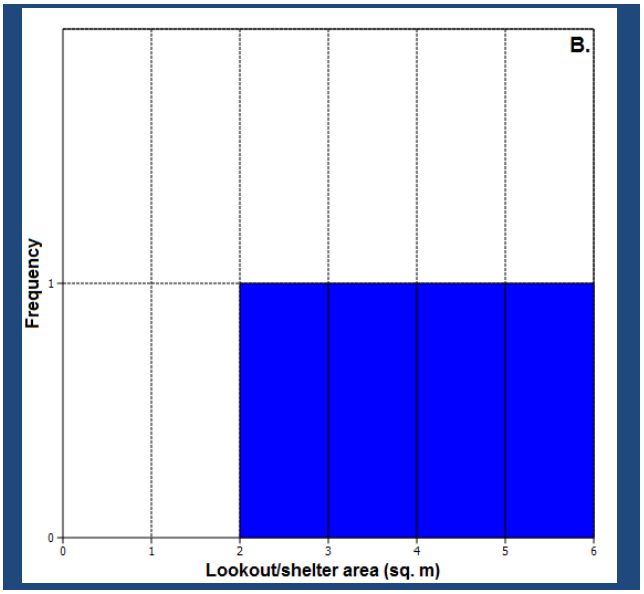
***Definition*:**

A lookout/shelter is a small rudimentary building intended for the temporary shelter of herders or travelers. Lookouts/shelters may or may not have been roofed.

Tab.6.11 – Lookout/Shelter Descriptive Statistics

N = 4	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	2.7	2.2	2.1	2.2	-	0.3
Width in m	2.2	1.2	1.8	1.7	-	0.4
Area in m^2	5.7	2.4	3.7	3.9	-	1.5
L/W-index	1.67	1.12	1.30	1.35	-	0.23
Dis_MD in m	428.8	367.8	400.5	404.8	-	30.7





Tab.6.11 Above: summary descriptive statistics for the sample of lookout/shelters (all measurements area external). Below: A) XY-plot of double sheep/goat shed lengths and widths in meters. B) Histogram of showing the frequency of different sized lookouts/shelters in square meters. Sample size is too small for meaningful calculation of interquartile ranges (IQR).

Surface interpretation and issues:

The surface interpretation of some ruins as lookouts/ shelters is admittedly uncertain. Although they are also characterized by being very small and insubstantial structures and perhaps not even roofed, the identification of lookouts/shelters rests mainly on the qualitative assertion that they are located in the terrain so as to provide a single or few persons a wide-ranging overview from sheltered location (Fig.6.15). Surely, lookouts/ shelters are underrepresented in the survey evidence, both because of the insubstantial construction and their location at considerable distance from other ruins.

Archaeological definition/surface identification:

Lookouts/shelters are visible on the surface as small features placed in the landscape so as to offer extensive overview of the surrounding terrain.

Lookout/shelter descriptive statistics:

The four recorded lookouts/shelters recorded are too few for statisical description to have significance on any level. However, as a group they are very similar in the very small dimensions (Tab.6.11). As expected of their function, the three lookouts/shelters with associated dwellings all lie quite far removed from it. They can apparently be built in any material.

Lookout/shelter discussion:

Clearly, the lookouts/shelters included in this sample are of limited importance. While it is easy to see them as shelters quickly thrown up to accommodate herder's tending the flocks at some distance from the farmsteads, this interpretation must remain conjectural. Undoubedly, quite a substantial number of such ruins are stilll to be found in the landscape between the farmsteads.

Fig.6.15 Ruin group E125's ruin no.13, Tuttutooq. The lookout/shelter is located at the top of a small pass some 430 west of the main farmstead ruins from where there is an unobstructed view both towards Narsaq/*Dýrnes* (E18) on the far side of the strait and back towards the farmstead in the other direction. Such structures are normally interpreted as Inuit shooting blinds, but some have a distinct Norse appearance (photo: M. Nielsen 2011).

Churches and Churchyards (Tab.6.12):

***Definition*:**

A church and surrounding churchyard.

Surface interpretation and issues:

The layout and appearance of the medieval Norse churches was reviewed in section 5.2 and will not be discussed further here. In the ruin table, churches and churchyards have been assigned different numbers because of their different building materials. However, because of their evident connection they are treated together here. The churches are mainly identifiable from their layout with a church building proper lying about centrally inside a churchyard enclosure wall, which can be of any shape. As other ruins also conform to this pattern – e.g. the grazing enclosures (see below) – most of the churches have been identified through full- or test excavation (cf. Tab.4.1). However, the example of the accidentally discovered so-called *Þjóðhildarkirkja* (E29a ruin no.59) shows that earliest churches may not be preserved so as to be visible on the surface, and neither could a churchyard enclosure wall be found during the excavation of the latter. Thus, other small churches could easily remain undiscovered.

Archaeological definition/surface identification:

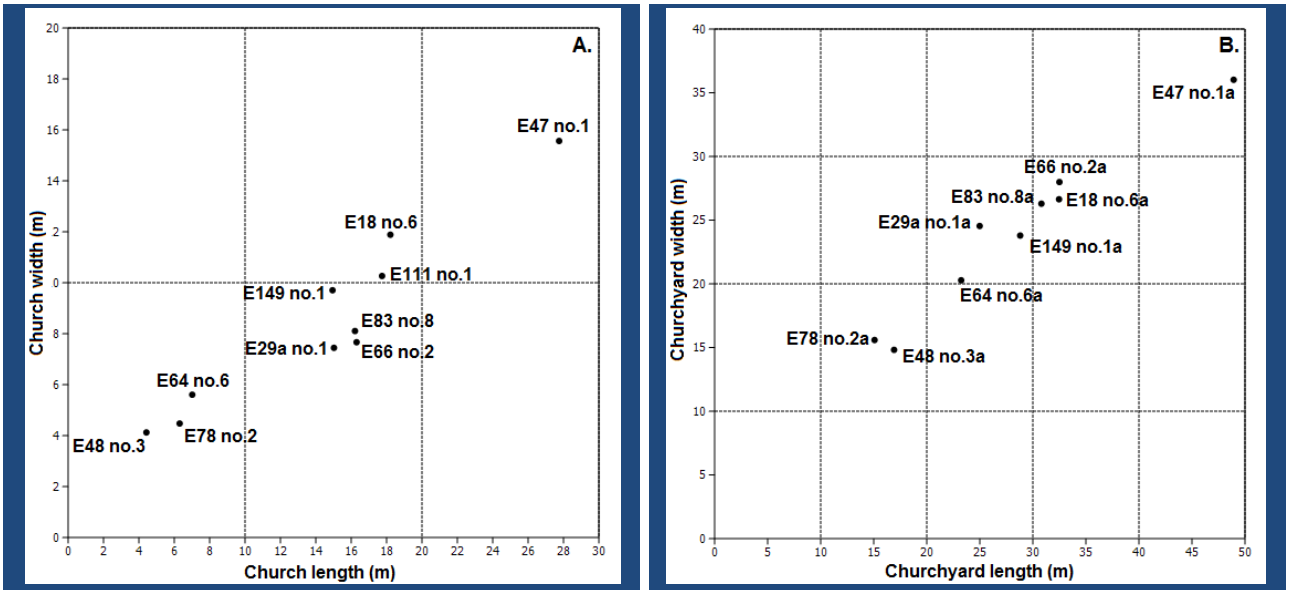
Churches and churchyards are visible on the surface as a central building surrounded by an enclosure wall, which must enclose a soil surface to allow interment of corpses (in contrast to some of the animal enclosures with a building surrounded by an enclosure wall).

Churches and churchyards descriptive statistics:

Tab.6.12 displays summary descriptive statistics for the churches and churchyards, but will not be discussed further here, because this have been treated extensively elsewhere (see section 5.2 and references).

Tab.6.12 – Church and Churchyard Descriptive Statistics

N = 10	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	27.8 (48.9)	4.4 (15.1)	14.4 (29.3)	15.6 (29.8)	6.8 (21.7) – 17.9 (34.2)	6.9 (10.1)
Width in m	15.6 (36.0)	4.1 (14.8)	8.5 (24.0)	7.9 (24.6)	4.1 (17.9) – 15.6 (27.3)	3.5 (6.5)
Area in m^2	852.0 (1713.9)	18.2 (190.1)	196.7(578.8)	126.5 (399.3)	31.1 (193.8) – 207.6 (834.4)	152.1 (502.3)
L/W-index	2.13 (1.36)	1.07 (0.97)	1.65 (1.15)	1.64 (1.16)	1.37 (1.08) – 2.00 (1.22)	0.35 (0.11)
Dis_MD in m	44.6 (37.8)	5.3 (0.0)	19.8 (12.5)	17.4 (5.5)	7.1 (0.5) – 31.2 (25.2)	13.3 (13.8)



Tab.6.12 Above: summary descriptive statistics for the sample of churches and churchyards (all measurements area external, churchyards shown in brackets). Below: A) XY-plot of church lengths and widths in meters. B) XY-plot of churchyard lengths and widths in meters. Both with indication of ruin numbers (note that ruin group E111's churchyard is partly eroded and therefore not included in Tab.6.12B.

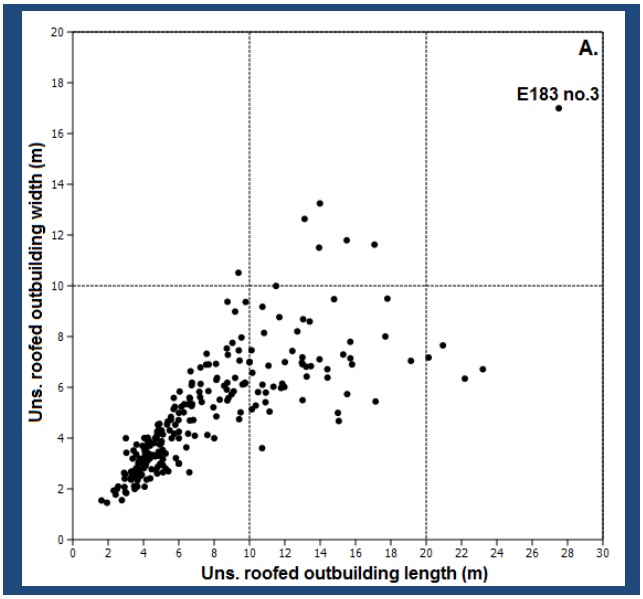
Churches and churchyards discussion:

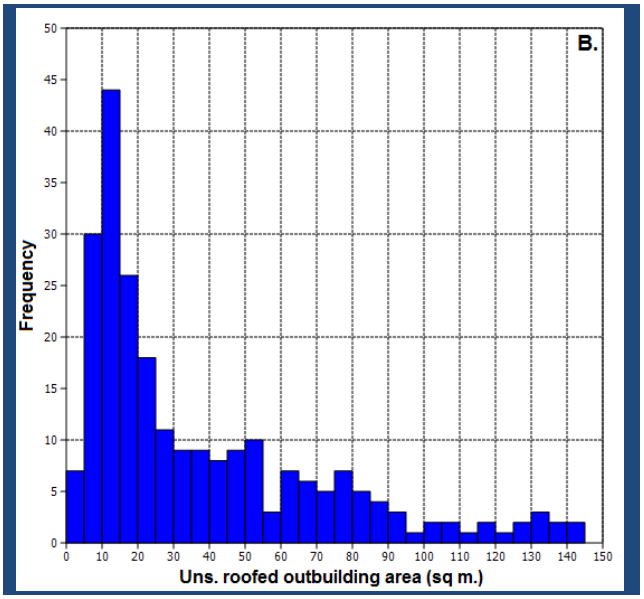
Briefly reviewing Tab.6.12, the churchyards display notable variation. Still, the different groups of churches discussed in secton 5.2 are clearly visible (Tab.6.12A-B): a group of small churches (E48, E64, and E78), a group of large churches (E18, 29a, E66, E83, E111, and E149), and the unique *Garðar* (E47). The association of churches with the largest manors is well-established and need not be tested here.

However, the new surveys and test excavations of churches in the Vatnahverfi (E64, E66, and E78) offer a chance to briefly revisit N. Lynnerup's population model (1998:106p): the new surveys show the churchyard areas of E64, E66, and E78 to be 303.9 m^2, 554.0 m^2, and 136.9 m^2, respectively; based on the new excavations, burial densities (not including disturbed burials) within these churchyards (excluding the area of the churches) is calculated to be 1.17 per/m^2, 1.25 per/m^2 (referring to Lynnerup 1998:Tab.27), and 2.0 per/m^2. The use of E64 dates to ca. 980-1200 (220 yrs.), E66 likely to the entire settlement period 980-1450 (470 yrs.), and E78 to ca. 980-1250 (270 yrs.) (cf. Tab.8.2). Following Lynnerup's calculation method (and using his average burial density estimate for E66), a total of 2876 individuals were buried in the Vatnahverfi churchyards (3739-4026 if assuming 30-40% subadult mortality), which is just a little more than the 2654 implied by his model (cf. Ibid.Tab.28). Applying Lynnerup's next model calculation, the average population in the Vatnahverfi (over 500 yrs.) would be just under 200 (194) people. However, burial densities at E64 and E78 have proven higher than the estimates used by Lynnerup (0.709 body/sq. m/100 yrs.) and the same will like prove true for E66 if re-excavated.

Tab.6.13 – Unspecified Roofed Outbuildings Descriptive Statistics

N = 256	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	23.2 (27.5)	1.6	7.4	6.0	4.2 – 9-6	4.2
Width in m	13.3 (17.0)	1.5	4.9	4.5	3.2 – 6.2	2.2
Area in m^2	151.6 (467.5)	2.3	38.5	22.8	12.9 – 54.7	35.1
L/W-index	0.00	3.49	1.48	1.36	1.18 – 1.68	0.48
Dis_MD in m	600.3	0.0	92.7	58.4	20.1 – 125.4	102.6





Tab.6.13 Above: summary descriptive statistics for the sample of unspecified roofed outbuildings (all measurements area external). Below: A) XY-plot of uns. roofed outbuilding lengths and widths in meters. B) Histogram of showing the frequency of different sized uns. roofed outbuildings in square meters. Note: numbers shown in bracket indicate the dimensions of the sample outlier ruin E183 no.3, which is not included in Tab.6.13.B.

Unspecified roofed outbuilding (Tab.6.13):

***Definition*:**

No other definition than a building that cannot be assigned to any other functional category, but was roofed and not a dwelling.

Surface interpretation and issues:

Because the category of uns. roofed outbuildings is a residue group of ruins which cannot be attributed a particular function with any certainty, very few shared or general traits can be outlined. Essentially, the only thing shared by all the ruins is that their surface appearance supports the assertion that they were originally roofed. There are several reasons that some ruins can only be assigned to this residue group: they may be very poorly preserved, they may lack adequate survey description, they may have been removed prior to proper recording, or they may just be of such uncharacteristic built or layout that they escape classification. In fact, almost all Norse buildings display considerable "uniqueness" and hardly any of them conform to the very straight angled house plans that early surveyors were in the habit of presenting. Rather, buildings opportunistically utilized different micro-topographical features and nearby and easily available building materials; buildings bent, bulged, and angled as walls and annexes were added, rebuilt, or removed; some were sunk below the surface, and others raised on outcrops or gravelly knolls. To this original constructional variation must be added various processes natural degradation following building abandonment. Many of the ruins described as uns. roofed outbuildings follow such labile constructional schemes or are so degraded that they omit functional identification.

Archaeological definition/surface identification:

Uns. roofed outbuildings are visible on the surface as the ruins of buildings that would originally have been roofed, but otherwise cannot be assigned any particular function.

Unspecified roofed outbuildings descriptive statistics:

With 256 examples, uns. roofed outbuildings are, unfortunately, the largest single category of roofed farmstead buildings. As expected from the vague definition they show considerable variation (Tab.6.13). However, as visible from Tab.6.13A.B. The single extreme outlier in the sample is E183 ruin no.3, which in terms of recorded size and L/W-index could be a stable-complex. However, as the site was not revisited during the Vatnahverfi-Project and the only existing survey description is very brief and uncertain, the ruin has been classified as an uns. roofed outbuilding. The other observerd paramters for the uns. roofed outbuildings also vary: of the 235 ruins where building material is decribed, 4% (10) were built in pure turf, 46% (109) in turf/stone, 28% (67) in stone/turf, 2% (9) in dry stone masonry, and 17% (40) preserved as a stone foundations for turf wall. The vast majority of turf-built houses in the sample (Buid_Mat 1-2, 5), and the very few built in stone, points to the condition that buildings with a large turf component are much more indistinct in their collapsed state. In terms of distance to the associated dwelling, the uns. roofed outbuildings range between 0.0-600.3 m, on average 92.7 m. Otherwise, the uns. roofed outbuildings display no notable patterns.

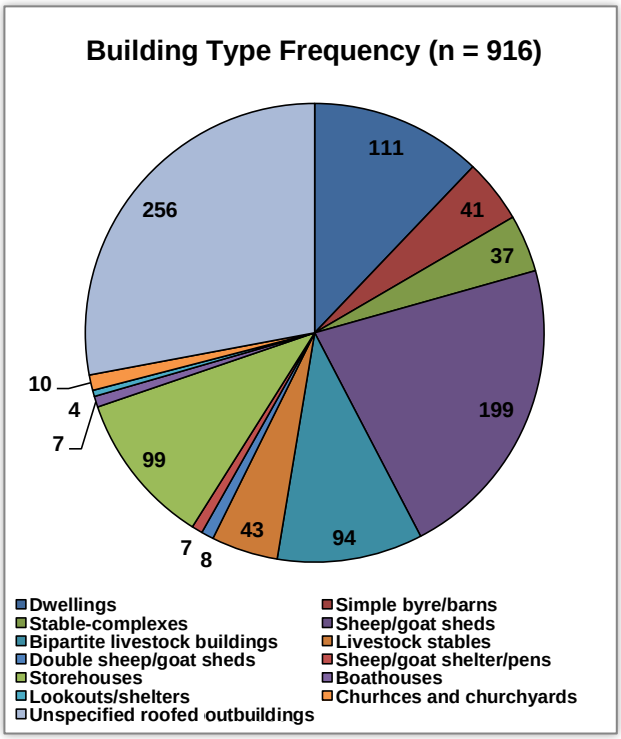


Fig.6.16 Displays the frequency of the different types of roofed Norse buildings presented in section 7.2.1.

Unspecified roofed outbuilding discussion:

Although here described as unspecified, it is among this large sample of ruins one finds the other functional outbuildings associated with the Norse farmsteads. For instance, a few smaller and mostly turf-built buildings have been identified as smithies through excavation or surface finds of iron slags (Nørlund and Roussell 1929:111p, Roussell 1936b:54p, Gulløv 2000a:24, Kapel and Clemmensen 2013:15), and the excavation of a small house in front of the dwelling of V52a provide it to be a bathhouse (Roussell 1936b:74p, 1936a). However, although such buildings were likely common on most farmsteads they can very rarely be identified from surface survey and must, at this time, be grouped in a residue class of buildings. Of the 20 largest uns. roofed outbuildings in the sample, 7 are associated with church farmsteads or the atypical E59, suggesting some, but not strong, correlation between uns. roofed outbuildings and overall farmstead size and status.

6.2.2 Roofed Buildings Summary Discussion

A total of 916 individual ruins can be identified as roofed buildings in the survey dataset. Fig.6.16 displays aggregate frequencies for the various building types presented and discussed in the above. As visible, the various types of roofed buildings are very differently represented. Still, their distributional pattern has a few implications: first, the fact that only 111 identified dwellings – whatever their size – can be identified among 157 ruin groups is direct evidence that around 30% of the sites are definite shielings, not farmsteads. Second, the outbuildings that are directly related to cattle farming – i.e. simple byre/barns and stable-complexes – are fairly few, whereas buildings related to other livestock – sheep/goat sheds, bipartite livestock buildings, and livestock stables – are quite numerous. This suggests the limited extent of cattle farming in Greenland that was, as outlined above, primarily a feature of larger farmsteads. Contrariwise, the abundance

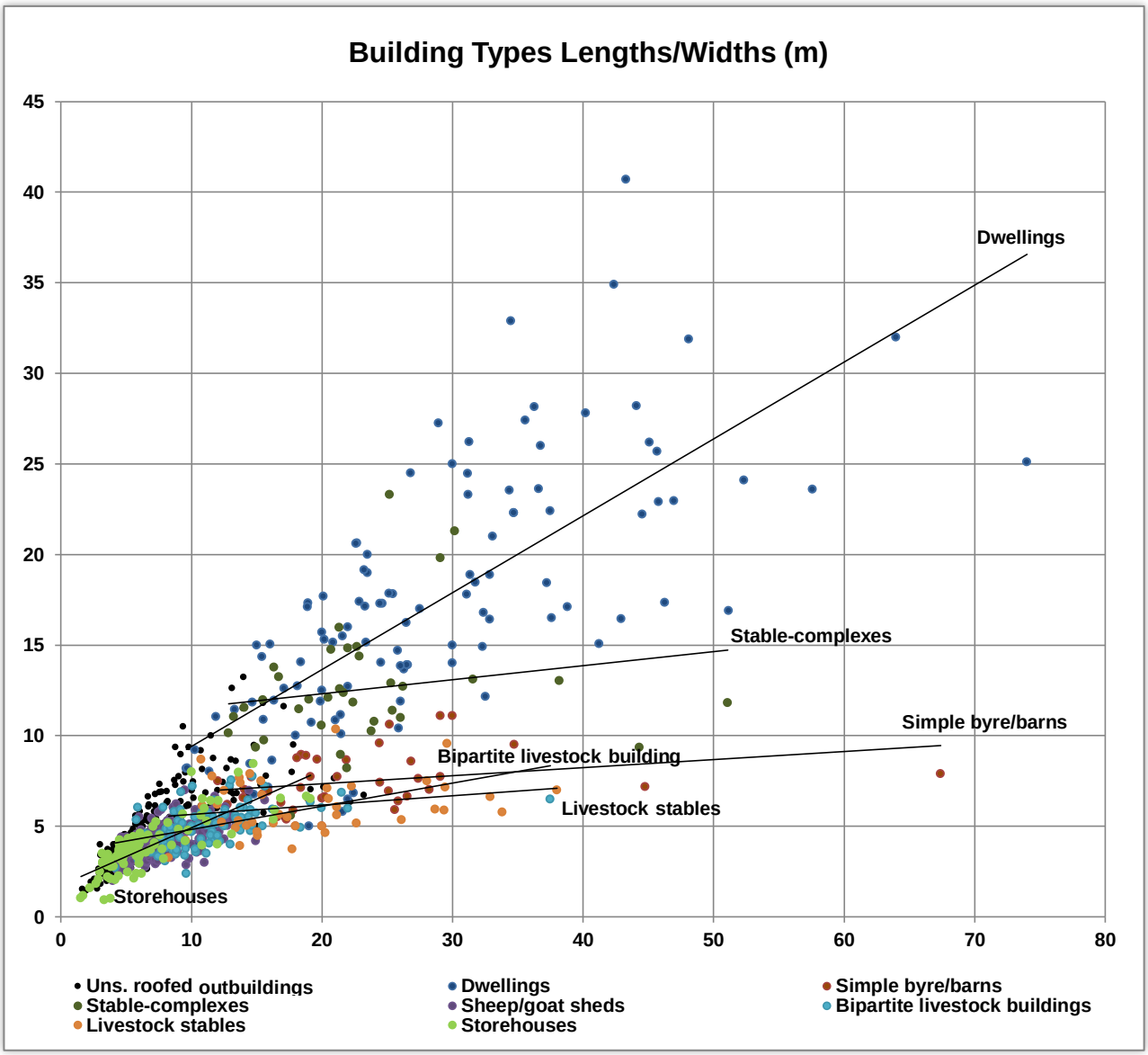


Fig.6.17 Scatterplot showing the length/width distribution of the 8 most common types of buildings identified in the ruin survey dataset (n = 857). Different colors indicate different building types; linear trendlines are shown for six of the building types. Although most of the building types display noticeable overlaps in length/width, the types do appear to stand out as "fuzzy" clusters with differences, which support their functional differentiation.

of other livestock buildings that were mostly related to sheep/goat keeping imply that they were more common buildings with no strong affiliation to any kind of farmstead. Third, the large number of storehouses unsurprisingly suggests that they too were of the most basic type of outbuildings found on all kinds of sites.

Fig.6.17 displays the lengths and widths of the eight most common types of dwellings and outbuildings, as well as linear trendlines for six of the types. The figure may on first glance appear inconclusive, but there are some overall patterns to the distribution: the dwellings display the greates variation, which is explainable by their function as main occupation building of very different sized farmhouses and shieling lodges, as well as by their complex building histories. The trendline also shows dwellings to be the most "round" ruins. The trendlines for the stable-complexes, simple byre/barns, and livestock stables summarize what was noted in the above i.e. that although they display some overlap, each type forms a "fuzzy", but visible cluster within the sample, mainly due to general size (width) differences. The trendlines also reveal these three livestock buildings that generally have fairly oblong (rectangular) layouts.

Fig.6.18 Ruin group E59's ruin no.13, Sissarluttoq on the Qaqortoq Peninsula, an example of a ruin classified as an enclosure with built wall. Note that even where the stone wall appears intact with no extra collapse stone (e.g. just in front of the person) it would not have been high enough to keep sheep/goat from escaping. Thus, the stone wall must have had a turf superstructure which has since disintegrated (*photo: C.K. Madsen 2008*).

The other building types included in Fig.6.17 seem to merge in one confused cluster, which partly owe to dimensional overlap, partly to obscuration by sheer number of ruins. However, even some of these small building types form "fuzzy" clusters: for instance, the storehouses clearly group somewhat differently in Fig. 6.17 than the bipartite livestock buildings (which cluster somewhat differently from the similar looking simple byre/barns). A linear trendline for the storehouses also show them to on average be "squarer" than the bipartite livestock buildings. However, although the building types separated here do appear to form overlapping and fuzzy, but real clusters, they are difficult to substantiate statistically, mainly because they are identified from qualitative, not quantitative parameters. Still, the building types appear distinct enough to support the differentiation.

Finally, using the church farmsteads as a benchmark for the farmstead and building layout of the largest manors, some buildings serve well as indicators of farmstead wealth and status, while others appear less suggestive. For instance, sheep/goat sheds, bipartite livestock buildings, and livestock stables do not appear strong indicators of farmstead wealth and status, but were common on all types of farmsteads; neither is dwelling size in itself a strong indicator of farmstead status, because it became practice at smaller farmsteads to combine dwelling and outbuildings into one big building, i.e. the 'centralized farms'. On the other hand, buildings such as simple byre/barns, stable-complexes, and large storehouses seem to be strong indicators of farmstead wealth and status. Yet, it is also clear from the above that none of these indicators can stand alone, but must be assessed against the combined layout of the farmstead and, not at least, the overall size of all its buildings. The latter seems to be the most potent parameter for surface identification of farmstead wealth and statues, whereas farmstead layouts with different types of outbuildings relate more to site-specific farming practices. Both these interpretative potentials are tested in chapter 7.

6.2.3 Unroofed Buildings

The term applied for the second group of farmstead buildings is self-explanatory: it comprises various kinds of enclosures and dykes that were not roofed. Since there was no collapsing roof material to obscure and disturb the walls after these enclosures and dykes were taken out of use, and because they were often built in stone – or on a stone foundation, cf. Fig.6.18 – many of them are among the most distinct and best preserved ruins. However, they have never been submitted to systematic or detailed archaeological investigation or discussion, but have only been described in the brief (e.g, Nørlund and Stenberger 1934:99p, Roussell 1941:230p).

The unroofed buildings all share several features that are outlined here to avoid unnecessary repetition in the below: like the other outbuildings, few unroofed buildings have been excavated; none after the introduction ^{14}C-dating (cf. Tab.4.1). At any rate, datable material would have to be found under or in the walls in order to tentatively date their construction. However, the lacking chronological framework for unroofed buildings can be argued to have less consequences for their interpretation: because of their lacking roofing, enclosures and dykes probably had a longer life-span than the roofed buildings. Essentially, repairing or enlarging the former would simply have entailed restacking or -arranging the stones and turfs. Accordingly, it is not unlikely that the enclosures visible on the surface today represent close to the actual maximum number used by the Norse *grænlendinga* in the Middle Ages. In relation to the walls, it must be noted that although a large proportion is described as built in dry stone masonry, many would have included a turf component, either as intermittent layers between the stones or as a turf super structure (cf. Fig.6.18). This is argued from the same grounds observation outlined for the storehouses, i.e. often there is not enough stone collapse for the walls to have stood high, at least not high enough to keep inside very agile sheep and goats.

In the below classification, I have generally favored the more neutral term “enclosure” over more explicit terms such as pen, fold, hay yard, horse paddock, garden etc. The reason for this is that in many cases there is no certain way proving what an enclosure originally enclosed. Also, some enclosures likely had multiple functions throughout the Norse seasonal round, e.g. an enclosure could serve as a gathering fold in the spring and a hay-yard in the fall; a large fold fertilized by cattle in the early spring could function as a fertilized garden or small hayfield during the summer etc. During the Vatnahverfi-Project we have test-trenched several enclosures for DNA-samples (Arneborg *et al.* 2009a:45p), but nowhere have we found indications that they were used as fenced gardens. While other functions cannot be excluded it is generally assumed in the below that most enclosures chiefly facilitated livestock herding. However, functional aspects particular to the various types of unroofed features is discussed below.

Enclosure with built wall (Tab.6.14):

***Definition*:**

A separate lying enclosure where the entire (or most) of the circumference is built wall; multiple functions are possible, but it had a primary function as livestock herding/management facility.

Surface interpretation and issues:

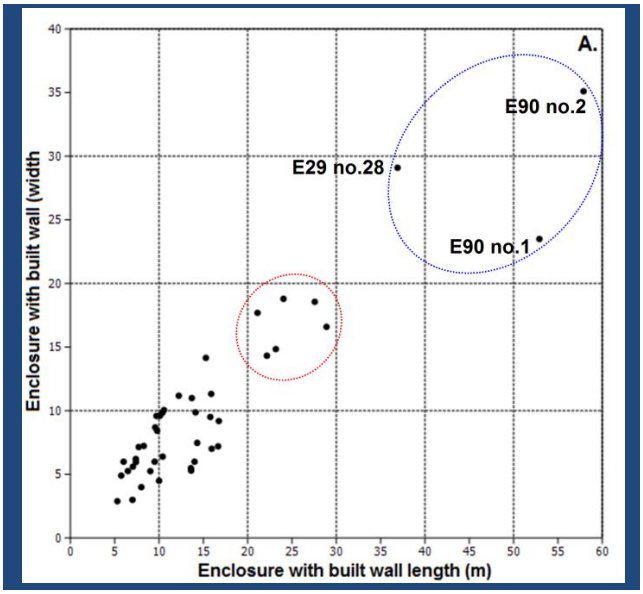
The enclosures with built wall are some of the most distinct Norse ruins and many are well-preserved (e.g., Fig.6.18). As implied by their label, the enclosures with built walls are characterized by having circumference walls that were completely constructed. However, many of the enclosures with built wall still incorporate natural features such large boulders or small rocky outcrops, apparently to minimize the extent of constructed wall. Some examples are built to be almost perfectly square or rectangular, but more often they are of more irregular shape and with somewhat rounded corners.

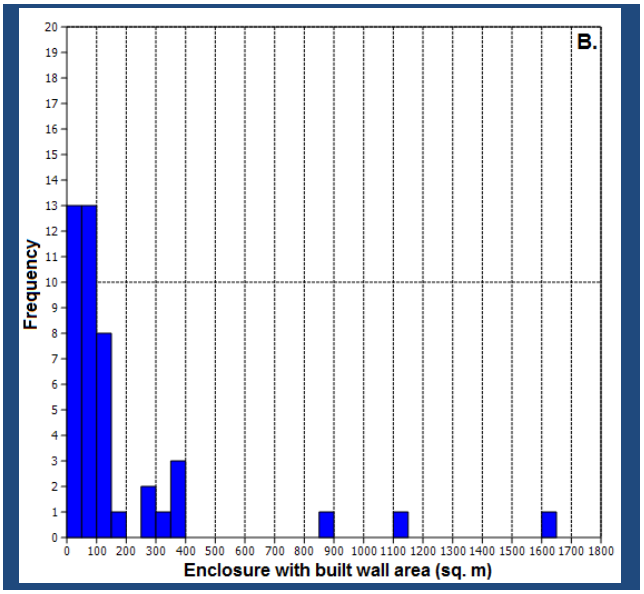
Archaeological definition/surface identification:

Enclosures with built wall are visible on the surface as features lying detached from other buildings, and where the space enclosed by a built wall was not roofed (estimated from building width and wall construction). The ruin outline can be any shape, but tend to be square or rectangular.

Tab.6.14 – Enclosure with Built Wall Descriptive Statistics

N = 45	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	28.9 (57.8)	(5.3)	12.8 (15.3)	10.6 (12.3)	8.1 - 15.8 (8.5 - 16.5)	5.9 (11.2)
Width in m	18.8 (35.1)	(2.9)	8.9 (10.3)	7.5 (8.7)	5.8 - 11.1 (6.0-11.5)	4.2 (6.7)
Area in m^2	394.4 (1635.5)	(14.3)	113.1 (187.7)	82.2 (86.5)	39.6 - 129.0 (41.7-148.4)	100.9 (307.6)
L/W-index	(2.57)	(1.00)	12.8 (15.3)	1.40 (1.43)	1.12 - 1.82 (1.41-1.82)	0.47 (0.47)
Dis_MD in m	(517.5)	(6.6)	124.3 (124.6)	96.0 (107.6)	39.3 - 197.0 (41.7-197.5)	(110.3)





Tab.6.14 Above: summary descriptive statistics for the sample of enclosures with built wall (all measurements area external). Below: A) XY-plot of enclosures with built wall lengths and widths in meters and with indication of outliers. B) Histogram of showing the frequency of different sized enclosures with built wall in square meters. Note: numbers shown in bracket include the three extreme outliers in the sample (cf. Tab.6.14A).

Enclosures with built wall descriptive statistics:

The enclosures with built wall are represented by 45 examples in the sample. As visible from their summary statistics (Tab.6.14) they display notable variation: there are three extreme outliers (Tab.6.14A-B), in all three cases really constituting atypically massive enclosures (both of the E90 enclosures in fact circumfere smaller enclosures, see below) and which all undoutebdly had different functions than the smaller enclosures with built wall. The latter are more moderate in size and seem to form two or three clusters, which also show up in a cluster analysis of lengths/widths/areas (Fig.6.19). Of the 20 largest enclosures, only three examples (E29a no.8, E59 no.13, and E47 no.38) are associated with the largest farmsteds, indicating that this building type relate more to particular farmstead functions than wealth and status.

Of the 43 enclosures with built wall where building material are described, 7% (3) are built in turf, 12% (5) in turf/stone, 49% (21) in dry stone masonry, and 30% (13) preserved as a stone foundation for a turf wall. Wall thicknesse vary accordingly: from 0.35-1.9 m with an average width of 1.0 m. Only 33 of the 45 enclosures with built wall have an associated dwelling, from which the enclosures lie removed by 6.6-517.5 m, on average 124.6m (Tab.6.14). Both latter observations suggest that the enclosures with built wall served mainly as herding facilities at the edge of the infield or at shielings. Of the 40 cases where there is sufficient information, 40% (16) are partitioned into two sections, where one is normally significantly smaller; large to small section ratios in these ruins vary between 1:2 to 1:90.8 (omitting the atypical E90 no.1) with an average of 1:14.4. This suggests that many of these enclosures were milking pens.

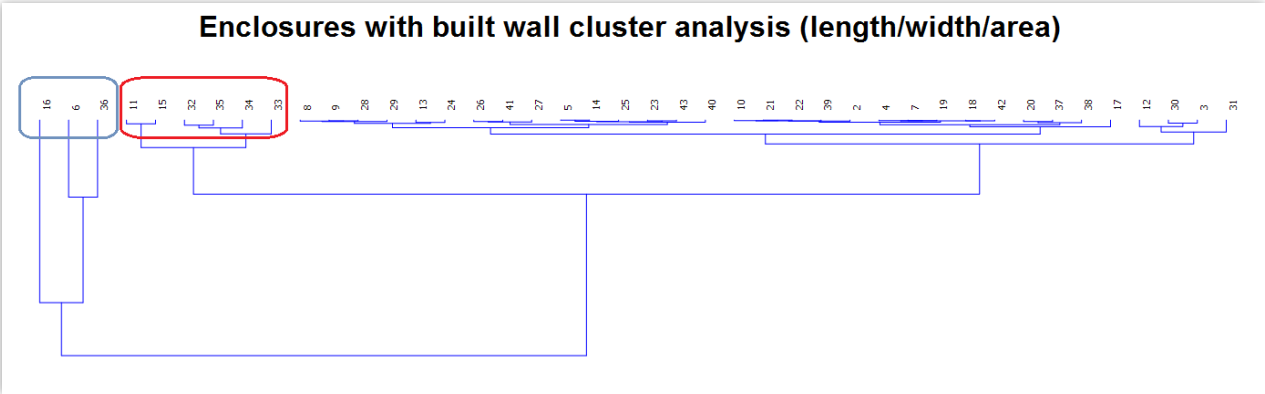


Fig.6.19 Cluster analysis (classical, paired group, two-way) of length/width/area of the sample of 42 enclosures with built wall. Indicated in the dark blue square are the three extreme outliers (discussed in the text); in the red square another distinct cluster (cf. Tab.6.14A). The remaining enclosures seem to group on two or three less distinct clusters.

Enclosure with built wall discussion:

Based on the above summary statistics and especially their partitioning in two sections, the small to averaged sized enclosures with built wall functioned either as folds/pens or hay-yards. This is also supported by the observation that only 31% (14) enclose a soil surface, 20% (9) a surface described as naked bedrock, and 22% (10) mixed stone soil surface (27% (12) has no description); thus at least 44% inclosed a surface that could not be tilled or gardened. The possibility that some functioned as hay yards cannot be excluded. For instance, ruin group E64's ruin no.5 was built on wind-exposed bedrock not too far from the nearest livestock building (Fig.6.20) and the walls equipped with openings for drainage (Fig.6.21), both conditions suggesing the function of a well-ventilated and -drained hay-yard. However, the averagely large distance of the enclosures with built wall from their assoicated dwellings would imply that they primarily functioned as pens/folds – *kvíar, nátthagi, stekkr* – and as argued from their internal partitioning, to facilite milking. Again, the possibility of mulitple and changing function must be considered.

Fig.6.20 Ruin group E64's ruin no.5, Kujalleq Fjord, an example of an enclosure with built wall. The placing of this enclosure on a slightly elevated and wind-exposed low outcrop, as well as the adding of draining openings to of the sides (cf. Fig.6.21), seems to suggest that this enclosure functioned primarily as a hay-yard. Note also the limited amount of collapse stone which suggests that the original stone walls stood little higher (photo: C.K. Madsen 2008).

Fig.6.21 Detail of the southern wall of ruin group E64's ruin 5 and one of the drainage openings (another is found in the eastern wall (*photo: C.K. Madsen 2008*).

An excellent example of such changing functions is the extreme outliers in the sample of enclosures with built wall E90 ruin nos.1&2, which are some of the most impressive in the Vatnahverfi region: as will be argued in secton 7, the western cluster of ruins (Fig.6.22) registered under ruin group E90c (App.2) in all likelihood constituted a separate shieling, one function of which was undoubtedly the biannual gathering of considerable numbers of livestock, hence the enormous size of the enclosures. The uneven stony ground inside them is vegeated by dwarf shrub, which suggests that the animals gathered were mostly sheep/goats. The lush vegetation inside the ruin and the nearby stream – which today has eroded one corner of ruin no.2 – meant that livestock could be kept in the enclosure for a number of days without having to worry about feeding them, e.g. for the duration of the livestock gathering.

Yet, the partitioning of ruin no.2's southwestern corner (Fig.6.22 B) – as well as the circular enclosure with built wall inside (Fig. 6.32 A) – and the tiny room added to the outside south wall (Fig.6.22 B) suggest another function, i.e. a classic setup with *stekkr* and *lambakró* for the milking of sheep/goats. Partitioning the large enclosure with built wall (no.2) undoutebdly made it easier to capture and milk the sheep/goats. Combined with fodder production and storeage (represented by storehouses nos. 3 and 5), this was probably the primary function of the shieling, where ruin no.8 served as the main shieling lodge during its summer occupation.

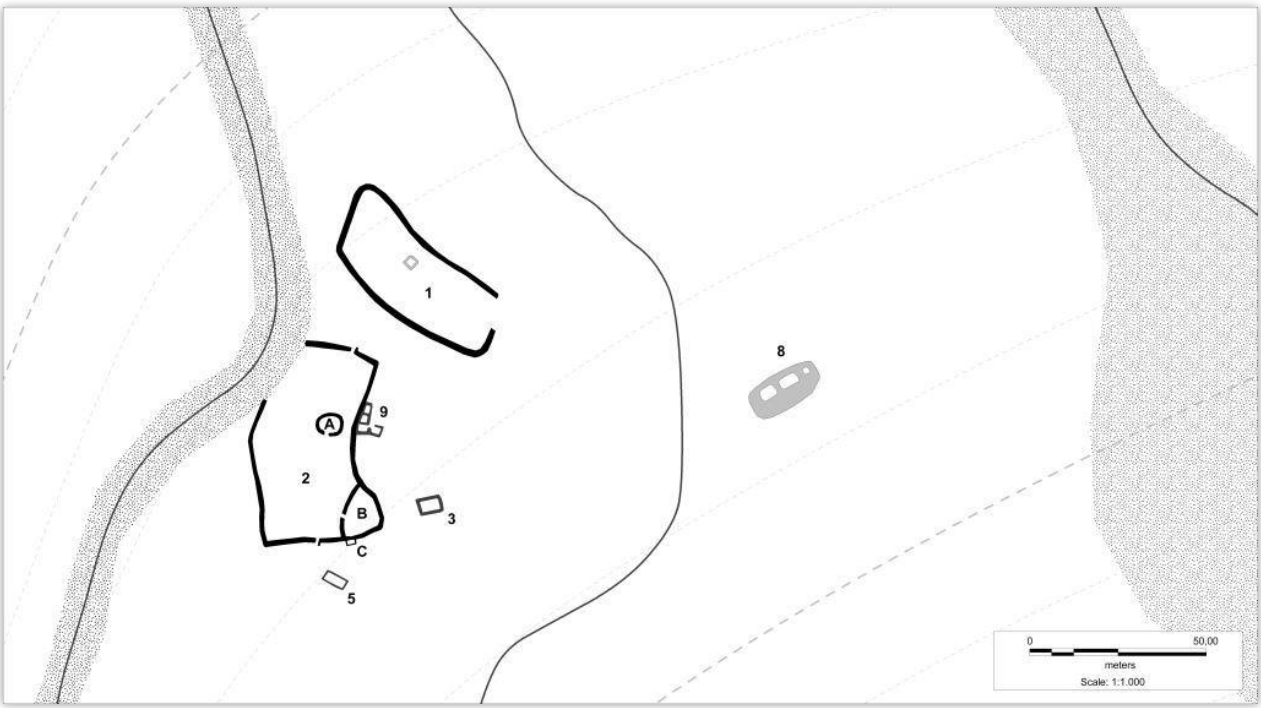
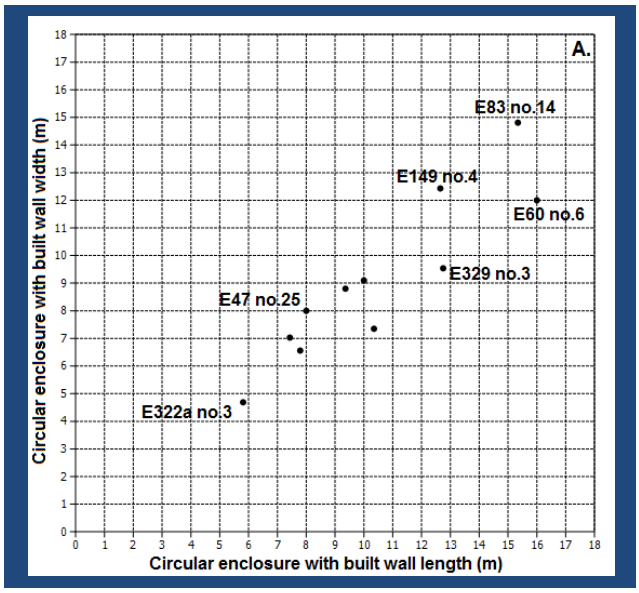
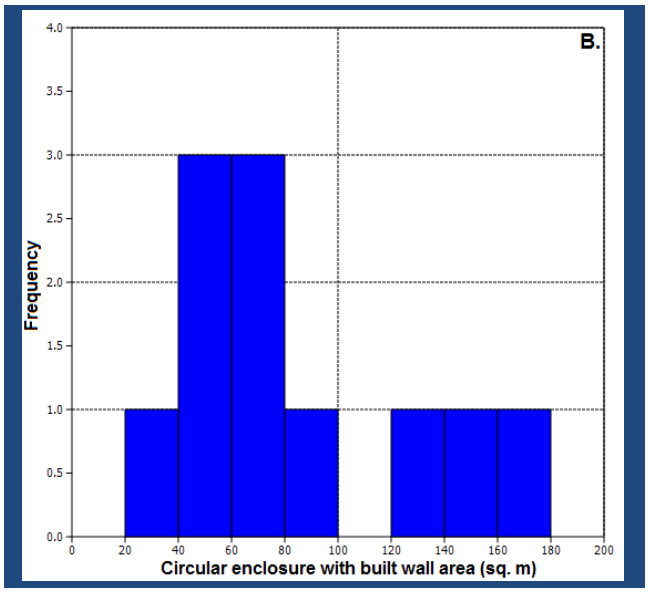


Fig.6.22 Survey plan of ruin group E90's western group of ruin, which likely formed an independent, and probably later, shieling where: ruin nos. 1 & 2 were large gathering folds, partitioning A, B, and C related to sheep/goat milking, ruins nos. 3 and 5 were storehouses for fodder processing and storage, no. 8 the shieling lodge, and no. 9 rooms or enclosures related to dairy production or separating the sheep. It is an excellent example of an enclosure with multiple functions.

Tab.6.15 – Circular Enclosure with Built Wall Descriptive Statistics

N = 11	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	16.0	5.8	10.5	10.0	7.8 – 12.8	3.3
Width in m	14.8	4.7	9.1	8.8	7.0 – 12.0	3.0
Area in m^2	175.1	21.8	82.0	81.3	44.2 – 153.2	49.5
L/W-index	1.41	1.00	1.16	1.10	1.04 – 1.33	0.15
Dis_MD in m	122.5	10.7	49.9	39.0	22.9 – 64.9	34.6





Tab.6.15 Above: summary descriptive statistics for the sample of circular enclosures with built wall (all measurements area external). Below: A) XY-plot of circular enclosures with built wall lengths and widths in meters and with indication of outliers. B) Histogram of showing the frequency of different sized circular enclosures with built wall in square meters.

Circular enclosure with built wall (Tab.6.15):

***Definition*:**

A separate lying circular or oval enclosure where the entire circumference is built wall; multiple functions are possible, but it had a primary function as a livestock herding/management facility.

Surface interpretation and issues:

Apart from their round or oval shape (Fig.6.23), the circular enclosures with built wall are identical to the former type with more square or rectangular outlines.

Archaeological definition/surface identification:

Circular enclosures with built wall are visible on the surface as features lying detached from other buildings, and where the space enclosed by a constructed wall was not roofed. The ruin is always circular or oval in shape.

Circular enclosure with built wall descriptive statistics:

Circular enclosures with built wall number only 11, which disqualifies statistical examination on any level of significance. As visible from Tab.6.15 they display notable variation in dimesions and size, their low length/width-index being the only constant and natural effect of the rounded shape. Three of the 11 circular enclosures with built wall are associated with church farmsteads and two of them are the largest examples (Tab.6.15A, E83 no.14 and E149 no.4), but otherwise any notion (e.g. GHM III:855) of particular association between the enclosures and the largest farmsteads must be excluded. Building material is described for 10 of the circular enclosures with built wall, one being built in stone/turf, seven in dry stone masonry, and two preserved as stone foundations for turf wall. Wall thicknesses vary from 0.65-1.75 m with an average of 1.09 m, i.e. about the same as the previous enclosure type.

Fig.6.23 Newly registered ruin group 0502's ruin no.1, northeastern Vatnahverfi, an example of a circular enclosure with built wall. Note again the limited amount of collapse stone, which suggests that the enclosure had a superstructure built in turf (*photo: C.K. Madsen 2005*).

Circular enclosures with built wall lie at distances of 29.2-393.3 m from their associated dwellings, 148.7 m on average, again quite similar to the former enclosure type (cf. Tab.6.14). In the seven cases where the enclosed bedding is described, three enclose soil surface, two mixed stone and soil, and two naked bedrock. Two enclosures are built on markedly sloping terrain.

Circular enclosures with built wall discussion:

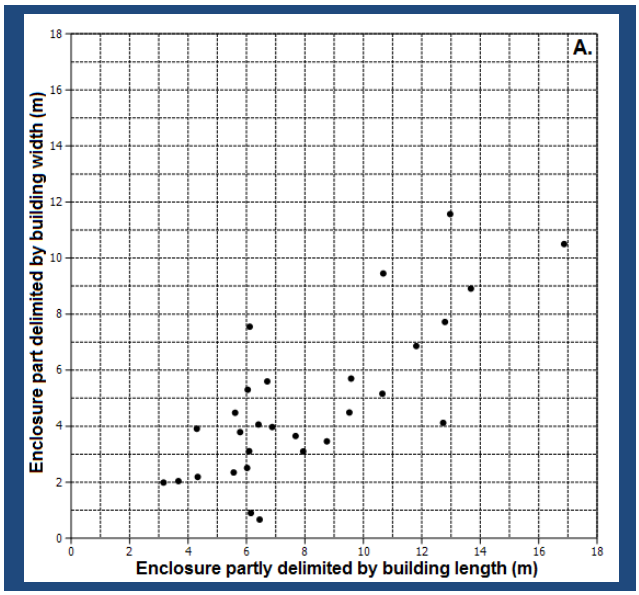
Although exemplified by too few to substantiate the claim statistically, the overall similarity of the circular enclosures with built wall with those of square or rectangular shape, their general similarity is notecable. Thus, it is reasonable to assume that they served the same primary functions related to livestock herding and management, i.e. as the Icelandic *kvíar*, *nátthagi*, and *stekkr* ; a possible secondary function as hay-yards is not unlikely. At any rate, any the notion that they could be the foundations for bell-towers or babtisteries (e.g., Holm 1883:97, Bruun 1895a:337) must be excluded, and neither does as function as cattle folds or corrals or paddocks for horses (e.g., Holm 1883:98, Roussell 1941: 35, 47) seem convincing because of their small size, slope, or bedding.

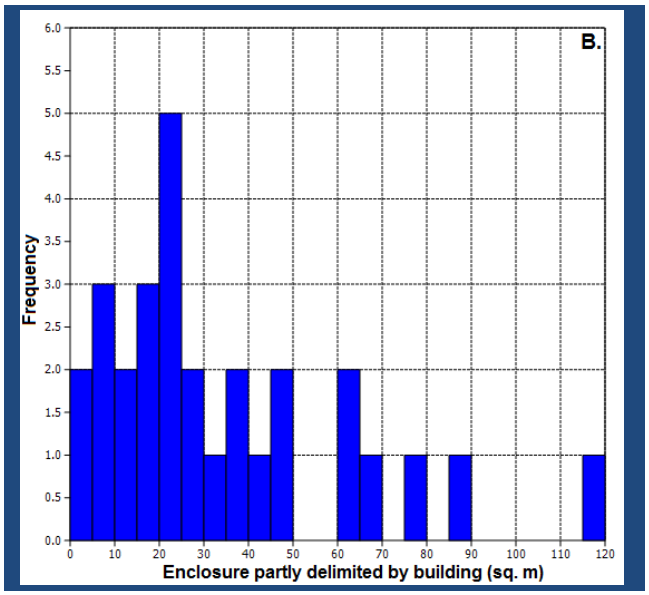
Enclosure Partly Delimited by Building (Tab.6.16):

An enclosure, where part of the circumference wall consists of the side or gable of another building; multiple functions are possible, but it had a primary function as a hay-yard or livestock herding/ management facility.

Tab.6.16 – Enclosure Partly Delimited by Building Descriptive Statistics

N = 29	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	16.9	2.7	8.1	6.7	5.9 – 10.7	3.4
Width in m	11.6	0.7	4.8	4.1	2.8 – 6.2	2.8
Area in m^2	119.4	1.7	34.5	23.9	14.4 – 42.3	27.8
L/W-index	9.63	0.81	2.19	1.72	1.24 – 2.25	1.79
Dis_MD in m	379.0	10.1	108.6	74.6	29.4 – 162.7	96.5





Tab.6.16 Above: summary descriptive statistics for the sample of enclosures partly delimited by building (all measurements area external). Below: A) XY-plot enclosures partly delimited by building lengths and widths in meters. B) Histogram of showing the frequency of different sized enclosures partly delimited by building in square meters.

Surface interpretation and issues:

The enclosures partly delimited by building are just what the label suggest, i.e. enclosures where one side of the circumference is constituted by a building (Fig.6.24). This effects that these ruins are often obscured by collapse material from the building. Thus it can be exceedingly hard to establish whether the ruin was a separate enclosure or simple collapse material from the adjoining building. There is therefore also a good chance that enclosures partly delimited by buildings are much underrepresented in the sample due to many examples being hidden under and obscured by collapse material.

Archaeological definition/surface identification:

An enclosure partly delimited by building is visible on the surface as a room or section recognized to have been unroofed (thin walls) or built in other material than the building to which it is attached and which forms part of the enclosures' circumference.

Enclosure partly delimited by building descriptive statistics:

Enclosures partly delimited by bulding number 29 examples. Compared to many of the other outbuildings, they form a rather uniform group of smallish ruins with some internal variability (Tab.6.16): the sample displays positive skewness (Tab.6.16B) with the larger share of enclosures being less than 50 m^2 in area; there are no truly extreme outliers. Tab.6.16B – which is somewhat similar to Tab.6.14B – seems to imply "fuzzy" clusters, which are however not emmidieately apparent in Tab. 6.16A. A classical cluster analysis of length/width/area measurements (paired group, two-way) do suggest four clusters in the sample, but again the statistical signifance is limited due to the low number of sample ruins. Of the 10 largest enclosures partly delimited by a building, three are associated with church farmsteads, but the corellation does not seem to be strong.

Of the 27 cases where building material is described, 4% (1) are built in pure turf, 26% (7) in turf/ stone, 19% (5) in stone/turf, 14% (4) in stone, and 37% (10) preserved as stone foundation for turf wall, i.e. showing overall variation. Wall thicknesses vary between 0.3-1.75 m with an average of 0.76 m, i.e. somewhat less than the previous two enclosure types. This implies a different function of the enclosures partly delimited by building, where insulation or sturdyness were not central to the layout. A difference in function could also be indicated by the distance to their associated dwellings, which is somewhat less than the former two types of enclosures (cf. Tab.6.14-6.15). For the 23 examples where it is described, the bedding inside the enclosures in 65% (15) of the cases consist of soil, in 13% (3) of naked bedrock, and in 22% (5) of mixed stone and soil. 83 % (24) of the enclosures orient towards the southern hemisphere, showing that solar heating was important in placing of the enclosure partly delimited by building.

Enclosure partly delimited by building discussion:

Of the different types of enclosures, those delimited by buildings are most likely to have functioned as hay-yards, as also suggested by D. Bruun (1895:428). This can be argued not only from the slightly varying building details and placing outlined above, but also from the observation that six of the enclosures partly delimited by buildings attach to storehouses, i.e. were placed so as to be wind-exposed. Another 14 attact to buildings mostly associated with sheep/goot keeping (sheep/goat sheds, double sheep/goat sheds, bipartite livestock buildings, and livestock stables), while another 4 attach to small examples of other roofed outbuildings, which could also relate to sheep/goat keeping. Livestock was only stabled during the winter, but was probably let out to graze the infield as long as weather permitted. Evidently, it would make little sense to let the animals out into a tiny enclosure right next to the stable. All in all, this suggest that the enclosures partly delimited by buildings were predominantly hay-yards functionally associated with fodder storage and winter stabling of sheep/goats.

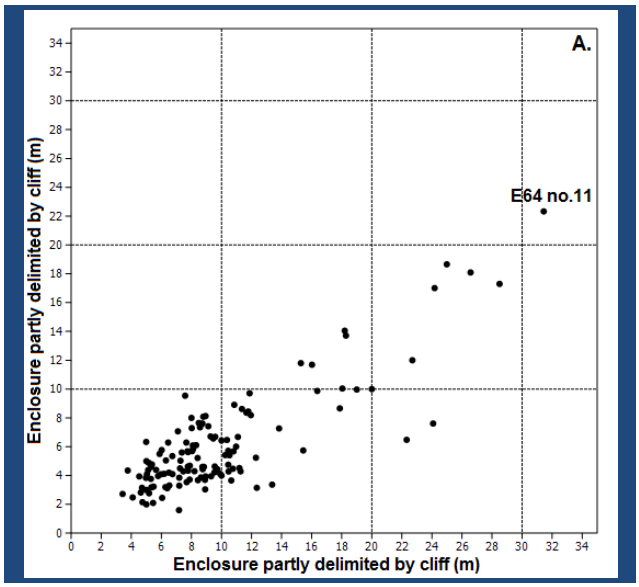
Enclosure Partly Delimited by Cliff (Tab.6.17):

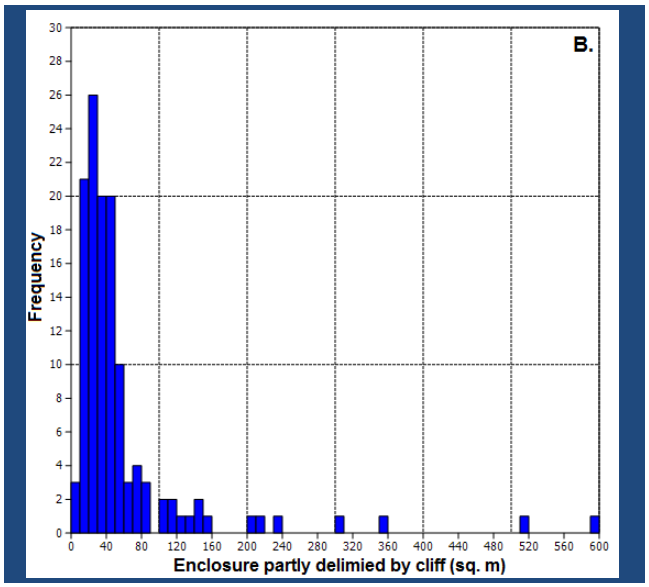
An enclosure, where part of the circumference consists of a vertical or steep cliff face or slope; multiple functions are possible, but it had a primary function as livestock herding/ management facility.

Fig.6.24 Ruin group E64's ruin no.1, north of the Kujalleq fjord, an example of a storehouse (left) with an attached enclosure part delimited by building (right of the storehouse with vegetation inside). Adjoining the storehouse and being placed on a well-drained, open, and wind-exposed surface, it seems most likely that the enclosure was used as a hay-yard (photo: C.K. Madsen 2005).

Tab.6.17 – Enclosure Partly Delimited by Cliff Descriptive Statistics

N = 128	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	31.4	3.4	9.9	8.5	6.4 – 10.9	5.4
Width in m	22.3	1.6	6.1	5.0	4.0 – 7.3	3.5
Area in m^2	594.8	7.0	58.8	34.0	22.3 – 54.3	83.1
L/W-index	4.48	0.79	1.75	1.64	1.30 – 2.06	0.64
Dis_MD in m	1000.0	16.7	160.6	122.5	69.9 – 199.4	144.3





Tab.7.17 Above: summary descriptive statistics for the sample of enclosures partly delimited by cliff (all measurements area external). Below: A) XY-plot of enclosures partly delimited by cliff lengths and widths in meters with indication of an outlier. B) Histogram of showing the frequency of different sized enclosures partly delimited by cliff in square meters.

Surface interpretation and issues:

The enclosures partly delimited by a cliff are also among the more characteristic ruins. As implied by the label, one side of these enclosures consists of a natural boundary formed by a vertical or steep cliff face or slope (Fig.6.25). Otherwise, these enclosures are identical to the regular and circular enclosures with built wall and I refer to these for interpretational issues (see above).

Archaeological definition/surface identification:

An enclosure partly delimited by cliff is visible on the surface as a ruin recognized (from wall thickness and ruin width) to be have been unroofed and which is built up against a vertical or steep cliff or slope, which forms part of the enclosures' circumference. The enclosure can be of any shape, but tends to be either square or semi-circular.

Enclosure partly delimited by cliff descriptive statistics:

With 128 examples, the enclosures partly delimited by cliff are the single most numerous type of unroofed feature in the sample. Unsurprisingly, they also show dinstinct variation in dimensions and size (Tab.6.17): the sample is strongly positively skewed (Tab.6.16B) with the larger share of enclosures partly delimited by cliff being less than 100 m^2 in area. There is only one noticeable, but not too extreme outlier (Tab.6.17A); ruin group E64's no.11 is simply a very large example of the type. The sample of enclosures partly delimited by cliff seems to have an overall area distribution (Tab.6.17B) fairly similar to enclosures with built wall (Tab.6.14B) and enclosures partly delimited by buildings (Tab. 6.16B), i.e. a large group of smaller examples and small groups of large examples. Apart from E64's no.11, however, there again seems to be no clear association between large farmsteads and the enclosures.

Fig.6.25 Ruin group E64's ruin no.11, Kujalleq Fjord, a – very large – example of an enclosure partly delimited by cliff. The enclosure wall forms a half-circle against the cliff and is so large that a few animals could graze inside for shorter periods. In the upper left corner, a smaller enclosure – a *lambakró* – is visible (photo: C.K. Madsen 2005).

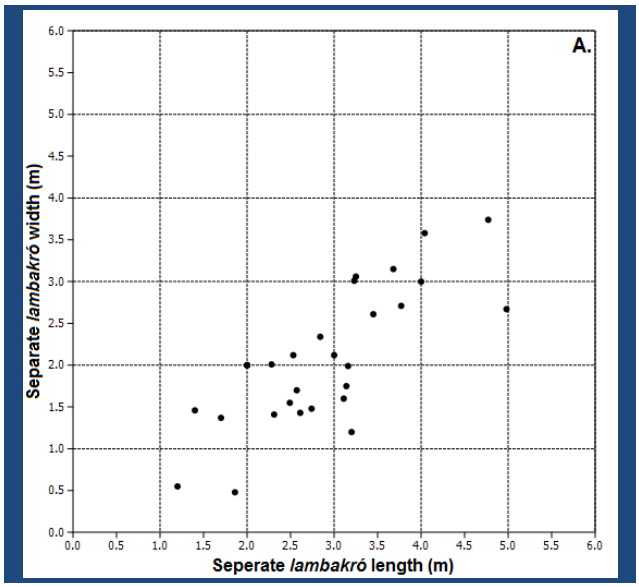
Of the 124 ruins where building material is noted, 7% (9) are built in turf/stone, 38% (48) in stone/turf, 31% (39) in dry stone masonry, and 23% (29) preserved as a stone foundation for turf wall, i.e. again showing overall variation. Wall thicknesses vary from 0.3-1.65 m with an average width of 0.79 m, i.e. a strong indication that the walls had no roof-bearing or insulation function. The enclosures lie between 16.7-1000 m from their associated dwellings, on average 160.6 m, implying that they related to activities in the edge of or outside the infield (Tab.6.17). Of the 109 examples where it is recorded, 18 are divided upon two sections, seven upon three sections, and five upon four secitons. In all cases, the addiotional sections are much smaller; the average large to small section ratio is 1:12.4, i.e. about the same ratio as for enclosures with built walls. As the latter case, the enclosures partly deliminted by cliff were used as milking folds. For the 108 cases where bedding is described, 32% (35) inclose a soil surface, 9% (10) naked bedrock, and 58% (63) a surface of mixed soil and stone. Thus, at least for 67% of the enclosures, a function as a fenced-in garden can be definetely excluded. Of the enclosures where orientiation is recorded (107), 88% open towards the southern hemisphere, suggesting that solar heating was very significant in the placing of these enclosures.

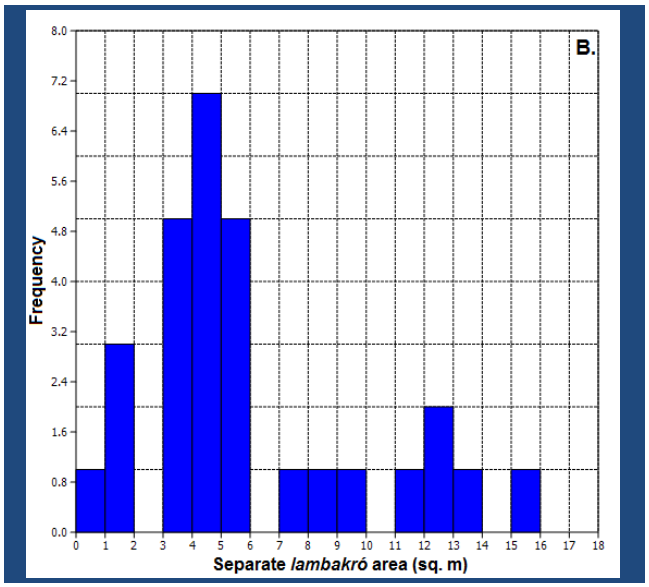
Enclosure partly delimited by cliff discussion:

The latter could appear to suggest that the enclosures partly delimited by cliff – like those delimited by buildings – served as fodder storage facilities, which has also been proposed elsewhere (Roussell 1941:230). Yet, several other conditions imply that the enclosures partly delimited by cliff instead facilitated livestock herding/ management: besides their subdivision with smaller compartments, or with nearby small enclosures (see below) – a layout of *stekkr* and *lambakró* – they are on average larger and located further from their associated dwellings than the enclosures partly limited by buildings (160.6 m versus 108.5m). This would suggest that the former were used for the rounding up of considerable numbers of livestock, as well as for periodic milking of select individuals, on the edge or outside the infield. Also, water tends to leek out through the crakcs in, and run down, the vertical cliff faces. They therefore do not provide the dry underlay one would expect of a fodder storage facility. Other reasons for building enclosures against cliff faces was that it decreased the labor needed to built and maintain the walls. Also, the vertical cliff provided shelter for penned livestock without blocking for solar heat. Located at distance from the farmsteads, livestock could have been sheltered and fed here during periods when they were grazing in the nearby *heimrast*.

Tab.6.18 – Separate *Lambakró* Descriptive Statistics

N = 31	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	5.0	1.2	2.9	2.8	2.0 – 3.3	0.9
Width in m	3.7	0.5	2.1	2.0	1.5 – 2.7	0.8
Area in m^2	15.3	0.7	5.9	4.5	3.5 – 8.2	3.8
L/W-index	3.9	1.0	1.5	1.3	1.13 – 1.81	0.61
Dis_MD in m	542.7	11.9	148.9	140.9	54.6 – 218.0	126.5





Tab.6.18 Above: summary descriptive statistics for the sample of separate *lambakró* (all measurements area external). Below: A) XY-plot of separate *lambakró* lengths and widths in meters. B) Histogram of showing the frequency of different sized separate *lambakró* in square meters.

Separate lambakró (Tab.6.18):

A separate lambakró is an unroofed compartment, which can be built in any manner or in any material, but is so small in size that it can only have been used as an enclosure for lambs/kids.

Surface interpretation and issues:

The separate *lambakró* is the only type of enclosure, where the label is chosen after Icelandic ethnographic example: as outlined in section 5.3.2, the *lambakró* was the smaller part of the bipartite Icelandic milking folds, where lambs could be separated from the ewes overnight, so that the latter could be milked in the morning. I have found no reference to a similar custom of building the *lambakró* separately in Iceland, but as I will demonstrate below, the separate lying Greenlandic examples (e.g., Fig.6.26) seem to have served the same purpose, not at least because they are so small that they could not have facilitated any other livestock. They are often built after a more random scheme – i.e. exploiting natural boulders, hollows, crevices etc. – but in all other respects they resemble the above enclosures – and the latters' smaller compartments serving the same purpose – and I refer to these for issues of ruin identification and construction.

Archaeological definition/surface identification:

A separate lying *lambrakró* is visible on the surface as a separate tiny compartment or enclosure (inside area < $5m^2$) which was never roofed. They can be built in any material or shape. They always lie in proximity to a larger enclosure. Unlike the sheep/goat shelters, separate *lambakró* comprise only one compartment.

Fig.6.26 Ruin group E60's ruins nos. 12 & 13, northeast Vatnahverfi region, an example of an enclosure with built wall (in front) and a separate lambakró (outside the far right corner of the large enclosure) (*photo: C.K. Madsen 2013*).

Separate lambakró descriptive statistics:

The separate *lambakró* is represented by 31 examples in this sample. Of all the buildings and features in the entire survey dataset (Tab.6.18), the separate lambakró sizewise constitute the most uniform sample, which of course partly owes to their archaeological definition here (see above). In terms of built and layout, they display just as much variation as the other building types: of the 26 where building material is recorded, 8% (2) are built in turf/stone, 46% (12) in stone/turf, 38% (10) in dry stone masonry, and 8% (2) preserved as stone foundation for turf wall. Wall thicknesses vary between 0.25-1.0 m with an average of 0.55 m, which shows what kind of small and simple features they are. In the 14 cases where separate *lambakró* are sheltered on one side, 12 orient towards the southern hemisphere, showing that exposure to solar heat was part of the layout scheme.

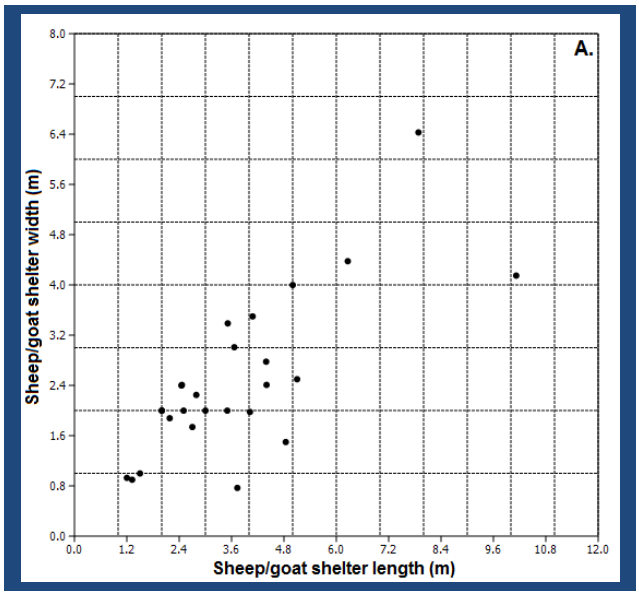
In the 20 examples where measurement can be made, the separate *lambakró* lie between 0.8-29.2 m from the nearest enclosure (of any type), on average only 8.5 m, clearly showing that they were functionally related to the other types of enclosures. It is therefore unsurprising that the *lambakró* are located at an avereage distance of 148.7 m from their associated dwellings, i.e. somewhere in between the enclosures with built wall and those partly delimited by cliff. In the entire sample, only 4 separate *lambakró* associate with church farmsteads and they are thus weak indicators of farmstead status.

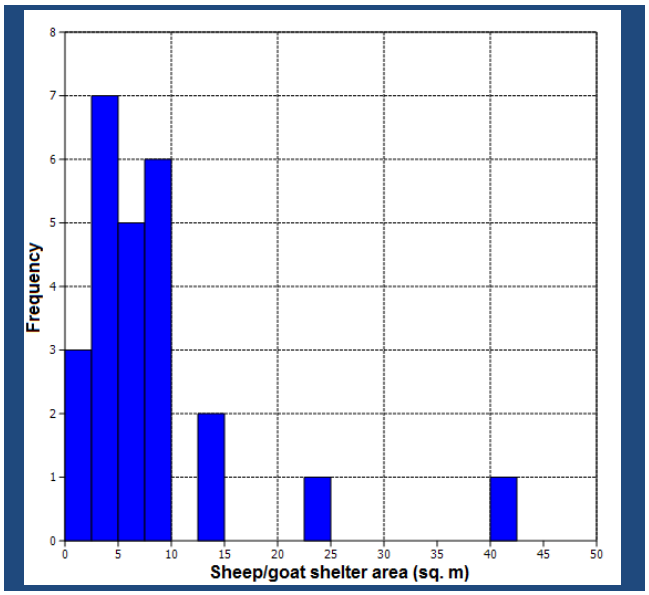
Separate lambakró discussion:

The basic function of the separate *lambakró* for penning lambs/kids is hardly debatable; the only thing different from the enclosures with inbuilt *lambakró* (Fig.5.21) is the separation of the feature in a separate building. One reason for this different pattern in the medieval sample of *lambakró* from Norse Greenland could be that they were later features, perhaps built as the milking of sheep/goat increased in importance? In several cases where separate lambakró lie near enclosures with built wall, they are of a distinctly different built (e.g., Fig.6.26); if not due to their different function, it could indicate phasing. This would be supported by the observation – which has unfortunately not been recorded systematically during the survey – that many of the "inbuilt" *lambakró* in the former enclosure types seem to be later additions as well.

Tab.6.19 – Sheep/goat Shelter Descriptive Statistics

N = 28	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	10.1	1.2	3.6	3.5	2.2 – 4.7	2.1
Width in m	6.4	0.8	2.5	2.1	1.8 – 3.1	1.3
Area in m^2	40.0	1.0	8.2	6.0	4.0 – 9.2	8.1
L/W-index	4.84	1.00	1.62	1.36	1.17 – 1.77	0.83
Dis_MD in m	449.9	3.9	162.2	151.6	83.0 – 215.7	118.2





Tab.6.19 Above: summary descriptive statistics for the sample of sheep/goat shelters (all measurements area external). Below: A) XY-plot of sheep/goat shelter lengths and widths in meters. B) Histogram of showing the frequency of different sized sheep goat shelters in square meters.

Sheep/goat shelter (Tab.6.19):

A sheep/goat shelter is a compartment fully or partly roofed by a natural overhang, but can otherwise be built in any manner or in any material; it is of such small in size that it can only have been used as shelter for sheep/goats and lambs/kids.

Surface interpretation and issues:

Sheep/goat shelters are transitional types of features, i.e. buildings that in terms of layout and built fall somewhere in between the roofed sheep/goat pens/ shelter, the smallest other types of enclosures, and the separate *lambakró*. Differentiating sheep/shelters from the separate *lambakró* is especially difficult and they may to a large extent have been used for the same purpose. However, the sheep/goat shelters are fully or partly roofed by a natural cliff/boulder overhang (Fig. 6.27). They also seem on average to have been slightly larger than the separate *lambakró* allowing the animals, or at least the lambs/kids, to move around a bit. The sheep/goat shelters are also of an even simpler and more makeshift character almost always exploiting natural crevices, cracks, hollows, or spaces under boulders and simply blocking any openings with stones or wall.

Archaeological definition/surface identification:

A sheep/goat shelter is visible on the surface as a separate small compartment or room, which is fully or partly roofed by a natural cliff or boulder overhang. They can be built in any material or shape. They are large enough to allow sheep/goats to move around, but too small and low to accommodate persons (e.g. Fig. 6.27). Unlike separate *lambakró* (see above), the sheep/ goat shelters may comprise more than one compartment.

Fig.6.27 Ruin group E188 ruin's no.9, outer fjord Vatnahverfi region, an example of a sheep/goat shelter. A roofed space of just under 8 m² and high enough for sheep/goats to move around (but not people!) have been made by exploiting the hollow space under a massive boulder, the open sides of which have been walled up by stones in a more or less casual manner (*photo: C.K. Madsen 2010*).

Sheep/goat shelter descriptive statistics:

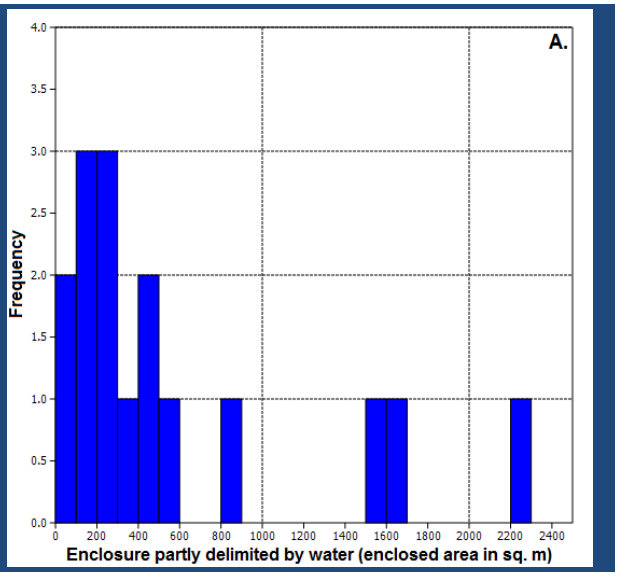
Sheep/goat shelters are represented by 28 ruins in this sample. As visible from Tab.6.19 they display notable variation within an overall small dimensional range, which is of course a expected effect of their use of natural features. Accordingly, few relevant implications are inferrable from statistical observation. One example is built in turf/stone, six in stone/turf, 12 in pure stone, and seven preserved as a foundation for turf wall. The area of their sheltered compartments (only recorded in 19 cases) ranges between 0.7 m^2 – 23.2 m^2, on average 5.74 m^2, showing their slightly larger size compared to the lambakró (average compartment area = 2.7 m^2). The sheep/goat shelters also differ in that only eight have an associated enclosure (compared to 20 of the 30 separate *lambakró*), from which they lie removed by an average of 25.0 m, i.e. more than double than the separate *lambakró*. In the entire sample of sheep/goat shelters, only a single example is associated with a church farmstead, cleary showing that they belong to more modest farmsteads.

Sheep/goat shelter discussion:

The sheep/goat shelters seem the most rudimentary and makeshif of the Norse farmstead outbuildings, i.e temporary shelters thrown up where easy and convenient and where there were no other buildings to facilitate them. It is not by conincident that only 16 of the 28 sheep/ goat shelters belong to sites with no dwelling, and that only one was associated with a church farmsteads: with their limited insulation, the sheep/goat shelters probably only used for the very temporary sheltering of sheep/goats – perhaps only lambs/kids – on shielings and modest farmsteads.

Tab.6.20 – Enclosure Partly Delimited by Water Descriptive Statistics

N = 18	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	65.0	5.0	27.0	24.4	12.3 – 33.5	18.2
Width in m	2.0	0.6	1.1	1.0	-	0.4
Area in m^2	101.7	2.2	39.5	35.5	13.0 – 62.3	27.1
L/W-index	-	-	-	-	-	-
Dis_MD in m	469.9	86.2	197.5	174.3	151.5 – 211.6	96.6



Tab.6.20 Above: summary descriptive statistics for the sample of enclosures partly delimited by water (all measurements area external). Note width statistics describe only the related wall stretches and that length/width index statistics are omitted for the same reason. Below: A) B) Histogram of showing the frequency of different sized enclosures partly delimited by water in square meters. Note that ruin group E332 is omitted because it has not been surveyed.

Enclosure Partly Delimited by Water (Tab.6.20):

An enclosure, where part of the circumference consists of a water body, either lake or river; multiple functions are possible, but it had a primary function as livestock herding/ management facility.

Surface interpretation and issues:

Again the label implies what characterizes these enclosures, i.e. they were built so that water – most often lakes, but occasionally a river – formed one part of the enclosure circumference. In most cases, this was achieved by exploiting the natural topography, e.g. by closing off with wall one end of a narrow headland (e.g., Fig.6.28), both ends of a narrow isthmus, or by building stretches of wall up from the lake shores where vertical cliff faces came close the water and could be exploited to form part of the barrier. As a result, the location and size of the enclosures partly limited by water was determined by natural topography, which in turn invalidates some of the observed quantitative parameters (e.g., enclosed area, distance to main dwelling). The enclosures delimited by water that associated with farmsteads are all located at some distance from the main cluster of buildings (see below). Others are not associated with farmsteads at all, but lie separately in the distant outfield. Thus enclosures partly delimited by water, especially those of the latter kind, are likely underrepresented in the sample.

Archaeological definition/surface identification:

An enclosure partly delimited by water is visible on the surface as a stretch of built wall, occasionally with an attached building, which functions to close of an area that is otherwise bounded on all sides, mostly by a natural body of water (lake/river). At times, a natural barrier such as a vertical cliff face forms part of the enclosure boundary.

Fig.6.28 Ruin group E174's ruin no.8, in the other fjord Vatnahverfi region, an example of a ruin described as an enclosure partly delimited by water. The large enclosure was created by building a wall across the land side of headland (parallel to where the gravel road now runs) (*photo: C.K. Madsen 2006*).

Enclosure partly delimited by water descriptive statistics:

Only 18 features in this sample are create enclosures partly delimited by water. However, some separately registered features belong to the same enclosure (E169 nos.2&3 and E332 nos.1&4), so that the sample consist of 16 examples. All of these are found in the Vatnahverfi region, which is probably a bias of survey intensity and methodology. Some descriptive statistics for the small sample is listed in Tab.6.20. Besides the small sample size, statistical inferences are limited by the fact that enclosure layouts are determined by natural features, as well as by the circumstance that the ruin itself consists of a stretch of wall, i.e. the ruin area only reflects the built boundary wall and tabled measurents in Tab.6.20 refer only to these walls (L/W-index and length/width scatterplot has been omitted, since they are irrelevant in this case). The average width of the walls is 1.0 m, which suggests that they were rather sturdily built features (since none could have been roof-bearing). One wall was built in pure turf, seven in turf/stone, four in stone/turf, three in dry stone masonry, and 1 preserved as a stone foundation for turf wall.

In the examples of enclosures partly delimited by water (12) where an associated dwelling is present, they are located 86.2-469.9 m apart, on average 197.5 m (Tab.6.20), showing that these features were related to actitivies on the edge of or beyond the infield. Tab.6.20A displays the enclosed area of the 16 examples, which show a notable degree of variation ranging between 27,3-2231.0 m^2 with an average enclosed area of 582.9 m^2, i.e. significantly more than any of the prior types of enclosures. The variation of these enclosures is partly explainable by their reliance on natural topograhy, but in a few cases clearly owing to different function (see below). In 12 cases, the surface inside the enclosure partly delimited by water is soil, in three cases mixed soil and stone (one case is not described). Three of the enclosures partly delimited by water are associated with church farmsteads (two of them at E64), but they do not seem a strong indicator of farmstead wealth and status.

Enclosure partly delimited by water discussion:

The enclosures partly delimited by water appear to separate on two main groups with somewhat overlapping functions: four examples – E171 no.14, E64 no.8, E169 no.2, and E184 no.14 – have a distinct layout with *stekkr*

and *lambakró* and must periodically have been used for milking. In the three latter cases, however, the enclosed area is so large that it also, perhaps primarily, served as gathering folds during annual livestock roundups. Another and large enclosure partly limited by water next to E64 no.8 may have served the same purpose. As also implied by the average distance to their associated dwellings, all these enclosures were located in the edge or some way beyond the infield, where livestock could be separated and culled before reaching the infield. The remaining enclosures certainly primarily served this purpose, although E66 no.24, E76 no.17, E164 no.12, E165 no. 2, and E174 no. lay so close to the main cluster of farmstead buildings that they conversely could serve as milking enclosures – *kvíar* and *nátthagi* – at times when the animals grazed in the nearby *heimrast*.

The enclosures partly delimited by water thus present other examples enclosures with multiple functions, much like ruin E90c nos.1&2 (see above). Their main function as gathering folds was enhanced by the condition that they enclosed a vegetated surface, which in combination with the nearby water meant that livestock, at least over shorter intervals, could feed and drink while being penned. They were therefore also suitable for use as *kvíar* for cattle in periods of summer dairy production. Conversely, they were only effective during the summer half of the year, because the lakes would freeze and the rivers dry up during the winter half; and even during the summer half of the year, the enclosures partly delimited by water could hardly have worked to pen livestock for prolonged periods, since the waters in front of the enclosures are always shallow.

Grazing enclosure (Tab.6.21):

A large enclosure with, where most or the entire circumference is built wall, but where a cliff, water body, or other natural feature may form part of the enclosure boundary; a building or compartment is always attached; multiple functions are possible, but it had a primary function as a cattle fold.

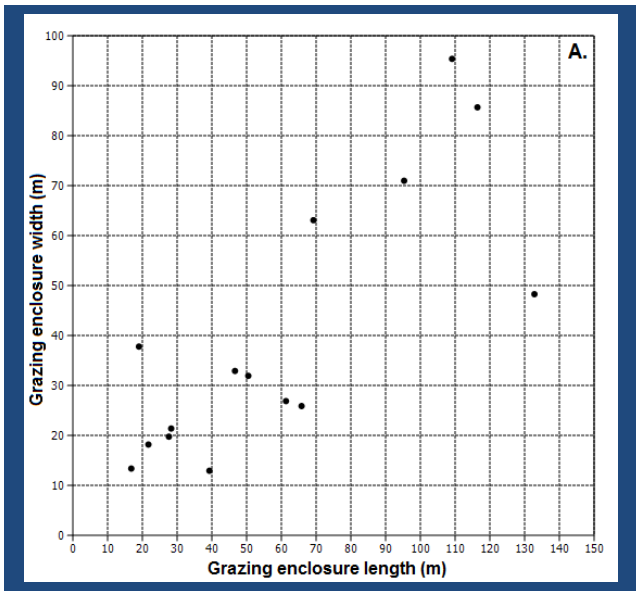
Surface interpretation and issues:

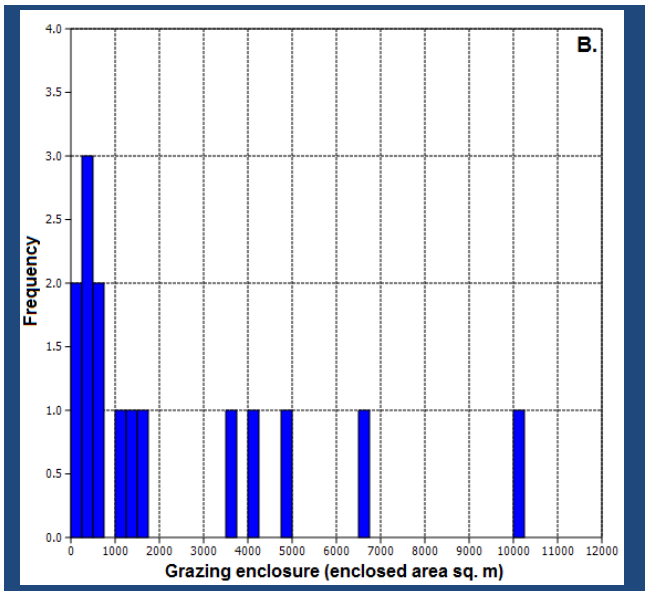
Grazing enclosures combines features of enclosures with built wall and those partly delimited by buildings/ cliff/water and liable to the same interpretational issues. However, the former are discernible by their large size (e.g., Fig.6.29), an attached building or compartment, and an inside bedding of vegetated soils. These enclosures were early singled out because of their impressive size and interpreted as cattle pens (e.g, Holm 1883:73, Bruun 1895a:233, 339, Nørlund and Roussell 1929), an interpretation that still seems to apply.

Fig.6.29 Ruin group E4's massive ruins nos. 6&7, Tasiusaq, some of the most impressive examples of grazing folds in the Norse Eastern Settlement. The overhanging ledges seen along the back of the enclosure created roofed shelters for the livestock (*photo: C.K. Madsen 2013*).

Tab.6.21 – Grazing Enclosure Descriptive Statistics

N = 15	Maximum	Minimum	Mean	Median	IQR	Standard dev.
Length in m	132.8	16.8	57.8	48.5	27.1 – 88.8	37.5
Width in m	95.4	13.0	40.3	32.0	19.8 – 63.1	25.6
Area in m^2	54.3	9157.3	2093.4	1109.6	284.5 – 1715.4	2589.4
L/W-index	3.03	0.50	1.61	1.36	1.19 – 2.28	0.70
Dis_MD in m	643.8	0.0	171.3	129.4	60.8 – 196.7	189.7





Tab.6.21 Above: summary descriptive statistics for the sample of grazing enclosures (all measurements area external). Below: A) XY-plot of grazing enclosure lengths and widths in meters. B) Histogram of showing the frequency of different sized grazing enclosure square meters.

Archaeological definition/surface identification:

A grazing enclosure is visible on the surface as an entirely or mostly built wall that encloses a large (>150 m^2) open (unroofed) area within which the soil surface is vegetated; a smaller part of the circumference may consist of a vertical cliff face, water body, or other built feature; a building or compartment is always attached to the enclosure.

Grazing enclosure descriptive statistics:

Only 16 unroofed wall features have been identified as being part of grazing enclosures, of which two (E59 no.21&39) belong to the same enclosure. Tab.6.21 shows descriptive statistics for the 15 grazing enclosures in the sample. The small sample and the circumstance that the grazing enclosure often exploits natural features as part of their barrier to some extent negates statistical and measured layout inferences on the same grounds as discussed for the former type. Tab.6.21A simply shows their dimensional variability, but little importance should be attached to the distribution. Tab.6.21B, on the other hand, displays a histogram of the enclosed areas, which is more telling of the size of the grazing enclosures; enclosed areas range from 153.2-10,250.0 m^2, 2399.1 m^2 on average, i.e. signifcantly more than the previous type, which would suggest somewhat differing function. The great size of the grazing enclosures is also imlied by the condition that four examples enclose a single entire building; three are built next to a building and the rest have two to four compartments forming part of the enclosure circumference. Seven of the 15 grazing enclosures are associated with church farmsteads and the singular E59, another two with the large farmstead E4, indicating strong association between these enclosures and the most weatlhy farmsteads.

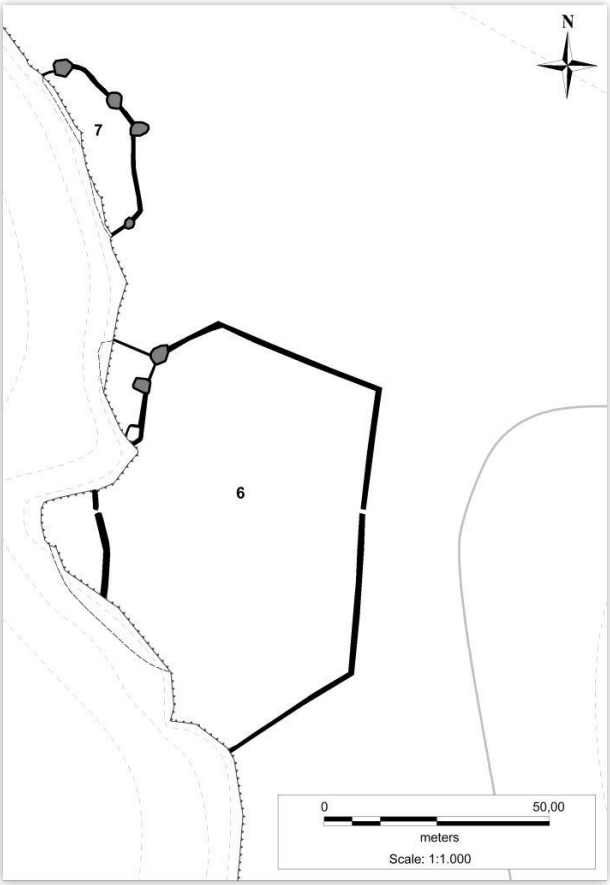


Fig.6.30 Survey plan of ruin group E4's ruin nos. 6&7 (cf. Fig.6.29).

Wall thicknesses range from 0.6-2.1m, on average 1.31 m, implying that these were sturdy constructions. Five examples were built in turf/stone, one in stone/turf, four in dry stone masonry, and five preserved as stone foundations for turf wall. The distance to their associated dwellings vary, but they generally lie towards the edge or beyond the infield (Tab.6.21) and display more variation than the enclosures partly delimited by water (cf. Tab.6.20). All the grazing enclosures are discribed as surrounding a soil surface.

Grazing enclosures discussion:

Their substantial size, associated buildings or compartments, and the often rather luxuriant grass found inside the grazing enclosures would suggest that they – as implied by the label – served for the periodic grazing of livestock, predominantly cattle. Yet, the enclosures could only have been used in this manner during certain parts of the year: during the hardest winter months, the cattle were stalled in the byres and during the summer months they would be grazing in the outfield pastures. This would seem to place the use of this enclosure type in the spring and fall. It is difficult to explain the building of such massive facilities solely for the periodic penning of cattle – e.g. as *kvíar* used in summer dairy production, implied for instance by E4 no.6 (Fig.6.29-6.30) – so they must have had other functions as well. Since the enclosures had probably been fertilized by grazing cattle, they could have had a secondary function as fenced and sheltered hayfields? This would account for their size and heavy construction. Perhaps the grazing enclosures provided sheltered grazing grounds for the cattle in early spring, while at the same making it easy to collect their manure? In any case, neither of these functions exclude that the grazing enclosures could have been used as gathering folds during annual livestock roundups, i.e. displayed a similar multi-functionality as suggested for the previous enclosure types.

Delimited grazing area (Tab.6.22):

> *A delimited grazing area is a pasture area, where a natural boundary – mostly a water body – forms most or the entire area circumference; it serves for the controlled movement and grazing of a select part of livestock.*

Surface interpretation and issues:

A delimited grazing area is – as the label implies – an area which livestock cannot stray from, but which provides grazing and water for longer continual upkeep. They are essentially enlarged versions of the enclosures partly delimited by water, but they are of such a size that they do not ease the handling of livestock. The delimited grazing areas come in two groups: those formed by peninsulas or headlands, where a built wall cuts off the area (e.g., Fig.6.31, Bruun 1917:Fig.45), or a natural boundary – e.g. a ravine or river – makes escape impossible; or those that relied fully on natural delineation, i.e. islands where animals were let out to graze, a practice known from all of the North Atlantic (e.g, Bruun 1897:53, Bruun 1929:297, Myhre and Øye 2002:376). In the latter cases, the identification of a grazing enclosure must be inferred from the presence of ruins relating to livestock herding the island. As it is rather get to islands in the inland during pedestrian survey, it is quite likely that some grazing areas remain undiscovered in the Vatnahverfi region.

Fig.6.31 Ruin group E76c in the central Vatnahverfi is located on the peninsula in the central left part of the photo (ruin group E76a is located on the three small islands to the right, but these seem too small to could have facilitated prolonged livestock grazing). A wall blocks off the peninsula at its narrowest point and an enclosure (partly delimited by cliff) is found inside this boundary; the whole peninsula probably served as a delimited grazing area (*photo: C.K. Madsen 2009*).

Archaeological definition/surface identification:

A delimited grazing area is identifiable on the surface either as a wall that cuts off a vegetated area too large to function as a regular enclosure (enabling easy herding and handling of livestock), or a vegetated island with ruins serving a herding or sheltering purpose.

Delimited grazing area descriptive statistics:

Since the layout of delimited grazing areas is fully determined by natural topography, and because only the group that are bounded by constructed wall have directly associated features (whereas buildings related to herding and management are classified under the above types), providing descriptive stastics really makes little sense. Thus, Tab.6.22 only shows the variable size of the five delimited grazing areas (as well as from a few comparative examples from the Middle Settlement) indentified in the sample.

Tab.6.22 – Delimited Grazing Areas

Ruin group no.	Approx. extent of grazing area (ha)
E76c (no.1)	5.58
E174 (no.9)	0.26
E174 (no.13)	1.88
E301	19.44
0604	27.96

Tab.6.22 The approximated area of the five delimited grazing areas in this sample.

Delimited grazing area discussion:

Two of the examples of delimited grazing areas (E76c and E174 no.13) are of the type, where a narrow peninsula is blocked by a wall (cf. Fig.6.31): E76c is another of example of an enclosure with mulitiple function: against the wall that cuts off the peninsula, two small rooms are attached, which were likely used during milking of sheep/goats, i.e. worked as a milking shieling. Three other delimited grazing areas are islands with buildings (0604 no.1, E174 no.9, and E184, the latter was not surveyed or visited, but refferred to by a local sheep farmer). The last example is a naturally bounded areas with buildings found on the oblong headland along the Amitsuarsuk fjord arm, which is bounded in both ends by ravines and extremely steep slopes; at the southern edge of the headland ruin roup E310 functions as a shieling for livestock milking and gathering.

In the cases where gathering folds are associated with the delimited grazing areas (E76c and E310), the maximum number of livestock (sheep/goats) grazing the area (i.e. the number the enclosure could pen) can be tentative estimated: assuming that the minimum space requiered per individual for sheep/goat gathering was 0.5 m^2 (see section 8.2.4), then enclosure E76c could have facilitated 20 sheep/goats indicating a grazing capacity of 130 m^2 per sheep/goat. In the case of E310, similar calculation indicates 373 sheep/goats with 750 m^2 pasture area per individual, which is a a lot more than at E76c, but the vegeation is also somewhat poorer and more broken on the headland with E310. Unfortunately, there are too few delimited grazing areas in the sample to follow up this interesting estimation Norse grazing intensity and must await the inclusion of further such ruin groups.

6.2.4 Unroofed Buildings Summary Discussion

A total of 310 individual ruins can be identified as unroofed buildings in this ruin group survey dataset. Fig.6.32 displays aggregate frequencies for the various feature types presented and discussed in the above. As seen in the figure, the various types of features are fairly evenly distributed. The only exception is the enclosures partly delimited by cliff, which clearly stands out as the most common type of enclosure in the dataset, followed by the enclosures with built wall. This overall frequency distribution has no apparent patterns of significance, but rather seems to imply the ordinariness of most these of features – except for the grazing enclosures – which were basic functional buildings on most farmsteads and shielings; this is also implied by the observation that very few of the enclosures show any particular affinity with the largest- and the church farmsteads.

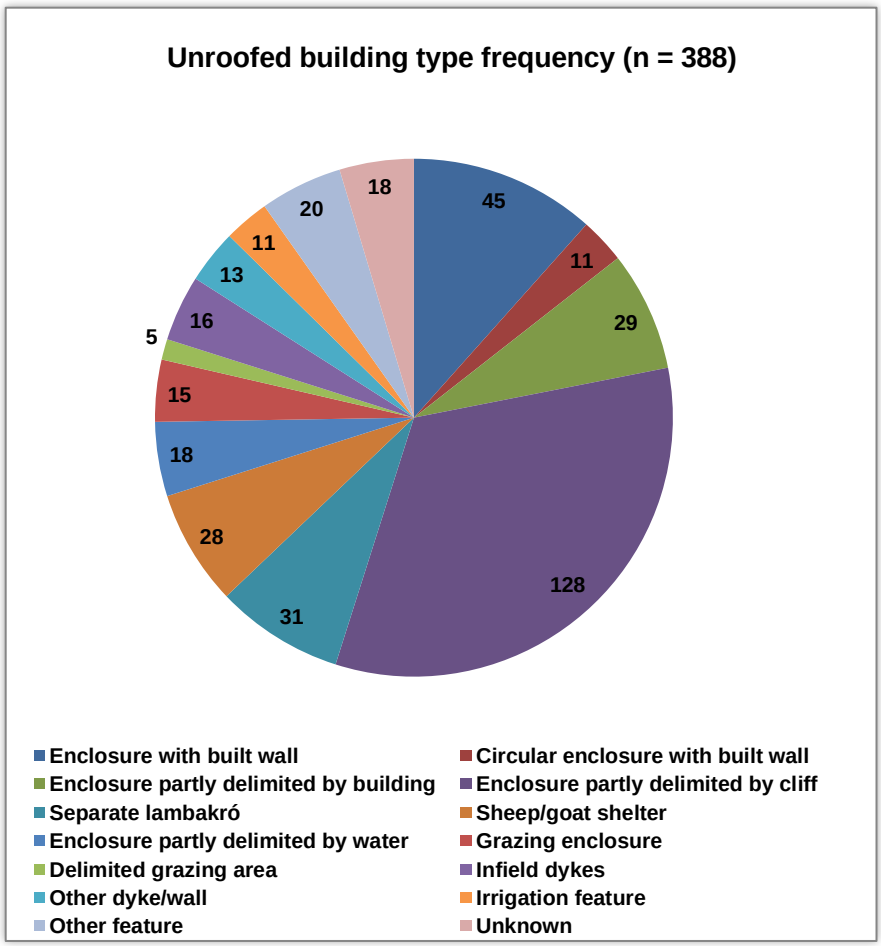


Fig.6.32 Displays the frequency of the different types of unroofed Norse buildings presented in section 7.2.3.

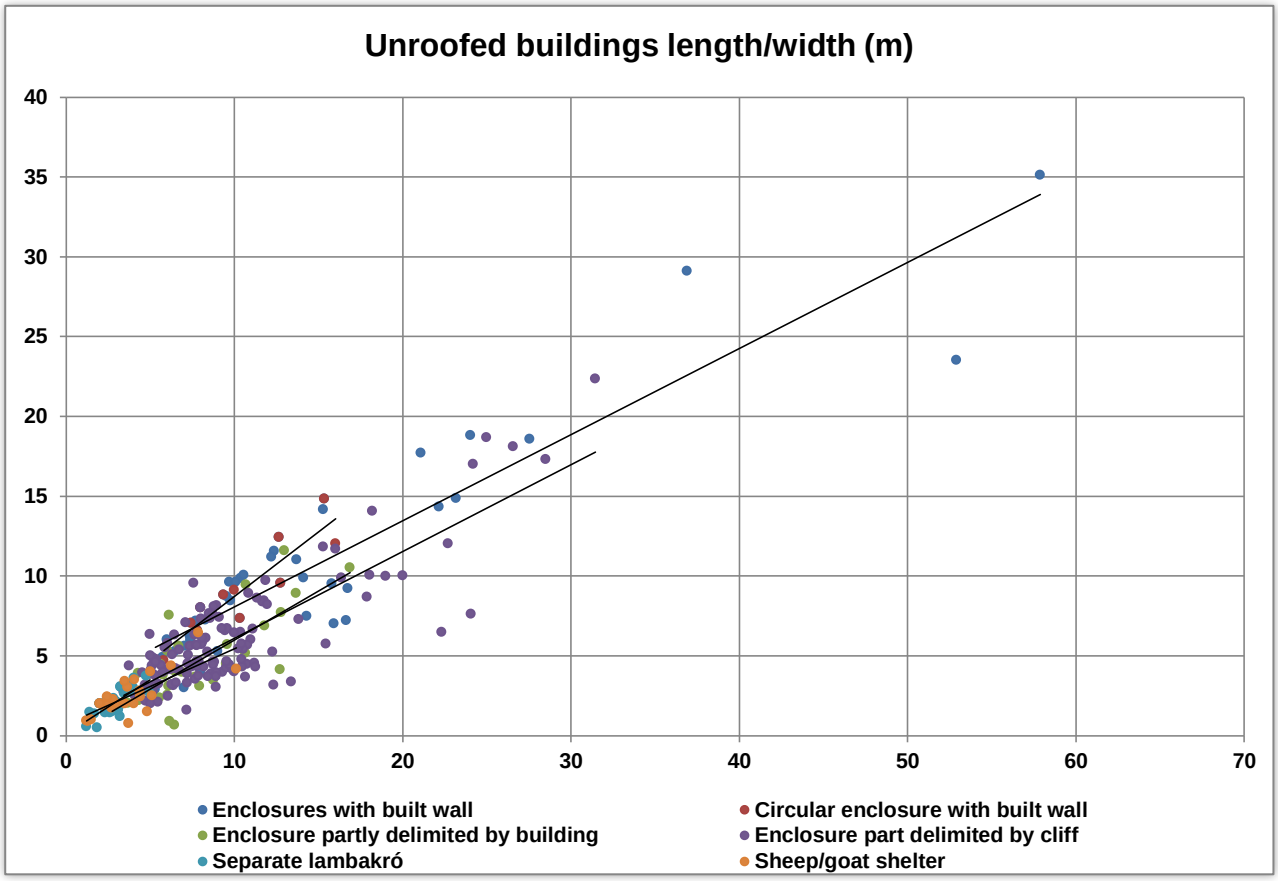


Fig.6.33 Scatterplot showing the length/width distribution of the 5 most common types of enclosures and herding features – as well as the circular enclosures with built wall – identified in the ruin survey dataset (n = 269). Different colors indicate different building types; linear trendlines are shown all building types, but are not discussed separately.

This fairly random distribution also echoes in length/ width scatterplot of the five most common types of herding related features in the survey dataset (as well as the circular enclosures with built wall, Fig.6.33). Unlike the dwellings and outbuildings (cf. Fig.6.17), there are hardly any visible patterns to their distribution and little trace even of "fuzzy" cluster; the only visible clusters are the separate *lambakró* and the sheep/goat shelters, which isolate because of their small dimensions. Also in contrast to the roofed buildings, the linear trendlines for the enclosures show no significant differences, except for the small group of circular enclosures with built wall that make for the steepest sloping trendline as an obvious effect of their roundedness. In comparison with the roofed buildings, it can be noted that the enclosure trendlines are overall more oblique or steep, a clear indication that the features were indeed unroofed and could therefore generally be built wider.

As for other general patterns to the enclosures, there are only four examples in the entire sample where there is any other internal division inside the enclosure that is not a separate compartment. Rather, the layout with *stekkr* and *lambakró* was the norm (see above). Only 18 of the enclosures in this sample are recorded as built over very sloping ground. This implies that the prevalence of such a type of enclosure – if even a type – introduced by (Nørlund and Stenberger 1934:99p) is not very common. A more consistent feature of enclosure layouts which was also noted above is their orientation: of all the types (180) that are built against and sheltered by a steep slope or cliff face, 83% (149) are open and orient towards the southern hemisphere. Whether in order to dry stored fodder quicker or to help animals keep warm when sheltering, influx of solar heat was evidently important.

Since it has been argued (see section 6.2.3) that the enclosures visible on the surface today reflect the near maximum number of Norse enclosures in use during the Middle Age, it is tempting also to try an estimate the maximum number of livestock they could facilitate. However, this is a very difficulat estimation to make for a number of reasons: first, as outlined above, the enclosures obviously had different and overlapping function, i.e. some where used for sheep/goats, some for cattle, some for both, some only periodically, some for round ups, milking, or grazing etc. Second, there is no way of knowing how many of the enclosures that were in contemporary use. Third, an estimate of the number of livestock an enclosure could facilitate depends on the enclosed area, not the ruin area, and not all enclosures are preserved or described so as to allow measuring of this, some means of conversion are needed for the latter type of poorly preserved ruins.

Such issues notwithstanding, even a rough estimation of livestock numbers would provide a welcome insight into stocking levels on the medieval Norse farmsteads and grazing pressure on the settlement landscapes. Not at least because such an estimate based on archaelogical surface survey evidence would also provide a good supplement to estimates based on the zooarchaeological record (McGovern *et al.* 1988:240), which can evidently only be applied to excavated sites. The above funcional distinction of enclosures may counter some of the problematic issues. However, a central interpretational interlude is required before such estimation can be made, i.e. differentiating between the farmsteads, where the livestock was gathered in the fall and spring, and the shielings where the livestock was taken during the summer, both types of sites having associated enclosures used at different times of the year. The attempt to model total sheep/goat numbers on the farmsteads in the Vatnahverfi region is therefore postponed to the classification in chapter 8.2.4.

As a concluding remark on this section, while few of the enclosures types in themselves are indicative of farmstead wealth and status, it is evident that they provide insights into the functional layout and economy of the farmsteads. Also, it is a reasonable assumption that the total area of the enclosures (TAE) must to notable extent reflect the number of livestock kept on the individual farmsteads and thereby also their size. I return to this in section 7.1.3.

6.2.5 Other Farmstead Features

The final group of archaeological remains singled out in this classsificaiton of surface survey evidence includes archaological features that are not buildings per se, as well as a remains that are not sufficiently described to provide any functional explanation, i.e. another residue group. Only few of these features are treated beyond this point and the presentation of the other farmstead features is therefore relatively brief.

Infield dyke (Tab.6.23):

An infield dyke is a functional (and legal) barrier that separates the cultivated infield from the uncultivated outfield.

Surface interpretation and issues:

The infield dyke is known from all of the North Atlantic, where it is described as one of the most common physical, legal, and symbolic delineations of the medieval farmsteads (e.g., Hastrup 1985:143, Øye 2003:402, Arge *et al.* 2005:601, Lárusdóttir 2006:54). Infield dykes have also been assigned the same general prevalence and function in the context of the Greenland Norse (e.g., Holm 1883:74, Roussell 1941:30, Krogh 1982b:74, Arneborg 2004:263). They mainly served to keep animal husbandry from feeding off and trampling the cultivated hayfields. Considering that they were sizable unroofed structural features, most of which should lie separate from other buildings and features, one would expect the infield dykes to be fairly obvious on the surface, i.e. both easy to identify and interpret. To the contrary, most of the examples identified in this sample are visible as rows interspersed larger stones which served as an foundation for a turf wall of which very little is normally left (e.g., Fig.6.34). In short, the infield dykes are likely underrepresented in the sample, and in the Greenland settlement evidence in general.

Archaeological definition/surface identification:

An infield dyke is visible on the surface as a separate lying stretch of wall (or walls), which on its own or by connection to natural barriers (water bodies, steep cliffs etc.) delimits an arable area with farmstead buildings.

Fig.6.34 Ruin group E94's infield dyke, outer fjord Vatnahverfi region, which is today preserved only as low mound covering a stone foundation (*photo: C.K. Madsen 2009*).

Infield dyke descriptive statistics:

17 features in this survey sample are identifed as infield dykes. However, some dykes registered under separate number a part of the same infield enclosure and total the sample comprises only 14 enclosed infields. Since the layout of infield dykes is to a considerable extent determined by natural topography, and the walls that demarcate the area are in themselves uninteresting, few descriptive stastics will be provided for them: they range in thickness from 0.5-2.15 m, with an average of 1.05 m, and were all turf built or preserved only as the foundation for turf wall. More interesting is the size of the enclosured areas, which are shown in Tab.6.23 for the nine examples, where it can be estimated:

All of the fenced infields in this sample are partly bounded by steep slope or water, which makes precise delineation problematic. Also, the listed areas include farmstead buildings, rocky outcrops, meadows etc., i.e. far from all of the listed area is arable land. Even so, the small sample present a fairly distinct pattern: apart from ruin group E59, the largest infield areas are all asccociated with church farmsteds, and notably all with churches of the large later type (see section 5.2). Another infield dyke which cannot be delineated is associated with church farmstead E78, so that all in all six of the 13 infield dykes are associated with church farmsteds. This highlights the strong association between infield dykes and the largest Norse farmsteads. There is a small leap down to the next group of smaller fenced infields, most of which still are associated with noticeable farmsteads.

Infield dyke discussion:

With 13 identified examples – eight of them in the Vatnahverfi region – of fenced infields in a sample of 157 ruin groups and 1308 ruins, the commoness of infield dykes on the Norse farmsteads in the Eastern Settlement, or at least in the Vatnahverfi region, must be reconsidered and probably laid to rest. Even if archaeologically underrepresented, infield dykes would have to be so in the extreme in order to shift this pattern; and, in fact, since the dataset includes a relatively larger number of church farmsteads for compartive cases, and infields dykes display a strong affinity with such sites, they may even be said to be somewhat overrepresented in the sample. Thus, six of the identified infield dykes are from church or large farmsteads outside the Vatnahverfi.

Tab.6.23 – Infield Areas

Ruin group no.	Approx. infield area (ha)
E18 (no.17)	10.01
E29a	11.68
E29	12.02
E29a/E29	22.03
E47 (no.47)	20.47
E59 (no.40)	16.96
E66 (no.18)	10.96
E76 (no.9)	5.97
E94 (no.7)	2.96
E111 (no.8)	8.12
E149 (no.22)	4,99
E178 (no.	5.97

Tab.6.23 Approximated areas of land enclosed by the infield dykes identified in the survey sample.

The notable absense of infield dykes in Greenland is in itself a very important observation (which was also noted, but not commented on by Bruun 1895a:429). It is difficult to imagine that there were any laws to prevent farmers from building infield dykes, and medieval legislation from elsewhere in the North Atlantic would indeed suggest quite the opposite (Myhre and Øye 2002:296). Thus, the absence of infield fencing on most farmsteads, but recurrent presence on the largest manors, must have other implications. One tempting explanation is that farming practices were fundamentally different in Greenland, or at least on the more average and modest farmsteads. However, this is opposed by other evidence of farming pracitices, such as the zoo-archaeological and pollen records (see sections 2.3.2 and 8). A more plausible explanaition could be that on normal and small farmsteads it was simply not worth the extensive labor effort to built and maintain infield fences: livestock herds on such farms were generally small and if herded intensively – i.e. brough to shielings during the summer – a single herder or watchman with a dog could have kept a few stray animals out of the hayfields on the main farmstead. By this inference, the lack of infields is one of the strongest implicators of shieling intensity.

Other dyke/wall:

A stretch of dyke or wall that cannot be attributed any particular function.

Surface interpretation, issues, and discussion:

Occasionally, surveyors happen upon a stretch of built wall that they cannot associate with any particular function. They may be found close to the farmsteads or buildings, or in the outfield; they could be remnants of buildings, enclosures, fences etc., but it simply cannot be determined from surface inspection. This survey dataset includes 13 such ruins, which will not be presented or discussed in any detail. Instead, I refer to the references in the ruin database for possible interpretations.

Fig.6.35 The single ruin of ruin group E327 in the outer fjord of the Vatnahverfi region. It is an example of a dyke (runs across the green pass and over the boulder), which cannot be attributed any particular function, but could be related to demarcation of, for instance, resources areas with different ownership rights? (*photo: C.K. Madsen 2009*).

I will briefly introduce two of the more interesting examples, E327 (Fig.6.35) and B102: both features are single stretches of wall in the outfield. Neither of them seem to form enclosures since they lack opposing walls and because the adjoining slopes can easily by climbed by both people and animals. The only explanation I can offer for these features – which are likely much underrepresented in the survey evidence – is that they are symbolic delineations, perhaps of the transition from resource areas with different ownership or use rights, e.g. transition from privately owned land to commons. Obviously, this interpretation is highly speculative until more such walls have been discovered.

Irrigation feature:

A channel, ditch, or dam facilitating irrigation or other water management.

Surface interpretation, issues, and discussion:

Irrigation features have been noted at six ruin groups in the sample (e.g, Fig.6.9, 6.36), among them the long recognized complex system of dams and channels found at Igaliku/*Garðar* (E47) (Ingstad 1960, Krogh 1974:78), the largest church farmstead in the Vatnahverfi region E66 (Bolender *et al.* 2010:2), and the large farmstead E59 (Clemmensen and Kapel 2008:16). Although irrigation features are very poorly represented in the sample, this could suggest they were mainly a feature of the larger farmsteads, which would be consistent with the seemingly more intensified arable farming implied by the infield dykes (see above). However, some form of water management is also witnessed at other sites (e.g., Fig.6.36), although normal field irrigation could hardly have been the purpose in the latter case.

Because irrigation and drainage channels require frequent maintenance in order not to fill up, they for obvious reasons tend to appear very indistinctly on the surface today. There is thus little doubt that irrigation features are underrepresented in the survey evidence. Conversely, recent test-trenching of proposed irrigation channels at Igaliku/*Garðar* (E47) have proved them to be natural (Edwards and Schofield 2013); and in 2012, we test-trenched the southernmost presumed irrigation channel at Kilaarsarfik/*Sandnes* (V51) (McGovern *et al.* 1996:Fig.4) and likewise found it to be a natural feature, likely an old well-trodden caribou trail (unpubl. field report). The latter investigations imply that great caution must apply to surface interpretation of irrigation features. For a discussion of other examples of Greenland Norse irrigation features see (Arneborg 2005).

Fig.6.36 2011 survey plan of ruin group 00-2 in the mountains of the Tasiusaq (field report under prep.). The site is a shieling located on small terrace near a stream (right) and small patch of meadow (left). Ruin no.1 is a small enclosure with built wall, no.2 a small shieling lodge, no. 3 a storehouse, and no.4 a large enclosure circling a depression. Ruins Nos. 5 & 6 are small dams that – for unknown purpose – lead water from the stream into the enclosure and two associated reservoirs.

Other feature:

A feature that does not conform to the layout or built of fit any of the above described features.

Surface interpretation, issues, and discussion:

Other features is a residue category that covers those surface remains that do not match any of the types described above. This dataset includes 20 examples, which span from possible manmade pits, cuts, and hollows, wells, bridge remains, as well as features that are not buildings, but cannot be explained. These will not be presented or discussed any further here.

Unknown:

No or inadequate ruin or feature description exists.

Surface interpretation, issues, and discussion:

The survey dataset include 18 ruins or features on which there is simply too insufficient existing information to suggest a possible function or even built. Such features are listed simply as unknown and will not be discussed further here.

6.3 Chapter Summary

In chapter 6, 1308 ruins from 133 sites in the Vatnahverfi region and 24 sites from elsewhere in the Norse Eastern Settlement have been functionally defined and classified on 12 types of roofed buildings, nine types of unroofed buildings (enclosures and shelters), three types of other features, and three residue categories. The classification is based on qualitative and quantitative observation of archaeological surface survey evidence. Most of the above building types have been shown to be characterized by fairly distinct traits that make their surface identification feasible, even when they are much collapsed. Most of the building types were known from prior archaeological investigations (see chapter 5), while others have been introduced here for the first time. In any case, the above presents the first formal attempt at functionally classifying all the different farmstead buildings and features. As a consequence some building and feature types have proved statistically significant and resilient, while other appear less so and call for future archaeological investigation and revision.

Besides presentation and classification of the raw survey data, the aim of chapter 6 has been to pinpoint those buildings and features that reflect both functional and hierarchical aspects of the medieval farmstead layouts: it is clear that some buildings and features – for instance sheep/goat sheds, bipartite livestock, livestock stables, and various types of enclosures – are very common farmstead features that relate mostly to basic functions; they provide detailed information on the farming practices and economy on the individual sites. However, using the church farmsteads as a benchmark for identifying traits of the manorial estates in Norse Greenland, it is equally clear that some buildings and features – for instance simple byre/barns, storehouses, grazing enclosures – are highly characteristic features of the largest farmsteads. Besides the churches, a few features – for instance the infield dykes and double sheep/goat sheds – even appear almost unique to the highest tier of farmsteads. In combination, the presented classification provides a defined analytical framework for site-level functional and hierarchical classification of both high-, low-, and intermediate status ruin groups based solely on the archaeological survey evidence. This approach is explored in the next chapter.

Also, chapter 6 has provided some very important side-implications deserving of brief recap: first, whereas large-scale cattle farming has long been related to the largest farmsteads, the above analysis has for the first time proven the economic alternative from archaeological surface survey evidence, i.e. the heavy, and seemingly increasing, reliance on sheep/goat milking as reflected in a near standard setup on most average and modest farmsteads with milking folds (*stekkr* and *lambakró*). Second, reviewing N. Lynnerup's (1998) population model against new evidence from churchyard excavations carried out during the Vatnahverfi-Project, his model was found to remain valid; only a slight population increase is noted, suggesting that the Vatnahverfi, or at least the central part, had an average population of ca. 200 people. Third, the detailed study of ruin evidence from 157 ruin groups has managed to produce only 13 infield dykes. Even if underrepresented, this must lay to rest any notion that infield dykes were common in Greenland. This rather suggests that infield dykes were related to farmstead size and status, and that the farming system as a whole had a somewhat different layout than elsewhere in the North Atlantic, probably reflecting greater intensity in herding practices and shieling activities.

7. Medieval Norse Settlement and Organization in the Vatnahverfi

'As to whether any sort of grain can grow there, my belief is that the country draws but little profit from that source. And yet there are men among those who are counted the wealthiest and most prominent who have tried to sow grain as an experiment; but the great majority in that country do not know what bread is, having never seen it'.

'It is reported that the pasturage is good and that there are large and fine farms in Greenland. The farmers raise cattle and sheep in large numbers and make butter and cheese in great quantities. The people subsist chiefly on these foods and on beef; but they also eat the flesh of various kinds of game, such as reindeer, whales, seals, and bears. That is what men live on in that country'.

King's Mirror 143-145, ca. AD 1250

The above quote is one of the very few written accounts of Norse farmsteads and farming in Greenland, which is supplemented only by very general comments on the settlement layout in Eriks saga Rauða and Ívar Bárðarson's Description of Greenland (see introduction to section 4.2). Both the latter sources would suggest that most of the land was owned by a few: according to Eriks saga Rauða by a few pioneering *landnámsmen*, in Ívar Bárðarson's later narrative by a few leading churches. It is of course very uncertain which of these two versions are most trustworthy; if any of them can be believed at all?; or if both hold a grain of truth, only portraying settlement scenarios at different times (i.e. *landnám* versus the later Middle Ages)? In any case, the above quote is somewhat ambiguous: on one hand, it speaks of large farms, lush pasturage, and considerable livestock herds. On the other hand, it also points to agricultural marginality, i.e. the problems of growing grain and general dependence of most commoners on wildlife resources. These contradictory points are probably all true to an extent, but rather depend on which time period and social group is in question. Yet, it is obvious that such questions on medieval Norse settlement layout and social organization can only be clarified through the archaeological evidence.

The aim of chapter 7 is to provide such a description of the Vatnahverfi region based on the ruin group survey evidence retrieved during the Vatnahverfi-Project. To achieve this, chapter 7 is divided on three main sections: section 7.1 builds directly on the description and analysis of Norse farmstead buildings provided in chapter 7 to outline a framework for the functional classification of ruin groups as different types and classes of farmsteads and shielings. This framework is based on the observed parameters listed in the Ruin Group Database (RGD, App.2). The next section 7.2 uses this classification system to describe functional aspects of settlement patterns in the Vatnahverfi region, which is discussed for each of the sub-regions outlined in section 8.2.2). In the final section 8.3, this functional settlement layout is used to advance the discussion to community level hierarchy and organization in the Vatnahverfi region. Chapter 7 concludes with a summary discussion bridging the above themes.

It is evident that with each analytical step in this approach, discussions are brought to a higher level of abstraction and thus uncertainty. The theoretical and empirical basis for taking these steps is based on the prior chapters and I will revisit particular topics only when imperative, but will otherwise refer to the above. Neither will I take up discussions of chronological issues in chapter 7. Such issues are discussed on a more general settlement level in chapter 8. As described in chapter 4, the chronological framework for understanding settlement development in Norse Greenland is still fragile and, as accentuated in chapter 6, the archaeological surface survey evidence is especially problematic in this concern. Accordingly, the ruin group survey evidence is in chapter 7 analyzed *en mass*, i.e. representing some 450 years of accumulated settlement evidence. However, in some cases relative chronological development can be discussed solely on the basis of survey evidence, whereas patterns of absolute chronology will, again, be postponed to chapter 8.

7.1 A Functional Classification of Norse Farmsteads and Shielings

In spite of the unique preservation of the medieval Norse settlement landscapes in Greenland, attempts at classifying ruin group functionally are relatively few: by referring to some ruin groups as farmsteads of different sizes and with particular focus on sheep/goat keeping or cattle ranging keeping, D. Bruun (1895) was the first to hint at such classification, although he did so rather informally and intermittently. Aa. Roussell's (1941) treatise on the ruin groups also implied some extent of functional differentiation, but was again mainly concerned with clarifying the layout of the dwellings. After Roussell, it would be some 40 years before research into functional aspects of Norse settlement were reinvigorated:

In a short article C. Andreasen (1981) proposed that the different layout schemes of the dwellings outlined by Aa. Roussell were not a function of chronology, but of economic and environmental differentiation (see section 5.2.1). C. Andreasen's argument was based on the same Western Settlement ruin group evidence use by Roussell supplemented by the few new excavations carried out during the Inuit/Norse-Project 1976-1977 (see section 4.1.5). At about the same time, T.H. McGovern and R. Jordan (1982) investigated settlement and land use patterns in the inner Nuuk Fjord. Although restricted to the Western Settlement area and working from very general premises, their study did bring attention to the very unequal distribution of and access to resources. T.H. McGovern went on (e.g, 1985, 1991, 1992) to develop his model of site differentiation by combining zooarchaeological, architectural, and environmental evidence. However, this model was mostly applicable to excavated sites and, in any case, more related to hierarchical than functional differentiation and therefore discussed below.

In the Norse Eastern Settlement, the only attempt at functional classification developed as a spin-off of the 1976-1977 'Nordic Archaeological Expedition' (see section 5.1.5), based on which C. Keller and S.E. Albrethsen (Keller 1983, Albrethsen and Keller 1986, Albrethsen 1991) developed a settlement and land use model for the valley of Qorlortuup Itinnera. This model of site differentiation was just as novel as T.H. McGovern's as it introduced more systematic functional differentiation between farmsteads and shielings coupled with environmental (pasture) evidence. The model was, however, based on survey evidence from a limited and fairly unique settlement area, and stated in section 5.1.3, the model since proven difficult to apply on settlement evidence elsewhere in the North Atlantic (e.g., Sveinbjarnardóttir 1991, Mahler 2007:386, Lucas 2008) . The most recent attempt at providing some extent of functional differentiation was O. Vésteinsson's (2010) discussion of the medieval parish structure in the Eastern Settlement, where he combined the results of surveys – not at least those of the Vatnahverfi-Project – with documentary evidence. While a novel approach, his study was mostly aimed at clarifying regional church organization and using existing rudimentary ruin group terminology and classification.

From this brief recap of archaeological research on the functional differentiation of ruin groups it is evident that there are few existing models that can be readily applied to the survey evidence from the Vatnahverfi-region. The aim of chapter 7 is therefore to provide such a functional classification model by relying on the new survey evidence and the building types outlined in chapter 6. The empirical basis for the classification is the Ruin Group Database (RGD, App.2, see section 8.1.1) that condenses the building evidence and adds some overall environmental observation parameters.

Before proceeding with the presentation of the RGD – the above examples of prior research related to functional differentiation accentuate a central point: that functional and hierarchical classification of farmsteads and shielings cannot be clearly separated, since site-specific activities naturally also reflect farmstead wealth, and thereby status. For instance, large farms with much livestock and rearing many heads of cattle required certain functional facilities not found on smaller farms that relied mostly on sheep/goat husbandry. Thus, although I take up hierarchical classification separately in the below section 7.3, distinctions largely reflect the functional classification carried out in sections 7.1-7.2. While this may appear a circular line of argumentation, it is really the only, and fairly commonsense, way of approaching the purely archaeological survey evidence.

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7.1.1 Overall Environmental Patterns

The first three observed parameters in the RGD – vegetation zone, elevation m.a.s.l., and ruin group orientation – confer some very basic and overall environmental characteristics relating to the individual sites. All three parameters combine to give a good impression of the fundamental site selection criteria involved in the placing the Norse sites:

Ruin groups and vegetation zones:

As discussed in section 3.2, four vegetation zones Fig.3.10 categorizes environmental change on a horizontal axis going from the sub-continental and subarctic inner fjord, over the sub-oceanic low-arctic middle fjord, to the oceanic, low-arctic outer fjord, and the hyper-oceanic, low-arctic coast. Fig.7.1 displays the total number of ruin groups (blue column, left vertical axis) and number of ruin groups per km^2 (red color, right vertical axis) in each of the vegetation zones.

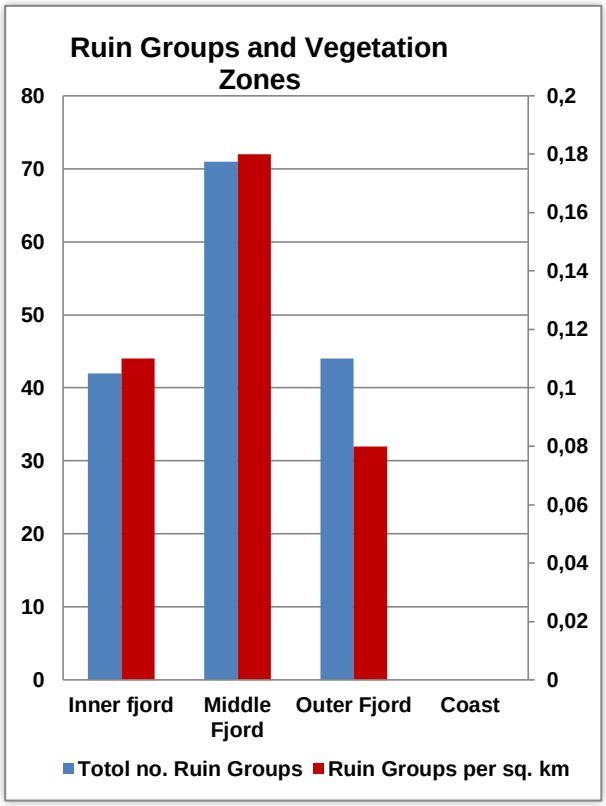

Fig.7.1 Displays the total number of ruin groups in the four vegetation zones after (Feilberg 1984a) (blue columns, left vertical axis), and the corresponding number of ruin groups per sq. km (red columns, right vertical axis).

In considering ruin group numbers (blue columns) a simple measure for settlement density, it appears from Fig.7.1 that settlement was densest in the middle fjord, whereas the inner and outer fjord where about equally densely settled. This is somewhat surprising considering the decreasing vegetation quality and total biomass as one travels out the fjord. The slight difference between the inner and outer fjord can be explained simply by the larger area of the latter; when reviewing ruin group densities per km^2, the outer fjord is clearly less densely settled than the inner fjord. The middle fjord area is about 30 km^2 larger than the inner fjord area, which is however not enough to shift the observed pattern of higher general ruin group density in the former area. However, it should also be realized that larger parts of the inner fjord area are more uninhabitable because the landscape becomes far more mountainous and affected by nearness to the Ice Cap and its glaciers, i.e. the large areas covered by glacial outwash plains and the sandur. Disregarding such areas would certainly shift ruin groups density in the inner fjord towards that of the middle fjord. Still, a final conclusion from Fig.7.1 must be that the middle fjord area was generally just as important a settlement area as the inner fjord, although in this case perhaps mainly due to the sheltered settlement area provided by the central Vatnahverfi lake basin (see section 3.2.2).

Ruin group elevation m.a.s.l.:

Whereas the vegetation zones categorizes environmental change on the horizontal axis, elevation implies variation on the vertical axis, going from warmer temperatures and more lush vegetation at lower altitudes to increasingly colder and barren conditions at higher altitudes. Fig.7.2 displays the number of ruin groups per elevation in 25 m intervals from 0-500 m.a.s.l. As evident from the figure, the vast majority of ruin groups are located at low altitudes: ca. 80% are located below 100 m.a.s.l – thereof 57% at 0-25 m.a.s.l – ca. 15% between 100-200 m.a.s.l, and only 5% above 200 m.a.s.l. Although high altitude ruin groups are surely somewhat underrepresented because these areas have been much less intensely surveyed and farmed, the pattern in Fig.7.2 appears definite: Norse settlement was narrowly tied to the warmer and lush lowlands, whereas higher settlement activity was – as will be demonstrated below – more sporadic and seasonal.

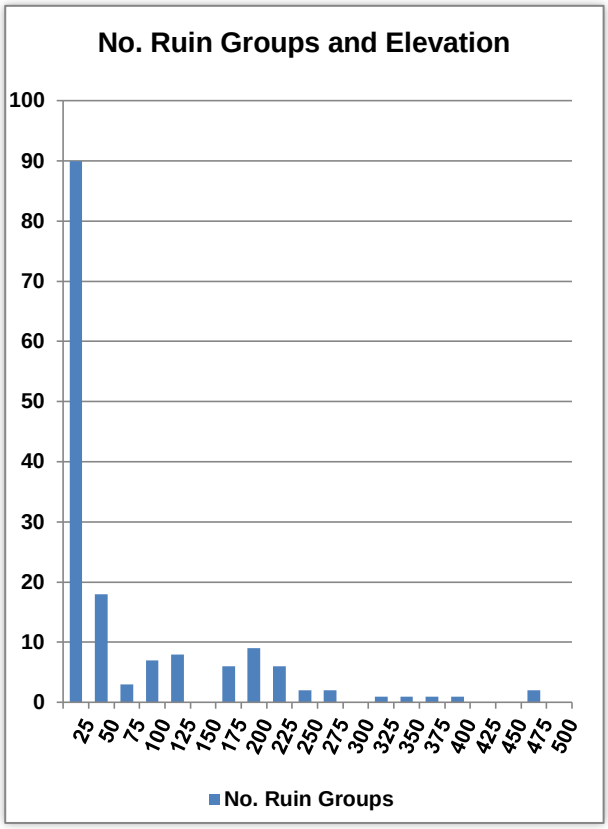

Fig.7.2 Histogram showing the number of ruin groups and their elevation above sea level upon 25m intervals (horizontal axis). The figure is discussed in the text.

Ruin group orientation:

The final ruin group parameter recorded and to be treated here is their general orientation. Fig.7.3 displays the orientation of the 157 ruin groups divided upon the 8 intercardinal directions, as well as a residue category (open) for those sites that were not shaded or sheltered from any angle. The pattern in Fig.7.3 is just as definite as the elevation. There was a very dominant preference for a site location that was exposed towards the southern hemisphere, preferably southeast or totally open, thereafter declining with the cardinal directions. Unsurprisingly, north was the least preferred orientation. The *grænlenindga* were very selectively locating their sites – both farmsteads and shielings – so as to maximize solar heating.

Although the above discussed parameters are very basic, they nonetheless seem to quite narrowly pinpoint some of the most important site selection criteria that determined the placing of Norse sites: whether in the inner or middle fjord, sites were located at as low altitude as possible and facing the southern hemisphere. In the above, this pattern has been explained mainly by environmental arguments, but other social, economic, and communicative aspects could have been in play. For instance, locating farmsteads close to the fjords – which also meant at low elevation – ensured access to a main source of transport, communication, trade, and extraction of marine resources. Another environmental concern not yet discussed, but which to a large extent may explain at least the pattern in ruin group elevation is snow cover: in a recent Ph.D.-study, L. Comeau (2013) has shown that snow cover during cold years and periods – has a significantly longer duration even at fairly low altitudes. Prolonged snow cover had a number of negative effects, but mainly it delayed and shortened the all-important growing season (cf. Fig.7.4). There is thus good reason also to include ruin group elevation in the functional discussion and classification of ruin groups, as I will explore later in this chapter.

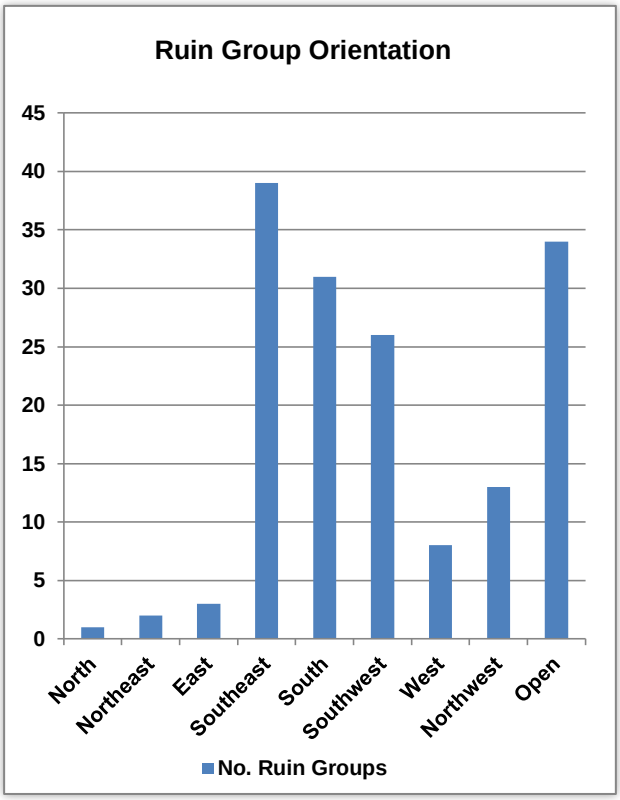

Fig.7.3 The ruin groups included in the survey dataset (vertical axis) divided on their general orientation (horizontal axis). The figure is discussed in the text.

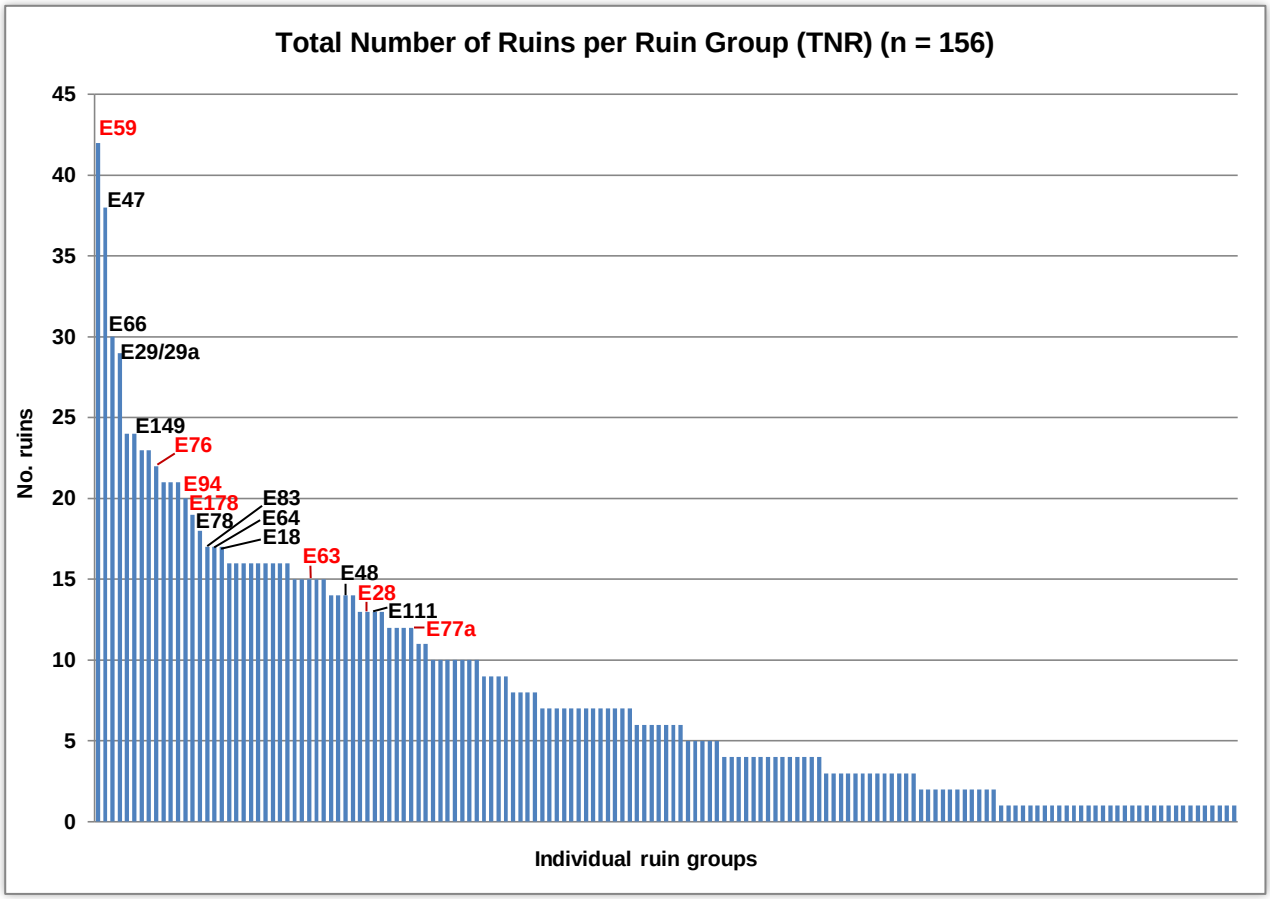

Fig.7.4 Displays the total number of ruins (TNR) registered at 156 individual ruin groups (note that ruin numbers for ruin groups E29/E29a are joined here). Marked in black are ruin groups with an associated church and in red the ruin groups with an associated infield dyke. The figure is discussed in the text.

7.1.2 Overall Ruin Distribution

Before attempting to classify the ruin groups in this survey sample, a brief review of overall ruin distribution patterns in the RGD serves to highlight those parameters that are most, and least, revealing of farmstead functions, size and status. For discussion of this differentiation, I again rely on the church farmsteads as a benchmark, but juxtaposed against farmsteads with no church, but infield dyke, the latter feature having been singled out as a trait of the largest (or latest) farmsteads (see section 6.2.4):

Fig.7.4 displays the *total number of ruins* (TNR) per individual ruin group in a sample of 156 (note that ruin numbers at E29/E29a have been joined here). The TNR displays a quite significant spread, ranging from 1-42 ruins at the individual ruin group (with a mean TNR of 8). Most noticeable in the figure is the very high TNR at ruin groups E59 and E47 (Igaliku/*Garðar*), which have stood out as unique in terms of their ruins in most of the above analyses. The next two ruin groups to separate are E66 and E29/29a, both multiple church farmsteads. After these, TNR at the ruin groups decline very continuously with no apparent interruptions, although it is of course noted that the remaining church farmsteads (black typo in Fig.7.4) all lie in a higher end of this regression, as does farmsteads with no church, but infield dyke (red typo in Fig.7.4).

There are several observations to Fig.7.4: first, the gradual regression in TNR demonstrates that it cannot stand alone in the classification of sites, the main reason being that it does not differentiate between small and large, and various types, of buildings. Thus, a small farmstead or shieling with many rudimentary sheep/goat sheds and shelters will score as high in TNR as a sizable farmstead with an equal number of large outbuildings. Second, still the fact that the church farmsteads (black typo in Fig.7.4) all lie in the higher, or highest, end of

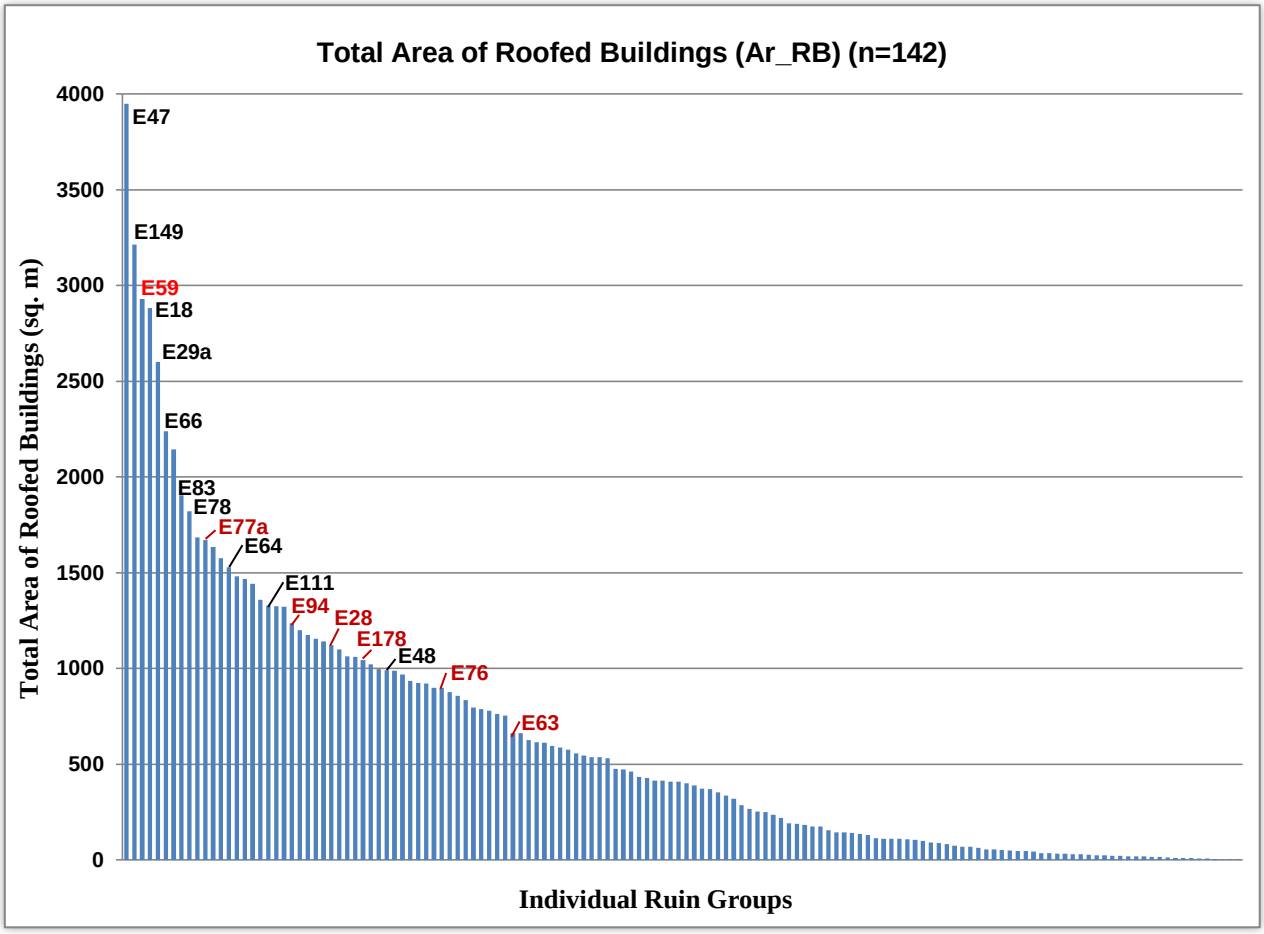

Fig.7.5 Displays the total areas of all roofed buildings (Ar_RB) at 142 individual ruin groups (note that ruin numbers for ruin groups E29/E29a are joined here). Marked in black are ruin groups with an associated church and in red the ruin groups with an associated infield dyke. The figure is discussed in the text.

the TNR distribution implies that this parameter to some extent does correlate with farmstead size and status. It can also be noted that the four farmsteads with highest TNR all have associated churches of the large type, whereas ruin groups with small early type churches have a lower TNR. A similar difference between farmsteads with early and later type churches was also noted in the spread of dwellings dimensions in section 6.2.1. Unalike the spread of dwelling, the three other ruin groups with large type churches (Fig.7.4, E18, E83, and E111) all have a TNR comparable to the farmsteads with small churches (E48, E64, E78), although this may in part be explained by erosion of ruins at the three former sites.

Third, while ruin misrepresentation could account for some pattern variation and inconsistency, Fig.7.4 may in fact imply that some farmsteads without churches were just as sizable and wealthy as the examples with churches. This is apparent if inspecting ruin groups with no church, but with associated infield dyke (red typo in Fig.7.4). In terms of TNR some of these ruin groups clearly compete with or excel those with church (note that E77a is highly eroded, which undoubtedly accounts for a fairly low TNR). Although the TNR cannot, as stated, stand alone in ruin group classification, it seems reasonable to argue from Fig.7.4 that a large farmstead should have no less than 12 roofed buildings (with the eroded E77a defining this lower limit).

Fig.7.5 displays the *total area of all roofed buildings* (AR_RB, Ruin Database types 1-12, 14) at 142 ruin groups (14 ruins have no identified roofed building, the ruins of E29/29a are joined here). The Ar_RB works from the basic logic assumption that the larger the roofed area, the greater the number of buildings, functions, and hence wealth of the farm. It is expected that the Ar_RB is more resistant to inter-site building variation than the TNR because large roofed buildings of a given type are

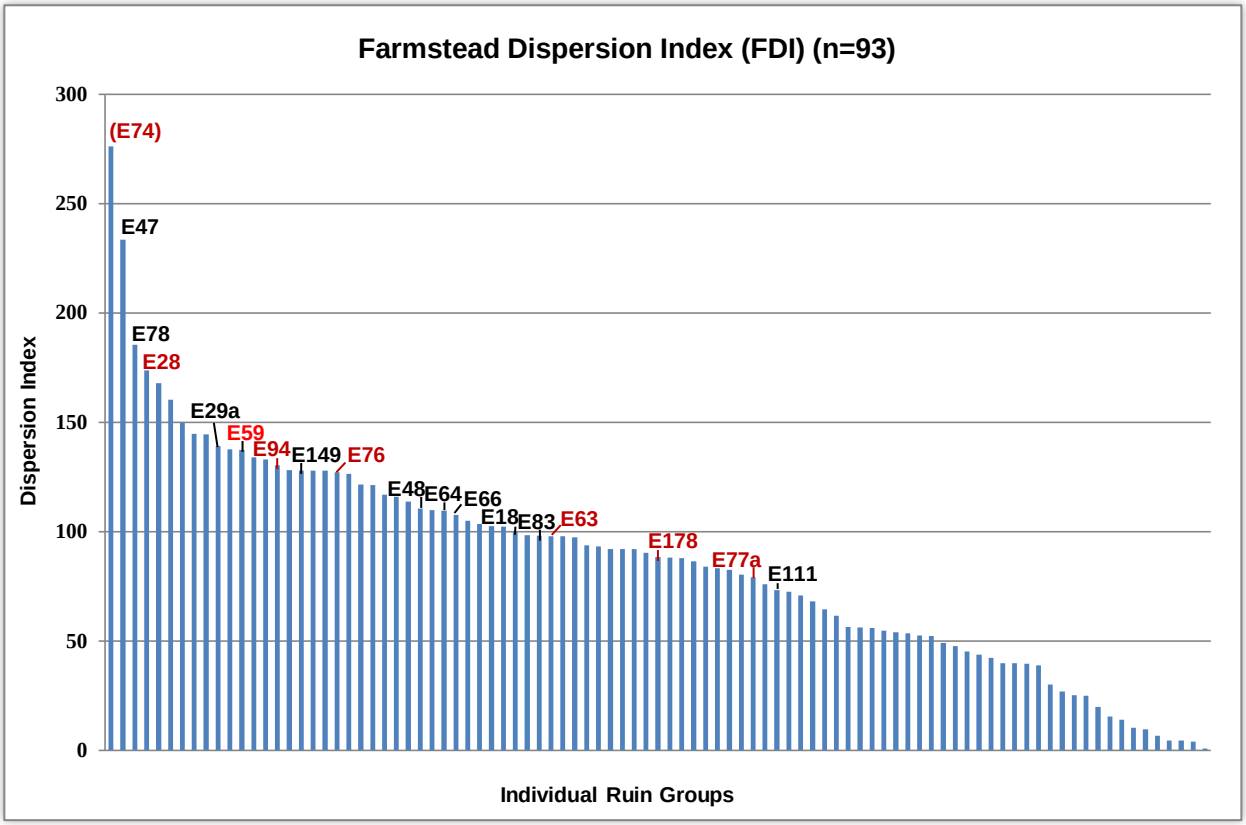

Fig.7.6 Displays the total areas of all roofed buildings (Ar_RB) at 142 individual ruin groups (note that ruin numbers for ruin groups E29/E29a are joined here). Marked in black are ruin groups with an associated church and in red the ruin groups with an associated infield dyke. The figure is discussed in the text.

"weighed" heavier than similar types of small buildings (see above). Also, the Ar_RB should be more resistant to cases where poor preservation effects that some multiple features are surveyed as one ruin, since this should just increase the total ruin outline. However, because ruin numbers and area obviously connected the two measures are still expected to display some overlapping patterns.

The Ar_RB displays great variation and ranges from 1-3947 m^2 with an average of 622 m^2. The distribution of Ar_RB is – as expected – roughly similar to that in Fig.7.4, i.e. a few extremely high value outliers followed by a continuous regression in Ar_RB values. Still, the Ar_RB distribution conforms noticeably more to the expected overall patterns than the TNR (cf. Fig.7.4-7.5):

The uniqueness of E47 (Igaliku/*Garðar*) – which has been stressed elsewhere (McGovern 1992a:220) – is striking (even though 10 roofed buildings have been excluded because they lack description of external dimensions). Apart from E48 and E111 (many buildings at the latter could have eroded), the church farmsteads – as well as the singular E59 – display the highest Ar_RB values, and noticeably those with large type churches (black typo in Fig.7.5). However, Ar_RB in Fig.7.5 goes even further nuancing this pattern that was also inferred from the TNR (Fig.7.4): except for the eroded E111, it can be noted from Fig.7.5 that all the farmsteads with small type churches – which likely started out in the top of the settlement hierarchy – appear more modest in the accumulated survey evidence and all have lower Ar_RB values than the farmsteads with large type churches. In fact, such "old church farmsteads" seem to have been "outcompeted" by several farmsteads without church, among these repetitions from Fig.7.4 (and Tab.6.23) with infield dyke. In terms of the latter examples, some have been shifted up, and some down, the hierarchy, yet they all lie in the higher end of Ar_RB values. Based on these ruin groups, it is reasonable to propose that a large farmstead should have a total area of roofed buildings no less than 750 m^2.

Fig.7.6 displays the *farmstead dispersion index* (FDI) for the 96 ruin groups in the sample that has a dwelling. The FDI – i.e. the average distance of all roofed outbuildings (excluding the single most distant one) to their associated dwelling – reflects how dispersed a layout scheme a farmstead or shieling has, which in turn could indicate the size of the cultivated infield area and, consequently, the function, wealth, and status of a farmstead. The FDI is expected to be less resistant to

random inter-site variation than both the total number of ruins (TNR) and the total area of roofed buildings (Ar_RB) because it is to a large extent determined by topography. In addition, at sites with few ruins it only takes one or two extreme outliers to bias the FDI significantly, which for instance accounts for the highest FDI-value in the sample (E74). In this concern, the issue of separating or joining proximate or distant ruins under one or two ruin group numbers becomes paramount. The expected greater variability in this parameter is affirmed by the overall more even distribution in index values displayed in Fig.7.6.

Unsurprisingly, the FDI values do not display the same fairly distinct distribution pattern as the TNR and Ar_RB (cf. Fig.7.4-7.6), although E47 still stands out as a unique case. Otherwise ruin group E78 (with early type church) is the only of the church farmsteads to clearly follow the above, and expected, distribution. Although the farmsteads with identified infield dyke, but with and without church, distribute fairly evenly, they do overall display overall higher than average FDI values, i.e. are more dispersed. Thus, these farmsteads have an average FDI value of 124.6 as compared to 86.6 of the entire sample. In fact, if excluding the two outliers – the heavily eroded and therefore probably misguiding E77a and E111 – among the emphasized ruin groups (black and red typo in Fig.7.6) all of them have FDI-indexes higher than the entire sample average. This goes some way to support the notion that the FDI does captures some measure of farmstead size and layout. Based on this, I suggest that no large farmstead (unless eroded) should have a FDI lower than 85.0, and the largest farmsteads a FDI over a 100.0. However, while the FDI does seem to summarize some of the difference between more and less dispersed farmsteads, it can only be applied with caution and after qualitative evaluation of ruin representativity. Neither does the FDI help much in differentiating the intermediate types of farmsteads.

The final indicator of farmstead function and wealth to be considered before proceeding with the ruin group classification is the *total area of enclosures* (TAE), i.e. the entire area in m^2 of ruins interpreted as enclosures (as opposed to the actually enclosure area) (Fig.7.7). The TAE works along the same lines as the total area of roofed buildings (Ar_RB) in that it assumes that large enclosed areas – whatever their specific function – must imply the need and capacity to facilitate large herds of livestock. To ensure that the TAE only reflects herding capacity related to individual farmsteads, it only includes certain types of enclosures (types 15-22 in the RD, and if type 21, only such that relate directly to farmstead function, i.e. lie less than 200 m from the dwelling. Note that the massive enclosures of E90 have been excluded because of their special function, see section 6.2.3). The TAE is expected to be a fairly reliable indicator of farmstead size and functions, because they rarely needed to be rebuilt and represent a “maximum capacity” (see section 6.2.3). Conversely, the layout of some enclosure types was largely decided by local topography, and some measure of random inter-site variation must be expected.

Reviewing TAE values of the 107 ruin groups with identified enclosure in this sample (Fig.7.7) the pattern is again fairly striking: three ruin groups – E47, E76, and E4 – are excluded in the figure because their TAE’s are so large (15.224, 10.640, and 6087 m^2, respectively) that they distort the figure. The first two are recurrences from the above highlighted group of large farmsteads with and without church (cf., Fig.7.4-7.6). Recurrent and distinct in Fig.7.7 are also the farmsteads with large churches that – except for E149 and E111 – all have higher TAE values than those with small churches (note that both E78 and E77a lack any recorded enclosures which surely owes to ruin misrepresentation). Another repetition is E178, which occupies a middle position, followed by a suit of ruin groups with larger than average, but declining, TAE’s, which finally evens out into a large group with small and more uniform TEA’s. The average TAE of the entire sample is 234,7 m^2, but it is seen in Fig.7.7 that the church farmsteads rarely have a TAE lower than 350 m^2. This owes to their associated large grazing enclosures (see section 6.2.3), as well as the presence of at least 4 different types of enclosures. Thus, it is realistic to suggest that the largest farmsteads should display a TAE value of at least 350 m^2 divided on at least 4 enclosures, whereas the subsequent suit of larger than average farms should display TAE values of at least 150m^2 divided on at least two different enclosures.

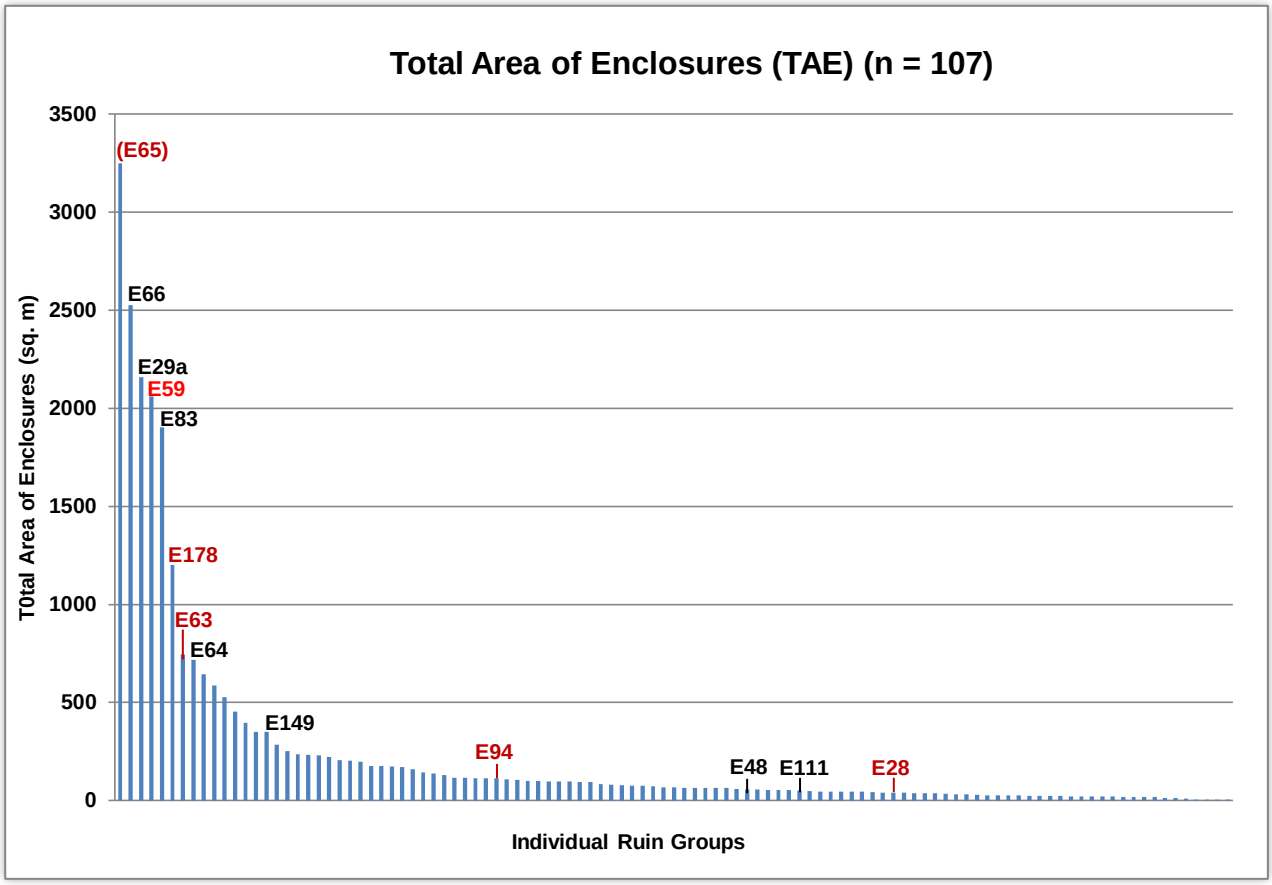

Fig.7.7 Displays the total external areas in sq. m of all enclosures (TAE) at 107 individual ruin groups where enclosures are registered (note that ruin numbers for ruin groups E29/E29a are joined here). Marked in black are ruin groups with an associated church and in red the ruin groups with an associated infield dyke. The figure is discussed in the text.

From the discussion and visualization of the above four ruin group parameters, it is clear that the sites – just as observed for the buildings in chapter 7 – display a notable degree of "fuzziness", i.e. depending on the parameter in question most of the ruin groups distribute differently. This "fuzziness" owes both to different levels of parameter correlation and, as emphasized above, issues of preservation. I will return to both caveats in the below. Despite such issues, some ruin groups nonetheless persistently show up prominently regardless which parameter is scrutinized: most conspicuous is the always exceptional episcopal see of Igaliku/*Garðar* (E47), as well as E59. The unique distinctiveness and geographical proximity of these two sites strongly indicates a special connection between them, but this will not be pursued further here, since they are included only for comparative purposes. The other ruin groups that stand out recurrently are farmsteads with large churches, which are also the sites characterized by massive infield enclosures (cf. Tab. 6.23). All in all, it seem to demonstrate beyond doubt that these ruin groups were really the large and wealthy manors – medieval parish centers – that has been stressed before (e.g., Roussell 1941, Berglund 1982, McGovern 1985, Arneborg 2006), and which stood apart not only in terms of their large churches, warehouses, and representational halls, but their entire farmstead layout and setup of farm buildings.

Just as importantly, the above analysis points to a recurrent assemblage of ruin groups that show up distinctly in some parameters, but not as much in others. Their variation is partly explainable by preservation conditions and they should undoubtedly be interpreted as the next substratum of farmsteads that were clearly not on level with the church manors, but certainly still in the top of the settlement hierarchy. Interestingly, one finds in this stratum all of the farmsteads with small churches, i.e. farmsteads that probably started out in the top of the

settlement hierarchy, but over time – or at least in the accumulated survey evidence – declined in prosperity and was even outcompeted by some farmsteads that had never had a church. The same development was implied by the dimensional distribution of the dwellings (see section 6.2.1). Identifying such large farmsteads without church from survey evidence is especially pertinent, because they have so far largely escaped archaeological recognition and reveal much about overall settlement patterns. Yet, while the above analysis may have provided a guideline for the identification of church manors and large farmsteads, it has only defined an upper limit for the great majority of lesser farmsteads and shielings.

7.1.3 A Functional Classification of Norse Ruin Groups

It is tempting to approach a functional classification of the survey data by pure statistics. I argue, however, that such an approach is impracticable for several reasons: first, almost no variable in the observed parameters display a normal distribution, but almost always display marked positive skewness. The data is therefore poorly suited for a majority of statistic test- and exploratory models (different methods of distribution normalization could of course be applied, but is beyond scope of this study). Second, at many ruin groups single parameter variables could not be recorded, either due to poor preservation or lacking, or varying, archaeological registration. Consequently, a substantial number of ruins and some ruin groups would have to be excluded in a purely statistical approach. Third, a purely statistic approach has no means of taking into consideration ruin representativity at the individual site, i.e. to which an extent ruin numbers reflect survey intensity and erosion (see section 6.1). Fourth, in the functional classification of ruins provided in chapter 7 each building type was assigned a single number in the RD, although some clearly had multiple functions; this would neither be picked up in the statistical analysis. In sum, even if a purely statistic approach was adopted, it would take a considerable extent of qualitative crosschecking and interpretation to validate the implications.

In this classification I therefore aim to take a middle position and combine exploratory statistics with some basic archaeological and qualitative interpretation and assessment. The latter primarily involves drawing on the functional building classification provided in chapter 6 and summarized in App.2. Secondarily, it entails blocking some "noise" ruin group complexity: the structural features and layout of the largest church manors and farmsteads is well established and was also evident in the above analysis, thereby segmenting the economic and functional upper stratum of ruin groups. In the other end of the specter, similar rational argument may be applied by segmenting those sites that could not have been farmsteads.

The ruin groups can be split on three basic functional categories: *simple shielings*, *complex shielings*, and *farmsteads*. The basic archaeological characteristics of these functional types were outlined in section 2.2 and need not be repeated here. Thus, although the below classification draw extensively on this prior record of shielings types and activities – not at least those discussed in the context of Norse Greenland (e.g., Keller 1983, Albrethsen and Keller 1986, Albrethsen 1991) – the below classification is primarily guided by the observed parameters (App.2). In consequence, some suggested site classes are new, while others are familiar from prior investigations. Each of the basic functional categories may be subdivided into a few more particular site types that are discussed in terms of identification, layout, and function, beginning with the simplest type of site and working towards increasing site complexity. Each ruin group type is summarized in terms of their observed parameter variables in Tab.7.1:

Simple shielings (n = 51):

Of the 157 ruin groups in the sample, 54 have no ruin identified as a dwelling (either farmhouse or shieling lodge), i.e. they are per definition shielings and could not have facilitated human or animal habitation over longer periods (note that the single ruins of 170a, 0501, and E300 are assigned to E74, E76b, and E170 in this analysis; there is no information on E167a and E237). They must therefore have served some other specialized outfield activity. I refer to such specialized sites as *simple shielings*, and the 50 ruin groups assigned to this class are treated as a subsample within the total sample of ruin groups.

Fig.7.8 Ruin group E167's ruin no. 16 in the central Vatnahverfi highland, an example of a *rétt*, i.e. a large enclosure used for the gathering of considerable herds of livestock, in this case created by building a wall across a peninsula. The enclosure is located some distance from the other ruins of the group, probably implying it's separate function (*photo: C.K. Madsen 2006*).

Reviewing the 50 ruin groups with no dwelling in App.2, they had between 1-8 other ruins, none of which were cattle housing or grazing enclosures. It should be noted that the two examples with most ruins (7 at E311 and 8 at E296) are poorly preserved, densely overgrown, and mixed with Inuit features. The remaining simple shielings have between 1-6 ruins, none of which were cattle housing or grazing enclosure (see App.2). Ar_RB's of the simple shielings range between 1-130.2 m^2, but on average only 23.6 m^2. Thus, it is reasonable to propose that simplshielings had between 1-6 (8) ruins of which none were dwelling, cattle housing, or grazing enclosure, and with a total roofed building area of some 1-150 m^2. Based on the functional building classification in App. 2, simple shielings can be divided on several different types:

Outfield walls/dykes (n = 3):

A site with only 1-2 stretches of wall/dyke that did not form an enclosure, i.e. sites that only comprised features identified as other wall/dyke (see section 6.2.4, Fig.6.35, type 25 in the RD). As discussed there, this type of feature is probably heavily under-represented, which would also account for the low number in this sample. Outfield walls/dykes were probably related to land demarcation or herding.

Landing place (n = 3):

A site with 1-2 ruins of which at least one is identified as a boathouse (type 10 in the RD). As implied by the label, the site was functionally related to boating, i.e. storing of boats and equipment and consequently always located close fjord or lakes. Such sites are probably also underrepresented as they are most prone to erosion and disturbance by later Inuit settlement.

Rétt (n = 3):

A site with 1-2 ruins of which at least one is identified as an enclosure partly delimited by water (Fig.7.8, type 21 in the RD), whereas the other may be of any type. As discussed in section 6.2.3, they appear to be rudimentary versions of the Icelandic and Faeroese *rétt* (Bruun 1928:288p, 1929:202p, Aldred 2006), i.e. large enclosures that mainly facilitated gathering of substantial numbers of livestock during seasonal roundups. Additional features at the sites indicate that they were also used as milking stations (see below). As also outlined in section 6.2.3, enclosures of this type are probably heavily underrepresented and could likely be increased by more systematic scouting for narrow peninsulas in the outfield. Besides the three separate lying examples, enclosures with similar function are

found at some distance from the other ruins at E64, E164, E167, E169, E174, E184, and E310 (shown in Fig.7.13, but not individually numbered). The very large enclosures with built wall at E90 (see section 7.2.3, Fig.6.22) undoubtedly also served as *réttir* (pl.).

Sheep/goat shelter (n = 2):

A site with a single small feature that is identified as a sheep/goat shelter (type 20 in the RD). With only two examples it seems a doubtful "type". Yet, such structures serving temporary sheltering of livestock in the most distant outfield are known from both Iceland and the Faroe Islands (Bruun 1897:65, e.g., Bruun 1928:194, Joensen 1979:108); and, as discussed in section 6.2.3, sheep/goat shelters are probably highly underrepresented because of their small size – the two examples in this study are only c. 6-6.6 m^2 in external area – rudimentary built, and location far from the farmsteads.

Forage Shieling (n = 4):

A site with 1-2 ruins of which at least one is identified as a storehouse (Fig.7.9, type 9 in the RD). With only four examples of this type of simple shieling it could again be discussed whether it even makes sense to speak about a "type", but it does correspond to similar examples in the Qassiarsuk area that were labeled haymaking *saeters* by Keller and Albrethsen (1986:96, their type C) after Reinton's Norwegian shieling model (see section 2.2.2). I envisage the same basic function for the forage shielings, but prefer to avoid the direct ethnographic parallel because the examples in this sample seems to have had little to do with haymaking in the normal sense, but with use of naturally occurring fodder resources (e.g. shrub vegetation, meadow-hay, cf. Fig.7.9). The forage shielings also seem to be placed so as to be easily accessible, for instance by small boat (cf. Fig.7.9).

Fig.7.9 E90b's ruin no. 1 in the Sioralik, an example of a simple shieling classified as a *forage shieling*, i.e. a ventilated building used for temporary storage of fodder or foods, in this case likely meadow hay from the below outwash plain. The ruin is located on the banks of a small arm of the melt water river, likely for the purpose of transport (photo: C.K. Madsen 2006).

Fig.7.10 Ruin group 1103's single ruin, in the central Vatnahverfi highland, an example of a herder's hut or shelter. Such ruins were – as evident from the photo – rather unsubstantially built and likely served for very temporary occupation (*photo: C.K. Madsen 2011*).

Herder's hut/shelter (n = 8):

A site with a single small building identified either as a shelter/lookout or unspecified roofed building (Fig. 7.10, type 11 & 14 in the RD). Since the herder's huts/ shelters provided temporary shelter for a single or a few herders or travelers, and perhaps a few select sheep/ goats, they had to be somewhat insulated and were all built in turf/stone, stone/turf, or turf walls on a stone foundation. Small huts of similar function are known from Iceland (Bruun 1928:284). The buildings range in area from 5.4-62.6 m^2 and can have up to three small rooms, or one large. The larger examples herder's huts/shelters do resemble tiny versions of the small complex shielings (see below), but always lie on their own and appear less substantially built. V53 excavated by Roussell may represent an example of such a feature (e.g., Fig.5.12).

Milking Station (n = 5):

A site with 1-4 unroofed buildings that are identified as enclosures, separate *lambakró*, or sheep/goat shelters (types 15-16, 18-20 in the RD). Again, it is a poorly exemplified type in the sample, although this probably owes somewhat to archaeological underrepresentation. The absence of roofed buildings at the milking stations suggests that there was no occupation of the site and that milkmaids or herder's would daily walk back and forth between the milking station and their place of residence. This agrees with the observation that the milking stations are located only between 400-1700m from the nearest farmstead or complex shieling. Similar milking stations are also recorded in the Qassiarsuk area (Guldager *et al.* 2002) and in the ethnographic record from elsewhere in the North Atlantic (Bruun 1897:53). The larger TAE of the milking stations appears to set them apart from the sheep/goat shelters, but they are normally not large enough to have been able to serve in seasonal roundups. The shieling excavated in the Kirkespirsdalen (Fig.5.13) could be an example of a milking station (Berglund 1998b).

Dairy shieling (n =15):

A site with at least 1 ruin identified as an enclosure (types 15-16, 18-20 in the RD) and 1-3 ruins identified as a roofed buildings that is not a dwelling or livestock housing (types 1-3 in the RD). This type of simple shieling corresponds exactly to Keller and Albrethsen's dairy saeter (1968: 98, their type B) and there is nothing to add to their basic functional description: it was a shieling that primarily facilitated milk production with a occasional secondary production of fodder. The layout for this site type seems fairly uniform, as for instance reflected in very similar enclosure areas: they overall range between 17.4-72.9 m^2, but with an interquartile range of only 20.9-59.2 m^2. The area of the associated roofed buildings (Ar_RB) is also roughly uniform, spanning from 9.0-83.8 m^2, but with an interquartile range of only 17.9-35.2 m^2. The main reason for separating dairy shielings from milking stations is that the former seems more substantial and – as opposed to the latter type – were intended for temporary habitation and a greater range of shieling activities.

Large simple shieling (n = 7):

A site with at least 3 ruins identified as roofed buildings (types 4-9, 14 in the RD) that are not dwellings or livestock housing (types 1-3 in the RD). With this type of simple shieling, the layout of the sites, as well as the number and size of the buildings is beginning to approach the appearance of a significantly different type of site or, i.e. a complex shieling (see below). This is reflected in the generally high Ar_RB (apart from E312, where half of the ruins could not be located in the dense shrub) and greater variation in types of functional buildings, which implies an increased range of outfield activities. Still, there is no discernable farmhouse or shieling lodge, neither is there any cattle housing. Also, the sites appear somewhat marginal locations in terms of farmland, but often with rich access to other resources (shrub vegetation, meadow-hay, pasturage). The large simple shielings seem to fall in between Keller and Albrethsen's dairy and hay-making saeters (1968:98, their type B-C), i.e. the type is best understood as a transitional type to the complex shielings:

Complex shielings (n = 42):

Having removed the "noise" of the 54 ruin groups without an identified dwelling in the above, 103 ruin groups with dwelling are left in this sample. These ruin groups still present a highly varied batch of survey data, which must reflect real differences in function and size. At the same time, it is a batch of ruin groups that share a lot of the same structural features – i.e. features are normally associated with farmsteads – although they appear in quite varying constellations. Although this is expectable from a survey dataset that consists of accumulated evidence, the slightly more marginal placing, smaller size and lower number of ruins, and more condensed layout schemes of a substantial number of these farmstead-like sites imply that they were, in fact, not regular farmsteads, but shielings, or at least different kinds of farmsteads. Here, I refer to this batch of not-quite-farmstead ruin groups as *complex shielings* and suggest that they came in small and large versions.

While the idea that a considerable number of the farm-like ruin groups could be shielings rather than farmsteads has been vaguely hinted at before (e.g., Nørlund and Stenberger 1934:45, Roussell 1941:45), but it is only Keller and Albrethsen (1986) that have attempted to define a framework for their interpretation. As outlined in section 2.2.2 and in the above, their classification model was based on Reinton's basic, but pioneering tripartite model of full-shielings, dairy shielings, and haymaking shielings (with a lot of ethnographically recorded sub variations (Reinton 1955, 1969). In their study of ruin groups in the Qorlortuup Itinnera valley, Keller & Albrethsen suggested that a number of their sites should be interpreted as full-shielings (1986:Tab.1-2) and proposed following definition:

'The ruin group should consist of living quarters and pens, possibly with barns and byres, and be located where full-time settlement seems unlikely. Elevation is probably important. Other conditions may, however, influence its position, such as local weather conditions that would make even the low country unacceptable for year-round settlement, but would permit summer settlement ' (Ibid.96).

In my opinion, the definition offered by Keller and Albrethsen touches upon all the central aspects of the sites that would appear not to be regular farmsteads, but shielings of a more complex type; the definition needs only to be specified to suit the quantitative parameter variables in this study. Thus, the concept of complex shielings introduced here is in some concerns, and at least functionally, parallel to their, and Reinton's, full-shieling. Besides evading unqualified parallelism, the new label term also means to signify the greater range of economic activities carried on the complex shielings, and the fact that they very likely changed function over time (see below).

In the above section 7.1.3, four parameter variables – the total number of ruins (TNR), the total area of roofed buildings (Ar_RB), the farmstead dispersion index (FDI), and the total area of enclosures (TAE) – were explored and it was demonstrated that these variables at least isolate the largest farmsteads. Summarizing the investigated parameter variables it was found that the church manors and largest farmsteads were characterized by being ruin groups displaying 1) at least twelve identified roofed buildings; 2) a total roofed area of at least 750 m^2; 3) a farmstead dispersion index not lower than 85 m^2; and 4) a total area of enclosures no less than 150m^2 divided upon least two enclosures (cf. App. II, cf. Tab.7.1). Since the complex shielings in terms of their layout and buildings were, as just described, simply miniature farmsteads it is sensible that they can be differentiated by the same parameter variables.

However, as visible from the figures in section 8.1.3, even the church manors and largest farmsteads showed considerable variation within the different parameters. As discussed, at least part of this variation is explainable by varying preservation conditions, survey intensity, and micro-topography. The variability is reflected in the varying degree of parameter variables correlation: with the total number of ruins (TNR) being the independent variable, the total area of all roofed buildings (Ar_RB), unsurprisingly, shows the highest correlation coefficient (r = 0.84), the total area enclosures somewhat less (r = 0.51), and the farmstead dispersion index the least (r = 0.44). In short, while all the parameter variables display positive correlation, no single parameter can stand on its own in the – statistically significant – classification of a site. Joining all of the parameters seems the logical solution.

Fig.7.11-7.12 displays to runs of multivariate cluster analysis (hierarchical unweighted pair-group average) of the TNR, Ar_RB, FDI, and TAE of 98 of the ruin groups with dwelling (note that five ruin groups that include only a single dwelling have been excluded because they provide no FDI-value, which is of little concern because they cannot have been regular farms in any case). One run (Fig.7.11) accentuates the FDI before the TAE, the other run (Fig.7.12) the opposite. Both analyses agree to considerable extent, but the first run (Fig.7.11) seems to better summarize the largest sites, the second run (Fig.7.12) the smaller sites. There is little to be said on the difference between the two runs, except that it should be accentuated that cluster analysis is an explorative statistical approach and can essentially be tweaked to produce just about any outcome. However, as both cluster analysis runs are based on average euclidean distance and not a predetermined number of clusters, the two runs are, at least statistically, unbiased.

The fact that both runs to notable extent capture – but display differently – the largest sites with and without church (cf. section 7.1.3) lends credibility to the model and to the notion that it can be applied to the ruin groups in lower settlement substrata as well. Accordingly, I mainly rely on the cluster analysis in the classification of farmsteads and shielings. Evidently, the cluster analysis does not specify exactly where one site class ends and a new one begins, so a good measure of archaeological interpretation and assessment is involved in the differentiation. It should also be noted that the cluster analysis does not take into consideration the sites with multiple farmhouses or shieling lodges where the associated outbuildings cannot be divided on particular dwellings (E72, E75, E76, E167, and E171). Such sites record in the analysis as single large sites, which are separated by argument of their multiple dwellings. Neither does the cluster analysis take into consideration issues of ruin representation, sites where *réttir* were assigned to a ruin group, but probably different use (e.g., E165, E169, E174), or the altitude of a site (a separate cluster analysis was run including this variable (ELE_MASL), but showed little apparent difference, probably because it is recorded as categorical data). In cases where I depart from the cluster analysis in the classification, interpretational arguments are explained individually for each case.

Small complex shieling (n = 23):

The small complex shielings show up fairly distinctly in both cluster analyses (cf. Fig.7.11-7.12). In terms of function and layout, small complex shielings combine features of dairy-shielings and large simple shielings (cf. Tab.7.1), the main difference from the latter being that the small complex shielings have an associated dwelling, i.e. could facilitate longer occupation. However, because of the fairly small size of the dwelling (50-250 m^2) and the lack of any type of cattle housing (cf. Tab.7.1), it is unlikely that the small complex shielings could have been occupied throughout the year. This is corroborated by the fact that no midden is observed at any of the sites (App.2). On the other hand, the number and size of the buildings suggest multiple shieling activities, which seem to have included both milk and fodder production (both storehouses and caprine enclosures are often found at the sites, cf. App.2, Tab.7.1). The layout of the small complex shielings was notably more clustered (average FDI = 32.8) than the large complex shielings (see below). They seem to come in two sub-types, one with a rectangular shieling lodge divided on three rooms (e.g., 0901, E90c, E175) and another rounded type with 3-6 clustered small rooms (e.g., E80b, E293, E80c). In short, the small complex shielings were a type of full-shieling, but probably only facilitated few people and mostly sheep/goat livestock during summer months.

Large complex shieling (clustered) (n = 19):

The large complex shielings show up fairly distinctly in both cluster analyses, but require some reclassification of individual sites in both analyses (cf., Fig.7.11-7.12). Whereas differentiating the large complex shielings from the small is fairly straightforward, separating them from small farmsteads (see below) is more difficult because they share so many similar traits. However, slight differences seem to set the large complex shielings apart: they tend to have fewer and less varied buildings than the regular farmsteads; they are more clustered (cf. Tab.7.1), and normally located more marginally in terms of access to resources. In accordance with the elevation site selection criteria discussed in section 8.1.2, sites that would have been classified as a farmstead but are located above 75-100 m.a.s.l. are instead interpreted as large complex shielings (e.g., the reclassification of E70 and E168 in Fig.7.11-7.12). Sites that consist of multiple dwellings (e.g., E167, E72) have also been reclassified to better reflect the size of the individual functional units.

The large complex shielings should principally be interpreted as the most varied and extensive type of Norse full-shieling, but where shieling activities had the most comprehensive scope; basically all functions of the regular farmstead were continued. Besides the above arguments, the interpretation of these sites as shielings and not farmsteads rests upon relation to corresponding lowland farmsteads (see below). That all the normal types of artifacts normally associated with farmsteads have been found at excavated large complex shielings (Vebæk 1992:76p) is expectable; many activities of the permanent farmstead would have continued and, for instance, finds of numerous artefacts related to textile production implements could even be taken as a shieling indicator because this activity was, in the context of the North Atlantic, mostly the women's domain (Hastrup 1989, Bratrein 1996:8, Myhre and Øye 2002:388). However, with their more substantial buildings and in a few cases cattle housing, it seems likely that many large complex shielings could have functioned as regular all-year small farmsteads during times with a large enough population to sustain them. Pollen-investigations at E70 (Ledger *et al.* 2013a) and the excavation of E74 (see section 5.1.3) have demonstrated exactly this kind of dynamism to the shielings. Both the small and the large complex shielings seem to correspond with Keller & Albrethsen's full-shieling (1986:98, their type A).

Small (clustered) farmstead (n = 15):

The label for this site class is self-explanatory and its basic characteristics outlined in chapter 6; they are simply the smallest examples of farmsteads. Obviously, the distinction between large complex shielings and medium farmsteads (see below) is fairly arbitrary and in this case based on interpretation of the cluster analyses, both of which imply a fairly distinct group (cf., Fig.7.11-7.12). Also, reviewing Tab.7.1 the small farmsteads on average appear slightly larger and more varied in their functional layout than the large complex shielings.

Medium (dispersed) farmsteads (n = 31):

Medium farmsteads are next in this site graduation and the first class to display the full range of functional buildings, often in multiple examples (cf. Tab. 7.1). The medium farmsteads also seem to separate from the small by their generally more dispersed layout. It is the most common site type in the dataset and appears fairly distinctly in both cluster analyses (Fig.7.11-7.12).

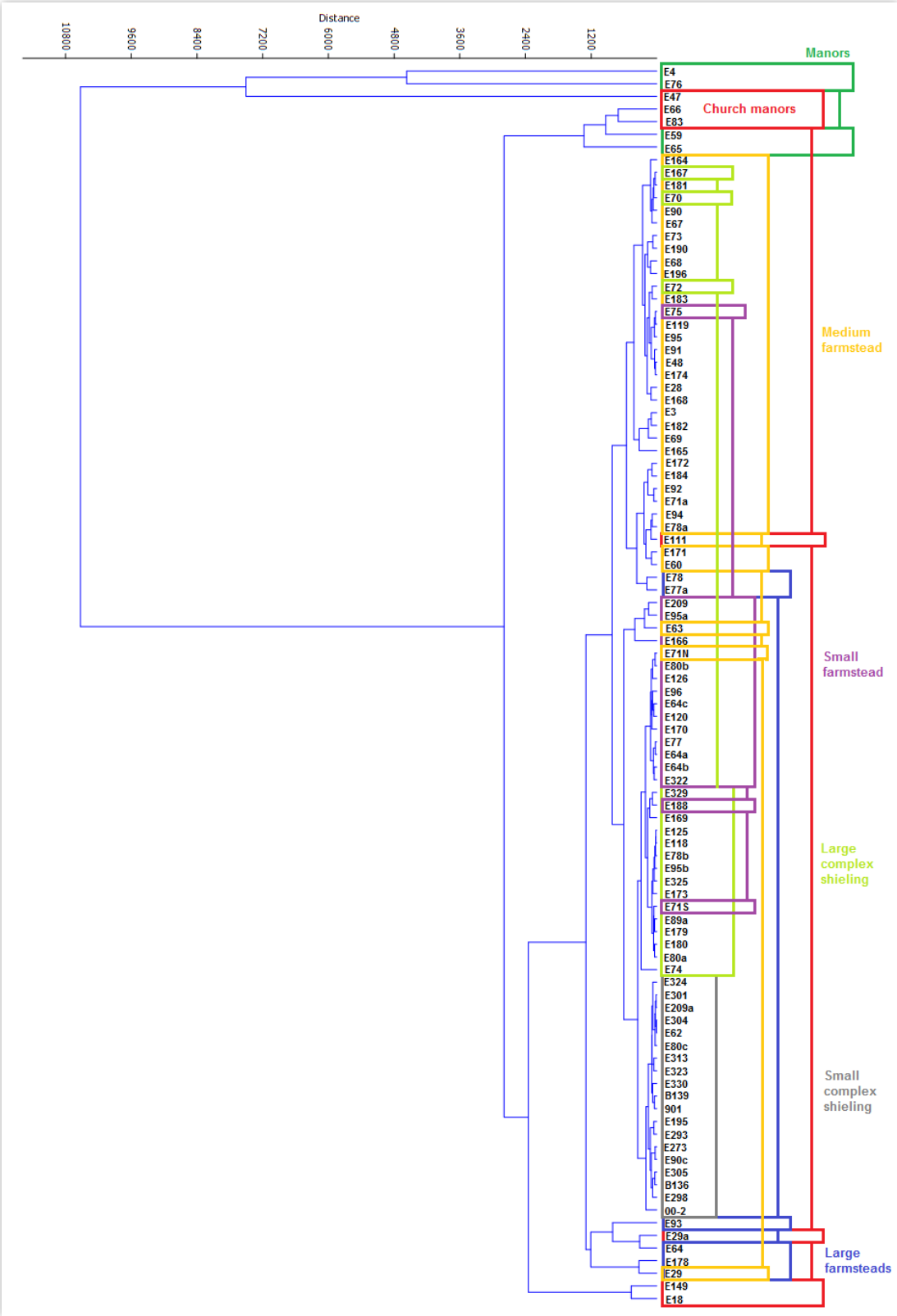

Fig.7.11 Multivariate cluster analysis (hierarchical unweighted pair-group average) of the TNR, AR_RB, FDI, and TAE of 98 of the ruin groups with dwelling and other ruins. Blue lines on the left displays the original cluster "dendrogram", colors on the right the interpretation of these clusters in terms of site classes.

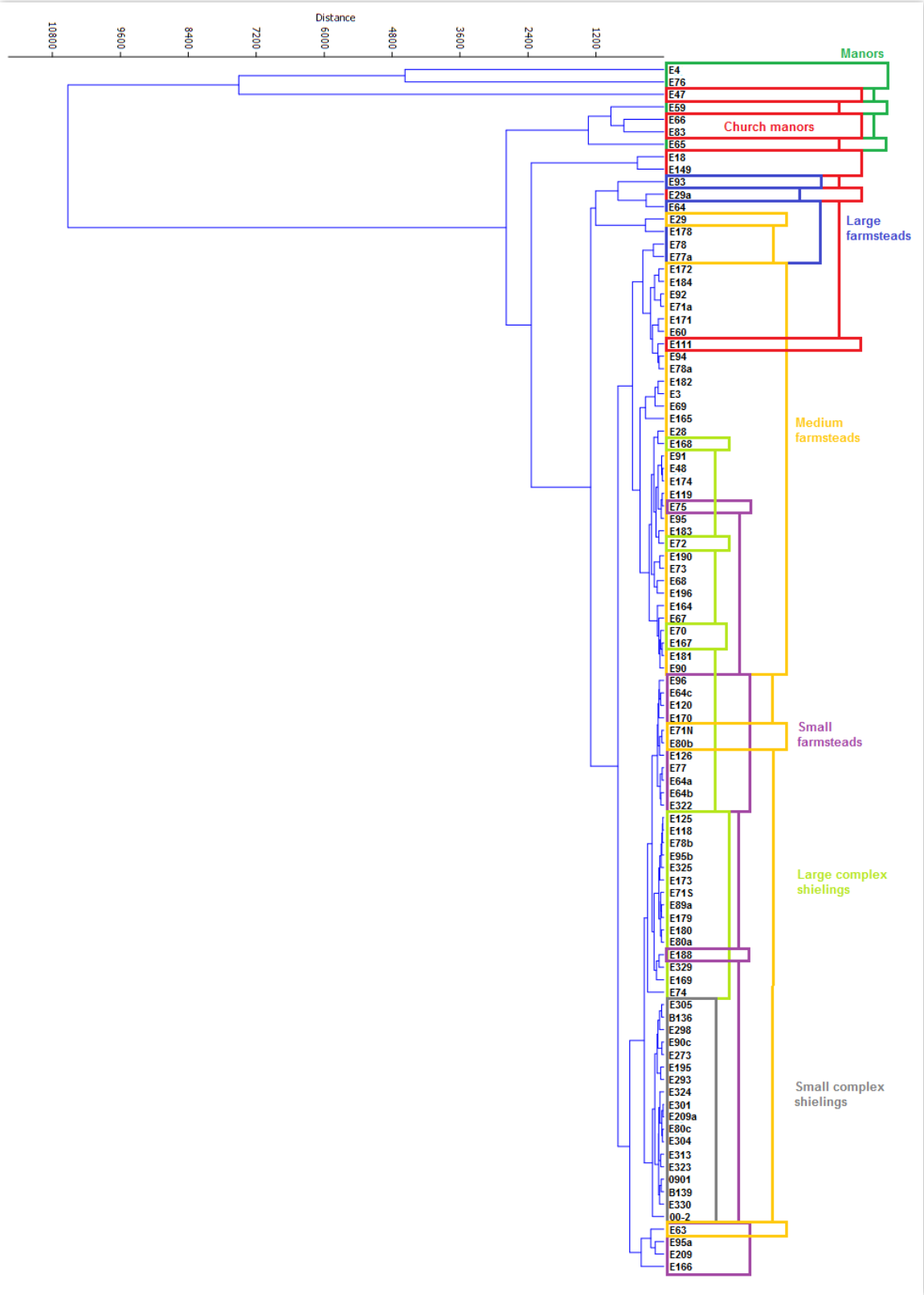

Fig.7.12 Multivariate cluster analysis (hierarchical unweighted pair-group average) of the TNR, AR_RB, TAE, and FDI of 98 of the ruin groups with dwelling and other ruins. Blue lines on the left displays the original cluster "dendrogram", colors on the right the interpretation of these clusters in terms of site classes.

Large (dispersed) farmsteads (n = 5):

Five ruin groups display such a number and scale of functional buildings that they stand out quite distinctly from the medium farmsteads in the cluster analyses (cf. Fig.7.11-7.12; note that ruin group E29 classifies within this group in both analyses, but was reclassified to a medium farmstead based on its proximity to church farmstead E29a, which probably was the dominant farm and owner of several of E29's buildings). However, while these were undoubtedly large farmsteads, it is worth noting from Tab.7.1 that they stand apart from the medium farmsteads only in terms of building sizes and numbers, not by building dispersion or basic functional layout. Consequently, they probably simply constituted the highest stratum of ordinary farmsteads with few other functions to set them apart. It is interesting to note that two examples within this class – E64 and E78 – had associated small (early) type churches. As discussed above, this would suggest that these early church farms never developed into manors or parish centers – E48 seems to have never developed beyond a medium farmstead – which in turn would imply a process of centralization, where wealth and influence ended up on fewer hands as evidenced by the next class of site:

Manors (highly dispersed) (n = 4):

In the analysis, four sites without an identified church stand out from the large farmsteads to such an extent (Fig.7.11-7.12) that they call for a separate class, here designated *manors*. This label is loosely borrowed from Icelandic settlement history and archaeology (Júlíusson 2010) – as a rough equivalent to an estate (Vésteinsson 2005b:19, 2007:123p) – but parallel interpretations should not be taken too far; it seems unlikely that the small and lightly settled communities of medieval Norse Greenland could have sustained many manors of the type known from later-medieval Iceland. The term 'manor' thus mainly serves to set these sites apart from the three classes of regular farmsteads. A reason to separate the manors from the regular farmsteads is that they stand out in the size and scale of the buildings, as well as in a notably more dispersed layout (cf. Tab.7.1). Thus, in terms of their functional setup, the manors appear almost identical to the church manors, i.e. they only lack the church. It is therefore not unreasonable to assume that they had the same supra-local economic importance as the church manors, i.e. as centers of governance, labor, fodder, and livestock.

Two of the ruin groups classified as manors – E59 and E76 – are notable repetitions from the above section 7.1.3 discussion of the features of the largest ruin groups. The other two sites – E65 and E93 – are new: the latter site stands out as the mostly impressive ruin group in the Alluitsup Kangerlua/*Siglufjörður*; the farmstead layout with a great number of smaller livestock buildings – in addition to sizable dwelling and stable-complex (App.2) – implies that this farmsteads economic wealth was largely based on large herds of sheep/goat husbandry. The manor of E65 seems to less convincing and stands out mostly because of its large grazing enclosure, as well as its massive dwelling and stable-complex. Otherwise, E65 seems to lack the many outbuildings of the other manors, which could owe to erosion. Speaking in favor of the interpretation of E65 as a manor is also the presence of a double sheep/goat shed (see section 6.2.1), a building type mostly recorded at the church manors, and a very nicely built and preserved large compartment with inner stone facing that forms part of the dwelling and could have a representational hall (Fig.7.13). However, this of course needs to be verified by excavation.

Church manors (highly dispersed) (n = 7):

The nature and layout of the church manors have been outlined several times and will not be repeated here. The cluster analyses (Fig.7.11.-7.12) agree on the separation of these impressive sites and their great scale – even compared to the regular manors – is plainly visible from Tab.7.1 (note that E111 falls into the class of medium farmsteads in both analyses, a circumstance that is explained by violent erosion). However, it should be observed that all the sites classified as church manors are characterized by having large churches, i.e. parish churches. Besides their notable scale, the church manors are characterized by their multiple grazing enclosures and their much dispersed layout (cf. Tab.7.1). Also, as described in sections 6.2.3 and 7.1.3, the church manors stand out by having dykes fencing their massive infields (only E83 lacks an infield dyke) and irrigation features (E47 and E66). Whereas the large grazing enclosures imply significant surplus livestock rearing and reservoir function, the infield dykes and irrigation features imply pooling of labor, or labor effort, at the church manors, although this was also noted for the manors without identified church.

Fig.7.13 Ruin group E65's dwelling (ruin no. 1) includes a very well-built stone faced room, which could perhaps be an example of the representational halls known from the largest Norse church sites (the room appears to have been cleared or excavated, but I have been able to find no record of such investigation (*photo: C.K. Madsen 2005*).

7.1.4 Section Summary Discussion

The above section 7.1 has presented a classification of 157 Norse Greenland ruin groups divided into three main groups: simple shielings, complex shielings, and farmsteads. The first site class is recognizable from its lack of dwellings, while the other two classes demand detailed analysis for their differentiation. Employing cluster analysis of four parameter variables – total number ruins, the total area of roofed buildings, the overall dispersion of farmstead buildings, and the total area of enclosures – the farmsteads have been divided on five classes of gradual increasing size and complexity: shieling that were seasonally occupied – the large complex shielings probably permanently during settlement peak – and variously sized farmsteads.

Cluster analysis is an explorative statistical approach and because the analyzed survey data presents accumulated settlement evidence, class distinctions will remain speculative and somewhat arbitrary until a more rigorous framework for the chronological development of the sites and buildings have been established. Tab.7.1 displays the overall characteristics of the distinguished classes based on the grouping of the functional buildings presented in chapter 6. As seen from the table, the sites display the expected notable overlaps from site class to site class, but the overall transgression to large and more complex sites is equally apparent. However, Tab.7.1 should not be envisaged as a strict definitional tool for the identification of site classes, but more as a helpful guideline in the sense that the Norse sites should be fitted into the model based on which class variables they agree with the most.

In spite of the problematic classification issues, both Tab.7.1 and the cluster analysis do suggest the presence of fairly distinct site classes, which in total included 58 farmsteads – hereof 46 in the Vatnahverfi region – and 91 shielings – hereof 89 in the Vatnahverfi region (Fig.7.14). The site class distinction is also affirmed by independent additional evidence: it is noted that infield dykes, double sheep/goat sheds, and irrigation features are almost exclusively found on the large farmsteads, manors, and church manors. This distribution pattern could reflect hierarchical, chronological, or both, conditions, but would certainly be worth investigating in the future. However, a more pertinent and readily applicable method of cross-checking the classification model is to subject it to a settlement pattern analysis: if the model is valid, the different functional sites classes should relate in a meaningful manner in the overall layout of settlement.

Tab.7.1 A Functional Classification of Norse Ruin Groups

	TNR	No. Roof. Build.	AR_RB	Mean FDI	TAE	No. Dwel-lings	Midden (yes/no)	Cattle house	Live-stock house	Sheep /goat house	Store-house	Other Roof. Build.	Caprine enclo-sures	Grazing enclo-sure	No. Ruin Groups[5]
Simple Shielings:															
Outfield wall/dyke	1-2	0	0	-	0	0	No	0	0	0	0	0	0	0	3
Landing Place[1]	1-2	1-2	< 50 m^2	-	-	0	No	0	0	0	0	1-2	0	0	3
Rétt[2]	1-2	0	0	-	> 200m^2	0	No	0	0	0	0	0	1	0	3 (11)
Sheep/goat shelter[3]	1	0	0	-	< 10m^2	0	No	0	0	0	0	0	1	0	2
Forage shieling	1-2	1-2	-	-	< 75m^2	0	No	0	0	0	Min. 1	Max.1	0	0	4
Herder's shelter/hut[4]	1	1	< 65m^2	-	0	0	No	0	0	0	0	1	0	0	8
Milking station	1- 4	0	-	-	10-80m^2	0	No	0	0	0	0	0	1-4	0	5
Dairy shieling	2-6	1-5	< 100m^2	-	15-80m^2	0	No	0	0	1	Max.1	Max.4	Min. 1	0	15
Large simple shieling	3-8	1-8	50-100m^2	-	-	0	No	0	0	1-2	1-2	2-8	1-2	0	7
Complex shielings															
Small complex shieling	1-7	1-6	35-285m^2	32.8	20-200m^2	Min. 1	No	0	1-2	1-2	1-2	1-4	1-2	0	20 (23)
Large complex shieling	4-12	2-8	200-1000m^2	80.0	20-250m^2	Min.1	Yes/no	Max.1	1-5	1-3	1-3	1-3	1-8	0	19 (17)
Farmsteads															
Small Farmstead	7-16	6-13	200-1000m^2	84.1	30-700m^2	Min.1	Yes	1-2	1-2	1-5	1-3	1-6	1-7	0	12 (12)
Medium Farmstead	8-24	6-20	750-1500m^2	102.1	40-700m^2	Min.1	Yes	1-4	1-5	1-5	1-4	1-8	1-7	Max. 1	31 (25)
Large Farmstead	12-24	8-20	1000-2200m^2	107.6	100-1200m^2	Min.1	Yes	Min.1	1-5	Min.1	Min.2	1-8	2-5	Max. 1	5 (5)
Manors	>15	10-30	1000-3000m^2	117.5	2000-12,000m^2	Min.1	Yes	Min.1	3-5	Min.1	2-4	2-8	2-8	1-3	4 (2)
Church Manor	>15	15-40	1200-3000m^2	125.6	-	Min.1	Yes	2-4	3-5	Min.2	2-6	2-10	3-8	1-4	7 (1)

Tab.7.1 Summarizes the characteristics of the functional classification on shielings and farmsteads. As visible, there are notable overlaps between several different site classes. However, they do present a gradual transition from the least to the most complex sites.[1] One ruin must be classified as a boathouse (10). [2] One ruin must be classified as a enclosure partly delimited by water (21); number in bracket indicates rétt located near farmsteads and not assigned a unique ruin group number. [3] The ruin must be classified as a sheep/goat shelter (20). [4] One ruin classified either as other roofed building (14) or lookout/shelter (11). [5] numbers in bracket indicate the number of ruin group in the Vatnahverfi region.

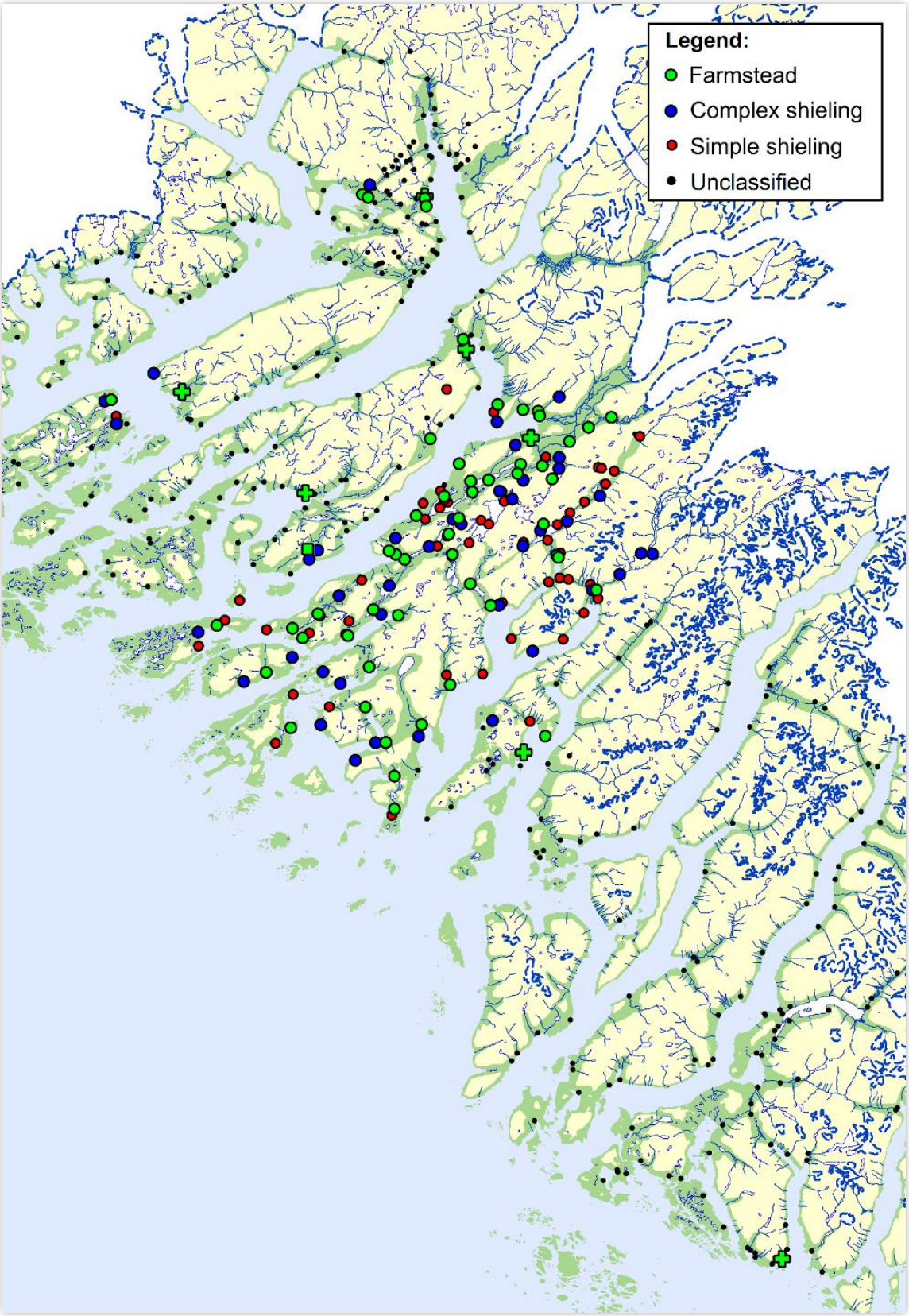

Fig.7.14 Displays the classification of the ruin group in the survey dataset divided upon three main classes of sites: simple shielings (red, n = 50), complex shielings (blue, n = 39), and farmsteads (green, = 59).

7.2 The Functional Settlement Landscape of the Vatnahverfi

Fig.7.15 The landscape setting of ruin group E178 in the innermost part of the Torsukattak, outer fjord Vatnahverfi region. The farmstead – one of the largest in the area – is situated on the isthmus on the far side of the river. The dry grass vegetation on the old infield and in the nearby meadow is plainly visible (*photo: P.B. Heide 2009*).

Having functionally classified the 157 Norse Eastern Settlement ruin groups in this survey dataset in section 7.1, section 7.2 explores how the different site classes distribute in the landscape: as just specified, if the site classification is valid, the farmsteads and shielings should display a meaningful functional and relational distribution in the landscape. However, in order for this approach to work, it will include only the 133 ruin groups from the Vatnahverfi region because they represent an – almost – complete settlement system, whereas the remaining sites were included for comparison and cannot be related (geographically).

Section 7.2 splits on two exploratory investigations: the first is a more formal mathematical approach, where the sites in the Vatnahverfi region that are classified as permanently occupied (i.e. the farmsteads) are used to create voronoi regions (or Thiessen's polygons) to investigate how they compare and match up with the sites that were not permanently occupied (i.e. the shielings). Besides indicating the validity of the classification, this analysis provides a framework for discussion overall functional settlement layout in the Vatnahverfi. In the second part of section 7.2, the settlement aspects are approached more "intuitively", i.e. using site classes and natural topographical boundaries to describe settlement patterns in the sub-regions of the Vatnahverfi. The chapter closes with a summary discussion of the findings in section 7.3.

7.2.1 Farmstead and Shieling Distribution

Based on the North Atlantic setup of transhumance, it gives that a seasonally occupied shieling should always have a matching "permanently" occupied farmstead. Thus, one way of checking if the site classification presented in section 7.1 is valid is by crosschecking it with the relational distribution of farmsteads and shielings in the Vatnahverfi region. One way of doing this, is by separating the landscape on voronoi regions:

Voronoi regions – also known as Thiessen's polygons – are regions created from points, where each polygon contains the area closest to that point. If the permanently occupied farmsteads are the points in this analysis, then one would expect its associated shielings to lie within the region, i.e. "the area of the farm". The simplicity of this approach is beguiling, but it also comes with issues:

First, the analysis is purely mathematical and does not take into consideration the natural and topographical features of the landscape. The fjords of south Greenland extent after a fairly random pattern; and since we know that natural features were often used to define ownership boundaries in the Middle Ages (e.g., Myhre and Øye 2002:309), the simplicity of mathematically defined the Voronoi regions is problematic. Second, the Voronoi regions are of course based on the assumption that all the points are present, something we cannot be sure of in terms of the Norse sites, although I have argued for a general high level of representativity in the Vatnahverfi region in the above (see section 4.2.4). Third, the voronoi regions do not consider that some area could have been commons. However, often such issues are not more aggravating than they can be resolved – at least on basic level – by interpretation.

Fig.7.16 displays a voronoi region analysis of the 133 ruin groups in the Vatnahverfi, where regions have been built around the 45 sites classified as "permanently" occupied farmsteads in the Vatnahverfi region. Even a first brief inspection shows that a model as simple as the voronoi regions captures a notable extent of settlement cohesion and there are several implications from the figure:

The model clearly seems to work best in the outer fjord, which is likely an effect of decreased settlement intensity in this sub-region to distort patterns. However, the model also seems to work agreeably in the central Vatnahverfi region, although there is clearly more settlement "noise" to distort the picture. However, lowland farmsteads (E69, E71N/S, E78a/E196, and E166) match up nicely with complex shielings at higher altitude (E70, E167, E175, 1104). The correlation model seems to work most poorly in the northern Vatnahverfi, except for E64/E209's upland complex shieling E293 and E60's two associated shieling simple and small complex shielings. Notably the three small farmsteads of E64a, E64b, E64c all seem to lack shielings (although E168 could relate to E64c). If not a flaw of the classification- or the voronoi regions models, this lack is so conspicuous that it would be tempting to search for shielings in the highlands above these farmsteads, even though they are fairly steep and high.

Of the 11 farmsteads with no clearly associated shielings, this can at least in a couple of the cases be explained by the layout of the fjords, while in other cases there are shielings lying so close to "territory" boundaries that they could easily belong to the neighboring farmsteads. Still, the lack of shielings at E65, E71a, and E171 in a well-surveyed and presently settled area is puzzling, and one would be tempted to view the medium sized farmstead of E71a serving a similar function of shieling for the manor of E65. In regard to boundaries, it is interesting to observe how many of the shielings – especially the complex examples – lie just on the verge of two "territories". One explanation for this distribution pattern could be that the complex shielings were really small farmsteads, which one would expect to display a fairly even dispersion, i.e. occupying land in between other existing farms. Another explanation could be that the distribution pattern is real and intentional, i.e. that shielings were located on the border of farmsteads, perhaps a way of asserting private ownership boundaries.

Finally, it is also clear from brief visual inspection of Fig.7.16 that farmstead "territories" increase as one move out from the inner to the outer fjord. This is not because the farmsteads in the outer fjord were larger, but rather because their associated pasture- and resource land was of poorer quality (see section 3.2.2) and larger areas were needed to maintain the same number livestock as in the middle and inner fjord. It serves as warning that voronoi regions cannot stand on their own in classifying farmsteads. One interesting aspect of different settlement patterns in the outer fjords that is plainly visible from Fig.7.16 is how the shielings shift

from being located upland from the farmsteads to being located at horizontal distance instead. This practice of horizontal shieling seems the most clear and conspicuous aspect of outer fjord settlement in the Norse Eastern Settlement, which I will return to in the below.

The voronoi region model to some extent confirms the classification of the ruin groups, although there are clearly also some that fall outside any explainable pattern. Using the voronoi model as a guideline, the aim of section 7.2.2 is to explore if these inconsistence can be resolved by a more traditional interpretive approach of the farmstead shieling interrelationship.

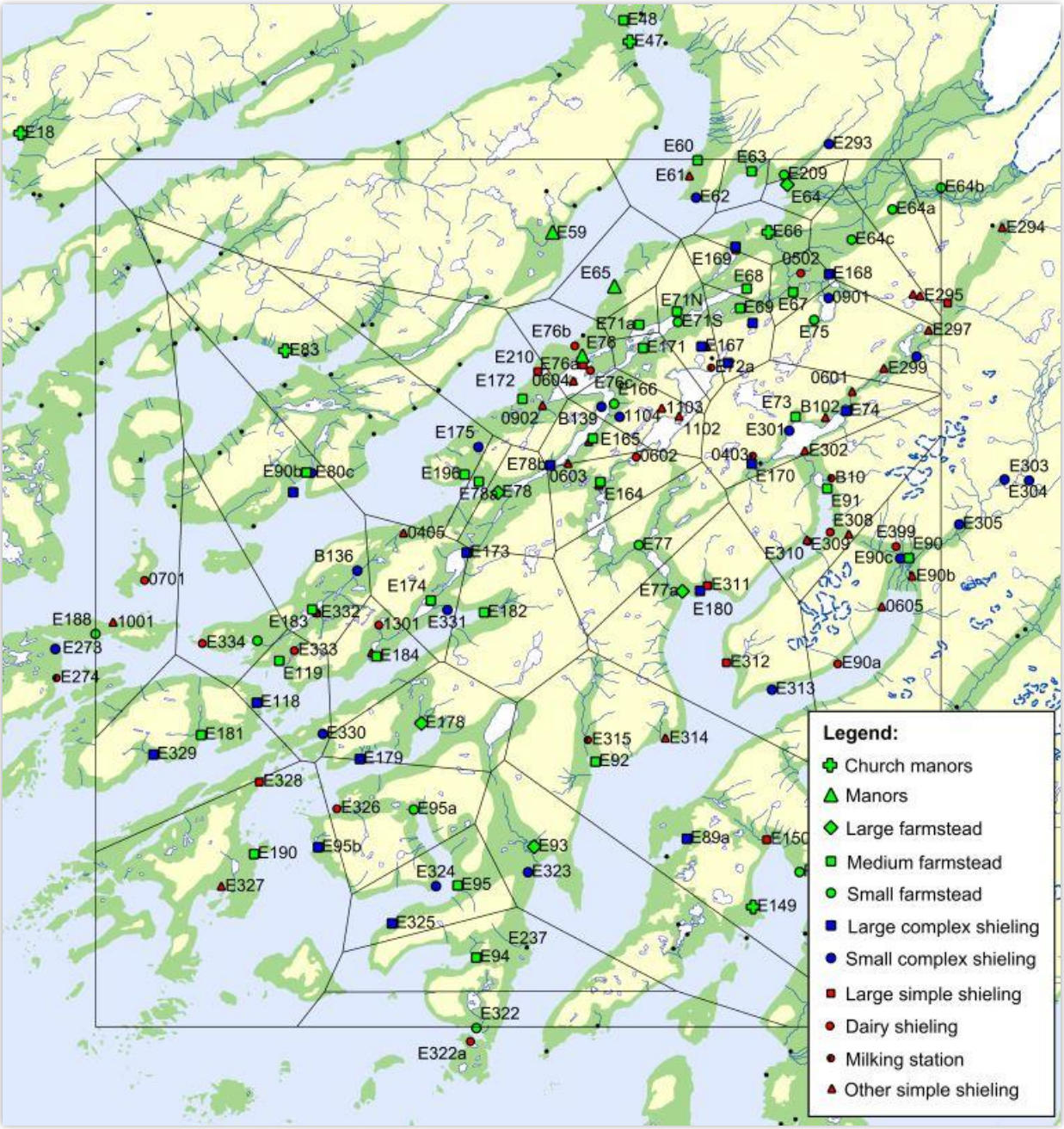

Fig.7.16 Displays the a voronoi region (Thiessen's polygons) analysis of the ruin groups functionally classified as farmsteads to compare their distribution with ruin groups identified as shielings. Optimally, these two main site classes should match up, which they do in the majority of cases, thereby certifying the validity of the classification model.

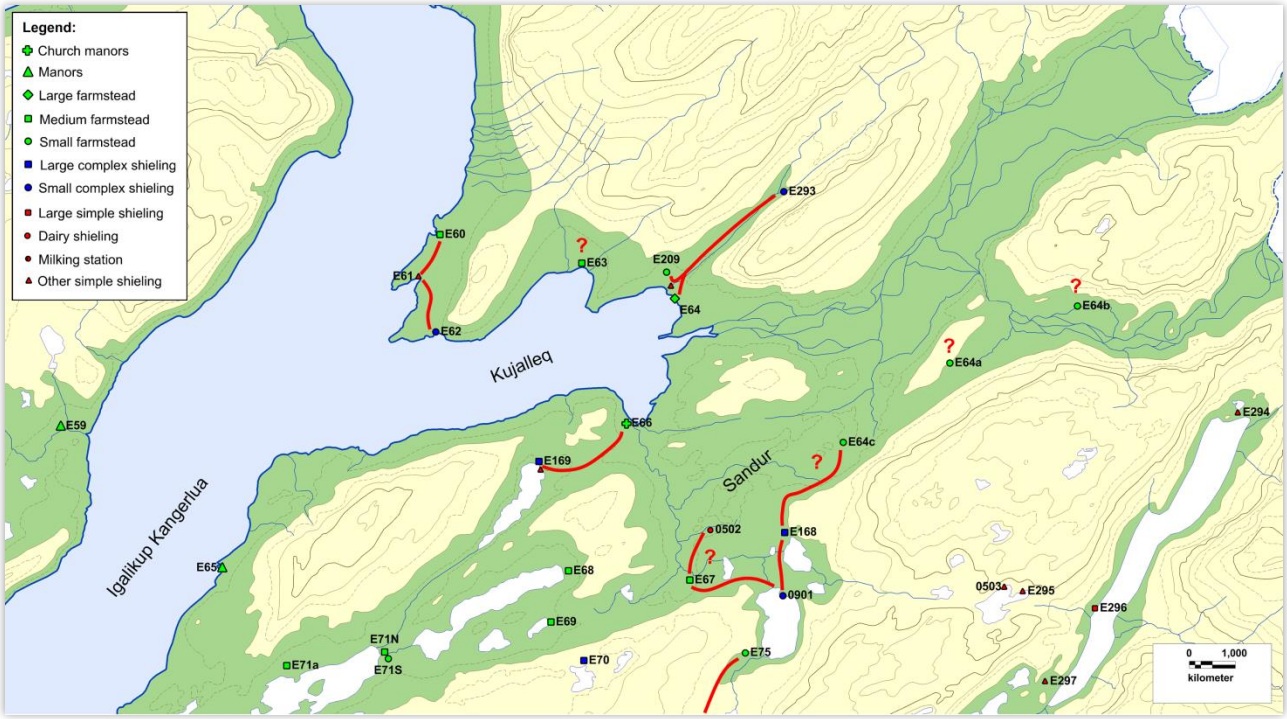

Fig.7.17 Farmsteads and associated shielings in the north Vatnahverfi region (conf. text).

7.2.2 Farmstead and Shieling Interrelation

The issues relating to interpretation of the voronoi regions were outlined above and section 7.2.2 takes a more straightforward approach to the model by trying to functionally match the site classes that are indicated by the voronoi analysis. In the below, 'voronoi territories' simply signify the areas indicated by Fig.7.17.

Northern Vatnahverfi region (Fig.7.17):

The northern Vatnahverfi region and the Kujalleq fjord present two fairly well-defined settlement areas divided by the near impassable melt water river from the inland glaciers: on the north side of this river and the Kujalleq are four farmsteads, two of medium size, one small, and one large. It appears a fairly simple settlement layout, where E64 was the dominating church farm and the nearby E209 a subsidiary farmstead lying in such close proximity that they should likely be interpreted in terms of a double- (multiple-) farm. Belonging to this farm was an upland small complex shieling (E293). It seems likely that the two medium farmsteads E60 and E63 were also subsidiary to E64; otherwise it is hard to explain the presence of such a relatively large farm in this fairly marginal resource area. E60 had two associated shielings – one small complex shieling and a conveniently located forage shieling in between, whereas E63 seems to lack a shieling.

South of the melt water and the Kujalleq, the northern Vatnahverfi region is completely dominated by the church manor of E66, which voronoi territory is fairly large (Fig.7.17). E66 is a double-farm with the church manor located on the western of the river and small farmstead on the eastern. This is, in fact, exactly the same setup as at E64, only there the ruin groups have been assigned different numbers although the distances between the related dwellings at E66 and E64/E209 is about the same. Part of the double farm E66 was undoubtedly the large complex shieling E169, which additionally served as *rétt* when the livestock of the church manor had to be rounded up. Again, the setup is identical to the north side of the Kujalleq.

Moving east from E66, there is quite a distance to the next farmsteads, which is probably testimony to the great size of the church manor: on the other side of the *sandur*, E64a-E64c form the northernmost part of the chain of farmsteads that run through the entire length of the Vatnahverfi; they are all small farmsteads, none of them with a clearly associated shieling, although seems quite

likely that large complex shieling E168 could have belonged to E64c, while 0901 was the complex shieling of medium farmstead E67, which appears to have had an additional associated simple milking shieling (0502). In support of the latter interpretation is the peculiar and slightly upland farmstead E75, which is a triple-multiple farm with three centralized dwellings (which accounts for its classification as a small farmstead although both cluster model runs suggest it was a medium farmstead, cf. Fig.7.11-7.12). The reason that E75 is not associated with either the closer 0901 or E168, but the instead more distant complex shieling E72 is that the latter ruin group is a triple-shieling, i.e. has three identified shieling lodges (and similarly to E75 should probably be classified as a small complex shieling, although I have decided to stay with the cluster analysis in this case). It is reasonable to assume that this triple farmstead and shieling was related.

Central Vatnahverfi region (Fig.7.18):

Moving into the central Vatnahverfi region, it overall appears the most regularly and densely settled area of the Vatnahverfi region with farmsteads neatly organized along the length of the central lake basin: from the north, medium farmstead E68 appears to have no associated or located shieling, but its voronoi region (Fig.7.16) extends upland to the north and E169, which could have been related to it. The next medium farmstead E69 is clearly associated with small complex shieling E70. Equally clear is the relation between the double farmstead of E71 (N/S) and the upland double large complex shieling E167, which additionally served as a *rétt*. The next to medium farmsteads E71a and E171 both lack shielings and the lake between them seem to exclude a direct relation between the two. Considering the blank area from E171 to the next farmstead or shieling to the south, this lack would appear an artifact of survey intensity, i.e. there could be an undetected shieling somewhere southeast of E171. E71a is harder to explain, but it could have been a subsidiary farmstead to manor E65, which also lacks any shieling, but is characterized by a rather large voronoi territory. If truly a manor, then E71a could be its subsidiary farmstead.

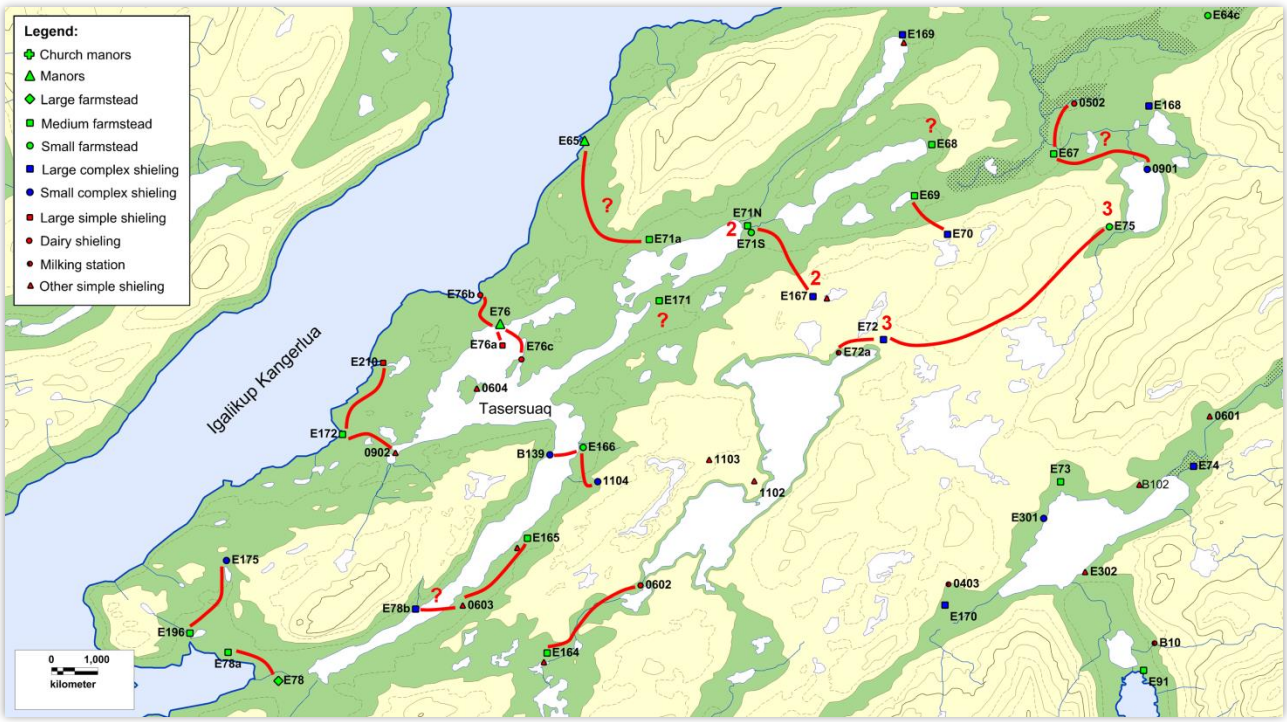

Fig.7.18 Farmsteads and associated shielings in the central Vatnahverfi region (conf. text).

The farmstead over is manor E76 – another double farm – which has four simple shielings within its fairly large voronoi territory. The special status of this site is corroborated by the observation that it is one of the farmsteads to lie at greatest distance from any neighboring farmstead. The next farmstead along the coast is medium sized E172, which appears to have had two associated shielings, of which one was a large simple shieling and the other a *rétt* conveniently placed for rounding up livestock grazing in the hills to the south. On the other side of the same hills and on the far side of lake Tasersuaq is a small farmstead, E166, which seem to have had two small complex shielings; this may seem too much for a small farmstead, but 1102 consists only of a single large building and could have been used at certain shorter intervals, whereas B139 on the other side of the fjord was intended for longer occupation.

Next along the lake shore is medium farmstead E165, which appears to have two shielings within its voronoi territory: one is a herder's hut/shelter (0602), the other a large complex shieling across the lake (E78b). The association with shieling E78b is not quite clear, but would correspond to the farmstead shieling layout of E166/B139. In addition, E165 has an associated *rétt* conveniently placed for driving of livestock herds along the lake shore. South and upland from this farmstead is E164, a medium farmstead with many small livestock buildings, suggesting that this was a farm based on a sheep/goat livestock economy, which also corresponds with its associated *rétt* and milking station (0602).

At the end of the central Vatnahverfi lake basin lies large farmstead E78 – with early small church – which has no apparent associated shieling (unless small complex shieling E173 near to its southern voronoi territory boundary had this function). However, the next medium farmstead E78a lies so close to E78 that it could – similarly to the other large farmsteads and manors – have been a directly subsidiary farmstead, which would also make E78 a double-farm. E78a has no directly associated shieling although the local sheep farmer claims that one should be located in the mountains just above. The last medium farmstead of the central Vatnahverfi region – E196 – has an associated small complex shieling (E175) lying upland from the coast. Yet, the proximity to E78a is unusual; and since the ruins of E196 are poorly preserved (and registered) would question the interpretation of this site.

Outer fjord Vatnahverfi region (Fig.7.19):

On the edge of E78's voronoi territory lies complex shieling E173, which is an example of a shieling which probably functioned as a small farmstead at some point. It is however within the voronoi territory of medium farmstead E174 with which it is tentatively associated here. To the north, herder's hut/shelter seems conveniently placed for any of the three neighboring farmsteads. At the very head of the Kangerluarsorujuk lies medium sized farmstead E182, which has no shieling within its own voronoi territory. However, if E173 was the shieling to E174, E331 could have served this function to E182, although this would be a somewhat atypical setup. According to the local sheep farmer at E331, an unregistered ruin group should be located in the hills above E174, which could change this picture. Further out the same fjord is medium farmstead E184, which has a nicely associated dairy shieling lying a bit inland.

Northwest over the hills from E184 lies E183, a supposedly medium farmstead (this site was not surveyed and the existing information on the site is rather vague), a combined dairy-shieling/*rétt* lies across from the farmstead and a small complex shieling up the valley to the east. At the head of the peninsula are two sites, one a small farmstead (E120) and the other a medium (E119), both with diary-shieling nicely situated within their voronoi territories. On the islands off the Vatnahverfi peninsula, Akia has a single small farmstead (E188) with an associated small complex shieling, which extended further to a milking station (E273); on the other side of the island is a forage shieling (1001) at a site which is even still today used for harvesting (meadow) hay. South on the island of Kangeq is a single medium farmstead (E181) with two large complex shielings within its voronoi territory, which appears to be an error of the model (unless E119 could have had a shieling on the island in addition to its dairy-shieling E333) or still missing ruin groups.

The southern part of the outer fjord Vatnahverfi region is where farmstead-shieling interrelation appears most persuasive: beginning at the sheltered inlet Tasiusaq at the very head of the Torsukattak fjord is the large farmstead E178, which has nicely associated large complex shieling within its voronoi territory (E179). There is an extraordinarily long distance to the next medium farmstead on the head of the peninsula (E190). This farmstead appears to have two associated shielings:

a large simple shieling (E328) within its voronoi territory and a small complex shieling further into the fjord (E330) and outside its territory. However, seeing as there are no other shielings on the peninsula (E327 is an outfield wall) it is fair to assume that E330 functioned as a shieling to E190, although further removed than usually. Across the Torsukattak fjord from E190 is large complex shieling (E95b) with no apparent farmstead. This is of course an unlikely scenario and is likely a flaw with the model, because E326 would aptly locate to be the diary-shieling to E95b if this was rather interpreted as a small farmstead. On the other hand, the marginal setting and poor pastureland of E95b is unmistakable (see section 3.2.2).

Moving overland from E95b to head of the Akulleq fjord, one finds first a small farmstead (E95a) and further out a medium farmstead (E95). The first has no associated shieling within its voronoi territory, the other has two; assuming the access and transport would have been along the coast of the fjord, small complex shieling E324 undoubtedly belonged to E95a and E325 to E95. The next small fjord of Serfartusoq has only a single medium farmstead (E94). Although its voronoi region suggests that E237 (black point) across land and down to Alluitsup Kangerlua could have been a shieling to the farmstead, it is doubtful because E237 was highly disturbed by the Moravian mission station founded there in the 18th century and appears a more likely candidate for a larger site (little information exists on the single ruin of E237).

The Alluitsup Kangerlua region (Fig.7.19):

At the extreme outer end of this fjord is a small farmstead (E322) with a nicely associated dairy shieling across the inlet (E322a). About half way in to the fjord is the large farm E93 which has a small complex shieling located agreeably within its voronoi territory (E323). In the next bay lies medium farmstead E92, which has both milking station and herder's hut/shelter within its territory. Close to where the Alluitsup Paa divides on two arms is the large farmstead E77a which has large complex shieling E180 and large simple shieling E311 within its voronoi territory. Located only some 990m distant, it is not improbable that E190 was instead a subsidiary farmstead to E77a and E311 its shieling. This would be consistent with the pattern at the other large farmsteads and manors (see above). Inland from E77a lies medium farmstead E77, which has no apparent associated shieling, which is best explained by the condition that it simply has not been located yet.

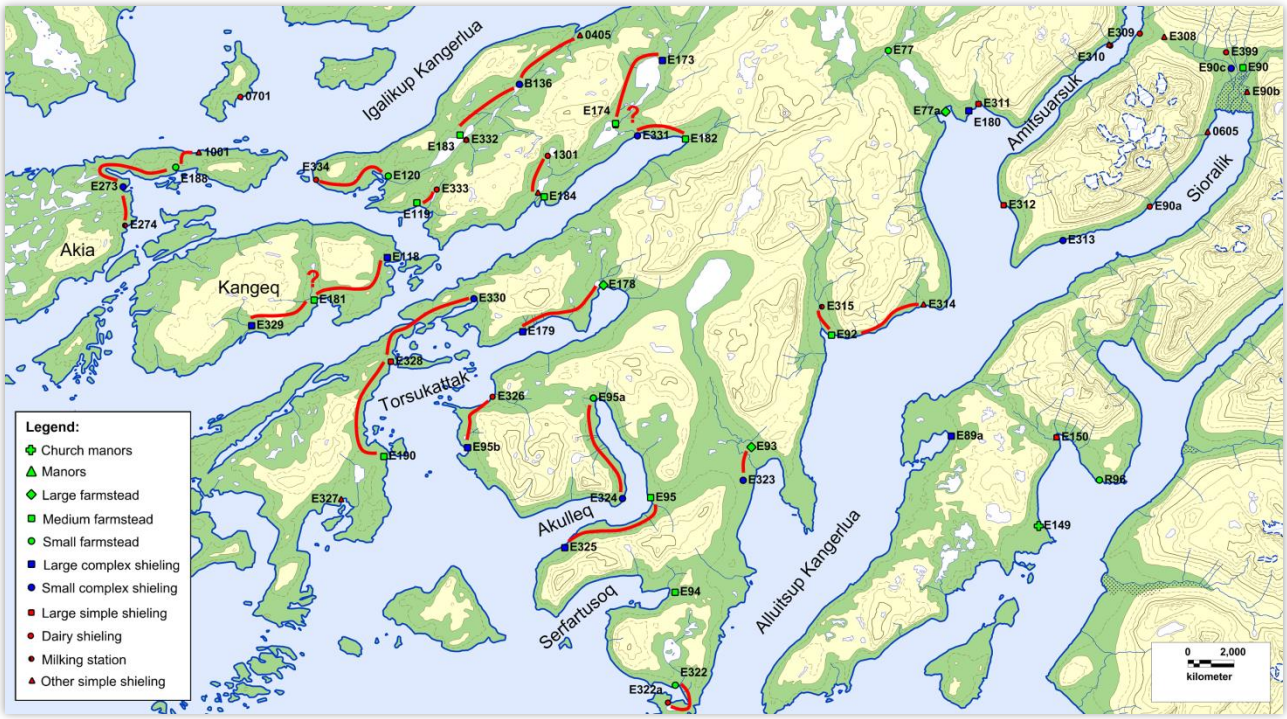

Fig.7.19 Farmsteads and associated shielings in the outer fjord and Alluitsup regions (conf. text).

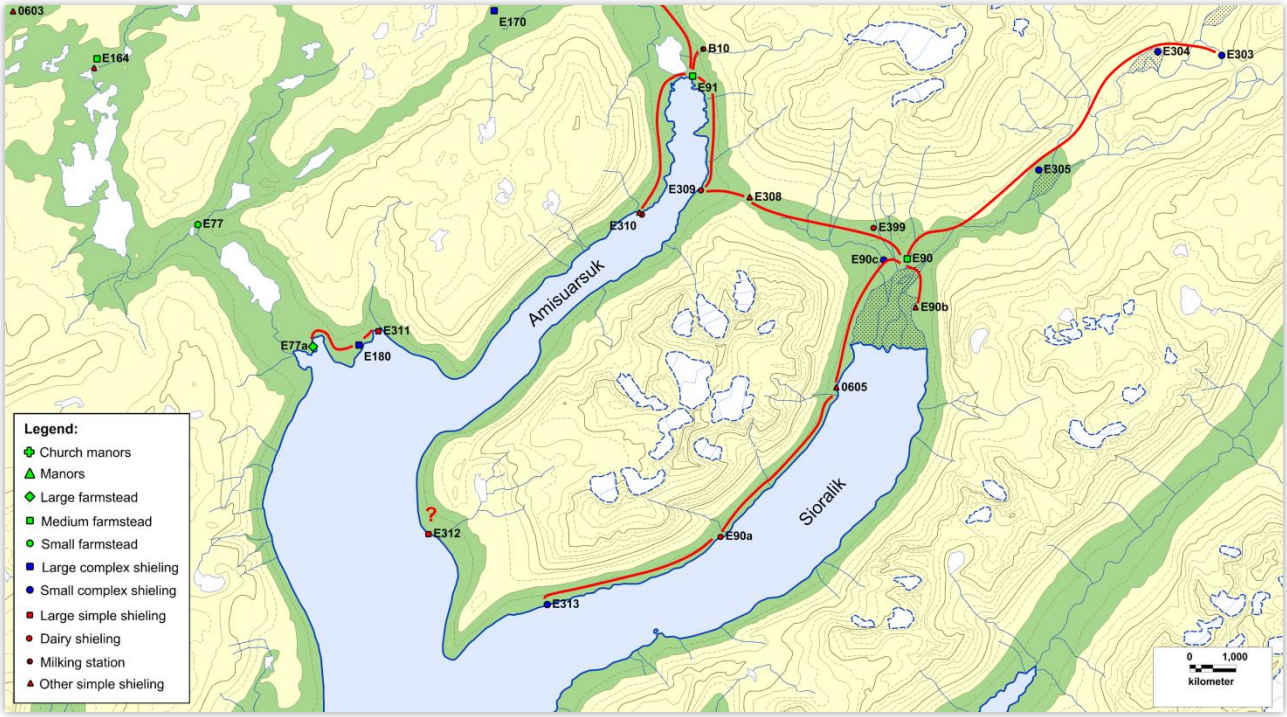

Fig.7.20 Farmsteads and associated shielings in the Sioralik and Amitsuarsuk regions (conf. text).

The Amitsuarsuk region (Fig.7.20):

The western fjord arm of the Alluitsup Kangerlua – the Amitsuarsuk – is occupied by a single medium farmstead (E91) with no less than four (almost five) shielings within its voronoi territory including two dairy shielings, one milking station and a *rétt*. This layout with multiple small shielings is highly consistent with the fact that the E91 is characterized by many small livestock buildings, i.e. was a farm based on a sheep/goat economy. This corresponds well with the surrounding vegetation, which presents some of the richest and densest shrub in the entire region (see section 3.2.2). Although it is outside its voronoi territory, I believe that E74 could have been the main full-shieling of E91 because a fairly large *rétt* is located in the southeast corner of the lake and south of the river, suggesting that livestock were herded down this lake bank and towards E91 rather than towards E73. If so, it is possible that the outfield wall B102 could have marked the boundary between the territories of E91 and E73.

The Sioralik (Fig.7.20):

In the other fjord arm at the head of the Alluitsup Kangerlua – the Sioralik – a single medium farmstead (E90) is found on the shrubby slope at the head of the fjord. It has several shielings within its voronoi regions and no less than five small complex shielings and three simple shielings could have belonged to the farmstead, which seems an unlikely scenario. E303, E304, and E305 are all small complex shielings of the classical upland type, whereas E313 follows the horizontal pattern of the outer fjord shielings. In this case, the site distribution pattern is likely a result of chronological difference. E303-305 could well have been the original shielings to E90, E399 a closer milking station, E90b a forage shieling, 0605 a landing place, and the sites further out the Sioralik related to intermittent sheep/goat herding. The small complex shieling close to E90 – labelled E90c – probably replaced E90 after its abandonment (and of most of its shielings), thereafter working as a *rétt* and dairy-shieling, perhaps under E91. Alternatively, E90 should be a major farmstead, where many ruins are hidden in the surrounding dense shrub vegetation.

The Qorlortorsuaq region (Fig.7.21):

The last farmstead in the Vatnahverfi region is the medium farmstead E73 on the north side of lake Qorlortorsuup Tasia. This is again a farmstead with many smaller livestock buildings suggestive of a sheep/

goat livestock economy. This also matches the dense shrub vegetation in the valley. The farmstead has one of the large voronoi regions in the survey sample and with no less than seven different shielings. Comparing with E91 and E90, it seems likely that a very complex layout with many different shielings was characteristic of sheep/goat farms in areas with heavy shrub vegetation. It strongly suggests a high extensive herding strategy, where herds were moved from shieling to shieling throughout the year.

7.2.3 Section Summary

Having submitted the functional classification model of section 7.1 to two interpretive approaches, it appears in general to be fairly accurate in describing overall settlement patterns: Tab.7.2 lists the farmsteads in the Vatnahverfi region, the distance to the nearest other (and more inland) farmstead, as well as to their related shielings. As seen from the table, it is possible to fairly confidently match farmstead with shieling in 32 of the 45 examples. In some examples, "missing" associated shielings are probably to be explained by ruin groups waiting to be located; this can of course be tested in the future by surveying areas where shielings appear to be missing. If this proves successful, the model can perhaps be used to predict new sites in other settlement areas.

Some of the "missing" shielings can be explained by the observation that all the middle and inner fjord large farmsteads and manors (except for E65) appear to be double-farms, at least accepting that in some cases (E78/E78a, E77a/E180, E64/E209) subsidiary farmsteads are located just distant enough to have been given separate ruin group number. At these double farms there is always only one associated shieling, which suggests a setup with a large farmstead/manor, a subsidiary farmstead, and a shieling which together constituted one *farm unit*. In turn, this suggests governance centralized on the largest farms and manors. It was also noted of the classification model that some farmsteads had multiple shielings, which especially seems to have characterized the inner fjord farmsteads specialized in sheep/goat keeping in areas dominated by shrub vegetation. Another key feature demonstrated above is how there existed two simultaneous shieling systems: one which involved moving vertically from lowland to highland (in the inner and middle fjord) and one that involved moving horizontally along the coast (in the outer fjord). This settlement layout pattern has not before been implied for Norse Greenland.

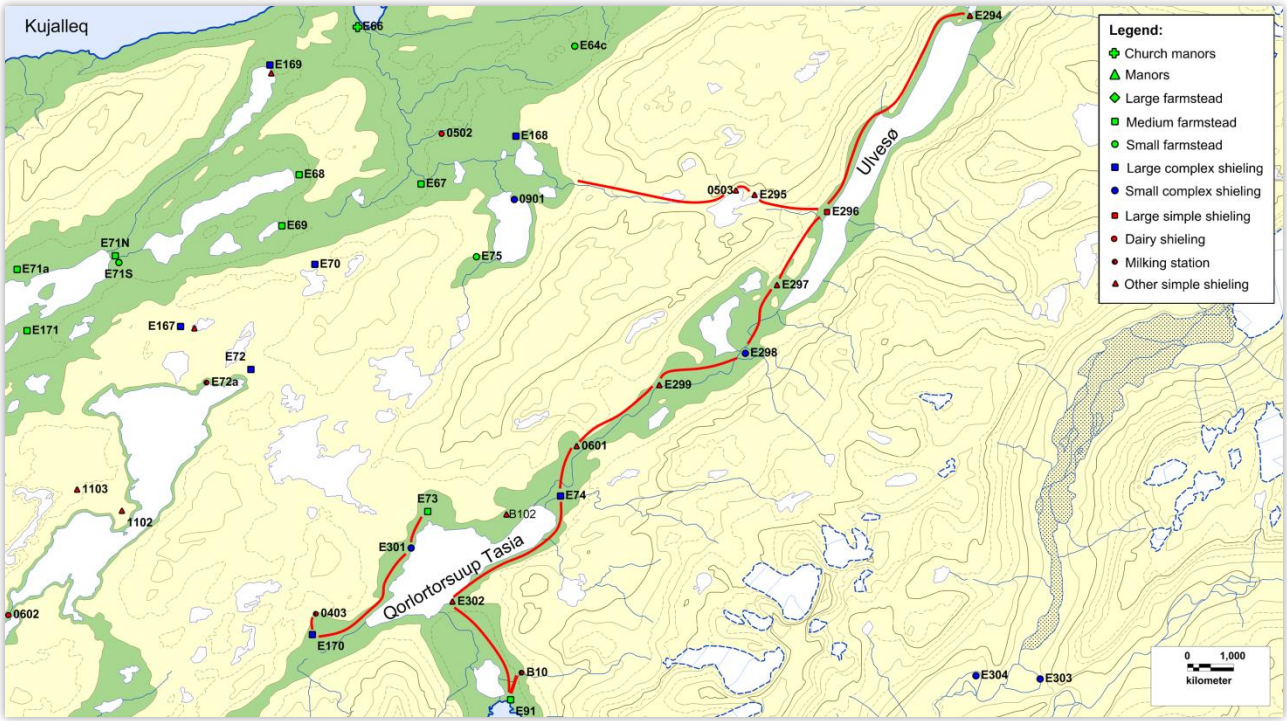

Fig. 7.21 Farmsteads and associated shielings in the Qorlortorsuaq regions (conf. text).

However, the above also clearly demonstrates that the model is not flawless, which is only natural considering the nature of the evidence. One recurrent issue arising in the coupling of farmsteads and shielings is that a few of the large complex shielings seems to have had their own associated smaller shielings, which would suggest that the former were small farmsteads rather than large complex shielings. However, this is of minor consequence because, as already stated above, this was expected of the large complex shielings. Thus, differentiating them from the small farmsteads offers an opportunity of estimating settlement and population at different times, i.e. settlement climax versus decline (see below).

In conclusion, considering the character of the survey evidence, the settlement classification and –pattern models outlined in the above appear to work with considerable reliability, or at least provides *one* explicit framework exploring class- and functional site differences. Such exploration could be furthered by "tweaking", adding, or removing parameters, cross-checking and -testing the various categories and parameters etc. The material and evidence is similar to that explored by prior archaeologists; the real difference is that the evidence is digital, which through data sharing will allow other research to approach the material from different angles and with different questions.

One final – and rather conclusive – way of testing the model is to go into the field to systematically survey for A) those shielings that appear to be missing; and B) searching for churches and churchyards at those sites that compare in size and layout to the identified church sites. The latter is especially pertinent in the Alluitsup Kangerlua where a church farmstead has yet to be identified. According to this model, the most obvious places to search would be E93 or E77a (although erosion may have moved any signs of church and churchyard at the latter). In the central Vatnahverfi region, E65 and E76 appear the most likely candidates. Leaving this for future investigation, I believe the model has provided adequate bases for some higher-level discussions:

Tab.7.2 – Farmstead and shieling distances

Ruin group no.	Distance to next nearest farmstead (km)	Distance to associated shieling (km)	Ruin group no.	Distance to next nearest farmstead (km)	Distance to associated shieling (km)
Northern Vatnahverfi			Outer fjord Vatnahverfi		
E60-E62	3.12	2.10	E174 (E173)	7.18	3.37
E209/64 (E293)	1.97	3.06	E182 (E331?)	3.08	2.07
E66 (E169)	2.91	2.05	E184 (1301)	4.40	1.78
E64b	3.01	-	E183 (B136)	4.94	3.35
E64a	2.82	-	E120 (E334)	3.56	3.11
E64c (E168)	2.86	2.31	E119 (E333)	1.67	1.03
E67 (0901?)	4.44	2.02	E188 (E273)	9.15	2.41
E75 (E72)	1.96	5.41	E181 (E329)	6.08	2.89
Central Vatnahverfi			E178 (E179)	4.57	4.02
E68	1.20	-	E190 (E330)	9.35	7.81
E69 (E70)	1.20	1.10	E95a (E324)	4.78	4.5
E71N/S (E167)	3.59	1.91	E95 (E325)	4.85	4.27
E71a	2.13	-	E94	4.21	-
E171	1.33	-	Alluitsuup Kangerlua		
E65	2.51	-	E322 (E322a)	3.99	0.81
E76 (E76b)	3.45	0.77	E93 (E323)	5.91	1.48
E172 (E210)	4.81	1.77	E92 (E315)	10.51	1.23
E166 (B139)	3.55	0.8	E77a (E180)	3.6	0.90
E165 (78b)	2.29	2.81	E77	4.18	-
E164 (0602)	2.49		Amitsuarsuk and Sioralik		
E78	6.16	-	E91 (E74)	4.43	4.51
E78a	1.25	-	E90 (E305)	6.05	3.41
E196 (E176)	0.91	1.74	E73 (E170)	5.58	3.62

Tab.7.2 Approximated areas of land enclosed by the infield dykes identified in the survey sample.

7.3 Community and Hierarchy in Norse Vatnahverfi

Having substantiated in the two above sections that the settlement classification model appears to credibly describe the main features of medieval Norse settlement in the Vatnahverfi region, section 7.3 concludes by exploring some wider aspects and perspectives of the observed settlement patterns. Three main questions are addressed; how many people constituted the community (-ies) of the region and how does this compare to other areas of the Eastern Settlement? How was the settlement layout and organization? And how does this reflection reflect social and hierarchical organization?:

7.3.1 The Norse Vatnahverfi Community

Having made probable how many ruin groups in the Vatnahverfi region were farmsteads and how many were shielings, a next logical step is to try and estimate how many people made up this community. Such estimation relies on the estimated average size of the households, which is a highly problematic issue, since such numbers were not recorded in the medieval documentary records. We do know a little about "household" sizes at the late medieval episcopal manors in Iceland: in AD 1388 there were no less than 64 "working people" at Hólar and in AD 1502 at Skálholt 63 people; the largest aristocratic farms may have had 40-50 people (Júlíusson 2010:19). However, these people did not all live under "the same roof", but were spread out on subsidiary farmsteads of the manors. Thus, average households on the latter farmsteads, and on those of free-holders, would have been more moderate. A 1703 Icelandic population census from various districts around the island imply a mean population of 6.14 person per household (Vésteinsson 2006:Tab.5.1) Although a low estimate, it is in fact higher than mean 4.5-5.5 household size modelled for Medieval Norway around AD 1300 (Pulsiano and Volf 1993:182). The safest approach seems to be to explore a reasonable range and I suggest for Norse Greenland a minimum of 4.5 and maximum 7.5 person per household (the latter is the highest district average in the Icelandic population census, Vésteinsson 2006:Tab.5.1).

45 sites in the Vatnahverfi region survey were classified farmsteads with a "permanently" occupied farmhouse; of these three (E66, E76, E171) were double-farms and one (E75) a triple-farm, summing up to 50 farmhouses in total. With a low estimate of 4.5 persons per household this corresponds to a community of some 225 souls, or 375 with a 7,5 persons household estimate. This is a little more than the average population estimate of 194 inferred from burial densities in the churchyards (see section 6.2.1). It is, however, not far off the mark, especially not if recalling that the 225-375 population estimate reflects the entire Vatnahverfi region. However, it is unlikely that the *grænlendinga* living on the Alluitsup Kangerlua side of the peninsula were buried in the churches in northern and central Vatnahverfi. Also, the estimate assumes that the sites were all occupied simultaneously, which is far from certain. In fact, archaeo-entomological evidence from GUS suggests several phases of occupation and abandonment (Panagiotakopulu *et al.* 2007). Thus, even if it is accepted that the large complex shielings could have functioned as small farmsteads during the peak of settlement – adding another 21 farmhouses to the equation (including one double- and one triple large complex shieling) – a maximum population of some 533 does not significantly change the impression of a very small community. All in all, the settlement and burial evidence seems to correlate well.

It is therefore reasonable to extend the population estimates to the rest of the Eastern Settlement: of the 133 ruin groups recorded in the Vatnahverfi region, only between 45 to 63 ruin groups are classified as farmsteads (excluding double- and triple farms), i.e. a shieling to farmstead ratio of between 1:0.34 and 1:0.47. As outlined in chapter 5 (cf., Fig.4.19), the total number of registered ruin groups in 2004 was about 550 (including the Vatnahverfi region known prior to the Vatnahverfi-Project). If shielings to farmstead ratios in the latter area are representative of other parts of the Eastern Settlement, then only between 187.0 and 258.5 of the total 550 ruin groups were regular farmsteads.

In a fairly similar calculation by Vésteinsson (2010:144p) the total number of farmsteads (small and large) in the Eastern Settlement was estimated at 345, i.e. somewhat higher than my above estimate. Two reasons can be given for Vésteinsson's higher estimate: first that he adjusts for suspected higher survey intensity in the central Eastern Settlement and the Vatnahverfi, and second that he differentiates differently between

farmsteads and shielings (see below). However, I believe that his adjustment for survey intensity is exaggerated: as outlined in section 4.1.4, O. Bak was highly active in surveying remote areas of, especially the southern, Eastern Settlement and the vast majority of the 142 sites added to the list by him and other after 1960 are not farmsteads proper, but various types of shielings. Thus, the later intense surveys in the central Eastern Settlement that Vésteinsson's assumes should be subtracted from the calculation should rather be considered belated versions of the surveys of Bak in the southern Eastern Settlement, which implies that farmstead numbers should, if anything, be adjusted in the other direction.

Retaining that "permanently" occupied farmsteads of the total 550 sites in the Eastern Settlement numbered between 187.0 and 258.5, and assuming an average household size of 4.5-7.5, the total minimum population in the entire Eastern Settlement can be estimated to ca. 842-1403 persons and a total maximum population ca. 1163-1939 persons. The first estimate seems rather low on account of the large complex shielings not being included as farmsteads, which they probably were at the peak of settlement (see above). Although the high estimate is more credible, it is still clearly very far from the 6000 people suggested in the most optimistic population estimates (see section 2.1.2). In fact, it is again very close to the maximum population estimates of N. Lynnerup (1998) of 1400-2200 people if the ca. 90 ruin groups in the Western Settlement is added (i.e. 138-317 people). The fact that the two population models, one based on archaeological settlement evidence and the other on burial densities, are completely independent, but highly matching, lends credibility to their combined correctness.

7.3.2 Vatnahverfi Settlement Organization

As outlined in the introduction, there are relatively few studies on settlement patterns in Norse Greenland. However, it is clear from the above analysis that the basic settlement layout in the Vatnahverfi consisted of single farmsteads with associated – in several cases multiple – shielings. This basic settlement layout is directly comparable to the system of lowland farmsteads and highland shielings that Keller & Albrethsen (Keller 1983, Albrethsen and Keller 1986, Albrethsen 1991) observed in the Qorlortup Itinnera, and is known from all over the North Atlantic. The only difference in the Vatnahverfi region is that shieling in the outer fjord was horizontal instead of vertical, i.e. transhumance moving along the coast. This change is explainable by deteriorating environmental conditions in the outer fjord, especially at higher altitudes. Also, as seen from Tab.7.2, settlement was more dispersed in the outer fjord with an average distances between farmsteads of 5.22 km compared to 3.04 km in the middle and inner fjord. In short, there was more available horizontal space.

In terms of the local settlement layout very few of the farmsteads seem truly isolated, i.e. there is not one farmstead from which it is not possible to reach the neighboring farmstead in an hour or two of walking: in the north Vatnahverfi region, the average distance between the farmsteads is 2.89 km, in the central Vatnahverfi 2.63 km, in the outer fjord 5.22 km, and in the Alluitsup Kangerlua/*Siglufjörður* 5.53 km. Any notion of (local) isolation is ascribable to unfamiliarity with the landscapes or a paradigm of arctic marginality; it is possible to walk from one side of the Vatnahverfi region to the other in about half a day, which the local sheep farmers do regularly for coffee visits! Still, overall settlement densities in the central Vatnahverfi are similar to the most dispersed settlements areas historically recorded in Iceland (Vésteinsson 2006:Tab5.1), and settlement in the outer fjord and Alluitsup Kangerlua/ *Siglufjörður* considerably more dispersed.

Staying with Icelandic parallels, O. Vésteinsson has argued (Vésteinsson 1998:19p, Vésteinsson *et al.* 2002:117p, Vésteinsson 2006:109) that settlements there came in three basic types: A) large clustered or complex settlements, B) large simple settlements, and C) planned settlements. Briefly summarized, A) was farmsteads first established on prime agricultural lands with access to meadows and other natural resources, and which later turned into large estates and parish centers with a large number of associated cottages at the edge of their property. The large simple settlements B) reflected a second wave of colonizers, who occupied the next best farmlands with less access to meadow, but decent access to pastureland and other resources. Central to such a holding was a large farmstead, often with a small church and with 1-3 cottages located on its periphery. Planned settlements C) constituted the final stage in subsequent settlement development, where the agriculturally poorer valleys which had to first be cleared of shrub and lands improved before it could sustain small single-household cottages under the authority of the chieftains on the first two types of settlement. Vésteinsson *et al.* (2002)

suggested that similar settlement layouts characterized Greenland, but were hesitant to specify. However, based on the above analysis, I think there is good reason to take up their idea of such a settlement model in the Vatnahverfi region, where settlement patterns appear similar to the first two Icelandic types, only adjusted to the local Greenlandic topography and environment. Yet, as this hypothesis rests on hierarchical distinctions I delay this discussion to section 7.3.3.

In terms of overall settlement patterns, Roussell based on his own archaeological investigations, and probably also the written accounts, assumed that the first pioneer farmers had claimed the best agricultural areas in the inner fjords, which ever since constituted the core of the settlements (Roussell 1941:12). Nuancing this settlement layout, C. Keller introduced (1991:31p) the idea that there existed two separate concentration of settlement, one in the inner fjord and one in the middle fjord, each with their own churches (Ibid.Fig.1). The settlement concentration in the middle fjord was aimed at exploiting marine resources, whereas the settlement concentration in the inner fjord was more agrarian; and through economic exchange and interdependence these two settlement areas could exploit the different environmental niches, claimed Keller (Ibid.32).

There is nothing in the new Vatnahverfi evidence to directly oppose Keller's idea. However, it should be remembered that the new dates from E78 (J. Arneborg, unpubl. data) suggest that E78 was closed down around AD 1250. This would imply that at least in the Vatnahverfi region, political and probably economic authority shifted towards the inner fjord at the very same time that the *grænlendinga* were becoming increasingly dependent on seal (Arneborg *et al.* 2012a:121p). This is also implied by the circumstance that all the farms here classified as manors are situated towards the inner fjord. Although Keller's idea should probably not be completely rejected, I suggest that the concentration of church farmsteads in the middle fjord, which is only truly dominant in the southern part of the Eastern Settlement, has another simpler explanation: south of Igalikup Kangerlua/*Einarsfjördr*, the heads of the fjords do not present the same favorable conditions for cattle based farming as in the central Eastern Settlement. Rather, as in the Alluitsup Kangerlua/ *Siglufjörðr*, these inner fjord areas are dominated by rich shrub vegetation better suited for sheep/goat husbandry, i.e. as implied for the farmsteads in the Amitsuarsuk and Sioralik. I instead suggest that the placing of church farmsteads in the middle fjords was probably more determined by the decent pasturage and meadows often found there.

7.3.3 Settlement Hierachy in the Vatnahverfi

With this final section of chapter 7, we return to the question posed in its introduction, i.e. who could claim authority and governance over the Vatnahverfi and its community? This is of course a difficult question, and one that depends on interpretation of the above site classification in terms of hierarchy. Although the labels of the site classes (cf. Tab.7.1) – especially the large ones – are strongly indicatory of hierarchical distinction. I have so far refrained from commenting on what these distinctions means in terms of hierarchy, but this issue must be addressed in order to answer the final question: excluding sites classified as shielings in the above, there are five classes of farmsteads to consider (where the small farmsteads could include large complex shielings):

Naturally, there have been earlier discussions of site class differences and hierarchy (Roussell 1941:189, Keller 1989:168, p306p). However, a more thorough site ranking system was developed by T.H. McGovern on the basis of combined zoo-archaeological and architectural records, mainly from the Western Settlement (McGovern 1985, McGovern *et al.* 1988, McGovern 1991, 1992a). Comparing his ranking model with the above, they seem to correspond fairly well: beginning in the upper stratum of society, the farmsteads classified as church manors correspond quite directly to McGovern's ranks 1-2, the only difference being that I have not separated Igaliku/*Garðar* (E47), although I fully agree with him on the uniqueness of the episcopal see (and its supposedly related E59). However, there is no equivalent in McGovern's model to the farmsteads here classified as large. While this could be an error within the classification model, it could perhaps also be explained by the absence of this type of farmstead in McGovern's sample, or perhaps even generally in the Western Settlement? His rank 3-4 rank farmsteads correspond to those classified as medium and small farmsteads (and large complex shielings. Thus, there is no conflict between the two farmstead ranking models, the main advantage of the present one simply being that it can be extended to farmsteads that have not been excavated.

Recently O. Vésteinsson has proposed a simpler site class differentiation between permanent farms, minor farms, and other sites (Vésteinsson 2010:Tab.2). According to his description of the site classes, his permanent farms appear to correspond to all the site types here classed anywhere between large complex shielings to church manors, whereas his minor farms correspond to the small complex shielings, and his other sites to the various types of simple shielings. It should be noted that in this study Vésteinsson was not attempting to produce a hierarchical model, but only to establish how many farms belonged to the individual parish centers. In light of the above analysis, there can be little doubt that Vésteinsson's minor farms – which he also holds functioned as "short-term experiments or as cottages" (Ibid.144) – are really small complex shielings. Otherwise, there is little conflict between the two models that simply have different agendas.

However, site rankings such as the above are relative and have no direct historical implications, i.e. do not clarify what types of farmsteads they really were within medieval societal organization. This may be approached by viewing the farmstead classes (cf. Tab.7.1) as a ranking system: standing out as the single church manor, there is no doubt that Igaliku Kujalleq/ *undir Höfða* was the magnate farmstead of the region, i.e. a parish center with supra-local authority and economy, at least in a later stage of settlement (see below). Reviewing the voronoi regions in Fig.7.16, it seems quite probable that the adjoining small and medium farmsteads E64a, E64C, E67, E75, and perhaps also E68 and E69 – with their associated shielings – could have been subsidiary farmsteads or cottages to E66. Since E66 in addition was a double-farm, it would fit well the characteristics of an estate and large complex settlement (see above); the fairly large distance to the subsidiary farmsteads is explainable the *sandur* that divides the area in two. On the other side of the Kujalleq is large farmstead with small early church E64, which has three associated smaller farmsteads or cottages, which would make it a perfect example of a large simple settlement (Vésteinsson's type B, see section 7.3.2).

Moving into the central Vatnahverfi, the next large site is the – somewhat uncertain – manor E65, which has two smaller farmsteads or cottages adjoining its voronoi territory (E71a and E71N/S). Again, this would make E65 a good example of a large simple settlement. The next manor is E76, which is surrounded by multiple shielings as well as number of smaller farmsteads (E71a, E166, E171, E172) that could have been cottages under this major farmstead. The fact that E76 has no identified church could simply mean that it was established slightly later than the other church sites. This, and its layout as a double farmstead, would seem to make E76 something in between the Icelandic large complex and large simple settlement (Vésteinsson's type A) and-B), see section 7.3.2). The next large farm E78 fits perfectly the description of large simple settlement with smaller farmsteads evenly distributed around its periphery and two (E78a, E196) more closely related. It seems to have been a larger holding than E64, which may explain why it managed to hold on to its church function for a while longer (see below).

Moving out into the outer fjord, the two large farmsteads E178 and E93 seem quite perfectly located to dominate the entire sub-region of more scattered small farmsteads or cottages. They both seem to be examples of large simple settlements. Moving into the Alluitsup Kangerlua/*Siglufjörður*, the next large farmstead over is E77a, which is again surrounded by a number of smaller farmsteads, and was perhaps even a double-farm (see above). This makes E77a another good example of a large simple settlement. As to the farmsteads in the Amitsuarsuk and the Sioralik, the pattern is less clear and this might simply have been small independent farmsteads.

If this interpretation model is valid, then only 8-10 of the farmsteads in the Vatnahverfi region would have been independent, which makes nearly all the farmsteads classified as medium and small the homes of cottagers and tenants. While this may seem an excessive number, it is a rather striking pattern in Fig.7.16 that apart from E66 and E64, which may be explained by natural topography (see above), direct interface of the voronoi regions of the large farmsteads or manors is either non-existent or very small, i.e. a settlement pattern strongly in favor of the above interpretation of the site classes. Neither is it inconsistent with settlement layout in Iceland, where it has been estimated that in 11-12th century there were about 3300 householders under the authority of some 730 estates (Vésteinsson 2007:131), i.e. 1 estate to 4.5 subsidiary farm. According to the classification model for the Vatnahverfi region there are 8 large farmsteads or manors to 37 small or medium farmsteads, i.e. one independent farm to 4.6 subsidiary farmsteads. This would suggest an almost identical land

tenure system in Greenland. If so, there is amble reason to suspect that the Greenlandic land tenure system was built on the same foundation as the Icelandic system, i.e. the renting of livestock (Ibid.131). This, in turn, would explain why the largest farmsteads are characterized by their large cattle grazing enclosures: the reservoir function of these large farmsteads were perhaps not so much meant to sustain settlement as it was to sustain and fortify their own status and authority. The apparent lack of planned settlements (Vésteinsson's type C), see section 7.3.2) in the Vatnahverfi region seems a likely result of low population densities: there were probably never enough people to ever warrant the need, and provide the labor, for extending settlement into more marginal areas.

On a concluding note, while these settlement patterns seem very persuasive they have so far failed to consider chronology and change. Also, the settlement pattern with several large farmsteads is somewhat in conflict with the documentary record that a single large farmer, or that the cathedral, owned all of *Einarsfjörðr* (see the introduction to chapter 5). As to the first issue, it has already been pointed out how the two other churches in the Vatnahverfi were taken out of use, E64 around AD 1200 and E78 about half a century later (J. Arneborg unpubl. data, Tab.8.2). Again, this is strongly suggestive of a growing centralization gathering on the parish center of *undir Höfða* (E66), which perhaps gave this farm the means to construct a large gothic style church around or after AD 1300. It is not unlikely that E64, along with its cottages, thereafter became a subsidiary farm to E66, whereas E78 maintained its position as a large independent farm. At least, the infield dyke registered at this farmstead suggests that it was still a farm of some means and status. That no church has been identified at E76 or E65 could owe to lacking archaeological identification. However, an even more convincingly scenario would be that there was still room for a certain extent of social mobility and that these farmsteads prospered after the habit of building small churches at the farmsteads was abandoned. Both these manors are characterized by having a double-sheep shed, which as discussed in section 7.2.3 appears to be a late feature.

Thus in conclusion, the question asked in the introduction may be answered with both yes and no: yes, the first *landnámsmen* may have claimed the whole territory of the Vatnahverfi, but other farmsteads later grew in wealth and prosperity. And yes, the church (manor) later became the major landowner in the district, but again probably supported by a few independent farms.

8. PASTURES FOUND… FARMING IN GREENLAND (RE)INTRODUCED

'Summer pastures are everywhere, especially outside the coastal areas, so abundant that there is sustenance for thousands of sheep and a not insignificant number of cattle.

'With Icelandic conditions in mind Sigurdsson asserts that there are pastures in Greenland, which can supply just as much and valuable grazing as 15,000 of Iceland's rural population use now, in other words, that Greenland's entire population, in terms of pasture, can subsist solely on animal husbandry'.

Therefore the cultivation and exploitation of Greenland's soils by Danish initiative and by Danish citizens is not only an economic concern, but equally a concern of national importance.'

(au. trans after Bendixen 1927:89, 91, 105)

The above excerpts are part of the concluding results of a field investigation in 1925 that evaluated the qualities of Greenland as 'pioneer country' for livestock farming (Bendixen 1927). Just as in the report of E. Thorhallesen (see the introduction to chapter 4) some 150 years earlier, such prospects were portrayed as very favorable indeed, and very much at odds with the perceived marginality of the Greenland settlements. And, just as Thorhallesen, the author of the latter report – settlement deputy O. Bendixen – held that reintroduced farming in Greenland had to involve resettlement of the Norse farms by Scandinavian farmers (Ibid.102 and above). This is surprising since locally based sheep farming had already been introduced in 1906 and, at the time of Bendixen's report, was rapidly expanding, not through involvement of Scandinavian farmers, but through local Inuit pioneers. Key in their success was the targeted resettling and exploitation of primary Norse farmlands. This was just what Bendixen called for, and the reason that he devoted an entire chapter of his report to descriptions of Norse farmsteads and farming practices. Thus, traditions of farming in Greenland – separated by a 400 year intermission – continued to interconnect.

However, although the two farming traditions were certainly related, they should not be thought of in terms of direct continuity, but rather in terms of parallel traditions: some aspects were shared, i.e. the livestock and environmental settings and confines, other aspects were not: the TEK, the tools and implements of farming, the economic context etc. The latter of course changed as farming matured throughout the 20th century. Chapter 8 aims to review aspects of the archaeological settlement evidence from the Vatnahverfi region against the comparative case study of pre-modern Inuit sheep farming in the same region of South Greenland. It is argued that this case study provides a guideline for the functional interpretation of the settlement evidence and for pinpointing the farming potentials and confines of this special environmental setting, i.e. approaching Greenlandic farming system-environment dynamics from a farmer's perspective.

Chapter 8 first presents a historic overview of the redevelopment of farming in Greenland. The overview is not extensive, but simply the outline needed to establish similarities and differences over time between the two farming traditions, and to mine for those comparative aspects that may realistically be explored against the archaeologically induced settlement and farming evidence from the Vatnahverfi region and Eastern Settlement. The second part of chapter 8 discusses comparative aspects of farming in South Greenland: settlement expansion and decline, fields and forage, herding strategies, and intensive versus extensive farming practices. Chapter 8's third section brings all of these comparative perspectives together in a summary discussion of the combined evidence in terms of *resilience* and *human securities*.

8.1 A Brief History of Farming in Greenand 1721-2006

Fig.8.1 Prospect of the Juliaanehaab Colony – todays Qaqortoq – about 1830. During the era of colonial era, farming in Greenland was mainly limited to gardening (fenced in gardens to the left) and keeping a few heads of livestock, mostly cattle and goats (right of the large colonial building) ***(water-color by J.M. Mathiesen 1800-1860).***

Providentially, renewed farming in Greenland, especially after 1906, makes for a very well described comparative case study: because the endeavors of early Inuit farmers received much attention by colonial Denmark for both economic and social reasons, the development of farming is richly documented and commented: first by a number of local or visiting observers and stakeholders, as well as local farmers, later by more systematic surveys and studies carried out and published in connection with professionalization and intensification of farming. Also, issues and advances in farming were frequent topics in Greenlandic newspapers, which often provide firsthand accounts to supplement to the more academic sources.

However, section 8.1 is nowhere near an attempt to describe and summarize this documentary evidence in its entirety: rather, I here outline in brief the development of renewed farming in Greenland divided on three main periods: *colonial farming 1721-1906*, *pre-modern farming 1906-1976*, and *mechanized farming 1976-2006*. Since the period of *pre-modern farming* is the most potent comparative case study – the aspects of which are explored in section 8.2 – I devote more space to the historic outline of that period. Finally, as the history of pre-modern sheep farming in Greenland in itself presents an excellent example of adaptive change in response to environmental impacts – and crossed thresholds – I take up this issue in terms of *resilience* and *adaptive cycles* specifically in section 8.3.

8.1.1 Colonial Farming – 1721-1906

Colonial farming began soon after H. Egede's arrival in the Nuuk fjord in 1721; and as colonies, trading posts, and mission stations were established along Greenland's West Coast, European livestock and garden crops were reintroduced. Fairly little is recorded about farming activities and practices in this period, but there is enough retrospective accounts to outline a general picture (e.g., Erslev 1877, Rink 1877:93p, Meldorf 1906, Jespersen 1915, Bendixen and Bobé 1921, Ostermann and Porsild 1921, Andersen 1969, Gad 1969:557p, Kleivan 1983):

Clearly, to speak of farming on any significant scale during the period 1721-1906 would be an exaggeration. By all accounts, it was a very subsidiary activity upon two domains: keeping a small number of livestock (cattle, horses, pigs, chickens, sheep, and quite a few goats, Fig.8.2); and small-scale gardening (cultivating chervil, cress, lettuce, radishes, parsley, leek, and turnips etc., Fig.8.1). Both activities only served to supplement imports and locally recovered foods, as well as probably to provide colonists with "a taste of home". Such cultural motivation would at least explain why these farming activities were attempted, and most often succeeded, well beyond the arctic circle (Ostermann and Porsild 1921:113, 465). Even sheep and goats could apparently be kept and fed with no excessive difficulty far up Greenland's West Coast. The latter is, however, likely a greater testimony to the low livestock numbers involved, since the gathering of fodder did not entail any form of cultivation, but relied on that which could be procured from "naturally" lush areas in the landscape, i.e. former Norse and Inuit habitation sites (Bruun 1895b:322, Walsøe 1919:37, Bendixen 1927:49). Livestock was kept mainly for a small outcome of milk and meat (Knuthsen 1906:45, Jespersen 1915:76, Bentzen 1920:35, Bendixen 1927:48, Kammp 1964:85). However, a few domestic animals bones found in Inuit archaeological contexts (Gulløv 1997:40) Møhl 1997;497) could also suggest limited trade or exchange.

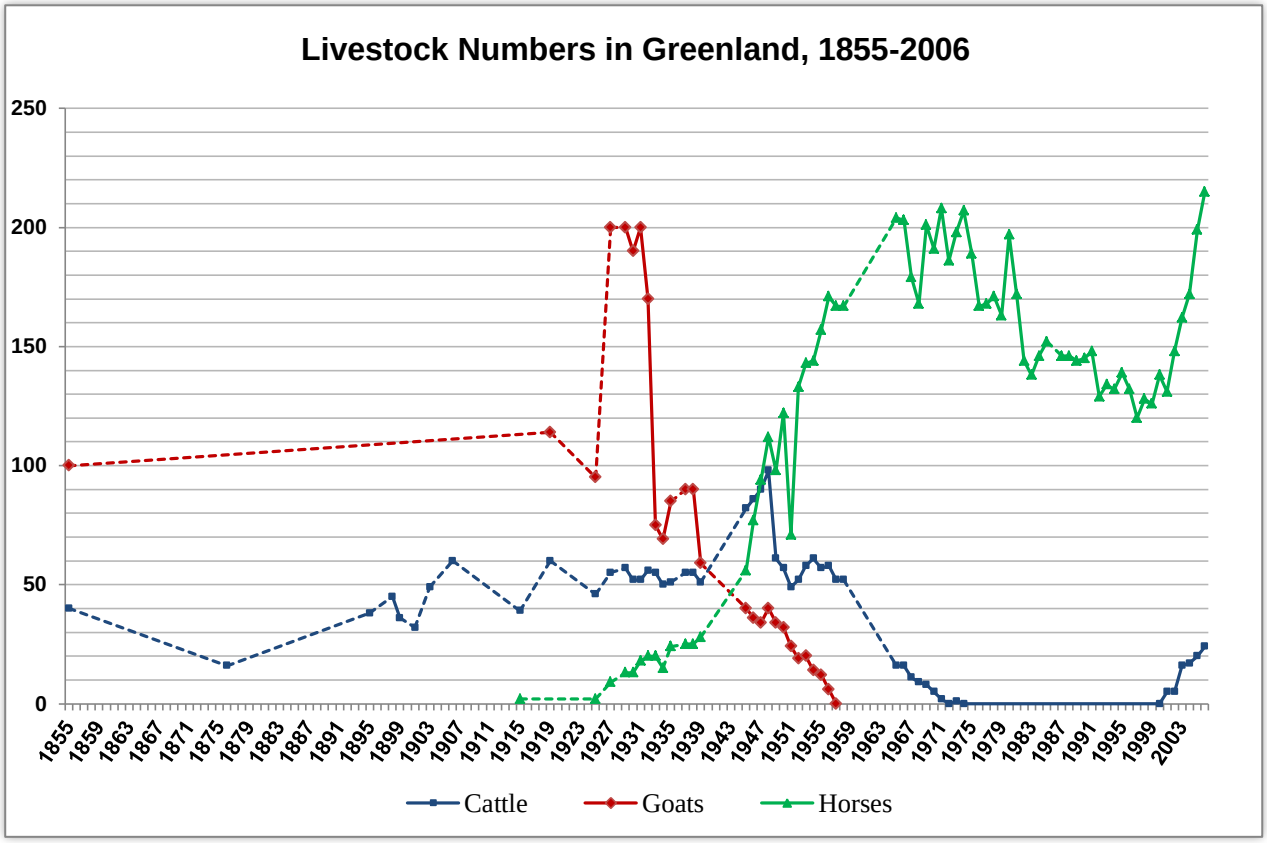

Fig.8.2 Numbers of cattle (blue), goats (red), and horses (green) in Greenland in the period 1855-2006; dashed line implies years with no counting (data after: Rink 1877, Steenstrup 1881, Bruun 1895, Meldorf 1906, Knuthsen *et al.* 1906, Jespersen 1915, Bendixen 1921, Hansen 1926, Danmarks statestik, Statistisk Årbog 1928-1985, Grønland: statistisk årbog 1970-2006).

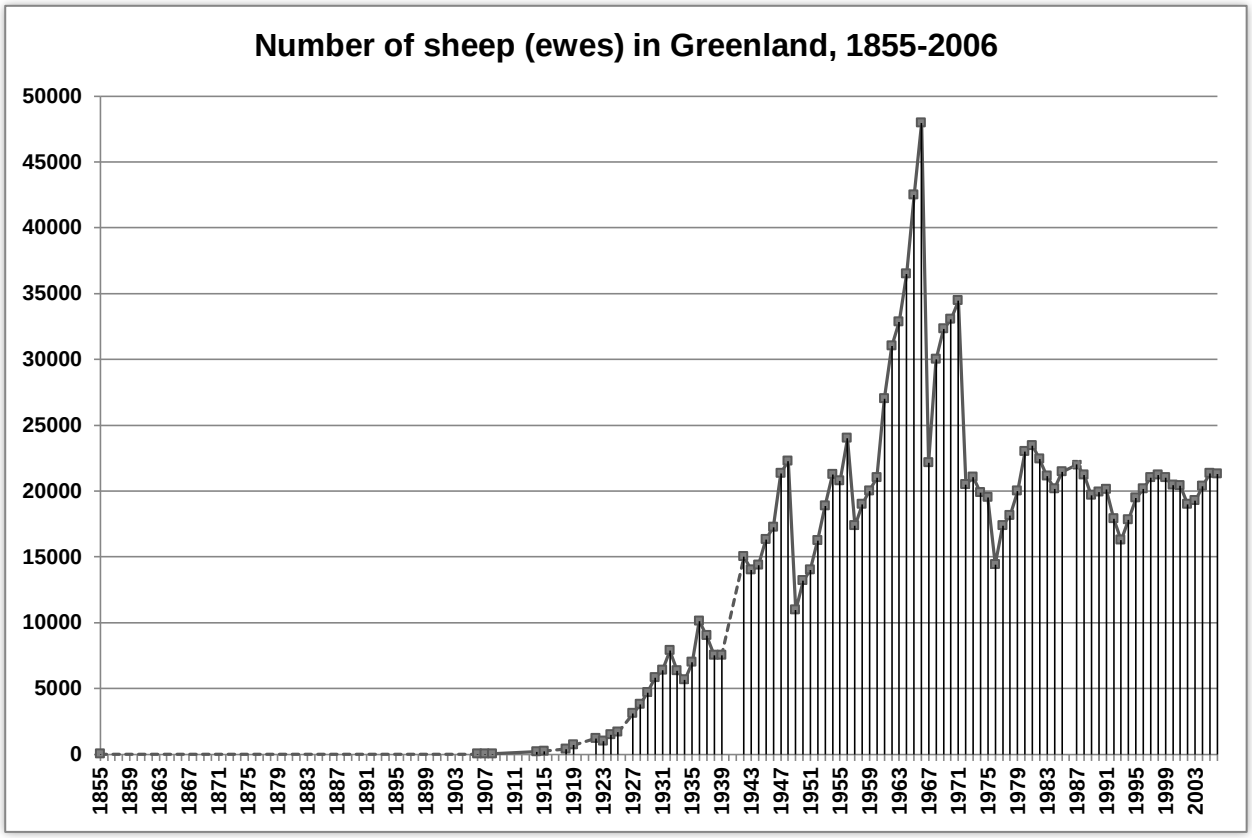

Fig.8.3 The number of sheep in Greenland 1855-2006; dashed lines imply years with no counts. Because most of the annual counts were made at the end of the year and after the slaughtering of lambs (at least after 1951), the given numbers mostly reflect the numbers of ewes and the summer maximum sheep population would have been substantially higher (data after: Chemnitz 1920, Walsøe 1918, Bendixen 1921, Kammp 1964, Hansen 1926, Danmarks statestik, Statistisk Årbog 1928-1985, Grønland: Statistisk Årbog 1970-2006).

Between 1721-1906, there were only two places in Greenland were farming was practiced on a larger scale: at Igaliku/*Garðar* (E47) where A. Olsen (see section 4.1.1) had reestablished farming in 1780-1782 (Rink 1877, Bendixen and Bobé 1921:96p) and the outpost of Narsaq – close to Norse *Dýrnes* (E18) – where cattle farming was taken up in the 1880's (Bendixen and Bobé 1921:460). There are few sources describing farming at Igaliku and Narsaq, but cattle seems to have been the primary livestock at both places, although at Igaliku there were also some sheep (Rink 1877:96p, Bruun 1895b:252p, Giesecke 1910:32). Because of the early archaeological, geological, and geographical surveys in the Eastern Settlement (see section 5.1.1-5.1.2) in South Greenland, it is possible to roughly trace the numbers of cattle and other livestock at Igaliku, Narsaq, and the colonies for a later part of the 1721-1906 period:

Fig.8.2 displays the total numbers of cattle, goats, and horses in Greenland in the period 1855-2006. Reviewing here only the period up to 1906, it is clear that cattle numbers lay fairly steadily around 40-50, since part of the visible fluctuation is an artifact of uncertain and unsystematic population counts. However, part of the fluctuation can also be attributed to the irrational mode of farming, in which little winter fodder was produced and the cattle simply slaughtered if they could not be fed (Rink 1877:97). Still, considering that most, if not all, of the cattle in this period descended from five heads of cattle imported in 1782 and 1784 (Ibid.96), and that cattle farming from this small stock was successfully practiced over some 150 years, does call into question, or at least moderate, the acuteness of retaining livestock reservoirs, a function suggested for the largest Norse church manors and farms (see above and: e.g., McGovern 1992a:212p, Dugmore *et al.* 2012:3659).

Before 1906, about 100 goats and 20 sheep were kept throughout Greenland (cf. Fig.8.2-8.3). Seeing that there were generally double the number of goats to cattle, it is surprising that when the debates on renewing farming stirred towards the close of the period, emphasis was on cattle rearing, not goat herding (e.g, Knuthsen *et al.* 1906, Meldorf 1906, Jespersen 1915, Simony 1918). It almost appears to reflect a cultural predisposition similar to that of the Norse, i.e. stressing both the economic- and sociocultural value of cattle husbandry. In any case, when large-scale farming eventually was renewed in Greenland, it involved neither cattle nor goats, but sheep:

8.1.2 Pre-Modern Farming – 1906-1976

The initiation of the period of pre-modern farming can accurately be set to 1906: this year reverend Jens Chemnitz in Narsaq Kujalleq/Frederiksdal (E223) at the head of the Narsap Saqqaa fjord and only some 50 km from the Cape Farewell – i.e. the southernmost part of the Eastern Settlement – received 2 rams and 9 lambs of Faroese stock, replenished in 1908 by another 8 sheep (Chemnitz 1920:30, Bak 1970a:370). Although a Dr. Deichman in the Qaqortoq (Julianehaab) colony had from 1904-1907 imported a few sheep of Scottish breed (Walsøe 1919:42), Chemnitz' 1906 sheep shipment represented a new and more organized initiative: for he received them on behest of the Danish governmental department concerned with Greenlandic affairs in order for him to conduct an actual sheep breeding experiment (Chemnitz 1920:30). This marked the onset a new era of farming in Greenland: specialized sheep farming, at first modestly subsidized by the Danish government.

J. Chemnitz' efforts showed promising results and in 1915 a more comprehensive sheep farming experiment was instigated by government initiative (Walsøe 1936): this year, Lt. L. Walsøe founded a sheep breeding station in Qaqortoq and brought in 170 sheep from northern Iceland. In addition, Walsøe also took over most of Chemnitz' Faroese flocks, which had grown to some 60 animals. Chemnitz was allowed to keep seven sheep, which four years later had already increased to around 50 (Chemnitz 1920:32, Walsøe 1936:167). Except for a few rams later imported from Iceland (Austrheim *et al.* 2008:49), the present Greenlandic sheep population all descent from these first ca. 230 sheep.

Although the sheep flock of J. Chemnitz had grown rapidly and sheep numbers were to increase even more dramatically, the first expansive phase of pre-modern farming after 1915 and up until the mid-1920's was characterized by a steady, but fairly slow increase in the sheep population (Fig.8.3). There was even a slight decline from 1922 to 1923, the first winter to clearly affect sheep numbers. The initial slow increase in the sheep population was due to the sheep breeding station first having to consolidate: in the beginning, the station would work as a stock reservoir and once sheep numbers were sufficiently high, animals should be distributed to able local Inuit at no immediate cost. In return, however, they were to repay the sheep breeding station an equal number of yearlings within 3 years (Hansen 1926:73). Also, the sheep breeding station was to educate local Inuit in farming and to aid in the construction of stables and barns. Initially, sheep were given only to the places were livestock was already being reared, i.e. Igaliku and Narsaq, which soon showed good results and aroused the attention of many locals (Walsøe 1936:161p).

Thus, the way was paved for a second expansive phase of pre-modern farming that can be described as Greenland's second *landnám*: the reclaiming of principal Norse farmlands in the inner fjords of South Greenland. Apart from Igaliku and Narsaq, these fjord areas had not seen permanent occupation since the Norse, because the seal- and fish based subsistence economy of the Inuit prevented them from staying in the inner fjord over the winter. However, in 1924 O. Frederiksen – a former apprentice at the sheep breeding station – moved to Qassiarsuk/*Brattahlið* (E29a) with his family and 145 sheep to subsist solely on sheep farming (Ibid.:163). The choice of site – one of the largest Norse farms – was not accidental, but a clear testimony to the careful selection, and limited extent, of the primary niches for farming, i.e. those formerly occupied by the *grænlendinga*. By 1935, sheep numbers had risen to 6691 individuals (Fig.8.3) and farming was practiced as a primary means of living at around 24 locations in South Greenland, as well as by a few farmers around Arsuk and Nuuk (Ibid. 170). In the latter area, a new sheep breeding station was established 1932 to promote sheep farming, but it never seriously caught on (Christiansen 1963:8, Kammp 1964:90p).

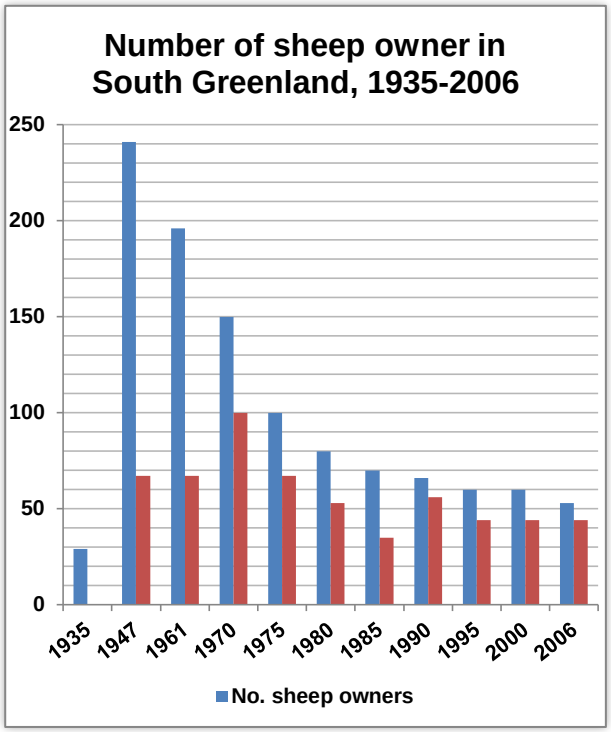

Fig.8.4 Number of sheep owners in Greenland at intervals in the period 1936-2006. Blue columns show total number of sheep owners, whereas the red columns show only those with sheep farming as their main occupation. Note the rapid decline in sheep owners after 1947 (data after: Walsøe 1936, Christiansen 1963, Grønland: Statistisk Årbog 1970-2006).

The period 1924-1948 thus witnessed rapid growth in both the number of both sheep and -farmers in Greenland (Fig.8.3-8.4). This increase owed partly to the larger and more specialized farms established in the inner fjords, and partly to an upsurge in the number of sheep owners living further out the fjord, who combined sheep rearing with fishing and sealing. By 1947, they made up more than three thirds of the sheep owners in South Greenland (Fig.8.3). The increase in such part-time sheep owners was undoubtedly stimulated by a need to be self-supporting in Greenland's isolation from Denmark during World War II, as well as by generally favorable conditions for extensive sheep farming (see below). Although the number of part-time sheep owners declined steadily after 1948 – while sheep owners with farming as their main occupation staid constant – combined fishermen/farmers even by the early 1960's still constituted close to a third of all sheep owners (Fig.8.4) in Greenland.

After the critical winter of 1966/1967 this changed drastically: although harsh winters had caused minor sheep population setbacks in 1932-1934, 1937-1938, and especially in 1948/1949 and 1956/1957, sheep number had generally increased: in 1966 they reached a thitherto peak of just below 48.000 ewes (Fig.8.3). However, the catastrophic winter of 1966/1967 more than halved that population; another harsh winter in 1971/1972 brought sheep numbers even lower, and with the catastrophic winter of 1975/1976, the total sheep population had been brought to a low it had not seen since before World War II.

Notable oscillations also extended to the number of other livestock (Fig.8.2), but for various reasons. Part of the visible fluctuation after 1906 owes to their numbers generally being so small that minor decreases or increases appear fairly marked. However, some of the fluctuation in their number must be ascribed to actual change: from being the most numerous livestock in Greenland through the entire period of colonial farming, goats quickly declined in numbers after 1919 and continued to do so until their total disappearance in 1957 (the marked increase after 1925 seems to be an artifact, probably of faulty or varying method of counting numbers). The only stated reason for the decline in goats is that the Inuit seems to have had little liking for goat milk (Jespersen 1915:78).

In contrast, the number of horses displayed an almost directly opposite trend: they increased with the resettlement of the inner fjord areas after 1924, where they were used for transport and draft. Until 1948, the increase appears to have been steady, but the winter of 1948/1949 broke this profile, where after horse numbers fluctuated even more frequently and noticeably than the sheep numbers (cf. Fig.8.2-8.3). The fluctuation in number of horses is unsurprising, since they were herded even more extensively than the sheep. Cattle numbers were fairly stable up until World War II, around which time there was a minor intensification so as to be self-supplied during Germany's occupation of Denmark (Christensen 1946:149). Cattle numbers peaked in 1948 with 98 heads across Greenland, but the winter of 1948/1949 also broke that positive curve. Although cattle numbers grew again during the early 1950's, they never recovered and after the winter of 1956/1957 declined steadily until their, preliminary, disappearance in 1974.

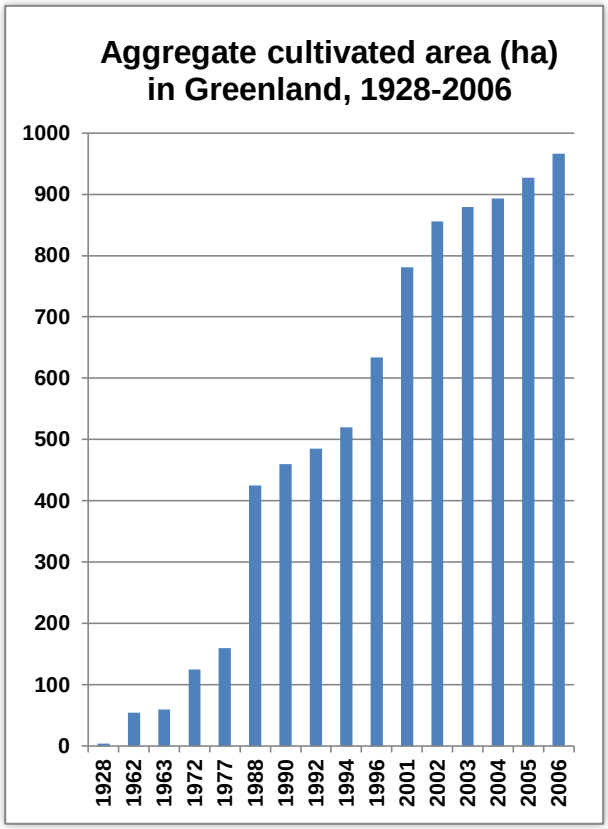

Fig.8.5 The aggregate area (in ha) of cultivated land in Greenland at intervals 1928-2006. Noticeable is the initial slow increase in the cultivated area, which persisted throughout the entire period of pre-modern farming. However, attempts at increasing the cultivated area after the catastrophic winter 1966/1967 are also evident (data after: Walsøe 1936, Christiansen 1963, Heerford *et al.* 1980, Grønland: Statistisk Årbog 1970-2006).

The isolation from Denmark during World War II also resulted in small-scale diversification of farming traditions in Greenland: a few farmers experimented with pig-keeping, but it never caught on; registered numbers never exceeded nine and after 1952 pig-keeping was completely given up (Christensen 1946:148, 152, Danmarks statestik, Statistisk Årbog 1945-1952). Chickens were being raised at many of the new Inuit sheep farms, a production that also intensified during World War II (Christensen 1946:152, Jensen 1951:68); in 1952 there were about 2500 chickens in Greenland (Danmarks statestik, Statistisk Årbog 1952), but thereafter they declined steadily in number until the 157 registered in 2006 (Høegh 2007:4). Besides the classical breeds of domestic livestock, pre-modern farmers in Greenland also experimented with raising rabbits, geese, and reindeer (Hansen 1926:75, Christensen 1946:170, Kammp 1964:75), of which only the latter production has proven successful. However, none of the above livestock experiments have any significance on our understanding of Norse farming and practices.

The boom-and-crash progress renewed farming in farming – which affected especially sheep farming, but also to some extent cattle and horses – is fairly easy to explain: throughout the first two phases of pre-modern farming – and indeed all the way up the critical winter of 1975/1976 – farming practices were markedly extensive, i.e. relying mainly on all-year outside grazing with limited winter fodder supplements (Jensen 1951:70, Christiansen 1963:7, Heerfordt *et al.* 1980:7p, Austrheim *et al.* 2008:48). This extensive mode of production did not owe to lacking knowledge. In fact, already the first sheep farmers were acutely aware of the importance of procuring sufficient winter fodder (e.g. (Knuthsen 1906:48, Hansen 1926:76, Bendixen 1927:89, Walsøe 1936:160). However, although Norse infields were being re-cultivated to meet this end, they were done so unsystimatically (Knuthsen *et al.* 1906:51, Christensen 1946:152, Jensen 1951:71p, Christensen 1955:149p); and even by the mid-20th century, sheep farmers still relied on the procurement of fodder from dispersed plots in the fjords with "naturally" rich vegetation, foremost the still unoccupied Norse sites (Walsøe 1919, Bentzen 1920:34p, Jensen 1951:71, Christensen 1953, Kristiansen 1955:464, Kammp 1964:86). This laborious work was carried out by foot, with horses, or small boats (Jensen 1951:71, Kristiansen 1955:464p).

Comparing the number of sheep owners (Fig.8.4), the number of sheep (Fig.8.3), and the aggregate cultivated area (Fig.8.5) up till 1960's there was a clear imbalance: for while the former two had increased dramatically, the aggregate area of cultivated land had not. Naturally, it became increasingly hard to procure enough fodder as sheep numbers increased and more farmers (and sheep) were competing for the same natural resource areas (e.g., Christensen 1946:152, Jensen 1951:71); and when the critical winters set in – as they had done earlier – their impact on sheep losses were proportionally higher, i.e. truly catastrophic winters. Thus, from the critical winter of 1948/1949 it became increasingly clear that the persisting farming system was highly unstable and with the catastrophic winter of 1966/ 1967, pre-modern sheep farming in Greenland went into its third reorganizational phase.

The solution was to cultivate more land to grow more winter fodder. But the remoteness of, and logistic issues with, farming in the fjords of South Greenland slowed this process: it was not until the 1950's that two tractors were purchased by the sheep breeding station, which local farmers could then hire cheaply to expand their infields (Christiansen 1963:10, Kammp 1964:87p, 1967:108). In addition, the sheep breeding station was in 1956 moved to Upernaviarsuk halfway into the Igaliku Fjord – Norse ruin group E82 – where there was space to expand cultivated fields for a surplus fodder production, which would – at a cheap price – serve as a fodder reservoir for sheep farmers in need (Kammp 1964:85p). Still, as displayed in Fig.8.5 the increase in aggregate cultivated land was still slow before 1976/1977 and was outmatched by the still high number of farmers and sheep (cf. Fig.8.3-8.4) relying on extensive farming.

Although the harsh winters were thus bound to take their toll, they did not affect all sheep farmers equally: reviewing Fig.8.4 it was clearly the fishermen/farmers in the middle and outer fjords that suffered most and their numbers continually dwindled after World War II. By 1975 – the year before the last catastrophic winter – they only outnumbered full-time sheep farmers only by one third. It is a clear indication of the lesser quality of the farmland in the outer fjords. In contrast, sheep farmers in the primary Norse farmlands in the inner and middle fjords suffered to far less extent and that is where many farms has survived and thrived to this day (Fig.8.8). In sum, throughout its third phase, climatic stress and environmental confines were pushing pre-modern farming in Greenland towards becoming a modern and specialized occupation.

8.1.3 Mechanized Farming after 1976

The last catastrophic winter of 1975/1976 set in motion a number of measures that would speed up the transformation of sheep farming in Greenland into the modern enterprise it is today: in 1975, a sheep farmer education had been set up at Upernaviarsuk (Grønland: statistisk årbog 1975:53) and in 1976, the sheep breeding station was converted into an independent institution (Heerfordt *et al.* 1980:10). In 1982, a 10-year developmental plan for sheep farming was outlined (Grønland: statitisk årbog 1988:125), which focused principally on stabilizing the sheep production by increasing winter fodder production and stable facilities, as well as initiating general modernization and mechanization of sheep farming by subsidizing it heavily. Part of the modernization agenda after 1976 was also a number of extensive surveys and monitoring of pasture areas and their carrying capacity (e.g., Laursen and Ørnsholt 1979, Heerfordt *et al.* 1980, Egede *et al.* 1982, Thorsteinsson 1983, Feilberg 1984b). Not at least, planning for an increase of cultivated and stables also involved archaeological inspection of sites of farming potential, since they were always marked by the ruins of earlier Norse activity.

The effect of the modernization Greenlandic farming after 1976 is clearly apparent in Figs.8.3-8.5: first, the total sheep population has stabilized significantly and lacks the truly drastic sudden declines of the pre-modern period (Fig.8.3). Second, the number of sheep owners has decreased continually, but seems to have found a fairly steady level after 1980 with very few active part-time farmers (Fig.8.4). Third, the aggregate cultivated area has multiplied by six since 1977 (Fig.8.5). The latter increase, however, has been achieved not primarily by extension of old Norse infields, but rather by claiming and draining meadows around the Norse farmsteads for cultivation (Fig.8.6). The latter was a clear break with pre-modern farming and, probably, also with Norse farming practices (see section 8.2.5).

8.1.4 Summary Discussion

Although only a cursory outline of the development of farming in Greenland after 1721, the above review is sufficient to establish that none of the described periods are directly parallel to farming in the medieval Norse Eastern Settlement:

The period of colonial farming 1721-1906 clearly has limited value as a comparative case study to medieval farming in Norse Greenland: livestock herding and gardening along Greenland's West Coast was subsidiary and supplemental, i.e. clearly not on the scale of Norse farming activities. Also, colonial period farming was geographically and environmentally associated with Inuit coastal habitation, i.e. a settlement pattern quite opposite to Norse occupation of inner fjords. However, the fact that both instances of larger-scale farming – at Igaliku (E47/*Garðar*) and Narsaq (E18/ *Dýrnes*) – first occurred at the largest Norse church farms does call for two observations: first, it implies an overlap in land use patterns and environmental boundaries, comparative aspects of settlement that I explore further in section 8.2. Second, the fact that these farms succeeded in keeping

low cattle numbers with no back-up livestock reservoirs or intensified fodder production over ca. 150 years implies that even low-intensity farming can be sustained in South Greenland, at least in the best agricultural areas.

The period of pre-modern farming would seem to offer the most comparative case study to Norse farming: the Inuit farmers of this period tended the same livestock as the Norse *grænlendinga*, occupied the same sites – including almost all of the largest Norse farmsteads – cultivated the same infields, initially with the same tools and technology, and summer grazed the same mountain pastures. However, there were also notable differences between the two farming systems: the Norse livestock included the full range of domestic animals, whereas the Inuit specialized in sheep farming, Norse farming was self-sustained, whereas Inuit farming was subsidized and increasingly marked oriented (a butchery was established in Julianehaab in 1929, replaced by a larger modern one in Narsaq in 1952 (Christiansen 1963:8); Norse farmers largely relied on the same tools and resources throughout the entire settlement period, whereas Inuit farmers increasingly had access to mechanical (agricultural machinery) and chemical (fertilizers, vaccines etc.) aids.

After 1976 the latter advances effected that the period of mechanized farming generally is an ill-fitted comparative case study to medieval Norse farming. However, as I will explore further in section 8.2.1, the stabilization of Inuit sheep farming in this period around relatively few sites, several of which were also the first to be reoccupied, implies that these constituted the principal and most sustainable farmlands in all of Greenland. Characteristic of these persisting sites is the associated substantial areas of former meadow – now drained (e.g., Fig.8.6) – which must have been a critical fodder resource to the Norse.

To conclude, although none of the above periods of farming in Greenland provide direct comparative case studies to farming practices in the Norse settlements, several particular aspects of farming in this specific environment may be explored – as they are in section 8.2 – through the experiences, successes, and failures of the Inuit farmers.

On a closing note, and offering another kind of comparative perspective, the history of reintroduced farming in Greenland also provides an example of "long-term" changing farming practices that may be discussed within the framework of *resilience theory* and its adaptive, and transformative cycles (see section 8.3.2, Fig.8.17): the transition from colonial to the pre-modern farming was a major transformation, i.e. (re)introduction of a "new" extensive farming system. After an initial period of growth up to 1966/1967 (*r*-phase), followed a period of conservation (*K*-phase) until the catastrophic winter of 1976/1977, which caused major reorganization (α-phase) of sheep farming (after 1976). The latter transformation was preceded by the completion of multiple lower-scale small-and-fast adaptive cycles which involved critical sheep population depletions and subsequent regrowth, each time pushing closer towards the final and major reorganization of the farming system as a whole. This is of course a simplified explanation for the development of the modern farming system, but nonetheless one that introduces aspects worth exploring: to which extent, when, and for how long, the Norse could rely on extensive grazing and farming contra more labor costly intensive farming.

Fig.8.6 Hay-stacking at Qassiarsuk/*Brattahlið* (E29a). Until the late 1960's, Inuit sheep farming was largely unmechanized and relied on the same labor and tools as used by the Norse (photo: Vebæk 1962).

8.2 Comparative Aspects of Farming in Greenland

In section 8.2, I explore select comparative aspects of Norse and pre-modern farming in Greenland based on the environmental, archaeological, and historical outlines presented in the above chapters: first, I compare the development of settlement on the two farming systems to identify similarities and differences that may inform us further on the nature of the Norse settlement and farming system. Second, I compare the two farming systems in terms of their range of relative "extensiveness" and "intensiveness" to identify the main obstacles of farming expansion and conservation facing farmers past and present. This is explored mainly through the discussion and analysis of the frequency of critical and catastrophic winters. Third, I address the related issue of how the farmers did, and could have, responded to stresses imposed by environmental confines in terms of feeding their livestock.

8.2.1 Farming Settlement Development

In the above, I have mostly treated the archaeological record as accumulated evidence, a natural consequence of the character of the surface survey evidence. It is clear, however, that this could be a major issue with the proposed classification and settlement model, and that chronological depth is the final dimension needed to verify its overall correctness. Yet, the lack of a robust chronological framework has always posed a major obstacle to Norse Greenland archaeology, first because most larger excavations were carried out prior to the introduction of ^{14}C-dating (cf. Tab.4.1), second because of the complex use histories of the sites, which could change from shieling to farmstead and back again, could be reoccupied and abandoned several times. Thus even with new dating methods, the inevitable question always remains: what are we actually dating?

While this will always be a highly problematic issue in the excavations of architecture, the focus on middens since the late 1970's – and in the Vatnhverfi-Project – has in part alleviated the problem: middens present stratified layers of refuse that must, at a minimum, represent the beginning and end of site occupation. However, it does not help at the sites without midden (or without midden preservation, cf. section 4.2.2 and 7.1.4). In recent years, palynological investigations in the Eastern Settlement have also gone a long way to help date local and regional activities and impacts (Edwards *et al.* 2007, Schofield *et al.* 2007, Gauthier *et al.* 2010, Schofield and Edwards 2011, Massa *et al.* 2012a, Massa *et al.* 2012b, Perren *et al.* 2012, Ledger *et al.* 2013b, 2013a, Schofield *et al.* 2013, Ledger *et al.* 2014a). Combining all this dating evidence provides us with a much more robust chronological overview.

Tab.8.1 presents a list of 56 "*landnám* dates" from 31 different Norse sites in the central Eastern Settlement, most of them in or near the Vatnahverfi region, and spanning the entire settlement dispersion from inner to outer fjord (Fig.8.7). The dated samples derive from different contexts: human bones from churchyards, animal bones (only terrestrial mammals are included) and textiles from middens and buildings, and charcoal from infields and peat deposits (cf. Tab.8.1). Where the archaeological context is uncertain or multiple dates are available, the two earliest dated samples have been selected. Despite of the diversity of these samples, the chronological implications are convincing:

Although there are inevitably overlaps, the dates generally seem to divide on two fairly distinct groups: those that fall before or shortly after AD 1000 and those that fall from around or shortly after AD 1000 but incline towards a later date (Tab.8.1). Note that E78 is included as an early site although the dates incline towards the second group on grounds that the dated burials overlay earlier undated graves (Møller *et al.* 2007). In Fig.8.7 the early group of dated sites is indicated with bright green dots, the later group with red dots. According to Fig.8.7, Roussel was apparently right when he claimed (1941:12) that the first Norse farmers settled at the heads of the fjords. But he was not completely right. For equally plain from Fig.8.7 is the observation that also the middle fjord farmsteads appear to have been occupied during the first settlement wave. All the earliest farmsteads were located close to the fjord, likely because these were the easiest places to settle (Ledger *et al.* 2013b:37) and also where the most extensive pastures and meadows were found, i.e. a *landnám* scenario quite similar to that suggested for Iceland (Vésteinsson 1998, Vésteinsson *et al.* 2002:120). Certainly, the scenario in Fig.8.7 seems quite at odds with the one-chieftain to one-fjord scenario portrayed by written narrative.

Tab.8.1 *Landnám* dates of Norse sites in the central Eastern Settlement8

Ruin group No.	Lab. No	14C-age BP	Cal-age AD	1-sigma range AD	2-sigma range AD	Reference:
E2 (mire)	UERC-8916	-	-	-	950-1020	Edwards *et al.* 2007
E17a (ruin 1)	AAR-6108	955+/-30	1035-1145	1025-1155	-	Arneborg et al. 2012:Tab.2
E17a (ruin 1)	AAR-6109	1140+/-35	0895-0935	0885-0975	-	Arneborg et al. 2012:Tab.2
E29a (ruin no.59a)	AAR-1273	1040+/-80	1011	0960-1040	-	Arneborg et al. 2012:Tab.3
E29a (ruin no.59a)	AAR-1275	1229+/-41	976	0894-0996	-	Arneborg et al. 2012:Tab.3
E29a (ruin no.59a)	AAR-1571	1225+/-51	985	0909-1017	-	Arneborg et al. 2012:Tab.3
E33 (ruin no.16a)	AAR-7885	1095+/-29	978	0897-0988	-	J. Arneborg unpubl. data
E33 (ruin no.16a)	AAR-7886	1017+/-30	1019	0997-1024	-	J. Arneborg unpubl. data
E34 (midden)	K-7047	1030+/-40	1005-1015	0985-1025	-	Nyegaard et al. unpubl. data
E34 (midden)	K-7049	880+/-40	1160-1180	1060-1220	-	Nyegaard et al. unpubl. data
E34 (midden)	K-7050	679+/-37	1295	1060-1220	-	Nyegaard et al. unpubl. data
E39 (mire)	SUERC-10507	-	933	-	780-1020	Schofield and Edwards 2011:Tab.1
E47 (midden)	AAR-17478	983+/-25	-	1017-1148	-	Nyegaard et al. unpubl. data
E48 (ruin 3a)	AAR-7876	912+/-34	1069-1158	1038-1186	-	J. Arneborg unpubl. data
E48 (ruin 3a)	AAR-7877	880+/-33	1163-1180	1067-1215	-	J. Arneborg unpubl. data
E48 (ruin 3a)	AAR-7878	906+/-46	1074-1159	1036-1209	-	J. Arneborg unpubl. data
E48 (ruin 3a)	AAR-7879	1008+/-35	1037	1025-1155	-	J. Arneborg unpubl. data
E60 (infield)	SUERC-52504	1108 ± 25	-	897-975	887-991	Simpson et al. unpubl. data
E60 (infield)	SUERC-52508	1070 ± 29	-	906-1016	896-1021	Simpson et al. unpubl. data
E64 (ruin no.6a)	AAR-12967	1089+/-30	-	0898-0990	893-1014	J. Arneborg unpubl. data
E64 (ruin no.6a)	AAR-12968	1153+/-31	-	0784-0965	779-972	J. Arneborg unpubl. data
E64 (ruin no.6a)	AAR-12969	1089+/-30	-	0898-0990	893-1014	J. Arneborg unpubl. data
E64a	Ua-1121	820+/-65	1220	1160-1280	-	J. Arneborg unpubl. data
E64a	Ua-1122	635+/-65	1300-1380	1290-1400	-	J. Arneborg unpubl. data
E64c	Ua-1120	695+/-55	1290	1280-1380	-	J. Arneborg unpubl. data
E65 (mire)	-	-	1000	975–1095	-	Ledger et al. 2014b:37
E70 (mire)	-	-	1090	-	1050-1150	Ledger et al. 2014b:37
E71	AAR-0909	945+/-60	-	1015-1165	0980-1220	J. Arneborg unpubl. data
E71 (ruin 12)	AAR-6145	965+/-35	1030	1020-1151	1015-1160	Arneborg et al. 2012:Tab.7
E71 (lake)	-	-	-	-	880-1000	Ledger et al. 2014b:37
E74 (ruin no.4)	KIA-25971	-	1022	1003-1032	0996-1050	J. Arneborg unpubl. data
E74 (ruin no.4)	SUERC-17590	-	-	1040-1160	1020-1210	J. Arneborg unpubl. data
E78 (ruin 2a)	AAR-12598	942+/-36	-	1032-1153	1020-1170	J. Arneborg unpubl. data
E78 (ruin 2a)	AAR-12600	919+/-36	-	1043-1159	1028-1207	J. Arneborg unpubl. data
E78a (mire)	-	-	970	-	775-1015	Ledger et al. 2014b:37
E80b (infield)	SUERC-52509	1105 ± 29	-	897-980	885-1012	Simpson et al. unpubl. data
E80b (infield)	SUERC-52510	1037 ± 26	-	990-1020	906-1031	Simpson et al. unpubl. data
E89a (infield)	SUERC-52532	1138 ± 29	-	882-970	856-983	Simpson et al. unpubl. data

Ruin group No.	Lab. No	14C-age BP	Cal-age AD	1-sigma range AD	2-sigma range AD	Reference:
E96 (infield)	SUERC-52533	1061 ± 26	-	973-1017	900-1023	Simpson et al. unpubl. data
E96 (infield)	SUERC-52534	946 ± 24	-	1032-1050	1027-1155	Simpson et al. unpubl. data
E119 (midden)	SUERC-52512	886 ± 29	-	1052-1210	1042-1219	Simpson et al. unpubl. data
E119 (midden)	SUERC-52513	990 ± 29	-	999-1147	989-1153	Simpson et al. unpubl. data
E167 (ruin no.1)	AAR-6132	970+/-40	1030	1020-1155	-	Arneborg et al. 2012:Tab.8
E167 (ruin no.1)	AAR-6133	940+/-35	1040-1150	1025-1160	-	Arneborg et al. 2012:Tab.8
E167 (ruin no.1)	AAR-6134	1090+/-30	0980	0900-0995	-	Arneborg et al. 2012:Tab.8
E171 (midden)	SUERC-45392	921 ± 45	-	1040-1160	1025-1209	C.K. Madsen et al. unpubl. data
E171 (midden)	SUERC-45396	868 ± 45	-	1051-1222	1040-1259	C.K. Madsen et al. unpubl. data
E172 (midden)	SUERC-33587	1050+/-35	-	0900-1030	0890-1030	K. Smiarowski unpubl. data
E172 (midden)	SUERC-33588	1080+/-35	-	0890-1020	0890-1020	K. Smiarowski unpubl. data
E172 (midden)	SUERC-33589	1035+/-35	-	0975-1025	0890-1120	K. Smiarowski unpubl. data
E174 (midden)	SUERC-52519	899 ± 29	-	1047-1186	1040-1211	Simpson et al. unpubl. data
E182 (ruin no.7)	AAR-15506	979+/-40	-	1016-1152	992-1157	J. Arneborg and C.K Madsen unpubl. data
E182 (infield)	SUERC-52521	981 ± 24	-	1018-1147	997-1153	Simpson et al. unpubl. data
E184 (midden)	SUERC-52522	890 ± 29	-	1050-1206	1042-1217	Simpson et al. unpubl. data
E188 (ruin no.1)	AAR-15508	899+/-24	-	1048-1180	1042-1211	J. Arneborg and C.K Madsen unpubl. data
E329 (ruin no.1)	AAR-15509	938+/-23	-	1037-1152	1031-1156	J. Arneborg and C.K Madsen unpubl. data

Tab..8.1 List of dates from Norse ruin groups in the central Eastern Settlement with indication of the sample context (added to the ruin group number in bracket) and references: ruin number followed by an "a" indicates dates on human bones from churchyards (except E33 which is on charcoal from a grave); ruin groups with no bracket indicates dates with no additional information.

Also noticeable in Tab.8.1 and Fig.8.7 is that *landnám* seems to haveunfolded in two steps: the second and slightly later group of dates suggests that the settlement of inland (E71, E171), upland (E34, E70, E74, E167), and outer fjord (E119, E182, E184, E188, E329) sites was delayed with some 50-100 years. This is also well in accord with other pollen evidence from the region (Schofield *et al.* 2013:Fig.4-6). Moreover, this delayed settlement expansion also seems reasonable seeing that these areas often were of poorer farming and grazing quality or required more work (clearing of shrub vegetation) before they could be settled. Still, at least by the end of the 11th century, the entire landscape between the Icecap and the arctic North Atlantic appears to have been claimed by the Norse. This is a quite different scenario than that forwarded by J. Berglund (1991), who held that settlement development was fairly gradual and continued into the 14th century with the major expansion occurring in the 13-14th centuries (Ibid.156). Rather, the dates seem to reflect exactly the kind of burst-and-trickle *landnám* outlined in section 2.1.1

There are also some inconsistences in the dates: for instance, it seems highly unlikely that Igaliku/*Garðar* (E47) should have been occupied in a second phase of *landnám*. The single recent date is from a 2012 excavation of refuse layers at some distance from the dwelling, which are probably not the earliest deposits. The slightly later date of E48 could be real, although the dated samples are all human bones from the churchyard, which may not have been established at very first *landnám*. In any case, this new settlement expansion evidence can be put into perspective by crosschecking with expansion of Inuit historic farming:

Fig.8.8 displays the distribution of sheep farms in the same area of the central Eastern Settlement in 1936 (bright green dots), 1963 (red dots), and 2008 (blue dots). There are both some obvious differences and similarities when compared with Fig.8.7: in 1935, the sheep farms were clearly concentrated in the outer fjords, the middle fjords oddly vacant, while the best inner fjord sites (E29a, E47, E66) had been reclaimed. Among the few middle fjord sites that had been resettled

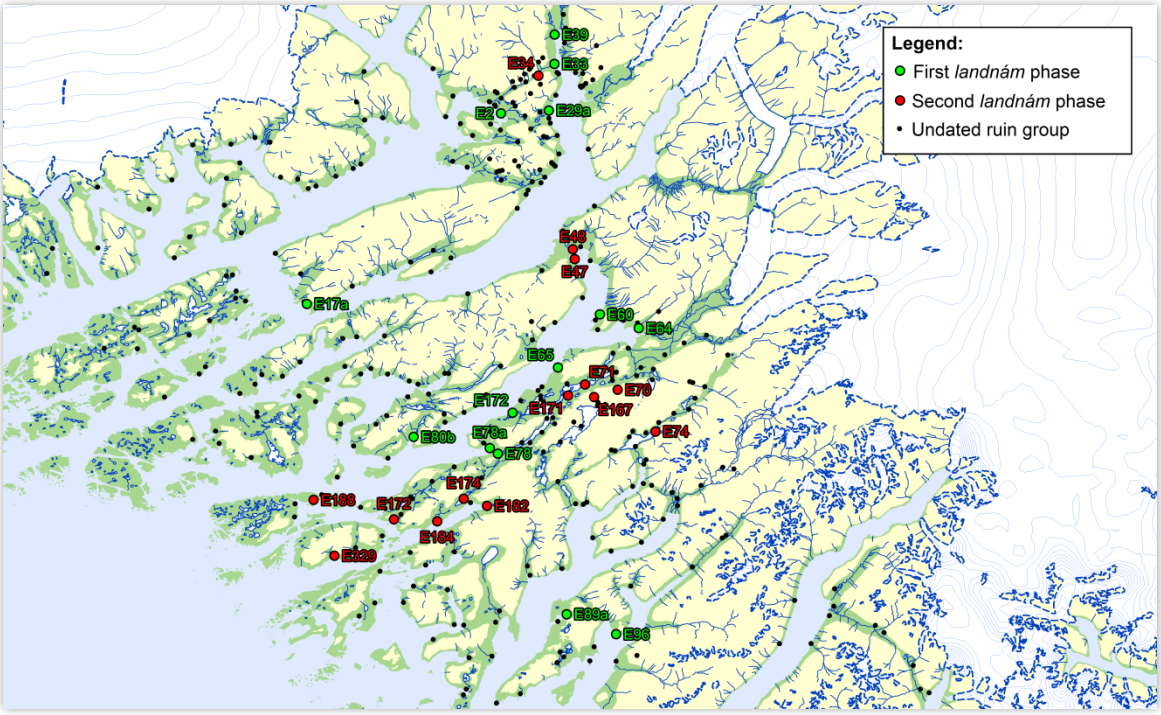

Fig.8.7 The geographical distribution of the dated settlement evidence listed in Tab.8.1 Green dots indicate the earliest group dates, the red dots the slightly later group. The figure is discussed in the text.

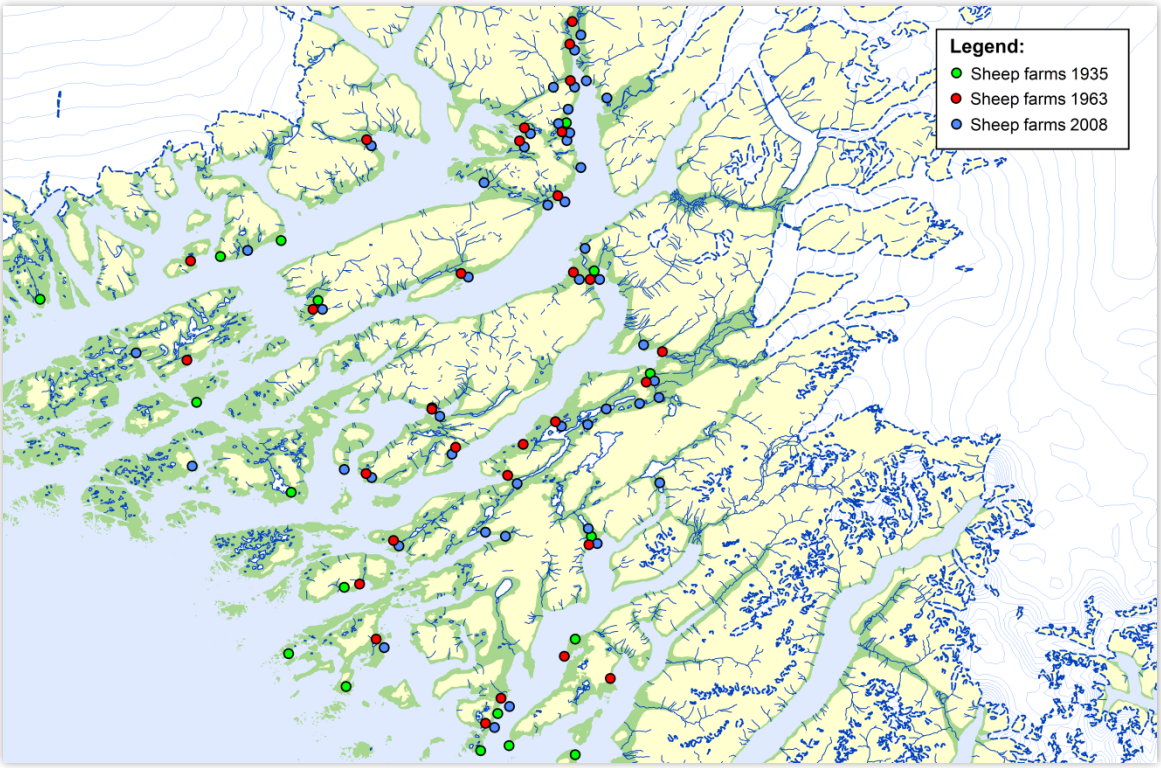

Fig.8.8 The distribution of Inuit sheep farms in 1935 (green dots), 1963 (red dots), and 2008 (blue dots). The gradual shift of the sheep farms towards the middle and inner fjord, and eventually to inland and upland areas, has some similarities with, and implications for, Norse settlement expansion (cf. Fig.8.7, conf. text).

was E18 and E77a, the first being classified as a church manor in the above, the second as a large farmstead. Thus, there seems to be a strong correlation between the first Inuit sheep farms established and the largest Norse sites, which needs little explanation: full-time sheep farmers settled the best Norse farmlands. Conversely, the sites in the outer fjords belonged to the small-scale fishermen-farmers, which for obvious reasons were bound to their old Inuit settlement pattern. One part of reintroduced Inuit farming followed the Norse *landnám* pattern, whereas the other did not. Considering how dependent the Norse were on seal from the beginning of settlement, it is a rather curious and interesting circumstance that their early settlement pattern did not resemble more that of the early Inuit farmers.

By 1963 the distribution of Inuit sheep farms had shifted noticeably: the concentration of farms (red dots in Fig.8.8) was now found in the middle and inner fjords. In the Qassiarsuk /*Brattahlið* area another three Norse church farmsteads had been resettled; in the Vatnahverfi region the two farmsteads with early small churches (E64 and E78) – large farmsteads according to the classification model – as well as manor E76 had been reclaimed. In addition, sheep farms had been established by the two church manors of E83 and 149, while farming continued at all the first inner fjord sites resettled. Combined with the abandonment of outer fjord part time sheep farms, the Inuit settlement pattern was obviously starting to look more like the Norse. This is again strong testimony to the marginality of the outer fjords sites over those in the middle and inner fjord in terms of livestock farming. Moreover, a significant observation from Fig. 8.8 is that even by 1963 the Inuit sheep farms were tied to the fjord, i.e. even such fertile inland or upland areas as the central Vatnahverfi and the Qorlotup Itinnera had not yet been claimed. This seems a direct parallel to Norse settlement development.

By 2008 the pattern of 1963 had solidified: the Inuit sheep farms now clustered in the Qassiarsuk/*Brattahlið* (E29a) area, around Igaliku/*Garðar* (E47), and at sheltered middle fjord sites. In addition, by this time we see the inland and upland areas – such as the central Vatnahverfi and the Qorlortup Itinnera – resettled. By this time then, the settlement pattern of the Inuit sheep farmers seems to have converged more or less fully with Norse settlements patterns.

It is evident that the distribution of Inuit sheep farms was never exactly identical to the Norse, and part of the settlement pattern should undoubtedly also be explained by other than environmental causes, for instance the presence of colonies, trade- and mission stations (e.g. Qaqortoq, Alluitsuup Paa, Lichtenau etc.). However, the gradual convergence of Norse and Inuit settlement patterns is a striking indication of settlement processes large guided by environmental possibilities and confines for livestock farming. Overall, the later Inuit settlement pattern lends credibility to the settlement pattern suggested by dated evidence. Also, the correlation between early and lasting Inuit sheep farms and the principal farmsteads of the Norse is so strong that it is both tempting and not completely unreasonable to extend the Inuit settlement distribution to the undated Norse sites: in short, the more colored dots a corresponding Norse site have in Fig.8.8, the more likely it is to have been settled early. Thus, although we have no founding dates for E66 and E77a in the Vatnahverfi region, it seems highly likely that these sites were among the first to be settled, whereas those with only two dots were perhaps only settled in the second phase of *landnám*. The question is if the Norse farmsteads with most dots were also the ones to survive the longest?

8.2.2 Farming Settlement Abandonment

The chronological framework for the abandonment of the Norse settlements is less developed and consistent. This owes in part to a notable plateau on the calibration curve, but even more so the trouble in pinpointing exactly what is being dated. For instance, in a recent palynological analysis of E70, a site in the central Vatnahverfi classified as a large complex shieling, it was demonstrated that there was a notable disintensification in site activities already from AD 1300-1390, but site abandonment only after AD 1325-1415 (Ledger *et al.* 2013a). Generally, the palynological investigations are far less adamant in dating settlement abandonment than they are in dating *landnám* (e.g, Edwards *et al.* 2007:15, Schofield and Edwards 2011:192, Massa *et al.* 2012a:122), among other reasons because the footprints of Norse settlement – introduced apophytes, increased soil erosion rates, coprophilous fungi, charcoal – was only gradually erased after site abandonment (e.g., Schofield *et al.* 2013:Fig.4-6). In short, interpreting the timing of settlement abandonment is far more difficult than interpreting the evidence for *landnám*.

Tab.8.2 “Terminal” dates of Norse sites in the central Eastern Settlement

Ruin group No.	Lab. No	14C-age BP	Cal-age AD	1-sigma range AD	2-sigma range AD	Reference:
E1 (ruin 1a)	AAR-8585	845+/-25	1426	1412-1438	-	J. Arneborg unpubl. data
E1 (ruin 1a)	AAR-8586	890+/-25	1308	1299-1324	-	J. Arneborg unpubl. data
E23 (ruin 3a)	AAR-8589	925+/-30	1320	1304-1388	-	J. Arneborg unpubl. data
E23 (ruin 3a)	AAR-8590	930+/-35	1299	1288-1314	-	J. Arneborg unpubl. data
E23 (ruin 3a)	AAR-8591	695+/-30	1448	1436-1469	-	J. Arneborg unpubl. data
E29a (midden)	SUERC-11552	775±35	-	-	1185-1285	Edvarsson et al. 2006:Tab.8
E29a (midden)	SUERC-11559	775±35	-	-	1185-1285	Edvarsson et al. 2006:Tab.8
E34 (midden)	CAMS-54416	770+/-30	1256+/-22	1229-1277	1214-1287	Nyegaard et al. unpubl. data
E34 (midden)	CAMS-54417	830+/-40	1214+/-47	1170-1255	1073-1276	Nyegaard et al. unpubl. data
E34 (mire)	SUERC-6391	590+/-35	.	.	1290-1420	Schofield et. al. 2007:Tab.3
E34 (mire)	SUERC-8906	665+/-35	-	-	1270-1440	Schofield et. al. 2007:Tab.3
E39 (mire)	SUERC-4311	615 ± 35	-	-	1290–1400	Schofield and Edwards 2011:Tab.1
E39 (mire)	SUERC-16819	845 ± 35	-	-	1050–1270	Schofield and Edwards 2011:Tab.1
E47 (midden)	SUERC-8576	625+/-35	-	1290-1400	-	Nyegaard et al. 2013 unpubl. data
E47 (ruin)	AAR-1438	880+/-90	1295	1256-1392	-	J. Arneborg unpubl. data
E48 (ruin 3a)	AAR-7877	880+/-33		1163-1180	1067-1215	J. Arneborg unpubl. data
E48 (ruin 3a)	AAR-7878	906+/-46	1074-1159	1036-1209	-	J. Arneborg unpubl. data
E65 (mire, modeled)	-	-	1215	-	1115–1300	Ledger et al. 2014:42
E66 (ruin 1a)	AAR-1441	880+/-55	1392	1312-1417	-	Arneborg et al. 2012:Tab.6
E66 (ruin 1a)	AAR-1442	890+/-45	1297	1279-1317	-	Arneborg et al. 2012:Tab.6
E70 (mire)	SUERC-33442	535±30	-	-	1320–1440	Ledger et al. 2013a:Tab.I
E70 (mire)	SUERC-33443	655±30	-	-	1280–1395	Ledger et al. 2013a:Tab.I
E71 (ruin 12)	AAR-6143	735+/-35	1280	1257-1289	1219-1377	Arneborg et al. 2012:Tab.7
E71 (ruin 12)	AAR-6144	700+/-40	1290	1268-1381	1229-1391	Arneborg et al. 2012:Tab.7
E71 (mire)	-	-	-	1350-1420		Ledger et al. 2014:13
E71a (mire)	SUERC-36590	705 ± 35	-	-	1250–1390	Ledger et al. 2014:Tab.1
E71a (mire)	SUERC-36591	730 ± 35	-	-	1220-1380	Ledger et al. 2014:Tab.1
E74 (ruin 4)	SUERC-17585	-	-	1155-1225	1040-1270	K. Smiarowski (unpubl. data)
E74 (midden)	SUERC-17582	-	-	1315-1415	1290-1430	K. Smiarowski (unpubl. data)
E78 (ruin no.2a)	AAR-12603	819+/-39	-	1186-1262	1155-1278	J. Arneborg unpubl. data
E78a (mire, modeled)	-	-	1285	-	1235–1320	Ledger et al. 2014:42
E89a (infield)	SUERC-52531	659 ± 29	-	1285-1385	1278-1392	Simpson et al. unpubl. data
E119 (midden)	SUERC-52511	612 ± 29	-	1301-1396	1295-1403	Simpson et al. unpubl. data
E119 (midden)	SUERC-52512	886 ± 29	-	1052-1210	1041-1219	Simpson et al. unpubl. data
E149 (ruin no.1a)	AAR-1263	845+/-50	1404	1329-1428	-	Arneborg et al. 2012:Tab.9
E149 (ruin no.1a)	AAR-1266	852+/-44	1399	1325-1418	-	Arneborg et al. 2012:Tab.9
E149 (infield)	SUERC-52539	587 ± 26	-	1316-1404	1301-1413	Simpson et al. unpubl. data
E150 (infield)	SUERC-52540	643 ± 26	-	1292-1387	1283-1394	Simpson et al. unpubl. data

Ruin group No.	Lab. No	14C-age BP	Cal-age AD	1-sigma range AD	2-sigma range AD	Reference:
E167 (ruin no.1)	K-5889	710+/-50	1275	1265-1285	-	Sidste nordbo".
E167 (ruin no.1)	AAR-6137	675+/-35	1295	1285-1380	-	Arneborg et al. 2012:Tab.8
E168 (midden)	AAR-16869	371+/-25	-	1454-1618	1447-1634	J. Arneborg and C.K Madsen unpubl. data
E168 (midden)	AAR-16870	849+/-25	-	1169-1219	1155-1259	J. Arneborg and C.K Madsen unpubl. data
E171 (midden)	SUERC-45397	736 ± 45	-	1227-1291	1210-1387	C.K. Madsen et al. unpubl. data
E171 (midden)	SUERC-45398	908 ± 45	-	1042-1172	1029-1214	C.K. Madsen et al. unpubl. data
E172 (midden)	Beta-320125	560+/-30	1400	1320-1340/1390-1410	1310-1360/1390-1430	K. Smiarowski unpubl. data
E172 (midden)	Beta-320126	600+/-30	-	1300-1360/1380-1400	1290-1410	K. Smiarowski unpubl. data
E174 (midden)	SUERC-52514	692 ± 26	-	1275-1377	1362-1386	Simpson et al. unpubl. data
E174 (midden)	SUERC-52518	588 ± 29	-	1315-1404	1299-1414	Simpson et al. unpubl. data
E182 (infield)	SUERC-52520	606 ± 29	-	1304-1397	1297-1405	Simpson et al. unpubl. data
E184 (midden)	SUERC-52523	648 ± 29	-	1290-1387	1281-1395	Simpson et al. unpubl. data
E184 (infield)	SUERC-52528	652 ± 24	-	1290-1385	1282-1392	Simpson et al. unpubl. data
E188 (ruin no.1)	AAR-15507	659+/-24	-	1286-1385	1280-1390	J. Arneborg and C.K Madsen unpubl. data

Tab.8.2 List of dates from Norse ruin groups in the central Eastern Settlement with indication of the sample context (added to the ruin group number in bracket) and references: ruin number followed by an "a" indicates dates on human bones from churchyards; ruin groups followed by 'modeled' in bracket indicates dates based on age-depth model from ^{14}C-dated benchmarks.

Tab.8.2 presents a list of 52 "terminal" dates from 22 sites in the same part of the central Eastern Settlement, and selected by the same criteria, as those listed in Tab.8.1 and shown in Fig.8.7. However, whereas most of the *landnám* dates provide a *terminus post quem* onset, the dates listed in Tab.8.2 do not necessarily provide a *terminus ante quem*, and are harder to interpret. Issues with the palynological dates were noted above, but the other contexts wherefrom the dates samples derive should equally be considered: for instance, several of the listed dates are from anthropogenic infields soils, i.e. cultural refuse material either purposefully or naturally deposited. However, if infields were no longer being cultivated and fertilized, the dates may effectively only date the abandonment of infield cultivation.

Issues with the midden dates are similar: the date of the latest deposits only pinpoints when no more refuse was added to a particular dump, but it may have been deposited elsewhere or used as fertilizer. This may explain why the latest dates from the midden at a prime farming location such as Qassiarsuk/*Brattahlið* (E29a) all fall before AD1300 (Tab.8.2.). Burials offer some of the best end dates for site abandonment, but as outlined in the above, some churchyards were closed down before others, while the farmsteads they were associated with may have continued. However, at sites where there are multiple agreeing dates from various context such issues are less deterring. Still the chronological framework for settlement abandonment is clearly not as rigorous as for the development of *landnám*.

The final abandonment of the Eastern Settlement is traditionally dated to around AD 1450 (Arneborg 1996), and there is nothing in Tab.8.2 to oppose this. However, it is clear from Tab.8.2 that relatively few of the "terminal" dates extend that far up in time. In fact the majority seem to fall already in the late 13th to14th centuries. Although the dates display notable overlaps one can – just as for the *landnám* dates – tentatively distinguish between those dates that fall considerately before or just barely creep into the 15th century AD, but are clearly inclined towards an earlier date, contra those dates that clearly fall after AD 1400. Fig.8.9 displays the geographical distribution of the "terminal" dates listed in Tab.8.2 in the same manner as in Fig.8.7, only in Fig.8.9 the bright green dots indicate sites where the dates fall mostly after AD 1400, the red dots those that mostly fall before.

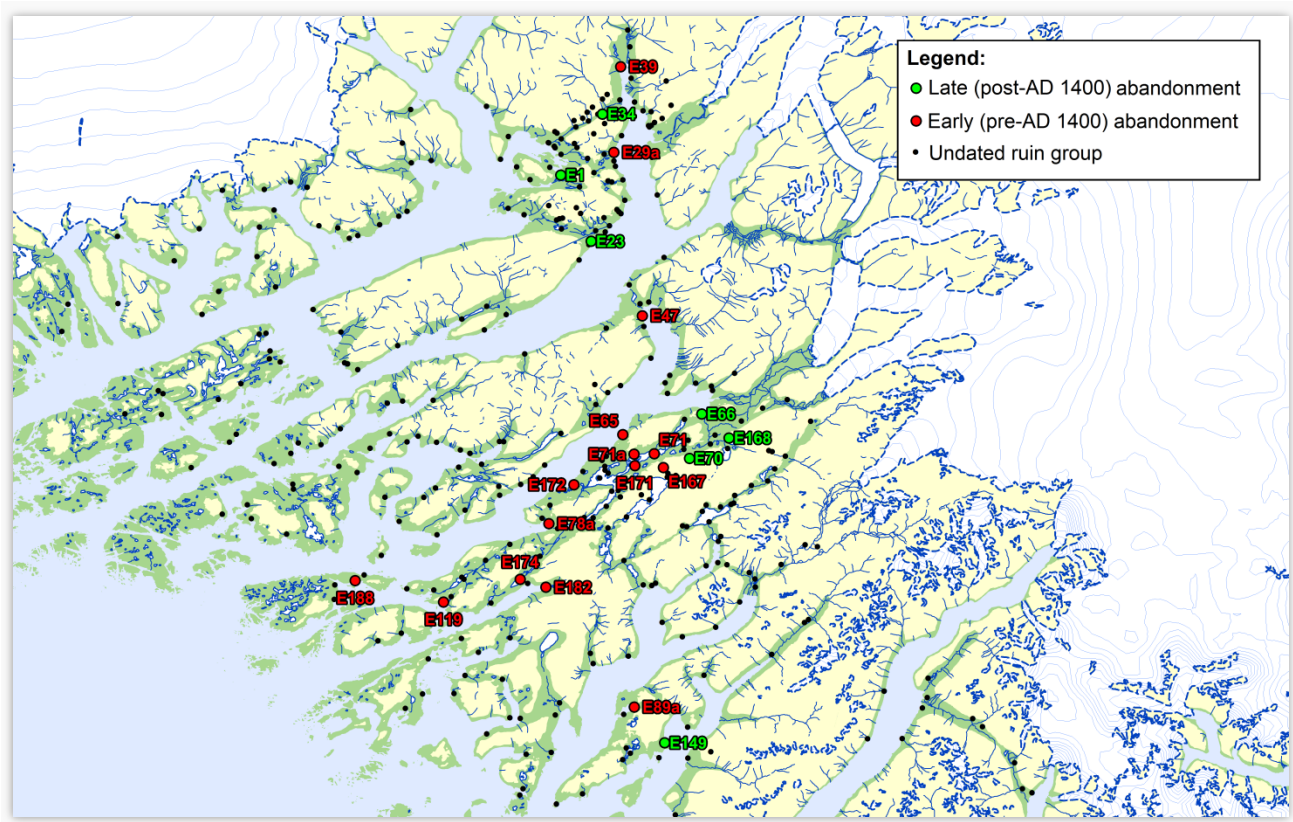

Fig.8.9 The geographical distribution of the dated settlement evidence listed in Tab.8.2 Green dots indicate sites abandoned ca. post AD 1400, the red dots the sites abandoned ca. pre AD 1400. The figure is discussed in the text.

There are clearly some aspects to Fig.8.9 that causes apprehension, for instance the early abandonment of Qassiarsuk/*Brattahlið* (E29a) and Igaliku/*Garðar* (E47) (note that for the latter site there is no indication that the dated contexts should be the latest). However, although the scenario implied by Fig.8.9 is perhaps uncertain in that it is built on rather few dates from several individual ruin groups, it is noted that several dates from different contexts generally correlate (cf. Tab.8.2); and even if some sites were extended into the early 15th century it would not change the overall picture: that the Norse settlement was contracting markedly already some time before AD 1400, in the outer fjord perhaps already during the late 13th century (cf. Tab.8.2).

Evident from Fig.8.9 is that all the sites with clear post-AD 1400 abandonment dates are located in the inner to middle fjord, and four of the sites to survive into the 15th century AD are church farmsteads (E1, E23, E66, and E149). Two of the sites with post-AD 1400 abandonment dates are large complex shielings E70 and E178, which could appear to contradict the classification of them as shielings. However, as already noted above, the latest activities at E70 were of another, less intensive nature than prior to AD 1300 (Ledger *et al.* 2013a:818). The same could apply to E168 which we test trenched in 2011: the lower layers were clearly midden deposits, the upper layers – from where late dated sample Tab.8.2 was retrieved – a layering of undisturbed peat and aeolian deposits with charcoal inclusions (Madsen *et al.*, interim report under preparation). That both sites continued to be in use at least into the 14th century is only natural if they were shielings (or cottages) under still operative church manor E66, as suggested in section 7.3.3. The unburied, supposed Norse skeleton from E167 (Vebæk 1992) constitutes a rather problematic sample and pre-AMS date (Tab.8.2 K-5889). However, even if adding 50-100 years to margin of the date, the deposition of a skeleton in the hallway would certainly suggest that the building was taken out of use prior to AD 1400. Suggestively, the terminal dates from E71 – which I have argued was the parent farm to E167 - also imply its abandoned pre-AD 1400.

This notion of a Norse Eastern Settlement contracting rather rapidly from some time during the 13th century is new and unexpected. However, it is corroborated by other evidence. As observed by J. Arneborg (pers. comm.), the small churches were apparently taken out use at the onset of this settlement contraction. Small churches included (in Tab.8.2, but not Fig.8.9) in this sample of dated sites are E48, E64, and E78, of which the former two were seemingly taken out use around AD 1200, the latter around AD 1250, after which E66 was the only (parish) church in the Vatnahverfi region. In addition, recent palynological and sediment studies have documented a notable decline in grazing pressure and erosion, and a rebound of the natural vegetation, already from the mid-14th century (Edwards *et al.* 2007:12, Gauthier *et al.* 2010, Schofield and Edwards 2011:194, Massa *et al.* 2012a:127, Ledger *et al.* 2013a:816, 2014a:6, 2014b:46). A regional investigation of pollen frequencies from species introduced by the Norse also display peak values around AD 1300 (Schofield *et al.* 2013:Fig.4-6). And finally, such a timing of the settlement contraction correlates perfectly with the AD 1257-58 climate event, or shock, discussed in section 3.1.3. In total, this evidence lends significant credibility to a scenario of a settlement and community changing fairly dramatically at latest from the 14th century.

Even if this settlement decline cannot be extended directly to the individual ruin groups and settlement patterns deduced from the classification model in chapter 7, it has notable implications: for if settlement in the outer fjord, inland, and upland occurred only in a second phase of *landnám* – as implied by Tab.8.1 and Fig.8.7 – and settlement contraction began already during the 14th century AD, then the most extensive settlement pattern – proposed in chapter 7 (cf. Fig.7.17) – had a maximum lifespan of 200-250 years, in the outer fjord perhaps even shorter. In other words, if the suggested settlement layout with manors, cottages, and shielings ever did exist contemporaneously, then it only did for a short time. The relatively short lifespan of the outer fjord settlement may also explain why these ruins often appear much less substantial than ruins found in the middle and inner fjord (cf. Fig.6.2-6.3). The implications of this new chronological framework is significant and it is clear that with continued multi-disciplinary dating efforts, the possibility of outlining settlement dynamics and social (re)organization on both regional and local scale is not an unrealistic future perspective.

Comparing Norse settlement abandonment dates with Inuit sheep farm development (cf., Fig.8.8-8.9) the two settlement patterns appear to have less in common than the *landnám* scenarios. Still, it is worth noting that the few farmsteads – i.e. not including the shielings – postdating AD1400 mostly have two or three dots in Fig.8.8, i.e. are where modern sheep farming has proven viable. Thus, there again seems to be some correlation between Norse and Inuit settlement patterns.

8.2.3 Intensive Versus Extensive Farming - and Catastrophic Winters

In the context of the North Atlantic and Greenland, farming practices past and present can be graded on a scale that has two extreme ends: completely *intensive* farming, where all the livestock was stalled and fed throughout the entire winter, mostly on fodder from cultivated fields, and herded throughout the summer; or, completely *extensive*, where all the livestock had to fend for itself in the terrain throughout the entire year, only to be rounded up seasonally. One may think of this as a *scale of farming intensity*, where the extreme ends are unviable in the North Atlantic setting and where historic (and archaeological) examples of farming systems are always somewhere in between.

Another reason to think of farming practices in such terms is that a farming system's relative position on the scale has several other repercussions: the more intensive the farming system, the more labor demanding it is: livestock housing has to be built and maintained, sufficient fodder has to be procured and stored, fields have to be extended, amended, irrigated, and fenced off to keep livestock from trampling and diminishing cultivated fields, livestock has to be tended constantly. Conversely, the more extensive the farming system, the less labor demanding it is: animal handling and herding is basically confined to single seasonal events. Finally, a farming system's position on a scale of farming intensity also has productive repercussions: the more intensive, the higher, or at least more stable, the productivity: the livestock has higher survival rates, and can potentially produce meat, milk, manure, and traction throughout the entire year. Conversely, the more extensive the farming system the less productive, or stable, it is: substantial livestock numbers can be lost to harsh (winter) weather or decease, milk production is negible, and meat and wool crops are limited to single event harvesting.

North Atlantic farming systems have traditionally – or at least since the "sheep revolution" in the 12th-13th centuries AD (see section 2.3.2) – always been fairly extensive (Bruun 1897, Kammp 1967, Joensen 1979, Austrheim *et al.* 2008); and as noted in section 8.2.1, so was pre-modern Inuit farming: although there were local variations, generally only the cattle husbandry and a select part of the sheep were stalled, whereas the remainder were left to fend for themselves in the terrain most of the year. In terms of a scale of farming intensity, such a general farming system layout was well-adjusted to, perhaps even necessitated off, the "fishing revolution" that was parallel to the "sheep revolution, i.e. freeing labor from farming to enable fishing.

In view of Greenland Norse subsistence economic reliance on wild resources, foremost seal (see section 2.3.1), and the very limited available labor force (see section 8.3.1), one would expect the *grænlendinga* to have adopted a similar strategy, i.e. a farming system adjusted towards the extensive end of the scale in order to free labor for sealing and hunting. On the other hand, however, the identification of functional buildings on the Norse farms outlined in Chapter 6 leave little doubt that a substantial number of livestock, including sheep/goat husbandry, was stalled, at least periodically. The first question is, then, if this more intensive farmstead layout reflected a later development? Was it ever possible for the *grænlendinga* to maintain farming system inclined towards an extensive mode of production? As noted in Chapter 7, there is little direct chronological basis for answering this question. Here, I propose to use the case study of pre-modern farming for comparative inference:

In the extensive mode of farming generally practiced throughout the North Atlantic, summer and fall pasturing is unproblematic: in most areas of the North Atlantic there is sufficient summer biomass to sustain large herds of livestock (Austrheim *et al.* 2008). The same goes for Greenland, where the evaluation of summer vegetation or biomass potential has led to optimistic predictions of maximum grazing capacity: estimates of the carrying capacity of the Eastern Settlement pastures has ranged between at between 60,000-900,000 ewes, not at least because of the rich shrub vegetation (Kammp 1964:93, Laursen and Ørnsholt 1979:77p, Egede *et al.* 1982:Tab.46, Hansen 1988:99).

Reviewing Fig.8.3 it is seen that the number of ewes never reached the lowest maximum estimate and was nowhere near of approaching the higher. The reason for this discrepancy is simple: summer biomass was not the issue. Rather the perpetual bottleneck of North Atlantic livestock farming was the winter and early spring: for the animals stalled, this was the time when stored fodder resources were almost expended; and for the animals grazing freely, the time when their fat reserves and available pasturage was at an absolute minimum. In short, in terms of defining the limits of the Greenlandic farming system on a scale of farming intensity, we need mainly concentrate on the winter half of the year.

As noted in the above, Inuit pre-modern farming was very extensive and thus provides us with an excellent example of such a mode of farming production in the specific environmental setting of Greenland. As visible in Fig.8.3, the sheep population 1906-1976 displayed intermittent drastic declines, a direct result of especially harsh winters, among them the so called 'catastrophic winters'. The harsh winters came in two different forms (Christensen 1959:359, Kammp 1964:89):

First, there were the winters that were more than usually cold and characterized by prolonged thick snow cover, especially if it set in towards the lambing season in spring. In such years, the sheep had difficulties digging through the snow to get to the vegetation underneath. Also, unable to find sufficient sustenance on land, the sheep would instead venture to the banks of the fjords to feed on the seaweed exposed at low tide. In order to do so, the sheep had to jump down from the snow-shelf along the coast. However, when the tide came back in the sheep – especially lambs – were unable to get back up on the snow-shelf, which would result in mass drowning. I have heard several sheep farmers recount how they, before they went to school, had to patrol kilometers of coastline searching for such sheep in distress and throw them back up on the snow-shelf.

The second type of harsh winters was also more than usually cold, but caused high sheep mortality for another reason: normally warm katabatic winds from the Ice Cap were vital to the extensively grazing sheep as such winds would thaw the snow cover in a few of hours, exposing the underlying vegetation. However, at times these katabatic winds would thaw most, but not all, of the snow cover, which would then freeze to a hard shell immediately afterwards. The sheep could not dig through by this ice shell and would die by starvation. Undoubtedly, such harsh winters were experienced by the Norse as well, but how and when did they occur?

Tab.8.3 Winters with sheep decline

Winter	Sheep decline	Sheep recovery	Cattle Decline	Horse Decline
1922/23	16.7%	1 year	-	-
1932/33	19.4%	-	1.8%	-
1933/34	11.0%	2 years	9.1%	11.0%
1936/37	11.1%	-	-	-
1937/38	16.3%	3 years	No	No
1938/39	0.2%	-	7.3%	No
1942/43	6.7%	2 years	-	-
1948/49	55.1%	7 years	37.8%	12.5%
1954/55	2.4%	1 year	6.6%	No
1956/57	27.5%	4 years	10.3%	2.3%
1966/67	53.8%	-	31.2	11.8%
1971/72	40.5%	-	-	10.6%
1973/74	5.5%	-	-	No
1974/75	2.0%	-	-	8.7%
1975/76	26.1%	-	-	11.7%

Tab.8.3 Displays proportional declines (from the previous year) of Greenlandic sheep, cattle, and horse populations in the period 1906-1976. Winters with no censuses are marked '-'; winters where there was no decline is marked 'No'.

Fig.8.10 displays the Greenlandic sheep population in the pre-modern period of farming 1906-1976 juxtaposed by the annual ice core proxy climate data from the climate model introduced in section 3.14; Tab.8.3 summarizes the years with livestock declines. Looking first at the sheep population, there are 15 years with decline, among them one instances of two consecutive years of decline (1932-1934) and one case of three years of consecutive decline (1936-1939, 1973--1976). Sheep population declines occurred every 4.6 years and with a trend of increasing severity as sheep numbers increased (cf. Fig.8.3). However, as seen from the population decline percentages in Tab.8.3, not of all these 15 years of decline can be characterized as catastrophic or even severe. Rather, the small declines (< 10%) seem natural fluctuations or occurred in the wake of catastrophic winters, likely as some sheep farmers gave up. Those winters with population declines between 10-20% we can describe as *severe winters* and those with > 20% die-off as *catastrophic winters*.

In this 70 year period, severe or catastrophic winters occurred every 7 year, both types occurring at an equal rate, i.e. once every 14 year. Although the sample of sheep die-off years is small, an expected correlation between magnitude of population decline and recovery is visible, i.e. the larger the decline the longer recovery. The recovery time for the sheep population after severe or catastrophic winters varied from 2-7 years, on average 4 years. Thus, when the population die-off rate exceeded the rebound time, there was an overall decline. This is what happened after the most catastrophic winter of 1966/67, after which sheep number never recovered to the level of the former period (which is the reason no rebound period is listed for these declines in Tab.8.3).

The severe and catastrophic winters did not only impact the sheep, but also the cattle and horses: as visible in Tab.8.3, even though the cattle were stalled, they nonetheless followed the sheep declines even to the extent of similar of relative magnitude. Also the horse population – which was herded even more extensively than the sheep (see section 8.1.2) – generally died off along with the sheep, although there are unexplained exceptions. Although it would be advantageous to include the cattle and horses in the below analysis, their population censuses are not as consistent as that for the sheep, and their small numbers (cf. Fig.8.2) cause that they are naturally liable to violent fluctuation. However, their synchronous population fluctuations imply that the catastrophic winter modelling below can be extended to the other Norse livestock as well.

Returning to Fig.8.10 and contrasting the severe and catastrophic winters against the Dye-3 $\delta^{18}O$ climate curve an extent of correlation is immediately apparent. The correlation is only clear with the "winter curve", which is unsurprising since it reflects exactly the critical period in extensive farming and furthermore is the data that best reflect observed South Greenland temperatures (Vinther *et al.* 2010:597). I therefore discount the "summer" and average curves in this analysis. However, even the correlation with the "winter curve" is somewhat difficult to substantiate and statistically it displays small correlation (r = 0.13). On the other hand, all the sheep population declines – disregarding their magnitude –

correlate with lower than average $\delta^{18}O$ winter temperatures, as reflected in their mean temperature of -29.27 as compared to the mean -28.70 of the entire 70 year period. There even seems to be a difference between the severe and the catastrophic winters, the former displaying a mean -28.49 winter temperature, the latter a mean -30.04.

Based on this, and taking a somewhat conservative stance, I find it reasonable to propose that *years with $\delta^{18}O$ winter temperatures colder than -30.00 are highly likely to effect population declines in sheep, and to some extent other livestock, ranging free in South Greenland*; *and that the magnitude of the sheep population decline is expected to exceed at least 20%*. With such a small sample of population declines, this claim must still be regarded as highly theoretical and simply a means data exploration. But seeing that there was only one winter (1963/64) with lower than -30.00 $\delta^{18}O$ temperature that did not correlate with a sheep decline, the model seems to identify most adverse winters, although perhaps not always catastrophic ones. The fortitude of this model is, of course, that the assumption may be extrapolated as far back in time the Dye-3 ice core temperature data allows:

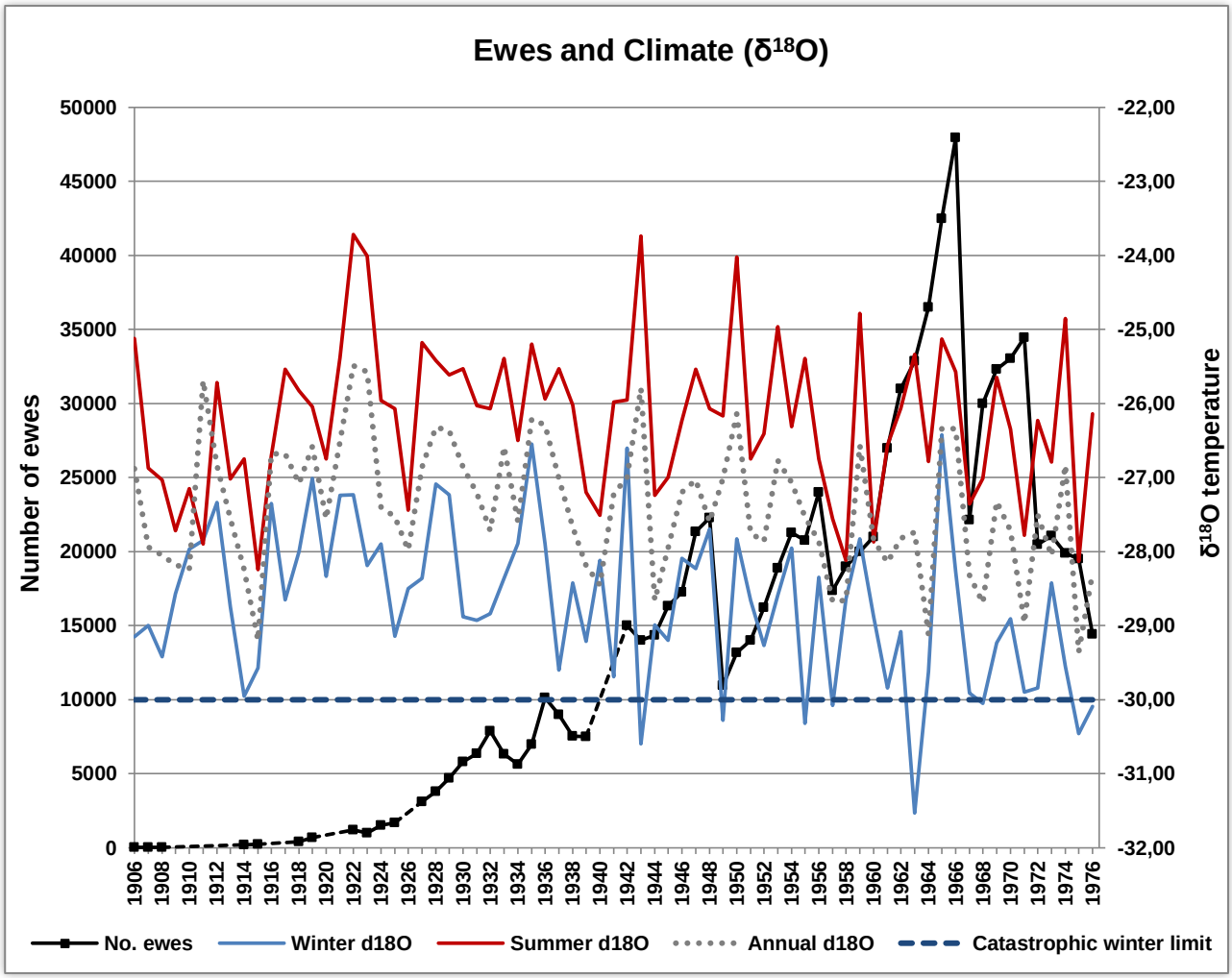

Fig.8.10 Displays the number of ewes in Greenland 1906 (black line and squares) against Dye-3 $\delta^{18}O$ summer (red line), winter (blue line), and annual average (grey dotted line) temperatures. It is noticeable how the decline in sheep numbers generally correspond to declines d18O winter temperatures. The historically recorded catastrophic sheep declines in 1948/19, 1956/57, 1966/67, 1971/72, and 1975/76 has been used to define a critical threshold at -30.00 (dashed dark blue line) for the likely occurrence of catastrophic winters (Dye-3 data after: Vinther *et al.* 2010).

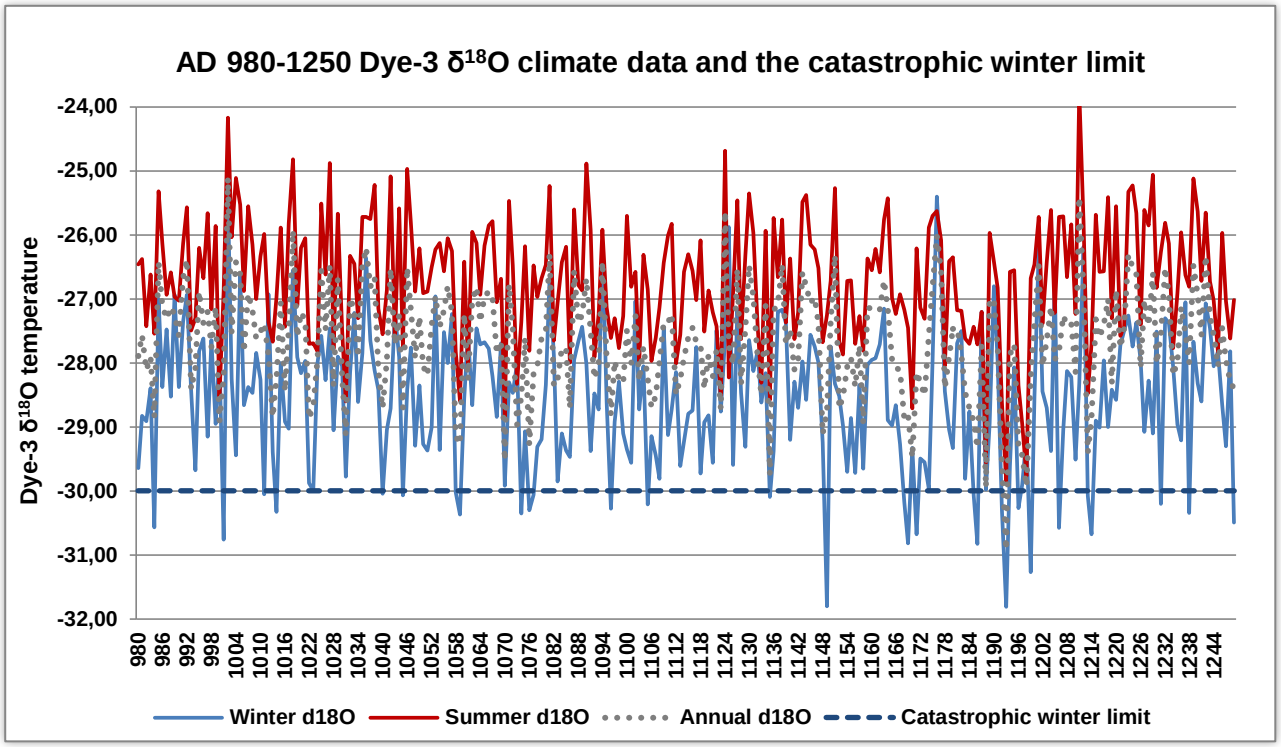

Fig.8.11 Displays Dye-3 δ18O summer (red line), winter (blue line), and annual average (grey dotted line) temperatures with demarcation of the catastrophic winter limit (dashed dark blue line): d18O temperatures below this -30.00 threshold are likely to corresponded with sheep declines in a free-ranging population in South Greenland (Dye-3 data after: Vinther *et al.* 2010).

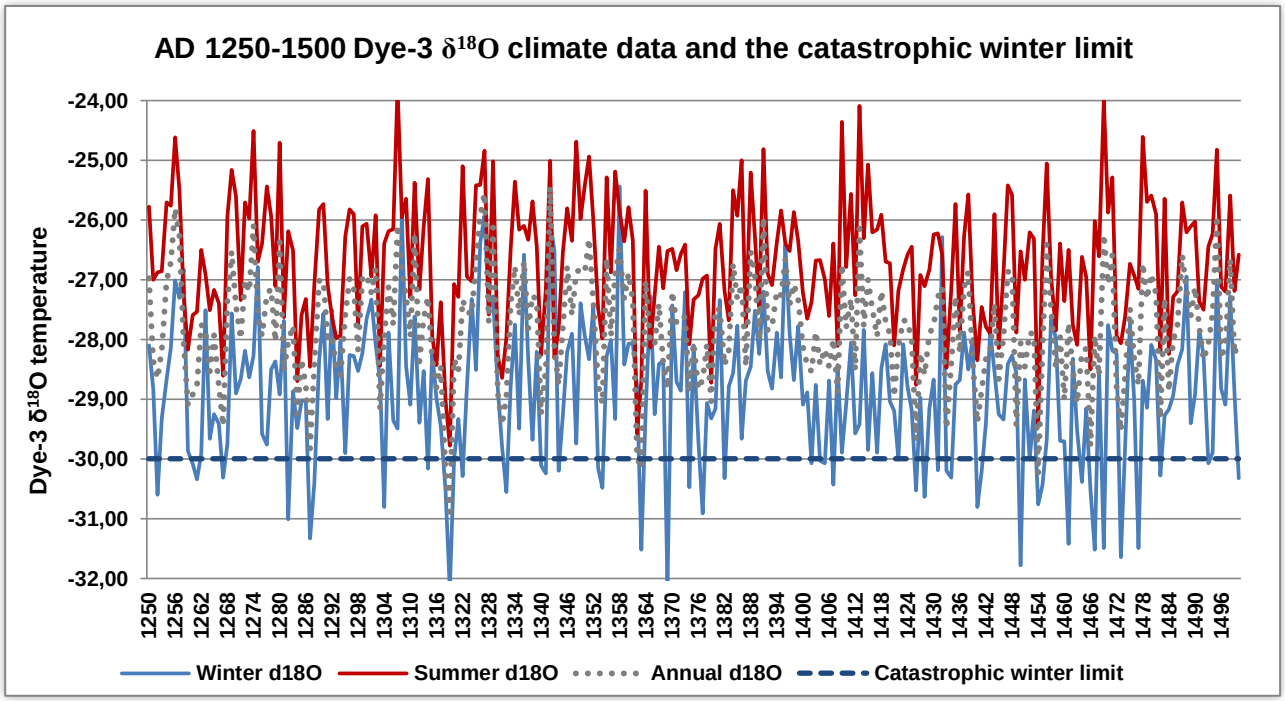

Fig.8.12 Displays Dye-3 δ18O summer (red line), winter (blue line), and annual average (grey dotted line) temperatures with demarcation of the catastrophic winter limit (dashed dark blue line): d18O temperatures below this -30.00 threshold are likely to corresponded with sheep declines in a free-ranging population in South Greenland (Dye-3 data after: Vinther *et al.* 2010)

Fig.8.11-8.12 displays a Dye-3 $\delta^{18}O$ temperature reconstruction for the period AD 980-1500 with demarcation of the -30.00 catastrophic winter d18O temperature limit, whereas Tab.8.4 shows the how many times this limit was exceeded in 25 year intervals over the same total period, i.e. the frequency of catastrophic winters. Contrasted against the historically recorded catastrophic winters that occurred every 14th year, the frequencies for the 25 year intervals in the period AD 980-1500 seem rather high. However, grouping the first 70 years of Norse settlement in Greenland, catastrophic winters are in Fig.8.11 and Tab.8.3 implied to have occurred every 11.7 year, which is not far from the pre-modern scenario, especially not considering that perhaps one out 5 years with below -30.00 winter Dye-3 d18O temperatures did not result in a sheep decline (cf., Fig.8.10 1963/64). Also, all the historically catastrophic winters only occurred over an interval of just some 30 years, i.e. once every sixth years, which would make the historic frequency even higher than during the first half of the Norse settlement. In short, while the catastrophic winter model is not accurate or trustworthy in the sense that it can pinpoint individual years or even decades of major sheep population die-off, it does seem to provide a 50-100 year resolution of catastrophic winter trends.

Emphasizing caution in the use of this simple model, it does have some very interesting implications: taking the example of pre-modern Inuit sheep farming, the frequency of catastrophic winters once every 14th year seems to have been a threshold for viable extensive farming, and towards the latter half of the pre-modern period where catastrophic winters increased in frequency to every sixth year, the threshold had been crossed, effecting total reorganization of the entire farming system into its later modern form. The threshold seems to have been when catastrophic winter frequencies came close to exceeding sheep population recovery rates of ca. 5.5 years (note that there are only two catastrophic winters to set this rate). Reviewing the catastrophic winter frequencies in Tab.8.4 against this 5.5 year population recovery rate, it appears that in an early stage of settlement, and especially during *landnám*, the *grænlendinga* could have relied on fairly extensive mode of farming. This could have been essential in freeing labor during early settlement expansion and for the hunting voyages to the *Norðrseta*.

Tab.8.4 Catastrophic winters AD 980-1500

Year AD	No. of Catastrophic winter	Catastrophic winter frequency per 25 yrs.
980-999	1	20.0
1000-1024	3	8.3
1025-1049	2	12.5
1050-1074	3	8.3
1075-1099	3	8.3
1100-1124	1	20.0
1125-1149	2	12.5
1150-1174	3	8.3
1175-1199	6	4.2
1200-1224	3	8.3
1225-1249	3	8.3
1250-1274	4	5.0
1275-1299	3	8.3
1300-1324	5	4.0
1325-1349	4	5.0
1350-1374	5	4.0
1375-1399	2	12.5
1400-1424	5	4.0
1425-1449	7	2.9
1450-1474	10	2.0
1475-1500	4	5.0

Tab.8.4 Displays the number and frequency of potentially catastrophic winters at 25 year intervals for the period AD 980-1450.

However, the potential for labor efficient extensive farming seems to have diminished fairly quickly: from AD 1175-1199, the sheep population recovery rate was almost exceeded by catastrophic winter frequencies; and after an intermittent amelioration between ca. AD 1200-1250, extensive farming became increasingly unviable, or at least risky. Thus, at least from the 14th century AD and continuing into the Little Ice Age, a fully extensive herding strategy must seem practically impossible.

The timing of when catastrophic winters could have made it impossible to maintain an extensive farming system is concomitant with both the settlement abandonment dates (cf., Fig.8.9) and the palynological evidence

for decreased land use intensity, and the AD 1257-1258 climatic event, and it is hard not draw a connection: the unfeasibility of extensive farming would have meant that farmers had to stall and feed a higher proportion of their livestock – perhaps reflected in large Greenland barn areas (see section 5.3.1) – which was likely a difficult prospect, especially for the cottagers or petty farmers who neither had access to the infields areas, nor the extra hands, needed to sustain intensified farming with the same number of livestock. Such problems would have been even more pertinent to farmers in the outer fjords – just as it was to the pre-modern Inuit farmers (see section 9.1.2) – who were additionally increasingly besieged by summer drift ice effecting a shorter growth season and lowered biomass productivity (Ogilvie *et al.* 2000, Ogilvie *et al.* 2009, Kuijpers *et al.* 2014).

To these farmers, only three choices, or a combination, would have been feasible: to cut down on the animal husbandry in favor of wild resources, which is what is suggested by the palynological (see above) and isotopic evidence (Arneborg *et al.* 2012a); to adjust the composition of the livestock to more hardy and frugal breeds, a change implied by the zooarchaeological evidence (see section 2.3.2); or to move to locations with better access to natural fodder resources, which is perhaps what the new farmstead abandonment dates suggest. However, the latter option would probably not have been completely open, but required acceptance of those who owned the more favorable land in the middle and inner fjords, i.e. the large farms and manors. Yet, the presence of some even fairly large farmsteads with many livestock building in the outer fjord Vatnahverfi region (cf. Fig.7.15, 7.17) implies that some farmers must have attempted the first solution and clung on to their land.

In the other end of the societal, and geographical, spectrum of the Norse Eastern Settlement, large farms and manors could for a while have tackled, perhaps even benefitted from, the change of the farming system from a more extensive to a more intensive mode of production: they were less effected by deteriorating environmental conditions, they owned the most productive infields and meadows, they had surplus husbandry to replenish diminished stocks, and could have made use of this resource to tie farmers to their service by a (cattle-) renting system similar to that in Iceland (Vésteinsson 2007:131). They also had access to a greater labor force, which they culd call on as payment of debths, taxes, or tithes (Júlíusson 2010:19p).

The latter scenario must for now remain speculative, although the convergence of site abandonment dates, land use patterns, and environmental changes must at least prompt new explanatory scenarios if future evidence points in the same directions. On a concluding note, however, it is redolent to observe that extensive farming succeeded in other North Atlantic regions under almost as harsh and deteriorating environmental conditions: catastrophic or severe winters, combined with decease which has not even been discussed for the Greenlandic scenario, took an equal toll on the sheep population in Iceland and the Faroes (Bruun 1897:67, 1928:276, Joensen 1979:107, Austrheim *et al.* 2008). A lesson from the latter is, perhaps, that changing environmental conditions do not necessarily effect immediate change in a farming system; rather a considerable delay is expected as new TEK is build and imprinted on the system within the boundaries of social and economic possibilities. In terms of the Norse *grænlendinga* the question is really how, and to what extent, they could have tackled a shift to towards more intensive farming?

8.2.4 Sheep/Goat Numbers

The question of to which extent environmental deterioration could have been forcing the Norse farming system into a more of intensive regime depends on the number of actual livestock kept on the farmsteads. Where they more or less abundant than during the period of pre-modern Inuit farming? The classification of outbuildings in chapter 7 tempts such estimation. There are several ways this could be approached, but here I only focus on the survey architectural evidence that provides the least unproblematic conversion into actual livestock numbers, i.e. the enclosures:

However, as stressed in section 6.2.4 even this more “unproblematic” evidence calls for critical consideration, such as for instance which type of livestock the enclosure was meant to facilitate, for which specific purpose and at what time of the year etc. These issues are discussed in connection with the description of the different types of enclosures in section 6.2.4 and I will not reiterate here. Here, I only attempt to estimate the maximum number of sheep/goats in the Vatnahverfi region based on the functional grouping of enclosures that were most likely to be related to sheep/goat herding, i.e. those grouped as caprine enclosures (Cap_Encl.) in the Ruin Group Database (see section 7.1.1, App.2):

The first step in the calculation is to consider which enclosures were in contemporary use: clearly enclosures used at the shielings cannot be grouped with enclosures at the farmsteads since these were facilitating the same herds of livestock, only at different times at year. Thus only the total enclosed area of farmsteads is considered and the classification from chapter 7 is used in this differentiation. However, since the aim is to estimate the maximum number of sheep/goats in the Vatnahverfi region and the large complex shielings, as discussed above, likely function as small farmsteads at the peak of settlement, they too must be included in the calculation.

The next step is to estimate the actual enclosed area at all the farmsteads and large complex shielings. For this calculation, the total area of the enclosures (TAE) used for the site classification is unsuited, because it comprises the whole area of the ruin, as opposed to the actually enclosed area, which varies with wall thicknesses of the enclosures. Because of their often fine preservation (see section 6.2.3), the areas enclosed by the various types of folds can often be established quite accurately. However, there are some enclosures too collapsed to establish this measure (cf. App.1). Thus, the areas of such poorly preserved enclosures need to be converted in actual enclosed area. To achieve this, I have used the average ratio of ruin area to enclosed area of the well-preserved examples to adjust the enclosed areas of the poorly preserved examples of the same type. Based on this calculation, the total enclosed area of the caprine enclosures in the Vatnahverfi region is 5564.26 m^2.

The final step in the calculation is to estimate how much livestock could be gathered in this total enclosed area. This estimate is rather flexible and depends on prevalent local herding practices, as well as how long the animals needed to be penned. Estimates of needed penning areas range from 0.4 m^2 per ewe with lamb(s) during the large and short annual round ups (Joensen 1979:38) to 1.75 - 2.0 m^2 per goat in a loose pen (Pyndt 1919:42, Mowlem 1992:23). Applying this range to the total enclose area of 5564.26 m^2, a maximum of 13,911 animals (ewes) could have been rounded up (0.4 m^2 per animal) in the farm near enclosures of the Vatnahverfi region, but there was only room to facilitated prolonged penning of some 2782 ewes/goats (2.0 m^2 per animal). Divided on the 60 farmsteads and large simple shielings were the folds were located, they could on average facilitate brief round ups of some 232 ewes/goats, and have penned for longer periods some 46 animals.

Again we are dealing with highly theoretical numbers and on the assumption that all of the sites were in contemporary use, which they seem to have been only for a brief time period (see section 8.2.2). Compared to the sheep numbers involved in pre-modern farming (cf. Fig.8.3), 13,911 animals is well within the range of pre-World War II numbers and does not seem completely unrealistic, especially not if considering that the 13,911 animals reflect the peak of Norse settlement, while pre-modern numbers reflect a farming system in an early stage. On the other hand, the sheep numbers in Fig.8.3 reflect all of South Greenland, which would make 13,911 animals a rather high estimate for the Vatnahverfi region on its own. It must of course be stressed that 13,911 is an absolute maximum, i.e. it is highly unlikely to reflect real numbers, although it can more confidently be considered an upper limit.

Only T.H. McGovern has attempted to model Norse Greenland livestock numbers from archaeological evidence, in this case on three Western Settlement farmsteads (McGovern *et al.* 1988:Tab.1, McGovern 1991:Fig.3): in his estimation, a second rank farmstead like V51/*Sandnes* (parallel to a church manor in my classification) would have kept ca. 28-37 sheep/goats; a third rank farmstead like V54/Nipaatsoq (parallel to a medium farmstead in my classification) ca. 30 ewes/ goats; and a fourth rank farmstead like V48/Niaqussat (parallel to a small farmstead/large complex shieling in my classification) ca. 18 ewes/goats. This is somewhat lower than my lowest estimate of an average 46 animals per farmstead in the Vatnahverfi region. However, considering that the environmental conditions for farming were more favorable in the Eastern Settlement, 46 animals per farmstead seems far from unlikely. This suggests that a 2 m^2 penning area per ewe/goat is a reasonable estimate and it also corresponds better to the function of the enclosures, many of which seemed to have been used for temporary sheltering of sheep/goats, i.e. were “loose pens” (see section 6.2.3). This would in turn suggest a total population of only some maximum 2782 ewes/goats for the entire Vatnahverfi region.

2782 ewes/goats would constitute a fairly small and fairly fragile sheep/goat population. However, the large *réttir* in the Vatnahverfi outfield (see section 6.2.3) were clearly able to facilitate greater animal numbers, which could indicate either they were higher at some point during settlement, if so undoubtedly in the early half of settlement; or that the *grænlendinga* in part relied on

storage on the hoof, i.e. allowing part of the sheep/goats – presumable the most hardy individuals such as rams/wethers – as it is known from Iceland and the Faroes (Bruun 1897:58, Joensen 1979) – to graze outside throughout most of or the entire year and hope for the best. As substantiated in section 8.2.3, this labor efficient herding practice would probably have been viable until the 14th century AD.

While this sheep/goat herding strategy may to some extent have enabled transition to a more intensive mode of farming, it did not help much in regard to the cattle. As outlined in section 2.3.2, even the smallest farmsteads kept a few heads of cattle. Since the cattle required higher quality fodder during winter stalling and climatic deterioration probably effected that they had to be stalled for longer, the need of procuring sufficient high quality fodder would have been a significant issue.

8.2.5 Fields and Forage

The primary source of high quality fodder for the Norse farmers was infields and meadows. Although accurate measuring of infield and meadow areas was attempted both during the Vatnahverfi field surveys and following from satellite imagery during post processing, such areas could only be satisfactorily established in a handful of cases (cf. App.2): whereas the areas of the fenced in infields are fairly easy to establish and measure (cf. Tab.6.23), the vast majority of Norse farmsteads had – as noted above – no infield boundary; and due to regrowth of natural vegetation or cultivation by present farmers, determining their original extent is often difficult. I therefore here take a more general approach:

As noted in section 8.1.4 (Fig.8.5) the aggregate area of cultivated fields in Greenland in 2006 – after some 25 years of mechanized farming and field expansion – amounts to 966 ha, which according to the vegetation classification in chapter 4 is less than 1 % of the total vegetated area in the central Eastern Settlement. Just to emphasize the extremely minute extend of this cultivated area, it covers only ca. 0.8% of the 116,000 ha presently cultivated in Iceland (Jóhannesson 2010:22). Seeing that most primary Norse farmlands had been occupied by pre-modern Inuit sheep farmers by the 1960's (cf. Fig. 8.8) and that the present cultivated area largely owes to prior meadows being drained, it is fair to assume that the Norse area of cultivated land hardly could have been larger than before the 1976/77 intensification, i.e. about 100 ha, 200 ha at most. According to an 1964 estimate – i.e. before farmers had easy and cheap access to field fertilizers and nutrients – one Greenlandic ha hayfield would winter feed about 100 sheep (Kammp 1964:88), meaning that the area cultivated prior to 1976/77 could winter feed a maximum of 10,000-20,000 sheep, and only sheep. However, as noted in section 8.1.2, pre-modern Inuit farmers were cultivating their fields irrationally. Thus, whether 10,000-20,000 sheep/goats could have been a limit for the Norse farmers as well depended on how intensively their cultivated their infields, as well as who had the option of doing so:

The difficulty of expanding, or even establishing, infields in the Greenlandic landscape was an obstacle in itself. Clearing of shrub vegetation by burning was noted early and has since been recorded at many Norse sites (e.g., Iversen 1934, Fredskild and Hulme 1991, Edwards *et al.* 2007, Ledger *et al.* 2013a). However, this was only the first part of the process and the laborious next part is vividly recorded by pre-modern farmers in Greenland: drained land had to be cleared of stones and without mechanical aids (Fig.8.13), but resorting to '*...spades, levers, hardy grips and dynamite...*' (au. trans. after Christensen 1951:408) and transforming the land was the most "*...tiresome and laborious work and even under the most favorable circumstances, not many square feet can be added every year*" (au. trans. after Walsøe 1919:37). It was a lengthy process where '*...what was left unfinished by the farther, was attained by the son*' (Ibid.48). Meadowland and small lacustrine plains had fewer stones, but had to be: "*...drained by open trenches that later require much maintenance*" (au. trans. after Christensen 1951;408).

Once the infield was established there were a number of other issues: on drained land, the most problematic issue was water evaporation (Christensen 1953:408), which have recently been demonstrated to have been a significant problem to the Norse as well (Adderley and Simpson 2006). The answer was, of course, irrigation which, as already stated above, have been recorded at a number of ruin groups (Krogh 1974, Arneborg 2005, Adderley and Simpson 2006, Buckland *et al.* 2009, Panagiotakopulu *et al.* 2012). However, maintaining dams and irrigation trenches was labor demanding. This may explain why irrigation systems have mostly been found at medium or large farmsteads.

Increased infield productivity was achieved by fertilizing the soils with animal dung and household

waste, which have been documented both directly and indirectly at several ruin groups in both the Eastern and Western Settlements (e.g., Schweger 1998, Commiso and Nelson 2006, 2007, 2008, Buckland *et al.* 2009, Commiso and Nelson 2010, Bishop *et al.* 2013). Most likely, the fertilizing was done either by lifting turf blocks in the infield, depositing the manure and waste on the exposed soil, and then replacing the turf, or by using turfs as matting in the byres, where they would soak up the droppings of the animals and could then be placed in the infield. Both fertilizing methods would crease the so-called 'plaggen soils', which have also been recorded in Greenland (Schweger 1998, Panagiotakopulu *et al.* 2012). Alternatively, livestock could be allowed to graze infield over certain times of year, thereby "naturally" fertilizing it, or manure was simply spread in a thin layer in the infield. Both practices are known historically from Iceland (Bruun 1897:32, Lárusdóttir 2006:54) and may also be implied by isotopic nitrogen values recorded in some Greenlandic livestock (Nelson *et al.* 2012:81).

In any case, fertilizing infields required manure or other nutrients. Although fertilizing with sea-weed is fairly commonly reported from elsewhere in the historic North Atlantic (e.g., Fenton 1997:276, Kaland 2009) – a resource which was also close at hand to most fjord-near Norse farmsteads in Greenland – its use as fertilizer has not yet been documented in the latter place. Thus, it seems *grænlendinga* must mainly have relied on their livestock for manure, which in turn must have effected that those farmers with most livestock also had the most fertilizer. Also, the task of gathering and spreading manure was labor demanding, although perhaps only periodically.

In the light of the above, there is probably little doubt that the first Norse *grænlendinga* very selectively would have searched out the niches in the landscape which – in addition to the site selection criteria outlined in section 7.1.1 – provided them with a labor-efficient and stable fodder resource, i.e. meadows in the lacustrine plains, naturally inundated slopes along the fjords and lakes. Vésteinsson has repeatedly pointed to this resource as a prime factor in the selection of early settlement sites in Iceland, which were also often the sites to develop into estates and parish centers, i.e. the large complex settlements discussed in the above section 7.3.3 (Vésteinsson 1998:7p, Vésteinsson *et al.* 2002:102). This was surely also the case in Greenland, which can be substantiated from the ruin group sample: of the total 157 ruin groups, only around 62 of the 157 are located in proximity to meadow or lush mire. However, considering only the sites could have had permanent occupation at some point, percentages are much higher: seven (37%) of 19 large complex shielings are located in proximity to meadow/ mire compared to eight (67%) of the 12 small farmsteads, 22 (76%) of the 29 medium farmsteads, four (60%) of the five large farmsteads, three (75%) of the four manors, and five (71%) of the seven church manors. Note the distinct leap in access to meadow/mire from the large complex shielings to the farmsteads, which again suggests a real difference between these types of sites.

Fig.8.13 Wooden spade found at V51/Sandnes (length 29.8 cm). Besides such spades and whale-bone shovels, the Norse had few technological aids to ease cultivation and amendment of fields (*photo: courtesy of the National Museum of Denmark*).

For those farmers not so fortuitously situated there were other resources they could resort to if short of hay fodder: in the textbook on sheep farming in Greenland (Jensen 1958) a number of such resources are listed, including various naturally occurring sedges and grasses, heather, moss, seaweed, dried and fresh fish, and not at least willow and birch leaf fodder. The abundance of leafy shrub shown by the modern vegetation patterns in the settlements (see section 3.2) suggest that it must have been especially important. This is also supported by new palynological evidence of medieval shrub woodland management, pollarding or coppicing, for instance in the willow rich central Vatnahverfi region (Schofield and Edwards 2011:193, Ledger *et al.* 2014a:13). The use of seaweed and fish as supplemental fodder is known historically from elsewhere in the North Atlantic (Bruun 1897:73, Fenton 1997:428).

Both seaweed and fish were abundant, not at least the herring-like ammassat (capelin/*Mallotus villosus*), which can at many places close to the Norse farmsteads be "scooped" out of the water with buckets. It is therefore surprising that a study of isotopic nitrogen and carbon values in Norse animal husbandry show them – apart from the pigs and dogs – to have a minimal marine intake (Nelson *et al.* 2012). Although marine fodder could taint the taste of meat and milk, it is hard to believe that the Norse would have led the valuable and hard-to-replace livestock starve to death rather than to have them survive with an unpleasant aftertaste. If disbanding with a paradigm of arctic marginality, could this be taken to indicate that other supplemental fodder resources were preferred and sufficient? However, foraging for other fodder sources at distance from the farmsteads must also have been labor intensive.

To summarize, there seems have been some options, even for small-scale cottagers with minimal infield areas, for coping with adverse environmental conditions. However, increasing infield productivity would clearly not have been open to smalltime farmers and since the above mentioned fodder sources were at best supplemental when it came to winter feeding cattle, they really only had the choice of adjusting the composition of their livestock towards the more frugal sheep and goats. At least, the timing of the increase in catastrophic winter frequency (cf. Tab.8.3) corresponds markedly well with the major change in the domestic archaeofauna towards keeping more caprines; and although there are at this point no dates to support the claim, one could speculate if not some of the *lambakró* that appear to be later additions to the folds (see section 6.2.3) were built at this point as some farmers became more dependent on the milk from sheep and goats?

Fig.8.14 'Peat-cutter's' in late 19th century Faroe Islands. Note the resemblance of their spades with the example from V51/Sandnes (Fig.8.13) (photo: *courtesy of the National Museum of Denmark*).

8.3 On the Security and Resilience of Pastoral Farming

Reviewing chapters 7 and 8, it is difficult not to notice that the societal and economic setup of the small Norse community of the Vatnahverfi region was characterized by several self-reinforcing mechanisms that to a notable extent only benefitted the upper stratum of society. Those who first occupied the most favorable environmental niches were from the onset poised to govern, or at least influence, subsequent developments; they had principal access to land and resources; they had the extra livestock numbers to provide surplus products in the good years and built up new stocks in the wake of the bad; they had access to extra labor for both improvement of their own farms and for the ships needed for the cash-crop hunt in the *Norðrseta*; they controlled contacts with and access to the world outside Greenland, and through their religious authority, to the world beyond. Although the settlement pattern analysis of the Vatnahverfi survey evidence implied that there was room for some social mobility, the major part of the community must largely have been at the mercy of the manorial centers.

In the final section of chapter 8 I explore dynamics of such societal mechanisms that related to the layout of the pastoral farming system, and to the Eastern Settlement in general. Summarizing the findings in the above chapters, I first briefly review aspects of pastoral farming in the Vatnahverfi region in a perspective of *human securities*, i.e. accentuating how farmers of different social strata could have experienced the deterioration of conditions for farming against their specific economic and social background. In the last section, I zoom out to explore how the observed larger changes in the Norse farming community of the Vatnahverfi may be understood within the framework of resilience theory.

8.3.1 The Human Securities of Farming in Medieval Vatnahverfi

The *human securities* approach or paradigm grew out of a 1994 Human Development Report published by the United Nations Development Programme (UNDP) on the main issues facing the people and cultures around the world at that, and present, time, i.e. hunger, violence, disease, political and gender oppression etc. (UNDP 1994). The aim of the report was to inform and influence policy makers and NGO's and to raise general awareness of these problems. The novelty of Human Securities idea or paradigm was that it stressed specifically the unique human experience of these problems, i.e. how they – whether economic, environmental, religious etc. – directly influenced peoples' lives.

Since 1994, the Human Securities approach has developed rapidly – unsurprisingly mainly in the humanistic disciplines – and now comes with a vast corpus of literature and its own journal (Journal of Human Securities). Although the approach may on the surface seem a far cry from archaeology, it has recently gained a foothold (e.g., Brewington 2013, Hegmon 2013, Hegmon *et al.* in press). While some of the Human Securities listed in the 1994 UNDP report (24p) seem unapproachable themes from the point of archaeology others – such as food securities, environmental securities, community securities – are clearly not; and certainly, a fundamental focus on the human experience can be extended to the people of the past as a common agenda of archaeology.

In terms of human securities, the Norse Greenland settlements provide an intriguing and potent case study: it was a fairly closed and delineated social-ecological system, which was facing major environmental and economic changes over a short time span, many aspects of which are with present and many other recent investigations documented in such resolution that they may be explored in detail. Here, however, I will limit the inquiry to exploring food-security aspects of pastoral farming in the Vatnahverfi-region.

Since 2013, I have had the privilege and enrichment of working with a group of collaborating archaeologists of the two research networks *North Atlantic Biocultural Organization* and *the Long-term Vulnerability and Transformation Project* (LTVTP). The collaboration aims to compare major changes and transformations in widely different societies facing acute environmental and social challenges in order to identify underlying similar mechanisms, which may in turn help us understand the key drivers of social and cultural change. As a tool for formal comparison of these very different archaeological cultures, we have adopted *Qualitative Comparative Analysis* (QCA):

QCA is an analytical and exploratory approach introduced by sociologist C. Ragin in (1987) and designed specifically to help social scientists working with "fuzzy sets", i.e. sets that are not dichotomous ("crisp"), e.g. religious (1) versus atheist (0). In all simplicity, QCA allow for partial membership in the interval between the two groups – "occasionally" religious, agnostic etc. – by scoring or scaling membership between 1 and 0. If religious is 1 and atheist is 0, then "occasionally" religious may be scored 0.5, agnostic at 0.1 etc. The approach thus quantifies complex categories and phenomena so that they may be analyzed and compared regardless of their categorical difference. QCA's has become a widely accepted approach with many angles and applications (e.g., Ragin 1987, Ragin and Pennings 2005, Berk-Schlosser *et al.* 2009, Breiger 2009). However, here I adopt a very simple QCA-approach aimed mainly to explore issue of labor and fodder accessibility in a Norse farming system facing increasing difficulties in maintaining an extensive mode of production, and perhaps to stake out some new lines of future inquiry:

Inspired by the approach applied in our collaborative network I ask three questions relating to above discussed aspects of pastoral farming in Norse Greenland and that relate to food- and environmental securities:

> *Was the impact of deteriorating environmental conditions severe enough to force a shift towards more intensive farming for any given societal class of farmers?*
>
> *Was the given societal class of Norse farmers facing increasing problems with continuing a low labor-input extensive mode of farming and shifting to more labor-costly intensive farming?*
>
> *Was the given societal class of Norse farmers increasingly facing problems with providing the labor needed to exploit other available fodder resources?*

Normally, such questions would be answered rather indeterminately with for instance "possibly", "to some extent" etc. Applying a QCA approach to the questions forces a more determinate answer and while this answer may still be difficult, or even impossible, to substantiate with our present knowledge, it at least has the potential of raising some research issues that may be worth pursuing in the future.

Each of the above questions is asked for three tentatively separated social classes of farmers in the Norse settlements, in this case consisting of *cottagers/ tenants* (who were limited in their possibility of action by contract or tenure of larger farms, or did not own their own land); *free-holders* (who owned their land and potentially a few associated cottages); and *magnates* (who owned their own their land, several cottages, and had religious and political hegemony). In the context of this simple exercise I will not go into lengthy discussion of these terms or their historical implications. Suffice to note that the class stratum designated cottagers/tenants could correspond archaeologically to the small and medium farmsteads, free-holders to the large farmsteads, and magnates the manors and church manors.

Each question is asked for each of the three time periods AD 980-1160, 1160-1300, 1300-1450. The answers to these questions are scored accordingly: "yes" (1.0), "more yes than no" (0.75), "more no than yes" (0.25), and "no" (0.0) (cf. Tab.8.4). From the experience of our network workshops, such a four partite membership attribution evades the tendency for answers to strand in a little informative middle category of "either or". Tab.8.5 displays the QCA scoring of the three questions asked for each social class for each of the three time periods, Fig.8.15 displays the aggregate mean scores for each time period. To elucidate the scoring of each question in turn:

The scoring of the first question is based on the catastrophic winter modeling (cf. section 8.2.3, Tab.8.3) and the general climate model (cf. section 3.1.4): these records indicate that few Norse farmers would have experienced problems in maintaining an extensive mode of production in the period AD 980-1160. When I still have scored cottagers/tenants at 0.25 it is based on the parallel with pre-modern Inuit farming, where extensive farming even in this fairly favorable climatic period was liable to some fluctuation, which would have impacted marginally situated cottagers/tenants the most (cf. section 8.1.3). In period AD 1160-1300, the catastrophic winter modelling implies that it became increasingly problematic to maintain an extensive mode of farming, although mostly for cottagers/tenants in marginal farmlands, which is why they are scored at 0.75 (as compared to the 0.25 of the other social classes). In the final period AD 1300-1450, or at least in its latter part, extensive farming overall became unviable and the societal classes all score at 1.0.

Tab.8.5 QCA-scoring of societal differences in food-securities			
Societal Class	**AD 980-1160**	**AD 1160-1300**	**AD 1300-1450**
QCA question: *Was the impact of deteriorating environmental conditions severe enough to force a shift towards more intensive farming for any given societal class of farmers?*			
Cottagers	0.25	0.75	1.00
Free-holders	0.00	0.25	1.00
Magnates	0.00	0.25	1.00
QCA question: *Was the given societal class of Norse farmers facing increasing problems with continuing a low labor-input extensive mode of farming and shifting to more labor-costly intensive farming?*			
Cottagers	0.25	1.00	1.00
Free-holders	0.00	0.75	1.00
Magnates	0.00	0.25	0.75
QCA question: *Was the given societal class of Norse farmers increasingly facing problems with providing the labor needed to exploit other available fodder resources?*			
Cottagers	0.25	0.75	1.00
Free-holders	0.00	0.25	1.00
Magnates	0.00	0.00	0.75
Aggregate mean:			
Cottagers	0.25	0.83	1.00
Free-holders	0.00	0.42	1.00
Magnates	0.00	0.17	0.92

Tab.8.5 Displays the QCA-scoring of three questions asked of each of three tiers of Norse Greenland farmers for each of three periods, where: 0.00 = no, 0.25 = more no than yes, 0.50 = more yes than no, and 1.00 = yes. The individual scorings are discussed in the text.

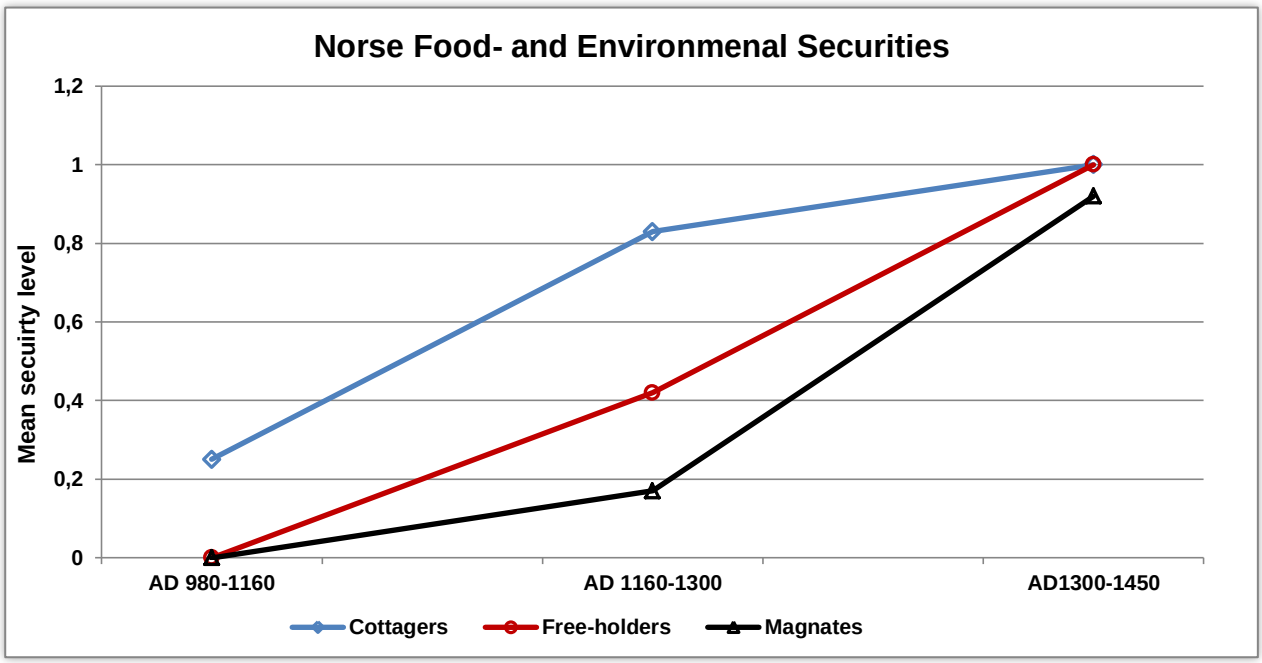

Fig.8.15 Graphic visualization of (aggregate means) the scoring of the QCA-questions listed in Tab.8.5, estimating temporal change the in food-securities of different societal class Norse Greenland farmers. The figure is discussed in the text.

The next question relates to the above discussion of infield and livestock intensification in response to the decreasing environmental conditions for extensive farming: in the period AD 980-1160, there is nothing to suggest that upper stratum farmers would have had problems adjusting to minor local conditions, and are scored at 0.0. The cottagers/tenants are again scored at 0.25 because of their smaller infields and more marginal pasture and resource areas, which meant that their fodder production was limited from the beginning of settlement. In the period AD 1160-1300, the latter problem could have become highly aggravating since the cotter/tenants probably had fairly little livestock (cf. section 8.2.4) and limited labor resources, which effected that infields could neither be expanded or fertilized, which in turn effected that little animal husbandry could be stalled for prolonged periods; hence the cottagers/tenants are scored at 1.0. The free-holders likely had less problems in this concern since they could draw on their larger infields and the labor of subsidiary farms; they are scored 0.25. The magnates probably had even better access to both resources and are consequently scored at 0.0.

In the period AD 1300-1450, shifting to more intensive farming had become largely unviable even to free-holders, which may have lost their subsidiary farms. At least the settlement contraction implied by the new abandonment dates (see section 8.2.2, Fig.8.9) suggest that there was less access to labor, which would have affected both free-holders and magnates. However, the late settlement dates for some manorial centers, and indicated economic and political centralization (see section 7.3.3) could indicate that the latter still had access to surplus labor; the free-holders are consequently scored at 1.0 as compared to 0.75 of the magnates.

The final question addressed the possibility of different societal class farmers on facilitating more intensive farming by relying on other natural fodder resources (see section 8.2.5): in the period AD 980-1160, the low labor force available to the cottagers/tenants again probably meant that even procuring sufficient natural fodder resources could have been problematic; they are scored at 0.25. The free-holders and magnates probably had no such issues, neither needed a large input of other fodder resources, and are both scored at 0.0. In the period AD 1160-1300, the inability of cottagers/ tenants in increasing infield production – cf. the scoring of the previous question – meant that they had to rely increasingly on natural fodder resources, which was again unfeasible due to their limited access to labor; they are scored at 0.75. Free-holders and magnates are scored at 0.25 and 0.00 respectively, since they still had the means of intensifying their infield production – cf. the scoring of the previous question – and thus relied less on natural fodder resources; and if needed, these resources could be easier exploited with their better labor accessibility, magnates having somewhat better access than the free-holders. In the period AD 1300-1450, the difficulties of procuring fodder from other sources must have become aggravating to all social classes of farmers, mainly as a result of labor deficiency and the limits to which infield production could be intensified (cf. the above scoring). Cottagers/tenants and freeholders are scored at 1.0, the magnates at 0.75.

The above must be regarded as a very tentative exploration and should not by any means be understood categorically. The model concerns only the possibility of intensifying farming in the settlements based on the assumption that it was forced to shift from a more to a less extensive mode production. Thus, the model says nothing about the other possibilities of the societal classes, i.e. intensifying hunting and sealing, adjusting the livestock composition etc. In short, the model has limited implication for overall settlement changes.

However, interpretively reviewing Fig.8.15 only in terms of food- and environmental securities some interesting conditions nonetheless appear visualized: if the scale from 0.0-1.0 is read as a measure of security – 0 being a high level of security and 1 of *in*security –the societal strata clearly followed different trajectories: cottagers/tenants started out with even some measure of insecurity and quickly moved into a regime of relatively high food- and environmental insecurity. The same transition in the other societal strata was delayed as they could draw on resources and labor from the lower strata, which perhaps further exacerbated the experience of food insecurity for the latter. In the end, however, the combined weight of environmental stress and accumulated labor deficiency may have affected an equally high level of insecurity in all societal strata.

On a final note, the comparison between this cursory security discussion and the isotopic study of Arneborg *et al*. (2013) has a very enticing point of convergence: As seen in Fig.8.16 the range of $\delta^{13}C$ values in the Norse skeletons varied; in the early period AD 980-1160 there was notable difference in the intake of marine foods, but overall everyone were more terrestrial; in the period AD

1160-1300 variation became greater as some were consuming a high marine diet, while others still fed on terrestrial resources; in the final period AD 1300-1450 everyone became more dependent on marine foods. The authors argued this could reflect social differences with lower societal strata increasingly changing to a more marine diet, whereas the upper societal strata for a while continued to have a higher terrestrial diet. In the end, however, everyone became very dependent on marine foods (Arneborg *et al.* 2012a:126p). This overall pattern in the isotope evidence compares precisely with the above food- and environmental securities model (cf. Fig.8.15), i.e. the "distance" or level in securities between farmers of different societal class mimics the distance of the $d^{13}C$ isotope values.

Evidently, this would also make perfect sense: with the increasing insecurity in maintaining their original farming system, cottagers/tenants would have been the first to resort to other food sources. The same effect was delayed in the other societal strata and for a while they managed to maintain a significant level of terrestrial food- and environmental security, among other things by tapping into the securities of the cottagers/tenants. In other words, they could maintain a higher intake of terrestrial foods, but were pushing cottagers/tenants even more towards the marine. In the end, however, labor deficiency and environmental stress had accumulated to such an extent that all social strata had to resort to a very marine diet. If this scenario is valid, then it is clear that self-reinforcing or acerbating mechanisms were an equal factor in driving change of Norse Greenland society. I suggest these mechanisms may be outlined by the framework of *resilience theory*.

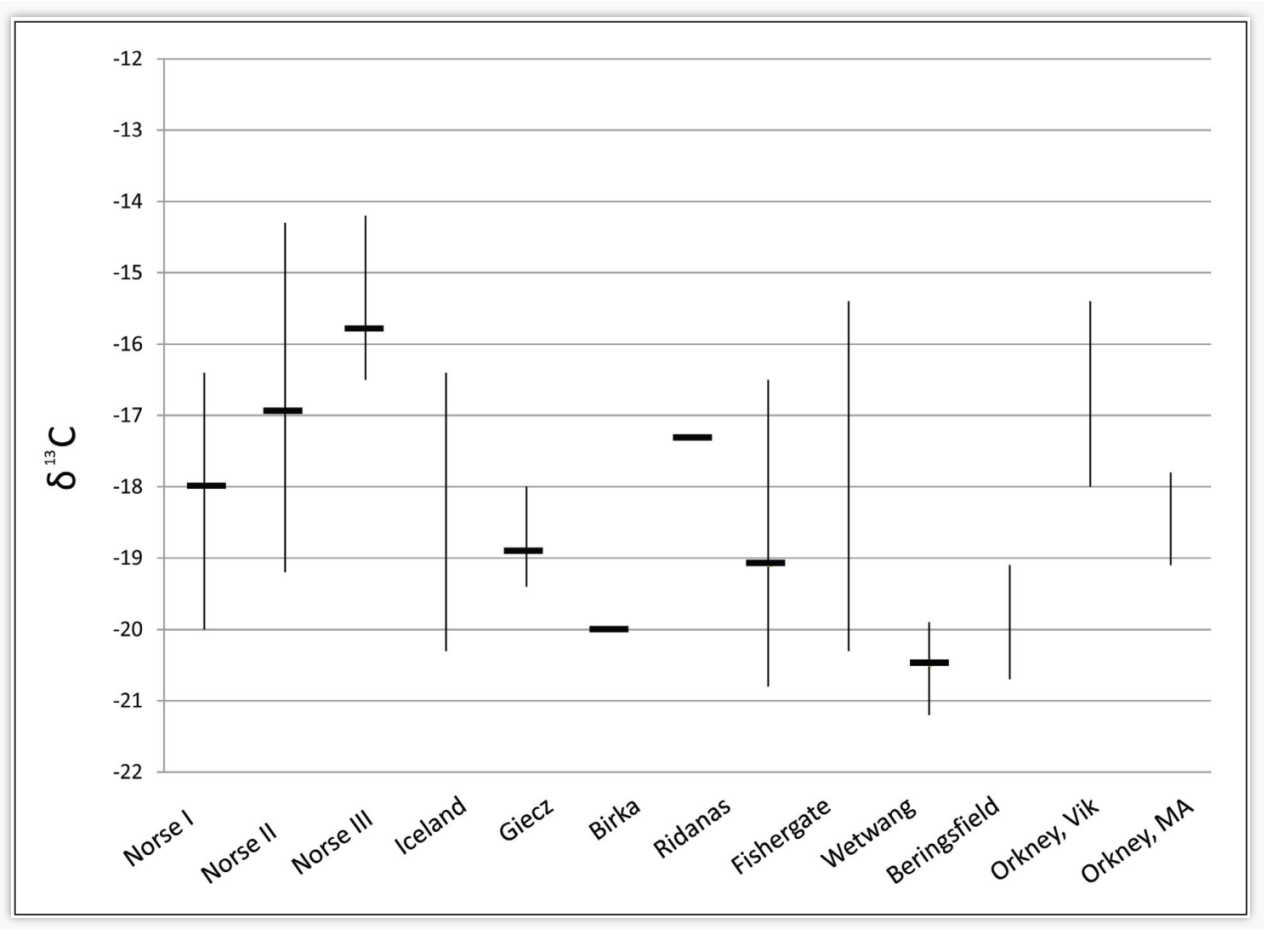

Fig.8.16 Graph showing then mean and range of Norse Greenland δ13C values for three settlement periods(compared to values in Iceland individuals). The trends for the Greenland Norse in this graph is comparable to the estimated food-security development shown in Fig.8.15 (conf. text) (*after Arneborg et al. 2012:Fig.7*).

8.3.2 The Resilience of Pastoral Farming

Briefly summarized, the conceptual framework of *Resilience theory*, or the *Panarchy*, first grew out of ecology as an explanatory model for describing and understanding changes and transformations in social-ecological systems (SES's, see section 1.2) (Gunderson and Holling 2001). Resilience theory is founded on four basic observations:

First, that change and transformation in SES's are rarely gradual, but often highly episodic. Second, that such episodic change occurs on different scales which concentrate and reorganize resources in different ways and across different levels. Third, that SES's are characterized by change on multiple different scales, some of which are in equilibrium, while others are not. Fourth, change and transformation in SES's must be understood as the dynamic interaction by these different scales feeding or tapping into each other. It is clear that such a complex model of change has potential for a great number of scientific disciplines and it has also been widely accepted in archaeology (e.g, Redman and Kinzig 2003, Redman 2005, Folke 2006, Hegmon *et al.* 2008, Øye 2013).

While complex and multifarious in its use and underlying concepts, the core concept of resilience theory is epitomized in the model of adaptive cycles (Fig.8.17). Briefly explained, an adaptive cycle consist of four phases: a (*r*) phase of *exploitation*, where any population (of people, plants, animals) rapidly occupy and fill out a niche; a (K) phase of *conservation*, where storage and energy is slowly accumulated in that niche; a (Ω) phase of *release*, where the population in a niche quickly declines due to changed conditions, and a (α) phase of *reorganization*, where the storage and energy is reorganized around the surviving population. As visualized in Fig.8.17, SES's are characterized by changes on many levels (adaptive cycles), some of which are small and fast, while other are large and slow. When change in a small and fast adaptive cycle overwhelms a large and slow cycle, it may affect change or transformation also in the latter, and thus even minor changes in lower scale adaptive cycles may cascade up to cause major transformation in the whole SES. Conversely, a change in a small and fast adaptive cycle can be absorbed, slowed, and reorganized by a lager adaptive cycle.

Although the resilience model in its full extent is much more complex, further detailed elaboration it is not necessary for the purpose of this discussion. Here I simply propose that one may think of resilience, adaptive cycles and the changes in the Norse Greenland farming system, and perhaps the settlements as a whole, along two lines:

First, one may consider the adaptive cycles in terms of regional Norse settlement scales (cf. Fig.8.17 left): in the more marginal farming areas in the outer fjord, environmental changes could already from the mid-13th century AD onwards have effected fast and major changes, as smalltime farmers (cottagers/tenants) were forced to adjust and reorganize their farming practices. If the settlement abandonment dates are credible (see section 8.2.2) these areas were depopulated from around AD 1250-1350, which meant that overall settlement level access to labor and resources diminished even at the larger farms situated in the more favorable middle and inner fjord. Thus lower scale fast changes in the marginal settlement areas could have cascaded up the system to eventually affect the large farmsteads and manors. This change may not have been gradual, but could have spiraled as some critical threshold was exceeded. For instance, the occurrence of several sudden and unprecedented catastrophic winters – such as for instance between AD 1180-1200 (cf. Fig.8.11) or the AD 1257-1258 climatic event – could have pushed the farming system beyond a threshold of no return: some farmers may either have been totally deprived of their livestock and had to tie themselves to the large farmsteads and manors, others may have had to rent animals to replenish their stocks. Whereas this could perhaps stabilize (reorganize) the system for a period, it would in the long run have undermined the possibility of maintaining the original farming system depending on the labor of the smalltime farmers.

As discussed above, environmentally related changes to the farming system such as the latter would probably not have affected all social strata at the same time, and one may therefore also consider the change in terms of social scales (cf. Fig.8.17 right): the idea is basically the same as described for the regional scales, i.e. environmental deterioration would – as discussed above – have hit the cottagers and tenants hardest, but eventually their deprivation would cascade up to affect

higher levels of the Norse community. Whether or not the *grænlendinga* ever had a chance of foreseeing the ultimate long-term diametrical effects of such development is uncertain, and even if they had, it is not certain that they would have adjusted their system to avoid it. It appears that for a long time, the large farmers and estate holders could even have benefited from the cascading deprivation and increasing insecurities of the smalltime farmers, and once this was realized, it may already have been too late to recover or even uphold the farming system in general.

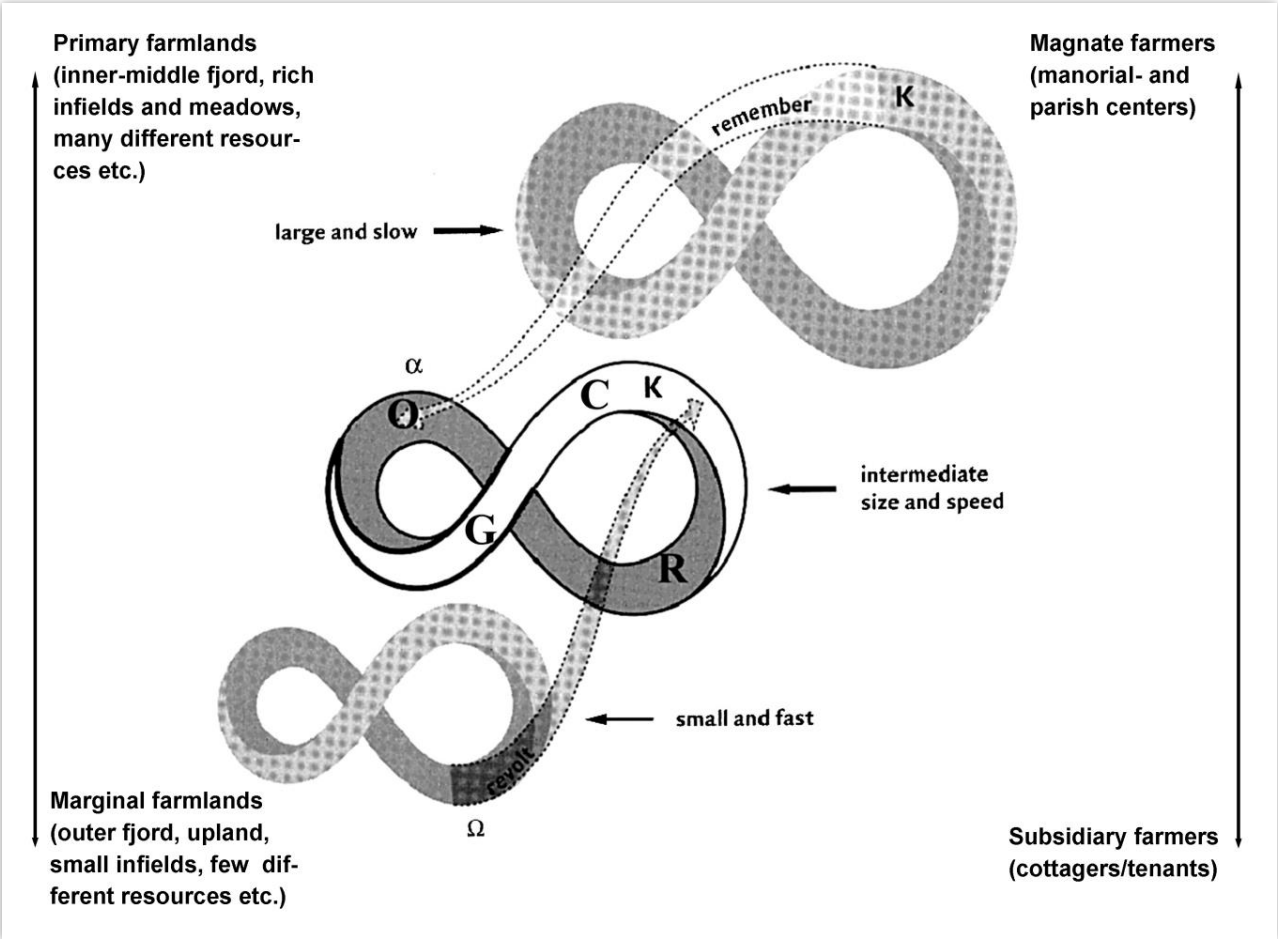

Fig.8.17 Greenland Norse pastoral farming and settlement development visualized in terms of resilience theory's adaptive cycles. Left: the development could be considered on a regional level scale, where farmers situated in marginal agricultural areas were quick to come under climatic and environmental stress, which would eventually cascade up through the system to affect the magnate farmers. Right: the same scenario can be conceived in terms of societal class differences, i.e. where cottagers and tenants were least resilient to various environmental adversities, but with their declining numbers, upper stratum farmers would be deprived of labor, taxes etc.

9. Conclusion

This Ph.D.-dissertation concludes eight years of archaeological surveys and excavations carried out between 2005-2011, and 2013 in the Vatnahverfi region, South Greenland, a core area of the medieval Norse Eastern Settlement. These investigations have been a major part of the Vatnahverfi Project, a research project initiated by J. Arneborg on behalf of the National Museum of Denmark, the first in more than three decades to approach questions of Greenland Norse settlement, economy, and cultural identity from a regional-level perspective and involving a range of collaborating interdisciplinary and international research teams (Chap. 4.). Many preliminary results of these investigations have been presented, discussed, and used in the above, but this dissertation has mainly concerned the archaeological record on Norse pastoral settlement, farming, and hierarchy in the Vatnahverfi region between ca. AD 980-1450 (Chaps. 6-7), a Ph.D.-project under the Northern Worlds research initiative at National Museum of Denmark, funded by the Augustinus Foundation.

The archaeological record investigated consists of 129 Norse ruin groups – including 18 newly discovered sites – and 798 individual ruins precision surveyed in the Vatnahverfi region during the Project, as well as a comparative record of 28 ruin groups from elsewhere in the Norse Eastern Settlement, surveyed either by the Vatnahverfi-Project team (survey plan are found in App.3) or by prior investigators (section 4.2). The survey evidence was cross-checked against archival records in both the National Museums of Denmark and Greenland, at the end of which the dataset included 1308 individual ruins at 157 ruin groups, which is about one third of all the ruin groups registered in the Eastern Settlement.

This impressive record was used to answer four key questions posed in the introduction of the dissertation, the first of which was:

What was the functional layout of the medieval Norse farmsteads in the Vatnahverfi region?

Answering this question involved classifying the 1308 ruins on 23 different functional categories of farm buildings, as well as three residue categories, presented and described in chapter 6 and summarized in App.1. This functional interpretation was based on a few existing prior investigations, and with outlook to other North Atlantic areas, outlined in chapters 5 and 6. It was argued that the Greenlandic farmsteads and buildings in most concerns followed developments in the medieval North Atlantic, including a *functional fragmentation* of the farmsteads, i.e. splitting farmstead functions on more specialized rooms and buildings. In this comparative perspective, the “unique” Greenlandic 'centralized farm' appears a local variation of poor to moderate farmsteads elsewhere in the North Atlantic.

Although the ruin classification was an intermediate step in approaching the layout of the Greenland farmsteads, it provided some significant implications: first, a strong emphasis on sheep/goats as milk animals, especially on smaller farmsteads, was implied by the frequent identification of milking folds with further architectural indication that this production became more important over time (section 6.2.3), likely as farming was adjusted to local environmental conditions. Second, it was adamantly demonstrated that 'infield dykes' – a feature commonly thought of as absolutely defining to North Atlantic farmsteads in general – is extremely rare on the Greenland farmsteads: among the 157 ruin groups, infield dykes were only recorded at 14 locations, significantly most of them church farmsteads; it suggests a different farming and land use system focused on intensive herding of livestock.

The infield dykes in most cases appear along with other particular farmstead features: e.g. grazing enclosures related to cattle keeping and double sheep-sheds, another uncommon, but distinct building type. Generally, it was noted that the outbuildings are poorly understood, especially in terms of chronology and contemporaneity (section 5.3.2): in a comparative North Atlantic perspective, many Greenland farmsteads appear to have an extraordinarily large number of outbuildings, but this may simply be explained as an “accumulated” record of up to 450 years (section 5.1.2). In order to clarify such issues, and the lineup of particular farmstead features, it was advised that future excavations should target outbuildings, fences, and dykes. Still, the ruin classification was sufficient to answer the second main research question of the dissertation:

What was the specific nature and layout of pastoral settlement and farming in the Vatnahverfi region?

This question was approached by classifying the combined ruin group evidence, presented and discussed in chapter 7 and summarized in App.2. Drawing on the interpretation of the ruin evidence, the ruin group classification was based on cluster analysis weighing four key parameters: the total number of ruins at a site (TNR), the total area of roofed buildings (Ar_RB), the farmstead dispersion index (FDI), and the total area of enclosures (TAE). The analysis indicated a classification of the ruin groups on 51 *simple shielings*, 42 *complex shielings*, and 59 *farmsteads*. The simple shielings could be divided on nine sub-types relating to extensive resource exploitation. The concept of 'complex shielings' was introduced here to differentiate sites with a more marginal location, but characterized by having a dwelling. Of these, *small complex shielings* were probably never used for year-round occupation, but were a type of full-shielings associated with summer pasturing and farming production. The *large complex shielings*, on the other hand, may have been permanently occupied small farmsteads at the height of settlement, but were more marginally placed than normal small farmsteads; suggestively, none of the large complex shielings were ever reoccupied by Inuit sheep farmers.

The farmsteads seem to divide on five classes (section 7.1.3): small, medium, and large farmsteads, characterized by the same basic layout and building types, but differing in their number and size. *Manors* were differentiable not only by many and large buildings, but by including rare building types such as large (cattle) enclosures, infield dykes, and/or double sheep/goat sheds. The last class of farmsteads – the church manors – is only separable from the manors by the presence of a church. Both types of manor were often found to be 'double-farms', i.e. with a small farmstead associated. A voronoi-region settlement pattern analysis (section 7.2.1) showed the large farmsteads and manors to be evenly distributed in the landscape with ordinary farmsteads situated in between. It was emphasized that it is a working site classification model, which through quality of its digital record can easily be reanalyzed, adjusted, and extended by input of future evidence.

In terms of overall settlement and farming patterns in the Vatnahverfi region, the new survey records implies the following (section 7.1.2): first, that site selection criteria for the location of sites was narrowly tied to low-lying areas (80% are situated < 100 m.a.s.l.), on southern facing slopes or in the open (ca. 82% of the sites), and in proximity to fen/meadow vegetation (ca. 70% of the farmsteads). Farmsteads in inner fjord areas dominated by shrub vegetation, or located at slightly higher altitude appear to have specialized in sheep/goat keeping, which included use of multiple shielings (milking stations, forage-, and dairy shielings). Second, that shieling activity appears to have been fundamental to Norse farming (section 7.2.2); based on the classification model, 32 of 45 farmsteads could be confidently associated with at least one shieling. Two shieling systems were observed: in the inner and middle fjords shieling was *vertical*, i.e. moving from lowland to highland areas as known from elsewhere in the North Atlantic. However, in the outer fjords, shieling appears to have been horizontal, i.e. moving along the fjords. Such a system has not been observed or commented on before, but corresponds well with the lower settlement density and pasture quality observed for this sub-region (the latter discussed in Chap. 3). All in all, the settlement evidence suggests a farming system heavily invested in the use of extensive landscape resources, which corresponds with estimated population densities and settlement-level organization:

What does the settlement pattern evidence imply in terms of regional organization and social hierarchy?

The site classification model and the settlement pattern analysis in chapter 7 was interpreted to reflect a community in the Vatnahverfi region, where only 8-10 farmsteads were independent, the remainder probably being subsidiary or dependent farmsteads, i.e. cottagers and tenants (section 7.3.3). The presented hierarchy model is in high agreement with earlier ranking models, the strength of the dissertation model mainly being that it may be extended to unexcavated farmsteads. The voronoi-region analysis suggested that the overall organizational setup in the Vatnahverfi region resembled evenly distributed examples of the type of *large simple settlements* that have been implied for early medieval Iceland (Vésteinsson 1998, Vésteinsson *et al.* 2002, Vésteinsson 2006). Based on the site classification, the average population of the Vatnahverfi region was estimated at between 225-533 people (section 7.2.3.). This is a little higher, but well within the range, of an average population of 194 people estimated from burial densities and new dates from churchyards excavated during the Vatnahverfi project (section 6.2.2). Extrapolating the site-class based population calculation model to the rest of the Norse Eastern Settlement

suggests an average maximum population of 1403-1939 persons, which is almost identical to population estimates overall settlement burial densities (Lynnerup 1998). The realism of such a population scenario is also substantiated by comparative settlement development in the North Atlantic (section 2.1.2). In sum, all the evidence outlines the Vatnahverfi region as a very small and fairly dispersed community organized around a few dominating farmsteads.

What changes did the pastoral farming community go through during the settlement period, who were affected the most, how, and when?

In addition to the archaeological settlement pattern evidence, these questions were investigated along two lines of evidence: a comparative case study of pre-modern Inuit sheep farming (section 8.1) and new dates from Norse sites in the Vatnahverfi region (section 8.2). The new dates imply a two-staged settlement expansion; with a first *landnám* around AD 1000 at fjord-near locations in the inner and middle fjords, and a secondary expansion around AD 1050-1100 in which the outer fjord, inland, and upland sites were occupied. Most surprisingly, the new dates imply settlement contraction setting already from, at least the second half of, the 13th century AD. This contraction involved abandonment of the outer fjord farmsteads, disintensification of shielings activities, as well as the closing down of small churches, in the Vatnahverfi region leaving only one parish church (E66) in a final stage of settlement. Besides the new archaeological dates, the overall change in settlement patterns is corroborated by palynological evidence of decreased grazing pressure and several climatic proxy records that imply an abrupt climatic change around AD 1250 (section 3.1.3).

Juxtaposing Inuit sheep farming experiences against local ice core temperature records (section 8.2.3), it was suggested that a Norse low-labor input extensive pastoral farming strategy was large unviable after ca. AD 1250. Based on the case study of Inuit farming (section 8.2.5) and vegetational patterns (section 3.2), this would at first most seriously have affected the smalltime farmers and tenants in the outer fjord. To explore class differentiated experience and dynamics of this change, section 8.3 provided an analysis and discussion of farming system in terms of food-securities and resilience: the former analysis implied that cottagers and tenants would quickly have struggled with maintaining an extensive mode or farming, and because they – based on the comparative case of the Inuit sheep farmers – had little possibility of intensifying production, they probably either had to submit to the governance of larger and wealthier farms, or abandon farming in the outer fjord; the latter is implied by the AD 1250 settlement contraction. In the long term, however, a resilience theory perspective (section 8.3.2) suggests that this deprivation in the lower societal strata of farmers could eventually have cascaded up through the system so that at the time when climatic and environmental deterioration became aggravating even to magnate farmers, whatever available resources there were could not be fully exploited due to lack of labor.

Although the topic of settlement abandonment has been explicitly avoided throughout the dissertation, which has instead focused on settlement, farming, and livelihood, the latter discussion opens this theme: while climatic deterioration and a marginal environment were serious challenges to Norse settlement in Greenland, there is no reason to assume that they were so much more aggravating than elsewhere in the North Atlantic that they should have caused a complete collapse. The *grænlendinga* adapted on several fronts, adjusting their livestock to resources and climate, cutting down on their number in favor of wild (marine) resources (section 2.3). Rather, emerging adamantly from this study is the key issue of small population size and low available labor force: it meant that, even if the Greenlandic landscapes could supply ample food and fodder resources to sustain people and livestock, there was no labor to extract these resources; at least not while maintaining a foreign trade and communication system that was based on luxury wild life exports (section 2.2). In several ways, the Greenland settlements would appear to have remained little more than a colony, and when political, economic, and climatic tides changed to disfavor continuation of the venture, it was perhaps simply abandoned. It would be a settlement process with many historic parallels.

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APPENDIX 1 – RUIN DATABASE PARAMETERS DESCRIPTION

The following defines and describes the parameters observed for the ruin survey evidence from the Vatnahverfi region and the other comparative Eastern Settlement sites, the Ruin Database (RD, App.1). Some parameters are referential or quantitative and need little explanation, others are more, or purely, qualitative and call for consideration.

Ruin Identification Number (Ruin_ ID):

The unique identification number of each individual ruin. The Ruin_ID consists of two numbers: first the number (after the old registrant) of the ruin group to which the ruin belongs and the unique number of the ruin following the oldest existing survey. Where a ruin consists of two or more parts of clearly different built and function – e.g. an enclosure built against a stable or a building inside an enclosure – they are recorded separately, one ruin under the original Ruin_ID, any other under the same number with an added letter to the end: for instance, ruins nos. E178_01 and E178_01a, where the former is an enclosure built against a vertical cliff face, the latter a building inside this enclosure.

Ruin Group Number (RG_NO):

The number of the ruin group (after the old registrant) to which the ruin belongs. Repetition of this number is redundant, but served as referential link to the *Ruin Group Database* (App.2) and for quick sorting and enquiry in the *Ruin Database*.

Ruin Length (R_Length):

The longest external distance in meters between two opposing walls (or outlines) of a ruin, i.e. most often the greatest outside distance between the two opposing gables measured along a roughly medial axis through the ruin. However, where the ruins were very collapsed and indistinct – as for instance often the dwellings – the R_Length is measured as the longest distance between the interpreted outer boundary of the ruin along a roughly medial axis through the ruin. In cases of irregular shaped ruins that were not DGPS-surveyed, an average of noted maximum and minimum outer length measurements is used.

Ruin Width (R_Width)):

The longest measured external distance in meters between two opposing walls (or ruin outlines) along an axis set at a ca. 90° angle against the R_Length and roughly medially through the building, i.e. most often the greatest outside distance between the middle of two ruin long walls or, as noted for R_Length, in cases where the ruin is very indistinct (see above), simply the outer ruin outline. In cases of irregular shaped ruins that were not DGPS-surveyed, an average of noted maximum and minimum outer width measurements is used.

Ruin Length/Width Index (RLW_Index):

Is simply the R_Length divided by the R_Width. The RLW_Index essentially expresses and quantifies the "roundedness" of the ruin, i.e. the lower the RLW_ Index, the more rounded the ruin. As discussed and analyzed in section 6.2.1, this value is mostly used in the discussion of different dwelling types.

Ruin Area (R_Area):

The precise area of the total ruin outline measured in square meters from the digitalized survey data; only in cases where ruin description is not based on DGPS-survey, but on prior sketch survey or description has the R_Area been calculated from the recorded R_Length and R_Width. Precise digital measurement of the ruin area is preferable because many ruins, especially the dwellings and other larger ruins, are irregular of shape, and have added annexes or projecting features. In short, DGPS-surveyed precise ruin outlines are more accurate.

Wall Thickness (Wall_Th):

The thickness of the walls measured in meters. While key in the identification of building function and on the face of it a simple measure, establishing the Wall_Th can be problematic for two reasons: First, walls often vary in thickness within the same building and the gables especially seem to have been wider than the long walls, probably because the former were roof supporting. Second, walls that include a lot of turf, or turf padding, tend to "flow out" when they collapse, making them narrow at the top and wide at the bottom. Long walls comprise the larger proportion of buildings and have limited roof-supporting function. They therefore better

reflect functional properties of the building. Accordingly Wall_Th was, where possible, measured as the estimated width of the long walls.

Building Material (Build_Mat):

The type of wall material that made up the major component of a building. Combined with Wall_Th, it is a key parameter for identifying building function, i.e. insulation versus ventilation. Still, only a few surveyors have commented on the interpretation of collapsed ruins from their preserved architectural features and the surrounding volume of collapse material (Holm 1883:98, Roussell 1941:232, Vebæk 1943:48). The survey of O. Guldager *et al*. (2002: 24) is the only one to attempt to define and use more formal building material categories in ruin description.

Employing any truly formal and quantitative scale to describe ruin building material is virtually, or at least practically, impossible: measuring or counting if there is more stone than turf in a collapsed ruin, or vice versa, is evidently unfeasible. Not at least because some buildings had one part built in more stone than turf (gables, the barn end of byre/barns), and vice versa. In present analysis, I have used five descriptive building material categories for the Build_Mat parameter; and similar to Guldager *et al*. (Ibid.), hese categories rely on qualitative visual inspection of which materials constitute the major part of a building on a gradual scale with the following definitions:

Turf: walls build almost entirely in turf; visible on the surface as an (often grass covered) turf ruin or mound with no or very few protruding stones (Fig.1).

Turf/stone: composite walls build mostly in turf, but with a component of stone; visible on the surface as an (often grass covered) turf ruin or mound, which includes a substantial amount of *in situ* or collapse stone (Fig.2-3).

Stone/turf: composite walls build mostly in stone, but with a component of turf; visible on the surface as predominantly stone built walls or considerable amounts of collapse stones, but including a turf wall component (as intermittent wall layers, wall infilling or core, upper turf super structure etc.) (Fig.4).

Fig.1 View of ruin group 1104's ruin no.1, central Vatnahverfi region, an example of a ruin where the building material is classified as pure turf, because it is a completely grass covered mound with no visible stones (*photo: C.K. Madsen 2011*).

Fig.2 Detail of well-preserved turf-stone built wall of ruin group E4's simple byre/barn (ruin no.5), an example of a ruin where the building material is classified as turf-stone (the stone part of the wall have here set into the building) (*photo: C.K Madsen 2011*).

Fig.3 Ruin group E64's ruin no.2, Kujalleq fjord, an example of a very collapsed ruin (bipartite livestock building) where the building material is classified as turf-stone, but is visible on the surface mainly as a grass covered mount with many protruding stones (*photo: C.K. Madsen 2005*).

Fig.4 Ruin group E174's ruin no.5, southern Vatnahverfi region, an example of a collapsed ruin (sheep/goat shed) where the building material is classified as stone-turf. Although stone clearly comprised a substantial component of the building material, there is not enough collapse stone for the building to have been purely in stone. Rather, the turf has here largely withered away, leaving only the stone component (*photo: C.K. Madsen 2006*).

Fig.5 Ruin group E167's ruin no. 4, central highland Vatnahverfi region, an example of a very well-preserved ruin (storehouse/skemma), where the building material is classified as dry stone masonry. As seen, the stones are neatly fitted with no mortar or other adhesive (*photo: C.K. Madsen 2006*).

Fig.6 Ruin group E209's ruin no. 5, Kujalleq Fjord, an example of a more collapsed ruin (storehouse/ skemma) where the building material is classified as dry stone masonry. Although fairly collapsed, the amount of surrounding collapse stone implies the function of the building (*photo: C.K. Madsen 2005*).

Fig.7 Ruin group E90's ruin no. 1, Sioralik, an example of a well-preserved ruin (enclosure wall) where the building material is classified as dry stone masonry (for a vertical view see Fig.8) (*photo: C.K. Madsen 2006*).

Fig.8 Detail of ruin group E90's ruin no.1, vertical view. Here the dry stone wall is built with two neatly fitted faces of larger stones and a wall-core filled with lesser rounded stones (*photo: C.K. Madsen 2006*).

Dry stone masonry: walls were built entirely in stone; visible on the surface either as preserved in situ walls (Fig.5-8, 6.1, 6.14) or *a sufficient amount of collapse stone to comprise the complete walls of a dry stone masonry building*. Having gone through prior surveys records from the Vatnahverfi region, it seems clear that the descriptive term 'dry stone masonry' has been applied to describe a great number of ruins, which upon closer inspection do not seem to include enough collapse stone for the walls to have stood to any height. Such ruins were probably, as they are interpreted here, built in stone/turf, but the turf component since completely disintegrated.

Stone foundation: walls built entirely in turf, but resting on a stone sill or foundation; visible on the surface either as a single or a few courses of *in situ* wall with little or no preserved turf superstructure. Essentially, stone foundations represent the same type of ruin and building material as the pure *turf* category, only here the turf components have since completely disintegrated (Fig.6.9-6.10).

Where a ruin consisted of two parts built in distinctly different material – for instance the turf-built insulated stable area and the ventilated stone-built storage area of byre/barns – it has only been attributed one Build_Mat category based on its preserved surface appearance.

Number of Compartments (No_Comp):

The number of identifiable sections or rooms in a ruin. Although multiple room outlines are often seen in the dwellings, they have not been recorded separately because they are almost impossible to define.

Area of Compartment + Number (Ar_Comp + No.):

The precise area in square meters of any identifiable section or room in a ruin; section or rooms are listed according to size from largest to smallest and attributed a serial compartment number. Areas are measured in MapInfo from the digitalized survey data; only in cases where ruin description is not based on DGPS-survey, but on prior sketch surveys or description has the Ar_Comp been calculated from average R_Length and R_Width.

Sunk (yes/no):

A parameter which describes if a ruin has been dug into the ground? However, it should be noted that a ruin described as 'sunk' is not equivalent to a 'pit house', although differentiating between the two is problematic: while the latter is a rather distinct building type in all of late Iron Age/Viking Age northern Europe, 'sunk' here only describes if a building had a floor buried to any depth below surface level. While 'sunken' ruins thus could be 'pit houses' in the traditional sense, most are not. In fact, judging from the excavated Norse ruins, sinking buildings slightly into the surface seems to have been the norm rather than the exception. Often it was a natural side effect of the houses being built on somewhat sloping ground whereby even leveling of the floors would cause, at least part of, the ruin to be sunk below the surrounding surface.

Fig.9 Ruin group E167's ruin no. 5, central highland Vatnahverfi region, an example of a ruin (storehouse /skemma or enclosure) where the building material is classified as a stone foundation. Since there is no stone collapse lying about, the ruin must clearly have had a superstructure of another building material, probably turf, but perhaps even wood (*photo: C.K. Madsen 2006*).

Fig.10 Ruin group E172 ruin no. 20, central Vatnahverfi region, an example of a ruin (storehouse /skemma) where the building material is classified as a stone foundation. Again, the lack of surrounding collapse stone precludes a larger original stone component and the superstructure of the building must consequently have been built in turf or wood (*photo: C.K. Madsen 2007*).

However, some buildings seem to have been more purposefully sunk into the ground, probably for the purpose of insulation, while at the same time conserving on turf building material. A large part of the surveyed ruins described as 'sunk' could belong to the latter category; for if the lowered floor layer of ruins – with caved-in roof and perhaps wall material – are visible from surface observation, then they must originally have been sunk more than a little into the surrounding surface. Unfortunately, neither prior surveyors, nor we during the Vatnahverfi-Project, have been completely consistent in the observation of this ruin parameter. At any rate, the observation of a ruin being sunk into the ground implies its primary function of insulation.

Ruin Interpretation (Ruin_Int):

The functional interpretation of the ruin after the building classes presented in section 6.2.

Distance to Main Dwelling (Dis_MD):

The distance in meters of a ruin to its associated dwelling. Where there is only one dwelling taking this measurement is unproblematic. However, at ruin groups with more than one dwelling, a good deal of qualitative assessment is involved, i.e. ascribing ruins to particular dwellings based on their location, proximity, or natural dividing features (e.g. streams, outcrops, bluffs, ravines etc.). The interpretation presumes that all the ruins, or at least the dwellings, were contemporary. As will be presented below, the Dis_MD uses the assumed centrality of the dwelling in farmstead activities to approximate functions of related outbuildings. This relationship is summarized in the *farmstead dispersion index*, which implies how nucleated or dispersed a farmstead is (see section 7.1.1).

Distance to nearest enclosure (Dis_Encl):

A parameter only recorded for buildings interpreted as enclosures that measures the distance to the nearest other enclosure; the parameter is used to identify functionally related enclosures, e.g. *stekkr* and *lambakró*.

Enclosure Facing (Encl_Face):

A parameter only observed for enclosures of the types built against a steep or vertical cliff face or against the side of a building. It describes the general heading towards which the enclosure is open (or is not sheltered). The Encl_Fac was included for the functional discussion of these enclosures (section 6.2.4). Rarely described in neither prior survey reports or those produced during the Vatnahverfi-Project, the Encl_Face was observed from the survey-data during digital post-processing.

Enclosure Bedding (Encl_Bed):

A parameter only recorded for enclosures, which separates the character of the enclosed surface on four categories: soil surface, naked bedrock, mixed stone and soil, and unknown. The Encl_Bed was included for the functional discussion of the enclosures, where examples with a soil surface could have been gardened, whereas the others could not, but had a draining function. Rarely noted in prior survey reports or those produced during the first part of Vatnahverfi-Project, the Encl_Face was recorded from field notes of vegetation, photographs, or simply omitted there was insufficient information.

Enclosure Slope (Encl_Slope, yes/no):

A parameter only observed for the enclosures, which describes whether or not the ruin was built on markedly sloping ground. Because precise measurement of the actual angle of Encl_Slope was unfeasible during the field surveys, 'markedly sloped' refers simply to the observation of the ruin runs over fairly steeply sloped ground, likely for the purpose of water run-off or drainage.

Survey from differential GPS (DGPS, yes/no):

A parameter that describes whether the ruin was DGPS surveyed or if listed observations are based on written description/sketch survey only. Ruins not DGPS-surveyed were added during the secondary post-processing (see section 4.2.3).

Reference (Ref.):

The primary literary reference(s) regarding the ruin and on which listed observations are based.

Additional Notes (Add.note):

Additional notes relating to the interpretation of or observations on the ruin, most often referring to the partial preservation of the ruin or renumbering of ruins to match earlier survey reports).

Wherever possible (ruin checked off as DGPS-surveyed), all of the above parameters were established from digital measurement or observation.

Ruin Data																								
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
00-2_	00-2														No	26					No	Yes	Field report under preparation	
00-2_01	00-2	7,04	5,61	38,28	1,25	5	0,6	1	24,63						No	15	2,3	3,8		2	No	Yes	Field report under preparation	
00-2_02	00-2	11,69	7,35	57,76	1,59	5	0,5	4	10,86	7,51	5,17	3,51			No	1					No	Yes	Field report under preparation	
00-2_03	00-2	3,21	2,94	10,78	1,09	5									No	9	18,9				No	Yes	Field report under preparation	
00-2_04	00-2	28,89	16,6	376,03	1,74	5	0,8	1	318,79						No	15	6,7	3,8		1	No	Yes	Field report under preparation	Note that R_Area and Ar_Comp1 is only somewhat accurate, because enclosure wall is not fully preserved.
00-2_05	00-2	3,59	0,92	3,27	3,90	4	0,9								No	27					No	Yes	Field report under preparation	
00-2_06	00-2	2,27	0,6	3	3,78	4	0,6								No	27					No	Yes	Field report under preparation	
0403_01	0403	14	6	84	2,33	2									No	15				4	No	No	Kapel et al. 2004;49	
0405_01	0405	5	3	15	1,67	2									No	14					No	No	Kapel et al. 2004;49	
0501_01	0501	4,28	2,75	11,61	1,56	1	0,5	1	5,94						Yes	4					No	Yes	Møller&Madsen 2006;31	
0502_01	0502	10	9,1	72,92	1,10	3	0,75	1	48,69						No	16				2	No	Yes	Møller&Madsen 2006;31	
0502_02	0502	7,48	4,3	31,93	1,74	2	0,65	1	14,96						No	4					No	Yes	Møller&Madsen 2006;31	
0502_03	0502	8,33	4,8	37,79	1,74	5	0,5	1	24,41						No	4					No	Yes	Møller&Madsen 2006;31	Note that wall dimensions has been altered according to photo/description
0502_04	0502	4,65	3,12	14,04	1,49	4	0,6	1	5,83						No	9					No	Yes	Møller&Madsen 2006;31	
0503_01	0503	12,11	0,8	9,86	15,14	5	0,8								No	25					No	Yes	Møller&Madsen 2006;32	
0601_01	0601	2,56	2,1	5,4	1,22	3	0,5	1	2,39						No	14					No	Yes	Møller&Madsen 2007;36	
0602_01	0602	2	2	4	1,00	4									No	20					No	No	Møller&Madsen 2007;36	No other information on the ruin could be found
0602_02	0602	6	4	18	1,50	3	1								Yes	14					No	No	Møller&Madsen 2007;36	No other information on the ruin could be found
0602_03	0602	5	2	20	2,50	4	1	3	20	6	4				No	18				1	No	No	Møller&Madsen 2007;36	No other information on the ruin could be found
0603_01	0603	7,54	6,9	32,24	1,09	2	0,75	3	5,62	4,49	3,91				No	14					No	Yes	Møller&Madsen 2007;36	
0604_01	0604	3	2	6	1,50	4									No	20					No	No	Møller&Madsen 2007;37	No other information on the ruin could be found
0605_01	0605	6,3	5,34	27,58	1,18		0,75	3	5,33	3,47	1,44				No	14					No	Yes	Møller&Madsen 2007;37	
0605_02	0605	7,53	4,58	26,2	1,64		0,8	1	15,67						Yes	10					No	Yes	Møller&Madsen 2007;37	
0701_01	0701	6,52	4,18	24,61	1,56	2									No	14					No	Yes	Møller et al. 2007;9	Note that the western part of ruin 1 is here considered a later disturbance, like reuse of the structure by Inuit
0701_02	0701	3,97	3,19	12,02	1,24	2	0,95	1	3,56						No	14					No	Yes	Møller et al. 2007;9	
0701_03	0701	2,45	2,4	5,28	1,02	2	0,8	1	1,44						No	20					No	Yes	Møller et al. 2007;9	
0901_01	0901	13,6	5,32	62,04	2,56	1	1,8	3	6,03	4,14	3,53				No	1					No	Yes	Madsen 2009;92	
0901_02	0901	10,57	5,06	46,68	2,09	1	1,8	2	5,63	4,54					No	5	0,7				No	Yes	Madsen 2009;92	
0902_01	0902	24,75	1,9	45,91	13,03	1	1,9	1	1649						No	21				1	No	Yes	Madsen 2009;93	Note that Ar_Comp1 is measured from GoogleEarth satellite imagery
1001_01	1001	4,91	3,31	14,46	1,48	2	1,1	2	4,56	2,5					No	14					No	Yes	Heide&Madsen 2010;36	
1001_02	1001	4,38	2,42	9,14	1,81	5	0,8	1	4,02						No	14					No	Yes	Heide&Madsen 2010;37	Note that R_Area, R_Width, Ar_Comp1 are only somewhat accurate because the structure is partially eroded.
1102_01	1102	4,84	1,5	6,15	3,23	6	0,5	1	4,22						No	20					No	Yes	Field report under preparation	
1103_01	1103	4,85	3,47	14,73	1,40	3	0,8	1	5,49						No	14					No	Yes	Field report under preparation	
1104_01	1104	11,95	4,77	49,92	2,51	1	1,2	3	9,71	5,21	3,29				No	1					No	Yes	Field report under preparation	
1301_01	1301	3,38	3,2	9,03	1,06	2	0,8	1	5,04						No	14					No	Yes	Field report under preparation	
1301_02	1301	18,28	13,71	135,14	1,33	5	1	4	78,32	9,83	8,73	1,76			No	18		1	NW	1	No	Yes	Field report under preparation	
1301_03	1301	7,17	1,6	9,66	4,48	4		1	8,74						No	18		1		1	No	Yes	Field report under preparation	
1301_04	1301	5,88	5,5	28,23	1,07	4	0,6	2	12,89	2,43					No	18		12,3		3	No	Yes	Field report under preparation	
1301_05	1301	8,73	7,61	54,81	1,15	4	0,5	1	40,71						No	18		9,2	SE	3	No	Yes	Field report under preparation	
1301_06	1301	4	4		1,00	4	0,5	4	1	1	1	1			No	28					No	No	Field report under preparation	
1301_07	1301	5	4		1,25	4	0,5	2	4	2					No	20		101,4			No	No	Field report under preparation	
60V1_00I_543_01	60V1_00I_543	10,33	4,14	42,75	2,50	5	0,8	1	19,96						No	10					No	Yes	Madsen 2010 (under preparation)	
B10_01	B10	3,5	2	7	1,75	3		1							No	20					No	No	NMA:Bak1969;B10	Ruin description after rough survey sketch and description only
B10_02	B10	1,5	1	1,5	1,50	5		1							No	20					No	No	NMA:Bak1969;B10	Ruin description after rough survey sketch and description only
B10_03	B10	5,1	2,5	13,4	2,04	3		2	8,35	5					No	20					No	No	NMA:Bak1969;B10	Ruin description after rough survey sketch and description only
B10_04	B10	2,5	2	5	1,25	3		1							No	20					No	No	NMA:Bak1969;B10	Ruin description after rough survey sketch and description only
B102_01	B102	22,5	1,59	5,76	14,15	2	1,5								No	25					No	Yes	NMA:Bak 1970;B102, Møller&Madsen 2007;21	
B136_01	B136	8	4	32	2,00	4	1	1	12	6					No	15				4	No	No	NMA:Bak 1971;B136-4	Ruin measurements from rough sketch and survey only.
B136_02	B136	4	3	12	1,33	3		1							No	4					No	No	NMA:Bak 1971;B136-2	Note that the surrounding turf collapse is not measured as part of the ruin. Ruin measurements from rough sketch and survey only.
B136_03	B136	10	4,5	45	2,22	4	1,25	1							No	15				4	No	No	NMA:Bak 1971;B136-4	Ruin measurements from rough sketch and survey only.
B136_04	B136	15	15	225	1,00	2									No	1					No	No	NMA:Bak 1971;B136-3	Ruin measurements from rough sketch and survey only.
B139_01	B139	10,22	3,97	34,97	2,57	2	1	3	5,77	3,76	3,13				No	1					No	Yes	NMA:Bak 139;B10, Møller&Madsen 2007;36	
B139_02	B139	5,04	4,09	19,93	1,23	5	0,5	2	8,02	5,26					No	18	39,7		SW	1	No	Yes	Møller&Madsen 2007;36	Note that Ar_Comp1 is only roughly accurate as the walls are not completely preserved
B139_03	B139	1,86	0,48	1,09	3,88	4		1	0,81						No	19	45,9	2,29		2	No	Yes	Møller&Madsen 2007;36	Wall thickness not described
E111_01	E111	17,74	10,27	156,17	1,73	4	1,8	1	88,12						No	12	44,6				No	Yes	Kapel&Clemmensen 2013;14	Note that the ruin is slightly eroded
E111_01a	E111	39,3				3	1,45	1							No	13	37,8				No	Yes	Kapel&Clemmensen 2013;14	Note that the ruin is eroded and R_Width and R_Area cannot be estimated
E111_02	E111	42,95	16,44	523,2	2,61	2									No	1					No	Yes	Kapel&Clemmensen 2013;14	
E111_03	E111	29,08	7,74	240,3	3,76	2	2	2	56,53	30,9					No	2	16,9				No	Yes	Kapel&Clemmensen 2013;14	
E111_04	E111	13,46	5,1	67,23	2,64	3	0,95	1	22,64						No	4	76				No	Yes	Kapel&Clemmensen 2013;14	
E111_05	E111	10,76	4,47	44,17	2,41	4	0,9	1	21,35						No	18	60,7		SE		Yes	Yes	Kapel&Clemmensen 2013;15	Note that Kapel&Clemmensen interpret ruin as outbuilding or storehouse
E111_06	E111	24,45	7,41	174,63	3,30	1	2	2	26,94	19,48					No	2	25,8				No	Yes	Kapel&Clemmensen 2013;15	
E111_07	E111	12,96	6,98	85,47	1,86	3	1,4	1	31,38						No	14	49,8				No	Yes	Kapel&Clemmensen 2013;15	
E111_08	E111	150,4	2,11	317,34	71,28		2,15	1	81209						No	24	29,9				No	Yes	Kapel&Clemmensen 2013;15	Note that Area_Comp 1 is only roughly accurate and based on an estimated projection of the homefield dyke

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E111_09	E111	12,29	5,24	60,95	2,35	4									No	18	170,4		SE		No	Yes	Kapel&Clemmensen 2013;15	
E111_10	E111	12,95	7,26	79,88	1,78	2	0,85	2	29,02	16,83					No	5	185,8				No	Yes	Kapel&Clemmensen 2013;15	
E111_11	E111	12,73	4,12	45,54	3,09	2	1,05	1	19,21						No	17	94,2		W		No	Yes	Kapel&Clemmensen 2013;15	
E111_12	E111		4,42		0,00		1	1							Yes	14	126,6				No	Yes	Kapel&Clemmensen 2013;15	Ruin is partially eroded and R_Length cannot be measured
E118_01	E118	6	3,35	19,18	1,79	2	0,6	1	6,89						No	4	14				No	Yes	Heide&Madsen 2010;12, Krogh&Berglund 1980;162	
E118_02	E118	25,8	14,7	313,49	1,76	2									No	1					No	Yes	Heide&Madsen 2010;12, Krogh&Berglund 1980;162	
E118_03	E118	5,1	2,66	13,49	1,92	5	0,5	1	5,97						No	14	75,3				No	Yes	Heide&Madsen 2010;13, Krogh&Berglund 1980;162	
E118_04	E118	5,97	3,23	19,01	1,85	5									No	9	75,2				No	Yes	Heide&Madsen 2010;13, Krogh&Berglund 1980;162	
E118_05	E118	4,77	4,26	19,16	1,12	2									No	14	55,8				No	Yes	Heide&Madsen 2010;13, Krogh&Berglund 1980;162	
E118_06	E118	6,45	4,12	24,34	1,57	2	0,75	1	7,57						Yes	4	62,7				No	Yes	Heide&Madsen 2010;13, Krogh&Berglund 1980;162	
E118_07	E118	7,89	4,68	21,69	1,69	5	0,5	1	14,43						No	18	146,9		SW	3	No	Yes	Heide&Madsen 2010;14, Krogh&Berglund 1980;163	
E119_01	E119	3,8	3,19	12,75	1,19	4	0,9	1	2,9						No	9	118,5				No	Yes	NMA:Albrethsen 1969, Møller et al. 2007;10	
E119_02	E119	9,53	4,22	31,88	2,26	3	0,5	1	26,8						No	18	94,7	128,8	NE	3	No	No	NMA:Albrethsen 1969, Møller et al. 2007;10	
E119_03	E119	12,41	5,56	68,77	2,23	2	1,2	2	14,38	13,68					No	5	65,3				No	Yes	NMA:Albrethsen 1969, Møller et al. 2007;10	
E119_04	E119	8,54	5,16	36,07	1,66	3									No	4	65,1				No	Yes	NMA:Albrethsen 1969, Møller et al. 2007;10	
E119_05	E119	33,1	21	507,74	1,58	2									No	1					No	Yes	NMA:Albrethsen 1969, Møller et al. 2007;10	
E119_06	E119	6,6	3	19,74	2,20	5	0,6	1	8,9						No	4	72,7				No	Yes	NMA:Albrethsen 1969, Møller et al. 2007;10, ??? 2013	
E119_07	E119	4,99	6,33	20,7	0,79	5	0,65	1	14,88						No	18	58,6	118,1	SE	3	No	Yes	NMA:Albrethsen 1969, Møller et al. 2007;10, ??? 2013	
E119_08	E119	7,16	5,83	33,8	1,23	2									No	14	9,5				No	Yes	NMA:Albrethsen 1969, Møller et al. 2007;11	
E119_09	E119	13,26	11,04	121,22	1,20	2									No	3	54,8				No	Yes	NMA:Albrethsen 1969, Møller et al. 2007;11	
E119_10	E119	5,9	4,25	24,82	1,39	5	0,5	1	15,14						Yes	9	94,1				No	Yes	NMA:Albrethsen 1969, Møller et al. 2007;11	
E119_11	E119	13,44	5,42	70,44	2,48	2	1,1	2							No	5	89				No	Yes	NMA:Albrethsen 1969, Møller et al. 2007;11, 2013 ????	
E119_12	E119	10,25	5,42	43,89	1,89	2	0,9	1	29,85						No	18	142,5	118,1	S	1	No	Yes	NMA:Albrethsen 1969, Møller et al. 2007;11	
E119_14	E119	2,31	1,94	4,38	1,19	5	0,3	1	2,33						No	14	186,7				No	Yes	NMA:Albrethsen 1969, Møller et al. 2007;11	
E120_01	E120	9,34	5,68	102,35	1,64	4	0,55	1	29,31						No	9	128,3				No	Yes	NMA:Abrethsen 1969, Møller et al. 2007;12	
E120_01a	E120	10,68	9,45	63,54	1,13	5	0,75	1	45,13						No	17	132,4		SW	2	No	No	NMA:Abrethsen 1969, Møller et al. 2007;12	Note that ruin dimensions are only roughly accurate, as they are based on descriptuin and rough survey sketch only (NMA:Albrethsen 1969)
E120_02	E120	10,47	4,28	33,88	2,45	3	0,8	1	23,7						No	18	157		S	1	No	Yes	NMA:Abrethsen 1969, Møller et al. 2007;12	
E120_03	E120	7,67	5,86	38,43	1,31	2									No	14	140,1				No	Yes	NMA:Abrethsen 1969, Møller et al. 2007;12	
E120_04	E120	30	15	450	2,00	2									No	1					No	No	NMA:Abrethsen 1969, Møller et al. 2007;12	Note that ruin dimensions are only roughly accurate, as they are based on descriptuin and rough survey sketch only (NMA:Albrethsen 1969)
E120_05	E120	5,57	3,37	14,44	1,65	5									Yes	4	19,2				No	Yes	NMA:Abrethsen 1969, Møller et al. 2007;12	
E120_06	E120	6	4,26	20,43	1,41	5									No	14	39,7				No	Yes	NMA:Abrethsen 1969, Møller et al. 2007;12	
E120_07	E120	9,61	3,99	35,79	2,41	3									No	4	79,3				No	Yes	NMA:Abrethsen 1969, Møller et al. 2007;12	Note that ruin dimensions are very approximate, because ruin is highly disturbed.
E120_08	E120	9,3	1	10,66	9,30	2	1								No	25	13,8				No	Yes	NMA:Abrethsen 1969, Møller et al. 2007;12	Disturbed stretch of dike
E125_01	E125	11,2	5,05	52,27	2,22	2	0,85	2	19,65	5,31					No	5	67,5				No	Yes	Field report under preparation	Note that Ar_Comp1 is slightly approximate, because the walls are not entirely preserved
E125_02	E125	22,64	5,16	108,58	4,39	2	1,2	3	21,18	16,58	6,88				No	6	25				No	Yes	Field report under preparation	Note that Ar_Comp1 and Ar_Comp2 are approximate, because the walls are not entirely preserved
E125_03	E125	16,18	8,63	108,06	1,87	2									No	1					No	Yes	Field report under preparation	
E125_04	E125	7,29	5,43	38,36	1,34	5	0,65	1	22,51						No	14	14,2				No	Yes	Field report under preparation	
E125_05	E125	5,23	3,28	16,75	1,59	2	0,8	2	5,84						No	4	20,2				No	Yes	Field report under preparation	
E125_05a	E125	2,73	2,24	5,95	1,22	5	0,35	1	4,03						No	17	20	105	SW	1	No	Yes	Field report under preparation	
E125_06	E125	5,7	5,15	27,27	1,11	1	1,25	1	8,62						Yes	14	42,5				No	Yes	Field report under preparation	
E125_09	E125	11,49	4,5	50,41	2,55	2	1	2	13,19	6,32					No	5	105,4				No	Yes	Field report under preparation	
E125_10	E125	3,65	2,1	7,59	1,74	2									Yes	14	9,4				No	Yes	Field report under preparation	
E125_11	E125	5,16	4,88	15,14	1,06	3	0,6	2	7,1	1,14					No	18	127,2	105	SW	1	No	Yes	Field report under preparation	
E125_13	E125	2,26	2,01	4,32	1,12	4	0,5	1	1,59						No	11	428,8				No	Yes	Field report under preparation	Note that ruin could be Inuit
E126_01	E126	18,9	17,1	295,61	1,11	2									No	1					No	Yes	Field report under preparation	
E126_02	E126	7,65	4,26	32,4	1,80	3									No	4	34,2				No	Yes	Field report under preparation	
E126_03	E126	8,36	5,4	44,62	1,55	5									No	4	31,2				No	Yes	Field report under preparation	
E126_04	E126	19	9,97	113,57	1,91	3	0,8	1	85,98						No	18	124,8		SE	3	No	Yes	Field report under preparation	
E126_05	E126	5,67	3,21	18,15	1,77	3	0,8	1	6,9						No	10	313,6				No	Yes	Field report under preparation	
E126_06	E126	12,78	6,21	78,83	2,06	2									No	2	0,5				No	Yes	Field report under preparation	Note that measurements are only very approximate, because the ruin is almost indistinguishable from ruin 01
E126_07	E126	9,5	7	66,5	1,36										No	4					No	No	Field report under preparation	Measurements from discription only (NMA: Nørlund 1921); included because it cannot be any of the registered ruins
E126_08	E126	10,25	5	51,25	2,05										No	4					No	No	Field report under preparation	Measurements from discription only (NMA: Nørlund 1921); included because it cannot be any of the registered ruins
E149_01	E149	14,94	9,71	142,32	1,54	4	1,5	1	76,98						No	12	30,1				No	No	From description and georeferenced survey plan: Vebæk 1991:25, Fig.24	
E149_01a	E149	28,8	23,8	192,79	1,21	5	1,6	1	372,2						No	13	23,2				No	No	From description and georeferenced survey plan: Vebæk 1991:33, Fig.24	
E149_02	E149	74	25,1	1587,62	2,95	2									No	1					No	No	From description and georeferenced survey plan: Vebæk 1991:46, Fig.24	
E149_03	E149	25,3	12,9	286,74	1,96	2									No	3	9,5				No	No	From description and georeferenced survey plan: Vebæk 1991:54, Fig.24	
E149_04	E149	12,65	12,43	127,77	1,02	5	1,75	1	55,06						No	16	160,1	4,8		4	No	No	From description and georeferenced survey plan: Vebæk 1991:54, Fig.24	
E149_05	E149	10,65	5,16	49,01	2,06	5	1,75	1	27,6						No	17	166	4,8	SW	4	No	No	From description and georeferenced survey plan:	

Ruin Data																								
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
																							Vebæk 1991:54, Fig.24	
E149_06	E149	6,04	5,3	31,37	1,14	4	1	1	11,28						No	17	152,9	26,6	SW	1	No	No	From description and georeferenced survey plan: Vebæk 1991:54, Fig.24	
E149_07	E149	15,48	6,78	116,14	2,28	2	1,3	1	47,61						No	2	139,2				No	No	From description and georeferenced survey plan: Vebæk 1991:54, Fig.24	
E149_08	E149	17,13	5,45	85,15	3,14	2	1,15	1	40,54						No	14	122,8				No	No	From description and georeferenced survey plan: Vebæk 1991:55, Fig.24	
E149_09	E149	25,58	5,91	132,29	4,33	2	1,6	2	37,56	11,88					No	2	47				No	No	From description and georeferenced survey plan: Vebæk 1991:55, Fig.24	
E149_10	E149	11,48	5,14	62,54	2,23		1,3	1	20,09						No	4	61,3				No	No	From description and georeferenced survey plan: Vebæk 1991:56, Fig.24	Note that Vebæk (191:56) interpreted the ruin as a pen
E149_11	E149	25,2	23,3	349,91	1,08	2									No	3	75,6				No	No	From description and georeferenced survey plan: Vebæk 1991:56, Fig.24	
E149_12	E149	9,54	7,97	69,99	1,20	2									No	14	66				No	No	From description and georeferenced survey plan: Vebæk 1991:57, Fig.24	
E149_13	E149	29,38	5,87	166,2	5,01										No	6	25,5				No	No	From description and georeferenced survey plan: Vebæk 1991:57, Fig.24	
E149_14	E149	9,58	5,7	39,4	1,68	4		1	24,88						No	17	144,2	22,7	SE	4	No	No	From description and georeferenced survey plan: Vebæk 1991:57, Fig.24	
E149_15	E149	4,77	3,74	15,27	1,28		1	1	4,59						No	19	170	22,7	SE	4	No	No	From description and georeferenced survey plan: Vebæk 1991:57, Fig.24	
E149_16	E149	12,62	6,08	77,18	2,08	5	1,2	1	33						No	4	121,7				No	No	From description and georeferenced survey plan: Vebæk 1991:57, Fig.24	
E149_17	E149	9,18	8,99	78,75	1,02										No	14	114,8				No	No	From description and georeferenced survey plan: Vebæk 1991:57, Fig.24	
E149_18	E149	6,68	3,66	23,92	1,83	3	1	1	4,5						No	4	186,5				No	Yes	Vebæk 1991:57, Fig.24, Field report under preparation	
E149_19	E149	7,96	4,99	35,29	1,60	3	1,15	1	17,16						Yes	4	280				No	Yes	Vebæk 1991:57, Field report under preparation	
E149_20	E149	3,77	2,71	9,24	1,39	3	0,5	2	4,72	1					No	19	331,5	9,4	E	3	No	Yes	Vebæk 1991:57, Field report under preparation	
E149_21	E149	11,95	8,19	77,7	1,46	4	0,9	4	23,56	18,26	3,96	2,84			No	18	334,5	9,4	SE	3	No	Yes	Vebæk 1991:57, Field report under preparation	
E149_22	E149	848,8	1	461	848,80	5	1	1	49870						No						No	Yes	Vebæk 1991:57, Field report under preparation	
E150_01	E150	6,75	5,35	37,27	1,26	3	0,9	1	7,14						No	14					No	Yes	NMA: Bak 1969, Field report under preparation	
E150_02	E150	3,32	2,51	8,29	1,32	5	0,6	1	4,52						No	14					No	Yes	NMA: Bak 1969, Field report under preparation	
E150_03	E150	11,61	4,73	58,49	2,45	2	1	2	8,67	5,92					No	5					No	Yes	NMA: Bak 1969, Field report under preparation	
E150_05	E150	4,71													No	27					No	Yes	NMA: Bak 1969, Field report under preparation	Short stretch of possible damn
E150_06	E150	6,73	3,46	22,59	1,95	2	0,8	1	9,47						No	4					No	Yes	NMA: Bak 1969, Field report under preparation	
E150_07	E150	8,61	3,67	28,4	2,35	2	0,95	2	7,35	2,63					No	5					No	Yes	NMA: Bak 1969, Field report under preparation	
E150_08	E150	15,88	11,33	177,08	1,40	4	0,9	1	129,04						No	15				2	No	Yes	NMA: Bak 1969, Field report under preparation	
E164_01	E164	19,2	10,72	159,19	1,79	2									No	1					No	Yes	NMA:Vebæk 1948;7, 8, Kapel et al. 2004;41, Møller&Madsen 2007;23	
E164_02	E164	13,77	7,39	75,88	1,86	2	1,1	3	14,69	12,71					No	6	8				No	Yes	NMA:Vebæk 1948;7, 8, Kapel et al. 2004;41, Møller&Madsen 2007;23	A third room is likely present, but cannot be measured. Ar_Comp measurements from Vebæk 1948 description and GoogleEarth© satellite imagery
E164_04	E164	8,12	4,86	36,45	1,67		1,05	1	16,28						No	14	145,9				No	Yes	NMA:Vebæk 1948;7, 8, Kapel et al. 2004;41, Møller&Madsen 2007;24	Note: Møller&Madsen 2007 ruin 17. Ruin measurements partly from GoogleEarth© satellite imagery
E164_05	E164	9,49	5,02	45,59	1,89										Yes	14	120,4				No	Yes	NMA:Vebæk 1948;7, 8, Kapel et al. 2004;41, Møller&Madsen 2007;24	Note: Møller&Madsen 2007 ruin 15. Ruin measurements partly from GoogleEarth© satellite imagery
E164_06	E164	9,74	6,19	52,11	1,57										No	14	56,9				No	Yes	NMA:Vebæk 1948;7, 8, Kapel et al. 2004;42, Møller&Madsen 2007;23	Note: Kapel et al. 2004 ruin 8 , Møller&Madsen 2007 ruin 8
E164_07	E164	12,17	4,17	50,31	2,92	3	0,9	2	11,76	10,65					No	5	84,5				No	Yes	NMA:Vebæk 1948;7, 8, Kapel et al. 2004;43, Møller&Madsen 2007;23	Note: Kapel et al. 2004 ruin 12 , Møller&Madsen 2007 ruin 6
E164_07a	E164	5,56	2,35	15,51	2,37	5	0,45	1	9,46						No	17	85,1	153,5	S	1	No	Yes	NMA:Vebæk 1948;7, 8, Kapel et al. 2004;43, Møller&Madsen 2007;23	Note: Kapel et al. 2004 ruin 12 , Møller&Madsen 2007 ruin 6. Note that ruin is built against ruin 164_07
E164_08	E164	5,8	3,37	19,2	1,72	4	0,95	1	6,71						No	9	43,1				No	Yes	NMA:Vebæk 1948;7, 8, Kapel et al. 2004;42, Møller&Madsen 2007;23	Note: Kapel et al. 2004 ruin 10 , Møller&Madsen 2007 ruin 4.
E164_09	E164	5,02	3,88	19,08	1,29	3	0,55	1	9,03						No	14	23,9				No	Yes	NMA:Vebæk 1948;7, 8, Kapel et al. 2004;42, Møller&Madsen 2007;24	Note: Møller&Madsen 2007 ruin 3.
E164_10	E164	10	5	53,39	2,00	2	1,1	2	10,84	9,89					No	5	41,4				No	No	NMA:Vebæk 1948;7, 8	Ruin dimensions and location based on rough survey sketch and description only (NMA:Vebæk 1948;8)
E164_11	E164	2,46	2,41	4,09	1,02	6	0,45	3	3,33						No	20	90,1				No	Yes	Kapel et al. 2004;42, Møller&Madsen 2007;24	Note: Møller&Madsen 2007 ruin 5.
E164_12	E164	28,63	1,1	64,36	26,03	3	1,1	1	329,51						No	21	188,8	15,1		1	No	Yes	Møller&Madsen 2007;24	
E164_13	E164	10,3	3,73	36,22	2,76	3	0,55	2	9,68	9,59					No	5	230,9				No	Yes	Kapel et al. 2004;43, Møller&Madsen 2007;25	Note: Møller&Madsen 2007 ruin 21.
E164_14	E164	4,81	3,32	13,94	1,45	3									No	14	232				No	Yes	Kapel et al. 2004;43, Møller&Madsen 2007;24	Note: Kapel et al. 2004 ruins 14 and 15 have been switched. Møller&Madsen 2007 ruin 19.
E164_15	E164	7,71	4,13	30,77	1,87	2	1,05	1	11,02						No	4	247,2				No	Yes	Kapel et al. 2004;43, Møller&Madsen 2007;25	Note: Kapel et al. 2004 ruins 14 and 15 have been switched. Møller&Madsen 2007 ruin 22.
E164_16	E164	3,86	2,57	9,47	1,50	2	0,65	1	3,89						Yes	14	156,1				No	Yes	Møller&Madsen 2007;24	
E164_17	E164	7,65	3,77	25,92	2,03	3	0,95	1	10,31						No	4	163,6				No	Yes	Møller&Madsen 2007;24	Note: Møller&Madsen 2007 ruin 11
E164_18	E164	5,74	4,18	22,45	1,37	3									No	14	136,5				No	Yes	Møller&Madsen 2007;24	
E164_19	E164	10,45	5,72	47,87	1,83	5	1,15	1	26,75						No	18	163,7	15,1	SE	3	No	Yes	Møller&Madsen 2007;24	Note: Møller&Madsen 2007 ruin 13
E164_20	E164	15,1	4,48	60,1	3,37	3	0,85	3	10,44	9,96	5,86				No	6	136,5				No	Yes	Møller&Madsen 2007;24	Note: Møller&Madsen 2007 ruin 14
E164_21	E164	5,52	3,09	17,27	1,79	3	0,65	1	5,78						No	4	126,2				No	Yes	Møller&Madsen 2007;24	Note: Møller&Madsen 2007 ruin 10
E164_22	E164	4,46	3,17	13,21	1,41	3	1	1	3,28						No	4	242,7				No	Yes	Møller&Madsen 2007;24	Note: Møller&Madsen 2007 ruin 20
E164_23	E164	6,21	4,14	23,09	1,50	2	1,05	1	8,18						No	4	91,3				No	Yes	Møller&Madsen 2007;23	Note: Møller&Madsen 2007 ruin 7
E164_24	E164	2,97	1,88	4,91	1,58										No	14	245,3				No	Yes	Møller&Madsen 2007	Ruin DGPS surveyed but not described or photographed
E164_25	E165	7,31	4,5	28,42	1,62	3									No	4	92,7				No	Yes	Møller&Madsen 2007;23	Note: Møller&Madsen 2007 ruin 9
E165_01	E165	34,5	32,9	839,87	1,05	2									No	1					No	Yes	NMA:Krogh 1981;ruin A, Møller&Madsen 2007	Note that note description exists; ruin measurements and detail is based solely on DGPS-survey and

Ruin Data																								
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
																								photograph
E165_02	E165	27,7	125	60,91	0,22	3	1,25	1	447,94						No	21	104,5			1	No	Yes	NMA:Krogh 1981;ruin B, Møller&Madsen 2007	Note that note description exists; ruin measurements and detail is based solely on DGPS-survey and photograph
E165_03	E165	5,63	3,32	16,23	1,70	5	0,6	1	7,59						No	4	119,7				No	Yes	Møller&Madsen 2007	Note that note description exists; ruin measurements and detail is based solely on DGPS-survey and photograph
E165_04	E165	1,93													No	27	225,5				No	Yes	Møller&Madsen 2007	Note that note description or photograph exist; ruin measurements from DGPS survey only. Ruin is only partially preserved and R_Width cannot be estimated.
E165_05	E165		1,04		0,00										No	27	229,6				No	Yes	Møller&Madsen 2007	Note that note description or photograph exist; ruin measurements from DGPS survey only. Ruin is only partially preserved and R_length cannot be estimated.
E166_01	E166	45,8	22,9	706,82	2,00	2									No	1					No	Yes	NMA:Krogh 1981, Møller&Madsen 2007;25	Krogh 1981 ruin C
E166_02	E166	7,57	7,33	54,67	1,03	3									No	14	7,9				No	Yes	Møller&Madsen 2007;25	
E166_03	E166	10,53	5,41	45,54	1,95	4	0,9	2	21,97	1,48					No	18	98,2		SW	1	No	Yes	NMA:Krogh 1981, Møller&Madsen 2007;25	Krogh 1981 ruin A
E166_04	E166	9	5,31	46,96	1,69	2	0,8	2	10,06	9,7					Yes	5	42,8				No	Yes	Møller&Madsen 2007;25	
E166_05	E166	10,24	3,41	31,46	3,00	3	0,45	4	5,35	4,61	4,35	2,66			No	8	201,7		W	1	No	Yes	NMA:Krogh 1981, Møller&Madsen 2007;25	Krogh 1981 ruin D
E166_06	E166	5,29				5	0,5	1							No	14	94,8				No	Yes	Møller&Madsen 2007;25	Ruin is partially eroded by lake and R_Width, R_Area, and Ar_Comp1 cannot be measured
E166_07	E166	2,24	2,22	4,06	1,01	5	0,4	1	2						No	27	248,7				No	Yes	Møller&Madsen 2007;25	Ruin is partially eroded by lake and measurements are only somewhat accurate
E166_08	E166	6	5	35	1,20										Yes	14	97				No	No	NMA:Krogh 1981	Krogh 1981 ruin B; ruin observations from summary description and sketch survey plan only
E167_01	E167	41,25	15,08	436,01	2,74	2									No	1					No	Yes	NMA:Vebæk 1949;13, Vebæk 1993;46pp, Møller&Madsen 2007;26	Note that ruin 2 is here considered part of ruin 1, despite that they where separated during excavation (Vebæk 1993;46)
E167_03	E167	17,73	3,74	67,4	4,74	3	0,6	3	18,29	9,7	7,46				No	6	30,7				No	Yes	NMA:Vebæk:1948;8, 1950;21, Vebæk 1993;58, Møller&Madsen 2007;26	
E167_04	E167	7,79	3,75	28,89	2,08	4	0,8	2	8,74	3,08					No	9	143,3				No	Yes	NMA:Vebæk:1948;8, Vebæk 1993;58, Møller&Madsen 2007;26	
E167_05	E167	4,8	3,34	16,16	1,44	5	0,8	1	5,98						No	9	86				No	Yes	NMA:Vebæk:1948;8, 1950;21, Vebæk 1993;60, Møller&Madsen 2007;26	Note: NMA:Vebæk 1948;8 ruin 6
E167_06	E167	8,94	8,13	46,3	1,10	3	0,7	1	30,11						No	18	70,3	356,5	SE	3	Yes	Yes	NMA:Vebæk: 1948;8, 1950;21, Vebæk 1993;69, Møller&Madsen 2007;69	Note: NMA:Vebæk 1948 ruin 5
E167_07	E167	31,75	18,47	520,8	1,72	2									No	1					No	Yes	Vebæk 1993;60pp, Møller&Madsen 2007;26	
E167_08	E167	6,92	3,55	24,21	1,95	3	0,65	2	7,44	3,26					No	5	5,7				No	Yes	NMA:Vebæk:1948;8, 1950;21, Vebæk 1993;69, Møller&Madsen 2007;69	
E167_09	E167	4,65	4,4	16,14	1,06	2	0,9	1	5,88						No	4	47,9				No	Yes	NMA:Vebæk: 1950;21, Vebæk 1993;69, Møller&Madsen 2007;69	Measurements after Vebæk:1950;21
E167_10	E167	5,12	3	15,79	1,71	5	1	1	5,06						Yes	4	96,9				No	Yes	NMA:Vebæk: 1950;21, Vebæk 1993;69, Møller&Madsen 2007;69	
E167_11	E167	7,88	3,21	22,79	2,45	4	0,75	1	9,41						No	9	177,1				No	Yes	NMA:Vebæk: 1950;21, Vebæk 1993;69, Møller&Madsen 2007;69	
E167_12	E167	7,36	5,6	32,46	1,31	2	1	1	20,15						No	18	192,5	356,5	NW	1	No	Yes	NMA:Vebæk: 1950;21, Vebæk 1993;69, Møller&Madsen 2007;69	
E167_13	E167	5,33	4,54	24,5	1,17	5	0,75	1	12,64						No	14	188				No	Yes	NMA:Vebæk: 1950;21, Vebæk 1993;69, Møller&Madsen 2007;69	
E167_14	E167	10,42	3,54	36,89	2,94	2	0,65	1							No	4	37				No	Yes	NMA:Vebæk 1950;21, Vebæk 1992;69, Møller&Madsen2007;26	
E167_15	E167	4,3	3,39	13,85	1,27	3	0,8	1	4,22						No	14	30,2				No	Yes	NMA:Vebæk 1950;21, Vebæk 1992;69, Møller&Madsen2007;26	
E167_16	E167	55,8	2	101,74	27,90	2	2	1	2230,98						No	21	234,7			1	No	Yes	Madsen 2009;44	Dike cuts off small headland
E168_01	E168	31,35	18,87	484,83	1,66	2									No	1					No	Yes	NMA: Vebæk 1948;7, Møller&Madsen 2006;23	Note: Vebæk 1948 ruin 2
E168_02	E168	11,13	5,05	50,53	2,20	1									No	14	6,8				No	Yes	Møller&Madsen 2006;23	
E168_03	E168	29,1	19,8	436,05	1,47	2									No	3	25				No	Yes	NMA: Vebæk 1948;7, Møller&Madsen 2006;23	Note: Vebæk 1948 ruin 1
E168_04	E168	15,64	7,2	92,24	2,17	1	1,5	2	20,84	12,65					No	5	3,8				No	Yes	Møller&Madsen 2006;23	
E168_05	E168	10,36	6,47	38,85	1,60	3	0,55	2	28,74	2,14					No	18	79		SE	3	No	Yes	Møller&Madsen 2006;23	
E168_06	E168	14,54	4,74	63,61	3,07	2	1,25	2	13,46	5,88					No	5	298,1				No	Yes	Møller&Madsen 2006;23	
E168_07	E168	6,08	4,6	28,04	1,32	4	1,1	1	9,02						No	9	360,7				No	Yes	NMA: Vebæk 1948;7, Møller&Madsen 2006;23	Note: Vebæk 1948 ruin 3
E169_01	E169	23,5	20	339,49	1,18	2									No	1					No	Yes	NMA:Vebæk:1948:8, NMA:Albrethsen 1971, Møller&Madsen 2006;24	
E169_02	E169	24,06	1	28,2	24,06	2	1	2	177,12	7,04					No	21	162	0		1	No	Yes	Møller&Madsen 2006;24	Stretch of dike bounding small headland
E169_03	E169	16,5	1	16,5	16,50	2	1	1	468,7						No	21	141	0		1	No	Yes	Møller&Madsen 2006;24	Note that the stated R_Length only includes the DGPS-surveyed (Møller&Madsen 2006;24) part of the ruin; GoogleEarth© satellite imagery shows an additional stretch of dike partially exploiting a natural difference in elevation. Ar_Comp1 reflects the area inside this supposed stretch of dike joining ruin 2's western part
E169_04	E169	7,95	4,36	31,89	1,82	3	0,85	1	16,29						No	4	177,9				No	Yes	Møller&Madsen 2006;25	
E170_01	E170	6,89	3,72	24,92	1,85	4	0,8	2	5,62	3,9					Yes	9	283,3				No	Yes	Møller&Madsen 2007;26	
E170_02	E170	6,04	3,36	20,24	1,80	4	0,65	2	5,94	2,75					No	9	132,3				No	Yes	Møller&Madsen 2007;26	
E170_03	E170	26,6	13,9	282,14	1,91	2									No	1					No	Yes	Møller&Madsen 2007;26	
E170_04	E170	5,77	5,24	22,01	1,10										No	14	46,5				No	Yes	Møller&Madsen 2007;26	Further description and photograph lacks
E170_05	E170	15,58	9,76	117,6	1,60	2	1,5	3	27,04	5,56					No	3	45,5				No	Yes	Møller&Madsen 2007;26	The ruin comprises at least 3 compartments, but only two could be clearly dinstiguished on the surface
E170_06	E170	14,3	7,48	95,82	1,91	3	1,05	1	58,15						No	15	331,4			3	No	Yes	Møller&Madsen 2007;26	Ruin description lacks
E170a_01	E170	15,3	7,3	109	2,10	2	1,5	2	23,33	17,26					No	14	481,9				No	Yes	Berglund 2001;2, Kapel et al. 2004;13, Møller&Madsen 2007;26	Note ruin has been reinterpreted from Kapel et al. 2004. Dis_MD is distance measured to ruin 3 of ruin group E170 to which ruin group E170a could likely belong
E171_01	E171	12,84	10,15	108,92	1,27	2	1,5	6	1,1	7,9	6,04	4,95	4,7	2,28	No	3	155,9				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;26	
E171_02	E171	29,1	11,1	265,71	2,62	1									No	2	119,1				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;26	
E171_03	E171	10,74	8,7	88,99	1,23	1	1,5	3	12,48	9,02	6,69				No	6	44,9				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;26	
E171_03a	E171	5,61	4,48	19,62	1,25	1	0,8	1	12,57						No	17	49,7	55,3	NE	1	No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;26	
E171_04	E171	22,32	6,48	108,54	3,44	3	0,75	1	87						No	18	96,1	55,3	S	3	No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;26	

Ruin Data																										
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E171_05	E171	13,98	13,25	117,66	1,06	2	1,16	3	23,1	7,91	4,54				No	14	17,9				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;27	Note: Møller&Madsen 2006 ruin 7 & 8, here interpreted as one ruin, see report description
E171_06	E171	21,6	15,5	243,78	1,39	2									No	1					No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;27	Note: Møller&Madsen 2006 ruin 9
E171_07	E171	14	6,58	69,11	2,13	2									No	2	54				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;27	Note that ruin dimensions from are from DGPS-survey, photograph, and Vebæk survey description
E171_08	E171	26,02	11	203,2	2,37	1	1,5	4	33,71	22,94	16,78	4,38			No	3	7,9				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;27	Note: Møller&Madsen 2006 ruin 10
E171_09	E171	25,46	17,82	350,8	1,43	2									No	1	0				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;27	
E171_10	E171	7,46	4,37	31,81	1,71	2	0,8	1	16,85						No	4	30,1				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;27, Madsen et al. 2012;??	Note: Møller&Madsen 2006 ruin 6
E171_11	E171	6,59	4,14	26,08	1,59	2	0,7	1	13,31						No	4	38,7				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;27, Madsen et al. 2012;??	Note: Møller&Madsen 2006 ruin 5
E171_12	E171	7,69	6,91	44,53	1,11	2									Yes	14	51,9				No	Yes	Møller&Madsen 2007;27	
E171_13	E171	11,21	5,35	51,75	2,10	2	1,2	2	10,07	7,92					Yes	5	67				No	Yes	Møller&Madsen 2007;27	
E171_14	E171	12,87	0,9	11,66	14,30	2	0,9	1	109,93						No	21	174,3	225,1	NW	1	No	Yes	Møller&Madsen 2007;28	Note: Møller&Madsen 2006 ruin 15
E171_15	E171	4,04	3,58	13,36	1,13	2	0,9	1	4,17						No	19	169,9	0,8		1	No	Yes	Møller&Madsen 2007;28	Note: Møller&Madsen 2006 ruin 16
E172_01	E172	16,6	5,5	91	3,02	2									No	2	72,9				No	Yes	NMA:Vebæk 1948, NMA:Albrethsen 1971, Madsen 2009;47	Madsen 2009 ruin 20
E172_03	E172	9,7	9,6	73,76	1,01	5	0,7	1	49,24						No	15	9	166,9		2	No	Yes	NMA:Vebæk 1948, NMA:Albrethsen 1971, Madsen 2009;47	Madsen 2009 ruin 11
E172_04	E172	38,8	17,1	535,19	2,27	2									No	1					No	Yes	NMA:Vebæk 1948, NMA:Albrethsen 1971, Møller&Madsen 2005;26	Møller&Madsen 2005 ruin 10
E172_06	E172	25,4	11,4	246,71	2,23	2									No	3	12,1				No	Yes	NMA:Vebæk 1948, NMA:Albrethsen 1971, Møller&Madsen 2005;25	Møller&Madsen 2005 ruin 08
E172_07	E172	9,1	5,85	38,32	1,56	2	1,25	1	26,17						No	14	112,3				No	Yes	NMA:Vebæk 1948, NMA:Albrethsen 1971, Møller&Madsen 2005;26	Møller&Madsen 2005 ruin 12
E172_08	E172	20,4	7,1	123,69	2,87	2	1,4	3	13,57	29,64	11,9				No	6	123,4				No	Yes	NMA:Vebæk 1948, NMA:Albrethsen 1971, Møller&Madsen 2005;26	
E172_09	E172	13,37	3,37	32,61	3,97	3	0,75	1	17,3						No	18	142,2		S	1	No	Yes	NMA:Vebæk 1948, Albrethsen 1971,	
E172_10	E172	21,53	6,87	133,9	3,13	2	1,2	2	34,55	13,82					Yes	5	139,5				No	Yes	NMA: Vebæk 1948, NMA:Albrethsen 1971, Møller&Madsen 2005;25	Møller&Madsen 2005 ruin 05
E172_11	E172	6,77	4,56	25,61	1,48	3	1	1	12,63						No	4	162,6				No	Yes	NMA: Vebæk 1948, NMA:Albrethsen 1971, Møller&Madsen 2005;25	Møller&Madsen 2005 ruin 06
E172_12	E172	29,46	7,16	198,8	4,11	2	1,4	4	31,72	20,53	17,21	6,18			Yes	6	120,6				No	Yes	NMA: Vebæk 1948, NMA:Albrethsen 1971, Møller&Madsen 2005;25	Møller&Madsen 2005 ruin 04
E172_13	E172	15,8	6,91	102,2	2,29	2	1,08								No	14	115				No	Yes	NMA: Vebæk 1948, NMA:Albrethsen 1971, Møller&Madsen 2005;25	Møller&Madsen 2005 ruin 03
E172_14	E172	9,46	4,18	39,2	2,26	2									Yes	4	112,6				No	Yes	NMA: Vebæk 1948, NMA:Albrethsen 1971, Møller&Madsen 2005;25	Møller&Madsen 2005 ruin 01
E172_15	E172	7,13	3,98	26,03	1,79	5	0,9	1	14,32						No	4	142,8				No	Yes	NMA: Vebæk 1948, Madsen 2009;47,	Madsen 2009 ruin 21
E172_16	E172	11,21	4,75	51,54	2,36	2									No	4	112,7				No	Yes	NMA: Vebæk 1948, NMA:Albrethsen 1971, Møller&Madsen 2005;25	
E172_17	E172	9,12	7,42	54,57	1,23	2	0,55	1	48,77						No	18	255,9	252,8	N	2	No	Yes	Møller&Madsen 2006;26	
E172_18	E172	46,59	0,75	11,88	62,12	3	0,75	1	585,5						No	21	469,9	338,6		3	No	Yes	Møller&Madsen 2006;26	
E172_19	E172	6,45	0,67	4,32	9,63	2	0,6	1	25,38						No	17	122,1	14,6	S	1	No	Yes	Møller&Madsen 2006;26	
E172_20	E172	5,12	2,46	11,41	2,08	5	0,35	1	7,39						No	9	189,2				No	Yes	Madsen 2009;47	Madsen 2009 ruin 22
E172_21	E172	4,15	3,48	10,38	1,19	3									No	14	136,3				No	Yes	Møller&Madsen 2006;25	Møller&Madsen 2005 ruin 07
E172_22	E172	8,09	6,09	34,74	1,33	3	0,68	1	31,02						No	18	229,2	162,9	S	3	Yes	Yes	Møller&Madsen 2006;26	Møller&Madsen 2005 ruin 15
E172_23	E172	5,12	0,4	1,35	12,80	2	0,4								No	25	117,1				No	Yes	Møller&Madsen 2006;26	Short strech of dike
E173_01	E173	17,1	12,6	190,37	1,36	2									No	1					No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;29	
E173_02	E173	10,16	6,58	58,33	1,54	2									No	14	6,1				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;29	
E173_03	E173	14,41	6,39	65,05	2,26	2									No	14	17,4				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;29	
E173_04	E173	12,34	5,23	74,04	2,36	3	1,2	3	12,5	12,3	5,1				No	6	52,2				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;29	
E173_05	E173	4,66	4,01	17,33	1,16	5	0,9	1	7,43						No	14	33,4				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;29	Møller&Madsen 2007 ruin 6
E173_06	E173	4,88	4	19,37	1,22	5	0,6	1	9,96						No	4	27,9				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;29	Møller&Madsen 2007 ruin 5
E173_07	E173	4,16	2,7	11,19	1,54	3	0,45	2	2,04	2,02					No	5	139,2				No	Yes	Møller&Madsen 2007;29	
E173_08	E173	4,98	3,25	15,91	1,53	2	0,8	1	5,83						No	4	165,1				No	Yes	Møller&Madsen 2007;29	
E173_09	E173	6,45	6,29	33,81	1,03	3	0,85	1	20,35						No	18	64,3		W	1	No	Yes	Møller&Madsen 2007;29	
E173_10	E173	12,35	3,15	32,23	3,92	6	0,5	1	31,38						No	18	55,5			3	No	Yes	Møller&Madsen 2007;30	
E173_11	E173	0,77	0,68	0,4	1,13	4	0,15								No	27	53,7				No	Yes	Møller&Madsen 2007;30	Ruin should more likely be interpreted as later Inuit feature
E173_12	E173	5,57	4,43	22,8	1,26	4	0,6	1	12,94						No	9	248,4				No	Yes	Møller&Madsen 2007;30	
E174_01	E174	7,58	4,5	31,99	1,68	4	0,5	1	23,03						No	9	171,6				No	Yes	NMA:Krogh&Albrethsen 1980;38, Møller&Madsen 2007;29	
E174_02	E174	9,22	6,9	55,3	1,34	2	1,45	2	9,21	7,26					No	5	84,4				No	Yes	NMA:Vebæk 1948;8, NMA:Krogh&Albrethsen 1980;38, Møller&Madsen 2007;29	Vebæk 1948 ruin 3
E174_03	E174	9,37	10,52	75,56	0,89	2	1,5								No	14	9,9				No	Yes	NMA:Vebæk 1948;8, NMA:Krogh&Albrethsen 1980;38, Møller&Madsen 2007;29	Vebæk 1948 ruin 2, Wall are not well enough preserved to establish Ar_Comp
E174_04	E174	31,17	24,47	632,47	1,27	2									No	1					No	Yes	NMA:Vebæk 1948;8, NMA:Krogh&Albrethsen 1980;38, Møller&Madsen 2007;29	Vebæk 1948 ruin 1
E174_05	E174	10,5	5,14	45,89	2,04	3	1	1	21,05						No	4	146,3				No	Yes	NMA:Krogh&Albrethsen 1980;38, Møller&Madsen 2007;29	
E174_06	E174	7,71	5,9	38,28	1,31	2	1	1	17,59						Yes	4	144,3				No	Yes	NMA:Vebæk 1948;8, NMA:Krogh&Albrethsen 1980;38, Møller&Madsen 2007;29	
E174_07	E174	7,73	5,68	38,01	1,36	4	1	1	23,12						No	18	208,8		SW	4	No	Yes	NMA:Krogh&Albrethsen 1980;38, Møller&Madsen 2007;29	
E174_08	E174	29,19	1	28,08	29,19	5	1	1	1502,9						No	21	86,2			1	No	Yes	Krogh&Albrethsen 1980;38,	Ar_Comp1 = area of bounded peninsula

Ruin Data																								
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
																							Møller&MaNMA:Krogh&Albrethsen 1980;38, Møller&Madsen 2007;29	
E174_09	E174					4				2612,76					No	23	583,7				No	No	NMA:Vebæk 1948;8, NMA:Krogh&Albrethsen 1980;38	Note DIS_MD is only rougly accurate. Ruin dimenstions are lacking. Ar_Comp2 = area of islet
E174_10	E174	7,66	4,19	29,3	1,83	2	0,8								No	4	40				No	Yes	Møller&Madsen 2007;30	Wall are not well enough preserved to establish Ar_Comp
E174_11	E174	10,8	5,75	55,86	1,88	2	1,35	2	11,04	6,31					No	5	58,7				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;30	Vebæk 1948 ruin 4
E174_12	E174	8	4	24	2,00										No	4	75				No	No	NMA:Vebæk 1948;8	Vebæk 1948 ruin 5. Ruin dimensions and location from rough survey sketch and description only
E174_13	E174	13,7						1	18783						No	23	490				No	No	NMA:Vebæk 1948;8	Ruin dimensions and location from rough survey sketch and description only
E175_01	E175	14,8	6,75	87,61	2,19	1	1,4	3	14,24	11,77	6,07				No	1					No	Yes	Møller&Madsen 2006;27	
E178_01	E178	46,63	32,93	1109,55	1,42	4	1,2	2	1008,19	17,62					No	22	151,5		SW	1	No	Yes	NMA:Vebæk 1948, NMA:Bak 1968;N178-2, NMA: Albrethsen 1971, Madsen 2009;52	Bak 1968 ruin 8
E178_01a	E178	5,92	3,33	19,52	1,78	4									No	9	161,6				No	Yes	NMA:Vebæk 1948, NMA: Albrethsen 1971, Madsen 2009;52	Building is too collapsed to estimate Wall_Th
E178_02	E178	7,35	3,69	26,93	1,99	5	0,8	1	11,12						No	4	59				No	Yes	NMA:Vebæk 1948, NMA:Bak 1968;178-1, NMA: Albrethsen 1971, Madsen 2009;52	Bak 1968 ruin 6
E178_03	E178	8,5	3,96	33,32	2,15	4	1,1	1	12,53						No	9	46				No	Yes	NMA:Vebæk 1948, NMA:Bak 1968;178-1, NMA: Albrethsen 1971, Madsen 2009;52	Bak 1968 ruin 5
E178_03a	E178	5,78	3,79	21,91	1,53	5	0,3	1	14,97						No	17	49,5	26,3	SW	3	No	Yes	NMA:Vebæk 1948, NMA: Albrethsen 1971, Madsen 2009;52	Note that the dike is only partially preserved and measurements only roughly accurate
E178_04	E178	7,84	4,56	34,41	1,72	5	0,8	1	17,33						No	4	48,6				No	Yes	NMA:Vebæk 1948, NMA: Albrethsen 1971, Madsen 2009;53	
E178_04a	E178	7,68	3,65	23,14	2,10	5	0,35	1	18,55						No	17	48,8	26,3	SW	3	No	Yes	NMA:Vebæk 1948, NMA: Albrethsen 1971, Madsen 2009;53	
E178_05	E178	46,98	22,95	737,25	2,05	2									No	1					No	Yes	NMA:Vebæk 1948, NMA:Bak 1968;178-1, NMA: Albrethsen 1971, Madsen 2009;53	Bak 1968 ruin 4, Ruin 01 undoubtedly consists of several buildings, including also the byre; however, the ruin is so collapsed as to make any further partition impossible
E178_06	E178	14,93	5,71	78,01	2,61	5	1,35	2	20,51	10,36					No	5	9,6				No	Yes	NMA:Vebæk 1948, NMA: Albrethsen 1971, Madsen 2009;53	Note that ruin dimension are very approximate, because of the ruins poor state of preservation
E178_08	E178	7,3	3,53	22,94	2,07	2									No	4	181,3				No	Yes	NMA:Vebæk 1948, NMA: Albrethsen 1971, Madsen 2009;54	
E178_09	E178	7,82	3,33	21,94	2,35	2									No	4	130,6				No	Yes	NMA:Vebæk 1948, NMA: Albrethsen 1971, Madsen 2009;54	Feature could be Inuit
E178_10	E178	58,9				5									No	24	226,8				No	Yes	NMA Vebæk 1948, NMA: Albrethsen 1971, Madsen 2009;54	Ruin dimensions and placement from rough survey sketch and description only. For enclosed area see ruin 11
E178_11	E178	198	0,5		396,00	5	0,5	1	59740						No	24					No	Yes	NMA Vebæk 1948, NMA:Bak 1968;N178-2, NMA: Albrethsen 1971, Madsen 2009;54	Bak 1968 ruin 7, Note that Ar_Comp1, i.e. bounded homefield area, is only roughly accurate, because the dike is not wholly preserved
E178_12	E178	3,37	2,67	8,1	1,26	5									No	14	49,3				No	Yes	NMA: Albrethsen 1971, Madsen 2009;54	
E178_13	E178	7,43	4,47	31,94	1,66	3	0,8	1	15,19						No	4	62,6				No	Yes	NMA:Vebæk 1948, NMA:Bak 1968;N178-1, NMA: Albrethsen 1971, Madsen 2009;54	Bak 1968 ruin 3, Ruin is likely Vebæk's (NMA: Vebæk 1948) ruin 7
E178_14	E178	9,01	5,26	37,3	1,71	5	0,35	2	10,1	9,27					No	15	83,5	31		3	No	Yes	NMA: Albrethsen 1971, Madsen 2009;55	Madsen 2009 ruin 15
E178_15	E178	6,04	2,93	18,07	2,06	2									No	4	92,3				No	Yes	NMA: Albrethsen 1971, Madsen 2009;55	Madsen 2009 ruin 14
E178_16	E178	3,43	3,52	11,82	0,97	2									No	14	115,5				No	Yes	NMA: Albrethsen 1971, Madsen 2009;55	
E178_17	E178	5,18	2,77	10,09	1,87	5	0,5	1	4,27						No	18	122,2	31		3	No	Yes	NMA: Albrethsen 1971, Madsen 2009;55	Madsen 2009 ruin 16
E179_01	E179	26,05	13,85	336,76	1,88	2									No	1					No	Yes	Madsen 2009;56	Note that the ruin likely consists of more than one building
E179_02	E179	3,26	2,39	6,06	1,36	2									No	14	10,2				No	Yes	Madsen 2009;57	
E179_03	E179	4,17	2,37	9,83	1,76	5	0,4	1	5,8						No	14	71,8				No	Yes	Madsen 2009;57	
E18_01	E18	10,86	6,51	67,19	1,67	4	1	2	18,37	12,61					No	9	241,5				No	Yes	Clemmensen&Kapel 2008;21	
E18_02	E18	21,89	8,65	177,43	2,53	2	1,55	3	38,64	26,19	26,06				No	2	203,4				No	Yes	Clemmensen&Kapel 2008;21	
E18_03	E18	5,66	3,94	21,34	1,44	4	0,75	1	9,63						No	9	127				No	Yes	Clemmensen&Kapel 2008;21	
E18_04	E18	28,25	7,01	187,72	4,03	2	1,8	4	26,88	23,39	21,95	9,62			Yes	2	15,1				No	Yes	Clemmensen&Kapel 2008;22	
E18_05	E18	44,1	28,2	1097,58	1,56	2									No	1					No	Yes	Clemmensen&Kapel 2008;22	
E18_06	E18	18,21	11,89	190,42	1,53	3									No	12	6,6				No	Yes	Clemmensen&Kapel 2008;23	
E18_06a	E18	32,46	26,65	662,95	1,22	5									No	13	1				No	Yes	Clemmensen&Kapel 2008;23	
E18_07	E18	11,48	5,89	65,33	1,95	3	0,85	1	37,17						No	4	48,7				No	Yes	Clemmensen&Kapel 2008;24	Note that ruin is here interpreted as a stone/turf building based on the photograph in the 2008 report.
E18_08	E18	12,58	5,9	69,42	2,13	2	0,9	2	21,51	13,98					No	5	162,2				No	Yes	Clemmensen&Kapel 2008;24	
E18_09	E18	26,12	5,34	134,81	4,89	2	1,3	4	19,04	16,5	11,76	9,43			Yes	6	165,1				No	Yes	Clemmensen&Kapel 2008;25	
E18_10	E18	11,99	4,49	53,37	2,67	2	0,75	2	15,51	14,2					No	5	132,8				No	Yes	Clemmensen&Kapel 2008;25	
E18_12	E18	9,74	6,15	54,18	1,58	5									No	14	41,8				No	Yes	Clemmensen&Kapel 2008;26	
E18_13	E18	5,4				3	1,05								No	14	89				No	Yes	Clemmensen&Kapel 2008;26	Ruin is eroded and R_length cannot be determined
E18_14	E18	10,79	5,21	52,88	2,07	3	0,8	1	30,14						No	4	160,1				No	Yes	Clemmensen&Kapel 2008;26	Note that ruin is here interpreted as a stone/turf building based on the photograph in the 2008 report.
E18_15	E18	0,85	0,82	0,7	1,04	6									No	27	37,5				No	Yes	Clemmensen&Kapel 2008;26	
E18_16	E18	11,07	4,81	48,97	2,30	2									No	4	93,3				No	Yes	Clemmensen&Kapel 2008;27	
E18_17	E18	46,77				5			101000						No	24	280,6				No	Yes	Clemmensen&Kapel 2008;27	Dyke width not described
E18_18	E18	9,31	3,95	20,91	2,36	5									No	18	69,9		SE	1	No	Yes	Clemmensen&Kapel 2008;27	Wall_Th not described or surveyed
E180_01	E180	8,98	4,93	42,62	1,82	3	1,35	1	13,16						No	4	18,8				No	Yes	NMA:Krogh 1968, NMA:Bak 1969;N180-2, Møller&Madsen 2007;30,	Møller&Madsen 2007a ruin 3
E180_02	E180	24,53	14,04	251,27	1,75	2									Yes	1					No	Yes	NMA:Krogh 1968, NMA:Bak 1969;N180-2, Møller&Madsen 2007;30,	
E180_03	E180	8,61	6,03	42,93	1,43	3	1,5	1	9,99						No	4	31,2				No	Yes	NMA:Krogh 1968, NMA:Bak 1969;N180-2, Møller&Madsen 2007;30,	Møller&Madsen 2007a ruin 1
E180_04	E180	8,57	7,35	52,66	1,17	5	1,1	1	34,54						No	18	156,9		S	1	No	Yes	NMA:Krogh 1968, NMA:Bak 1969;N180-2, Møller&Madsen 2007;30,	Note that ruin dimensions have been corrected using Bak's sketch survey, because of poor GPS signal during the 2006 survey

Ruin Data																								
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E181_01	E181	10,76	4,66	41,85	2,31	2									No	4	143,1				No	Yes	NMA:Bak 1968;N181-1, Gulløv 2000;19, Madsen 2009;59,	
E181_02	E181	7,76	4,07	31,23	1,91	3	0,6	1	17,15						No	4	127,6				No	Yes	NMA:Bak 1968;N181-1, Gulløv 2000;19, Madsen 2009;60,	
E181_03	E181	8,95	3,59	31,01	2,49	3	0,75	1	14,43						No	4	92				No	Yes	NMA:Bak 1968;N181-2, Madsen 2009;60,	Note that Wall_Th and ruins dimensions are uncertain, because of reuse of stones by later Thule-culture grave.
E181_08	E181	31,3	26,21	532,72	1,19	2									No	1					No	Yes	NMA:Vebæk 1950;16, NMA:Bak 1968;N181-3, Gulløv 2000;19, Madsen 2009;60,	
E181_09	E181	8,77	7,29	50,43	1,20	2									No	14	13,2				No	Yes	NMA:Bak 1968;N181-3, Gulløv 2000;19, Madsen 2009;61,	
E181_10	E181	9,14	5,4	46,56	1,69	3	0,8	1	23,47						No	4	46,2				No	Yes	NMA:Bak 1968;N181-3, Gulløv 2000;19, Madsen 2009;61,	Note that Wall_Th and ruins dimensions are somewhat uncertain, because of reuse of stones by later Thule-culture grave.
E181_11	E181	4,47	3,7	27,97	1,21	5	0,8	1	12,08						No	9	114				No	Yes	NMA:Bak 1968;N181-3, Madsen 2009;61,	Note that ruin dimensions are only rouchly accurate, because of poor ruin preservation.
E181_14	E181	10,8	5,68	49,17	1,90	3									No	18	62,8		E	1	No	Yes	Madsen 2009;62	Note that ruin is here interpreted as enclosure, because the Thule-culture Inuit not costumarily build winter houses against cliff surfaces
E182_01	E182	6,66	3,89	24,6	1,71	2	1,05	1	7,69						No	4	225,4				No	Yes	Krogh&Berglund 1980;172, Møller&Madsen 2007;30	
E182_02	E182	5,71	5,59	28,31	1,02	2	1,25	2	4,24	3,66					No	14	218,4				No	Yes	Krogh&Berglund 1980;172, Møller&Madsen 2007;30	Note: Møller&Madsen 2007 ruin 10. Structure can Inuit winterhouse
E182_03	E182	26,57	18,09	304,3	1,47	3	1	3	213,31	18,88	12,04				No	18	137	8,8	SE	3	Yes	Yes	Krogh&Berglund 1980;172, Møller&Madsen 2007;31	
E182_04	E182	4,87	3,73	17,64	1,31	4	0,8	1	6,07						No	9	50,4				No	Yes	Krogh&Berglund 1980;172, Møller&Madsen 2007;31	Note: Møller&Madsen 2007 ruin 5
E182_04a	E182	6,71	5,6	25,93	1,20	5	0,8	1	16,17						No	17	50,4	75,1	NE	3	No	Yes	Møller&Madsen 2007;31	Note: Møller&Madsen 2007 ruin 5. Possible addition to ruin 04.
E182_05	E182	23,25	19,15	357,46	1,21	2									No	1					No	Yes	Krogh&Berglund 1980;173, Møller&Madsen 2007;31	Note: Møller&Madsen 2007 ruin 6
E182_06	E182	10	7	70	1,43	3									No	14	30,7				No	No	Krogh&Berglund 1980;173	Structure has since been removed and given dimensions are only estimate
E182_07	E182	18,84		142,75		2									No	3	98,5				No	Yes	Krogh&Berglund 1980;173, Møller&Madsen 2007;31, Heide&Madsen 2010;19	Ruin is partly eroded and R_Width is unknown
E182_08	E182	21,34	15,97	261,63	1,34	2									No	3	130,2				No	Yes	Krogh&Berglund 1980;173, Møller&Madsen 2007;31, Heide&Madsen 2010;19	
E182_09	E182	9,18	6,38	51,77	1,44	3									No	14	123,8				No	Yes	Krogh&Berglund 1980;173, Møller&Madsen 2007;31, Heide&Madsen 2010;19	
E182_11	E182	10	7	70	1,43	3									No	14	201,6				No	No	Krogh&Berglund 1980;174	Ruin dimensiones from description and rough survey plan only
E182_12	E182														No	14					No	Yes	NMA:Krogh 1987;81	Ruins mentioned, but no survey plan or accurate description provided
E182_13	E182							2							No	14					No	Yes	NMA:Krogh 1987;81	Ruins mentioned, but no survey plan or accurate description provided
E182_14	E182	24,08	7,61	129,47	3,16	3	1,25	4	58,06	9,2	7,86	2,66			No	18	97,7	8,8	SE	3	No	Yes	Krogh&Berglund 1980;172, Møller&Madsen 2007;31	Note: Krogh&Berglund 1980 ruin 3, Møller&Madsen ruin 4. Ruin here treated seperately
E182_15	E182	19,13	7,05	124,76	2,71	2									No	14	284,7				No	Yes	Møller&Madsen 2007;30	Note: Møller&Madsen 2007 ruin 2
E182_16	E182	7,68	3,57	26,45	2,15	2	0,6	2	8,36	4,27					No	5	82				No	Yes	Heide&Møller 2010;18	
E182_17	E182	10,15	7,83	76,1	1,30										No	28	375,6				No	No		Ruin identified and described from GoogleEarth satellite imagery, but not surveyed
E183_01	E183	27,5	17	467,5	1,62	2									No	1					No	No	NMA:Vebæk 1950;16	Ruin measurements based on rough survey description only
E183_02	E183	12,5	5	62,5	2,50	2									No	5					No	No	NMA:Vebæk 1950;16	Ruin measurements based on rough survey description only
E183_03	E183	27,5	17	467,5	1,62										No	14					No	No	NMA:Vebæk 1950;16	Ruin measurements based on rough survey description only
E183_04	E183	12,5	5	62,5	2,50										No	28					No	No	NMA:Vebæk 1950;16	Ruin measurements based on rough survey description only
E183_05	E183														No	28					No	No	NMA:Vebæk 1950;16	Ruin measurements based on rough survey description only
E184_01	E184	19	12	228	1,58	2									No	3					No	No	NMA:Vebæk;1950, NMA:Albrethsen 1971	Note that ruin was not relocated in 2007 and ruin description is based on sketch survey descritption only
E184_02	E184	42,4	34,9	946,06	1,21	2									No	1					No	No	NMA:Vebæk 1950, NMA:Albrethsen 1971, Møller&Madsen 2007;14	Møller&Madsen 2007 ruin 5
E184_03	E184	20,5	12,1	191,74	1,69	2									No	3	9,5				No	Yes	NMA:Vebæk 1950, NMA:Albrethsen 1971, Møller&Madsen 2007;14	Møller&Madsen 2007 ruin 4
E184_04	E184	5,29	2,9	14,26	1,82	4	0,95	1	5,39						No	15	55,3	16,4		3	No	Yes	NMA:Vebæk 1950, NMA:Albrethsen 1971, Møller&Madsen 2007;14	Møller&Madsen 2007 ruin 7
E184_05	E184	16,74	9,2	122,26	1,82	3	0,9	2	89,02	0,98					No	15	73,4	79,3		3	No	Yes	NMA:Vebæk 1950, NMA:Albrethsen 1971, Møller&Madsen 2007;15	Møller&Madsen 2007 ruin 9
E184_06	E184	4,5	3,12	13,25	1,44	3									No	4	73,8				No	Yes	Møller&Madsen 2007;14	
E184_07	E184	4,3	3,1	12,64	1,39	2	0,5	1	7,02						No	4	179				No	Yes	Møller&Madsen 2007;14	Møller&Madsen 2007 ruin 3
E184_08	E184	3,25	3,06	7,71	1,06	3	0,53	1	4,25						No	19	60,3	1		3	No	Yes	Møller&Madsen 2007;14	
E184_09	E184	3,4	2,7	7,23	1,26	2	0,5	2	2,8	0,67					No	14	185,6				No	Yes	Møller&Madsen 2007;14	Møller&Madsen 2007 ruin 2
E184_10	E184	7,23	3,15	22,16	2,30	2	0,85	1	8,81						No	4	54,8				No	Yes	Møller&Madsen 2007;15	
E184_11	E184	2,42	1,78	3,64	1,36	2									Yes	14	39				No	Yes	Møller&Madsen 2007;15	
E184_12	E184	17,07	11,63	132,11	1,47	2									No	14	92,5				No	Yes	Møller&Madsen 2007;15	
E184_13	E184	5,26	3,57	18,07	1,47	5	0,5	1	11,3						No	9	189,1				No	Yes	Møller&Madsen 2007	
E184_14	E184	60	1,05	51,87	57,14	2	1,05	3	820,6	320,87	3,41				No	21	290,6	350,4	N	1	No	Yes	Madsen et al. 2013;	
E188_01	E188	19,9	11,9	201,17	1,67	2									No	1					No	Yes	Heide&Madsen 2010;29	
E188_02	E188	3,16	1,99	5,41	1,59	3	0,3	1	1,96						No	19	11,9	11,8		1	No	Yes	Heide&Madsen 2010;29	
E188_03	E188	1,7	1,37	1,94	1,24	3	0,4	1	1,01						No	19	27,2	7,67	SW	1	No	Yes	Heide&Madsen 2010;29	
E188_04	E188	3,74	2,56	8,09	1,46	2	0,5	1	4,93						No	14	33,9				No	Yes	Heide&Madsen 2010;29	Note that R_Area and Ar_Comp 1 are only rougly accurate, because the ruin is not fully preserved.
E188_05	E188	9,55	4,2	38,52	2,27	4	1	2	11,27	4,33					No	9	27,9				No	Yes	Heide&Madsen 2010;30	
E188_05a	E188	12,97	11,57	78,32	1,12	5	0,95	1	58						No	17	23,4	7,67	W	3	No	Yes	Heide&Madsen 2010;30	
E188_06	E188	24,02	10,78	180,78	2,23	2	1,5								No	3	295,7				No	Yes	Heide&Madsen 2010;30	
E188_07	E188	8,06	4,84	32,45	1,67	2	1,2	2	7,15	4,15					No	5	296,6				No	Yes	Heide&Madsen 2010;31	
E188_08	E188	7,78	5,63	34,07	1,38	3	0,8	1	24,78						No	18	314,6	357,6	NW	3	No	Yes	Heide&Madsen 2010;31	
E188_09	E188	3,51	3,39	9,79	1,04	6		1	7,82						No	20	333,6	38,7			No	Yes	Heide&Madsen 2010;31	
E188_10	E188	4,2	3,32	12,63	1,27	3									No	14	59,3				No	Yes	Heide&Madsen 2010;32	
E190_01	E190	26,48	16,24	303,3	1,63	2									No	1					No	Yes	NMA:Vebæk 1950, NMA:Albrethsen 1971, Madsen 2009;66	

Ruin Data																								
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E190_02	E190	18,25	11,46	180,43	1,59	2									No	3	27,9				No	Yes	NMA:Vebæk 1950, NMA:Albrethsen 1971, Madsen 2009;66	
E190_03	E190	25,18	10,63	223,76	2,37	2									No	2	65,9				No	Yes	NMA:Vebæk 1950, NMA:Albrethsen 1971, Madsen 2009;66	
E190_04	E190	18,04	10,04	149,26	1,80	3	0,8	1	112,61						No	18	115,4	34,8	E	1	No	Yes	NMA:Vebæk 1950, NMA:Albrethsen 1971, Madsen 2009;66	Enclosure could have a small internal compartment, but this part of the ruins has been disturbed by recent activities
E190_05	E190	8,11	5,86	40,36	1,38	3	0,55	1	30,64						No	18	135,8	34,8	E	1	No	Yes	NMA:Vebæk 1950, NMA:Albrethsen 1971, Madsen 2009;67	
E190_06	E190	8,87	4,23	34,74	2,10	2	1,25	1	15,88						No	4	42,9				No	Yes	NMA:Albrethsen 1971, Madsen 2009;67	
E190_07	E190	3,96	3,2	11,78	1,24	5									No	14	21,1				No	Yes	Madsen 2009;67	Wall_Th and Ar_Comp1 cannot be estimated, because the ruin is too poorly preserved
E190_08	E190	16,32	13,78	174,35	1,18	2									No	3	40,5				No	Yes	Madsen 2009;67	
E190_09	E190	7,23	6,14	40,85	1,18	2									No	14	130,5				No	Yes	Madsen 2009;67	
E190_10	E190	8,02	7,29	46,89	1,10	4	0,8	2	24,95	1,61					No	18	188,7	177,4	E	3	No	Yes	Madsen 2009;67	
E195_01	E195	21,6	5,8	122,23	3,72	2									No	1					No	Yes	Field report under preparation	
E195_02	E195	7,84	6,04	40,86	1,30	2	1,25	2	8,33	4,82					No	5	20,2				No	Yes	Field report under preparation	
E195_03	E195	3,83	2,75	10,33	1,39	5	0,5	1	4,87						No	9	51				No	Yes	Field report under preparation	
E195_04	E195	7,58	9,54	52,83	0,79	5	1	1	37,61						No	18	83,5	58,6	S	3	No	Yes	Field report under preparation	Note that measurements are only roughly accurate because the walls are not wholly preserved
E195_05	E195	7,68	3,54	24,06	2,17	3	1,1	1	15,74						No	18	54,2	58,6	SW	3	No	Yes	Field report under preparation	
E195_06	E195	6,26	4,38	13,14	1,43	4	0,8	2	2,67	2,46					No	20	190,7	1,3	SE	3	No	Yes	Field report under preparation	
E195_07	E195	4,4	2,41	8,89	1,83	4	0,75	1	4,45						No	20	189,4	1,3	S	2	No	Yes	Field report under preparation	
E196_01	E196	30	11,1	275,62	2,70	2									No	2	34				No	Yes	Møller&Madsen 2006;27	D_MD is only approximate as the main dwelling was not DGPS surveyed.
E196_02	E196	15,5	11,8	136,78	1,31	2	1,8	2	50,82	14,92					No	14	33,8				No	Yes	Møller&Madsen 2006;27	D_MD is only approximate as the main dwelling was not DGPS surveyed.
E196_03	E196	8,74	5,49	42,49	1,59	2	1,5	1	13,57						No	14	38,1				No	Yes	Møller&Madsen 2006;27	D_MD is only approximate as the main dwelling was not DGPS surveyed.
E196_04	E196	21,7	18,2	284,52	1,19	5	1,1	1	232,07						No	22	67,9			1	No	Yes	Møller&Madsen 2006;27	D_MD is only approximate as the main dwelling was not DGPS surveyed.
E196_05	E196	12,14	4,7	63,3	2,58	2									No	4	13,9				No	Yes	Møller&Madsen 2006;27	D_MD is only approximate as the main dwelling was not DGPS surveyed.
E196_06	E196	30	25	623,03	1,20	2									No	1					No	No	NMA:Thorvildsen 1964;14	Note that location and dimensions of dwelling is based on description and photographs.
E196_07	E196														No	28					No	No	NMA:Thorvildsen 1964;14	No additional description of ruin
E196_08	E196														No	28					No	No	NMA:Thorvildsen 1964;14	No additional description of ruin
E209_01	E209	20,2	15,3	239,6	1,32	2	1,5								No	1					No	Yes	NMA:Krogh 1968, Møller&Madsen 2006;28	
E209_02	E209	10,1	7,2	66,73	1,40	2	1,2	2	8,04	13,23					Yes	5	8,5				No	Yes	NMA:Krogh 1968, Møller&Madsen 2006;28	
E209_03	E209	9,33	5,2	55,41	1,79	5	1,2	2	9,28	15,12					No	8	41,7				No	Yes	NMA:Krogh 1968, Møller&Madsen 2006;28	
E209_03a	E209	7,66	6,29	41,84	1,22	3	0,8	1	37						No	18	67,4		SE	1	No	Yes	NMA:Krogh 1968, Møller&Madsen 2006;28	
E209_03b	E209	8,83	4,6	25,36	1,92	4	1	1	22,27						No	18	264,4	10,1	SE	1	No	Yes	NMA:Krogh 1968, Møller&Madsen 2006;28	
E209_04	E209	4,74	2,15	10,48	2,20	5	0,8	1	4,36						No	18	16,7	10,1	SE		No	Yes	Møller&Madsen 2006;28	
E209_05	E209	4,6	3,6	16,06	1,28	4	1,1	1	7,33						No	9	88,5				No	Yes	Møller&Madsen 2006;28	
E209_06	E209	5,55	3,05	15,61	1,82	2	1,2								Yes	4	15,4				No	Yes	Møller&Madsen 2006;28	
E209_07	E209	5,37	3,23	15,76	1,66	2	0,6								No	4	16,9				No	Yes	Møller&Madsen 2006;28	
E209_08	E209	5,45	2,1	10,94	2,60	3	0,7	1	8,12						No	18	25,8	27,8	SE	1	No	Yes	Møller&Madsen 2006;28	
E209_09	E209	21,1	17,7	327,34	1,19	5	0,7	1	283,85						No	15	55,5	27,8		2	Yes	Yes	Arneborg et al. 2009;43	
E209_10	E209	10,12	4,15	23,29	2,44	4	0,4	1	23,29						No	20	86,9	16,8	SE	1	No	Yes	Arneborg et al. 2009;43	
E209_11	E209	24,18	17,01	205,74	1,42	4	0,6	1	205,74						No	18	264,4	218,7	S	2	Yes	Yes	Arneborg et al. 2009;43	
E209_12	E209	6	3	18	2,00										No	14					No	No	NMA: Krogh 1968	Note ruin measurements are only approximate
E209_16	E209	16,69	0,8	13,11	20,86	4	0,8								No	25	312,9				No	Yes	Guldager 1999, Madsen 2009	Guldager 1999 R23. Stretch of dike, associated with E209 R17
E209_17	E209	8,16	0,8	6,99	10,20	4	0,8								No	25	329,2				No	Yes	Madsen 2009	Stretch of dike, associated with E209 R16
E209a_13	E209a	15,9	7,14	94,27	2,23	5	0,75	2	58,1	6,91					No	1					No	Yes	Guldager 1999, Bolender 2010;46	Guldager 1999 R20. Note that ruin is likely an early phase dwelling
E209a_14	E209a	4,24	4,02	16,45	1,05	3									No	14	3,9				No	Yes	Guldager 1999, Bolender 2010;46	Guldager 1999 R21. Note that Dis_MD is measured to ruin 13, to which phase the structure is interpreted to belong
E209a_15	E209a	5,98	4,72	25,81	1,27	3									No	14	7,2				No	Yes	Guldager 1999, Bolender 2010;46	Guldager 1999 R22. Note that Dis_MD is measured to ruin 13, to which phase the structure is interpreted to belong
E210_01	E210	4,01	2,82	9,99	1,42	1	0,7	1	5,38						Yes	14					No	Yes	NMA:Krogh 1968	Ruin description based on sketch survey and photograph only
E210_02	E210	6,53	3,31	21,93	1,97	2	0,6	1	14,73						No	18		4,97	E	3	No	Yes	NMA:Krogh 1968, Møller&Madsen 2006;28	Note Møller&Madsen 2006 ruin 1
E210_03	E210	8,88	4,02	34,98	2,21	2									No	4					No	Yes	Møller&Madsen 2006;29	
E210_04	E210	2,74	1,48	3,53	1,85	2	0,5	1	1,73						No	19		4,97	N	3	No	Yes	Møller&Madsen 2006;29	Note Møller&Madsen 2006 ruin 2
E210_05	E210	10,22	4,8	42,62	2,13	2	1,05	1	18,83						No	4					No	Yes		Ruin description based on 2006 DGPS survey and photograph only
E210_06	E210	13,76	6,03	81,84	2,28	5	1,2	2	28,1	8,83					No	5					No	Yes		Ruin description based on 2006 DGPS survey and photograph only
E210_07	E210	5,02	4,31	21,51	1,16	2	0,6	1	11,78						No	14					No	Yes		Ruin description based on 2006 DGPS survey and photograph only
E237_01	E237														No	28					No	No	Krogh&Berglund 1980;49	No information on ruin exists
E262_01	E262	22,45	6,84	141,91	3,28	1	1,2	3	39,91	11,7	8,37				Yes	1					No	Yes	Kapel 1994;22, Madsen et al. 2011	The ruin has an additional, indistinct collapse area in the SE corner, which has been measured as part of the ruin area
E273_01	E273	21,43	11,15	184,52	1,92	2									No	1					No	Yes	Heide&Madsen 2010;39	
E273_02	E273	4,48	3,57	16,06	1,25	4	0,65	1	6,55						No	9	106,2				No	Yes	Heide&Madsen 2010;39	
E273_03	E273	8,73	4,6	30,33	1,90	4	0,5	3	16,68	0,99	0,31				No	18	110,3	40,4	S	3	No	Yes	Heide&Madsen 2010;39	
E273_04	E273	4,76	3,21	15,09	1,48	4	0,7	1							No	9	150,6				No	Yes	Heide&Madsen 2010;40	
E273_05	E273	6,74	4,1	24,34	1,64	4	0,65	1	15,45						No	18	128,5	40,4	S	4	No	Yes	Heide&Madsen 2010;40	
E273_06	E273	7,39	3,95	26,94	1,87	2	1,2	1	8,93						No	4	43,6				No	Yes	Heide&Madsen 2010;40	Note that Ar_Comp1 is only roughly accurate, because of ruin might have been seperated in two rooms
E273_07	E273	3,9	2,56	10,07	1,52	2	0,5	1	6,57						No	14	79,8				No	Yes	Heide&Madsen 2010;40	
E274_01	E274	5,33	3,18	14,2	1,68	4	0,8	1	8,41						No	18			SE	3	No	Yes	Heide&Madsen 2010;44	
E28_102	E28														No	24	97,3				No	No	Guldager et al.2002:Fig.105	No details on dyke are recorded

Ruin Data																								
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E28_46	E28	64	32	2048	2,00	2									No	1					No	No	Bruun 1895:284p, Nørlund & Stenberger 1934:160, Guldager et al. 2002:Fig.105	Ruin is likely a combined dwelling and byre
E28_47	E28	23,33	17,14	325,53	1,36	2									No	1					No	No	Nørlund&Stenberger 1934:Fig.59	Measurements based on referenced excavation plan
E28_48	E48	10	8	80	1,25	4									No	9	39,3				No	No	Nørlund&Stenberger 1934:160, Guldager et al. 2002:Fig.105	Measurements based on rough survey description. Dis_MD is the distance to ruin 47
E28_49	E28	20	5	100	4,00	2		3	23,4	12	9				No	6	181,5				No	No	Nørlund&Stenberger 1934:160, Guldager et al. 2002:Fig.105	Measurements based on rough survey description. Dis_MD is the distance to ruin 47
E28_50	E28	11	5	55	2,20			1	25,5						No	4	175,8				No	No	Nørlund&Stenberger 1934:160, Guldager et al. 2002:Fig.105	Measurements based on rough survey description. Dis_MD is the distance to ruin 47
E28_51	E28					4		1							No	9	396				No	No	Nørlund&Stenberger 1934:160, Guldager et al. 2002:Fig.105	Measurements based on rough survey description. Dis_MD is the distance to ruin 47
E28_52	E28	25	5	125	5,00	3		3							No	8	332,8				No	No	Nørlund&Stenberger 1934:160, Guldager et al. 2002:Fig.105	Measurements based on rough survey description. Dis_MD is the distance to ruin 47
E28_52a	E52	15	5	75	3,00	3		2							No	8	326,6				No	No	Nørlund&Stenberger 1934:160, Guldager et al. 2002:Fig.105	Measurements based on rough survey description. Dis_MD is the distance to ruin 47
E28_53	E28	16	4	64	4,00	3		2	22	10,8					No	8	339,1				No	No	Nørlund&Stenberger 1934:160, Guldager et al. 2002:Fig.105	Measurements based on rough survey description. Dis_MD is the distance to ruin 47
E28_54	E28	22	6	132	3,67			2							No	5	72,2				No	No	Nørlund&Stenberger 1934:160, Guldager et al. 2002:Fig.105	Measurements based on rough survey description. Dis_MD is the distance to ruin 47
E28_55	E28	10	4	40	2,50	4		1	20						No	18	122,5		N	4	No	No	Nørlund&Stenberger 1934:160, Guldager et al. 2002:Fig.105	Measurements based on rough survey description. Dis_MD is the distance to ruin 47
E28_56	E28														No	18	62,8				No	No	Nørlund&Stenberger 1934:160, Guldager et al. 2002:Fig.105	Measurements based on rough survey description. Dis_MD is the distance to ruin 47. Ruin could simply be part of infield dyke
E28_57	E28	13	4	52	3,25			2							No	5	147,5				No	No	Nørlund&Stenberger 1934:161, Guldager et al. 2002:Fig.105	Measurements based on rough survey description. Dis_MD is the distance to ruin 47
E28_58	E28	18	5	90	3,60	3		3	19,5	12,5	7,5				No	6	188,4				No	No	Nørlund&Stenberger 1934:161, Guldager et al. 2002:Fig.105	Measurements based on rough survey description. Dis_MD is the distance to ruin 47
E29_18	E29	23,38	15,15	309,45	1,54	2									No	1					No	No	Nørlund&Stenberger 1934:Fig.42	Measurements based on referenced excavation plan
E29_19	E29	26,53	6,64	194,82	4,00	2	1,65	2	41,72	35,29					No	2	40,5				No	No	Nørlund&Stenberger 1934:89, Fig.56	Measurements based on referenced excavation plan. Note that only the wall proper is included in the measurements, not the outer turf padding
E29_20	E29	9,83	3,2	37,95	3,07	3	0,9	1	12,91						No	4	61,3				No	Yes	Nørlund&Stenberger 1934:89, Fig.56, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29_21	E29					1		1	46,2						No	4	53,3				No	No	Nørlund&Stenberger 1934:159, Guldager et al. 2002:Fig.99	
E29_22	E29	10,84	3,94	42,71	2,75	4	0,8	1	27,97						No	9	119,3				No	No	Holm 1883:Tavle III, Nørlund&Stenberger 1934:159, Guldager et al. 2002:Fig.99	Note ruin measurements based on old survey plan
E29_24	E29	11	3	33	3,67			1	12,5						No	4	128,7				No	No	Nørlund&Stenberger 1934:159, Guldager et al. 2002:Fig.99	Note that ruin has been removed and measurements are based on rough description
E29_25	E29	16,87	6,31	105,1	2,67	2	1,9	2	19,81	16,78					No	2	65,9				No	Yes	Nørlund&Stenberger 1934:159, Fig.56, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29_26	E29	9,02	4,82	44,14	1,87	4	0,85	1	19,11						No	9	155,5				No	Yes	Nørlund&Stenberger 1934:159, Guldager et al. 2002:Fig.99	
E29_27	E29	28,5	17,3	516,1	1,65	4	1,2	1	481,7						No	18	305,4		E	1	No	Yes	Nørlund&Stenberger 1934:102, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29_28	E29	36,9	29,1	859	1,27	2	1,3	1	708,2						No	15	202,3				No	Yes	Nørlund&Stenberger 1934:101p, Guldager et al. 2002:Fig.99	
E293_01	E293	13,83	7,27	88,79	1,90	3	0,8	1	70,07						No	18	26,6		SE	2	Yes	Yes	NMA:Bak 1971;B118-2, Møller&Madsen 2006;29	
E293_02	E293	7,88	6,43	40,18	1,23	3	0,55	2	9,2	4,25					No	20	11,5			1	No	Yes	NMA:Bak 1971;B118-3, Møller&Madsen 2006;29	
E293_03	E293	4,08	3,5	9,55	1,17	3	0,55	1	4,14						No	20	3,9			1	No	Yes	NMA:Bak 1971;B118-3, Møller&Madsen 2006;29	
E293_04	E293	16,04	15,03	173,59	1,07	2									No	1					No	Yes	NMA:Bak 1971;B118-3, Møller&Madsen 2006;29	
E294_01	E294	3,5	2	7	1,75	3		1							Yes	14					No	No	NMA:Bak 1970;B104, Møller&Madsen 2006;29	Ruin measurements from rough survey sketch and description only
E295_01	E295	25,65	1	28,39	25,65	4	1	1	268,83						No	21				2	No	Yes	NMA:Bak 1970;B105-1, Møller&Madsen 2006;29	
E295_02	E295	2				4									No	19				2	No	No	NMA:Bak 1970;B105-2	
E296_01	E296	3,8	2,5	9,3	1,52	5	0,5	1	4,28						No	14					No	Yes	NMA:Bak 1969;B68-2, Møller&Madsen 2006;30	
E296_02	E296	3,02	1,84	5,44	1,64	5	0,45	1	1,88						No	14					No	Yes	NMA:Bak 1969;B68-2, Møller&Madsen 2006;30	Møller&Madsen 2006 ruin 4
E296_03	E296	1,93	1,46	2,66	1,32	3									No	14					No	Yes	NMA:Bak 1969;B68-2, Møller&Madsen 2006;30	
E296_04	E296	2,93	2,41	6,36	1,22	5	0,55	1	2,26						No	14					No	Yes	NMA:Bak 1969;B68-2, Møller&Madsen 2006;30	Møller&Madsen 2006 ruin 2
E296_05	E296	3,87	3,12	11,76	1,24	5	0,5	1	6,14						No	14					No	Yes	NMA:Bak 1969;B68-2, Møller&Madsen 2006;30	
E296_06	E296	4,71	2,73	12,33	1,73	5	0,55	1	5,99						No	14					No	Yes	NMA:Bak 1969;B68-2, Møller&Madsen 2006;30	
E296_08	E296	3,94	3,7	14,62	1,06	5	0,6	1	6,35						No	14					No	Yes	NMA:Bak 1969;B68-2, Møller&Madsen 2006;30	
E296_09	E296	3,77	2,78	10,87	1,36	5	0,6	1	5,22						No	14					No	Yes	NMA:Bak 1969;B68-2, Møller&Madsen 2006;30	
E297_01	E297	7,95	5,22	20,16	1,52	3									Yes	14					No	Yes	NMA:Bak 1969;B67-2, Møller&Madsen 2006;30	
E298_01	E298	20	15,7	250,41	1,27	2									Yes	1					No	Yes	NMA:Bak 1970;B106-2, Møller&Madsen 2006;33	
E298_02	E298	5,32	4,6	12,06	1,16	4		2	6,49	5,56					No	18			SE	4	No	No	NMA:Bak 1970;B106-3	Note that ruins measurements are based on a rough sketch and are only approximate; no wall thickness is given and the area of the compartments is somewhat less than stated
E299_01	E299	5,59	2,12	11,03	2,64	4	0,5	1	6,23						No	9				4	No	Yes	NMA:Bak 1969;B103-1, Møller&Madsen 2006;31	
E29a_01	E29a	15,02	7,45	119,1	2,02	3	1,45	1	57,78						No	12	22,4				No	Yes	Nørlund&Stenberger 1934:29p, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29a_01a	E29a	24,98	24,55	609,4	1,02	3	0,95	1	420,5						No	13	12,6				No	Yes	Nørlund&Stenberger 1934:34p, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29a_02	E29a	51,18	16,89	717,49	3,03	2									No	1					No	No	Nørlund&Stenberger 1934:Fig.26	Measurements based on referenced excavation plan
E29a_03	E29a	13,1	4,55	57,81	2,88	4	1	1	28,03						No	9	4,6				No	Yes	Nørlund&Stenberger 1934:157, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29a_04	E29a	12,5	4,28	54,13	2,92	3	0,8	1	33,93						No	4	11,4				No	Yes	Nørlund&Stenberger 1934:157, Clemmensen&Kapel 2014 (unpubl. Survey-data)	

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E29a_05	E29a	51,1	11,8	424,76	4,33	2	1,7	6	34,07	33,4	29,77	18,68	14,86	13,51	No	3	39,1				No	Yes	Nørlund&Stenberger 1934:83, Fig.49	Measurements based on referenced excavation plan. Note that only the wall proper is included in the measurements, not the outer turf padding
E29a_06	E29a														No	14	28,2				No	No	Nørlund&Stenberger 1934:157, Guldager et al. 2002:Fig.99	
E29a_07	E29a	14,69	7,75	70,75	1,90	2	1,15	2	21,62	17,92					No	5	65,9				No	Yes	Nørlund&Stenberger 1934:159, Guldager et al. 2002:Fig.99, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29a_08	E29a	27,56	18,57	394,4	1,48	3	1,1	1	280,5						No	15	37			2	No	Yes	Nørlund&Stenberger 1934:100p, Guldager et al. 2002:Fig.99, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29a_09	E29a	12	4	48	3,00	4		1	19						No	9	111,5				No	Yes	Nørlund&Stenberger 1934:158, Guldager et al. 2002:Fig.99, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29a_10	E29a	12,19	5,21	63,28	2,34		1,1	1	27,3						No	4	174,9				No	Yes	Nørlund&Stenberger 1934:158, Guldager et al. 2002:Fig.99, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29a_11	E29a	9,52	4,49	43,83	2,12		0,8	1	30,39						No	17	182,9		NW	4	No	Yes	Nørlund&Stenberger 1934:158, Guldager et al. 2002:Fig.99, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29a_12	E29a	19	6,52	118,9	2,91	2	1,7	2							No	2	279,9				No	Yes	Nørlund&Stenberger 1934:158, Guldager et al. 2002:Fig.99, Clemmensen&Kapel 2014 (unpubl. Survey-data)	Note that ruin is partially excavated, which has removed part of the ruin, which cannot be measured in the full
E29a_13	E29a	6	4	24	1,50	4		1							No	9	291,2				No	Yes	Nørlund&Stenberger 1934:158, Guldager et al. 2002:Fig.99, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29a_14	E29a	15,9	6,92	107,5	2,30	2	1,8	2	18,01	15,17					No	2	328,7				No	Yes	Nørlund&Stenberger 1934:158, Guldager et al. 2002:Fig.99, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29a_15	E29a	7,2	3,97	27,92	1,81	4	0,7	1	13,23						No	9	387,9				No	Yes	Nørlund&Stenberger 1934:158, Guldager et al. 2002:Fig.99, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29a_16	E29a	12,22	11,19	124,6	1,09	3	0,8	1	93,59						No	15	302,9		S	1	No	Yes	Nørlund&Stenberger 1934:99p, Guldager et al. 2002:Fig.99, Clemmensen&Kapel 2014 (unpubl. Survey-data)	
E29a_17	E29a	18,2	14,05	219,48	1,30	3	0,8	3	105,57	30,23	11,71				No	18	1000		SE	1	No	No	Nørlund&Stenberger 1934:102p, Fig.68	Measurements based on referenced survey plan. Dis_MD is only approximate
E29a_61	E29a	178,5	1,1	86,35	162,27	2	1,1	1	116800						No	24	84,2				No	Yes	Nørlund&Stenberger 1934:Plate 1, Guldager et al. 2002:Fig.99, Clemmensen&Kapel 2014 (unpubl. Survey-data)	Area_Comp 1 is a rough estima based on the preserved stretches of infield dyke, isolines, and the stream separating E29a from E29
E3_01	E3	8,2	4,3	32,25	1,91	5	0,65	1	21,92						No	18	130,1	109,9	N	2	No	Yes	Field report under preparation	
E3_02	E3	9,56	8,7	69,22	1,10	4	0,8	2	34,21	1,79					No	15	218	163,6		2	No	Yes	Field report under preparation	Note that ruin has small opening
E3_03	E3	10,37	9,84	89,02	1,05	5	0,8	1	58,08						No	15	43,4			1	No	Yes	Field report under preparation	
E3_04	E3	21,9	8,2	150,95	2,67	2	1,6	5	31,96						No	3	17,5				No	Yes	Field report under preparation	Note that the smaller rooms are very uncertain
E3_05	E3	7,95	4,02	30,59	1,98	5	0,75	2	6,52	3,66					No	4	25,3				No	Yes	Field report under preparation	
E3_06	E3	34,7	22,3	414,51	1,56	2									No	1					No	Yes	Field report under preparation	
E3_07	E3	8,1	4,91	38,85	1,65	5	0,75	1	21,2						No	4	23,2				No	Yes	Field report under preparation	
E3_08	E3	7,08	4,2	28,28	1,69	2	1	1	10,47						Yes	4	20,5				No	Yes	Field report under preparation	
E3_09	E3	6,27	5,02	27,32	1,25	2	0,8	1	11,11						No	14	10,7				No	Yes	Field report under preparation	
E3_10	E3	22,7	14,9	228,38	1,52	2									No	3	71,7				No	Yes	Field report under preparation	
E3_11	E3	8,17	6,2	48,59	1,32	2	0,65	2	18,71	9,43					No	7	125,9				No	Yes	Field report under preparation	
E3_11a	E3	16,87	10,5	119,43	1,61	5	0,7	1	94,79						No	17	131	107,3	SW	1	No	Yes	Field report under preparation	
E3_12	E3	16,02	11,69	150,24	1,37	5	0,55	1	111,64						No	18	45	24,8	SW	3	Yes	Yes	Field report under preparation	
E3_13	E3	3,81	3	9,58	1,27	4	0,5	1	6,29						No	9	33,9				No	Yes	Field report under preparation	
E3_14	E3	9,5	3,38	28,84	2,81	2	0,65	2	8,11	6,05					No	5	65,8				No	Yes	Field report under preparation	
E3_15	E3	4,85	2,92	13,84	1,66	5	0,5	1	6,65						No	9	243				No	Yes	Field report under preparation	
E3_16	E3	14,25	5,03	65,55	2,83	3	0,6	4	10,9	8,91	8,52	7,76			No	6	388				No	Yes	Field report under preparation	
E3_17	E3	11,09	6,68	66,58	1,66	5	0,8	1	50,95						No	18	49,8	24,9	S	3	No	Yes	Field report under preparation	
E3_18	E3	9,91	4,12	33,46	2,41	3	0,55	1	24						No	18	206,5	108,7	N	2	No	Yes	Field report under preparation	
E3_19	E3	5,8	2,4	12,8	2,42	4	0,6	1	7,72						No	9	169,9				No	Yes	Field report under preparation	
E3_20	E3	3,34	0,93	2,48	3,59	4	0,4	1	2,07						No	9	180				No	Yes	Field report under preparation	
E3_21	E3	2,77	1,56	2,29	1,78	4	0,3	1	2,15						No	14	24,1				No	Yes	Field report under preparation	
E3_22	E3	5,12	3,46	17,86	1,48	2	0,6	1	8,83						No	14	13,7				No	Yes	Field report under preparation	Note that Ar_Comp1 is only roughly accurate, because S longwall could not be measured
E300_01	E300	7,58	4,57	31	1,66	3	1	2	6,99	5,99					No	5	322,3				No	Yes	NMA: Bak 1969 (B66), Kapel et al. 2004;9	
E301_01	E301	6,04	5,84	24,46	1,03	3	0,85	1	9,46						No	14	32,9				No	Yes	NMA:Bak 1970;B101-2, Kapel et al. 2004;12, Møller&Madsen 2007;31	
E301_02	E301	4,31	2,56	9,78	1,68	5									No	4	6,7				No	Yes	NMA:Bak 1970;B101-2, Kapel et al. 2004;12, Møller&Madsen 2007;32	
E301_03	E301	11,87	11,04	88,54	1,08	5	0,5								No	1					No	Yes	NMA:Bak 1970;B101-2, Kapel et al. 2004;12, Møller&Madsen 2007;32	Note: Møller&Madsen 2007 ruin 03 and 04 are here interpreted as one ruin (ruin 3)
E301_05	E301	10,35	5,29	21,44	1,96	3	0,55								No	14	2,4				No	Yes	NMA:Bak 1970;B101-2, Kapel et al. 2004;12, Møller&Madsen 2007;32	Note: Bak 1970 ruin 4-7 are here interpreted as one ruin
E301_08	E301	3,11	1,6	4,52	1,94		0,5	1	2,18						No	19	49,3		SE	3	No	Yes	NMA:Bak 1970;B101-2, Kapel et al. 2004;12, Møller&Madsen 2007;32	Note: Ruin measurements are somewhat uncertain as detailed description is lacking
E302_01	E302	3,63	2,08	7,21	1,75	5		1							No	10					No	Yes	NMA:Bak1969;B11, Kapel et al. 2004;8	Note that ruin measurements assumes the shape first interpreted by Bak and not the possible extention recorded in the 2004 survey
E303_01	E303	22	6,5	143	3,38	2									No	1					No	No	NMA:Bak 1969;B69-1	Ruin measurements from rough survey sketch and description only
E304_01	E304	14,51	8,46	98,15	1,72	1									Yes	1					No	Yes	NMA:Bak 1969;B65, Møller&Madsen 2007;32	

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E304_02	E304	4,07	3,49	13,12	1,17	1	0,8	1	4,54						Yes	14	4,4				No	Yes	NMA:Bak 1969;B65, Møller&Madsen 2007;32	
E305_01	E305	13,69	11	97,6	1,24	4	0,8	2	53,34	6,52					No	15	13,6			3	No	Yes	NMA:Bak 1969;B64-2, Møller&Madsen 2007;32	Note that second compartment is from rough survey sketch and description only
E305_02	E305	4,4	3,25	13,92	1,35	2	1	1	5,34						No	14	7,2				No	Yes	NMA:Bak 1969;B64-2, Møller&Madsen 2007;32	
E305_03	E305	16,32	11,94	164,96	1,37	2									No	1					No	Yes	NMA:Bak 1969;B64-2, Møller&Madsen 2007;32	
E305_04	E305	3,53	2,72	9,51	1,30	2	0,85	1	2,15						No	14	6,9				No	Yes	NMA:Bak 1969;B64-2, Møller&Madsen 2007;33	
E305_05	E305	3,76	3,2	11,84	1,18	2	0,9	1	3,13						Yes	14	9,3				No	Yes	NMA:Bak 1969;B64-2, Møller&Madsen 2007;33	Ruin could be partially eroded
E305_06	E305	8,81	3,45	29,51	2,55	3	0,6	2	8,63	7,2					No	5	10,4				No	Yes	NMA:Bak 1969;B64-2, Møller&Madsen 2007;33	
E305_07	E305	8,69	5,8	37,66	1,50	2	1	2	8,88	7,36					No	5	15,5				No	Yes	NMA:Bak 1969;B64-2, Møller&Madsen 2007;33	Note that all state dimensions except R_length&Ar_Comp1 are somewhat uncertain, because the ruin is partially eroded
E308_01	E308	2	1,5	3	1,33	5	0,5	1							No	11					No	Yes	NMA:Bak 1967;B13-1, Møller&Madsen 2006;33	
E309_01	E309	4,5	4,25	19,01	1,06	4	0,95	1	6,4						No	9					No	Yes	NMA:Bak 1968;B12-1, Møller&Madsen 2006;21	
E309_02	E309	5,4	2,7	14,58	2,00			1							No	14					No	No	NMA:Bak 1968;B12-2	Note that the ruin was not included in the 2006 survey
E309_03	E309	9,55	4,63	39,52	2,06	4	0,4	1	29,17						No	18			NW	3	No	Yes	NMA:Bak 1968;B12-2, Møller&Madsen 2006;21	Møller&Madsen 2006 ruin 2
E310_01	E310		6		0,00	3									Yes	14					No	No	NMA:Bak 1968;B9-1	Sketch survey description only
E310_02	E310	3	4	12	0,75	3									No	14					No	No	NMA:Bak 1968;B9-1	
E310_03	E310	10,4	1,1	10,43	9,45	3	1,1	1	186,66						No	21			SW	1	No	Yes	NMA:Bak 1968;B9-1, Møller&Madsen 2006;34	Møller&Madsen 2006 ruin 1
E310_04	E310	3,68	3,15	11,5	1,17	3	0,75	1	4,42						No	19			W		No	Yes	NMA:Bak 1968;B9-1, Møller&Madsen 2006;34	
E310_05	E310	2,84	2,34	5,85	1,21	6	0,4	1	2,11						No	19				1	No	Yes	NMA:Bak 1968;B9-1, Møller&Madsen 2006;34	
E311_01	E311	6,96		33,09		3	1,5								No	14					No	Yes	NMA:Bak 1968/69;B76, Møller&Madsen 2007;35	The ruin is partially eroded and its excact dimensions cannot be determined. Note that the indistinct collapse area w of the ruin described in the 2007a survey report is here considered collapse/later disturbance.
E311_01a	E311	6,15	0,9	4,34	6,83	3	0,85								No	17			SE		No	Yes	NMA:Bak 1968/69;B76, Møller&Madsen 2007;35	Møller&Madsen 2007a ruin 3. The ruin is a short stretch of possible dike
E311_02	E311		5,14	14,57	0,00	2	1								No	14					No	Yes	NMA:Bak 1968/69;B76, Møller&Madsen 2007;35	The ruin is partially eroded and its excact dimensions cannot be determined.
E311_03	E311	10	5,03	43,45	1,99	1	1,5	1	10,9						No	4					No	Yes	NMA:Bak 1968/69;B76, Møller&Madsen 2007;35	Møller&Madsen 2007a ruin 4.
E311_04	E311			4,78		2	1								No	14					No	Yes	NMA:Bak 1968/69;B76, Møller&Madsen 2007;35	Møller&Madsen 2007a ruin 5. The ruin is almost completely eroded and its excact dimensions cannot be determined.
E311_05	E311	6,09	3,55	20,72	1,72	1	0,95	1	6,67						No	4					No	Yes	Møller&Madsen 2007;35	Møller&Madsen 2007a ruin 6.
E311_06	E311	1,2	0,93	4,76	1,29	5	0,3		0,74						No	20					No	Yes	Møller&Madsen 2007;35	Møller&Madsen 2007a ruin 7. Note that ruin dimensions are only roughly accurate due to poor GPS signal
E312_01	E312	2,5	2	5	1,25	5	0,8	1	1,4						No	14					No	Yes	NMA:Bak 1967;B15-1, Møller&Madsen 2007;33	Note that ruin dimensions are only roughly accurate, because of poor GPS signal and survey
E312_02	E312	4	3	12	1,33	5	0,7	1							No	14					No	No	NMA:Bak 1967;B15-1	Ruin measurements based on sketch survey, Bak 1967 ruin 4
E312_05	E312	3,8	1	3,8	3,80	5		1							No	9					No	Yes	NMA:Bak 1967;B15-1	Ruin measurements based on sketch survey, Bak 1967 ruin 5
E312_06	E312		3		0,00	5		1							No	28					No	Yes	NMA:Bak 1967;B15-1	Ruin measurements based on sketch survey, Bak 1968 ruin N4
E313_01	E313	6				4									No	14					No	No	NMA:Bak 1971;B141-2	Ruin is partially eroded, no further description exits
E313_02	E313	16,66	7,21	101,45	2,31	4	1	1	64,25						No	15	6,6				No	No	NMA:Bak 1971;B141-2	Ruin measurements from Google Earth© satellite imagery and Bak 1971 description
E313_03	E313	1													No	20					No	No	NMA:Bak 1971;B141-2	Shelter under boulder, likely a lambakró. No further description exits
E313_04	E313	11,38	8,03	67,48	1,42	2									No	1					No	No	NMA:Bak 1971;B141-2	Ruin measurements from Google Earth© satellite imagery and Bak 1971 description
E313_05	E313	8	4	32	2,00	4	1	1	12						Yes	14					No	No	NMA:Bak 1971;B141-3	No further description exits
E313_06	E313	4	3	12	1,33	3									No	19					No	No	NMA:Bak 1971;B141-3	No further description exits
E313_07	E313	4,5	3,5	15,75	1,29	3									No	28					No	No	NMA:Bak 1971;B141-3	No further description exits
E314_07	E314	11,35	6,03	62,58	1,88	3	1,45	1	25,09						No	14					No	Yes	NMA:Bak 1967;B8-2, Madsen 2009;71	
E315_01	E315	13,59	5,49	74,61	2,48	4	0,75	2							No	15					No	No	NMA:Petersen 1894;19, Bruun 1895;419	Ruin observations based on rough survey sketch and description only
E322_01	E322	32,4	16,8	354,2	1,93	2									No	1					No	Yes	NMA:Bak 1966;B7-4, Madsen 2009;73	Note: Bak 1966;B7 & Madsen 2009 ruin 9
E322_02	E322	7,44	3,34	23,81	2,23	5	0,4	2	9,4	4,17					No	5	25				No	Yes	NMA:Bak 1966;B7-4, Madsen 2009;73	Note: Bak 1966;B7 & Madsen 2009 ruin 10
E322_03	E322	7,43	3,07	22,19	2,42	5	0,4								No	4	69,5				No	Yes	Madsen 2009;74	Note: Madsen 2009 ruin 15. Poor ruin preservation excludes estimation of other dimensions/partitions
E322_04	E322	7,16	3,46	24,56	2,07	5	0,45	1							No	4	79,9				No	Yes	NMA:Bak 1966;B7-3, Madsen 2009;72	
E322_05	E322	13,4	8,6	91,09	1,56	2									Yes	14	52				No	Yes	NMA:Bak 1966;B7-3, Madsen 2009;73	
E322_06	E322	6,83	3,25	22,07	2,10	5	0,4	1	14,79						No	4	40,9				No	Yes	NMA:Bak 1966;B7-3, Madsen 2009;73	Note: Bak 1966;B7 & Madsen 2009 ruin 11
E322_07	E322	11,66	8,36	82,03	1,39	3	0,8	1	53,12						No	18	100,1		S	3	No	Yes	Madsen 2009;74	Note: Madsen 2009 ruin 16
E322a_01	E322a	4,12	2,92	11,88	1,41	5	0,5	1	6,07						No	14					No	Yes	NMA:Bak 1966;B7, Madsen 2009;75	
E322a_02	E322a	4,35	3,2	13,87	1,36	3									No	14					No	Yes	NMA:Bak 1966;B7, Madsen 2009;75	
E322a_03	E322a	5,81	4,69	21,57	1,24	4	0,75	1	10,66						No	16					No	Yes	NMA:Bak 1966;B7, Madsen 2009;75	Note that the ruin is very collapsed and that stated measurements are only roughly accurate
E323_01	E323	19	5	95	3,80	2									No	1					No	No	NMA:Bak 1971;B140-2, Krogh&Berlund 1980;45, 192	Ruin description based on rough survey plan and description. Note that ruin 1 has here been seperated in two seperate structures, ruin 1 & 4. Ruin measurements from Krogh&Berlund 1980;193
E323_02	E323	9,5	6	57	1,58	4	0,9	1							No	15					No	No	NMA:Bak 1971;B140-2, Krogh&Berlund 1980;45, 192	Ruin description based on rough survey plan and description only.
E323_03	E323	3,5	2,5	8,75	1,40	5		1							No	14					No	No	NMA:Bak 1971;B140-2, Krogh&Berlund 1980;45, 192	Ruin description based on rough survey plan and description only.
E324_01	E324	6,97	3,75	23,75	1,86	5									No	10	106,2				No	Yes	NMA:Bak 1968:B5-1, Madsen 2009;76	Note that ruin is slightly eroded and R_Width is only roughly accurate
E324_03	E324	8,63	3,87	28,99	2,23	3	0,5	2	13,15	0,9					No	18	27,7		S	3	No	Yes	NMA:Bak 1968:B5-2, Madsen 2009;77	
E324_04	E324	13,33	11,45	101,03	1,16	2									No	1					No	Yes	NMA:Bak 1968:B5-2, Madsen 2009;77	
E324_05	E324	4,77	2,61	12,33	1,83	2	0,75	1	3,28						Yes	14	0,9				No	Yes	NMA:Bak 1968:B5-2, Madsen 2009;77	
E324_07	E324	4,04	4,01	15,97	1,01	2									No	14	9,8				No	Yes	NMA:Bak 1968:B5-3, Madsen 2009;77	
E324_07a	E324	3,67	2,04	7,49	1,80	2	0,4								No	17	10,1		SE	1	No	Yes	Madsen 2009;77	Short stretch of dike or wall
E324_08	E324	6,12	3,9	21,1	1,57	2									No	4	12,6				No	Yes	NMA:Bak 1968:B5-3, Madsen 2009;77	
E324_09	E324	4,06	2,09	7,48	1,94	2	0,6	1	1,93						Yes	14	23,5				No	Yes	NMA:Bak 1968:B5-3, Madsen 2009;77	
E324_10	E324	1,62	1,55	2,33	1,05	3	0,45	1	0,98						Yes	14	104,4				No	Yes	Madsen 2009;78	
E325_01	E325	20,86	15,16	288,11	1,38	2									No	1					No	Yes	NMA:Bak 1969;B6-2, Madsen 2009;79	
E325_02	E325	12,99	7,19	79,87	1,81	2									No	14	17,4				No	Yes	NMA:Bak 1969;B6-2, Madsen 2009;79	

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E325_03	E325	4,94	3	14,5	1,65	5	0,45	1	8,04						No	14	106,3				No	Yes	NMA:Bak 1969;B6-2, Madsen 2009;79	
E325_04	E325	4,81	3,82	18,25	1,26	5	0,7	1	7,7						No	9	118,5				No	Yes	NMA:Bak 1969;B6-2, Madsen 2009;79	
E325_05	E325	7,46	4,29	22,35	1,74	4	0,8	1	14,03						No	18	167,4	6,5	N	3	No	Yes	NMA:Bak 1969;B6-2, Madsen 2009;80	
E325_06	E325	3	2,12	5,56	1,42	6	0,7	1	2,57						No	19	172,5	6,5	N	2	No	Yes	NMA:Bak 1969;B6-2, Madsen 2009;80	
E326_01	E326	5,28				5	0,35	1							No	14					No	Yes	NMA:Bak 1967;B4-1, Madsen 2009;81	Ruin is partially eroded and R_Width and Ar_Comp cannot be estimated
E326_02	E326	6,27	3,2	19	1,96	4	0,55	1	12,91						No	18			N	3	No	Yes	Madsen 2009;81	
E327_01	E327	13,91	1	10,36	13,91	4	1								No	25					No	Yes	Madsen 2009;82	Feature is a single stretch of dike
E328_01	E328	6,9	4,1	32,16	1,68	5	1	1	9,15						No	14					No	Yes	NMA:Bak 1967;B2-1, Madsen 2009;84	
E328_02	E328	5,26	2,8	14,58	1,88	2									No	14					No	Yes	Madsen 2009;84	
E328_03	E328	3,3	2,37	7,34	1,39	2									No	14					No	Yes	Madsen 2009;84	
E329_01	E329	18,4	14,07	193,21	1,31	2									No	1					No	Yes	NMA:Bak 1968;B1-2, Madsen 2009;86	
E329_02	E329	18,09	8,77	143,35	2,06	2									No	2	17,5				No	Yes	NMA:Bak 1968;B1-2, Madsen 2009;86	
E329_03	E329	12,75	9,54	87,94	1,34	4	1,8	2	35,19	4,75					No	16	40,7	24,2		3	No	Yes	NMA:Bak 1968;B1-2, Madsen 2009;86	
E329_04	E329	2,57	1,7	4,03	1,51	6	0,65	1	2,38						No	19	57,7			1	No	Yes	NMA:Bak 1968;B1-2, Madsen 2009;86	
E329_05	E329	5,91	3,89	21,32	1,52	5	0,75	1	9,74						No	4	28,8				No	Yes	NMA:Bak 1968;B1-2, Madsen 2009;86	
E329_06	E329	13,7	7,67	103,17	1,79	3	1,1	3	18,42	7,87	7,63				No	6	52,4				No	Yes	NMA:Bak 1968;B1-2, Madsen 2009;86	
E329_07	E329	7,88	3,72	26,14	2,12	5	0,65	1	12,13						No	18	61,3	24,2	S	1	No	Yes	Madsen 2009;87	
E329_08	E329	3,45	2,61	4,89	1,32	4	0,5	1	3,04						No	19	60,4	10,8	S	1	No	Yes	Madsen 2009;87	
E329_09	E329	3,14	1,75	5,01	1,79	4	1	1	2,05						No	19	64,1	14,4	S	3	No	Yes	Madsen 2009;87	
E329_10	E329	3,66	3,01	8,93	1,22	4		1	8,82						No	20	83	14,3		2	No	Yes	Madsen 2009;87	
E329_11	E329	5,37	4,77	19,15	1,13	5	1	1	8,43						No	18	68,6	5,11	S	3	No	Yes	Madsen 2009;87	
E329_12	E329	5,12	4,38	18,08	1,17	5	1	1	7,62						No	18	72,4	5,11	S	3	No	Yes	Madsen 2009;87	
E330_01	E330	9,7	8,2	64,62	1,18	2									No	1					No	Yes	NMA: Bak 1968;B3-2, Madsen 2009;88	
E330_02	E330	4,53	3,93	17,63	1,15	5	0,5	1	10,41						No	9	37,3				No	Yes	NMA: Bak 1968;B3-2, Madsen 2009;89	
E330_03	E330	3,73	0,77	2,06	4,84	6	0,4	1	1,2						No	20	88,5	8	S	3	No	Yes	NMA: Bak 1968;B3-2, Madsen 2009;89	
E330_04	E330	4,63	2,82	10,17	1,64	4	0,55	1	5,52						No	18	78,9	8	E	3	No	Yes	NMA: Bak 1968;B3-2, Madsen 2009;89	
E330_05	E330	7,19	3,85	25,15	1,87	4	0,8	1	16,27						No	18	74,6	29,6	SE	3	No	Yes	NMA: Bak 1968;B3-2, Madsen 2009;90	
E330_06	E330	4,17	2,05	8,3	2,03	5	0,5	1	3,35						No	9	81,3				No	Yes	NMA: Bak 1968;B3-2, Madsen 2009;90	Note that Ar_Comp1 is slightly uncertain because the ruin is not wholly preserved
E331_01	E331	18,95	17,33	219,39	1,09	2									No	1					No	Yes	Møller&Madsen 2007;34	
E332_01	E332	8													No	21					No	No	NMA:Bak 1971;B123	No additional information on ruin. Dike probably forms enclouse with R04
E332_02	E332	6	3	18	2,00	3		2							No	14					No	No	NMA:Bak 1971;B123	No additional information on ruin
E332_03	E332	2	2	4	1,00										No	20					No	No	NMA:Bak 1971;B123	No additional information on ruin. It is likely a lambakró to R01&04
E332_04	E332	5				4									No	21					No	No	NMA:Bak 1971;B123	No additional information on ruin. Dike probably forms enclouse with R01
E333_01	E333	7,61	4,13	28,25	1,84	2	0,8	2	5,86	4,35					No	14					No	Yes	NMA:Bak 1971;B122-2, Madsen et al. 2013	
E333_02	E333	3,5	3,2	9,26	1,09	5	0,75	1	4,15						No	9					No	Yes	NMA:Bak 1971;B122-2, Madsen et al. 2013	
E333_03	E333	8,75	4,44	31,36	1,97	4	0,8	1	15,82						No	18			SE	3	No	Yes	NMA:Bak 1971;B122-2, Madsen et al. 2013	
E334_02	E334	7	4	28	1,75	3									No	4					No	No	NMA:Bak 1971:B117-2	Ruin observations from rough survey sketch and description only. Note that Møller et al. 2007 ruin 02 was reinterpreted as the foundation of a recent feature
E334_03	E334	2	2	4	1,00	3									No	19					No	No	NMA:Bak 1971:B117-2	Ruin observations from rough survey sketch and description only. Note that Møller et al. 2007 ruin 03 was reinterpreted as Inuit communal house
E334_04	E334	5	3,5	17,5	1,43	3									No	4					No	No	NMA:Bak 1971:B117-2	Ruin observations from rough survey sketch and description only. Note that Møller et al. 2007 ruin 04 was reinterpreted as Inuit communal house
E334_04a	E334	7	3	29,94	2,33	4									No	15					No	Yes	NMA:Bak 1971:B117-2	Ruin observations from rough survey sketch and description only. Note that Møller et al. 2007 ruin 04 was reinterpreted as Inuit communal house
E399_01	E399	4	3	12	1,33	3									No	14					No	No	NMA:Krogh 1981-84;16	Ruin observations from rough survey description only
E399_02	E399	5	5	25	1,00	4									No	18					No	No	NMA:Krogh 1981-84;16	Ruin observations from rough survey description only
E4_	E4														No	26					No	Yes	Madsen et al. , field report under preparation	
E4_01	E4	12,09	6,42	79,86	1,88	4	1,5	2	27,96	6,11					No	9	78,1				No	Yes	Madsen et al. , field report under preparation	
E4_01a	E4	19	37,8	602,16	0,50	5	0,6	2	571,16	10,12					No	22	60,8	6,7	S	1	Yes	Yes	Madsen et al. , field report under preparation	The enclosure is bounded to the north by ruin 1 & 2.
E4_02	E4	11,2	5,27	57,22	2,13	4	1,1	1	31,85						No	9	65				No	Yes	Madsen et al. , field report under preparation	
E4_03	E4	7,2	4,09	29,12	1,76	4	0,75	1	14,35						No	9	22,3				No	Yes	Madsen et al. , field report under preparation	
E4_03a	E4	6,11	7,55	36,93	0,81	2	0,6	1	28,12						No	17	16,7	6,5	W	1	No	Yes	Madsen et al. , field report under preparation	
E4_04	E4	37,6	16,5	543,57	2,28	2									No	1					No	Yes	Madsen et al. , field report under preparation	
E4_05	E4	34,74	9,5	297,59	3,66	2	2,4	2	64,47	50,29					No	2	9,7				No	Yes	Madsen et al. , field report under preparation	
E4_06	E4	95,3	71	4716,07	1,34	4	1,35	4	4048,15	246,03	151,57	6,84			No	22	575		E	1	No	Yes	Madsen et al. , field report under preparation	
E4_07	E4	39,26	12,95	430,63	3,03	5	1,1	1	356,57						No	22	643,8		E	1	No	Yes	Madsen et al. , field report under preparation	
E4_08	E4	13,06	7,54	89,41	1,73	2	1,4	2	29,7	10,51					No	5	83,5				No	Yes	Madsen et al. , field report under preparation	
E4_09	E4	4,44	2,26	9,76	1,96	5									No	9	324,2				No	Yes	Madsen et al. , field report under preparation	
E4_10	E4	20,25	4,65	88,62	4,35	2	1,4	3	11,35	10,62	10,02				No	6	217,4				No	Yes	Madsen et al. , field report under preparation	Note that comp 3 is connected with comp 1
E4_11	E4	23,17	14,85	260,67	1,56	5	0,6	2	180,18	9,54					No	15	30,9	6,7	S	1	Yes	Yes	Madsen et al. , field report under preparation	
E4_12	E4	14,52	5,9	79,69	2,46	2	1,35	2	19,86	15,25					No	5	121,6				No	Yes	Madsen et al. , field report under preparation	
E4_13	E4	25,11	6,94	148,67	3,62	2	1,6	3	29,47	23,64	8,06				No	2	106,5				No	Yes	Madsen et al. , field report under preparation	
E4_14	E4	13,22	5,65	71,91	2,34	2	1,2	1	26,99						No	4	138,7				No	Yes	Madsen et al. , field report under preparation	
E4_15	E4	15,47	5	75,98	3,09	1	1,1	2	22,54	8,8					No	5	11,7				No	Yes	Madsen et al. , field report under preparation	
E4_16	E4	9,72	4,44	40,42	2,19	5	0,6	1	26,74						No	18	297,4	310	SW	3	No	Yes	Madsen et al. , field report under preparation	
E4_17	E4	3,03	3,43	9,61	0,88	2	0,6	1	2,84						No	14	12,1				No	Yes	Madsen et al. , field report under preparation	
E4_18	E4	10,51	1,22	13,48	8,61	2	1,2								No	25	0				No	Yes	Madsen et al. , field report under preparation	
E4_19	E4	6,72	6,09	40,92	1,10	2	1,7	1							No	14	134,2				No	No	Culling et al 1976;50, Madsen et al. 2011	Culling et al 1976 ruin 15, measurements from 1976 report. Dis_Md only roughly accurate

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E47_01	E47	27,75	15,57	362,02	1,78	4	1,8	4	146,46	32,32	15,06	9,72			No	12	7,3				No	No	Nørlund 1929:32, Fig.51	Measurements based on referenced excavation plan
E47_01a	E47	48,92	36,03	1713,94	1,36	4	1,35	1	1180,88						No	13	0				No	No	Nørlund 1929:53, Fig.51	Measurements based on referenced excavation plan
E47_02	E47	4,83	4,54	21,58	1,06	4	1	1	6,42						No	14	1,9				No	No	Nørlund 1929:47, Fig.51	Measurements based on referenced excavation plan
E47_03	E47	8,71	7,54	65,88	1,16	3	1,4	1	26,85						No	14	3,2				No	No	Nørlund 1929:54, Fig.51	Measurements based on referenced excavation plan
E47_04	E47	8,1	6,93	57,23	1,17	5	1,05	1	28,22						No	14	16,7				No	No	Nørlund 1929:50, Fig.51	Measurements based on referenced excavation plan
E47_05	E47	13,63	7,98	110,77	1,71	4	1,45								No	9	24,6				No	No	Nørlund 1929:55, Fig.51	Measurements based on referenced excavation plan
E47_06	E47	7,29	5,25	39,5	1,39	5	1,3	1	12,76						No	9	18,4				No	No	Nørlund 1929:112, Fig.51	Measurements based on referenced excavation plan
E47_07	E47	6,82	4,72	31,62	1,44	3	0,95	1	13,22						No	14	12,4				No	No	Nørlund 1929:113, Fig.51	Measurements based on referenced excavation plan
E47_08	E47	52,32	24,09	934,93	2,17	2									No	1					No	No	Nørlund 1929:77, Fig.42	Measurements based on referenced excavation plan
E47_09	E47	67,4	7,9	498,46	8,53	2	1,95	2	136,31	125,08					No	2	10,8				No	No	Nørlund 1929:115, Fig.51	Measurements based on referenced excavation plan. Note that only the wall proper is included in the measurements, not the outer turf padding
E47_10	E47	10,9	5,42	60,08	2,01	6	1,5	1	19,62						No	14	19,5				No	No	Nørlund 1929:114, Fig.51	Measurements based on referenced excavation plan
E47_11	E47	8,71	5,92	52,65	1,47	3	1,3	1	16,55						No	14	33,8				No	No	Nørlund 1929:111, Fig.51	Measurements based on referenced excavation plan
E47_12	E47	18,84	6,65	125,37	2,83	4	1,75	1	54,99						No	9	46,4				No	No	Nørlund 1929:114, Fig.51	Measurements based on referenced excavation plan. Note that only the later stone building has been included.
E47_13	E47	13,96	7,11	99,28	1,96	6	1,65	1	39,95						No	14	51,7				No	No	Nørlund 1929:103, Fig.51	
E47_14	E47	44,76	7,18	316,83	6,23	2	1,5	2	88,47	84,21					No	2	38,8				No	No	Nørlund 1929:115, Fig.51	Measurements based on referenced excavation plan. Note that only the wall proper is included in the measurements, not the outer turf padding
E47_15	E47	2,55	2,44	6,22	1,05	4									No	27	92,6				No	No	Nørlund 1929:109, Fig.51	Measurements based on referenced excavation plan.
E47_16	E47	20													No	2	136,4				No	No	Nørlund 1929:118	Ruin width not described
E47_17	E47	28,68	5,93	171,65	4,84	2	1,1	3	42,04	22,76	16,87				No	6	238,1				No	No	Nørlund 1929:120, Fig.66	Measurements based on referenced excavation plan
E47_18	E47														No	5	229,5				No	No	Nørlund 1929:120	Ruin dimensions not described
E47_19	E47					5		1	6,21						No	14	362,3				No	No	Nørlund 1929:132	Only inside ruin dimensions are recorded
E47_20	E47	16,3	5,38	94,01	3,03	4	1,5	1	54,35						No	9	366,4				No	No	Nørlund 1929:131, Fig.75	Measurements from referenced survey plan
E47_21	E47	10	4,5	45	2,22	5									No	10	517,5				No	No	Nørlund 1929:132	Wall_Th not described
E47_22	E47					4		1	21,28						No	9	538,2				No	No	Nørlund 1929:132	Only inside ruin dimensions are recorded
E47_23	E47														No	4	308,4				No	No	Nørlund 1929:118	Ruin measurements not recorded
E47_24	E47	37,5	6,5	243,75	5,77	2	1,25	2							No	5	331,5				No	No	Nørlund 1929:118	Ruin measurements based on rough description
E47_25	E47	8	8	200	1,00	4	1,25	1	50,27						No	16	393,3				No	No	Nørlund 1929:108	Ruin measurements based on rough description
E47_26	E47														No	27					No	No	Nørlund 1929:127	Likely not ruin, but could be other feature
E47_27	E47	21,15	6,08	130,31	3,48	5	1,65	3	14,26	13,22	11,99				No	6	527,9				No	No	Nørlund 1929:128, Fig.74	Measurements based on referenced excavation plan
E47_28	E47														No	27					No	No	Nørlund 1929:127	Likely not ruin, but could be other feature
E47_29	E47														No	27					No	No	Nørlund 1929:127	Likely not ruin, but could be other feature
E47_30	E47							2							No	4	533				No	No	Nørlund 1929:127p	Ruin measurements not recorded
E47_31	E47														No	15	517,5				No	No	Nørlund 1929:127p	Ruin measurements not recorded
E47_32	E47														No	4	538,2				No	No	Nørlund 1929:127p	Ruin measurements not recorded
E47_33	E47														No	4	567,1				No	No	Nørlund 1929:127p	Ruin measurements not recorded
E47_34	E47	20,13	7,18	139,89	2,80	5	1,35	1	74,2						No	14	600,3				No	No	Bruun 1895;343, Nørlund 1929:120, NMA:Krogh&Albrethsen 1968	Ruin measurements based on rough description
E47_35	E47	32,91	6,63	221,38	4,96	2	1,35	3	66,76	23,71	21,94				No	6	657,2				No	No	Nørlund 1929:120, Fig.66	Measurements based on referenced excavation plan
E47_36	E47	14,75	8,44	125,78	1,75	4	1,35	1	67,27						No	9	825,9				No	No	Nørlund 1929:132, Fig.76	Measurements from referenced survey plan
E47_37	E47								62,5						No	14	212,2				No	Yes	Nørlund 1929:118	
E47_38	E47	22,16	14,33	273,92	1,55	4	1,85	2	106,06	16,84					No	15	124,2			4	No	No	Nørlund 1929:122p, Fig.70	Measurements from referenced survey plan
E47_39	E47	132,8	48,3	5592,78	2,75	4	1,75	2	4782,24	42,42					No	22	129,4		NE	1	No	No	Nørlund 1929:123p, Fig.72	Measurements from referenced survey plan
E47_40	E47	116,4	85,7	9157,33	1,36	4	1,9	2	6664,32	1701,96					No	22	196,7			1	No	No	Nørlund 1929:124p, Fig.72	Measurements from referenced survey plan
E47_41	E47														No	26					No	No		
E47_42	E47														No	26					No	No		
E47_43	E47														No	26					No	No		
E47a_44	E47														No	5					No	No	Nørlund 1929:122	Ruin measurements not recorded
E47a_45	E47a	19,13	6,51	122,42	2,94	4	1,45	1	50,22						No	9					No	No	Nørlund 1930:121, Fig.66	Measurements based on referenced excavation plan. Note that the ruin is built together with ruin E47a_45a, which together constitute a type 21 ruin
E47a_45a	E47a	19,98	6,01	119,59	3,32	3	1,45	2	32,32	20,68					No	5					No	No	Nørlund 1930:121, Fig.66	Measurements based on referenced excavation plan. Note that the ruin is built together with ruin E47a_45, which together constitute a type 21 ruin
E48_01	E48	23,78	10,26	224,96	2,32	2	1,8	4	41,77	38,68	16,34	5,64			No	3	15,7				No	Yes	Bruun 1895;344, NMA:Krogh&Albrethsen 1968, NMA:Krogh 1983, Arneborg 2001, Kapel 2005	
E48_02	E48	32,88	16,41	500,62	2,00	2									No	1	0				No	Yes	Bruun 1895;344, NMA:Krogh&Albrethsen 1968, NMA:Krogh 1983, Arneborg 2001, NMA: Kapel 2005	The room visible in the back (NE) of the ruin is likely a seperate building
E48_03	E48	4,42	4,13	18,24	1,07	3	0,8	1	9,49						No	12	11				No	Yes	Bruun 1895;344, NMA:Krogh&Albrethsen 1968, NMA:Krogh 1983, 1986, Arneborg 2001, NMA: Kapel 2005	
E48_03a	E48	16,91	14,83	240,02	1,14	2	1,2	1	168,03						No	13	5				No	Yes	Bruun 1895;344, NMA:Krogh&Albrethsen 1968, NMA:Krogh 1983, 1986, Arneborg 2001, NMA: Kapel 2005	
E48_04	E48	14,64	5,03	69,19	2,91	2	1,2	2	20,04	12,68					No	5	28,9				No	Yes	Bruun 1895;344, NMA:Krogh&Albrethsen 1968, NMA:Krogh 1983, 1986, Arneborg 2001, NMA: Kapel 2005	
E48_05	E48	6,15	4,79	26,23	1,28		0,8	1	11,35						Yes	4	84,5				No	Yes	Bruun 1895;344, NMA:Krogh&Albrethsen 1968, NMA:Krogh 1983, 1986	
E48_06	E48	6	5,5	33	1,09										Yes	4	88,8				No	No	Bruun 1895;344, NMA:Krogh&Albrethsen 1968, NMA:Krogh 1983, 1986	Ruin measurements based on rough survey sketch and description only
E48_07	E48	9,58	6,69	40,31	1,43	3	0,9								No	18	88,1		SW	3	No	Yes	Bruun 1895;344, NMA:Krogh&Albrethsen 1968, NMA:Krogh 1983, 1986	

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E48_08	E48	5,09	4,15	20,99	1,23	2									No	14	347,1				No	Yes	Bruun 1895;343, NMA:Krogh&Albrethsen 1968	Ruin could be part of a small, independent milking shieling
E48_08a	E48	6,09	3,11	19,03	1,96	3	0,65	1	9,58						No	17	350		SE		No	Yes	Bruun 1895;343, NMA:Krogh&Albrethsen 1968	Ruin could be part of a small, independent milking shieling
E48_09	E48	1,2	0,55	0,66	2,18	4									No	19	262,9	24,19	SW	2	No	No	Bruun 1895;343, NMA:Krogh&Albrethsen 1968	Ruin measurements based on rough survey sketch and description only
E48_11	E48	12	7	84	1,71	2									No	14	62,1				No	No	Bruun 1895;343, NMA:Krogh&Albrethsen 1968	Ruin measurements based on rough survey sketch and description only
E48_12	E48	4,14	3,69	14,65	1,12	4	0,6	1	7,6						No	14	332,6				No	Yes	Field report under preparation	Ruin could be part of a small, independent milking shieling
E59_01	E59	6	4	24	1,50	4									No	9	470				No	Yes	Holm 1883:106, Clemmensen&Kapel 2010:7	
E59_02	E59	18,34	4,94	82,05	3,71	3	0,75	2							No	5					No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:7	
E59_03	E59	16,83	6,54	112,07	2,57	4	1,15	1	61,9						No	9	130,7				No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:8	
E59_04	E59	8,98	5,73	51,04	1,57	4	1,2	1	20,3						No	14	56,4				No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:9	
E59_05	E59	10,75	5,58	16,17	1,93	4	0,95	1	31,97						No	9	42,8				No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:9	
E59_06	E59	8,8	5,58	48,75	1,58	3	1,05	1	22,15						No	14	32,1				No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:10	
E59_07	E59	16,38	5,89	93,76	2,78	4	1,25	1	44,16						No	9	196,3				No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:10	
E59_08	E59	22,86	14,39	240,71	1,59	2	1,8								No	3	90,4				No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:10	
E59_09	E59	12,7	5,51	66,89	2,30	3	0,75	1	41,15						No	4	3,6				No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:11	
E59_10	E59	36,63	23,61	529,83	1,55	2									No	1					No	Yes	Holm 1883:110, Clemmensen&Kapel 2010:11	
E59_11	E59	44,34	9,35	391,28	4,74	2	1,6	4							No	3	17,9				No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:12	
E59_12	E59	17,36	5,52	93,53	3,14	3	1,25	3	16,68	13,03	8,26				No	6	81,9				No	Yes	Holm 1883:110, Clemmensen&Kapel 2010:13	
E59_13	E59	10,55	10,06	105,4	1,05	4	1,9	1	45,95						No	15	198,6			1	No	Yes	Holm 1883:110, Clemmensen&Kapel 2010:13	
E59_14	E59	15,44	5,74	75,91	2,69	3	0,75	1	59,96						No	18	119,2		SW	1	No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:14	
E59_15	E59	14,43	6,98	90,96	2,07	5	1,15	1	40,17						No	4	112,4				No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:14	
E59_16	E59	20,21	6,63	123	3,05	2	1,6	2	46,05	17,03					No	2	87,7				No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:14	
E59_17	E59	20,94	7,66	140,8	2,73	1	0,31	1	76,64						No	14	129,8				No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:15	Note that ruin is considered an early longhouse type dwelling
E59_18	E59	15,6	1,2	16,25	13,00	5	1,2								No	25	179,4				No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:15	
E59_19	E59	17,82	5,88	100,24	3,03	2	1,6	2	39,68	17,8					No	2	184,1				No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:15	
E59_20	E59	11,27	4,29	43,64	2,63	5	0,5	1	35,33						No	18	213,7		S	1	No	Yes	Holm 1883:107, Clemmensen&Kapel 2010:16	
E59_21	E59	61,3	26,9	1408	2,28	5	0,9	2	1359						No	22	123,1		S	1	No	Yes	Holm 1883:110, Clemmensen&Kapel 2010:16	Note that Ar_Comp 1 is the estimated area between ruin 21 and 39, which are considered part of the same enclosure
E59_22	E59	7,51	4,08	30,24	1,84	5	0,6	1	16,5						No	4	237,2				No	Yes	Clemmensen&Kapel 2010:16	
E59_23	E59	4,82	4,53	16,64	1,06	1	0,75	1	9,67						No	14	157,4				No	Yes	Clemmensen&Kapel 2010:17	
E59_24	E59	6,66	6,64	41	1,00	1	1,1	1	17,44						No	14	141,1				No	Yes	Clemmensen&Kapel 2010:17	
E59_25	E59	13,82	5,48	74,99	2,52	2	0,9	2	21,4	18,75					No	5	51,1				No	Yes	Clemmensen&Kapel 2010:17	
E59_26	E59	6,72	5,27	34,57	1,28	1	0,95	1	17,07						No	14	57,7				No	Yes	Clemmensen&Kapel 2010:17	
E59_27	E59	12,36	11,56	143,9	1,07	5	1,5	1	74,85						No	15	113,2			1	No	Yes	Clemmensen&Kapel 2010:17	
E59_28	E59	10	6,43	57,08	1,56	5	0,9	2	26,94	2,93					No	18	128,1			1	No	Yes	Clemmensen&Kapel 2010:18	Ar_Comp 1 and 2 assumes that there was a partition of the small annex
E59_29	E59	7,76	4,62	44,2	1,68	3	0,55	2	23,18	4,44					No	18	91,8		S	1	No	Yes	Clemmensen&Kapel 2010:18	Ruin is here interpreted as an enclosure
E59_30	E59	10,65	3,66	36,42	2,91	3	0,55	1	25,82						No	18	134,1		NW	4	No	Yes	Clemmensen&Kapel 2010:18	
E59_31	E59	10,87	6,11	57,04	1,78	2	1,1	3	11,82	7,19	6,23				No	6	274,8				No	Yes	Clemmensen&Kapel 2010:18	
E59_32	E59	22,18	6,35	128,1	3,49	1	1	1	74,96						No	14	361,3				No	Yes	Clemmensen&Kapel 2010:19	Note that ruin could be considered an early longhouse type dwelling
E59_33	E59	11,82	6,25	68,5	1,89	5	1,1	1	36,08						No	4	417,2				No	Yes	Clemmensen&Kapel 2010:19	
E59_34	E59	11,81	6,64	75,37	1,78	2	1,05	1	38,72						No	4	36,5				No	Yes	Clemmensen&Kapel 2010:19	
E59_35	E59	5,92	3,97	21,5	1,49	2	0,65	1	13,03						No	4	90,2				No	Yes	Clemmensen&Kapel 2010:19	
E59_36	E59	5,78	3,97	18,13	1,46	5	0,45	1	14,45						No	18	377		NW	4	No	Yes	Clemmensen&Kapel 2010:19	
E59_37	E59	7,55	4,2	30,16	1,80	5	0,65	1	17,45						No	4	177,7				No	Yes	Clemmensen&Kapel 2010:20	
E59_38	E59	5,37	3,49	17,71	1,54	5	0,85	1	7,5						No	4	187,1				No	Yes	Clemmensen&Kapel 2010:20	
E59_39	E59	27				5									No	22					No	Yes	Clemmensen&Kapel 2010:20	Ruin is considered part of ruin 21
E59_40	E59	180,6				5		1	169600						No	24	167,9				No	Yes	Clemmensen&Kapel 2010:21	Area_Comp 1 is the estimate homefield area
E59_41	E59														No	26					No	Yes	Clemmensen&Kapel 2010:21	
E59_42	E59	8,93	4,76	40,52	1,88	1	0,65	1	22,87						No	4	159,9				No	Yes	Clemmensen&Kapel 2010:22	
E59_43	E59	15,63	6,43	89,37	2,43	2	1,05	1	47,44						No	4	8,8				No	Yes	Clemmensen&Kapel 2010:22	
E60_01	E60	16,71	13,23	190,58	1,26	2									No	3	33,2				No	Yes	NMA;Bruun 1894 II;78p, Bruun 1895;362, Møller&Madsen 2006;8	Møller&Madsen 2006 ruin 4
E60_01a	E60	8,75	3,46	27,61	2,53	2	0,8	1	22,65						No	17	47,6	101,2	N	1	No	Yes	Møller&Madsen 2006;8	Møller&Madsen 2006 ruin 4
E60_02	E60	6,08	2,29	13,92	2,66	2	0,5	2	5,31	5,98					No	8	143,4	101,2	SW	1	No	Yes	NMA;Bruun 1894 II;78p, Møller&Madsen 2006;7	Møller&Madsen 2006 ruin 3
E60_02a	E60	1,4	1,46	1,75	0,96	3	0,4	1	1,5						No	19	140,9	1,63	SW	2	No	Yes	Møller&Madsen 2006;7	Møller&Madsen 2006 ruin 3
E60_03	E60	40,2	27,8	909,84	1,45	2									No	1					No	Yes	NMA;Bruun 1894 II;78p, Bruun 1895;362, NMA:Krogh et al. 1968, Møller&Madsen 2006;7	Møller&Madsen 2006 ruin 1
E60_04	E60	3,29	2,68	8,87	1,23	2									No	14	0				No	Yes	NMA:Bruun 1894 II:78, Krogh et al. 1968, Madsen et al. 2014:	Madsen et al. 2014 ruin 13_1
E60_05	E60	29,6	9,55	252,67	3,10	2	1,2	3	53,65	48,9	46,57				No	6	14,3				No	Yes	NMA;Bruun 1894 II;78p, Bruun 1895;362, NMA:Krogh et al. 1968, Møller&Madsen 2006;7	Møller&Madsen 2006 ruin 2
E60_06	E60	16	12	153,94	1,33			1							No	16				4	No	No	NMA;Bruun 1894 II;78p, Bruun 1895;362	No DGPS survey exists, measurements only approximate
E60_07	E60	10	4	40	2,50										No	4					No	No	NMA:Bruun 1894 II;78, Bruun 1895;362	
E60_08	E60	2	2	4	1,00			1							No	19					No	No	NMA:Bruun 1894 II;78, Bruun 1895;362	
E60_09	E60	8,05	5,7	39,94	1,41	4	0,75	1	25,36						No	18	206,3	1,77	NW	3	No	Yes	NMA:Bruun 1894 II:78, Krogh et al. 1968, Madsen et al. 2014:	Madsen et al. 2014 ruin 13_2
E60_10	E60	4,71	3,12	14,53	1,51	4	0,6	1	7,62						No	9	329,1				No	Yes	Møller&Madsen 2006;8	Møller&Madsen 2006 ruin 5
E60_11	E60	3,19	3,51	11,17	0,91	4	0,7	1	3,65						No	9	436,5				No	Yes	Madsen et al. 2014:	Madsen et al. 2014 ruin 13_1
E60_12	E60	2,47	2,4	5,79	1,03	5	0,35	1	3,51						No	28	262,2	141,8	SE	2	No	Yes	Madsen et al. 2014:	Madsen et al. 2014 ruin 13_4
E60_13	E60	2,31	1,41	3,25	1,64	5	0,3	1	1,58						No	19	211,9	1,17		2	No	Yes	Madsen et al. 2014:	Madsen et al. 2014 ruin 13_2

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E61_01	E61	10,71	3,61	34,56	2,97	5	0,65	1	17,75						No	14					No	Yes	Bruun 1895;363; Møller&Madsen 2006;8	
E61_02	E61	6,59	2,66	16,29	2,48	5	0,8	1	7,13						No	14					No	Yes	Bruun 1895;363; Møller&Madsen 2006;8	
E62_01	E62	15,54	10,89	114,62	1,43	5	0,9	3	27,08	24,63	11,23				No	1					No	Yes	Bruun 1895;363, Møller&Madsen 2006;8	Annex described in Møller&Madsen 2006;8 is interpreted as a seperate room
E62_02	E62														No	14					No	No	Bruun 1895;363, Møller&Madsen 2006;8	No DGPS survey or skecth of the ruin exists, but it is described by Bruun as being somewhat like ruin 01.
E63_01	E63	7,1	5,07	34,97	1,40	3									No	4	202,1				No	Yes	Bruun 1895;364, Møller&Madsen 2006;9	Møller&Madsen 2006 ruin 6
E63_01a	E63	11,81	6,86	67,59	1,72	4	1	2	46,21	3,87					No	17	202,1	6,1	SE	2	No	Yes	Bruun 1895;364, Møller&Madsen 2006;9	Møller&Madsen 2006 ruin 7-8
E63_01b	E63	13,68	8,91	63,72	1,54	3	1,65	1	48,11						No	17	202,1	0	SE	2	No	Yes	Bruun 1895;364, Møller&Madsen 2006;9	Møller&Madsen 2006 ruin 9
E63_02	E63	4,27	3,35	14,3	1,27	4		1							No	9	343				No	No	Bruun 1895;364	No DGPS survey exists, measurements only approximate
E63_03	E63	30	14	355,77	2,14	2	1	4							No	1					No	Yes	Bruun 1895;364, Krogh et al. 1968*, Møller&Madsen 2006;9	Møller&Madsen 2006 ruin 1. Ruin 1 was surveyed as a single farm mound, but this clearly covered several ruins identified by D. Bruun (1894;364pp), which also showed clearly after his survey plan was georeferenced from satelite imagery. Measurements are only approximate and based on a combination of the new and the Bruun survey.
E63_03a	E63	28,27	21,4	528,85	1,32	3	0,9		494,8						No	22	0	217,5		1	No	No	Bruun 1895;364, Krogh et al. 1968*	Ruin observations are based on georeference of old survey plan (Bruun 1894;364) and measurements are only approximate
E63_04	E63	17,62	5,6	67,41	3,15	2	1,1	3	12,91	12,62	2,38				No	3	8,4				No	No	Bruun 1895;366	Ruin observations are based on georeference of old survey plan (Bruun 1894;364) and measurements are only approximate
E63_05	E63	10,83	3,66	38,82	2,96	2	1	1	16,46						No	4	2,3				No	No	Bruun 1895;366	Ruin observations are based on georeference of old survey plan (Bruun 1894;364) and measurements are only approximate
E63_06	E63	8,27	5,19	37,61	1,59	2	1	1	19,65						No	4	15,5				No	Yes	Bruun 1895;366, Møller&Madsen 2006;9	Møller&Madsen 2006 ruin 2
E63_07	E63	9,74	4,71	46,66	2,07	2	0,93	1	23,31						No	4	90,3				No	Yes	Bruun 1895;366, Møller&Madsen 2006;9	Møller&Madsen 2006 ruin 11
E63_08	E63	3,6	3,75	12,74	0,96	2	0,9	1	3,55						No	14	2,3				No	No	Bruun 1895;366	Ruin observations are based on georeferencing of old survey plan (Bruun 1894;364) and measurements are only approximate
E63_09	E63	8,51	0,8	7,66	10,64	5	0,8								No	25	0				No	No	Bruun 1895;366	Ruin observations are based on georeferencing of old survey plan (Bruun 1894;364) and measurements are only approximate
E63_10	E63	10,9	5,07	54,96	2,15	2	1,04	1	29,95						No	4	204,9				No	Yes	Møller&Madsen 2006;9	Møller&Madsen 2006 ruin 4
E63_10a	E63	12,79	7,72	85,37	1,66	2	1	1	76,62						No	17	204,9	6,1	SE	3	No	Yes	Møller&Madsen 2006;9	Møller&Madsen 2006 ruin 5
E63_11	E63	25,5	0,8	20,67	31,88	5	1								No	24	137,4				No	Yes	Møller&Madsen 2006;9	Stretch of homefield dike. Møller&Madsen 2006 ruin 10
E64_01	E64	4,02	2,82	11,32	1,43	4	0,7	1	3,95						No	9	379				No	Yes	Bruun 1895;367, Krogh 1968, Møller&Madsen 2006;11,	Note. Møller&Madsen 2006 ruin 5
E64_01a	E64	4,33	2,19	9,46	1,98	3	0,65	1	4,41						No	17	379	280,3	E	1	No	Yes	Bruun 1895;367, Krogh 1968, Møller&Madsen 2006;11	Note. Møller&Madsen 2006 ruin 5
E64_02	E64	19,14	6,34	109,62	3,02	2	1,4	2	24	21,01					No	5	80,1				No	Yes	Bruun 1895;367, Krogh 1968, Møller&Madsen 2006;11	Note. Møller&Madsen 2006 ruin 9
E64_03	E64	38,21	13,03	380,14	2,93	2									No	3	4,1				No	Yes	Bruun 1895;367, Krogh 1968, Møller&Madsen 2006;11	Note. Møller&Madsen 2006 ruin 7
E64_04	E64	37,24	18,43	561,37	2,02	2									No	1					No	Yes	Bruun 1895;367, Krogh 1968, Møller&Madsen 2006;11	
E64_05	E64	6,48	5,27	32,39	1,23	5	0,55	1	21,71						No	15	119,3	33,2		2	No	Yes	Bruun 1895;367, Krogh 1968, Møller&Madsen 2006;11	Note. Møller&Madsen 2006 ruin 15
E64_06	E64	7,01	5,61	36,05	1,25	3	0,85	1	17,17						No	12	13,8				No	Yes	Bruun 1895;367, Krogh 1968, Møller&Madsen 2006;11	
E64_06a	E64	23,23	20,29	399,32	1,14	5	1	1	303,86						No	13	5,5				No	Yes	Bruun 1895;367, Krogh 1968, Møller&Madsen 2006;11	Note that ruin measurments are only roughly accurate, because churchyard wall is only partially preserved
E64_07	E64	5,5	1,75	9,63	3,14										No	28					No	No	Bruun 1895;368	Note: ruin measurements based on rough survey description only
E64_08	E64	10,71	10,72	62,64	1,00	4	0,55	2	27,03	8,53					No	21	183,8	11,8		3	No	Yes	Bruun 1895;368, Krogh 1968, Møller&Madsen 2006;11	Note. Møller&Madsen 2006 ruin 12
E64_09	E64	21,43	8,96	168,4	2,39	2									No	3	2,8				No	Yes	Bruun 1895;368, Krogh 1968, Møller&Madsen 2006;10	Note. Møller&Madsen 2006 ruin 13
E64_10	E64	14,78	9,48	132,19	1,56	3									No	14	19,8				No	Yes	Bruun 1895;368, Krogh 1968, Møller&Madsen 2006;10	Note. Møller&Madsen 2006 ruin 1
E64_11	E64	31,44	22,33	594,78	1,41	4	1,1	2	505,65	12,42					No	18	466,4	345,7	S		No	Yes	Bruun 1895;368, Krogh 1968, Møller&Madsen 2006;10	Note. Møller&Madsen 2006 ruin 16
E64_12	E64	6,54	3,56	22,34	1,84	5									No	9	106,7				No	Yes	Bruun 1895;368, Krogh 1968, Møller&Madsen 2006;10	Note. Møller&Madsen 2006 ruin 2
E64_13	E64	3,76	4,35	15,26	0,86	5	0,65	1	10,85						No	18	108,8	33,2	S		No	Yes	Møller&Madsen 2006;10	
E64_14	E64	9,3	5,16	47,87	1,80	3	0,85	2	16,32	9,32					No	5	107,1				No	Yes	Møller&Madsen 2006;10	
E64_15	E64	8,47	3,26	26,07	2,60	2	0,8	1	16,68						No	4	32,6				No	Yes	Møller&Madsen 2006;10	Note. Møller&Madsen 2006 ruin 8
E64_16	E64	18,24	0,75	2,15	24,32	2	0,7	1	77						No	21	173,6	11,9		3	No	Yes	Arneborg et al. 2008;44	Arneborg et al. 2008 ruin 12
E64_17	E64	1,93	1,34	2,11	1,44	1	0,25	1	0,89						No	27	35,8				No	Yes	Møller&Madsen 2007	Note: feature seems more a cut or pit than a structure
E64a_01	E64a	32,85	18,87	419,31	1,74	2									Yes	1					No	Yes	Vebæk 1943;23, Møller&Madsen 2007;10	Ruin dimensions measured after georeference of Vebæk survey plan (1943;fig.15)
E64a_02	E64a	5,1	3,18	16,48	1,60	3	0,85	1	4,5						No	14	1				No	Yes	Vebæk 1943;48, Møller&Madsen 2007;10	Ruin dimensions measured after georeference of Vebæk survey plan (1943;fig.15)
E64a_03	E64a	10,33	3,58	37,79	2,89	3	0,8	2	6,17	4,44					No	5	1,5				No	Yes	Vebæk 1943;48, Møller&Madsen 2007;10	Ruin dimensions measured after georeference of Vebæk survey plan (1943;fig.15)
E64a_04	E64a	8,31	6,11	44,47	1,36	4	0,9	1	30,98						No	18	141,2		SE	2	No	Yes	NMA:Vebæk 1939, Vebæk 1943;50, Møller&Madsen 2007;10	Ruin dimensions measured after georeference of original Vebæk survey plan (1939)
E64a_05	E64a	4,55	4,16	17,85	1,09	4	0,95	1	5,24						No	9	261,2				No	Yes	NMA:Vebæk 1939, Vebæk 1943;50, Møller&Madsen 2007;10	Ruin dimensions measured after georeference of original Vebæk survey plan (1939)
E64a_06	E64a	6,03	3,95	20,96	1,53	3	1,1	1	5,48						No	4	180,9				No	Yes	NMA:Vebæk 1939, Vebæk 1943;51, Møller&Madsen 2007;10	Ruin dimensions measured after georeference of original Vebæk survey plan (1939)
E64a_07	E64a	5,76	3,64	18,95	1,58	3	0,9	1	4,65						No	4	162,5				No	Yes	NMA:Vebæk 1939, Vebæk 1943;52, Møller&Madsen 2007;10	Ruin dimensions measured after georeference of original Vebæk survey plan (1939)
E64a_08	E64a	4,96	3,19	13,87	1,55	5	0,6	1	6,02						No	4	142,7				No	Yes	NMA:Vebæk 1939, Vebæk 1943;52, Møller&Madsen 2007;10	Ruin dimensions measured after georeference of original Vebæk survey plan (1939)
E64b_01	E64b	24,63	17,29	323,11	1,42	2									No	1					No	No	Jespersen 1912;101, NMA:Roussell 1926, Roussell 1941;70	Note that because of the poor quality of Roussell's 1926 sketch survey, present ruin description is based on Google Earth© satellite imagery and the very corresponding Jespersen 1912 survey. Note

Ruin Data																								
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
																								that the ruin has been divided into three separate structures (ruin 1, 8 & 9)
E64b_02	E64b	6,4	3,33	19,84	1,92	5	0,95	1	6,29						No	4	25,1				No	No	Jespersen 1912;104, NMA:Roussell 1926, Roussell 1941;70	Ruins description from Google Earth© satellite imagery, and NMA:Roussell 1926 description and photograph. Jespernsen 1912 (fig.3a) ruin 6.
E64b_03	E64b	3,57	2,19	7,94	1,63	4	1	1	1,31						No	9	126,1				No	No	Jespersen 1912;104, NMA:Roussell 1926, Roussell 1941;70	Ruins description from Google Earth© satellite imagery, and NMA:Roussell 1926 description and photograph. Jespernsen 1912 (fig.3a) ruin 8.
E64b_04	E64b	8,94	3,94	32,79	2,27	3	0,9	1	20,31						Yes	18	152,4		SE	1	No	No	Jespersen 1912;104, NMA:Roussell 1926, Roussell 1941;70	Ruins description from Google Earth© satellite imagery, and NMA:Roussell 1926 description and photograph. Jespernsen 1912 (fig.3a) ruin 7.
E64b_05	E64b					3	0,8	1							No	4					No	No	NMA:Roussell 1926, Roussell 1941;70	Ruin dimensions not described
E64b_06	E64b					5		1							No	4	50				No	No	NMA:Roussell 1926, Roussell 1941;70	Ruin dimensions not described
E64b_07	E64b														No	27					No	No	NMA:Roussell 1926, Roussell 1941;70	Well or other feature
E64b_08	E64b	5,29	4,01	19,8	1,32		0,95	1	6,92						No	9	9,2				No	No	Jespersen 1912;101, NMA:Roussell 1926, Roussell 1941;70	Note that because of the poor quality of Roussell's 1926 sketch survey, present ruin description is based on Google Earth© satellite imagery and the very corresponding Jespersen 1911 survey. Note that the ruin has been divided into three separate structures (ruin 1, 8 & 9)
E64b_09	E64b	14,95	9,34	114,04	1,60	2	1,7	3	17,48	10,44	6,5				No	3	1				No	No	Jespersen 1912;101, NMA:Roussell 1926, Roussell 1941;70	Note that because of the poor quality of Roussell's 1926 sketch survey, present ruin description is based on Google Earth© satellite imagery and the very corresponding Jespersen 1911 survey. Note that the ruin has been divided into three separate structures (ruin 1, 8 & 9)
E64b_10	E64b	6,91	4,39	30,33	1,57			1							No	4					No	No	Jespersen 1912;104	Note Jespersen 1912 ruin 4; further description lacks
E64b_11	E64b	5,02	4,39	22,04	1,14			1							No	4					No	No	Jespersen 1912;104	Note Jespersen 1912 ruin 5; further description lacks
E64c_01	E64c	18,15	12,75	146,01	1,42	2	2,3								No	1					No	Yes	Vebæk 1939;fig.41, Møller&Madsen 2006;12	Ruin dimensions measured after georeference of Vebæk (1943;fig.41) survey plan
E64c_02	E64c	22,01	14,82	208,66	1,49	2	2,2								No	3	5,5				No	Yes	Vebæk 1939;fig.41, Møller&Madsen 2006;12	Ruin dimensions measured after georeference of Vebæk (1943;fig.41) survey plan
E64c_03	E64c	20,72	14,74	186,17	1,41	2	2,1								No	3	40				No	Yes	Vebæk 1939;fig.51, Møller&Madsen 2006;12	Ruin dimensions measured after georeference of Vebæk (1943;fig.51) survey plan
E64c_04	E64c	5	3,5	17,5	1,43	4	0,5	1	5,32						No	9	94,2				No	No	NM:Vebæk 1940, 1940, Vebæk 1943;79	Ruin dimensions and situation only from description (NM:Vebæk 1940 unpublished excavation report) georeferenced survey plan (Vebæk;1943.fig.40).
E64c_05	E64c	5,3	4,1	21,02	1,29	5	1	1	6,57						No	4	94,6				No	Yes	NM:Vebæk 1939, 1940, Vebæk 1943;79, Møller&Madsen 2006;11	Ruin dimensions measured after georeference of original Vebæk survey plan (NM; Vebæk 1939;R05 original survey plan)
E64c_06	E64c	6,2	2,4	14,88	2,58	5	0,6	1							No	9					No	No	NM:Vebæk 1940, 1940, Vebæk 1943;79	Ruin dimensions, construction, and situation on only from description (NM:Vebæk 1940 unpublished excavation report) and photo (C.K. Madsen 2006), and therefore only appromiximate.
E64c_07	E64c	6,5	4,2	28,21	1,55	5	0,65	1	21,12						No	18	213,8		Nw	3	No	Yes	NM:Vebæk 1940, 1940, Vebæk 1943;79, Møller&Madsen 2006;12	Note that Wall_th is based on fotograph (C.K. Madsen 2006) and only roughly accurate
E64c_08	E64c	10,45	4,75	41,01	2,20	3	1	2	20,04	1,03					No	18	260,6		N	1	No	Yes	NM:Vebæk 1939, 1940, Vebæk 1943;79, Møller&Madsen 2006;11	Møller&Madsen 2006 ruin 03. Ruin dimensions measured after georeference of original Vebæk survey plan (NM; Vebæk 1939;R08 original survey plan)
E64c_09	E64c	8,9	3,7	31,09	2,41	3	0,65	1	21,52						No	18	327,1		N	3	No	Yes	NM:Vebæk 1940, 1940, Vebæk 1943;79, Møller&Madsen 2007	Note that Wall_th is based on fotograph (C.K. Madsen 2006), and sketch survey plan (NM:Vebæk 1940), and only roughly accurate
E64c_10	E64c	4,92	3,75	18,26	1,31		0,95	1	5,72						No	14	101,8				No	Yes	NM:Vebæk 1939, 1940, 1943;79, Møller&Madsen 2006;11	Ruin dimensions measured after georeference of original Vebæk survey plan (NM; Vebæk 1939;R10 original survey plan)
E65_01	E65	43,3	40,7	1322,96	1,06	2									No	1					No	Yes	Møller&Madsen 2006;12	Note that Møller&Madsen Ruin 1 & 2 are interpreted and described as one
E65_02	E65	2,71	2,15	5,72	1,26	3	0,6	1	1,93						No	11	404,8				No	Yes	Møller&Madsen 2006	Note that there is no ruin description, only DGPS-survey and photograph
E65_03	E65	69,2	63,1	3115,42	1,10	2	0,6	1	3515,42						No	22	11				No	Yes	Møller&Madsen 2006;12	Stretch of dike. Ar_Comp has been estimated by continuing DGPS-surveyed lines
E65_04	E65	6,42	3,64	22,34	1,76	3									No	14	20,2				No	Yes	Møller&Madsen 2006;12	
E65_05	E65	21,67	12,36	226,51	1,75	2									No	3	5,7				No	Yes	Møller&Madsen 2006;12	
E65_06	E65	6,19	5,64	30,03	1,10	2	1	2	6,64	5,28					Yes	7	68				No	Yes	Møller&Madsen 2006;12	
E65_07	E65	5,25	3,4	17,39	1,54	3									Yes	14	62,3				No	Yes	Møller&Madsen 2006;13	
E65_08	E65	12,99	6,92	60,62	1,88	2	1	1	30,09						Yes	14	41,4				No	Yes	Møller&Madsen 2006;13	
E65_09	E65	9,52	5,34	45,21	1,78	6									Yes	27	82,2				No	Yes	Møller&Madsen 2006;13	Possible boathouse foundation cut into the slope
E65_10	E65	12,55	4,37	54,36	2,87	6									Yes	27	69,2				No	Yes	Møller&Madsen 2006;13	Possible boathouse foundation cut into the slope
E65_11	E65	11,87	9,71	75,77	1,22	3	0,85	1	57,19						No	18	165,6	182	NW	3	No	Yes	Møller&Madsen 2006;13	
E65_12	E65	10,85	8,91	57,47	1,22	3	0,8	2	42,66	1,54					No	18	314,5	182	NW	3	No	Yes	Møller&Madsen 2006;13	
E66_	E66														No	26					No	Yes	Bolender et al. 2010:13	
E66_01	E66	5,18	4,33	22,45	1,20	4	1,1	1	6,15						No	9	451,1				No	Yes	Holm 1883;114, Bruun 1895;370, Møller&Madsen 2006;14, NMA: Clemmensen&Kapel 2009;9	
E66_02	E66	16,3	7,67	122,14	2,13	4	1,45	1	64,44						No	12	5,3				No	Yes	Holm 1883;115, Bruun 1895;372, Møller&Madsen 2006;14, NMA: Clemmensen&Kapel 2009;9	
E66_02a	E66	32,5	28	875,94	1,16	4	1,9	1	553,96						No	13	0				No	Yes	Holm 1883;116, Møller&Madsen 2006;14, NMA: Clemmensen&Kapel 2009;9	
E66_03	E66	27,4	7,64	202,81	3,59	2	2,05	3	45,13	28,78	7,58				No	2	9,9				No	Yes	Holm 1883;116, Møller&Madsen 2006;14, NMA: Clemmensen&Kapel 2009;11	
E66_04	E66	16,75	5,65	84,65	2,96	2	1,4	3	13,32	13,19	4,15				No	6	113,2				No	Yes	Holm 1883;116, Møller&Madsen 2006;14, NMA: Clemmensen&Kapel 2009;11	
E66_05	E66	13,81	5,28	68,29	2,62	2	1,2	2	13,83	11,53					No	5	18,2				No	Yes	Holm 1883;117, Møller&Madsen 2006;14, NMA: Clemmensen&Kapel 2009;12	
E66_06	E66	11,28	5,76	60,39	1,96	3	1,2	2	15,41	8,48					No	5	35,5				No	Yes	Holm 1883;117, Møller&Madsen 2006;15, NMA: Clemmensen&Kapel 2009;13	
E66_07	E66	12,6	5,61	66,17	2,25	2	1,25	2	18,58	11,11					No	5	36,2				No	Yes	Holm 1883;117, Møller&Madsen 2006;15, NMA: Clemmensen&Kapel 2009;13	
E66_08	E66	8,27	7,24	49,74	1,14	2	1,25	1	23,93						No	15	61,9	141,9	W	1	No	Yes	Holm 1883;117, Møller&Madsen 2006;15, NMA: Clemmensen&Kapel 2009;14	Ruin dimensions are somewhat uncertain because the ruin has been disturbed
E66_09	E66	13,62	5,31	66,49	2,56	2	0,9	3	13,13	13,07	5,25				No	6	41,8				No	Yes	Holm 1883;118, Møller&Madsen 2006;15, NMA: Clemmensen&Kapel 2009;14	
E66_10	E66	9,64	9,95	92,8	0,97	2	1,2	2	25,81	18,82					No	7	139,9				No	Yes	Holm 1883;118, Møller&Madsen 2006;15, Bruun 1895;384, NMA: Clemmensen&Kapel 2009;14	
E66_11	E66	8,49	7,65	54,75	1,11	3	0,85	1	40,04						No	18	175,1	141,9	E	1	No	Yes	Holm 1883;117, Møller&Madsen 2006;15, Bruun 1895;384, NMA: Clemmensen&Kapel 2009;15	
E66_12	E66	6	3	18	2,00	2	1,25	1							No	14	196,1				No	Yes	Holm 1883;118, Møller&Madsen 2006;15, NMA: Clemmensen&Kapel 2009;15	Note that ruin is partially eroded and all measurements are uncertain
E66_13	E66	9,78	9,37	80,08	1,04	2	1,35	1	37,07						No	14	181,5				No	Yes	Holm 1883;118, Møller&Madsen 2006;15, NMA:	

Ruin Data																								
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
																							Clemmensen&Kapel 2009;16	
E66_15	E66	36,3	28,14	737,46	1,29	2									No	1					No	Yes	Holm 1883;118, Møller&Madsen 2006;15, NMA: Clemmensen&Kapel 2009;17	Note that Ar of ruin is only a rough estimta as ruin is very collapsed
E66_16	E66	15,05	4,68	64,73	3,22	2									No	14	48				No	Yes	Holm 1883;118, Møller&Madsen 2006;15, NMA: Clemmensen&Kapel 2009;17	
E66_17	E66														No	4					No	No	Holm 1883;118, Møller&Madsen 2006;15, NMA: Clemmensen&Kapel 2009;18	Ruin was never accurately described and could not be relocated in 2009 (see Clemmensen&Kapel 2009;18)
E66_18	E66	144,3	1,8	259,74	80,17	2	1,5	1	109600						No	24	110,3				No	Yes	NMA: Clemmensen&Kapel 2009;18	
E66_19	E66	16,42	5,9	69,9	2,78	3	1,5	2	25,1	17,04					No	5	215,4				No	Yes	NMA: Clemmensen&Kapel 2009;18	
E66_20	E66	14,66	4,48	62,93	3,27	3	0,9	3	15,56	9,75	5,66				No	8	370,3				No	Yes	NMA: Clemmensen&Kapel 2009;18	
E66_21	E66	50,45	31,95	1591,7	1,58	2	1,85	2	675,08	646,72					No	22	132,8	14,9		1	No	Yes	Bruun 1895;388, Møller&Madsen 2006;16, NMA: Clemmensen&Kapel 2009;19	Bruun 1895 ruin 8, Møller&Madsen 2006 ruin 25,Note that ruin dimensions are somewhat uncertain, as ruin is partially eroded; ruin measurements include the area until the river gorge.
E66_22	E66	12,26	12,05	145,08	1,02	2	1,25	2	40,59	36,32					No	7	127,9				No	Yes	Bruun 1895;388, NMA: Clemmensen&Kapel 2009;20	Bruun 1895 ruin 7, Møller&Madsen 2006 ruin 224
E66_23	E66	16,78	13,39	221,7	1,25	2	1,5	1	153,2						No	22	124,8	14,9		1	No	Yes	Bruun 1895;388, NMA: Clemmensen&Kapel 2009;20	Bruun 1895 ruin 6
E66_24	E66	17,1	1,5	42,69	11,40	2	1,15	1	214,96						No	21	186,7	15,7	W	1	Yes	Yes	Bruun 1895;388, NMA: Clemmensen&Kapel 2009;20	Bruun 1895 ruin 5, Møller&Madsen 2006 ruin 22, Ruin dimensions are somewhat uncertain as part of it is eroded;ruin measurements include the area until the river.
E66_25	E66	27,61	19,77	473,57	1,40	2	1,8	2	306,05	19,2					No	22	202,1	15,7	SW	1	Yes	Yes	Bruun 1895;388, Møller&Madsen 2006;16, Clemmensen&Kapel 2009;20	Bruun 1895 ruin 4, Møller&Madsen 2006 ruin 21
E66_26	E66	8,75	9,38	81,62	0,93	2	1,6	1	39,2						No	14	205,3				No	Yes	Bruun 1895;388, Møller&Madsen 2006;16, Clemmensen&Kapel 2009;21	Bruun 1895 ruin 4, Møller&Madsen 2006 ruin 21
E66_27	E66	8,27	3,11	24,15	2,66	6									Yes	27	42,6				No	Yes	Møller&Madsen 2006;16, Clemmensen&Kapel 2009;21	
E66_28	E66	9,9	3,99	37,76	2,48	6									Yes	27	36,4				No	Yes	Møller&Madsen 2006;16, Clemmensen&Kapel 2009;21	
E66_29	E66	8,91	3,04	26,52	2,93	5	0,8	1	16,78						No	18	46,5		SW	3	No	Yes	Clemmensen&Kapel 2009;21	
E66_30	E66	45,7	25,69	993,22	1,78	2									No	1	0				No	Yes	Møller&Madsen 2006;16, NMA:Clemmensen&Kapel 2009;22	Møller&Madsen 2006 ruin 26. Note that ruin is here interpreted as dwelling; midden was found on the slope below by coring.
E66_31	E66	33,84	5,77	193,13	5,86	2	1,15	4	38,65	32,62	19,62	9,72			No	6	9,2				No	Yes	Bruun 1895;388, Møller&Madsen 2006;16	Bruun 1895 ruin 3
E66_32	E66	8	8	64	1,00	2									No	18	34,4		SW		No	No	NMA: Albrethsen (in Bruun 1895;385	Note that ruin is sketched in on Bruun 1895's survey in the copy kept at the National Museum, Middle Ages and Renaissance
E67_01	E67	24,46	17,3	357,77	1,41	2									No	1					No	Yes	Møller&Madsen 2006;17	Redrawn after Møller&Madsen 2006 and georeferenced Google Earth © satellite imagery
E67_02	E67	2,22	1,59	2,69	1,40	5									No	9	165,7				No	Yes	Madsen 2009;10	The ruin can alternative be interpreted as a recent collapsed cairn
E67_03	E67	6,49	2,75	16,76	2,36	5	0,4								No	4	156,5				No	Yes	Madsen 2009;10	Note the ruin dimensions are only roughly approximate because the structure is only partially preserved
E67_04	E67	10,92	5,8	57,31	1,88	2	1,4	1	22,35						No	14	8,9				No	No	Møller&Madsen 2006;17	Redrawn after Møller&Madsen 2006 and georeferenced Google Earth © satellite imagery
E67_05	E67	38	7	260,62	5,43	2	1,2	4	57,16	48,39	37,59	24,56			No	6	2,5				No	No	NMA:Bruun 1894 II, Møller&Madsen 2006;17	Redrawn after Bruun 1894 sketch plan, Møller&Madsen 2006 and georeferenced Google Earth © satellite imagery. Ruin measurements are very uncertain
E67_06	E67	13,23	6,43	76,6	2,06	2	1,6	1	27,89						No	14	11,3				No	No	Møller&Madsen 2006;17	Redrawn after Bruun 1894 sketch plan, Møller&Madsen 2006 and georeferenced Google Earth © satellite imagery. Ruin measurements are very uncertain
E67_07	E67	11,97	6,02	64,28	1,99	2	1,25	1	27,45						No	14	38,6				No	No	Møller&Madsen 2006;17	Redrawn after Bruun 1894 sketch plan, Møller&Madsen 2006 and georeferenced Google Earth © satellite imagery. Ruin measurements are very uncertain
E68_01	E68	17,68	8,01	134,09	2,21	2		1							No	14	142,3				No	Yes	NMA:Bruun 1894 III;34, Bruun 1895;391, Møller&Madsen 2006:17	Note: Part of Møller&Madsen 2006 ruin 3. Two rooms visible, but the extent is uncertain due to poor preservation
E68_02	E68	13,47	6,84	81,56	1,97	2		1							No	14	125,7				No	Yes	NMA:Bruun 1894 III;34, Bruun 1895;391, Møller&Madsen 2006:17	Note: Part of Møller&Madsen 2006 ruin 3. Two rooms visible, but the extent is uncertain due to poor preservation
E68_03	E68	31,1	17,8	449,26	1,75	2									No	1					No	Yes	NMA:Bruun 1894 III;34, Bruun 1895;391, Møller&Madsen 2006:18	Note: Møller&Madsen ruin 6. Ruin has been divided on four individual structures (ruin 3, 4, 9, 11) based on Bruun description and GoggleEarth satellite imagery
E68_04	E68	24,4	9,6	215,62	2,54	2									No	2	4,8				No	Yes	NMA:Bruun 1894 III;34, Bruun 1895;391, Møller&Madsen 2006:18	Note: Part of Møller&Madsen ruin 6. Ruin has been seperated from ruin 3 based on Bruun description and GoggleEarth satellite imagery, and its dimensions are only roughly accurate
E68_05	E68														No	28					No	No	NMA:Bruun 1894 III;34, Bruun 1895;391	Ruin mentined by Bruun, but not described further
E68_06	E68	9,78	8,43	69,39	1,16	3	0,8	2	29,12	12,32					No	15	71,2	57,5		1	No	Yes	NMA:Bruun 1894 III;34, Bruun 1895;391, Møller&Madsen 2006:18	Note: Møller&Madsen ruin 7
E68_07	E68	15,78	9,52	132,99	1,66	5	1,1	1	95,04						No	15	28,1	57,5	W	1	No	Yes	Møller&Madsen 2006;17	Note: Møller&Madsen ruin 4
E68_08	E68	6,44	4,3	27,66	1,50	4	0,8	1	12,18						No	9	341,6				No	Yes	Møller&Madsen 2006;18	
E68_09	E68	5,37	4,66	20,79	1,15	3	1,05	1	8,34						Yes	14	19,6				No	Yes	Møller&Madsen 2006;18	Note: Møller&Madsen ruin 5
E68_10	E68	8,74	6,19	46,83	1,41	2									No	14	2,5				No	Yes	NMA:Bruun 1894 III;34, Bruun 1895;391, Møller&Madsen 2006:17	Note: Part of Møller&Madsen ruin 6. Ruin has been seperated from ruin 3 based on Bruun description and GoggleEarth satellite imagery, and its dimensions are only roughly accurate
E68_11	E68	11,68	8,77	87,46	1,33	2									No	14	9,9				No	Yes	NMA:Bruun 1894 III;34, Bruun 1895;391, Møller&Madsen 2006:17	Note: Part of Møller&Madsen ruin 6. Ruin has been seperated from ruin 3 based on Bruun description and GoggleEarth satellite imagery, and its dimensions are only roughly accurate
E69_01	E69	8,56	6,07	46,99	1,41	4	1,5	1	22,93						No	14	290,4				No	Yes	Bruun 1895;392, Møller&Madsen 2006:19	Note: Møller&Madsen 2006 ruin 9
E69_02	E69														No	28					No	No	NMA: Bruun 1894 III;33	Ruin mentioned by Bruun, probably removed
E69_04	E69	37,5	22,4	661,01	1,67	2									No	1					No	Yes	Bruun 1895;392, Møller&Madsen 2006:18	Note: Møller&Madsen 2006 ruin 2
E69_05	E69	14,68	5,23	71,5	2,81	2	1,2	4	11,78	7,98	5,76	5,38			No	6	31,2				No	Yes	Bruun 1895;392, Møller&Madsen 2006:18	Note: Møller&Madsen 2006 ruin 3
E69_06	E69	10,48	5,82	53,16	1,80	2									No	14	59,1				No	Yes	NMA: Bruun 1894 III;33, Møller&Madsen 2006:18	Note: Møller&Madsen 2006 ruin 1, ruin has been divided on three individual structures based on Bruun description and GoggleEarth satellite imagery
E69_07	E69	6,5	5,34	27,64	1,22	2	1	1	14,75						Yes	14	79,7				No	Yes	Bruun 1895;392, Møller&Madsen 2006:19	
E69_08	E69	24,99	18,66	350,5	1,34	3	0,5	3	220,76	65,86	4,32				No	18	638,6		S	3	Yes	Yes	Bruun 1895;392, Arneborg et al. 2008;41	Note: Arneborg et al. 2008 ruin 0822
E69_09	E69	6,98	4,88	29,43	1,43	3	1,5	1	12,36						No	4	448,7				No	Yes	Bruun 1895;392, Arneborg et al. 2008;41	Note: Arneborg et al. 2008 ruin 0821
E69_10	E69	20,53	6,51	128,12	3,15	2	1,5	3	37,58	11,5	5,03				No	6	119,4				No	Yes	Bruun 1895;392, Møller&Madsen 2006:19	Note: Møller&Madsen 2006 ruin 8
E69_11	E69	11,07	6,86	74,71	1,61	2	1	1	37,72						No	14	144,6				No	Yes	Bruun 1895;392, Møller&Madsen 2006:19	Note: Møller&Madsen 2006 ruin 6
E69_12	E69	10,8	5,13	49,19	2,11	2									No	4	70,2				No	Yes	NMA: Bruun 1894 III;33, Møller&Madsen 2006:18	Note: Møller&Madsen 2006 ruin 1, ruin has been divided on three individual structures based on Bruun description and GoggleEarth satellite imagery
E69_13	E69	10,3	5,9	56,63	1,75	2									No	4	59,4				No	Yes	NMA: Bruun 1894 III;33, Møller&Madsen 2006:18	Note: Møller&Madsen 2006 ruin 1, ruin has been divided on three individual structures based on Bruun description and GoggleEarth satellite imagery

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E70_01	E70	32,55	12,15	330,3	2,68	2									No	1					No	Yes	Bruun 1895;393, NMA:Vebæk 1948;8, 1950;21, Vebæk 1992;72, Møller&Madsen 2006;19	Ruin has been partially excavated (Vebæk 1993;72). Possible extension to the W
E70_02	E70	22,27	7,2	153,52	3,09	2	2	3	17,31	13,54	11,94				No	6	16,5				No	Yes	Bruun 1895;393, NMA:Vebæk 1948;8, Vebæk 1992;72, Møller&Madsen 2006;20	Note: Møller&Madsen 2006 ruin 3. Possile extension to the W (see ruin E70_02a): an enclosure. Ruin measurements partly from DGPS-survey, GoogleEarth©satellite imagery, and Bruun 1895 survey
E70_02a	E70	6,88	3,97	23,85	1,73										No	17	21,8		W	1	No	Yes	Bruun 1895;393	Ruin dimensions from rough description and rough survey sketch only
E70_03	E70	7,02	4,55	31,31	1,54	2	1	1	11,89						No	4	38,3				No	Yes	Bruun 1895;393, NMA:Vebæk 1948;8, Vebæk 1992;72, Møller&Madsen 2006;20	Note: Møller&Madsen 2006 ruin 4. Ruin measurements partly from DGPS-survey, GoogleEarth©satellite imagery, and Bruun 1895 survey
E70_04	E70	19,65	8,7	148,29	2,26	2									No	2	28,8				No	Yes	Bruun 1895;393, NMA:Vebæk 1948;8, Vebæk 1992;72, Møller&Madsen 2006;20	Note: Møller&Madsen 2006 ruin 5
E70_05	E70	7,42	4,54	30,58	1,63	2	1,2	1	9,54						No	4	67				No	Yes	Bruun 1895;393, NMA:Vebæk 1948;8, Vebæk 1992;72, Møller&Madsen 2006;20	Note: Møller&Madsen 2006 ruin 6
E70_06	E70	6	2,95	17,92	2,03	4	0,65	1	6,32						No	9	123,2				No	Yes	Bruun 1895;393, NMA:Vebæk 1948;8, Vebæk 1992;72, Møller&Madsen 2006;20	Note: Møller&Madsen 2006 ruin 8
E70_07	E70	4,26	3,7	13,65	1,15	2	1,05	1	3,88						No	14	51,9				No	Yes	Møller&Madsen 2006;20	Ruin measurements partly from DGPS-survey and GoogleEarth©satellite imagery
E70_08	E70	6,62	4,7	27,77	1,41	2	1,25	1	7,42						Yes	14	8,7				No	Yes	Møller&Madsen 2006;19	Note: Møller&Madsen 2006 ruin 2. Ruin measurements partly from DGPS-survey, GoogleEarth©satellite imagery, and Bruun 1895 survey
E70_09	E70	2,18	1,88	3,22	1,16	5	0,3	1	1,93						No	20	77,5				No	Yes	Arneborg et al. 2008;42	
E71a_01	E71a	48,11	31,89	1072	1,51	2									No	1					No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;11	
E71a_02	E71a	10,13	5,14	47,33	1,97	3									No	14	9				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;11	
E71a_03	E71a	19,98	10,58	148,27	1,89	2	1,5								No	3	6,4				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;11	Note that the ruin has several visible rooms, but too collapsed to measure them with any accuracy
E71a_04	E71a	11,64	5,49	71,28	2,12	2	1,3	2	12,61	7,24					No	5	54,4				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;11	
E71a_05	E71a	9,36	8,8	64,26	1,06	4	1,1	1	33,49						No	16	29,2			1	No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;11	Note: Møller&Madsen 2006 ruin 7
E71a_06	E71a	10,27	5,5	51,03	1,87	2	1,25	2	11,74	6,49					No	5	124,6				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;12	Note: Møller&Madsen 2006 ruin 9
E71a_07	E71a	6,72	4,51	28,91	1,49	5	1,1	1	10,43						No	9	218,9				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;11	Note: Møller&Madsen 2006 ruin 6
E71a_08	E71a	9,17	5,92	47,14	1,55	2	1,1	2	12,73	8,48					Yes	5	92,2				No	Yes	NMA:Vebæk 1948;8, Møller&Madsen 2007;11	
E71a_10	E71a	17,58	1	17,58	17,58	2	1								No	25	68				No	Yes	Møller&Madsen 2007;11	Stretch of homefield dike
E71N_08	E71N	6,04	3	16,59	2,01		0,8	1	5,75						No	4	113,1				No	Yes	Vebæk 1993;37, Møller&Madsen 2006;11	Note description Build_Mat or photograph
E71N_09	E71N	6,05	2,45	14	2,47	3	0,8	1	6,32						No	18	79	345,8	S	1	No	Yes	Vebæk 1993;37, Møller&Madsen 2006;11	
E71N_10	E71N	6,61	3,04	20,74	2,17	2	0,95	1	7,41						Yes	4	60,8				No	Yes	Vebæk 1993;37, Møller&Madsen 2006;11	
E71N_11	E71N	6,46	3,74	21,71	1,73	2	0,8	1	9,3						Yes	4	53,8				No	Yes	Vebæk 1993;37, Møller&Madsen 2006;11	
E71N_12	E71N	26,05	11,89	228,59	2,19	2	1,5								No	1					No	Yes	Vebæk 1993;25pp, Møller&Madsen 2006;11	
E71N_12a	E71N	21,18	7,73	112,11	2,74	2	1,6	3	27,22	5,77	9,46				No	2	0				No	Yes	Vebæk 1993;36pp, Møller&Madsen 2006;11	Note that the byre is here treated as a separate building. Dimensions of the two smallest rooms are somewhat uncertain as the ruin is not wholle preserved
E71N_13	E71N	5,08	3,54	14,94	1,44	5									No	14	17,3				No	Yes	Vebæk 1993;38pp, Møller&Madsen 2006;11	Poor ruin preservation and description excludes further estimates of dimensions
E71N_14	E71N	6,16	4,67	25,55	1,32		0,95	1	10,29						No	4	5,8				No	Yes	Vebæk 1993;38pp, Møller&Madsen 2006;11	Area_Comp is somewhat uncertain, because ruin is not wholly preserved. Build_Mat unknown
E71N_15	E71N	9,76	4,78	46,79	2,04	4	0,85	1	25,75						No	9	36,8				No	Yes	Vebæk 1993;38pp, Møller&Madsen 2006;11	
E71N_16	E71N	16,31	5,17	83,3	3,15	2	1,2	3	14,61	11,98	7,38				No	6	52,5				No	Yes	Vebæk 1993;38pp, Møller&Madsen 2006;11	
E71N_17	E71N	8,41	5,22	41,56	1,61	5	1,2	1	16,68						No	18	81,1	147,4	SW	4	No	Yes	Vebæk 1993;38pp, Møller&Madsen 2006;11	
E71N_18	E71N	5,1	2,94	14,62	1,73	2	0,6	1	4,87						Yes	14	119,6				No	Yes	Vebæk 1993;38pp, Møller&Madsen 2006;11	
E71N_19	E71N	6,95	5,42	29,5	1,28	3	1,05	1	8,31						No	4	156				No	Yes	Vebæk 1993;38pp, Møller&Madsen 2006;11	
E71N_20	E71N	15,28	11,8	145,53	1,29	3	1,1	4	71,72	26,21	2,07	1,86			No	18	242,5	18	S	2	Yes	Yes	NMA:Vebæk 1949;13, Vebæk 1993;38pp, Møller&Madsen 2006;11	
E71N_21	E71N	4,39	2,78	7,82	1,58	6	0,4	1	5,38						No	20	222,5	18	SE	1	No	Yes	NMA:Vebæk 1949;13, Vebæk 1993;38pp, Møller&Madsen 2006;11	
E71N_22	E71N	3,2	1,2	3,84	2,67										No	19			S		No	Yes	Bruun 1895;394	Note: ruin lacks further description, but cannot be mistaken for any of the ruins descriped by Vebæk (1993)
E71S_01	E71S	4,84	4,33	19,3	1,12	2	0,9	1	5,91						No	14	18,7				No	Yes	Vebæk 1993;43, Møller&Madsen 2006;11	
E71S_02	E71S	21,05	10,85	193,89	1,94	2									No	1					No	Yes	Vebæk 1993;38p, Møller&Madsen 2006;11	
E71S_03	E71S	14,1	7,01	78,78	2,01	2	1,25	3	15,07	7,3	5,34				No	2	5				No	Yes	Vebæk 1993;38p, Møller&Madsen 2006;11	
E71S_04	E71S	8,78	3,89	32,87	2,26	3	1	1	10,9						No	4	15,2				No	Yes	Vebæk 1993;44, Møller&Madsen 2006;11	Note that the stated dimensions are somewhat uncertain as ruin is not wholly preserved
E71S_05	E71S	7,99	4,58	34,49	1,74	2	0,85	1	14,91						No	4	32,2				No	Yes	Vebæk 1993;44, Møller&Madsen 2006;11	
E71S_06	E71S	4,74	3,99	15,99	1,19	2	0,65	2	3,26	1,53					Yes	14	27,9				No	Yes	Vebæk 1993;44, Møller&Madsen 2006;11	
E71S_07	E71S	5,28	2,68	13,91	1,97	3	0,65	1	4,67						No	4	33,5				No	Yes	Vebæk 1993;44, Møller&Madsen 2006;11	
E72_01	E72	20,02	6,54	113,54	3,06	2	1,75	2	23,18	16,26					No	2	5,1				No	Yes	Bruun 1895;395, Møller&Madsen 2007;12	Note: Møller&Madsen 2007 ruin 6. Ruin measurements partly from DGPS-survey, GoogleEarth©satellite imagery, and Bruun 1895 survey
E72_02	E72	5,99	4,09	22	1,46	3	1,1	1							No	18	56,7	170,4	SE	1	No	Yes	Bruun 1895;396, Møller&Madsen 2007;12	Note: Møller&Madsen 2007 ruin 7. Dis_Encl is only approximate
E72_03	E72	3,47	3,15	8,62	1,10	5	0,5	1	3,7						No	9	132,8				No	Yes	Bruun 1895;396, Møller&Madsen 2007;12	Note: Møller&Madsen 2007 ruin 8
E72_04	E72	25,89	10,4	186,14	2,49	2	1,55	4	33,53	15,66	11,39	9,85			No	1					No	Yes	Bruun 1895;395, Møller&Madsen 2007;12	Note: Møller&Madsen 2007 ruin 4. Ruin measurements partly from DGPS-survey, GoogleEarth©satellite imagery, and Bruun 1895 survey
E72_05	E72	13,75	4,77	63,35	2,88	2	1,25	2	17,2	7,54					No	5	21,9				No	Yes	Bruun 1895;395, Møller&Madsen 2007;13	Note: Møller&Madsen 2007 ruin 12. Ruin measurements partly from DGPS-survey, GoogleEarth©satellite imagery, and Bruun 1895 survey
E72_06	E72	9,21	4,78	40,71	1,93	2	1,2	1	14,34						No	4	25,2				No	Yes	Bruun 1895;395, Møller&Madsen 2007;13	Note: Møller&Madsen 2007 ruin 10. Ruin measurements partly from DGPS-survey, GoogleEarth©satellite imagery, and Bruun 1895 survey
E72_07	E72	16,24	5,93	88,34	2,74	2	1,5	2	19,83	8,84					No	5	32,6				No	Yes	Bruun 1895;395, Møller&Madsen 2007;13	Note: Møller&Madsen 2007 ruin 13. Ruin measurements partly from DGPS-survey, GoogleEarth©satellite imagery, and Bruun 1895 survey
E72_08	E72	6,9	4,46	28,84	1,55	2	1,15	1	9,21						No	4	68,2				No	Yes	Bruun 1895;395, Møller&Madsen 2007;13	Note: Møller&Madsen 2007 ruin 16. Ruin measurements partly from DGPS-survey, GoogleEarth©satellite imagery, and Bruun 1895 survey
E72_09	E72	46,27	17,34	530,69	2,67	2									No	1					No	Yes	Bruun 1895;395, Møller&Madsen 2007;13	Note: Møller&Madsen 2007 ruin 15. Ruin measurements partly from DGPS-survey, GoogleEarth©satellite imagery, and Bruun 1895 survey. Some rooms corresponding with Bruun's description (1896;395) are clearly visible on satellite imagery, but others are burried beneath collapse: No_Comp have therefor been omitted
E72_10	E72	5,65	4,39	24,8	1,29			1							No	18	69,2	317,9	NE		No	No	Bruun 1895;395	Ruin measurements from Bruun description and rough survey sketch only

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E72_11	E72	8,38	4,3	34,25	1,95	3	0,95	2	8,88	3,84					No	5	116,8				No	Yes	Bruun 1895;396, Møller&Madsen 2007;13	
E72_13	E72	9,41	4,08	38,39	2,31										No	28		99,5		2	No	No	Bruun 1895;395	Ruin measurements from Bruun description and rough survey sketch only
E72_14	E72	14,37	5,52	72,34	2,60	2	1,15	2	17,7	9,11					No	5	23				No	Yes	Møller&Madsen 2007;12	Note: Møller&Madsen 2007 ruin 1. Ruin measurements partly from DGPS-survey and GoogleEarth©satellite imagery.
E72_15	E72	4,09	3,34	12,56	1,22	2	1,05	1	2,18						Yes	14	20				No	Yes	Møller&Madsen 2007;12	Note: Møller&Madsen 2007 ruin 3. Ruin measurements partly from DGPS-survey and GoogleEarth©satellite imagery.
E72_16	E72	6,14	5,24	27,49	1,17	2	1,25	1	6,67						No	14	21,7				No	Yes	Møller&Madsen 2007;12	Note: Møller&Madsen 2007 ruin 2. Ruin measurements partly from DGPS-survey and GoogleEarth©satellite imagery.
E72_17	E72	21,47	10,09	176,35	2,13	2									No	1					No	Yes	Møller&Madsen 2007;12	Note: Møller&Madsen 2007 ruin 4. Ruin measurements partly from DGPS-survey and GoogleEarth©satellite imagery.
E72_18	E72	9,13	4,36	38,34	2,09	2	0,95	2	7,53	6,68					No	5	14,8				No	Yes	Møller&Madsen 2007;12	Note: Møller&Madsen ruin 5
E72a_01	E72a	5	3	15	1,67										No	18					No	No	NMA:Vebæk 1948;8, Møller&Madsen 2006;13	Ruin not reidentified in 2006
E73_01	E73	9,62	8,18	61,02	1,18	5	0,9								No	1					No	Yes	Holm 1883;126, Kapel 2004;11, Møller&Madsen 2007	
E73_02	E73	16,37	9,87	104,45	1,66	3	0,9	3	45,85	21,71	10,43				No	18	186,2	310,9	SE	3	No	Yes	Holm 1883;126, Kapel 2004;10, Møller&Madsen 2007	
E73_03	E73	6,19	4,12	21,24	1,50	4	0,9	1	12,09						No	18	186,3		SE		No	Yes	Holm 1883;126, Kapel 2004;10, Møller&Madsen 2007	
E73_04	E73	9,56	3,76	33,87	2,54		1	2	7,94	3,73					No	5	166,5				No	Yes	Holm 1883;126, Kapel 2004;11, Møller&Madsen 2007	Build_Mat not described
E73_05	E73	8,14	3,52	28,58	2,31		0,9	1	10,37						No	4	177,8				No	Yes	Holm 1883;127, Kapel 2004;11, Møller&Madsen 2007	Build_Mat not described
E73_06	E73	6,68	3,43	22,72	1,95	3	0,65	1	10,95						No	4	196,5				No	Yes	Holm 1883;127, NMA:Petersen 1894;12, Kapel 2004;10, Møller&Madsen 2007	Note: NMA:Petersen ruin VII
E73_07	E73	11,16	3,5	39,14	3,19	3	0,75	2	6,25	5,56					No	5	159,3				No	No	Holm 1883;127, NMA:Petersen 1894;12, Kapel 2004;10, Møller&Madsen 2007	Note: NMA:Petersen ruin VI. Ruin was not DGPS surveyed or identified in the Kapel et al. or Møller&Madsen surveys, but is clearly visible on GoogleEarth© satellite imagery, from which ruin has been placed and measured
E73_08	E73	15,7	7,15	109,96	2,20	5	1,5	1	50,73						Yes	14	97,9				No	Yes	Holm 1883;127, NMA:Petersen 1894;12, Kapel 2004;10, Møller&Madsen 2007	Note: NMA:Petersen ruin VIII, Kapel et al. & Møller&Madsen R07
E73_09	E73	4,9	4,57	21,72	1,07	2	0,9	1	8,89						Yes	14	108,9				No	Yes	Holm 1883;127, NMA:Petersen 1894;12, Kapel 2004;10, Møller&Madsen 2007	Note: Kapel et al. & Møller&Madsen R08
E73_10	E73	13,1	5,4	67,73	2,43	3	1,15	1	28,43						No	4	134,6				No	Yes	Holm 1883;127, NMA:Petersen 1894;12, Kapel 2004;10, Møller&Madsen 2007	Note: NMA:Petersen ruin V(?), Kapel et al. & Møller&Madsen R09
E73_11	E73	15,93	7,02	98,02	2,27	5	1,05	2	45,91	7,57					No	15	108,4	314,1		1	No	Yes	Holm 1883;126, NMA:Petersen 1894;11, Kapel 2004;10, Møller&Madsen 2007	Note: NMA:Petersen ruin IV,Kapel et al. & Møller&Madsen R10
E73_12	E73	9,41	4,75	44,16	1,98	3	0,85	1	21,53						No	14	76,4				No	Yes	Holm 1883;127, NMA:Petersen 1894;11, Kapel 2004;10, Møller&Madsen 2007	Note: NMA:Petersen ruin III
E73_13	E73	22,68	20,64	288,35	1,10	2									No	1					No	Yes	Holm 1883;127, NMA:Petersen 1894;11, Kapel 2004;10, Møller&Madsen 2007	Note: NMA:Petersen ruin I
E73_14	E73	4,34	3,87	15,62	1,12	3	0,7	1	6,93						No	14	62,4				No	Yes	Holm 1883;127, NMA:Petersen 1894;13, Kapel 2004;10, Møller&Madsen 2007	Note: NMA:Petersen ruin XI
E73_15	E73	5,59	4	22,76	1,40	3	0,85	1	9,22						No	14	105,4				No	Yes	Holm 1883;127, Kapel 2004;10, Møller&Madsen 2007	
E73_16	E73	13,39	4,9	63,21	2,73	3	1	3	10,02	9,92	9,12				No	6	97,3				No	Yes	Holm 1883;127, NMA:Petersen 1894;13, Kapel 2004;10, Møller&Madsen 2007	Note: NMA:Petersen ruin X
E73_17	E73	11,61	7,76	66,94	1,50	3	1	4	8,54	8,05	8,05	3,96			No	6	116,3				No	Yes	Holm 1883;127, NMA:Petersen 1894;13, Kapel 2004;10, Møller&Madsen 2007	Note: NMA:Petersen ruin IX
E73_18	E73	9,13	4,36	39,03	2,09	2	1,05	1	16,2						No	4	247				No	Yes	Holm 1883;127, Kapel 2004;10, Møller&Madsen 2007	
E73_19	E73	4,5	4	18	1,13	4		1	18						No	9	129,2				No	No	Kapel et al. 2004;11	Ruin is too collapsed to estimate dimensions. Ar_Comp 1 from ruin description
E73_20	E73	4,37	3,71	15,85	1,18	2	0,9	1	5,05						No	14	245,1				No	Yes	Møller&Madsen 2007	Note that ruin description is lacking and the measurements are based on ruin description and photograph
E73_21	E73	9,59	3,98	36,92	2,41		1,05	2	7,05	5,97					No	5	57,7				No	Yes	Kapel et al. 2004;10	Note: Kapel et al. ruin XI
E74_01	E74	22,7	12	232,11	1,89	4	0,9	2	189,09	10,07					No	18	374		S	3	No	Yes	Bruun 1895;397, NMA:Bak 1969;N74, Kapel et al. 2004;8	Note that the structure is here, based on photographs and visual inspection (2006), reinterpreted as having compartment in the NE corner
E74_02	E74	8,26	3,25	24,66	2,54	2	1,05	3	4,65	3,79	1,4				No	6	325,8				No	Yes	Bruun 1895;397, NMA:Bak 1969;N74, Kapel et al. 2004;8	
E74_03	E74	14,62	7,7	106,31	1,90	2									No	2	23,4				No	Yes	Bruun 1895;397, Kapel et al. 2004;8	
E74_04	E74	20,12	17,69	298,41	1,14	2									No	1					No	Yes	Bruun 1895;397, Kapel et al. 2004;8	Note: Bak 1969 ruin 2
E74_05	E74	6,54	3,56	21,21	1,84										No	28					No	Yes	NMA:Bruun 1894;85, Berglund 2001;3; Kapel et al. 2004;8	
E74_06	E74	4	3	12	1,33										No	28					No	No	NMA:Bruun 1894;85, Berglund 2001;3, Kapel et al. 2004;8	
E74_07	E74	8,12	6,3	44,2	1,29	2	0,75	3	10,46	5,47	4,9				No	14	381,4				No	Yes	Bruun 1895;397, Kapel et al. 2004;9	
E74_08	E74	1,32	0,9	0,96	1,47	6	0,3	1	0,81						No	20	449,9				No	Yes	Møller&Madsen 2007	
E75_01	E75	25,14	17,84	376,88	1,41	2									No	1					No	Yes	Bruun 1895;398, Møller&Madsen 2006;20	
E75_02	E75	8,84	4,9	41,7	1,80	3	0,5	2	9,48	7,56					Yes	5	56,1				No	Yes	Bruun 1895;398, Møller&Madsen 2006;20	
E75_03	E75	8,31	5,52	46	1,51	5	1	1	19,96						No	14	54,1				No	Yes	Bruun 1895;398, Møller&Madsen 2006;20	
E75_04	E75	31,2	23,3	541,15	1,34	2									No	1					No	Yes	Bruun 1895;398, Møller&Madsen 2006;20	
E75_05	E75	26,5	13,9	325,79	1,91	2									No	1					No	Yes	Bruun 1895;399, Møller&Madsen 2006;21	
E75_06	E75	5,65	3,15	16,53	1,79	3	1	1	5,53						No	4	18,8				No	Yes	Bruun 1895;399, Møller&Madsen 2006;21	
E75_07	E75	7,53	3,49	24,04	2,16	3	0,95	1	7,69						Yes	4	28,8				No	Yes	Bruun 1895;399, Møller&Madsen 2006;21	
E75_08	E75	6,84	3,55	22,97	1,93	3	0,85	1	8,37						No	4	77,8				No	Yes	Møller&Madsen 2006;21	
E75_09	E75	3,58	3,37	11,69	1,06	2	0,6	1	4,1						Yes	14	54,1				No	Yes	Møller&Madsen 2006;21	
E75_10	E75	5,48	4,31	22,57	1,27	2	1	1	6,5						Yes	14	9,4				No	Yes	Møller&Madsen 2006;21	
E75_11	E75	9,6	6,12	50,73	1,57	2	1,2	2	8,7	1,4					Yes	14	19,5				No	Yes	Møller&Madsen 2006;21	
E75_12	E75	14,35	6,43	88,31	2,23	2	1	2	21,79	19,64					Yes	5	35,4				No	Yes	Møller&Madsen 2006;21	
E75_13	E75	5,83	3,22	24,13	1,81	3	0,65	1	7,76						No	14	75,9				No	Yes	Møller&Madsen 2006;21	
E75_14	E75	3,06	2,92	7,64	1,05	1	0,8	1	2,76						Yes	27	37,4				No	Yes	Møller&Madsen 2006;21	
E75_15	E75	3,69	2,82	10,28	1,31	3	0,7	1	3,53						No	14	135,1				No	Yes	Field report under preparation	

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E75_16	E75	5,43	3,95	21,06	1,37	3	0,8	1	9,09						No	4	539,3				No	Yes	Field report under preparation	
E75_17	E75	17,87	8,66	116,12	2,06	5	0,6	2	96,04	1,45					No	18	573,1		SE	2	No	Yes	Field report under preparation	
E76_01	E76	22	16	352	1,38	2									No	1					No	No	Bruun 1895;400, NMA:Krogh&Albrethsen 1968/71	Note that ruin has been removed and all measurements are based on prior roough survey sketches. There is notable disagreement between the prior surveys as to the size and type of structure
E76_02	E76	20	5	100	4,00										No	2	39,6				No	No	Bruun 1895;400	Measurements based on rough survey sketch and description
E76_03	E76	18	5	90	3,60										No	2	32,6				No	No	Bruun 1895;400	Measurements based on rough survey sketch and description
E76_04	E76	4,2	3,93	15,63	1,07	3	1	1	3,11						No	14	29,8				No	Yes	Bruun 1895;400, NMA:Krogh&Albrethsen 1968/71, Møller&Madsen 2007;14	
E76_05	E76	9,6	2,4	23,04	4,00	3	0,55	2	5,97	3,13					No	5	67,5				No	No	Bruun 1895;400, NMA:Krogh&Albrethsen 1968/71, Møller&Madsen 2007;14	Measurements based on rough survey sketch and description
E76_06	E76	18	10	180	1,80	2									No	1					No	No	Bruun 1895;400, NMA:Krogh&Albrethsen 1968/71, Møller&Madsen 2007;14	Note that ruin has been removed and all measurements are based on prior roough survey sketches. There is some disagreement between the prior surveys as to the size and type of structure
E76_07	E76	13,56	5,09	63,65	2,66	1	1,25	2	13,93	8,62					No	5	214,9				No	Yes	NMA:Krogh&Albrethsen 1968/71, Møller&Madsen 2007;14	
E76_07a	E76	3,95	3,58	15,59	1,10	1									No	25	228,7	119,9	E	1	No	No	NMA:Krogh&Albrethsen 1968/71, Møller&Madsen 2007;14	Dike built against stable, measurements based on rough survey plan
E76_08	E76	15,52	5,74	78,86	2,70	1	1,75	1	25,11						No	14	253,2				No	Yes	NMA:Krogh&Albrethsen 1968/71, Møller&Madsen 2007;14	
E76_09	E76	70	1	70	70,00	2	1	1	59680						No	24	253,6				No	Yes	NMA:Krogh&Albrethsen 1968/71, Møller&Madsen 2007;14	Stretch of homefield dike (see also ruin 17-18)
E76_10	E76	7,78	4,34	27,92	1,79	3	0,65	1	21,22						No	18	545,4	315,3	SE	3	No	Yes	NMA:Krogh&Albrethsen 1968/71, Møller&Madsen 2007;14	
E76_11	E76	10,74	4,29	40,83	2,50	2	1,05	2	8,28	5,98					No	5	109				No	Yes	NMA:Krogh&Albrethsen 1968/71, Møller&Madsen 2007;14	
E76_11a	E76	6,29	5,19	29,83	1,21	2	1	1	20,28						No	25		119,9	S	1	No	Yes	NMA:Krogh&Albrethsen 1968/71, Møller&Madsen 2007;14	Dike built against stable, measurements based on rough survey plan
E76_12	E76	7,1	7,07	43,01	1,00	2	1	1	26,59						No	18	44,7	7,4	S		Yes	Yes	NMA:Krogh&Albrethsen 1968/71, Møller&Madsen 2007;14	Distance to dwelling is only roughly accurate, as the position of the latter is based on rough survey sketch
E76_13	E76	8,36	8,07	60,13	1,04	2	1,45	2	14,1	9,24					Yes	7	149				No	Yes	NMA:Krogh&Albrethsen 1968/71, Møller&Madsen 2007;14	
E76_14	E76	15	5	75	3,00	3		1							No	14	210,2				No	No	NMA:Krogh&Albrethsen 1968/71	Measurements based on rough survey sketch and description
E76_15	E76	11,78	8,45	82,8	1,39	3	1,5	1	52,27						No	18	75,4	6,1	S	3	No	Yes	NMA:Krogh&Albrethsen 1968/71, Møller&Madsen 2007;15	Distance to dwelling is only roughly accurate, as the position of the latter is based on rough survey sketch
E76_16	E76	2,53	2,12	5,41	1,19	3	0,45	1	2,03						No	19	92,4	6,1	S	3	No	Yes	NMA: Krogh&Albrethsen 1968/71, Møller&Madsen 2007;15	Distance to dwelling is only roughly accurate, as the position of the latter is based on rough survey sketch
E76_17	E76	64,95	1	64,95	64,95	2	1	1	230,29						No	21	171,1	79,9		1	No	Yes	NMA: Krogh&Albrethsen 1968/71, Møller&Madsen 2007;15	Stretch of homefield dike; for enclosed area Ar_Comp 1 see ruin 9. Note Møller&Madsen 2006 ruin 14. istance to dwelling is only roughly accurate, as the position of the latter is based on rough survey sketch
E76_18	E76	109,1	95,4	54,3	1,14	2	1	1	10250						No	22	151,2		S	1	No	Yes	NMA: Krogh&Albrethsen 1968/71, Møller&Madsen 2007;15	Strech of homefield dike; Ar_Comp1 measures area between ruin 17 & 18.
E76_19	E76	20	10		2,00			1	200						No	18	39,2	7,1	S	3	No	Yes	NMA: Krogh&Albrethsen 1968/71, Møller&Madsen 2007;14	Likely enclosure. Measurements based on rough survey sketch and description
E76a_01	E76a	6,64	3,8	25,23	1,75	2	0,8	1	9,67						No	4					No	Yes	Bruun 1895;401, Møller&Madsen 2007;15	Note that ruin dimensions are somewhat estimate and based on Bruun's survey description (1896;401), because the ruin is not wholly preserved.
E76a_02	E76a	5,45	3,42	18,16	1,59	2	0,85	1	7,26						No	4					No	Yes	Bruun 1895;401, Møller&Madsen 2007;15	Note that ruin dimensions are somewhat estimate and based on Bruun's survey description (1896;401), because the ruin is not wholly preserved.
E76a_03	E76a	11,99	6,21	65,33	1,93	2	1,05	3	14,03	8,88	5,78				No	6					No	Yes	Bruun 1895;401, Møller&Madsen 2007;15	Note that ruin dimensions are somewhat estimate and based on Bruun's survey description (1896;401), because the ruin is not wholly preserved.
E76a_04	E76a	4,2	3,09	12,89	1,36	3	0,5	1	6,64						No	14					No	Yes	Bruun 1895;401	Note that ruin dimensions are based on 2006 DGPS and photograph only
E76a_05	E76a	3,66	2,34	8,54	1,56	3	0,5	1	3,86						No	14					No	Yes	Bruun 1895;401	Note that ruin dimensions are based on 2006 DGPS and photograph only
E76b_01	E76b	6,4	4	25,6	1,60										No	4					No	No	Bruun 1895;399	All ruin observations based on Bruun's rough survey description (1895;399) and the estimation of "one pace" as 0,8m
E76b_02	E76b	10,4	6,4	66,56	1,63										No	15					No	No	Bruun 1895;399	All ruin observations based on Bruun's rough survey description (1895;399) and the estimation of "one pace" as 0,8m
E76c_01	E76c	30,96	1,5	49,86	20,64	2	1,5	1	55788						No	23					No	Yes	Møller&Madsen 2007;15	Stretch of dike bounding peninsula
E76c_01a	E76c	5,95	3,15	19,17	1,89	2	0,65	2	5,02	4,28					No	5					No	Yes	Møller&Madsen 2007;15	Structure built against dike E76c_01
E76c_02	E76c	8,43	3,68	25,4	2,29	2	1,65	1	9,98						No	18			NW	1	No	Yes	Møller&Madsen 2007;15	
E76c_03	E76c	1,7	1,17	1,97	1,45	5									No	9					No	Yes	Møller&Madsen 2007;15	
E77_01	E77	8,2	5,19	42,58	1,58	4	1	1	20,25						No	9	149,9				No	Yes	Holm 1883;123, NMA:Bak 1969;N77-3, NMA:Krogh 1981, Møller&Madsen 2007;17	Note: Bak 1977 ruin 11, Krogh 1981 ruin I, Møller&Madsen 2007 ruin 12
E77_02	E77	4,53	3,94	15,44	1,15	4	0,55	2	9,35	0,86					No	18	141,3		S	3	No	Yes	Holm 1883;123, NMA:Bak 1969;N77-3, NMA:Krogh 1981, Møller&Madsen 2007;17	Note: Bak 1977 ruin 9, Krogh 1981 ruin H, Møller&Madsen 2007 ruin 11
E77_03	E77	9,27	6,71	49,38	1,38	4	0,8	1	33						No	18	130,7		S	3	No	Yes	Holm 1883;123, NMA:Bak 1969;N77-2, NMA:Krogh 1981, Møller&Madsen 2007;16	Note: Bak 1977 ruin 8, Krogh 1981 ruin G, Møller&Madsen 2007 ruin 10
E77_04	E77	4,66	3,29	14,52	1,42	5	0,9	1	6,62						Yes	14	96,8				No	Yes	Holm 1883;123, NMA:Bak 1969;N77-2, NMA:Krogh 1981, Møller&Madsen 2007;16	Note: Bak 1977 ruin 6, Krogh 1981 ruin F, Møller&Madsen 2007 ruin 8
E77_05	E77	5,91	3,67	21,75	1,61	4	0,8	1	9,11						No	9	95,5				No	Yes	Holm 1883;123, NMA:Bak 1969;N77-2, NMA:Krogh 1981, Møller&Madsen 2007;16	Note: Krogh 1981 ruin E, Møller&Madsen 2007 ruin 9
E77_06	E77	12,52	6,96	82,24	1,80	3	0,8	4	10,98	9,58	9,02	8,68			No	6	58,3				No	Yes	Holm 1883;123, NMA:Bak 1969;N77-2, NMA:Krogh 1981, Møller&Madsen 2007;16	Note: Bak 1969 ruin 4, Krogh 1981 ruin E. Note that ruin room division and dimensions has been reconstructed from Holm 1883, Bak 1969, and 2006 DGPS survey
E77_07	E77	20,02	12,51	204,64	1,60	2									No	1					No	Yes	Holm 1883;123, NMA:Bak 1969;N77-1, NMA:Krogh 1981, Møller&Madsen 2007;16	Note: Bak 1969 ruin 1, Krogh 1981 ruin A, Møller&Madsen 2007 ruin 9. Ruin dimensions has been reconstructed from Bak 1969 sketch and 2006 DGPS survey
E77_08	E77	9,65	4,85	43,29	1,99	2									No	4	7,4				No	Yes	NMA:Bak 1969;N77-1, NMA:Krogh 1981, Møller&Madsen 2007;16	Note: Bak 1969 ruin 2, Krogh 1981 ruin A, Møller&Madsen 2007 ruin 2.
E77_09	E77	6,86	4,4	28,01	1,56	2									No	4	13				No	Yes	NMA:Bak 1969;N77-1, NMA:Krogh 1981, Møller&Madsen 2007;16	Note: Bak 1969 ruin 3, Krogh 1981 ruin A, Møller&Madsen 2007 ruin 3.
E77_10	E77	2	2	4	1,00	6		1	4						No	19	153,6	7,5			No	No	NMA:Bak 1969;N77-3	Note ruin location, dimensions, and desciption from sketch survey plan only

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E77_11	E77	6,08	3,86	23,61	1,58	2	0,95	1	10,72						No	4	96,2				No	Yes	NMA:Bak 1969;N77-2, NMA:Krogh 1981, Møller&Madsen 2007;16	Note: Bak 1969 ruin 7, Krogh 1981 ruin E, Møller&Madsen 2007 ruin 7.
E77_12	E77	3,5	2,5	8,75	1,40	3		1							No	14	244,9				No	No	NMA:Bak 1969;N77-3	Note ruin location, dimensions, and desciption from sketch survey plan only
E77_13	E77	4,85	2,58	12,26	1,88	5	0,5	1	5,34						No	4	217,4				No	Yes	NMA:Bak 1969;N77-3, Møller&Madsen 2007;17	
E77_14	E77	4,02	2,78	10,89	1,45	4	0,6	1	6,15						No	9	161,6				No	Yes	Møller&Madsen 2007;17	
E77_15	E77	6,06	3,7	21,48	1,64	2	0,9	1	8,14						No	4	49,6				No	Yes	Møller&Madsen 2007;16	Note: Krogh 1981 ruin C, Møller&Madsen ruin 4
E77_16	E77	4,61	3,81	16,86	1,21	2	1,05	1	4,33						No	14	60,1				No	Yes	Møller&Madsen 2007;16	Note: Krogh 1981 ruin D, Møller&Madsen ruin 5
E77a_01	E77a	45,1	26,18	764,11	1,72	2									No	1					No	Yes	NMA: Krogh&Albrethsen 1968, Møller&Madsen 2006;17	Ruin 01 likely consists of several indistinguishable buildings. The ruin is being eroded by the sea in the N end.
E77a_02	E77a	11,5	10	150	1,15	3									No	14	41,2				No	No	NMA: Krogh&Albrethsen 1968	Ruin 02 has completely eroded; stated description is basen on rough survey sketch and 1968 photograph; ruin measurements are only roughly accurate
E77a_03	E77a	22,39	11,83	230,64	1,89	2									No	3	5,5				No	Yes	NMA: Krogh&Albrethsen 1968, Møller&Madsen 2006;17	
E77a_04	E77a	13,93	11,51	116,83	1,21	2									No	14	41,9				No	Yes	NMA: Krogh&Albrethsen 1968, Møller&Madsen 2006;17	Note: Møller&Madsen 2007 ruin 5
E77a_05	E77a	13,03	8,69	94,83	1,50	3									No	14	60,6				No	Yes	NMA: Krogh&Albrethsen 1968, Møller&Madsen 2006;17	Note: Møller&Madsen 2007 ruin 4
E77a_06	E77a	8	4	32	2,00	3									Yes	4	230,8				No	No	NMA: Krogh&Albrethsen 1968	Ruin 06 was not located during the Møller&Madsen 2006 survey; stated description is basen on rough survey sketch and 1968 photograph; ruin measurements are only roughly accurate
E77a_07	E77a	10,73	9,18	85,78	1,17	3									No	14	105,1				No	Yes	NMA: Krogh&Albrethsen 1968, Møller&Madsen 2006;17	
E77a_08	E77a	7,09	4,82	33,25	1,47	3	1,2	1	11,12						No	4	123,6				No	Yes	NMA: Krogh&Albrethsen 1968, Møller&Madsen 2006;17	
E77a_09	E77a	9	4	36	2,25	3									No	4	98,7				No	No	NMA: Krogh&Albrethsen 1968	Ruin 09 was not located during the Møller&Madsen 2006 survey; stated description is basen on rough survey sketch and 1968 photograph; ruin measurements are only roughly accurate
E77a_10	E77a	14,4	6,72	91,74	2,14	3									No	14	60,3				No	Yes	NMA: Krogh&Albrethsen 1968, Møller&Madsen 2006;18	
E77a_11	E77a	16,54	1	16,54	16,54	5	1								No	24	290,9				No	Yes	Møller&Madsen 2007;18	Short stretch of dike
E77a_12	E77a	7,64	5,08	36,2	1,50	3									No	4	23,7				No	Yes	Møller&Madsen 2007;18	
E78_01	E78	34,36	23,53	636,74	1,46	2									No	1					No	Yes	NMA:Albrethsen 1968/71, NMA:Krogh 1981, Møller&Madsen 2006;22, Møller et al.2007;28	Note that ruin 1 has been redefined/reinterpreted on basis of georeferenced 2007 1:20 drawing (Møller et al.2007;28) and test trenches.
E78_02	E78	6,3	4,48	28,44	1,41	3									No	12	21				No	Yes	NMA:Albrethsen 1968/71, NMA:Krogh 1981, Møller&Madsen 2006;22	Note that ruin description is based on the 2007 1:20 scale drawing.
E78_02a	E78	15,07	15,6	194,73	0,97	2	1,3	1	136,85						No	13					No	Yes	NMA:Albrethsen 1968/71, NMA:Krogh 1981, Møller&Madsen 2006;22	Note that ruin description is based on the 2007 1:20 scale drawing. The dike is only partially preserved and stated measurements are only roughly accurate (assuming Wall_Th and shape of the preserved parts of the dike). Area_Comp 1 excludes the area of the church building itself.
E78_03	E78	10,6	4,3	41,97	2,47	5	0,5	1							No	4	32,8				No	Yes	NMA:Albrethsen 1968/71, NMA:Krogh 1981, Møller&Madsen 2006;22	A division was noted, but not surveyed
E78_04	E78	13,2	6,82	82,02	1,94	3									No	14	44,8				No	Yes	NMA:Albrethsen 1968/71, NMA:Krogh 1981, Møller&Madsen 2006;22	The enclosure noted by Albrethsen could not be relocated.
E78_05	E78	78,8	1,5	114,16	52,53	5	1								No	24	92,5				No	Yes	NMA:Albrethsen 1968/71, NMA:Krogh 1981, Møller&Madsen 2006;22	
E78_06	E78	12,77	5,03	60,01	2,54	3	1	1	28,32						Yes	4	208,7				No	Yes	NMA:Albrethsen 1968/71, NMA:Krogh 1981, Møller&Madsen 2006;22	
E78_07	E78	13,74	3,91	49,83	3,51	3	1	3	7,06	6,8	4,77				Yes	6	231,8				No	Yes	NMA:Albrethsen 1968/71, NMA:Krogh 1981, Møller&Madsen 2006;23	
E78_07a	E78	2,95	2,58	4,56	1,14	4	0,6	1	2,68						No	14	242,2				No	Yes	NMA:Albrethsen 1968/71, NMA:Krogh 1981, Møller&Madsen 2006;23	
E78_08	E78	28,07	7,5	203,83	3,74	5	1,1	4	64,84	23,97	12,42	12,23			No	6	490,3		SW		No	Yes	NMA:Albrethsen 1968/71, NMA:Krogh 1981, Møller&Madsen 2006;23	
E78_09	E78	5,29	3,56	18,2	1,49	5									No	4	414				No	Yes	NMA:Albrethsen 1968/71, NMA:Krogh 1981, Møller&Madsen 2006;23	Note: Møller&Madsen 2006 ruin 11
E78_10	E78	11,9	5,17	59,56	2,30	2		2							No	5	43,1				No	Yes	NMA:Albrethsen 1968/71, NMA:Krogh 1981, Møller&Madsen 2006;23	Note: Møller&Madsen 2006 ruin 13. A division in two rooms was surveyed, but a lacking of Wall_Th precludes measurement of Ar_Comp
E78_11	E78	6,62	5,57	35,44	1,19	3									No	14	56,7				No	Yes	Møller&Madsen 2006;23	Note: Møller&Madsen 2006 ruin 10
E78_12	E78	25,84	6,38	149,24	4,05	2	2	3	28,17	14,64	8,23				No	2	410				No	Yes	Møller&Madsen 2006;23	
E78_13	E78	4,06	3,59	13,9	1,13	2	1,5	1	2,27						Yes	14	481,1				No	Yes	Møller&Madsen 2006;23	Note: Møller&Madsen 2006 ruin 9
E78_14	E78	7,35	4,78	32,54	1,54	2	1,2	1	11,33						No	4	548,5				No	Yes	Møller&Madsen 2007;18	Note: Møller&Madsen 2007 ruin 13
E78_15	E78	26,2	12,7	279,69	2,06	2									No	3	11				No	Yes	Møller et al.2007;28	Note that ruin 15 has been redefined/reinterpreted on basis of georeferenced 2007 1:20 drawing (Møller et al.2007;28) and test trenches.
E78_16	E78	18,8	8,9	124,88	2,11	2									No	2	2,4				No	Yes	Møller et al.2007;28	Note that ruin 16 has been redefined/reinterpreted on basis of georeferenced 2007 1:20 drawing (Møller et al.2007;28) and test trenches.
E78a_01	E78a	34,7	22,3	726,55	1,56	2									No	1					No	No	Vebæk 1943;8	Measurements from georeferenced Vebæk (1939) survey plan
E78a_02	E78a	15,4	6,72	92,91	2,29	2	2,2	3	9,08	5,09	4,79				No	6	13,4				No	No	Vebæk 1943;8	Measurements from georeferenced Vebæk (1939) excavation plan
E78a_03	E78a	11,74	6,43	70,89	1,83	2	1,9	2	9,03	4,93					No	5	58,9				No	No	Vebæk 1943;8	Measurements from georeferenced Vebæk (1939) excavation plan
E78a_04	E78a	13,4	5,6	71,46	2,39	2	1,85	2	8,87	7,88					No	5	27,4				No	No	Vebæk 1943;8	Measurements from georeferenced Vebæk (1939) excavation plan
E78a_05	E78a	4,54	3,2	13,98	1,42	4	1	1	3,15						No	9	188,7				No	No	Vebæk 1943;8	Measurements from georeferenced Vebæk (1939) excavation plan
E78a_06	E78a	14,07	11,56	126,88	1,22	2									No	3	18,8				No	No	Vebæk 1943;8	Measurements from georeferenced Vebæk (1939) excavation plan
E78a_07	E78a	4	2	8	2,00	5									No	4					No	No	Vebæk 1943;11	Ruin is described by Vebæk (1939;11) but not mapped. Measurements are only approximate.
E78a_08	E78a	8,79	8,08	52,07	1,09	3	1,6	3	21,65	6,84	0,71				No	18	540,3			3	No	Yes	Heide&Madsen 2010;8, Vebæk 1943;11	Note that Heide&Madsen 2010 ruin 9 is here considered part of ruin 8 (compartment 3)
E78a_09	E78a	6,6	5,6	30,47	1,18	3	1								No	14	67,1				No	Yes	Møller&Madsen 2007a;18	Møller&Madsen 2007a ruin 3. Note that the ruin has been partially disturbed by modern road and its full dimensions cannot be estimated.
E78a_10	E78a	14,5	7,9	103,6	1,84		1,4	3	31,72	22,66	8,12				No	6	110,4				No	Yes	Møller&Madsen 2006;23	Møller&Madsen 2007a ruin 2.
E78a_11	E78a	9,45	6,57	52,22	1,44	5	0,9	1	39,14						No	18	65,7		SW	2	No	Yes	Møller&Madsen 2007a;18	Møller&Madsen 2007a ruin 7. Note that this ruin could be Vebæk's (1943;11) ruin 7, although that the stated dimensions are very different from the measured

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E78a_12	E78a	6,52	4,58	27,46	1,42	2	1,4	2	2,89	2,85					Yes	5	182,5				No	Yes	Heide&Madsen 2010;9	Heide&Madsen ruin 12. Note that the collapse area in front of the ruin has here been omitted.
E78a_13	E78a	2,61	1,43	3,11	1,83	3	0,3	1	2,03						No	19	542,7				No	Yes	Heide&Madsen 2010;8	Heide&Madsen ruin 10.
E78a_14	E78a	8,16	6,38	49,32	1,28	2	2	1	15,69						Yes	14	316,6				No	Yes	Heide&Madsen 2010;8	Heide&Madsen ruin 11.
E78b_01	E78b	23,5	19	344,58	1,24	2									No	1					No	Yes	NMA:Krogh 1981, Møller&Madsen 2007;19	Krogh 1981 ruin B
E78b_02	E78b	7,99	4,95	34,95	1,61	3	0,8								No	4	37,3				No	Yes	NMA:Krogh 1981, Møller&Madsen 2007;19	Krogh 1981 ruin C
E78b_03	E78b	5,81	3,84	20,52	1,51	2	1	2	3,19	2,6					No	5	62,6				No	Yes	NMA:Krogh 1981, Møller&Madsen 2007;19	Krogh 1981 ruin A
E78b_03a	E78b	6,41	4,06	22,77	1,58	4	0,8	1							No	17	64,1		NW	1	No	Yes	NMA:Krogh 1981, Møller&Madsen 2007;19	Møller&Madsen 2007 ruin 4
E78b_04	E78b	5,5	3,5	19,25	1,57	2									No	4					No	No	NMA:Krogh 1981	Krogh 1981 ruin D. Ruin description and measurements from rough sketch plan only
E78b_05	E78b	4,8	2,87	13,59	1,67	2	0,1	1	3,65						Yes	14	60,5				No	Yes	Møller&Madsen 2007;19	
E78b_06	E78b	1,53	1,04	1,61	1,47	4	0,25	1	0,76						No	9	87,3				No	Yes	Møller&Madsen 2007;19	
E80a_11	E80a	6,95	3,92	25,34	1,77	3	0,75	1	11,74						No	4	96,1				No	Yes	Madsen et al., field report under preparation	
E80a_12	E80a	26,3	13,66	271,38	1,93	2									No	1					No	Yes	Madsen et al., field report under preparation	
E80a_19	E80a	6,45	3,63	23,16	1,78	3	0,65	1	12,03						No	4	36,8				No	Yes	Madsen et al., field report under preparation	
E80a_20	E80a	4,97	3,84	17,68	1,29	5	0,6	1	10,46						No	18	53,8		SW	1	No	Yes	Madsen et al., field report under preparation	
E80b_04	E80b	3,2	3,02	9,27	1,06	4	0,7	1	3,19						No	9	630				No	Yes	Madsen et al., field report under preparation	Note that the ruin is interpreted as part of E80b, although lying in closer proximity to E80c
E80b_05	E80b	17,3	5,38	112,56	3,22	2	1,6	3	25,89	15,77	2,01				No	2	18,1				No	Yes	Madsen et al., field report under preparation	
E80b_07	E80b	22	12,7	241,95	1,73	2									No	1					No	Yes	Madsen et al., field report under preparation	
E80b_08	E80b	7,17	4,1	28,49	1,75	3	0,7	1	14,39						No	4	26,4				No	Yes	Madsen et al., field report under preparation	
E80b_09	E80b	5,71	4,33	24,46	1,32	2	0,9	1	9,72						No	4	53,7				No	Yes	Madsen et al., field report under preparation	
E80b_10	E80b	10,35	7,35	61,01	1,41	4	0,65	1	42,9						No	16	153,9			2	Yes	Yes	Madsen et al., field report under preparation	
E80b_13	E80b	8,52	6,91	56,54	1,23	2	1,1	2	11,04	10,47					No	7	17,7				No	Yes	Madsen et al., field report under preparation	
E80b_14	E80b	6,39	3,12	19,57	2,05	2	0,75	1	11,74						No	18	55,4		SW	1	No	Yes	Madsen et al., field report under preparation	
E80b_15	E80b	4,71	3,15	13,87	1,50	2	0,8	1	5,73						No	18	69,9		SW	1	No	Yes	Madsen et al., field report under preparation	
E80b_16	E80b	5,91	6,04	35,12	0,98	5	0,85	2	8,52	7,46					No	5	123,8				No	Yes	Madsen et al., field report under preparation	
E80b_17	E80b	5,73	4,91	28,24	1,17	5	0,5	1	18,4						No	15	163,9			1	No	Yes	Madsen et al., field report under preparation	
E80b_18	E80b	4,45	2,78	12,37	1,60	2	0,7	1	4,8						Yes	14	77,2				No	Yes	Madsen et al., field report under preparation	
E80b_21	E80b	7,22	6,79	46,16	1,06	2									Yes	14	3,6				No	Yes	Madsen et al., field report under preparation	
E80b_22	E80b	7,37	6,22	38,56	1,18	5	0,6	1	25,27						No	15	27,4			2	No	Yes	Madsen et al., field report under preparation	
E80b_23	E80b	4,12	3,68	16,57	1,12	2	0,75	1	5,6						No	14	114,8				No	Yes	Madsen et al., field report under preparation	
E80b_24	E80b	3,61	3,45	11,8	1,05	5	0,5	1	7,22						No	9	631,1				No	Yes	Madsen et al., field report under preparation	
E80c_01	E80c	10,28	9,22	87,26	1,11	2									No	1					No	Yes	Madsen et al., field report under preparation	
E80c_02	E80c	5,3	3,77	18,53	1,41	4	0,65	1	11,04						No	18	21,6		SE	3	No	Yes	Madsen et al., field report under preparation	
E80c_03	E80c	4,54	3,34	13,94	1,36	2	0,9	1	4,68						No	14	28,6				No	Yes	Madsen et al., field report under preparation	
E80c_25	E80c	3,58	2,82	8,03	1,27	2	0,75	1	3,23						No	14	51,1				No	Yes	Madsen et al., field report under preparation	
E83_01	E83	21,36	12,57	250,63	1,70	2	1,95	3	56,94	22,19	20,32				No	3	152,2				No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	
E83_02	E83	7,86	4,92	37,48	1,60	2	0,95	1	15,12						No	4	116,8				No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	
E83_03	E83	8,16	5,29	41,83	1,54	2									No	4	110,8				No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	
E83_04	E83	15,7	7,8	111,52	2,01	2									No	14	60,3				No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	
E83_05	E83	5,81	4,57	24,36	1,27	2	0,95	1	9,67						No	4	59				No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	
E83_06	E83	35,6	27,4	794,44	1,30	2									No	1					No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	
E83_06a	E83	65,8	25,9	1715,41	2,54	5	2,1	1	1569,82						No	22	0		S	1	No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	
E83_07	E83	26,85	8,58	207,5	3,13	2	1,8	2	36,45	36,02					No	2	1				No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	
E83_08	E83	16,21	8,11	130,89	2,00	4	1,3	1	74,61						No	12	34,6				No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	
E83_08a	E83	30,8	26,3	792,8	1,17	5	1,5	1	509,22						No	13	27,1				No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	
E83_09	E83	5,04	4,03	20,31	1,25	4									No	9	44,2				No	Yes	Roussell 1941;36, Fig.18	
E83_10	E83	12,11				4									No	9	118,9				No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	Note that the ruin is partially eroded and the R_Width cannot be measured
E83_11	E83	10,7	7,02	73,72	1,52	2	0,95	2	15,94	13,25					No	7	87				No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	
E83_12	E83	14,95	4,2	60,19	3,56	2									No	4	126,7				No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	
E83_13	E83	23,2	6,72	142,37	3,45	2	1,2	1	67,81						No	14	221,9				No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	
E83_14	E83	15,34	14,81	175,11	1,04	4	0,85	1	122,54						No	16	211,4	11,2		3	Yes	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	
E83_15	E83	4,98	2,67	12,07	1,87	5	0,6	1	4,87						No	19	233,7	11,2			No	Yes	Roussell 1941:34p, Clemmensen 2004, by permission	Note that ruin was interpreted as a grave by Roussell (1941:95)
E89a_01	E89a	15,4	14,36	192,34	1,07	2									No	1					No	Yes	NMA: Holtved 1932, Madsen et al., field report under preparation	
E89a_02	E89a	9,25	5,66	48,41	1,63	2	1,1	1	22,17						No	4	34,1				No	Yes	NMA: Holtved 1932, Madsen et al., field report under preparation	
E89a_03	E89a	4,77	4,14	19,46	1,15	5	0,6	1	10,02						No	14	63,8				No	Yes	NMA: Holtved 1932, Madsen et al., field report under preparation	
E89a_04	E89a	14,03	6,01	80,24	2,33	2	1,45	2	19,78	13,81					No	5	64,4				No	Yes	NMA: Holtved 1932, Madsen et al., field report under preparation	
E89a_05	E89a	7,95	4,09	31,35	1,94	5	0,8	2	6,67	5,92					No	5	81,6				No	Yes	NMA: Holtved 1932, Madsen et al., field report under preparation	
E90_01	E90	52,9	23,5	1129,66	2,25	4	1,8	2	903,3	4,06					No	15	73,3	13,1		3	No	Yes	Bruun 1895;412, Møller&Madsen 2007;20	Møller&Madsen 2007 ruin 06. Note that the corner of the enclosure have collapsed and measurements in that area are only roughly accurate. Note that the interior compartment is built in stone/turf. Ruin is interpreted as part of E90c (see this)
E90_02	E90	57,88	35,11	1635,45	1,65	4	1,5	3	1265,77	92,69	2,51				No	15	107,6	13,1		1	No	Yes	Bruun 1895;412, Møller&Madsen 2007;19	Møller&Madsen 2007 ruin 01. Note that compartment 3 is a separate round enclosure (Møller&Madsen 2007 R02). The NW corner of R02 has eroded away and measurements from this area are only roughly accurate. Ruin is interpreted as part of E90c (see this)
E90_02a	E90	7,79	6,56	42,24	1,19	4	0,95	1	22,92						No	16	114	2,41		1	No	Yes	Bruun 1895;412, Møller&Madsen 2007;19	Ruin is interpreted as part of E90c (see this)
E90_03	E90	7,08	4,98	33,94	1,42	4	0,9	1	16,5						No	9	91				No	Yes	Bruun 1895;413, Møller&Madsen 2007;19	Møller&Madsen 2007 ruin 04. Ruin is interpreted as part of E90c (see this)
E90_05	E90	6,8	3,6	21,75	1,89	5	0,5	1	13,75						No	4	123,6				No	Yes	Bruun 1895;413, Møller&Madsen 2007;19	Møller&Madsen 2007 ruin 03. Ruin is interpreted as part of E90c (see this)

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E90_08	E90	21,09	10,35	190,76	2,04	3	1,5	3							No	1					No	Yes	Bruun 1895;413, Møller&Madsen 2007;20	The ruin is so collapsed that although rooms are visible, they cannot be measured acurately. Ruin is interpreted as part of E90c (see this)
E90_09	E90	9,43	7,06	38,77	1,34	4	0,9	4	5,22	4,4	3,38	3			No	14	103,1				No	Yes	Bruun 1895;413, Møller&Madsen 2007;20	The structure is built against R02; it is probably milking enclosures. Ruin is interpreted as part of E90c (see this)
E90_10	E90	28,94	27,24	584,33	1,06	2									No	1					No	Yes	Møller&Madsen 2007;20	Møller&Madsen 2007 ruin 09.
E90_11	E90	11,85	6,15	63,16	1,93	2	0,95	1	37,81						No	14	4,3				No	Yes	Møller&Madsen 2007;20	Møller&Madsen 2007 ruin 10.
E90_12	E90	7,92	4,03	28,58	1,97	2	0,75	2	6,63	5,33					No	5	163,9				No	Yes	Møller&Madsen 2007;20	
E90_13	E90	8,52	5,24	38,38	1,63	2	1	1	18,76						No	4	182,1				No	Yes	Møller&Madsen 2007;20	Møller&Madsen 2007 ruin 11.
E90_14	E90	11	6	66	1,83	4		1							No	9	257,9				No	No	NMA:Bak 1969:N90-3	Note that ruin location and dimension is based on description and rough sketch plan only. There is a chance that Bak ruin N90-3 is the same as R13; however, this seems unlike based on building material and placing.
E90a_01	E90a	13,61	5,3	65,73	2,57	4	0,9	1	43,81						No	15				3	No	Yes	NMA:Bak 1969;N90a-2, Møller&Madsen 2007;20	
E90a_02	E90a	7,26	2,92	20,03	2,49	3									No	4					No	Yes	Møller&Madsen 2007;21	
E90a_03	E90a	3,7	3	10,92	1,23	5	0,4	1	8,71						No	14					No	Yes	Møller&Madsen 2007;21	
E90b_01	E90b	11,48	6,4	70,01	1,79	4	1,3	1	30,75						No	9					No	Yes	NMA:Krogh&Albrethsen 1968, NMA:Bak 1969;B19-2, N90-3, Møller&Madsen 2007;21	
E91_01	E91	7,27	5,03	31,2	1,45	3	0,5	1	21,76						No	18	279,2	242,4	SE	3	No	Yes	NMA:Bak 1969;N91-3, Møller&Madsen 2007;21	
E91_02	E91	2,92	2,08	6,32	1,40	3	0,5	1	1,81						No	14	286,3				No	Yes	NMA:Bak 1969;N91-3, Møller&Madsen 2007;21	
E91_03	E91	8,88	3,69	32,79	2,41	3	0,75	2	11,63	1,79					No	5	245,5				No	Yes	Møller&Madsen 2007;21	
E91_04	E91	17,8	9,5	151,64	1,87	2									No	14	197,9				No	Yes	NMA:Bak 1969;N91-3, Møller&Madsen 2007;21	
E91_07	E91	10,11	7,47	61,75	1,35	2									No	14	136,5				No	Yes	NMA:Bak 1969;N91-4, Møller&Madsen 2007;22,	
E91_08	E91	6,92	3,95	24,9	1,75	3	0,8	1	10,87						No	4	201,5				No	Yes	NMA:Bak 1969;N91-4, Møller&Madsen 2007;22	
E91_09	E91	8,1	3,82	27,7	2,12	5	0,85	2	7,11	3,85					No	5	130,8				No	Yes	NMA:Bak 1969;N91-4, Møller&Madsen 2007;22	
E91_10	E91	8,39	4,69	39,5	1,79	2	0,8	2	9,57	4,93					No	5	131,3				No	Yes	NMA:Bak 1969;N91-5, Møller&Madsen 2007;22	
E91_11	E91	11,19	4,52	41,91	2,48	5	1	1	27,01						No	18	89,2	242,4	S	4	No	Yes	NMA:Bak 1969;N91-5, Møller&Madsen 2007;22	
E91_12	E91	7,66	3,83	29,13	2,00	3	0,8	1	13,79						No	4	79				No	Yes	NMA:Bak 1969;N91-5, Møller&Madsen 2007;22	
E91_13	E91	12,04	7,51	78,56	1,60	2									No	2	48,3				No	Yes	NMA:Bak 1969;N91-5, Møller&Madsen 2007;22	
E91_14	E91	22,6	20,6	394,97	1,10	2									No	1					No	Yes	Bruun 1895;416, NMA:Bak 1969;N91-5, Møller&Madsen 2007;22	Bruun 1895 ruin 4
E91_15	E91	2,88	2,06	5,85	1,40	4									No	9	3				No	Yes	NMA:Bak 1969;N91-5, Møller&Madsen 2007;22	
E91_16	E91	3,58	3,02	10,19	1,19	5									No	9	8,1				No	Yes	NMA:Bak 1969;N91-5, Møller&Madsen 2007;22	
E91_17	E91	15,48	11,96	158,34	1,29	2									No	3	111,6				No	Yes	Møller&Madsen 2007;22	
E92_01	E92	13	5,5	71,5	2,36	2		2							Yes	14	119,5				No	No	NMA: Petersen 1894;19, NMA:Krogh 1981	Ruin observations from rough survey sketch and description only
E92_02	E92	7,43	7,03	44,2	1,06	5	1	1	22,92						No	16	86,6	178,9		1	No	Yes	NMA: Petersen 1894;19, NMA:Krogh 1981, Madsen 2009;15	Note: Madsen 2009 ruin 13
E92_03	E92	57,6	23,6	1042,26	2,44	2									No	1					No	Yes	NMA: Petersen 1894;19, Bruun 1895;419, Krogh&Berglund 1980;178, NMA:Krogh 1981, Madsen 2009;13	Ruin likely consists of more than one building
E92_04	E92	4,29	3,34	14,1	1,28	2									No	14	39,2				No	Yes	NMA: Petersen 1894;19, Krogh&Berglund 1980;178, NMA:Krogh 1981, Madsen 2009;13	
E92_05	E92	13,11	12,64	128,95	1,04	2									No	14	54,5				No	Yes	NMA: Petersen 1894;19, Krogh&Berglund 1980;178, NMA:Krogh 1981, Madsen 2009;13	
E92_06	E92														No	28					No	No	NMA: Petersen 1894;19	Ruin has been completely eroded away
E92_07	E92	7,77	4,34	30,63	1,79	3	0,9	2	6,8	5,29					No	5	168,8				No	Yes	NMA: Petersen 1894;19, Krogh&Berglund 1980;178, NMA:Krogh 1981, Madsen 2009;14	Western gable of ruin has eroded and ruin measurements are only approximate
E92_08	E92	5,8	5,34	25,72	1,09	2	0,85	2	10,46	1,95					No	5	143,4				No	Yes	NMA: Petersen 1894;19, Krogh&Berglund 1980;178, NMA:Krogh 1981, Madsen 2009;14	
E92_09	E92	8,5	5,5	46,75	1,55	2									No	28	70,8				No	No	Krogh&Berglund 1980;179, NMA:Krogh 1981	Ruin observations based on rough survey sketch and description only
E92_10	E92	7,7	7,16	40,54	1,08	4	1	2	14,3	0,97					No	15	224,4	0,9		1	No	Yes	Krogh&Berglund 1980;179, NMA:Krogh 1981, Madsen 2009;15	
E92_11	E92	8,42	4,03	33,65	2,09	2	0,75	2							No	5	47,1				No	Yes	NMA:Krogh 1981, Madsen 2009;12	Note: Madsen 2009 ruin 01. Room partition noticed, but not surveyed or described
E92_12	E92	11,68	5,52	62,06	2,12	3	1,05	2	21,81	7,28					No	5	104				No	Yes	NMA:Krogh 1981, Madsen 2009;15	
E92_13	E92	4,92	3,07	14,89	1,60	5	0,55	1	7,8						No	4	53				No	Yes	Madsen 2009;12	Note: Madsen 2009 ruin 02
E92_14	E92	5	3,8	16,59	1,32	2									No	14	68,3				No	Yes	Madsen 2009;16	
E92_15	E92	3,23	3,01	8,69	1,07	3	0,7	1	3,27						No	19	224,1	0,9		1	No	Yes	Madsen 2009;14	Note: Madsen 2009 ruin 09
E92_16	E92	2,23	1,88	3,25	1,19										No	27					No	Yes	Madsen 2009;16	Note: Madsen 2009 ruin 11; it is not a structure, rather a pit or other man-made feature
E93_01	E93	15,28	14,16	149,89	1,08	4	1,4	2	77,7	10,4					No	15	132	115,8		3	Yes	Yes	NMA:Petersen 1894;20, Bruun 1895;421, Krogh&Berglund 1980;181, 187, Madsen 2009;18	
E93_02	E93	8,92	4,36	38,28	2,05	3	0,75	1	18,95						No	4	93,3				No	Yes	NMA:Petersen 1894;20, Bruun 1895;421, Krogh&Berglund 1980;181, Madsen 2009;18	
E93_03	E93	9,44	4,33	40,21	2,18	3	0,75	1	20,25						No	4	83,1				No	Yes	NMA:Petersen 1894;20, Bruun 1895;421, Krogh&Berglund 1980;181, Madsen 2009;18	
E93_04	E93	6,71	4,23	27,48	1,59	2	0,9	1	12,6						No	4	25,8				No	Yes	NMA:Petersen 1894;20, Bruun 1895;421, Krogh&Berglund 1980;181, Madsen 2009;18	
E93_04a	E93	7,94	3,1	22,04	2,56	5	0,5	2	10,71	4,36					No	17	28,5	115,8	SE	1	No	Yes	Madsen 2009;18	Feature is part of ruin 04. The wall is not fully preserved and its dimensions can only be estimated approximately
E93_05	E93	44,55	22,21	896,83	2,01	2									No	1					No	Yes	NMA:Petersen 1894;20, Bruun 1895;421, Krogh&Berglund 1980;181, Madsen 2009;19	
E93_05a	E93	18,38	7,13	119,28	2,58	2									No	2	5,6				No	Yes	NMA:Petersen 1894;20, Bruun 1895;421, Krogh&Berglund 1980;182, 188, Madsen 2009;19	Note that Petersen (NMA:1984) and Bruun (1896;421) interpreted ruin 05 and 05a as one ruin
E93_06	E93	10,82	8,15	68,2	1,33	2	0,8								No	14	25,6				No	Yes	NMA:Petersen 1894;20, Bruun 1895;422, Krogh&Berglund 1980;182, Madsen 2009;19	
E93_07	E93	7,99	3,08	31,85	2,59	2	0,75	2	8,66	4,27					No	5	29,5				No	Yes	NMA:Petersen 1894;20, Bruun 1895;422, Krogh&Berglund 1980;182, Madsen 2009;19	

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E93_08	E93	8,39	4,95	41	1,69	3	0,65	2	11,05	6,88					No	5	51				No	Yes	NMA:Petersen 1894;20, Bruun 1895;422, Krogh&Berglund 1980;182, 188, Madsen 2009;20	
E93_09	E93	15,33	7,51	91,47	2,04	2	1								No	6	40,5				No	Yes	NMA:Petersen 1894;20, Bruun 1895;422, Krogh&Berglund 1980;182, 188, Madsen 2009;20	
E93_10	E93	7,48	5,78	41,88	1,29	5	0,9	1	23,17						No	4	94,9				No	Yes	NMA:Petersen 1894;20, Bruun 1895;422, Krogh&Berglund 1980;183, 189, Madsen 2009;20	
E93_11	E93	8,84	6,23	49,41	1,42	2	1,15	1	22,38						No	4	89,9				No	Yes	NMA:Petersen 1894;21, Bruun 1895;422, Krogh&Berglund 1980;183, Madsen 2009;20	
E93_12	E93	6,74	6,19	40,73	1,09	3	1,05	1	18,9						Yes	14	124,6				No	Yes	NMA:Petersen 1894;21, Bruun 1895;422, Krogh&Berglund 1980;183, 189, Madsen 2009;20	
E93_13	E93	31,58	13,1	384,05	2,41	2									No	3	30,5				No	Yes	NMA:Petersen 1894;21, Bruun 1895;422, Krogh&Berglund 1980;183, 189, Madsen 2009;20	
E93_14	E93	10,73	6,11	65,57	1,76	3	1	1	36,01						No	14	45,5				No	Yes	NMA:Petersen 1894;21, Bruun 1895;422, Krogh&Berglund 1980;183, Madsen 2009;21	Note: Krogh&Berlund 1980 ruin 15
E93_15	E93	6,09	3,58	21,46	1,70	5	0,95	1	7,95						No	9	105,6				No	Yes	NMA:Petersen 1894;21, Bruun 1895;422, Krogh&Berglund 1980;184, 190, Madsen 2009;21	Note: Krogh&Berlund 1980 ruin 16
E93_16	E93	9,39	7,46	66,55	1,26	3									No	14	121,6				No	Yes	NMA:Petersen 1894;21, Bruun 1895;423, Krogh&Berglund 1980;184, 190, Madsen 2009;21	Note: Krogh&Berlund 1980 ruin 19. Note that walls can be discerned but not measured with any accuracy
E93_17	E93	10,1	9,61	82,2	1,05	5	0,95	1	55,95						No	15	196,4	257,4		2	No	Yes	Krogh&Berglund 1980;184, 190, Madsen 2009;21	Note: Madsen 2009 ruin 21
E93_18	E93	4,2	4	16,8	1,05										No	14	106,1				No	No	Krogh&Berglund 1980;184	Ruin observations based on rough survey sketch and description only
E93_19	E93	10	4,7	47	2,13	1		2							No	5	37,4				No	No	Krogh&Berglund 1980;184, 191	Note: Krogh&Berlund 1980 ruin 14, Ruin observations based on rough survey sketch and description only
E93_21	E93	5,55	4,73	24,49	1,17	5	1,05	1	8,23						No	14	22,3				No	Yes	NMA:Petersen 1894;21, Bruun 1895;422, Krogh&Berglund 1980;184, Madsen 2009;22	Note: Madsen 2009 ruin 17
E93_22	E93	5,27	5,18	27,12	1,02	5									No	10	979,8				No	Yes	NMA:Petersen 1894;21, Bruun 1895;423, Madsen 2009;22	Very uncertain ruin by the fjord
E93_23	E93	2,7	1,83	4,63	1,48	5	0,4	1	2						No	9	275,2				No	Yes	Madsen 2009;22	Note: Madsen 2009 ruin 19
E94_01	E94	30,2	21,28	385,25	1,42	2	1,65		25,96						No	3	61,2				No	Yes	Bruun 1895;423, NMA:Bak 1967;N94-2, Madsen 2009;25	Note that the ruin has several rooms, but only 1 could be firmly measured (probably a byre)
E94_02	E94	11,78	5,98	70,9	1,97	2	0,9								No	14	36,3				No	Yes	Bruun 1895;423, Madsen 2009;25	Note that only a short stretch of wall is measurable.
E94_03	E94	26,8	24,5	484,79	1,09	2									No	1					No	Yes	Bruun 1895;423, Madsen 2009;25	
E94_04	E94	9,21	5	44,26	1,84	5	1	2	11,14	7,92					No	5	41,2				No	Yes	Bruun 1895;423, Madsen 2009;25	
E94_05	E94	9,11	5,37	47,55	1,70	5	1,4	2	7,73	4,84					No	5	142,3				No	Yes	Bruun 1895;423, Madsen 2009;26	
E94_06	E94	12,7	8,21	101,67	1,55	3	1,3								No	14	136,9				No	Yes	Bruun 1895;423, Madsen 2009;26	Note that only a short stretch of wall is measurable.
E94_07	E94	24,5	0,6	14,28	40,83	5	0,6		29620						No	24	151,5				No	Yes	Madsen 2009;27	Stretch of homefield dike
E94_08	E94	3,47	2,12	7,34	1,64	2	0,6	1	1,9						No	14	110,1				No	Yes	Madsen 2009;27	
E94_09	E94	2,9	2,64	6,7	1,10	3	0,65	1	2,09						No	14	91,3				No	Yes	NMA:Bak 1967;N94-2, Madsen 2009;27	
E94_10	E94	3,42	2,72	6,98	1,26	3	0,8	1	3,81						No	18	81,1	17,4	SE	3	No	Yes	NMA:Bak 1967;N94-2, Madsen 2009;27	
E94_11	E94	9,57	4,22	36,18	2,27	3	0,75	3	6,31	2,73	1,12				No	6	73,2				No	Yes	NMA:Bak 1967;N94-2, Madsen 2009;27	Note that there are at least 4 rooms, but the latter was to collapsed to measure its dimensions
E94_12	E94	5,48	3,23	12,51	1,70	3	0,75	1	7,81						No	18	70,4	17,4	SW	3	No	Yes	NMA:Bak 1967;N94-2, Madsen 2009;27	
E94_13	E94	72,9	0,7	60,93	104,14	5	0,8								No	24	47,4				No	Yes	Madsen 2009;28	Stretch of homefield dike
E94_14	E94	51,8	0,7	40,94	74,00	5	0,8								No	24	93,3				No	Yes	Madsen 2009;28	Stretch of homefield dike
E94_15	E94	7,39	5,97	30,32	1,24	4	1,15	2	9,28	1,58					No	15	226,8	11,78	W	3	No	Yes	NMA:Bak 1967;N94-3, Madsen 2009;28	
E94_16	E94	7,24	4,5	28,81	1,61	3	1,2	2	15,81	1,2					No	18	244,8	6,5	W	3	No	Yes	NMA:Bak 1967;N94-3, Madsen 2009;28	
E94_17	E94	6,73	5,35	28,3	1,26	4	1	1	15,68						No	18	257,4	6,5	NW	3	No	Yes	NMA:Bak 1967;N94-3, Madsen 2009;29	
E94_18	E94	9,87	5,11	50,13	1,93	5	0,8	1	29,43						No	4	348,1				No	Yes	NMA:Bak 1967;N94-3, Madsen 2009;29	
E94_19	E94	2	1,2	2,4	1,67	4		1							No	11	367,8				No	No	Madsen 2009;29	Ruin measurements from description and photograph only
E94_20	E94	6	6	36	1,00	4	1	1							No	15					No	Yes	NMA:Bak 1967;N94-3	Ruin measurements from sketch survey plan and description only. Distance to dwelling unknown
E95_01	E95	18,44	8,96	114,52	2,06	2									No	2	40,4				No	Yes	Bruun 1895;424, Madsen 2009;32	
E95_02	E95	36,77	26,01	646,43	1,41	2									No	1					No	Yes	Bruun 1895;424, Madsen 2009;32	
E95_03	E95	6,96	3,82	23,53	1,82	2									Yes	4	59,8				No	Yes	Bruun 1895;424, Madsen 2009;32	
E95_04	E95	5,24	2,95	15,44	1,78	5	0,4	1	10,62						No	4	100,9				No	Yes	Bruun 1895;424, Madsen 2009;32	
E95_05	E95	9,03	7,76	45,1	1,16	3	0,5								No	14	106,4				No	Yes	Madsen 2009;32	Ruin preservation and erosion does not allow for detailed measurements
E95_06	E95	2,28	2,01	4,5	1,13	3	0,45	1	1,67						No	19	36			1	No	Yes	Madsen 2009;33	
E95_06a	E95	4,3	3,91	13,27	1,10	2	0,4	1	8,9						No	17	31,6	154,4	S	1	No	Yes	Madsen 2009;33	
E95_07	E95	12,42	7,44	77,58	1,67	2									No	14	3,3				No	Yes	Madsen 2009;33	
E95_08	E95	4,02	1,98	7,69	2,03	5									No	20	195,1				No	Yes	Madsen 2009;33	
E95_09	E95	2,79	2,25	4,7	1,24	3	0,35	1	2,31						No	20	269,2			3	No	Yes	Madsen 2009;33	
E95_10	E95	7,19	3,3	25,67	2,18	4	0,5	1	14,22						No	18	191,9	2,49	S	3	No	Yes	Madsen 2009;34	
E95_11	E95	4,09	2,48	8,04	1,65	4	0,4	1	3,81						No	18	187,5	2,49	S	2	No	Yes	Madsen 2009;34	
E95a_01	E95a	22,86	17,4	292,83	1,31	2									No	1					No	Yes	NMA:Bak 1968;N95a-1, Madsen 2009;36	NMA:Bak 1968;N95a-1, ruin 1
E95a_02	E95a	5,8	4,53	26,29	1,28	2									No	14	2,1				No	Yes	NMA:Bak 1968;N95a-1, Madsen 2009;36	NMA:Bak 1968;N95a-1, ruin 2
E95a_03	E95a	10,9	4,32	37,73	2,52	5	0,6	1	20,15						No	4	2,4				No	Yes	NMA:Bak 1968;N95a-2, Madsen 2009;37	NMA:Bak 1968;N95a-1, ruin 6?
E95a_04	E95a	7,2	5,62	38,84	1,28	2	0,5								No	14	17,1				No	Yes	Madsen 2009;37	
E95a_05	E95a	4,8	4,14	19,79	1,16	2	0,65	2	4,92	4,21					No	7	19,7				No	Yes	Madsen 2009;37	
E95a_06	E95a	7,93	4,83	33,29	1,64	2	1	1	13,41						No	4	28,6				No	Yes	Madsen 2009;37	
E95a_06a	E95a	6,02	2,51	10,69	2,40	3	0,5	1	7,24						No	17	28,6	44,4	SE	1	No	Yes	Madsen 2009;37	Ruin dimensions are only roughly accurate, because the feature is not wholly preserved
E95a_07	E95a	11,36	8,62	76,08	1,32	3	0,5	1	59,2						No	18	116,7	93,3	W	3	No	Yes	Madsen 2009;38	
E95a_08	E95a	6,3	5,05	24,93	1,25	4	0,8	1	12,29						No	18	78,2	18,4	SE	3	No	Yes	NMA:Bak 1968;N95a-2, Madsen 2009;38	NMA:Bak 1968;N95a-1, ruin 10
E95a_09	E95a	2,49	1,55	3,48	1,61	6	0,25	1	2,2						No	19	51,5	8,3	E	3	No	Yes	Madsen 2009;38	
E95a_10	E95a	24,03	18,8	357,51	1,28	4	1,1	1	290,21						No	15	40	8,3		1	No	Yes	NMA:Bak 1968;N95a-2, Madsen 2009;38	NMA:Bak 1968;N95a-1, ruin 9

Ruin Data																									
Ruin_Id	RG NO	R_Length	R_Width	R_Area	L/W_Index	Build_mat/style	Wall_Th	No_Comp	Ar_Comp 1	Ar_Comp 2	Ar_Comp 3	Ar_Comp 4	Ar_Comp 5	Ar_Comp 6	Sunk	Ruin_Int	Dis_MD	Dis_Encl	Encl_Fac	Encl_Bed	Slope	DGPS	Ref	Add
E95a_11	E95a	14,11	9,88	113,32	1,43	4	1,15	2	50,98	11,53					No	15	114,5	79,78	SE	3	No	Yes	Madsen 2009;38	
E95a_12	E95a	4,78	2,59	12,41	1,85	2	0,55	1	5,55						No	4	67,4				No	Yes	Madsen 2009;39	
E95a_13	E95a	11,36	4,06	46,86	2,80	3	0,8	2	12,35	11,14					No	5	52,1				No	Yes	Madsen 2009;39	NMA:Bak 1968;N95a-1, ruin 3
E95a_14	E95a	8,9	5,01	40,15	1,78	2									No	4	13,3				No	Yes	NMA:Bak 1968;N95a-1, Madsen 2009;39	NMA:Bak 1968;N95a-1, ruin 2
E95a_15	E95a	3	2,5	7,5	1,20	4									No	9					No	No	NMA:Bak 1968;N95a-3	NMA:Bak;N95a-1, ruin 11. Ruin measurements from rough sketch survey only.
E95b_01	E95b	32,3	14,9	376,01	2,17	2									No	1					No	Yes	NMA:Bak 1968;N95b-2, Gulløv 1999;19, Madsen 2009;41	NMA:Bak 1968;N95b-2, ruin 3
E95b_02	E95b	7	4,42	30,43	1,58	5									No	4	81,3				No	Yes	Madsen 2009;41	
E95b_03	E95b	10,97	6,01	54,01	1,83	5	0,5	1	41,34						No	18	30,5		S	3	No	Yes	Madsen 2009;42	Madsen 2009 ruin 05
E95b_04	E95b	3,92	3,16	8,78	1,24	3	0,7	1	3,67						No	14	87,2				No	Yes	NMA:Bak 1968;N95b-2, Madsen 2009;42	NMA:Bak 1968;N95b-2, ruin 9
E96_01	E96	11,57	4,2	48,82	2,75	2	0,95	2	12,1	9,46					No	5	152,2				No	Yes	Madsen et al., field report under preparation	
E96_02	E96	7,67	4,16	30,73	1,84	2	0,8	1	14,88						No	4	183,1				No	Yes	Madsen et al., field report under preparation	
E96_03	E96	2,7	1,74	4,3	1,55	4	0,75	1	1,3						No	20	184,2				No	Yes	Madsen et al., field report under preparation	
E96_04	E96	19,14	7,73	118,25	2,48	2									No	2	146,1				No	Yes	Madsen et al., field report under preparation	
E96_05	E96	3,79	2,1	7,77	1,80	4									No	9	227,6				No	Yes	Madsen et al., field report under preparation	
E96_06	E96	14,67	11,83	131,05	1,24	2									No	1					No	Yes	Madsen et al., field report under preparation	
E96_07	E96	9,61	2,86	25,96	3,36	5									No	4	111,5				No	Yes	Madsen et al., field report under preparation	
E96_08	E96	21,13	5,63	112,33	3,75	3	0,9	4	17,97	10,94	10,6	10,16			No	6	119,7				No	Yes	Madsen et al., field report under preparation	
E96_09	E96	7,96	4,21	33,15	1,89	5	0,65	1	19,31						No	4	124,3				No	Yes	Madsen et al., field report under preparation	
E96_10	E96	3,56	2,83	10,04	1,26	4									No	9	97,1				No	Yes	Madsen et al., field report under preparation	
E96_11	E96	3,72	3,07	11,54	1,21	5	0,65	1	5,13						No	14	131,1				No	Yes	Madsen et al., field report under preparation	
E96_12	E96	7,68	3,8	29,46	2,02	2	0,8	1	13,82						No	4	26,5				No	Yes	Madsen et al., field report under preparationMadsen et al., field report under preparation	
E96_13	E96	8,25	4,73	38,78	1,74	3	0,8	1	19,94						No	4	149				No	Yes	Madsen et al., field report under preparation	
E96_14	E96	5,55	4,84	26,82	1,15	3									No	14	135,1				No	Yes	Madsen et al., field report under preparation	
E96_15	E96	6,02	5,77	25,51	1,04	4	0,65	1	18,53						No	18	105		W	3	No	Yes	Madsen et al., field report under preparation	

APPENDIX 2 – RUIN GROUP DATABASE PARAMETERS DESCRIPTION

A few introductory points should be made in regard to the RGD (App.2): first, it should be recognized that a *ruin group* is a nominal category (of archaeological registration), i.e. it is not directly equivalent to a discrete and defined Norse functional unit or site. Fortunately, most ruin groups do in fact seem to correspond to discrete sites. However, in a few cases – for instance E71 and E90 – two functionally distinctive sites are grouped under one ruin group number. In a few other cases the problem is just the opposite, i.e. separate ruin group numbers have been ascribed to archaeological features that are obviously part of the same functional unit. In such cases, the RGD attempts to either split or assemble ruin group evidence on functional units – for instance E71N, E71S, and E90c – although it is not feasible in all cases – for instance E167 – because there are no topographic features to guide such distinction.

Second, unlike the Ruin Database (RD, see section 6.1.2, App.1) most of the parameters observed for the sites in the Ruin Group Database were recorded during survey data post processing and drawing on various digital geographic and topographic data. The different parameters are explored in the following sections, but described together here for convenience. Some parameters are referential or quantitative and need little explanation, others are more, or purely, qualitative and call for extended explanation:

Ruin Group Identification Number (Ruin Group_ ID):

The *unique identification number of each individual ruin group*. Ruin group numbering follows the old registration system. In the RGD this number refers directly to the RD.

Nunatta Katersugaasivia Allagaateqarfialu Number (NKA_No.):

Ruin group unique identification number after the new registrant of the National Museum of Greenland. Note that ruin groups located after 1982 only have a NKA number and are numbered with this also under the Ruin Group_ID.

Location Name (Loc_Name):

The current Greenlandic place name of the location of a ruin group.

Survey Category (Survey_Cat):

Describes whether the main ruin group survey evidence is based on: 1) DGPS-survey; 2) published modern surveys (carried out with basic analogue survey equipment, but aimed at uniform and precise ruin description, e.g., Fig.4.15); 3) georeferenced/digitalized surveys (of the former type of survey evidence for digital measuring); 4) surveys based on satellite imagery or aerial photography without ground thruthing; and 5) survey based on sketch plans/description only. This parameter is included for quick overview and survey quality assessment.

Region (Reg.):

The larger geographical region where the ruin group is located (cf. Fig.3.2) and where: 1) is the Vatnahverfi region; 2) is the Qaqortoq Peninsula; 3) is the Qassiarsuk/*Brattahlid* region; 4) is the Uunartoq Fjord; and 5) the southern Eastern Settlement. This parameter was included for general overview, sorting, and for any future develop-ment and extension of the RGD.

Vegetation Zone (Veg_Zone):

The vegetation zone (Fig.3.10) after Feilberg (1984) in which the ruin group is located and where zones are described as: 1) sub-continental, subarctic; 2) sub-continental, low-arctic zone; 3) sub-oceanic, low- or subarctic; 4) oceanic, low-arctic; 5) hyper oceanic, low-artic; or 6) residual zone. These nature of these vegetation zones are described in section 3.2.1

Elevation in meters above sea level (Ele_m.a.s.l.):

The elevation of a ruin group in meters above sea level. Because ruin groups mostly consist of several ruins that can be located at different altitude, the parameter is divided on 25m categories, within which the majority of the ruins are located. The 0-25 m category is labelled '1' in the Ruin Group Database, the next 25-50m category '2' etc.

Ruin Group Orientation (RG_OR):

If sheltered and shaded from one or more sides by steep mountain slopes, ruin group orientation signifies the general orientation towards which the ruin group is

lies exposed divided on 8 intercardinal directions (beginning with '1' for north and increasing clockwise) and 9 if the ruin groups lies in open terrain.

Ruin Group Excavation (Exc., yes/no):

Binary parameter that describes if a ruin group in the sample has been excavated at any point. For details on the excavation and references, see Tab.4.1.

Total Number of Ruins (TNR):

The total number of ruins (including building types 1-25 in the RD, but excluding irrigation features, other features, and unknown features, since these to a limited extent and somewhat arbitrarily reflect site functions.

Number of Roofed Buildings (No_RB):

The total number buildings are classified as roofed in the RD (1-12).

Total Area of Roofed Buildings (Ar_RB):

The summed up area of all buildings classified as roofed in the RD (1-12, 14).

Total Area of Enclosures (TAE):

Is the total enclosed area of enclosures with built wall (15-16), enclosures partly delimited by building and cliff (17-18), separate *lambrakró* (19), sheep/goat shelters (20), and grazing enclosures (22). Although these enclosures, as discussed in chapter 7, clearly had different functions they all relate to individual farmstead activities and must on some level reflect the overall scale of livestock farming on a given site after the assumption that much livestock equals large enclosures.

Farmstead Dispersion Index (FDI):

The average distance of all outbuildings to the main farmhouse. As presented in chapter 6, the distance of various outbuildings to their associated dwellings seem fairly distinctly associated with function. At the same time, it was outlined in section 5.1.2 how some farmsteads have a noticeably more dispersed layout schemes than others that appear more nucleated. It was argued there that these different layout schemes reflect different farmstead types. Thus it seems reasonable that the overall dispersion of outbuildings is applicable as a measure for farmstead function and size. The FDI is simply the total average distance of outbuildings to their associated dwellings excluding the single ruin that lies most distant, because one or a few ruins quite often are located atypically remote. Where there is only one ruin apart from the dwelling, their inter-distance is used.

Number of Dwellings (No_Dwell):

The numbers of buildings classified as dwellings (1) in the RD.

Area of Main Dwelling (Ar_MD):

The area of the dwelling (cf. App.1); in cases where there two dwellings, only the largest is indicated.

Midden (Midd., yes/no):

Is a midden registered at the site?

Number of Cattle Houses (Cattle_House.):

The numbers of buildings that primarily facilitated housing and stalling of cattle (classified as simple byre/barns (2) and stable-complexes (3) in the RD).

Number of Livestock Houses (Livestock_House.):

The numbers of buildings that could facilitate cattle, but was primarily related to the housing and stalling of other livestock (buildings classified as bipartite livestock buildings (5) and livestock stables (6) in the RD).

Number of Sheep/Goat Houses (Sheep/Goat_House.):

The numbers of buildings that solely facilitated housing and stalling of sheep/goats (buildings classified as sheep/goat sheds (4), double sheep/goat sheds (7), and sheep/goat shelter/pens (8) in the RD).

Number of Storehouses (Storehouse.):

The numbers of buildings classified as storehouses (9) in the RD.

Number of Other Roofed Houses (Roof_House):

The numbers of buildings classified as unspecified roofed outbuildings (14) in the RD.

Number of Caprine Enclosures (Cap_Encl.):

The number of enclosures at a ruin group that primarily facilitated herding and milking of sheep/goat husbandry (buildings classified as enclosures with built wall, enclosures partly limited building or cliff, separate *lambakró*, and sheep/goat shelters types 17-21 in the RD). Enclosures partly delimited by building are

included here because they could have functioned as pens/folds, and were mainly associated with minor sheep/goat houses, i.e. facilitated management and housing of the latter livestock (see section 6.2.3).

Number of Grazing Enclosures (Graz_Encl):

The numbers of buildings at a ruin group that primarily facilitated cattle herding and milking (buildings classified as enclosures with partly delimited by water (21) and grazing enclosures (22) in the RD).

Infield Area (Ar_Infield):

The approximate area of land at a ruin group that could be cultivated (infield). Although DGPS-surveyed in a few instances, most of the Ar_Infield have been measured from GoogleEarth satellite imagery.

Meadow (yes/no?):

Is fen/meadow vegetation found within 500m of the site?

Additional notes (Add.):

Additional description or notes on a ruin group, most often stressing if a ruin group was split or assembled differently from earlier registration.

In conclusion, it is obvious from the above outline that the RGD condenses some of the categories of livestock outbuildings and enclosure and "fuzzy" clusters outlined in chapter 6. As discussed there, the building types to some extent overlap in functions and dimensions. Thus, the grouping of outbuildings offered in the RGD should be understood as a transitional guideline: the simple byre/barns and stable complexes were *more* specifically associated with cattle housing than the bipartite livestock buildings and livestock stables; the latter were associated *more* with general livestock housing than the sheep/goat sheds and shelter/pens, which were *more* specifically associated with sheep/goat housing. The grouping of enclosures is explained along the same lines: enclosures with built wall, partly delimited by cliff, the separate lambakró, and sheep/goat shelters were functionally *more* related to milking and farm-near livestock herding than the enclosures partly delimited by water that were related to large-scale livestock roundups or cattle grazing, the latter function being even *more* significant at the cattle grazing enclosures etc. The grouping of farmstead buildings is explored in section 7.1.4)

Ruin Group Info																												
RG_No	NKA_NO	Loc_Name	Surv_Cat	Reg	Vege_Zone	Ele_ASL	RG_Or	RG_Class	Exc	TNR	No_RB	Ar_RB	TAE	Dis_Index	No_Dw	Ar_MD	Midd	Cattle_House	Livestock_House	Sheep/goat_House	Storehouse	Roof_House	Cap_Encl	Graz_Encl	Ar_HF	Meadow	Add
00-2			1	3	1	9	4	10	Yes	4	2	10,78	207,16	4,5	1	57,76	No	0	0	0	1	0	2	0		Yes	
0403			2	1	3	8	4	7	No	1	0	0	84	0	0	0	No	0	0	0	0	0	1	0	0	No	
0405			5	1	4	1	8	6	No	1	1	15	0	0	0	0	No	0	0	0	0	1	0	0	0	No	
0501			1	1	3	1	8	1	No	1	1	11,61	0	0	0	0	No	0	0	1	0	0	0	0	0	No	
0502		Yessletten	1	1	1	4	8	8	No	4	3	83,76	72,92	0	0	0	No	0	0	2	1	0	1	0	0	Yes	
0503		Snesø	1	1	1	19	4	1	No	1	0	0	0	0	0	0	No	0	0	0	0	0	0	0	0	No	
0601			1	1	1	7	2	6	No	1	1	5,4	0	0	0	0	No	0	0	0	0	1	0	0	0	No	
0602			5	1	3	8	8	8	No	3	1	18	24	0	0	0	No	0	0	0	0	1	1	0	0	No	
0603		Tasersuaq	1	1	3	1	8	6	No	1	1	32,24	0	0	0	0	No	0	0	0	0	1	0	0	0	No	
0604			5	1	3	1	5	4	No	1	0	0	6	0	0	0	No	0	0	0	0	0	1	0	0	No	
0605		Sioralik	1	1	3	1	3	2	No	2	2	53,78	0	0	0	0	No	0	0	0	0	1	0	0	0	No	
0701	60V2-0IV-44	Karrarmiut	1	1	4	1	5	8	No	3	2	36,63	5,28	0	0	0	No	0	0	0	0	2	1	0	0	No	
0901		Taseq Ammolortoq	1	1	1	7	5	10	No	2	2	46,68	0	0,7	1	0	No	0	1	0	0	0	0	0	0	No	
0902			1	1	3	1	9	3	No	1	0	0	0	0	0	0	No	0	0	0	0	0	0	0		No	
1001		Akia	1	1	4	1	9	5	No	2	2	23,6	0	0	0	0	No	0	0	0	0	2	0	0	0	Yes	
1102		Tasikulooq	1	1	3	9	9	4	No	1	0	0	6,15	0	0	0	No	0	0	0	0	0	1	0	0	No	
1103		Naasaangitsup Tasia	1	1	3	13	9	6	No	1	1	14,73	0	0	0	0	No	0	0	0	0	1	0	0	0	No	
1104		Tasersuaq	1	1	3	9	6	10	No	1	1	0	0	0	1	49,92	No	0	0	0	0	0	0	0	0	No	
1301			1	1	4	2	4	8	No	6	1	9,03	56,96	0	0	0	No	0	0	0	0	1	5	0		No	
60V1_00I_543	60V1_00I_543		1	4	3	1	2	2	No	1	1	42,75	0	0	0	0	No	0	0	0	0	0	0	0	0	No	
B10			5	1	3	9	6	7	No	4	0	0	26,9	0	0	0	No	0	0	0	0	0	4	0		No	
B102	60V2-I0V-527	Qorlortuup Tasia	1	1	3	5	7	1	No	1	0	0	0	0	0	0	No	0	0	0	0	0	0	0	0	No	
B136			5	1	3	4	4	10	No	4	2	12	77	0	1	225	No	0	0	1	0	0	2	0		No	
B139		Tasersuaq	5	1	3	1	3	10	No	3	1	0	21,2	39,7	1	34,97	No	0	0	0	0	0	2	0		No	
E111	59V1-0IV-502	Ikigaat	1	6	4	1	4	16	Yes	13	8	803,68	50,22	73,3	1	523,2	Yes	2	1	1	0	2	3	0		No	
E118	60V2-0IV-572	Sarfarmiut	1	1	4	1	5	11	No	7	6	95,18	21,69	70,8	1	313,49	Yes	0	0	2	1	2	1	0	4558	Yes	Note that only the area nearest the dwelling (R02) is counted as homefield proper, as the other areas are deemed to wet.
E119	60V2-0IV-575	Illorsuit	1	1	4	2	5	13	No	13	10	391,99	96,47	86,5	1	507,74	Yes	1	2	2	2	2	3	0	10713	Yes	
E120	60V2-0IV-574	Tasiluk	1	1	4	1	6	12	No	9	6	211,44	97,42	92,1	1	450	Yes	0	0	2	1	2	2	0		Yes	Note that several ruins have been removed before proper registration; Ar_Mid, Ar_HF cannot be estimated as these have been removed and are now cultivated
E125	60V1-00I-531	Asorutit	1	4	4	2	5	11	No	11	9	305,55	21,09	53,9	1	108,06	No	0	3	1	0	3	2	0		No	
E126	60VI-00I-529	Igannaq	1	4	3	1	5	12	No	8	7	291,75	113,57	47,7	1	295,61	Yes	1	0	4	0	0	1	0		Yes	
E149	60V2-0IV-504	Narsarsuaq	3	5	4	1	9	16	Yes	22	14	1626,42	349,76	127,8	1	1587,62	Yes	4	1	4	0	3	7	0		Yes	
E150	60V2-0IV-506	Puiattuaraq	1	5	4	1	4	9	No	6	5	155,04	177,08	0	0	0	No	0	2	1	0	2	1	0		Yes	
E164	60V2-0IV-590	Kallunatsiaq	1	1	3	5	4	13	No	24	20	637,78	116,32	126,3	1	159,19	Yes	0	5	5	1	8	3	0		Yes	Ar_HF could not be measured
E165	60V2-0IV-591	Tasersuaq	1	1	3	1	1	13	No	4	3	16,23	396,98	149,9	1	839,87	Yes	0	0	2	0	0	0	0	1486	No	Note: only the DGPS-survey exists from the 2006 survey, no description
E166	60V2-0IV-592	Tasersuaq	1	1	3	1	7	12	No	7	6	168,09	45,54	90,4	1	707,82	Yes	0	1	1	0	3	1	0	2462	No	
E167	60V2-0IV-603	Tasikulooq (Abel's Farm)	1	1	3	10	4	11	Yes	15	12	266,62	45,54	92,1	2	520,8	Yes	0	0	3	3	2	2	0	5301	Yes	
E167a	60V2-0IV-604		5	1	3	10	9		No	1	0	0	78,76	0	0		No	0	0	0	0	0	0	0	0	No	Ruins are very uncertain, only sketch description exists
E168	60V2-0IV-541	Zucerip Tasia	1	1	1	11	4	11	Yes	7	6	670,47	38,85	82,5	1	484,83	Yes	1	2	0	1	1	1	0	3262	Yes	
E169	60V2-0IV-610	Hestespor Sø	1	1	1	4	9	11	Yes	4	2	31,39	177,12	160,3	1	339,44	Yes	0	0	1	0	0	2	0	0	Yes	

Ruin Group Info																											
RG_No	NKA_NO	Loc_Name	Surv_Cat	Reg	Vege_Zone	Ele_ASL	RG_Or	RG_Class	Exc	TNR	No_RB	Ar_RB	TAE	Dis_Index	No_Dw	Ar_MD	Midd	Cattle_House	Livestock_House	Sheep/goat_House	Storehouse	Roof_House	Cap_Encl	Graz_Encl	Ar_HF	Meadow	Add
E170	60V2-0IV-547	Saarap Qoorua	1	1	3	7	4	11	No	7	6	293,77	95,82	167,8	1	282,14	Yes	1	0	0	2	2	1	0	1	No	Note that ruin group E170a is here treated as part of E170
E170a	60V2-0IV-546	Saarap Qoorua	1	1	2	5	9		No	1	1	109	0	0	0		No	0	0	0	0	0	0	0		No	
E171	60V2-0IV-601	Tasilikulooq	1	1	3	1	9	13	Yes	16	12	1007,76	251,45	64,5	2	350,8	Yes	4	2	2	0	2	3	1		Yes	Note that Ar_HF cannot be measuret as it is now cultivated
E172	60V2-0IV-593	Tatsip Ataa	1	1	3	1	9	13	Yes	21	14	1098,79	198,88	127,8	1	535,19	Yes	2	3	4	1	3	5	0	7761	Yes	
E173	60V2-0IV-583	Ammassiviup Tasia	1	1	4	3	9	11	No	11	9	284,02	66,04	61,48	1	190,37	Yes	0	2	2	1	3	2	0	0	Yes	
E174	60V2-0IV-580	Qemertut Tasia	1	1	4	1	5	13	No	13	9	356,18	66,09	137,7	1	632,47	Yes	0	2	4	1	1	1	0		Yes	Note that Ar_HF cannot be measuret as it is now cultivated
E175	60V2-0IV-588		1	1	3	7	5	10	No	1	1	0	0	0	1	87,61	No	0	0	0	0	0	0	0	0	No	
E178	60V2-0IV-569	Tasiusaq	1	1	4	1	9	14	No	19	12	307	1201,99	88,24	1	737,25	Yes	0	1	6	2	2	4	1	622556	Yes	Note that ruin 1 in all likelihood covers several buildings and midden, but was too poorly preserved to establish
E179	60V2-0IV-568	Torsukattak	1	1	4	1	5	11	No	3	3	15,89	0	10,2	1	336,76	No	0	0	0	0	2	0	0	2305	No	
E18	60V1-00I-520	Narsaq	1	4	3	1	4	16	Yes	17	14	1784,59	20,91	99,7	1	1097,58	Yes	2	3	3	2	2	1	0		Yes	
E180	60V2-0IV-549	Qallimiut Imaa	1	1	3	1	4	11	No	4	3	85,55	52,66	25	1	251,27	No	0	0	2	0	0	1	0	0	No	
E181	60V2-0IV-571	Itilleq	1	1	4	1	3	13	No	8	7	229,05	49,17	76	1	532,72	No	0	0	4	1	1	1	0	8220	No	Note that ruin 1 could hide midden
E182	60V2-0IV-582	Kangerluarsorujuup Qinngua	1	1	4	1	6	13	No	16	13	817,91	454,99	133,1	1	357,46	Yes	2	1	1	1	7	3	0		Yes	Note that Ar_HF cannot be measuret as it is now cultivated
E183	60V2-0IV-577		5	1	4	2	4	13	No	3	3	530	0	0	1	467,5	No	0	1	0	0	1	0	0		No	Note that only rough a survey description exists from this ruingroup
E184	60V2-0IV-579	Tasiluaraq	1	1	4	1	6	13	No	14	10	628,84	144,23	92	1	946,06	Yes	2	0	3	1	3	3	0		Yes	Note that midden could not be distinguished from ruin. Note that Ar_HF cannot be measuret as it is now cultivated.
E188	60V2-0IV-637	Akia	1	1	4	1	4	12	Yes	10	6	272,47	129,53	121,2	1	201,17	Yes	1	1	0	1	2	4	0	1975	Yes	
E190	60V2-0IV-564	Qaarsutsiaq	1	1	4	1	4	13	Yes	10	7	665,91	236,51	72,5	1	303,3	Yes	3	0	1	0	2	3	0	15634	Yes	Note that midden could not be distinguished from ruin. Note that Ar_HF does not include recently cultivated field that was likely meadow
E195	60V1-00I-530	Igannaq	1	4	3	1	4	10	No	7	3	51,19	98,92	52,2	1	122,23	No	0	1	0	1	0	2	0		No	
E196	60V2-0IV-587	Nimerialik	1	1	3	1	4	13	No	6	5	518,19	284,52	30	1	623,03	No	1	0	1	0	2	1	1		Yes	
E209	60V2-0IV-614	Kallunatsiaq	1	1	1	2	5	12	No	16	7	187,57	644,99	97,3	1	239,6	Yes	0	1	3	1	1	7	0	737	No	
E209a		Kallunatsiaq	1	1	1	2	6	12	No	3	3	42,26	0	3,9	1	94,27	No	0	0	0	0	2	0	0		No	
E210	60V2-0IV-594	Tatsip Ataa Kangilleq	1	1	3	1	5	5	No	7	5	190,94	25,46	0	0	0	No	0	1	2	0	2	2	0	0	No	
E237	60V2-0IV-556	Eqaluqaarsuit	5	1	4	1	4		No	1	0	0	0	0	0	0	No	0	0	0	0	0	0	0	0	No	
E262	60VI-00I-521	Nuummiut	1	4	3	1	9	10	No	1	1	0	0	0	1	141,91	No	0	0	0	0	0	0	0		Yes	
E273	60V1-00I-502	Akia	1	1	4	2	5	10	No	7	5	68,16	54,67	93,7	1	184,52	No	0	0	1	2	1	2	0	3465	No	
E274	60V1-00I-501	Nuuk Qaqortoq	1	1	4	1	4	7	No	1	0	0	14,2	0	0	0	No	0	0	0	0	0	1	0	0	No	
E28	61V3-III-541	Qassiarsuk	2	3	1	1	9	13	Yes	13	10	773	40	173,8	1	325,53	Yes	0	4	3	1	0	2	0		Yes	
E29	60V3-III-540	Qassiarsuk	3	3	1	1	9	13	Yes	10	8	457,72	1375,1	103,4	1	309,45	Yes	2	0	3	2	0	2	0		Yes	
E293	60V2-0IV-613	Inoqquassaap Kuua	1	1	1	8	7	10	No	4	1	0	138,53	15,4	1	173,59	No	0	0	0	0	0	3	0	0	Yes	
E294	60V2-0IV-537	Ulvesøen	5	1	1	9	4	6	No	1	1	7	0	0	0	0	No	0	0	0	0	1	0	0	0	No	
E295	60V2-0IV-535	Snesø	1	1	1	19	9	3	No	2	0	0	0	0	0	0	No	0	0	0	0	0	1	0	0	No	
E296	60V2-0IV-536	Amaqqup Tasia	1	1	1	8	4	9	No	8	8	73,34	0	0	0	0	No	0	0	0	0	8	0	0	0	No	
E297	60V2-0IV-534	Amaqqup Tasia	1	1	1	7	9	6	No	1	1	10,16	0	0	0	0	No	0	0	0	0	1	0	0	0	Yes	
E298	60V2-0IV-533	Petrusip Tasia	1	1	1	7	8	10	No	2	1	0	12,06	0	1	250,41	No	0	0	0	0	0	1	0	0	No	
E299	60V2-0IV-532	Daniel Bruun	1	1	1	8	4	5	No	1	1	1	0	0	0	0	No	0	0	0	1	0	0	0	0	No	

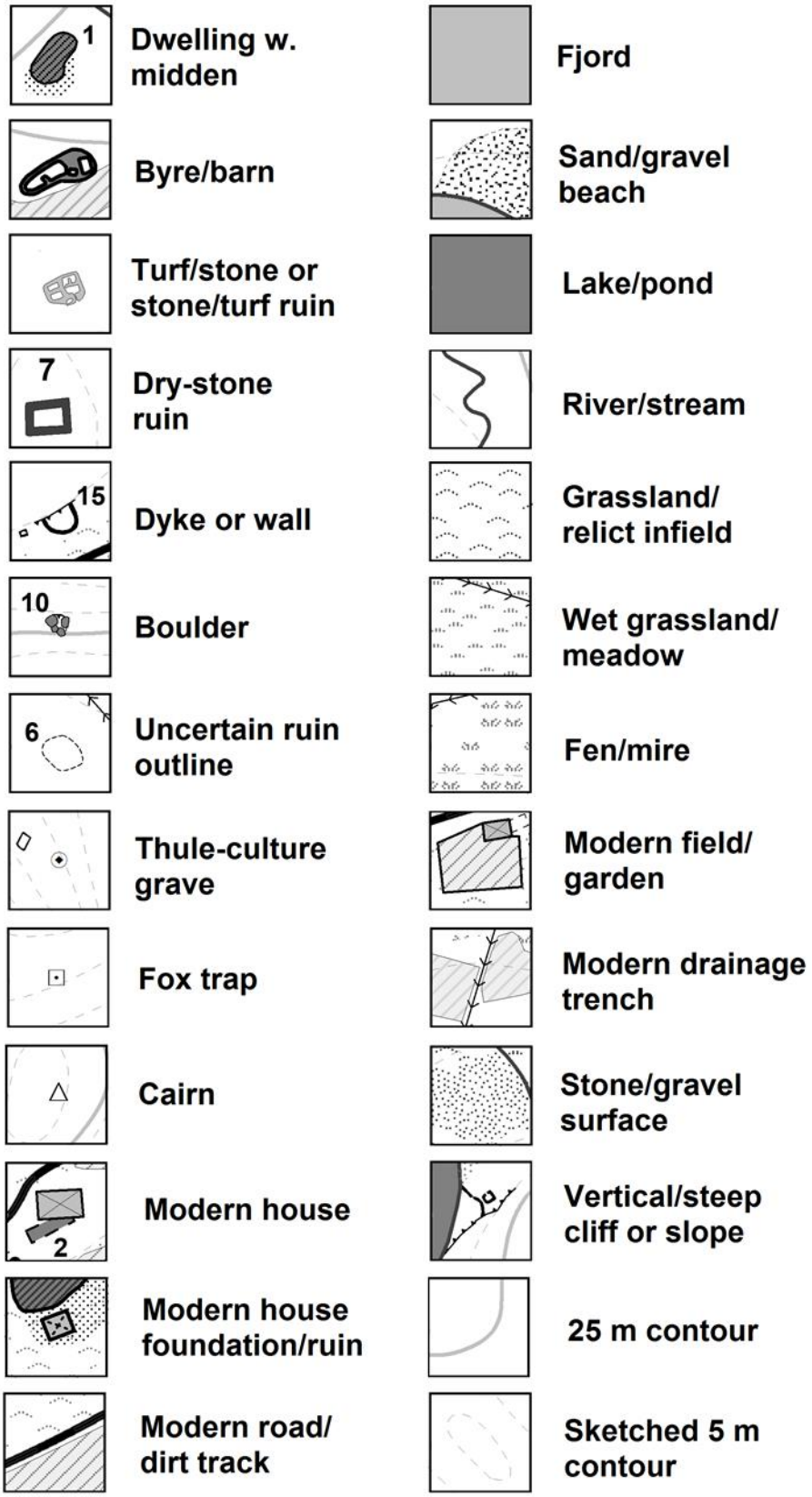
Ruin Group Info																											
RG_No	NKA_NO	Loc_Name	Surv_Cat	Reg	Vege_Zone	Ele_ASL	RG_Or	RG_Class	Exc	TNR	No_RB	Ar_RB	TAE	Dis_Index	No_Dw	Ar_MD	Midd	Cattle_House	Livestock_House	Sheep/goat_House	Storehouse	Roof_House	Cap_Encl	Graz_Encl	Ar_HF	Meadow	Add
		Qoorua																									
E29a	61V3-III-539	Qassiarsuk	3	3	1	1	9	16	Yes	19	13	1116,15	782,31	139,1	1	717,49	Yes	3	1	2	4	1	5	0		Yes	
E3	61V3-III-535	Tasiusoq	1	3	1	1	9	13	Yes	23	14	706,2	527,95	88	1	414,51	Yes	2	2	4	4	3	7	0		Yes	
E300	60V2-0IV-531	Daniel Bruunip Qoorua	1	1	1	5	8		No	1	1	31	0	0	0	0	No	0	1	0	0	0	0	0		No	
E301	60V2-0IV-545	Qorlortorsuup Tasia	1	1	3	5	4	10	No	5	4	55,58	4,52	14	1	88,54	No	0	0	1	0	2	1	0	0	No	
E302	60V2-0IV-529	Qorlortorsuup Tasia	5	1	3	5	8	2	No	1	1	7,21	0	0	0	0	No	0	0	0	0	0	0	0	0	No	
E303	60V2-0IV-517	Siorallit Qoorua	5	1	1	16	6	10	No	1	1	0	0	0	1	143	No	0	0	0	0	0	0	0	0	No	
E304	60V2-0IV-518	Isortoq	1	1	1	15	6	10	No	2	2	13,12	0	4,4	1	98,15	No	0	0	0	0	1	0	0	0	Yes	
E305	60V2-0IV-519	Isortoq	1	1	3	14	4	10	No	7	6	102,44	97,6	9,48	1	164,96	No	0	2	0	0	3	1	0	0	Yes	
E308	60V2-0IV-522	Itilleq	5	1	3	8	9	6	No	1	1	3	0	0	0	0	No	0	0	0	0	0	0	0	0	No	
E309	60V2-0IV-523	Amitsuarsuk	1	1	3	1	8	8	No	3	2	33,59	39,52	0	0	0	No	0	0	0	1	1	1	0	0	No	
E310	60V2-0IV-527	Uluammittariaq	1	1	3	1	5	3	No	5	2	17,85	17,35	0	0	0	No	0	0	0	0	2	2	0	0	No	
E311	60V2-0IV-548	Qallukasik	1	1	3	1	5	11	No	7	5	111,83	9,1	0	0	0	No	0	0	2	0	3	2	0	9511	No	Note that several ruins, including a dwelling could have eroded completely away
E312	60V2-0IV-524	Akuliarusinnguaq	5	1	3	1	6	9	No	3	3	20,8	0	0	0	0	No	0	0	0	1	2	0	0		No	Note that the area and ruins are rather poorly surveyed and heavily overgrown with scrub vegetation
E313	60V2-0IV-525	Akuliarusersuaq	4	1	3	1	5	10	No	6	3	32	113,45	6,6	1	67,48	No	0	0	0	0	2	2	0	336	No	
E314	60V2-0IV-551	Nuuluk	1	1	3	1	5	6	No	1	1	62,58	0	0	0	0	No	0	0	0	0	1	0		0	No	Note that there are most likely more Norse structures, some disturbed by later Inuit features (see Mathiassen 1936)
E315	60V2-0IV-522	Nipisat Kuuat	5	1	3	3	6	7	No	1	0	0	74,61	0	0	0	No	0	0	0	0	0	1	0		No	
E322	60V2-III-530	Illunnguaq Qinngorleq	1	1	4	1	4	12	No	7	6	183,72	82,03	53,5	1	354,2	No	0	1	3	0	1	1	0	7781	No	Note that the existing Inuit features could hide more Norse ruins
E322a		Iliversuit	1	1	4	1	9	8	No	3	2	25,75	21,57	0	0	0	No	0	0	0	0	2	1	0	0	No	
E323	60V2-0IV-555	Ujarasussuit	5	1	4	1	9	10	No	3	2	8,75	57	0	1	95	No	0	0	0	0	1	1	0	0	No	
E324	60V2-0IV-560	Qoornukasik Saqqarleq	1	1	4	1	4	10	No	9	7	82,96	36,48	27	1	101,3	No	0	0	1	0	4	2	0	0	No	
E325	60V2-0IV-558	Qanisartuut	1	1	4	1	8	11	No	6	4	112,62	27,91	102,4	1	288,11	No	0	0	0	1	2	2	0	0	No	
E326	60V2-0IV-562	Kallit Illua	1	1	4	1	8	8	No	2	1	1	19	0	0	0	No	0	0	0	0	1	1	0	0	No	
E327	60V2-0IV-565	Sarfakasia Kujalleq	1	1	4	2	6	1	No	1	0	0	0	0	0	0	No	0	0	0	0	0	0	0	0	No	
E328	60V2-0IV-566	Sarfaa Avannarleq	1	1	4	1	4	9	No	3	3	54,08	0	0	0	0	No	0	0	0	0	3	0	0	0	Yes	
E329	60V2-0IV-570	Eqalugaarsuit	1	1	4	1	5	11	Yes	12	4	267,84	174,17	52,4	1	193,21	No	1	1	1	0	0	8	0	1432	Yes	
E330	60V2-0IV-567	Suilaasaq	1	1	4	1	6	10	No	6	3	25,93	37,38	68	1	64,62	No	0	0	0	2	0	3	0	0	No	
E331	60V2-0IV-581	Kangerluarsorujuk	1	1	4	1	9	10	No	1	1	0	0	0	1	219,39	No	0	0	0	0	0	0	0	2474	No	Note that several ruins have likely eroded away
E332	60V2-0IV-578		5	1	4	2	8	8	No	4	1	18	0	0	0	0	No	0	0	0	0	1	1	0	0	No	
E333	60V2-0IV-576		5	1	4	2	4	8	No	3	2	37,51	31,36	0	0	0	No	0	0	0	1	1	1	0		No	Note that there could be a small homefield area
E334	60V2-0IV-573	Upernaviarsuk	1	1	4	1	6	8	No	4	2	45,5	33,94	0	0	0	No	0	0	2	0	0	2	0	0	Yes	Note that several Norse are likely disturbed by later Inuit settlement or have eroded
E399	60V2-0IV-663	Itilleq	5	1	3	8	5	8	No	2	1	12	25	0	0	0	No	0	0	0	0	1	1	0	0	No	
E4	61V3-III-534	Tasiusaq	1	3	1	1	9	15	Yes	22	14	780,77	6086,88	121,4	1	543,57	Yes	2	4	1	4	2	3	3		No	
E47	60V2-0IV-621	Igaliku	2	2	1	1	4	16	Yes	38	31	3013,04	15224,03	233,4	1	934,93	Yes	3	6	4	6	10	3	2		Yes	
E48	60V2-0IV-620	Igaliku	1	2	1	1	6	13	Yes	14	11	491,26	60	110,6	1	500,62	Yes	1	1	2	1	3	3	0		Yes	
E59	60V2-0IV-626	Sissarluttoq	1	2	2	3	5	15	Yes	42	30	2400,96	2060,78	137,3	1	529,83	Yes	4	4	10	4	7	8	2		Yes	

Ruin Group Info																												
RG_No	NKA_NO	Loc_Name	Surv_Cat	Reg	Vege_Zone	Ele_ASL	RG_Or	RG_Class	Exc	TNR	No_RB	Ar_RB	TAE	Dis_Index	No_Dw	Ar_MD	Midd	Cattle_House	Livestock_House	Sheep/goat_House	Storehouse	Roof_House	Cap_Encl	Graz_Encl	Ar_HF	Meadow	Add
E60	60V2-0IV-618	Isotarfik	1	1	1	1	9	13	Yes	15	8	531,74	230,49	113,6	1	909,84	Yes	1	1	2	2	1	6	0	16205	Yes	
E61	60V2-0IV-617	Fox Bay	1	1	1	1	9	5	No	2	2	50,85	0	0	0	0	No	0	0	0	0	2	0	0	0	Yes	
E62	60V2-0IV-616	Kujalleq	1	1	1	1	5	10	No	2	2	0	0	0	1	114,62	No	0	0	0	0	1	0	0	0	No	
E63	60V2-0IV-615	Iterlak	1	1	1	1	5	13	No	15	9	307,47	745,53	97,9	1	355,77	Yes	1	0	5	1	1	3	1		No	
E64	60V2-0IV-612	Inoqquaasaq	1	1	1	1	6	14	No	17	10	966,39	716,68	109,5	1	561,37	Yes	2	2	1	2	1	5	1	40875	No	
E64a	60V2-0IV-539	Enok's Ruins	1	1	1	4	4	12	Yes	8	7	125,9	44,47	105	1	419,31	Yes	0	1	3	1	1	1	0	3363	No	Midden is hidden under aeolian deposists and cannot be delimited
E64b	60V2-0IV-538	Enok's Ruins	3	1	1	4	5	12	No	10	9	213,99	32,79	42,3	1	323,11	Yes	1	0	5	2	0	1	0	6068	No	Midden is hidden under aeolian deposists and cannot be delimited
E64c	60V2-0IV-540		3	1	1	4	6	12	Yes	10	7	466,49	100,31	115,8	2	146,01	Yes	2	0	1	2	0	3	0		Yes	Midden is hidden under aeolian deposists and cannot be delimited. Homefield area has been revegetated by willow scrub and cannot be estimated
E65	60V2-0IV-599	Atikerleq	1	1	1	1	7	15	Yes	10	7	362,61	3248,66	84	1	1322,96	Yes	1	0	1	0	3	2	1	22515	Yes	Note that Ar_HF only includes the lush patch centrally around the dwellling, not the stretch of grassland trailing along the coast
E66	60V2-0IV-611	Igaliku Kujalleq	1	1	1	1	4	16	Yes	30	20	1501,66	2524,67	107,7	2	737,46	Yes	1	0	3	1	4	4	4		Yes	
E67	60V2-0IV-542	Qorlortukasik	4	1	1	4	7	13	No	7	7	478,26	0	43,6	1	357,77	Yes	0	0	1	1	3	0	1		Yes	Note that several ruins are probably undiscovered
E68	60V2-0IV-609	Skyggesø	1	1	1	2	6	13	Yes	10	8	614,01	202,38	56,3	1	449,26	Yes	1	0	0	1	5	2	0		Yes	Note that Ar_Midd, Ar_HF cannot be measuret as it is now cultivated; survey is partially baed on georeferenced Google Earth satellite imagery
E69	60V2-0IV-608	Timerliit	1	1	1	2	7	13	No	12	10	537,37	350,5	144,7	1	661,01	Yes	0	2	3	0	4	1	0		Yes	Note that Ar_HF cannot be measuret as it is now cultivated; survey is partially baed on georeferenced Google Earth satellite imagery
E70	60V2-0IV-607	The Mountain Farm	1	1	1	11	6	11	Yes	10	8	423,04	23,85	38,8	1	330,3	Yes	1	1	2	1	2	2	0	2704	Yes	
E71a	60V2-0IV-600	Saqqaata Tasia	1	1	3	2	4	13	No	9	7	393,96	64,26	54,8	1	1072	Yes	1	3	0	1	1	1	0	8793	Yes	
E71N	60V2-0IV-602	Saqqaata Tasia	1	1	3	2	9	13	Yes	16	11	385,85	171,19	83,2	1	228,59	Yes	1	1	5	1	2	5	0		Yes	Note that Ar_HF cannot be measuret as it is now cultivated
E71S	60V2-0IV-602	Saqqaata Tasia	1	1	3	2	9	12	Yes	7	7	195,34	41,56	19,8	1	193,89	Yes	1	0	3	0	2	0	0		Yes	Note that Ar_HF cannot be measuret as it is now cultivated. Note that one part of enclosure E71N R20 is considered part of E71s
E72	60V2-0IV-606	Tasikulooq	1	1	3	10	6	11	No	16	14	528,38	46,8	39,6	3	530,69	Yes	1	5	2	1	2	2	0	2962	No	
E72a	60V2-0IV-605		5	1	3	8	5	7	No	1	0	0	0	0	0	0	No	0	0	0	0	0	1	0	0	No	Note that the Møøer&Madsen 2006 ruin may not be identical to Vebæk's 1948 registration
E73	60V2-0IV-544	Qorlortorsuup Tasia	1	1	3	5	5	13	Yes	21	18	646,21	223,71	134	1	288,35	Yes	0	5	4	1	6	3	0		Yes	Note that if there ever was a homefield, it is now completely revegetated by willow scrub
E74	60V2-0IV-530	Qorlortorsuup Tasia	1	1	1	5	8	11	Yes	9	4	175,17	233,07	276,2	1	232,11	Yes	0	1	0	0	1	2	0	0	No	Note that ruin group E300 is here considered part of E74

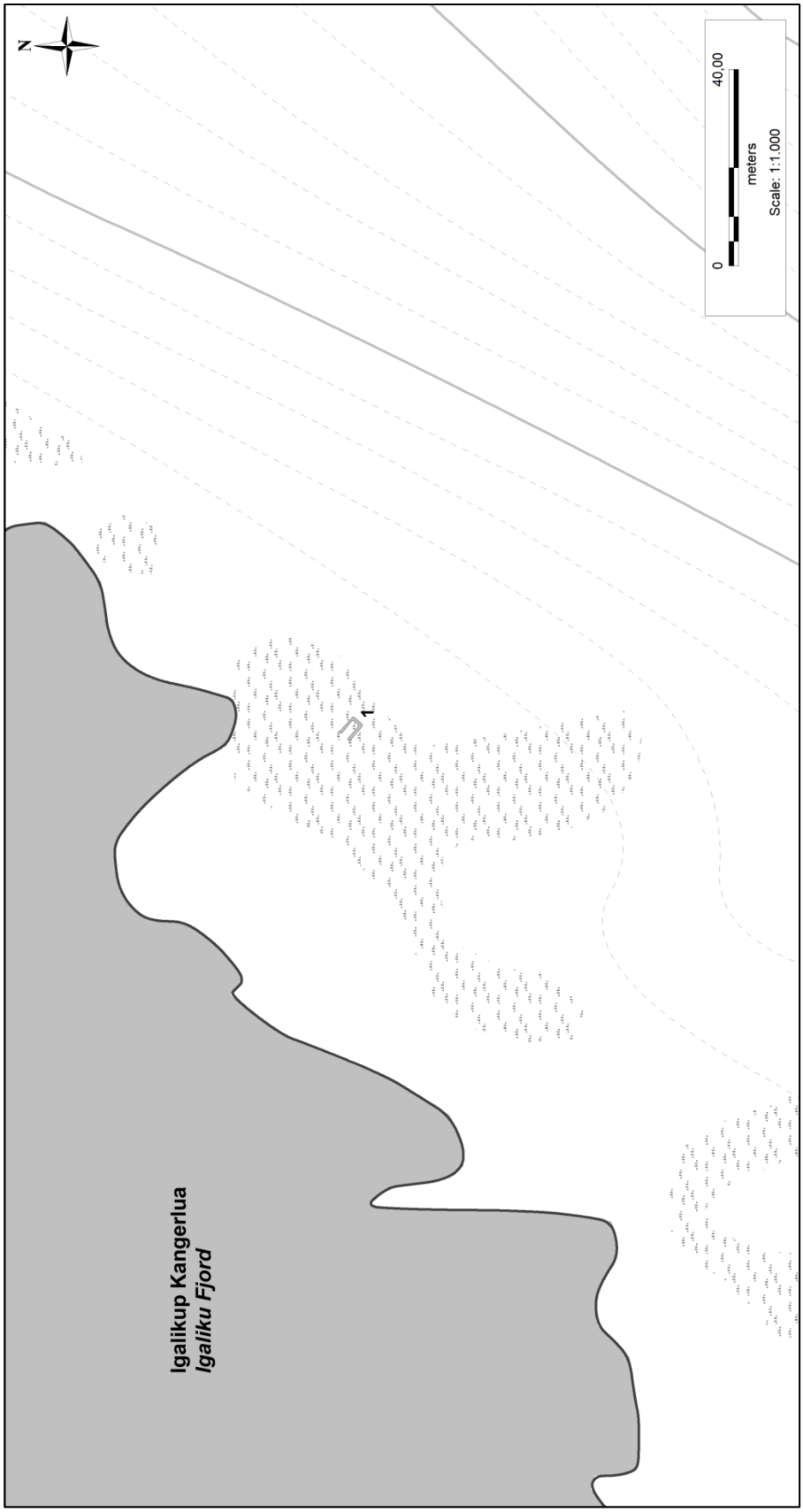
Ruin Group Info																												
RG_No	NKA_NO	Loc_Name	Surv_Cat	Reg	Vege_Zone	Ele_ASL	RG_Or	RG_Class	Exc	TNR	No_RB	Ar_RB	TAE	Dis_Index	No_Dw	Ar_MD	Midd	Cattle_House	Livestock_House	Sheep/goat_House	Storehouse	Roof_House	Cap_Encl	Graz_Encl	Ar_HF	Meadow	Add
E75	60V2-0IV-543	Taseq Ammalortoq	1	1	1	8	4	12	No	16	15	380,1	116,12	87,8	3	541,15	Yes	0	2	4	0	6	1	0	6714	Yes	
E76	60V2-0IV-597	Qanisartuut	1	1	3	1	5	15	No	21	11	547,14	10639,43	127,2	2	352	Yes	2	3	1	0	3	5	2	48685	Yes	Note that Ar_HF, Ar_Mid cannot be measured because the ruins have been removed. Note that the structures of ruin group E76a is here considered part of E76
E76a	60V2-0IV-596	Tasersuaq	1	1	3	1	9	9	No	5	3	130,15	0	0	0	0	No	0	1	2	0	2	0	0		No	
E76b	60V2-0IV-598	Qanisartuut	1	1	3	1	7	8	No	2	1	25,6	66,56	0	0	0	No	0	0	1	0	0	1	0	0	No	Note that ruin 0501 is interpreted as part of E76b
E76c	60V2-0IV-595	Qeqertarooq	1	1	3	1	9	8	No	4	2	21,14	25,4	0	0	0	No	0	1	0	1	0	1	0	0	No	
E77	60V2-0IV-584	Ukkusip Saqqaata Tasia	1	1	3	2	6	12	Yes	16	13	326,24	68,82	102,2	1	204,64	Yes	0	1	5	3	3	3	0	0	Yes	Note that Ar_HF cannot be measuret as it is now cultivated
E77a	60V2-0IV-550	Qallimiut	1	1	3	1	9	14	No	12	11	907,27	0	79,1	1	764,11	Yes	1	0	4	0	5	0	0		Yes	Note that Ar_HF, Ar_Mid cannot be estimated because the areas are either cultivated or have eroded
E78	60V2-0IV-585	Eqaluit	1	1	3	1	9	14	Yes	18	16	1184,11	0	185,5	1	636,74	Yes	3	3	4	0	4	0	0		Yes	Note that Ar_HF cannot be measuret as it is now cultivated
E78a	60V2-0IV-586	Eqaluit	1	1	3	1	6	13	Yes	14	11	594,97	107,4	144,5	1	726,55	Yes	1	5	1	1	2	3	0		Yes	Note that Ar_HF cannot be measuret as it is now cultivated
E78b	60V2-0IV-589	Tasersuaq	1	1	3	1	4	11	No	7	6	89,92	22,77	56,1	1	344,58	No	0	1	2	1	1	1	0	1977	No	
E80a	60V2-0IV-634	Kanassut	1	2	3	1	4	11	No	4	3	48,5	17,68	45,3	1	271,38	Yes	0	0	2	0	0	1	0		No	
E80b	60V2-0IV-634	Kanassut	1	2	3	1	4	13	No	16	11	353,34	161,25	109,7	1	241,95	Yes	1	1	3	2	3	5	0		Yes	
E80c	60V2-0IV-634	Kanassut	1	2	3	2	6	10	No	4	3	21,97	18,53	25,1	1	87,26	No	0	0	0	0	2	1	0		No	
E83	60V2-0IV-646	Qaqortukulloq	1	2	3	1	5	16	Yes	17	14	1110,8	1902,52	98	1	794,44	Yes	2	0	5	2	2	2	1		No	
E89a	60V2-0IV-507	Tasiusaarsuup Kilua	1	5	3	1	9	11	Yes	5	5	179,46	0	49	1	192,34	Yes	0	2	1	0	1	0	0		No	
E90	60V2-0IV-521	Sioralik	1	1	3	1	5	13	No	5	5	196,12	0	116,8	1	584,33	Yes	0	1	1	1	1	0	0		No	Note that if there ever was a homefield, it is now completely revegetated by willow scrub. Note that ruin description does not include ruins 1-9, which has been treated seperatedly as E90c
E90a	60V2-0IV-526	Sioralik	1	1	3	1	4	8	No	3	2	30,95	65,73	0	0	0	No	0	0	1	0	1	1	0	0	No	
E90b	60V2-0IV-520	Sioralik	1	1	3	1	5	5	No	1	1	70,01	0	0	0	0	No	0	0	0	1	0	0	0	0	No	
E90c		Sioralik	1	1	3	1	5	10	No	6	4	94,46	44,75	97,8	1	190,76	No	0	0	1	1	1	3	0	0	No	Note that the westernmost structures of ruin group E90 has here bere seperated as E90c; only R02a is considered part of the TEA
E91	60V2-0IV-528	Amitsuarsuk	1	1	3	1	6	13	Yes	15	13	626,67	41,91	127,8	1	394,97	Yes	2	3	2	2	3	2	0	3187	Yes	Note that the surrounding area is presently being farmed
E92	60V2-0IV-553	Nipisat	1	1	4	1	6	13	No	14	10	438,63	93,43	98,3	1	1042,26	Yes	2	4	1	0	4	3	0	12193	No	
E93	60V2-0IV-554	Kangerluluup	1	1	4	2	6	14	No	24	20	1247,46	104,24	80,2	1	896,83	Yes	2	4	5	2	6	3	0		Yes	
E94	60V2-0IV-557	Serfartusup Qinngua	1	1	4	1	7	13	No	20	11	752,38	112,6	130,2	1	484,79	Yes	1	3	1	0	4	6	0	24430	No	
E95	60V2-0IV-559	Amitsuarsuk	1	1	4	1	9	13	No	12	6	276,17	63,87	93,3	1	646,43	Yes	1	0	2	0	2	6	0	7077	Yes	
E95a	60V2-0IV-561	Akulliip Qinngua	1	1	4	1	4	12	No	16	10	262,86	586,01	39,7	1	292,83	No	0	1	5	1	2	6	0	14495	Yes	Note that the wet area is treated as homefield here
E95b	60V2-0IV-563	Kapiivik	1	1	4	1	6	11	No	4	3	39,21	54,01	55,9	1	376,01	Yes	0	0	1	0	1	1	0	1871	No	

Ruin Group Info																											
RG_No	NKA_NO	Loc_Name	Surv_Cat	Reg	Vege_Zone	Ele_ASL	RG_Or	RG_Class	Exc	TNR	No_RB	Ar_RB	TAE	Dis_Index	No_Dw	Ar_MD	Midd	Cattle_House	Livestock_House	Sheep/goat_House	Storehouse	Roof_House	Cap_Encl	Graz_Encl	Ar_HF	Meadow	Add
E96	60V2-0IV-505	Portusooq	1	5	3	1	5	12	Yes	15	12	493,65	29,81	128,1	1	131,05	Yes	1	2	5	2	2	2	0	181818	Yes	

Appendix 3 - Survey Plan Legend:



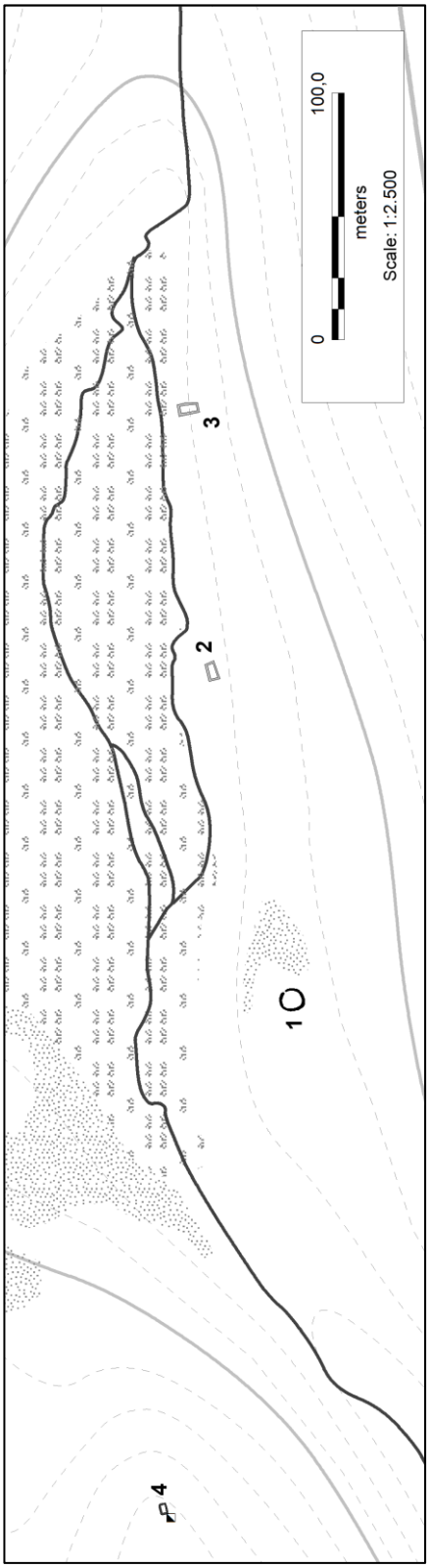
0501 **No place name** **App.3.1**



1 Ruin

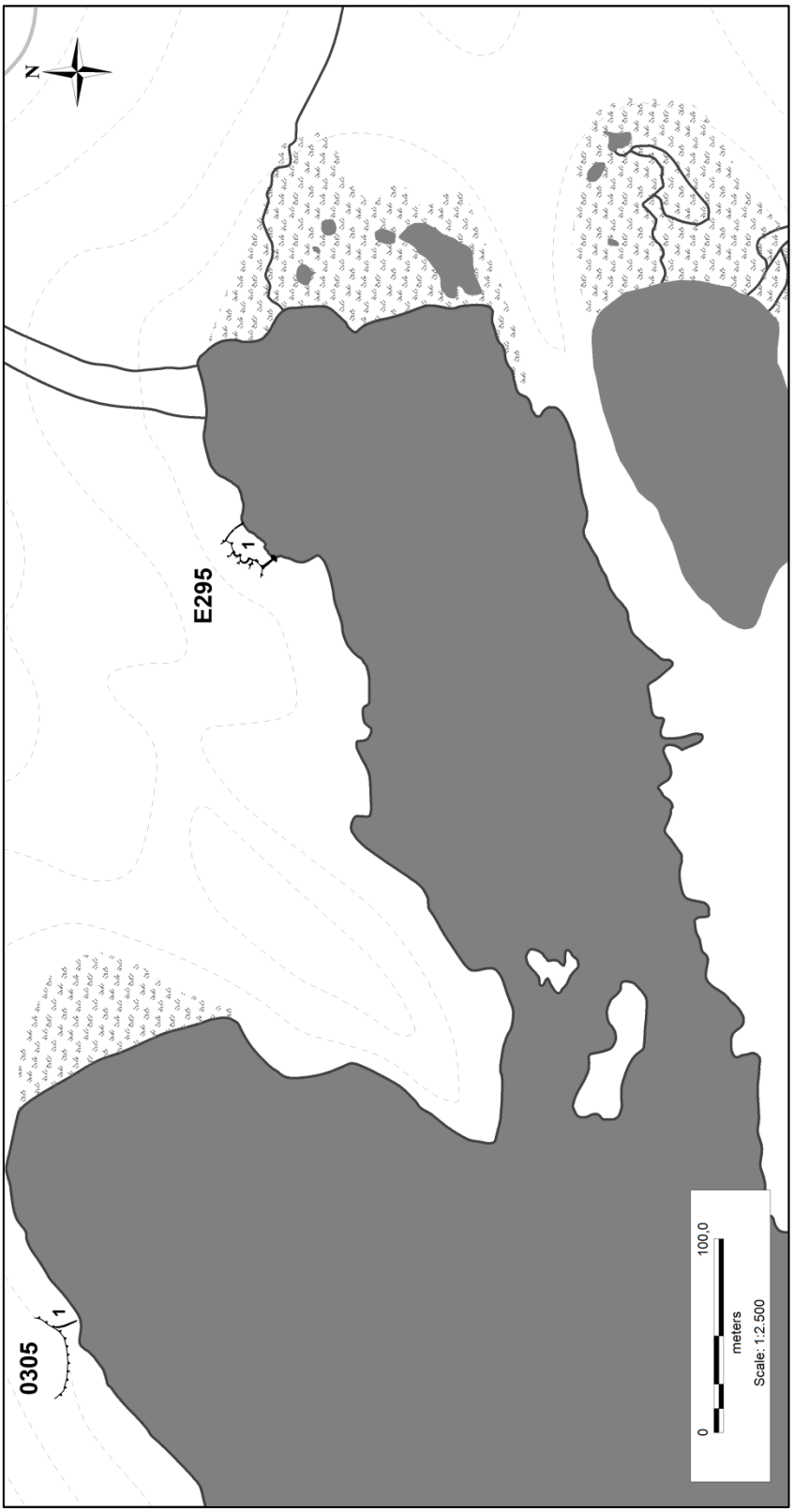
Unclassified/Inuit

0502 **’Sandsletten’** **App.3.2**



4 Ruins

Dairy shieling



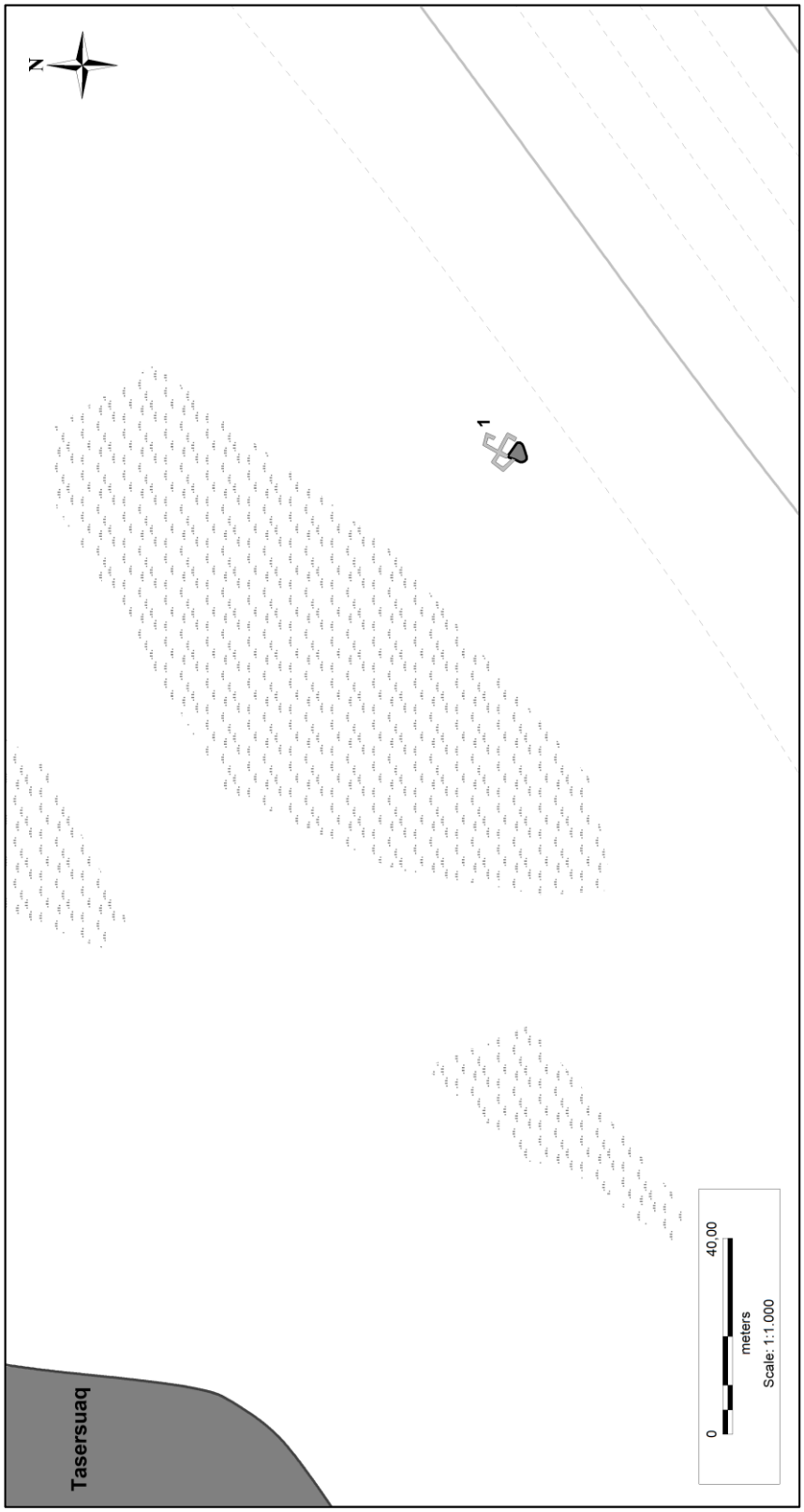
1 Ruins

Outfield wall/dyke

0601 **No place name** **App.3.4**

1 Ruin

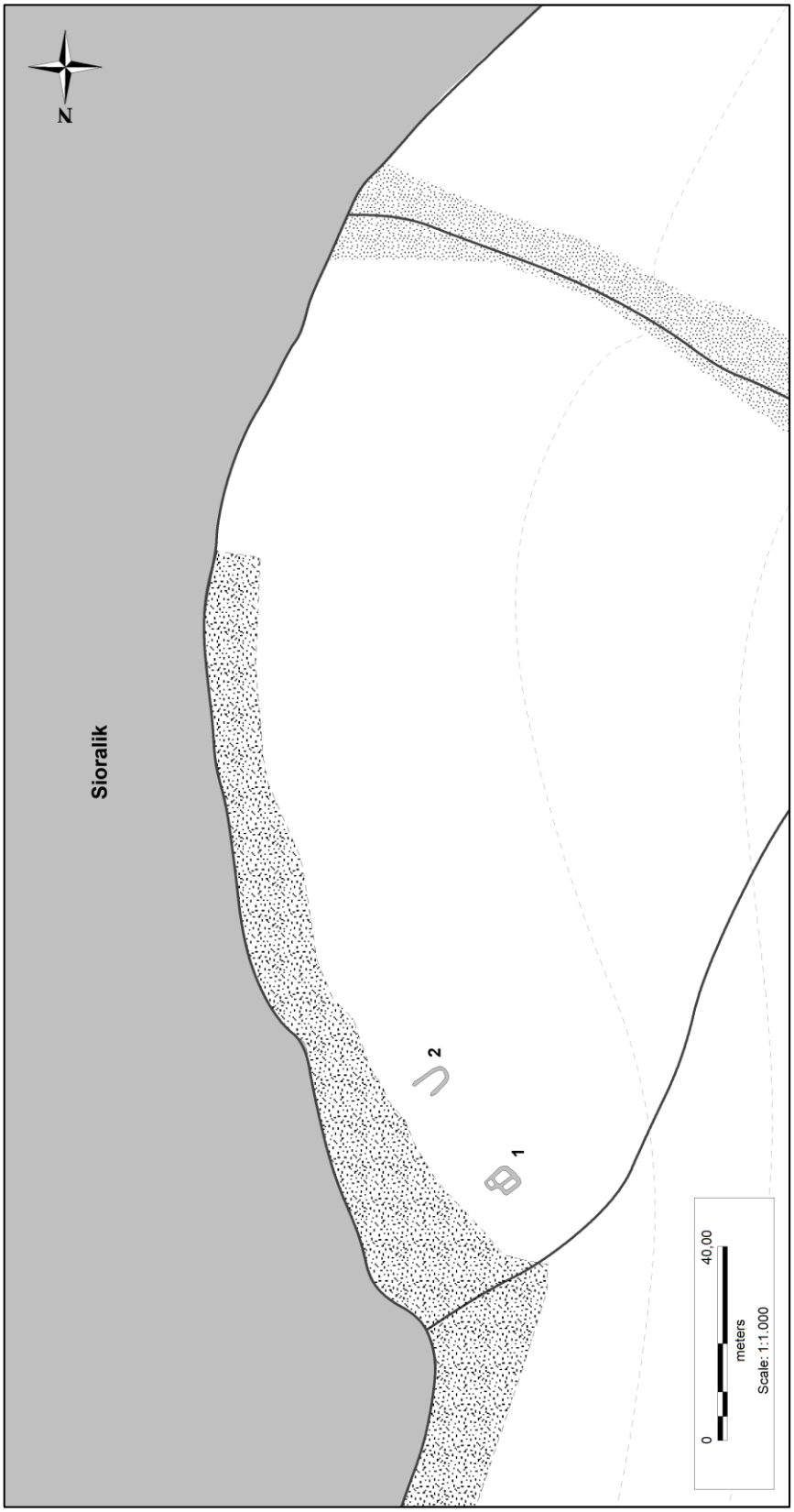
Herder's hut/shelter



1Ruin

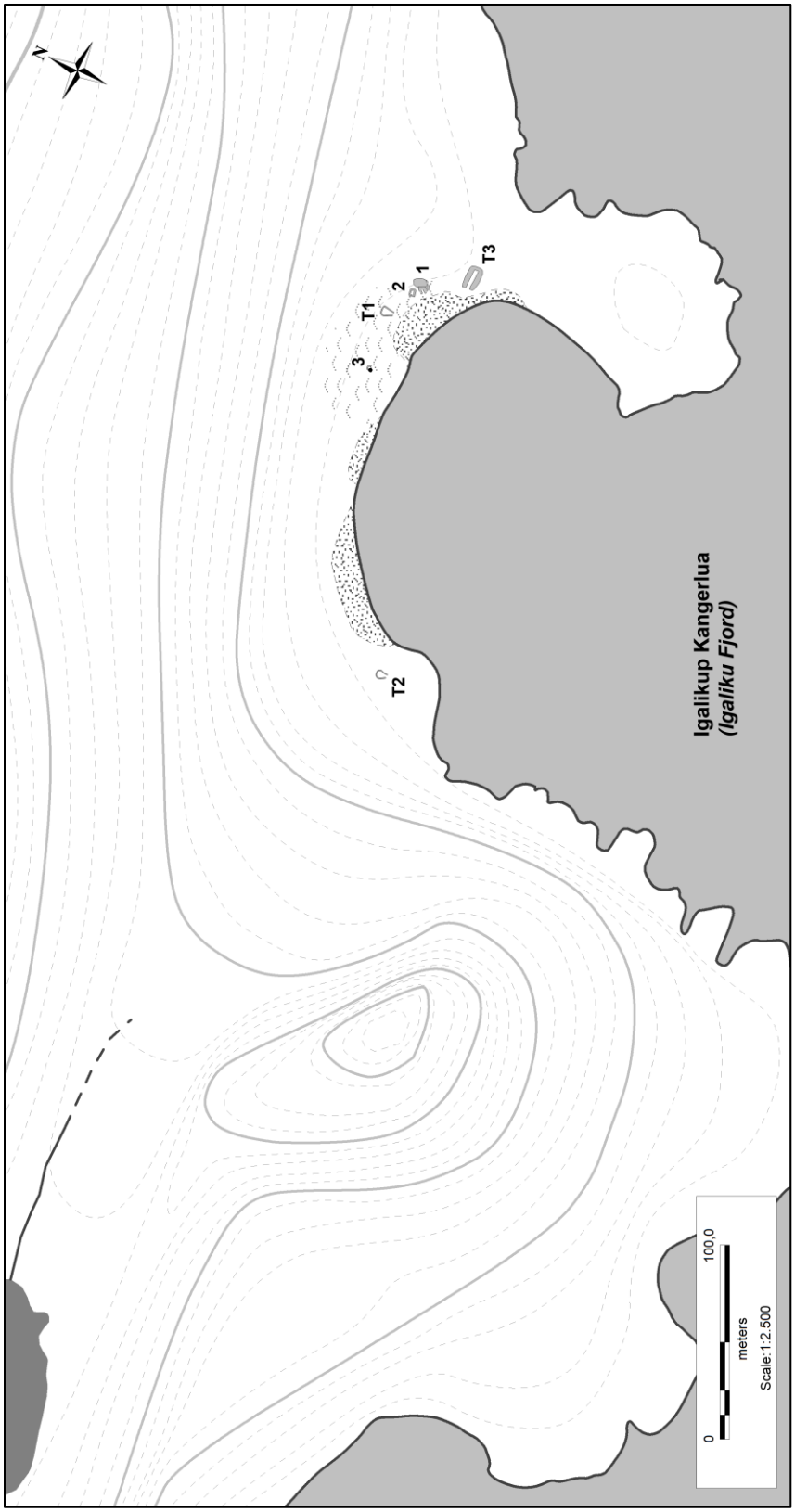
Herder's hut/shelter

0605 **Sioralik** **App.3.6**



2 Ruins

Landing place



3 Ruins

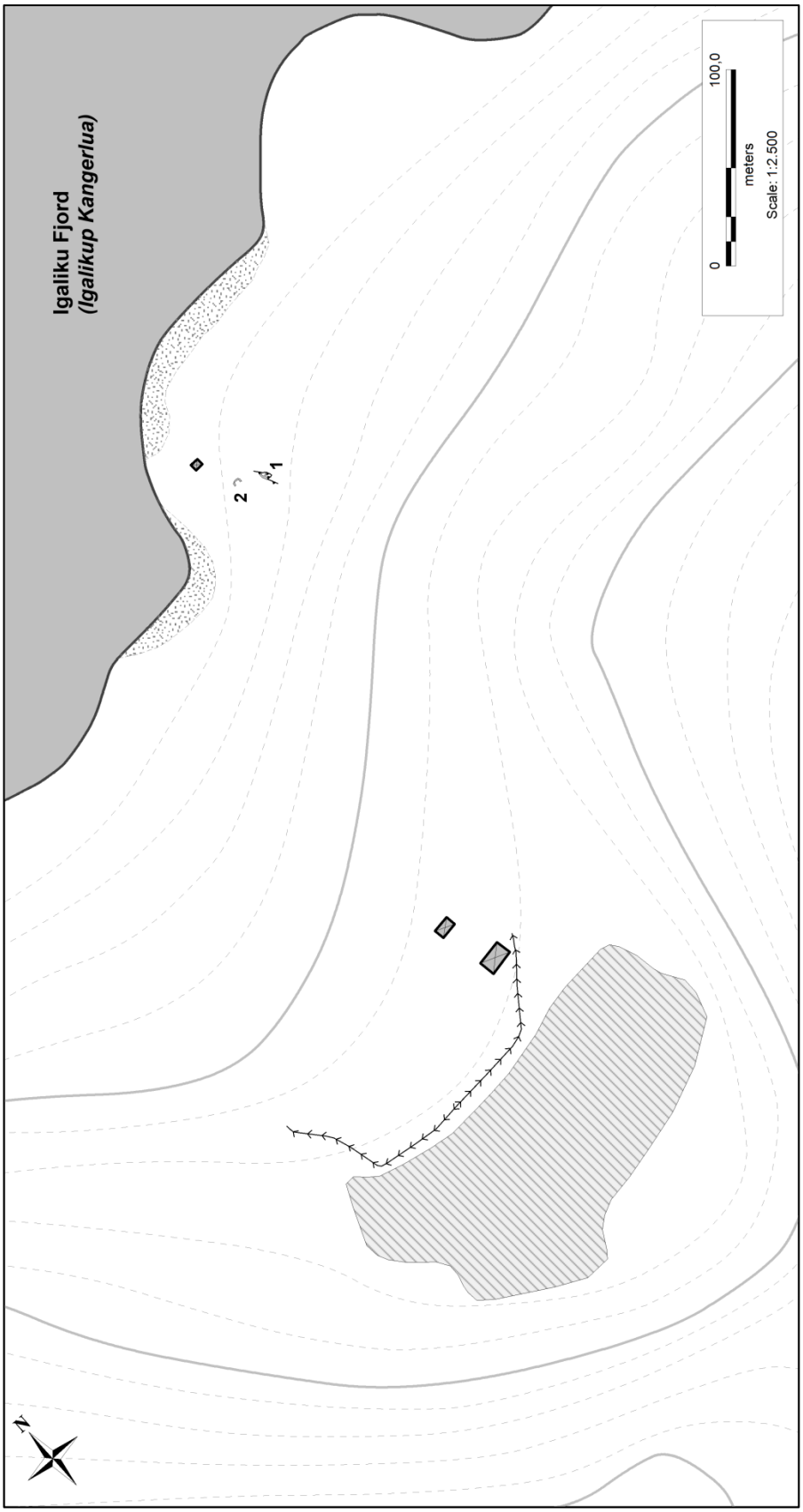
Dairy shieling

60V2-0IV-44

0901 **Taseq Ammalortoq** **App.3.8**

2 Ruins

Small complex shieling



2 Ruins

Forage shieling

1102 **Tasikulooq** **App.3.10**

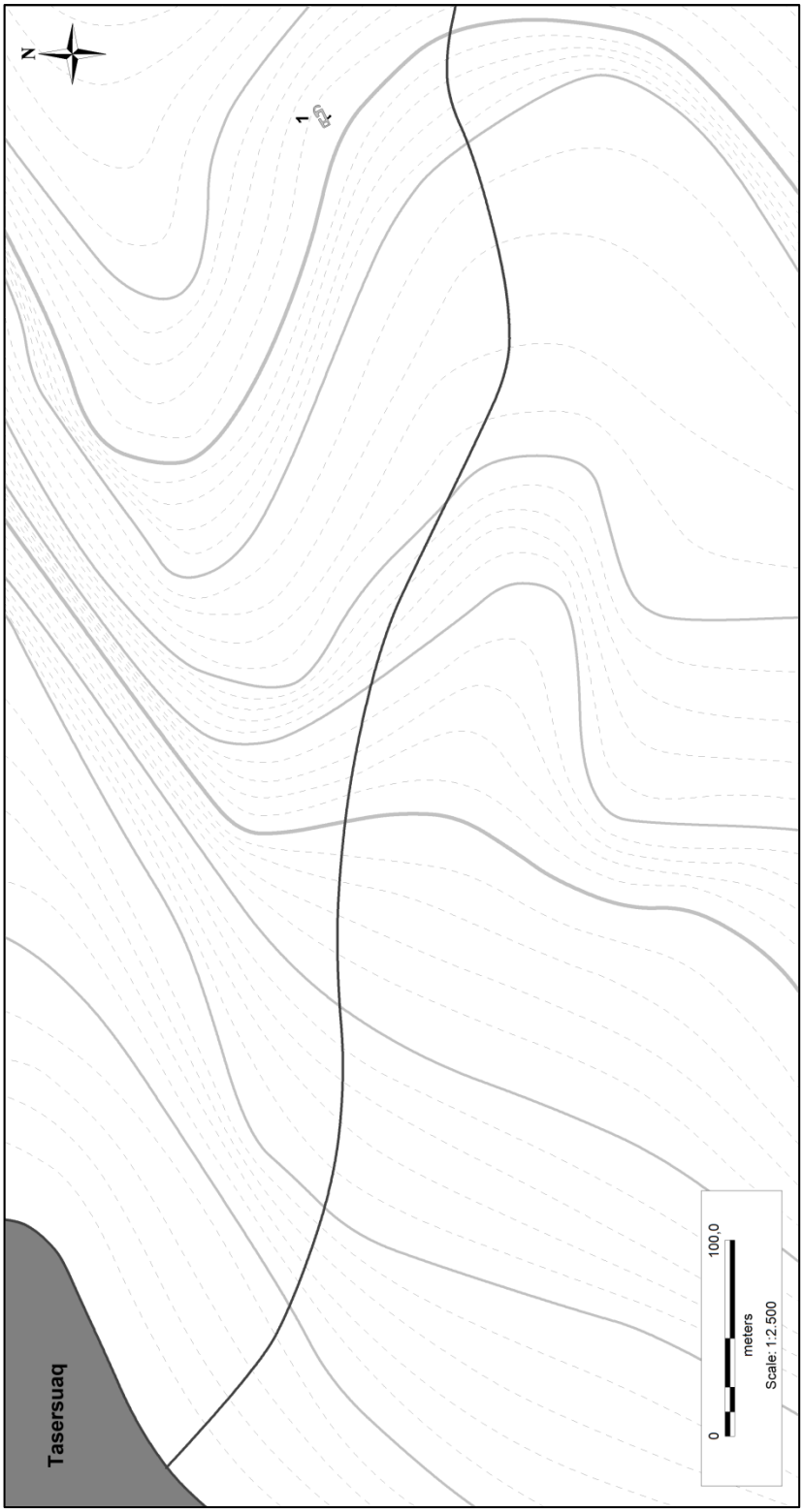
1 Ruin

Sheep/goat shelter

1103 **Naasaangitsup Tasia** **App.3.11**

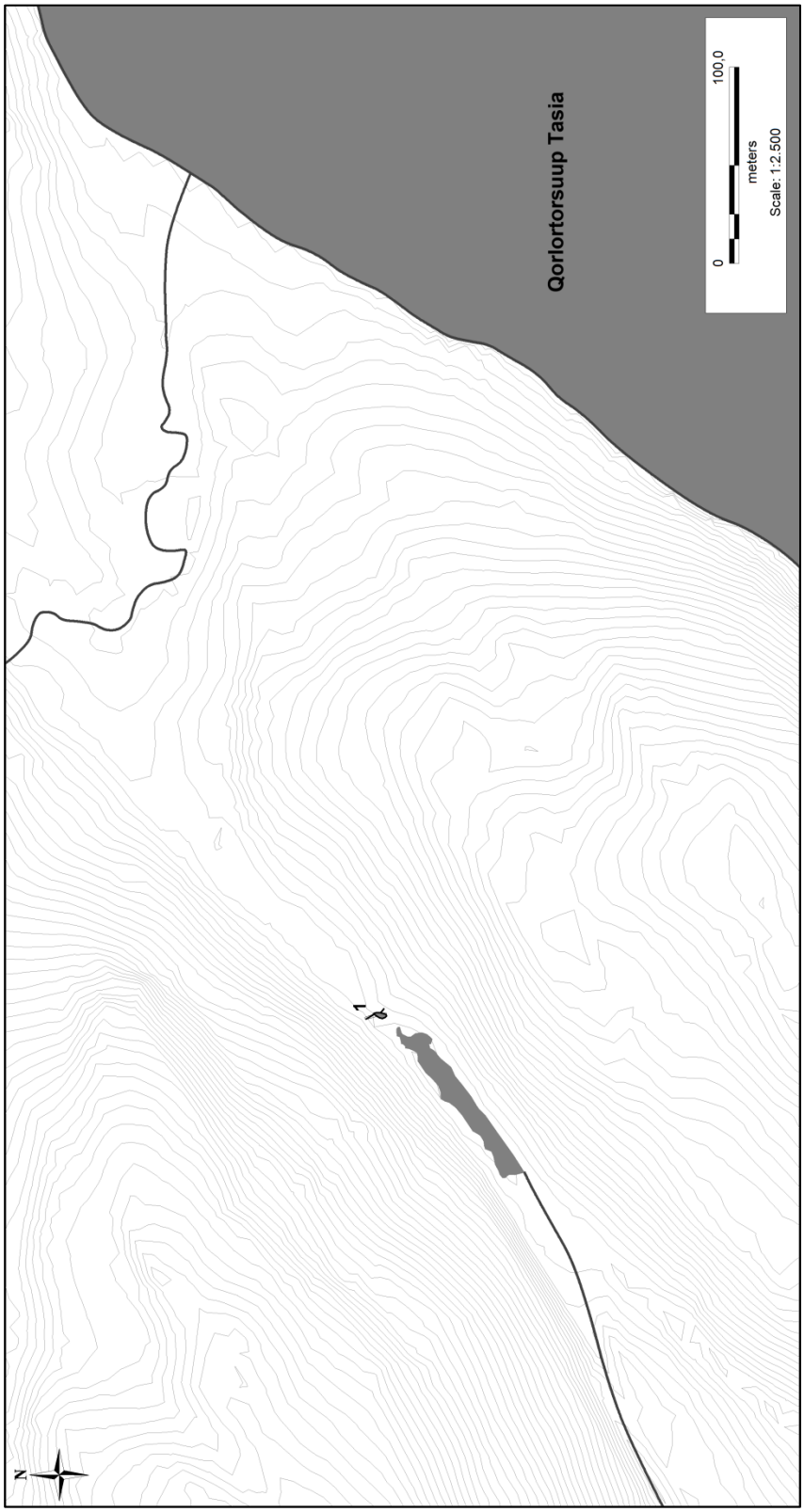
1 Ruin

Herder's hut/shelter



1 Ruin

Small complex shieling



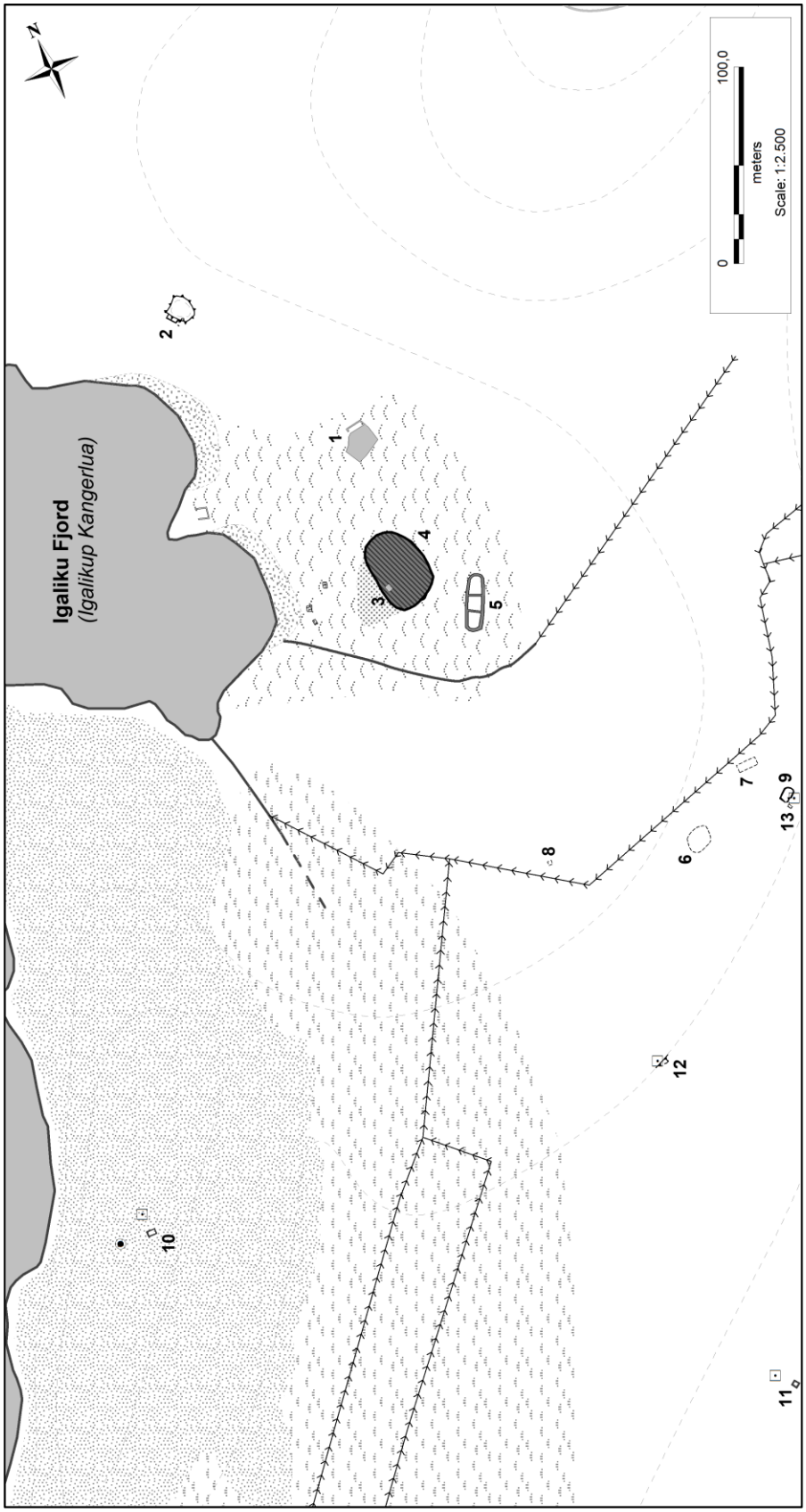
1 Ruin

Outfield wall/dyke

60V2-0IV-527

Small complex shieling

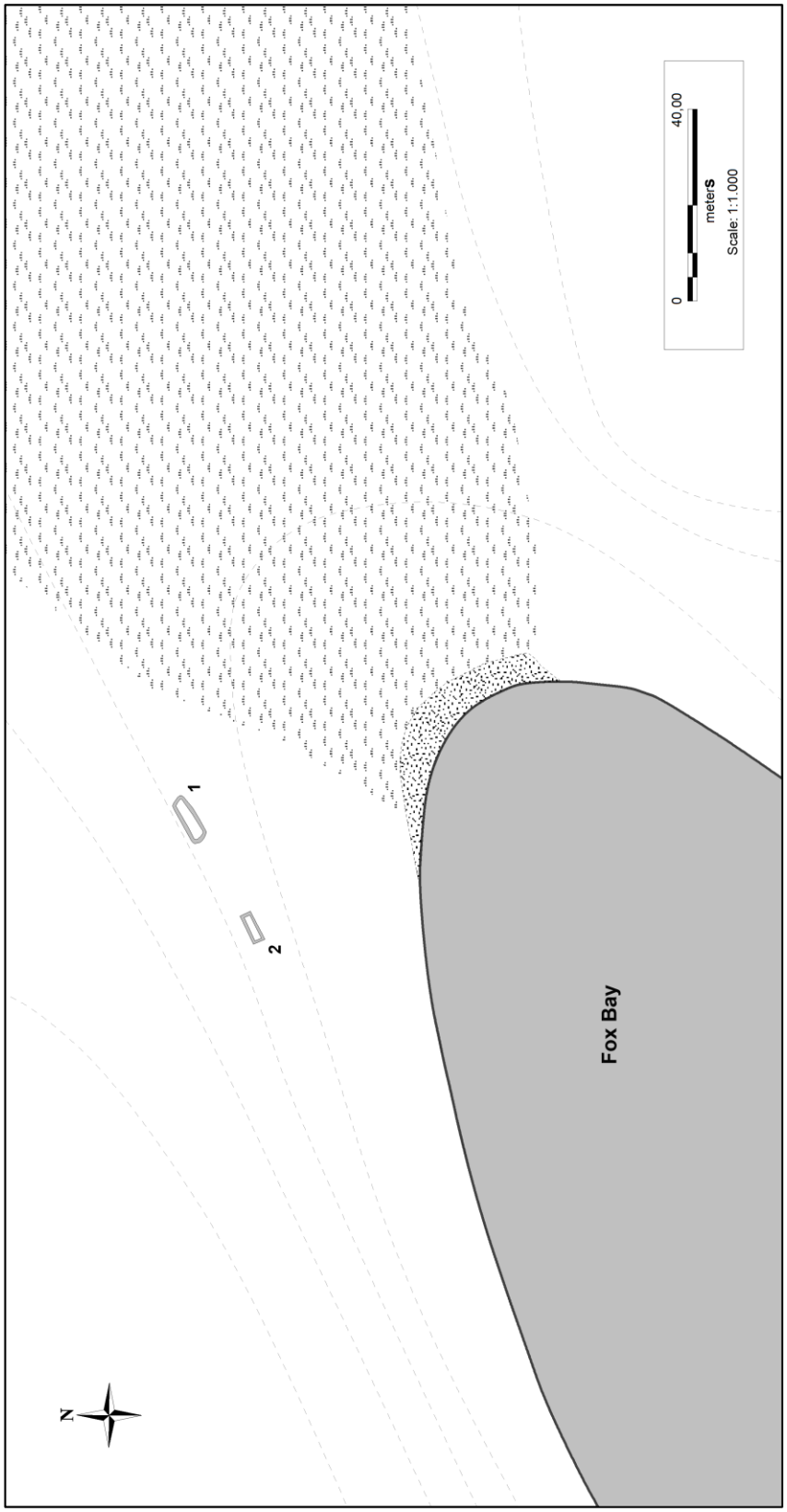
3 Ruins



15 Ruins

Medium Farmstead

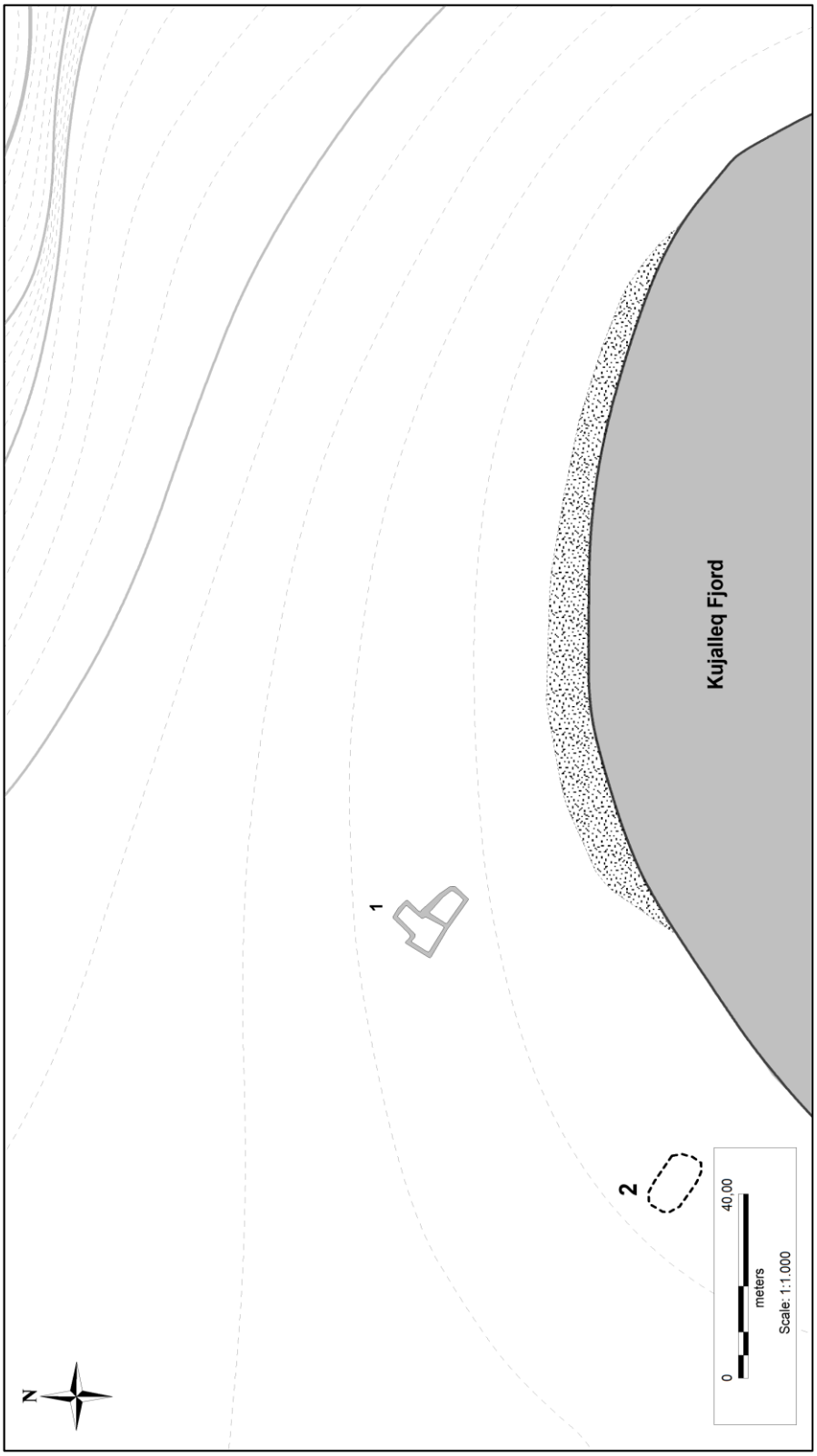
60V2-0IV-618



2 Ruins

Forage shieling

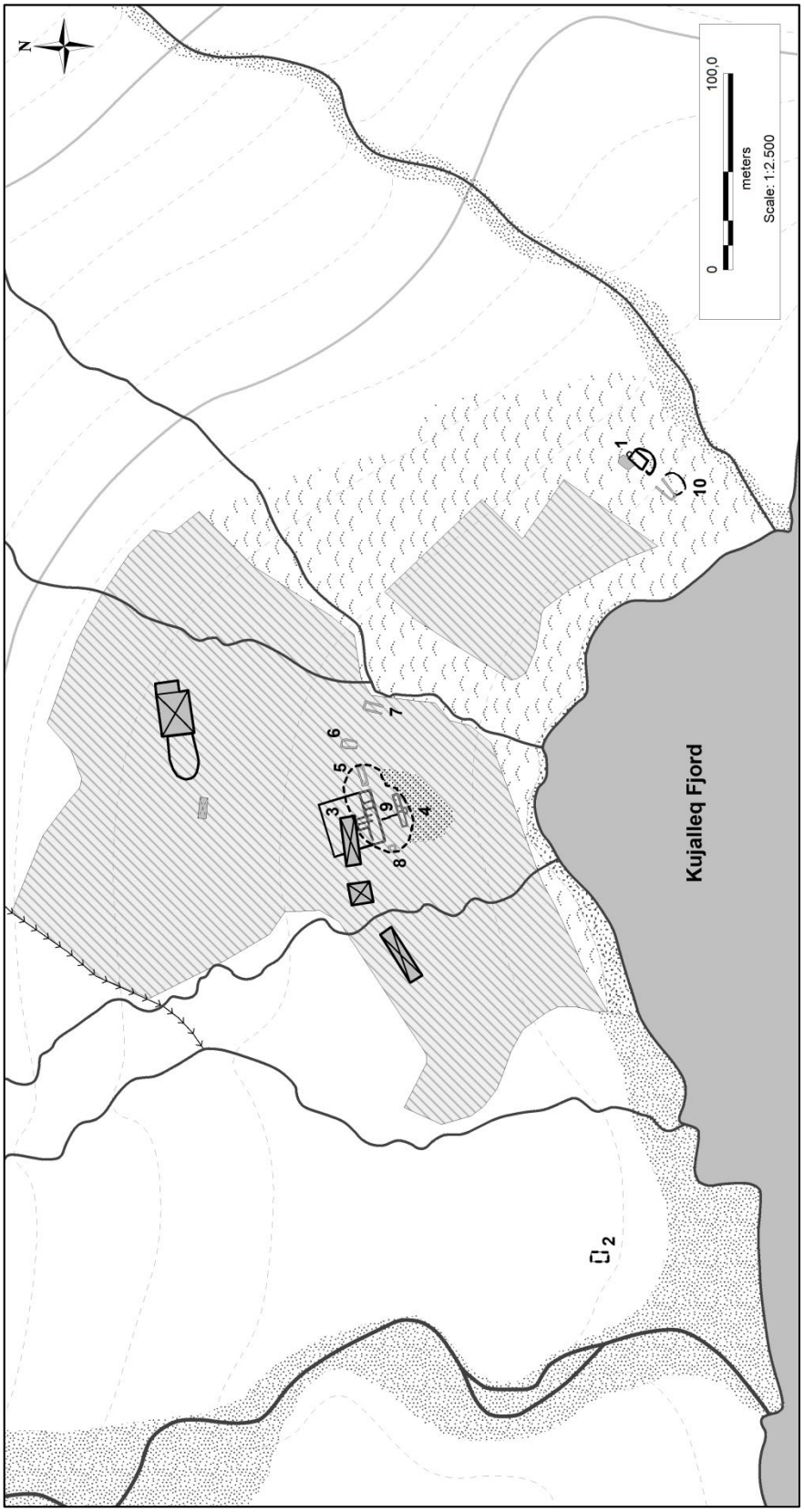
60V2-0IV-617



2 Ruins

Small complex shieling

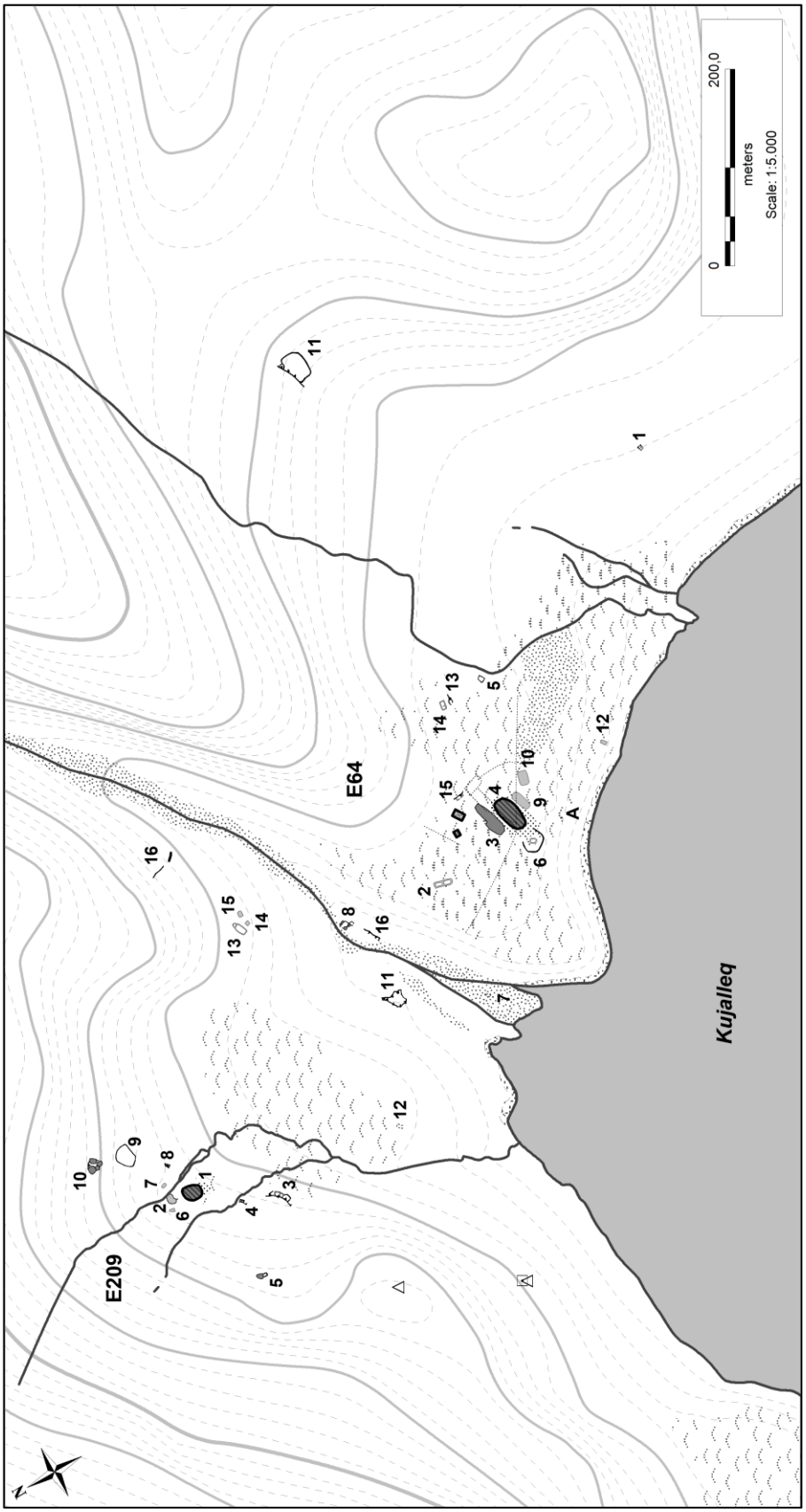
60V2-0IV-616



15 Ruins

Medium Farmstead

60V2-0IV-615

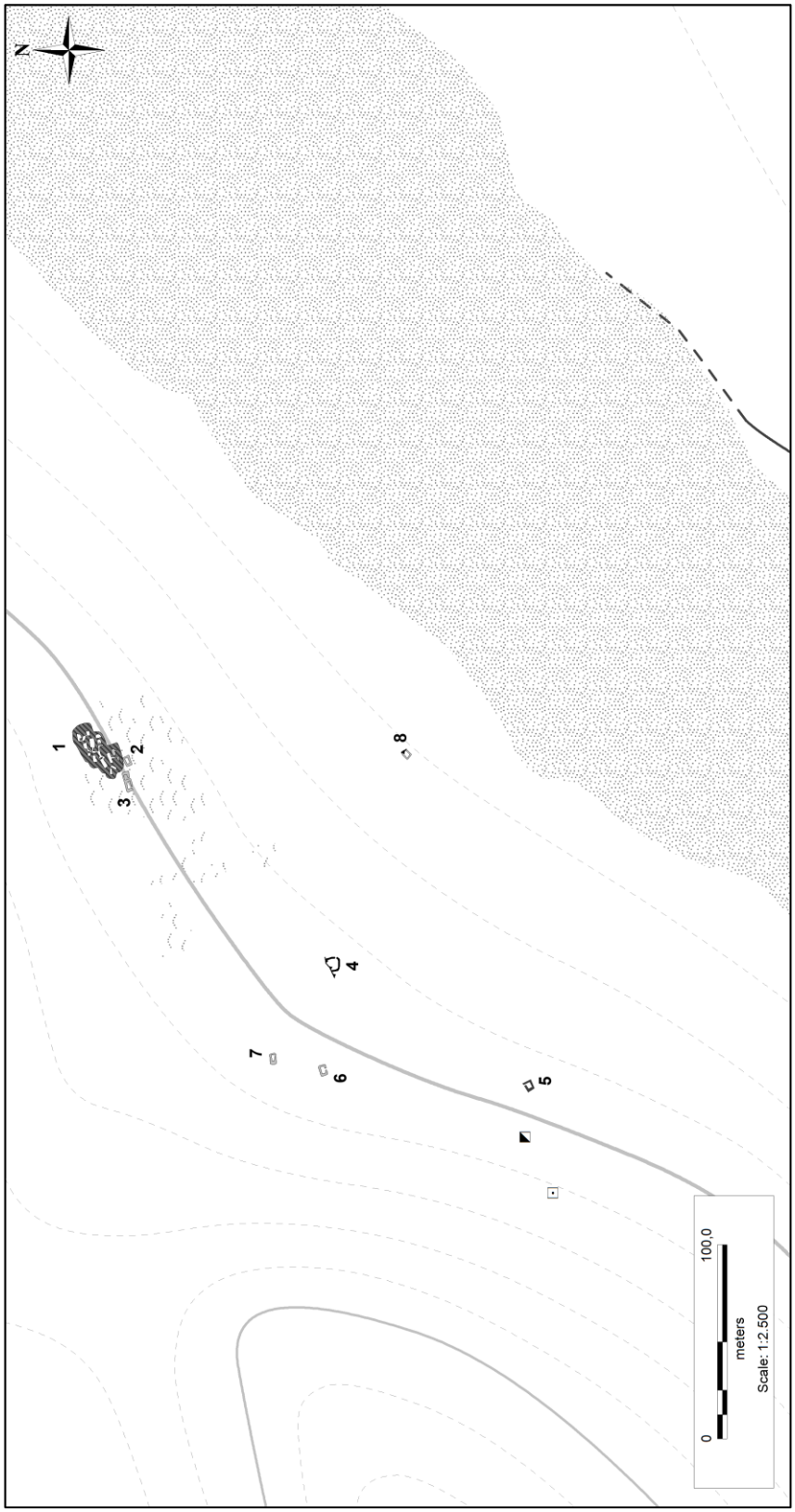


17 Ruins

Large Farmstead

60V2-0IV-612

E64a **Enok's Ruins** **App.3.20**



8 Ruins

Small Farmstead

60V2-0IV-539

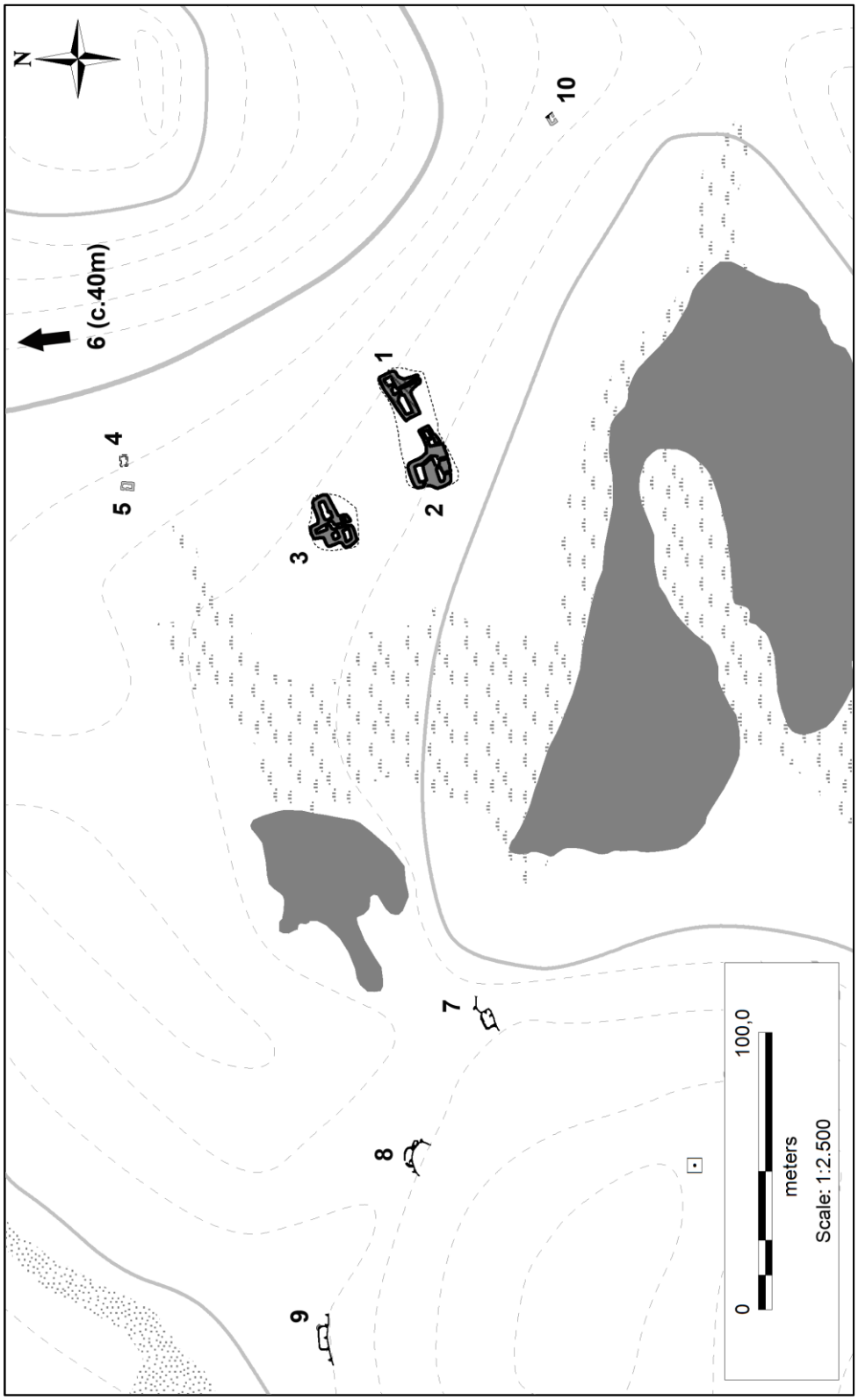
E64b **Enok's Ruins** **App.3.21**

10 Ruins

Small Farmstead

60V2-0IV-538

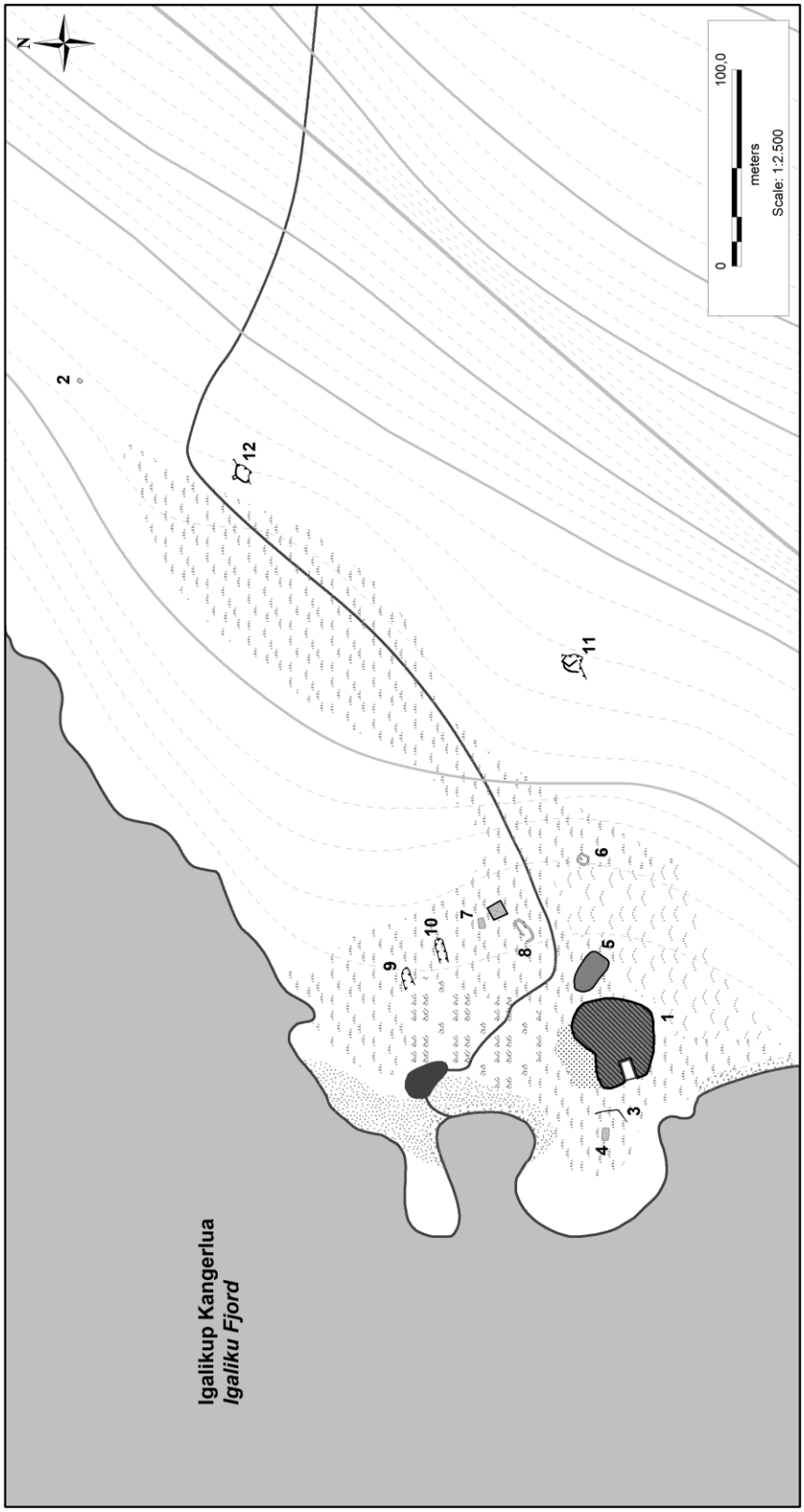
E64c **No place name** **App.3.22**



10 Ruins

Small Farmstead

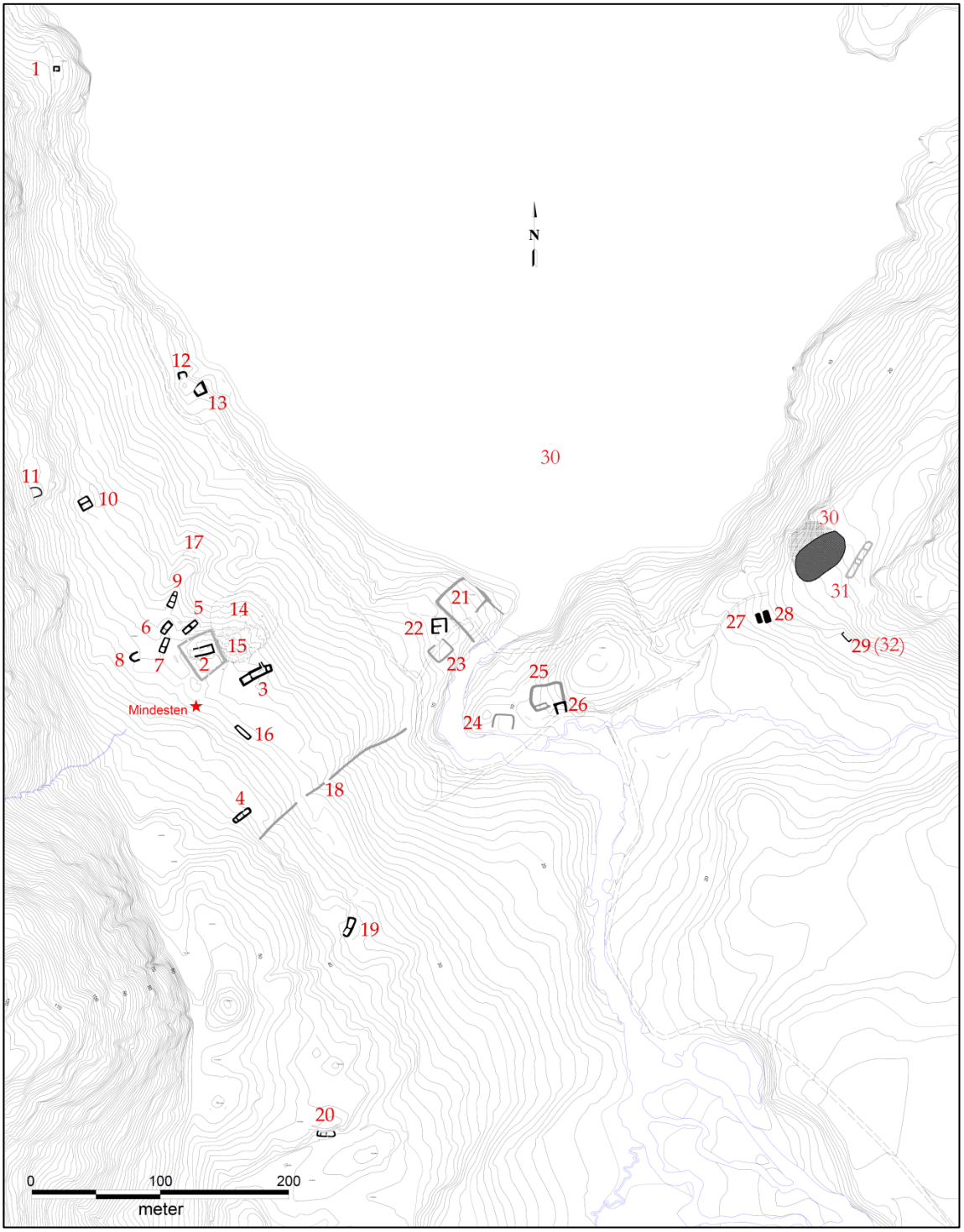
60V2-0IV-540



10 Ruins

Manor

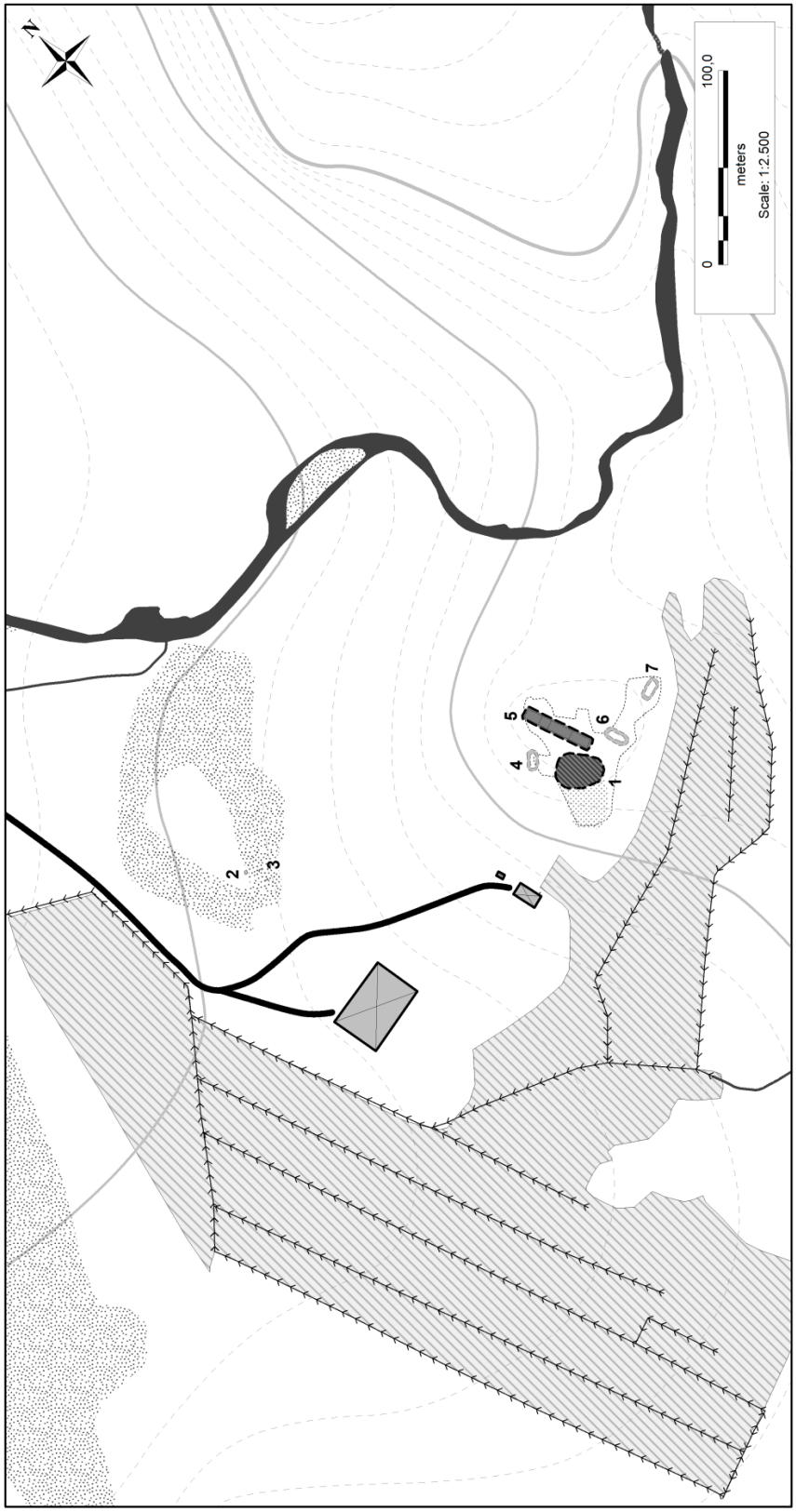
60V2-0IV-599



30 Ruins

Church Manor

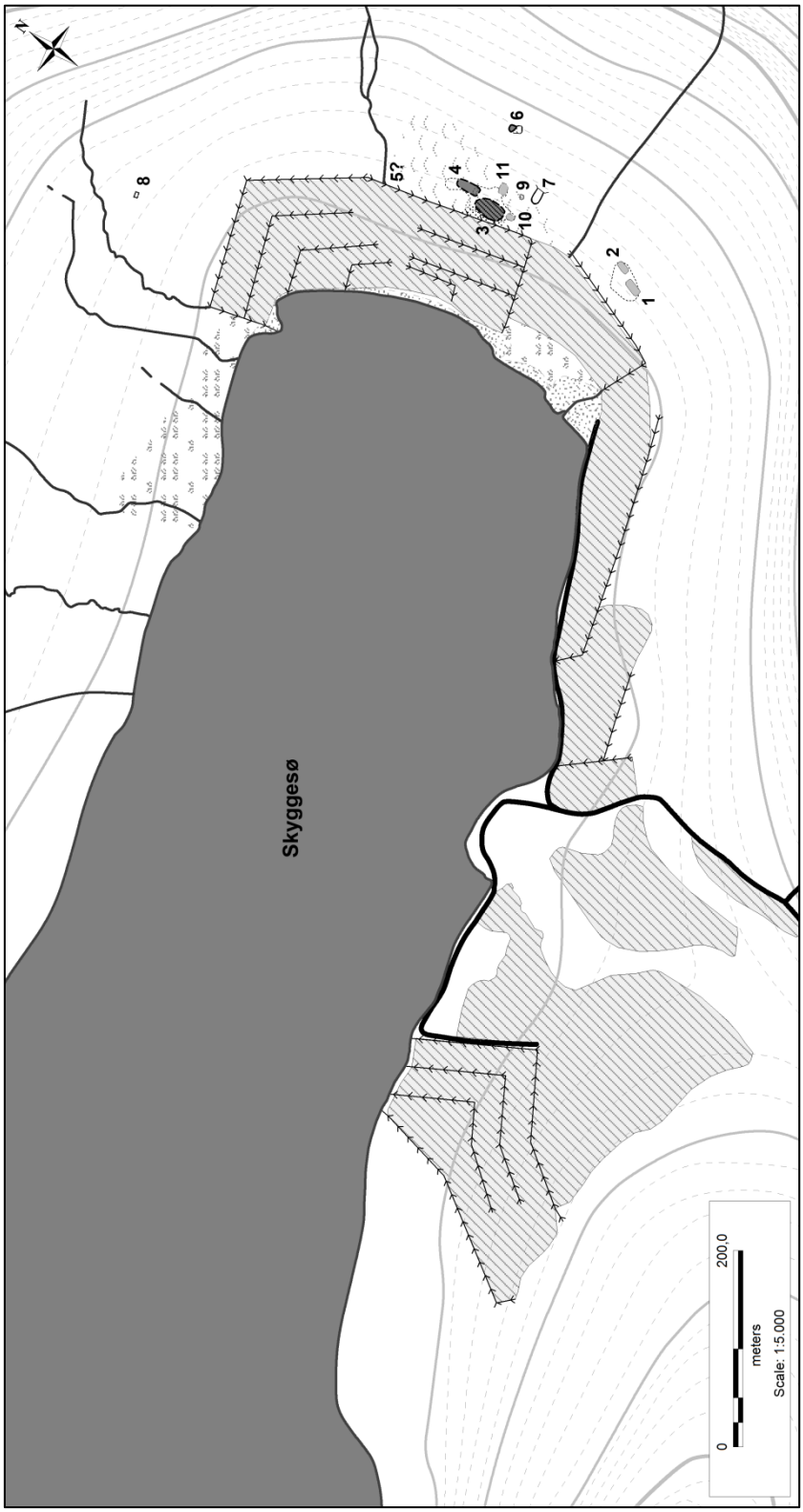
60V2-0IV-611



7 Ruins

Medium Farmstead

60V2-0IV-542



10 Ruins

Medium Farmstead

60V2-0IV-609

12 Ruins

Medium Farmstead

60V2-0IV-608

10 Ruins

Large complex shieling

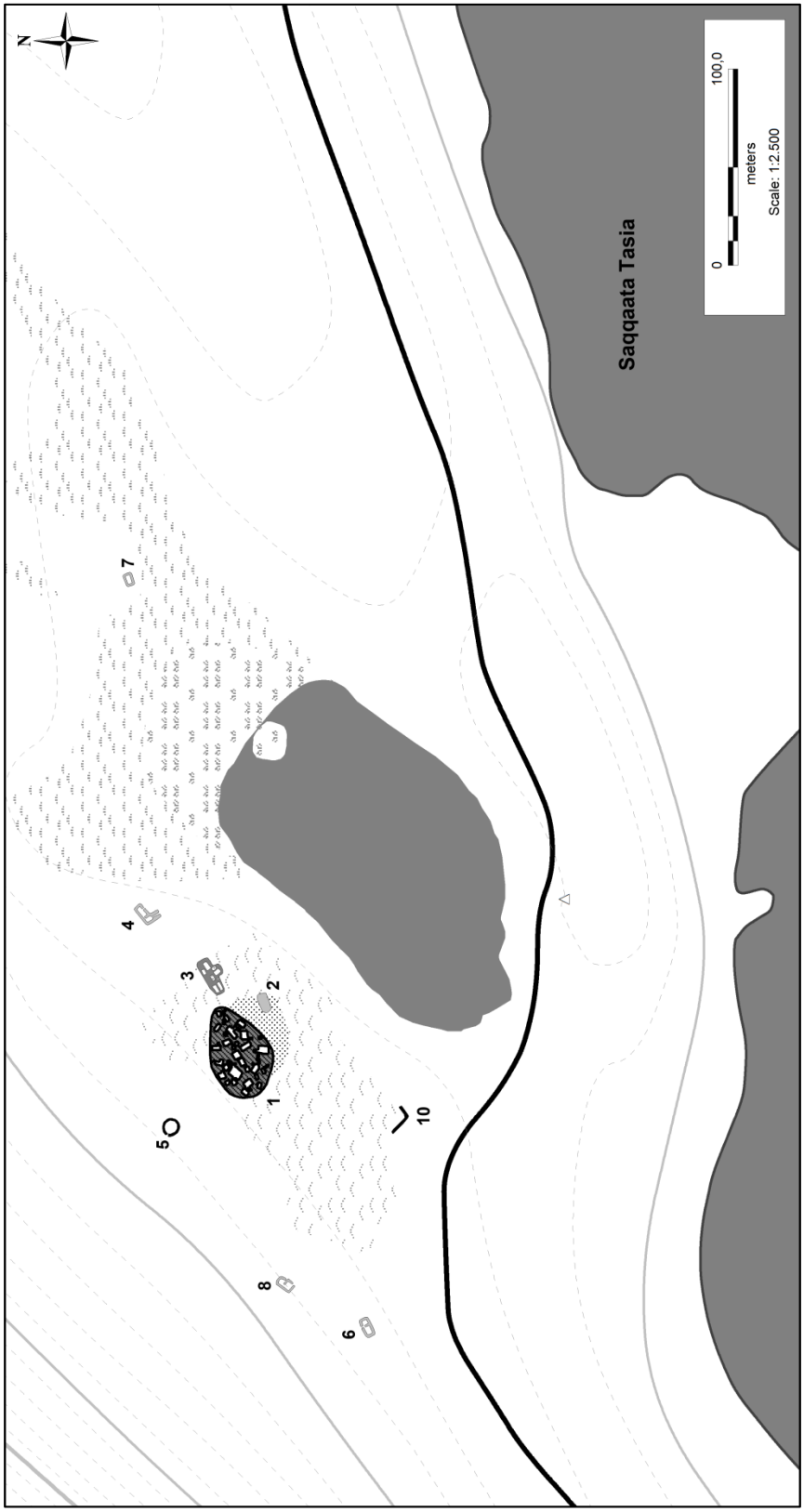
60V2-0IV-607

23 Ruins

Medium Farmstead & Small Farmstead

60V2-0IV-602

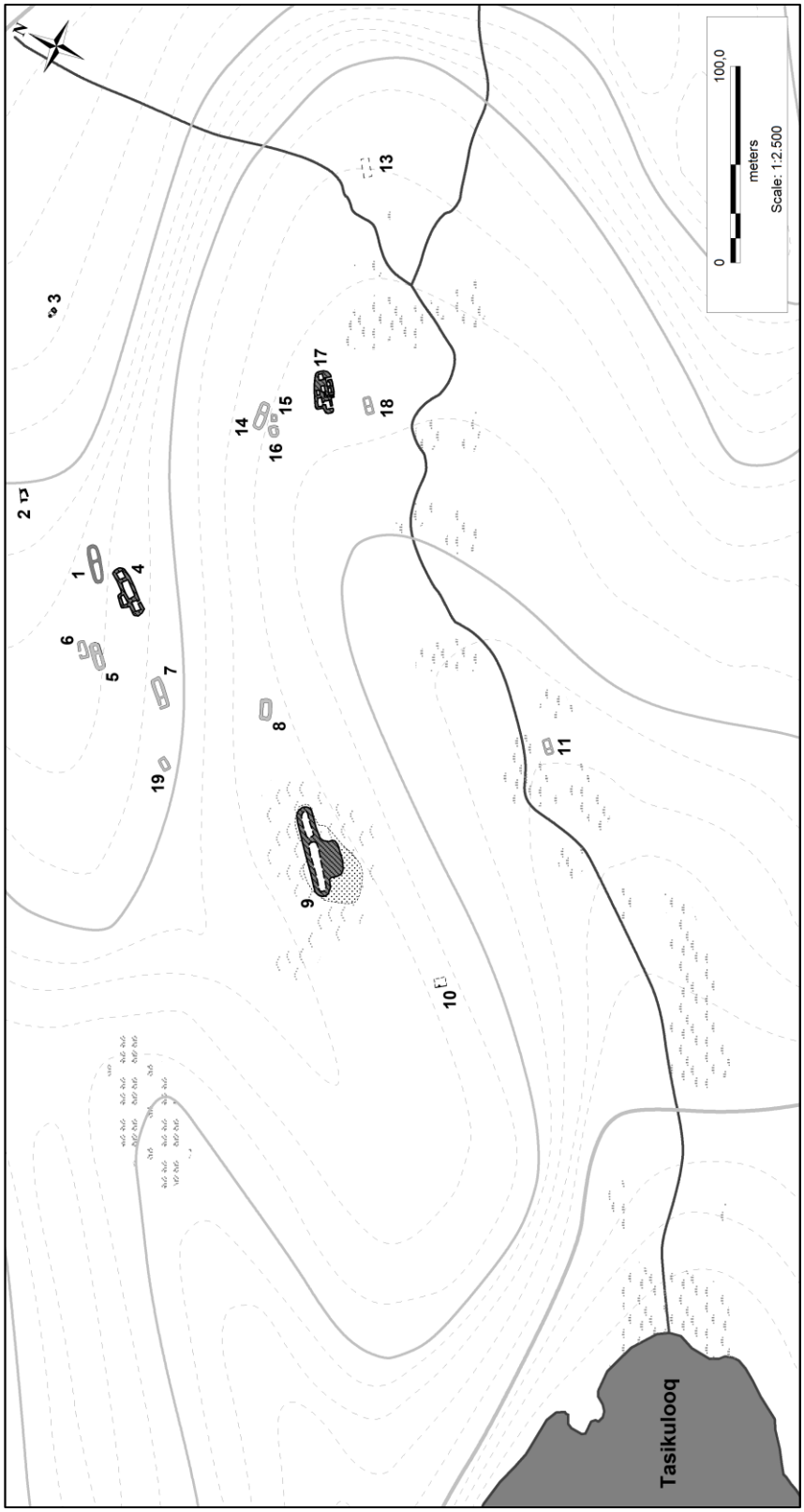
E71a **Saqqaata Tasia** **App.3.30**



9 Ruins

Medium Farmstead

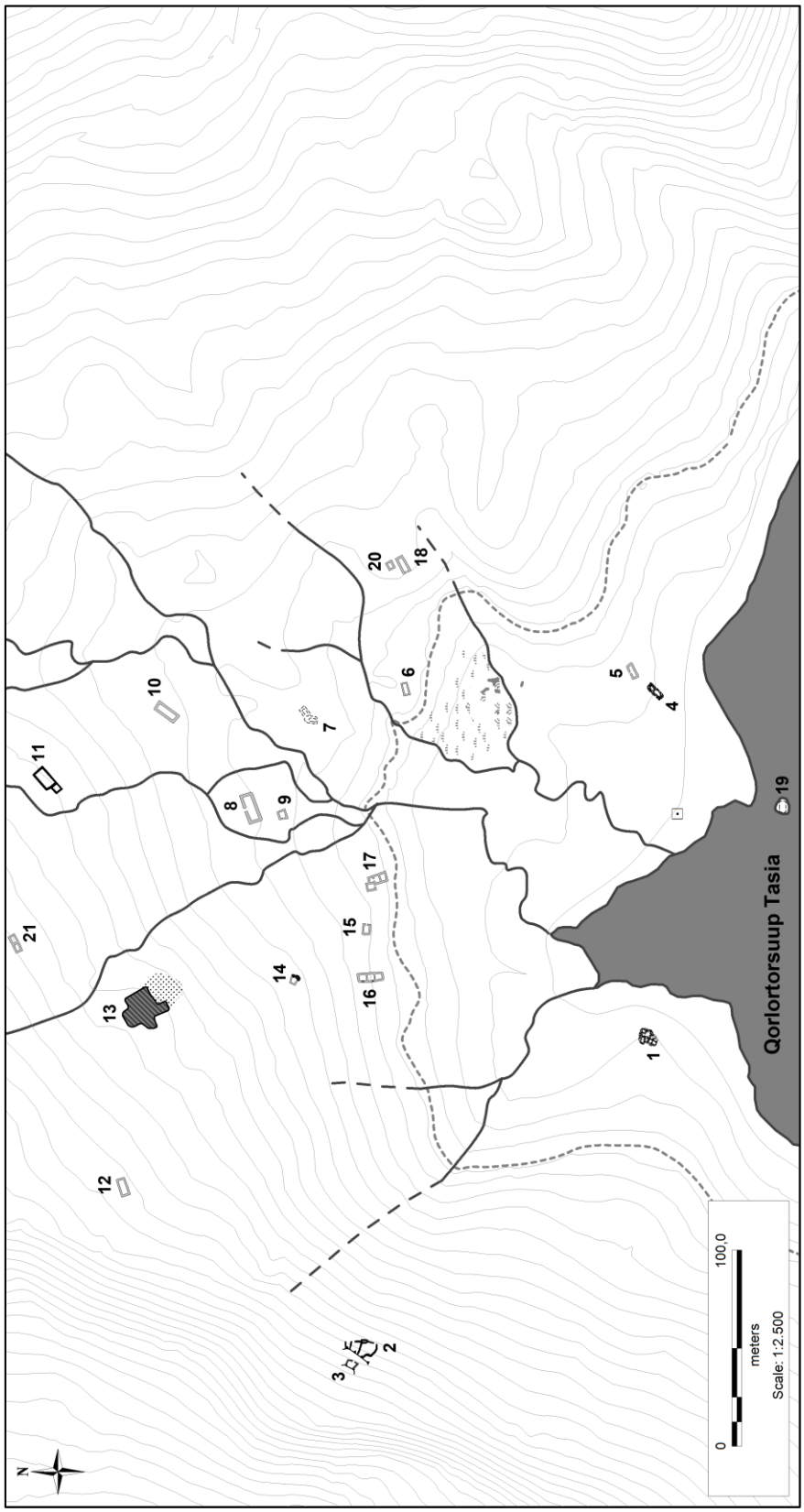
60V2-0V-600



16 Ruins

Large complex shieling

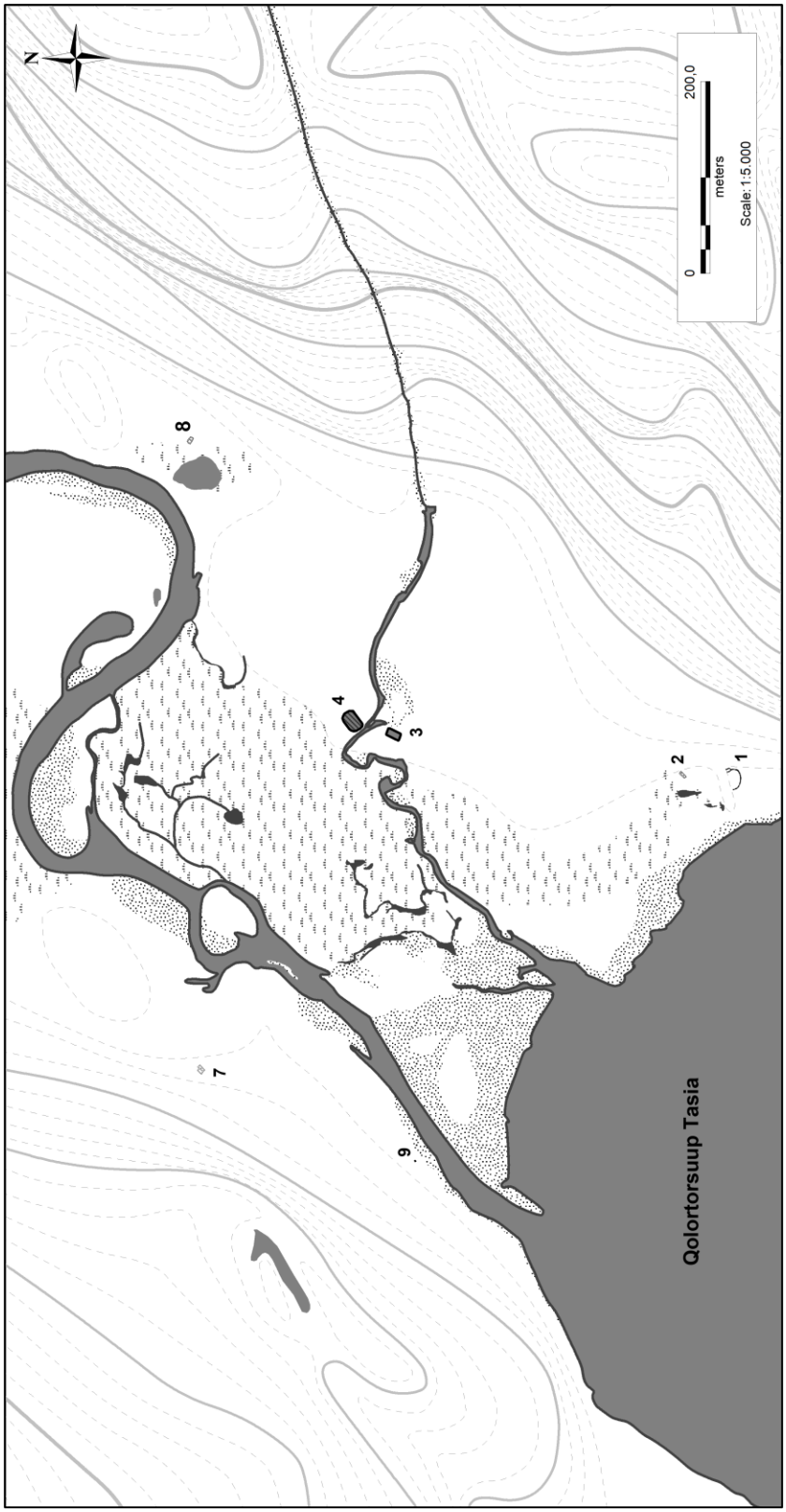
60V2-0IV-606



21 Ruins

Medium Farmstead

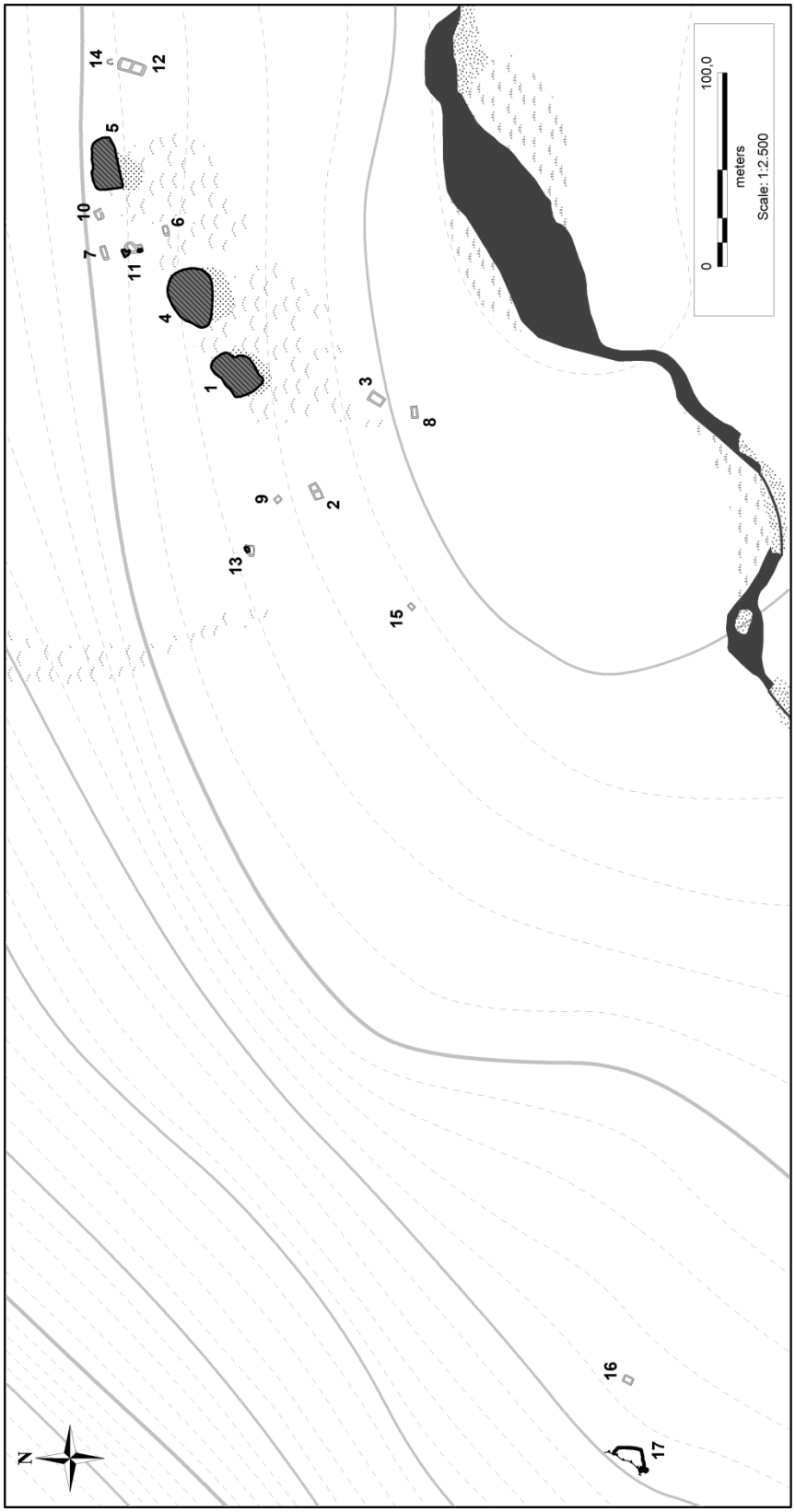
60V2-0IV-544



9 Ruins

Large complex shieling

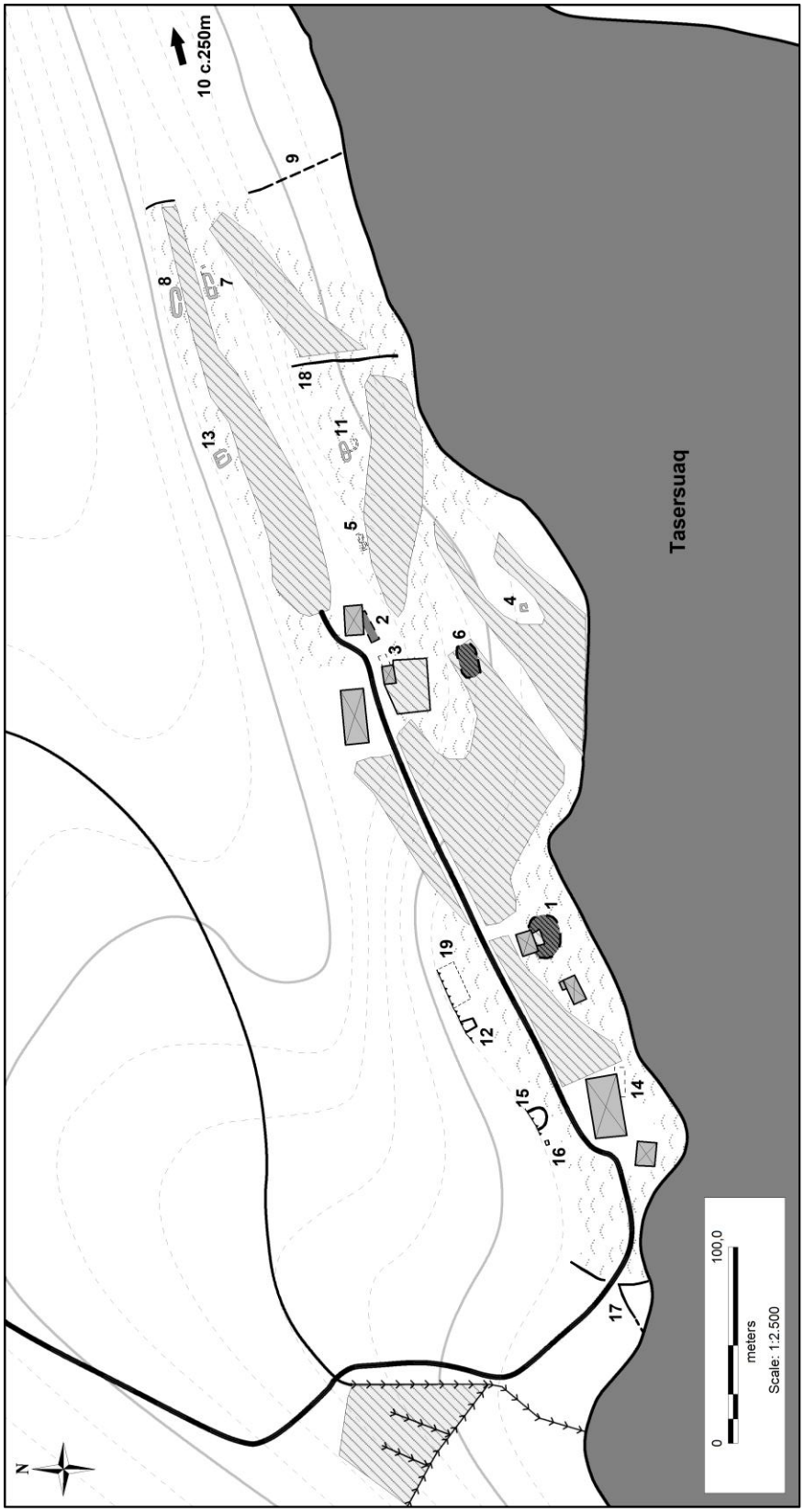
60V2-0IV-530



60V2-0IV-543

Small Farmstead

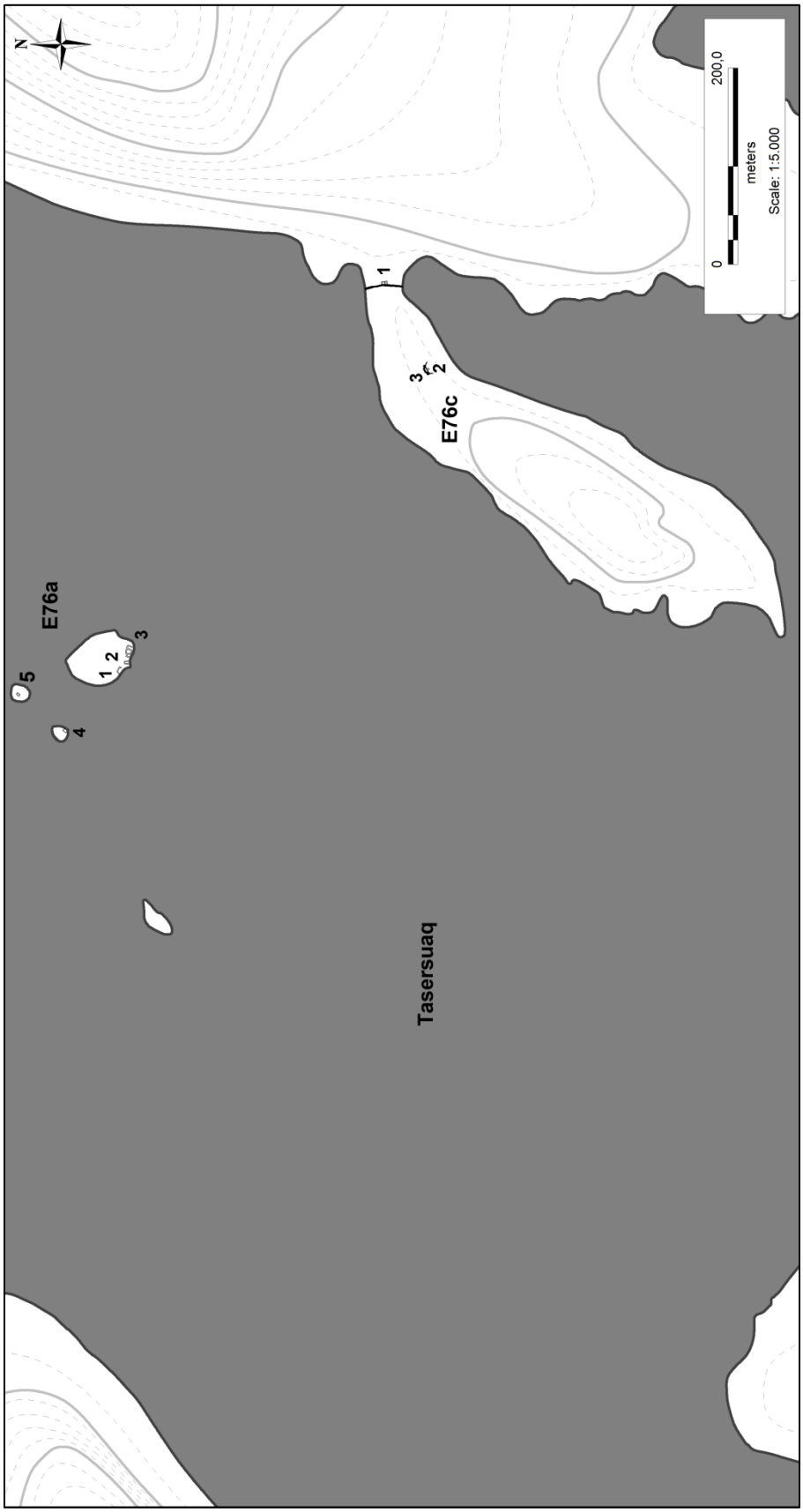
16 Ruins



21 Ruins

Manor

60V2-0IV-597

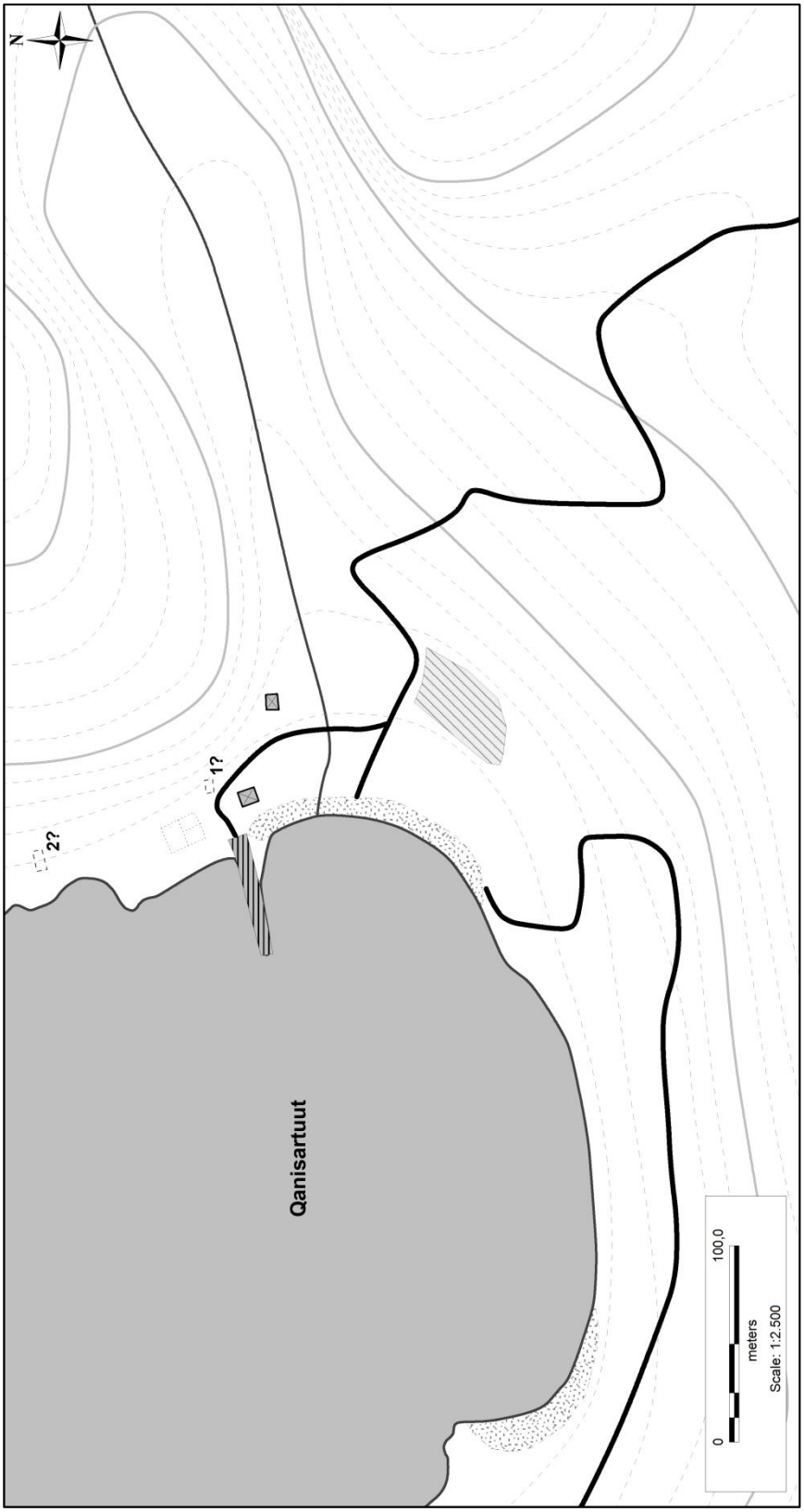


5 Ruins

Large simple shieling

60V2-0IV-596

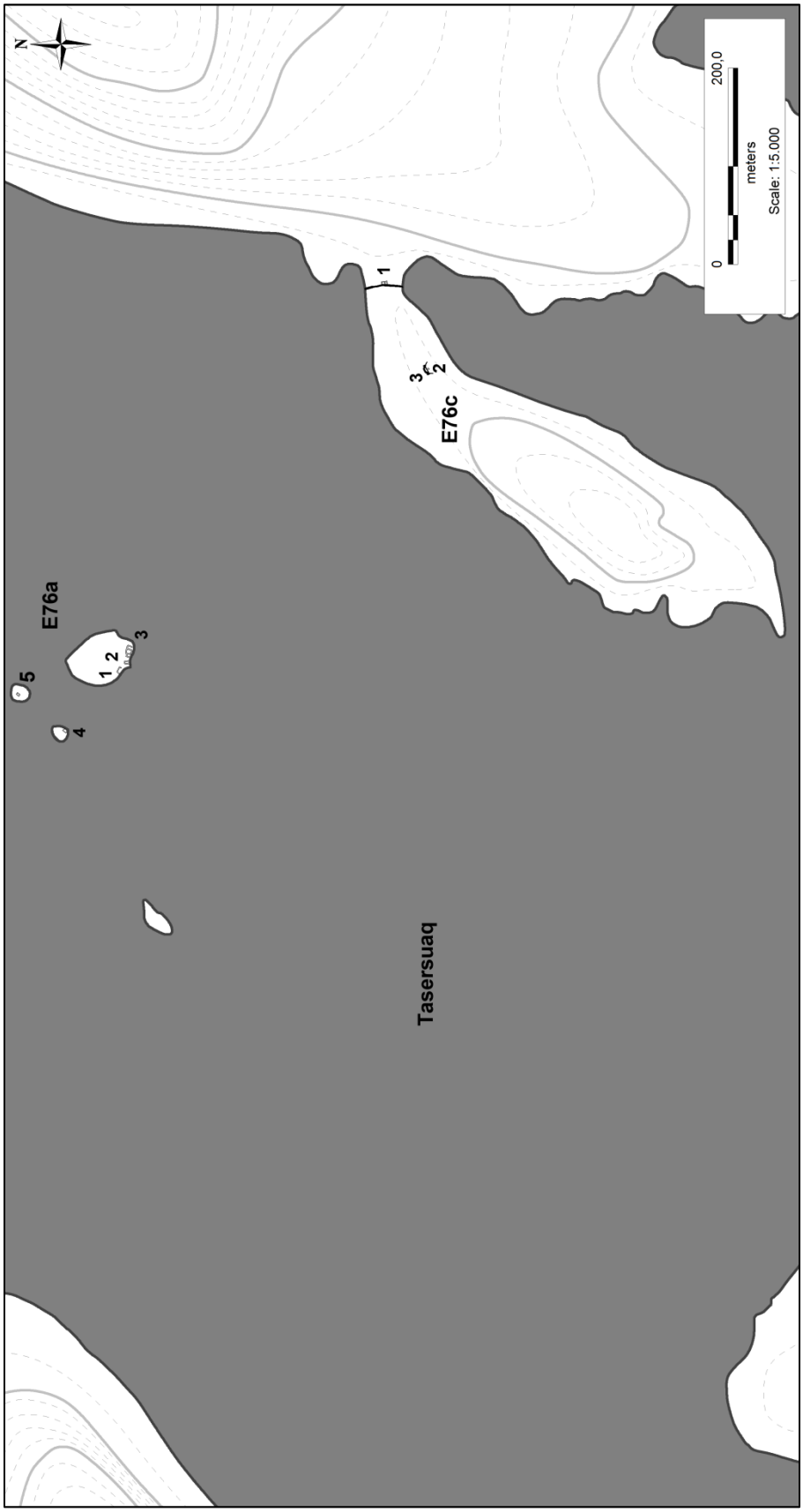
E76b **Qanisartuut** **App.3.37**



2 Ruins

Dairy shieling

60V2-0IV-598



4 Ruins

Dairy shieling

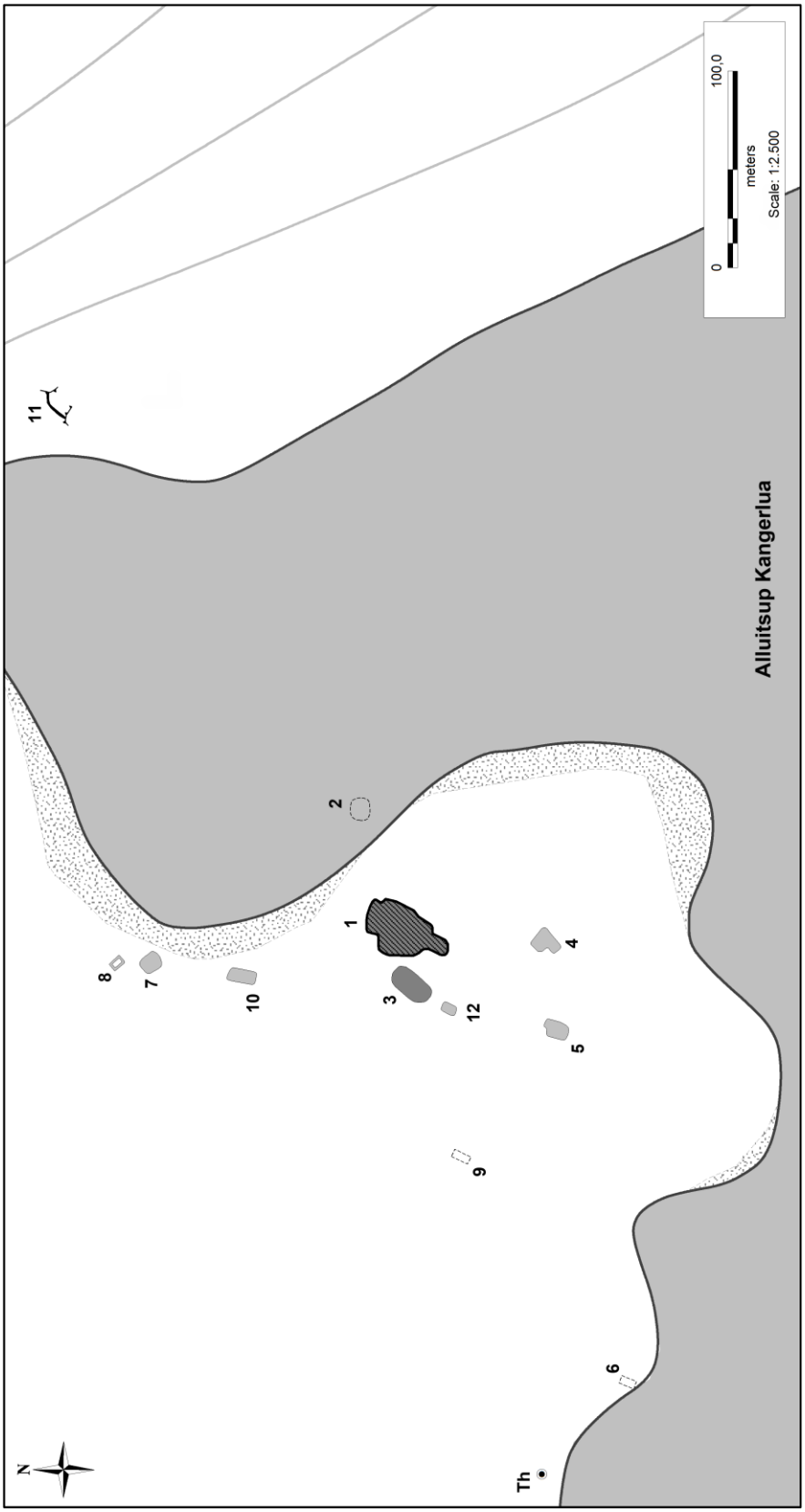
60V2-0IV-595

E77 **Ukkusip Saqqaata Tasia** **App.3.39**

16 Ruins

Small Farmstead

60V2-0IV-584



12 Ruins

Large Farmstead

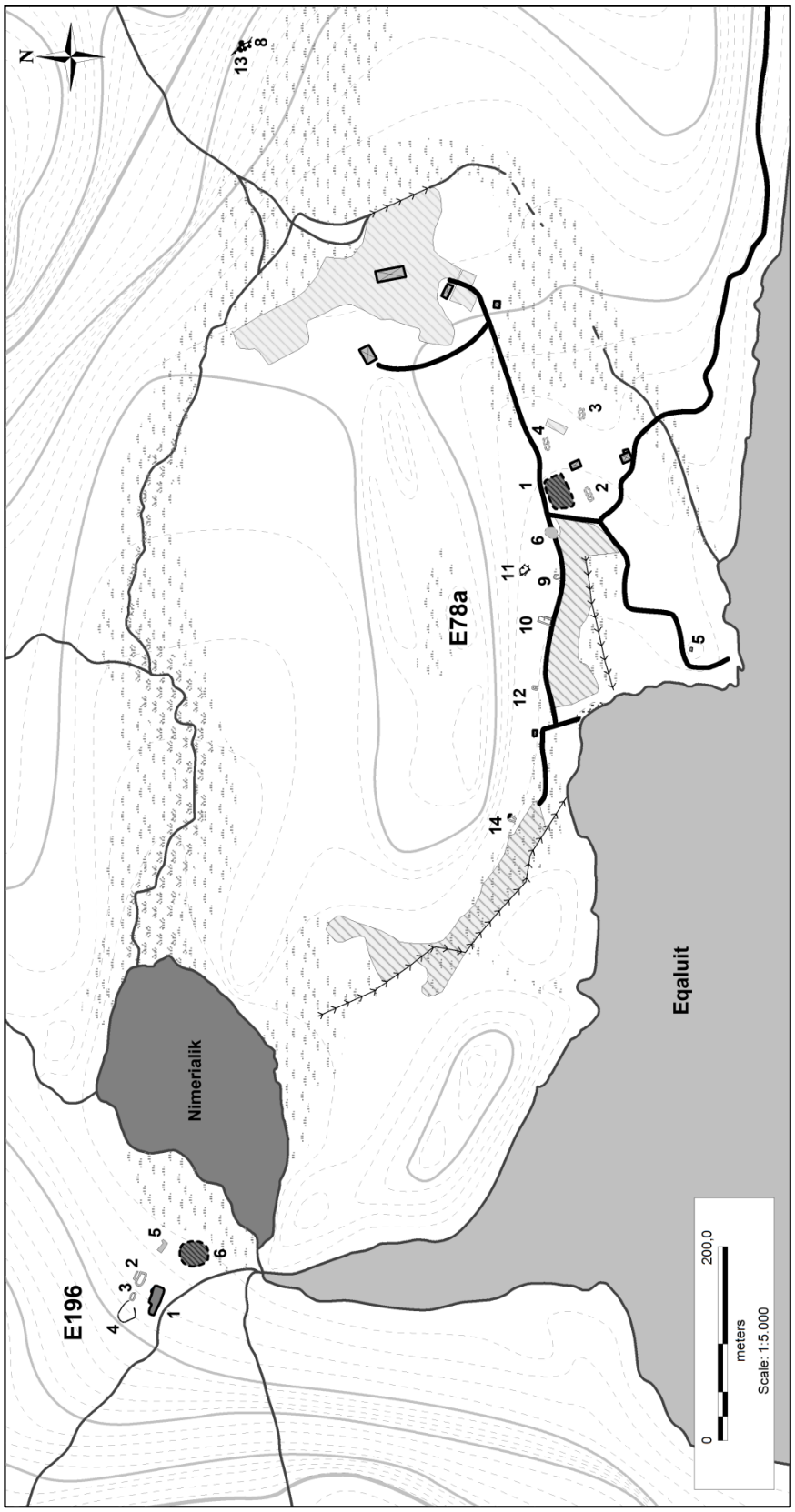
60V2-0IV-550

18 Ruins

Large Farmstead

60V2-0IV-585

E78a **Eqaluit** **App.3.42**



14 Ruins

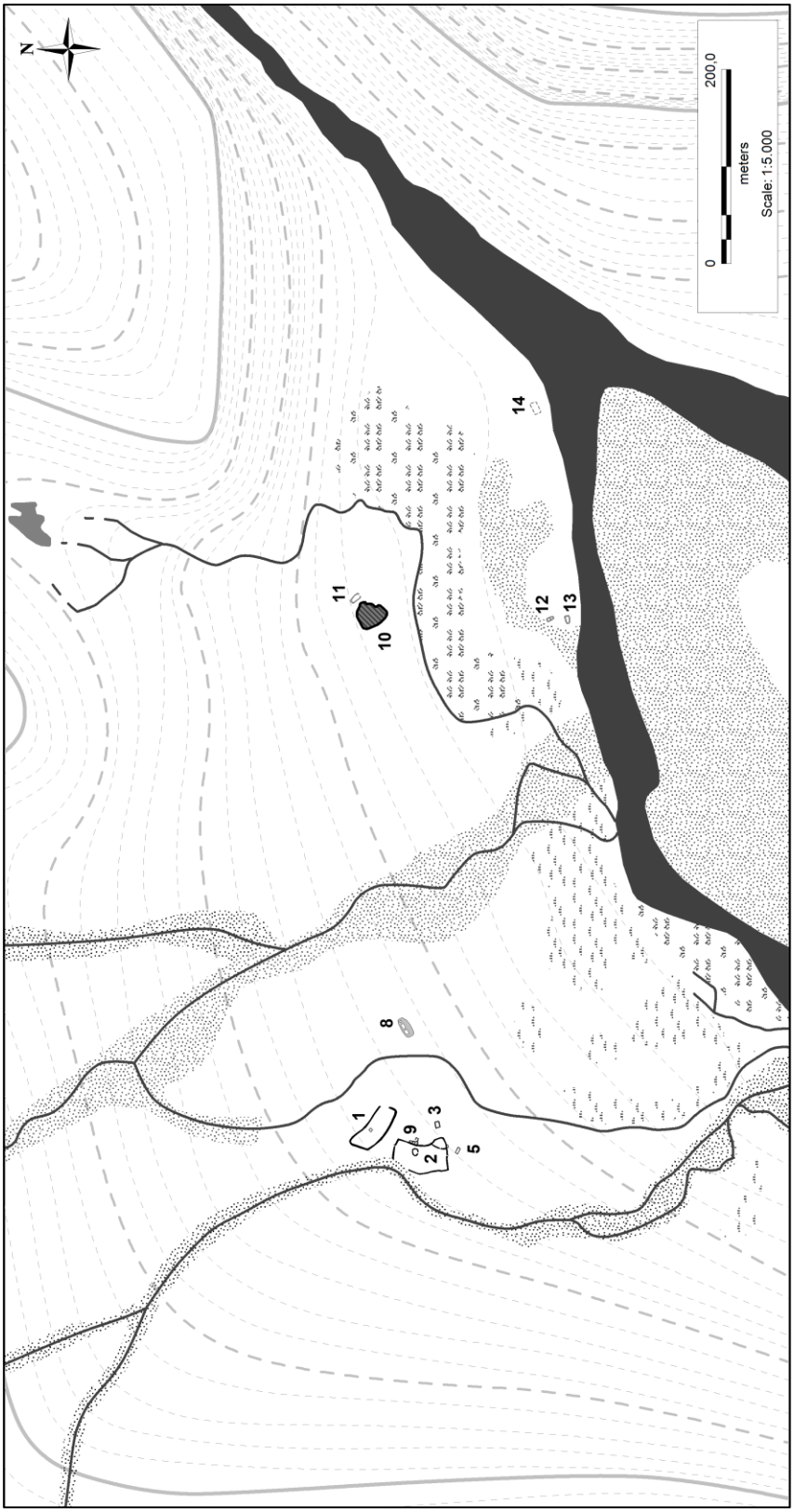
Medium Farmstead

60V2-0IV-586

7 Ruins

Large complex shieling

60V2-0IV-589



5 Ruins

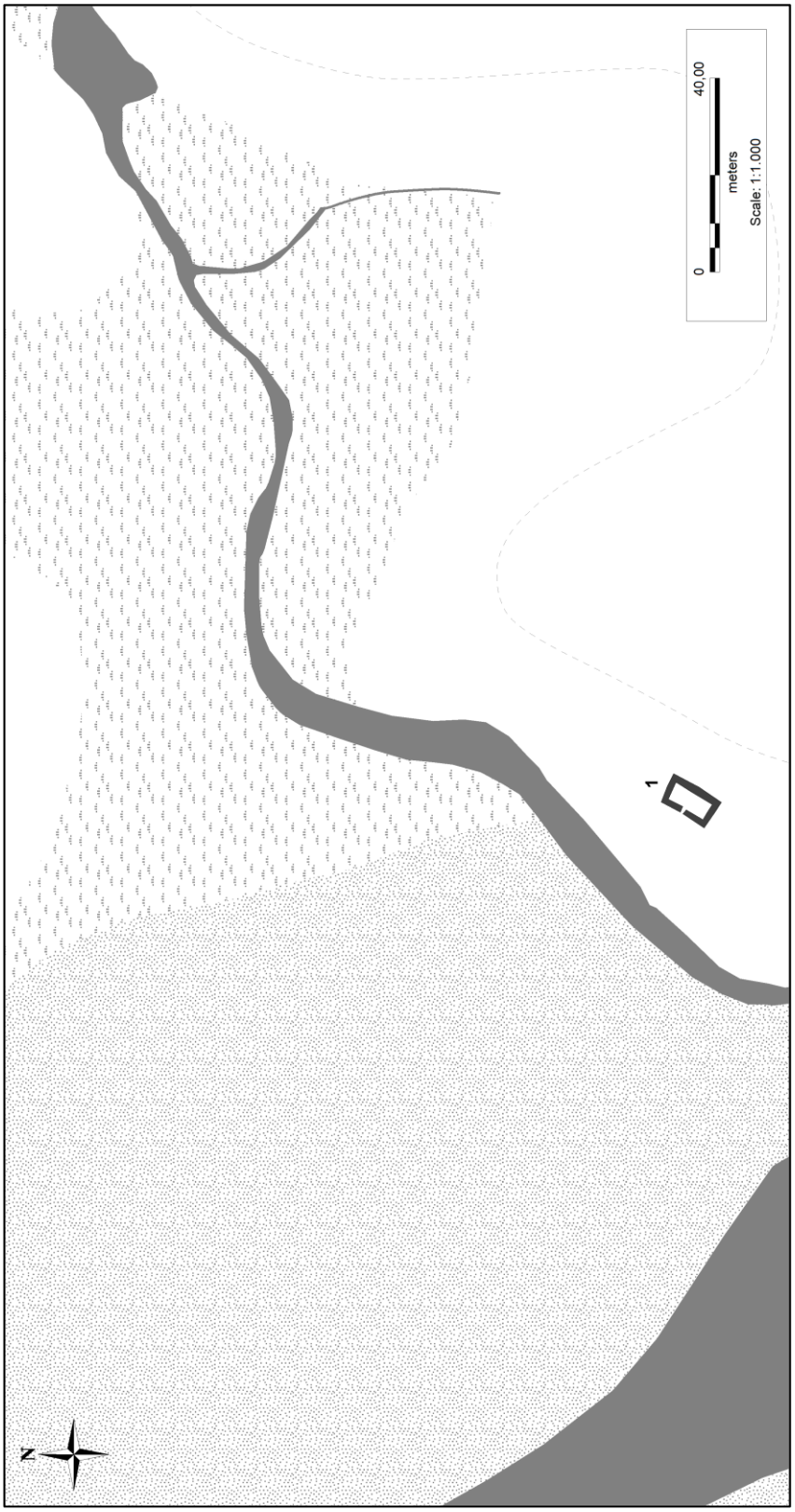
Medium Farmstead

60V2-0IV-521

3 Ruins

Dairy shieling

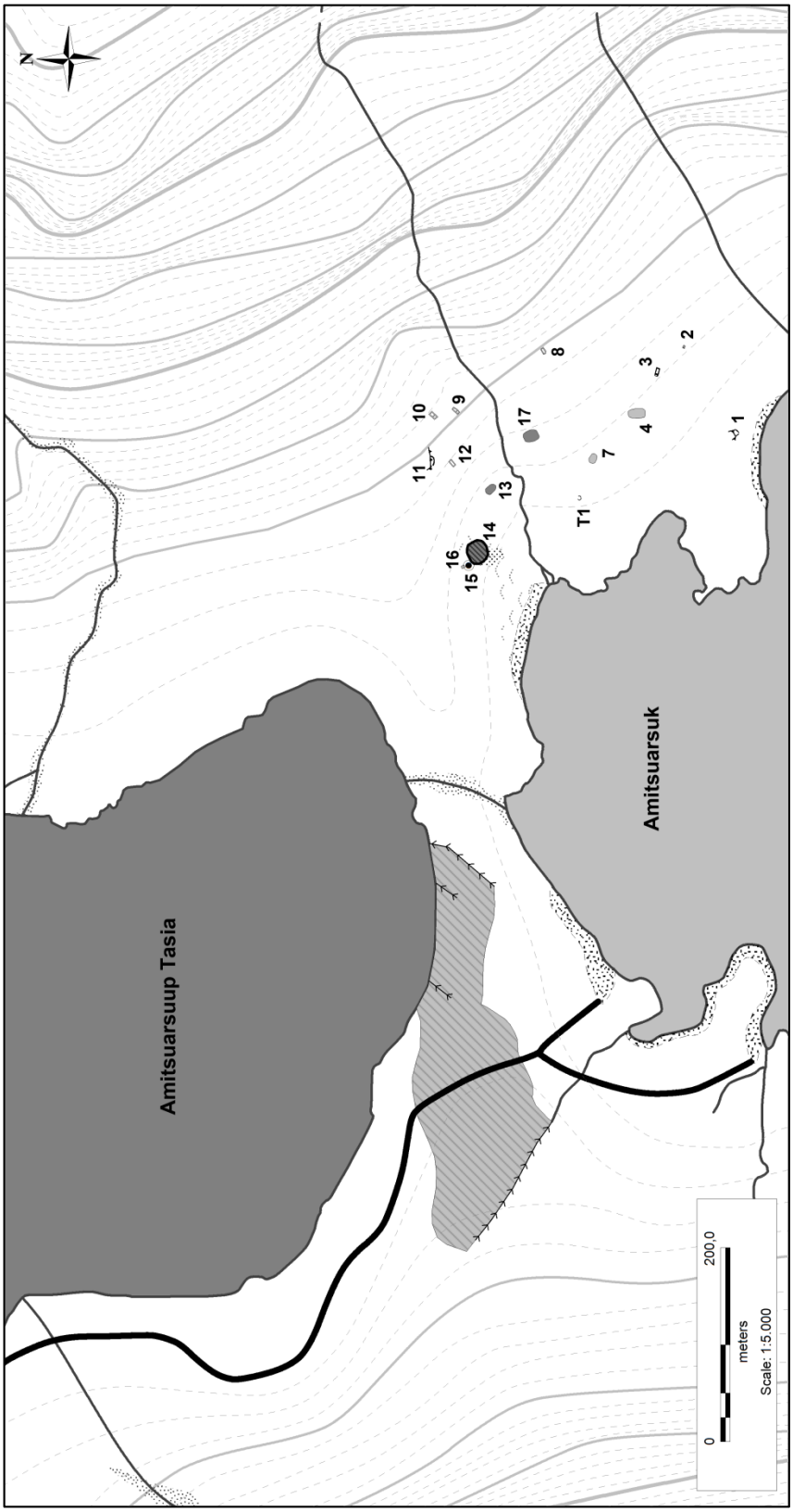
60V2-0IV-526



1 Ruin

Forage shieling

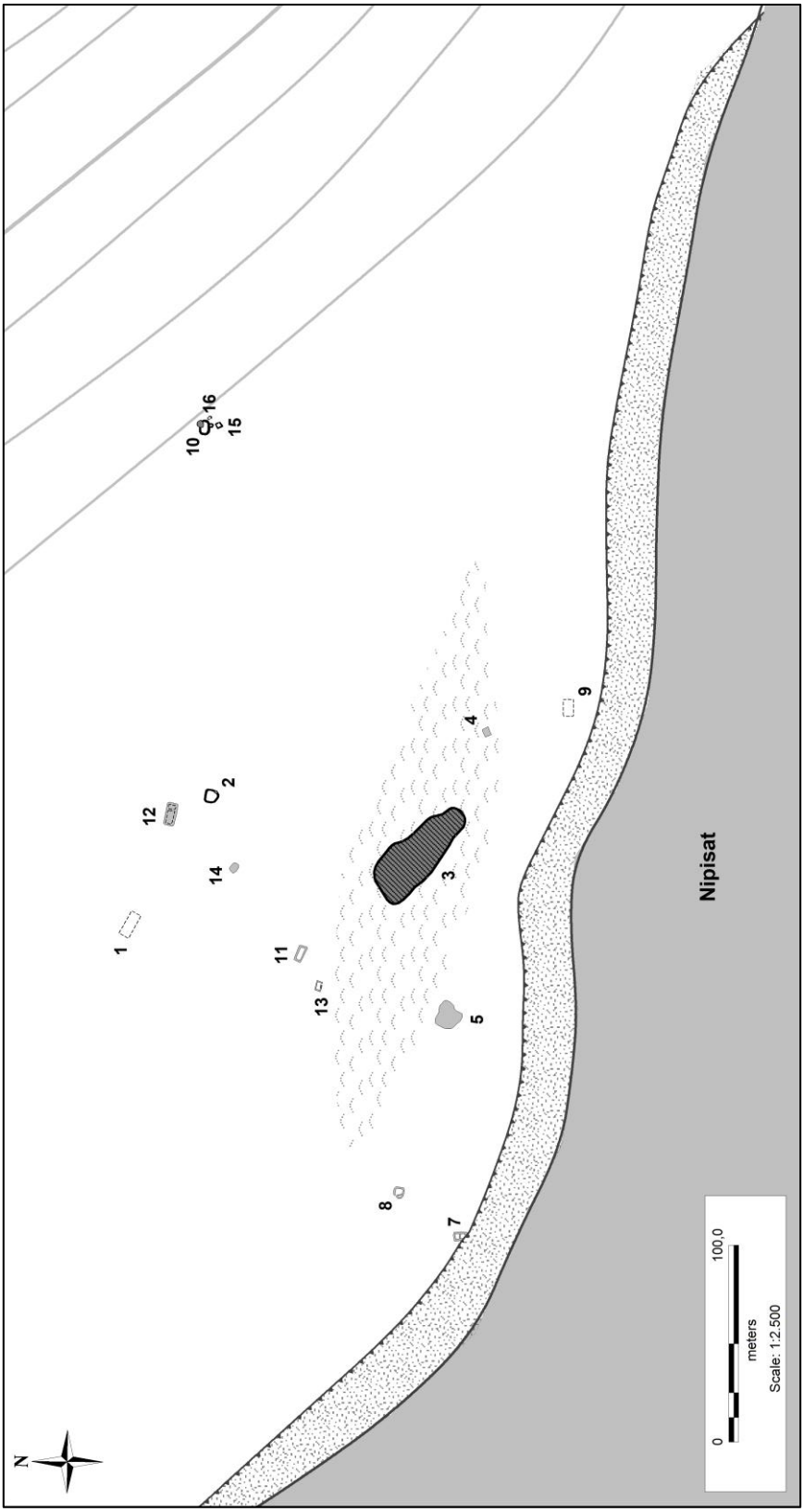
60V2-0IV-520



15 Ruins

Medium Farmstead

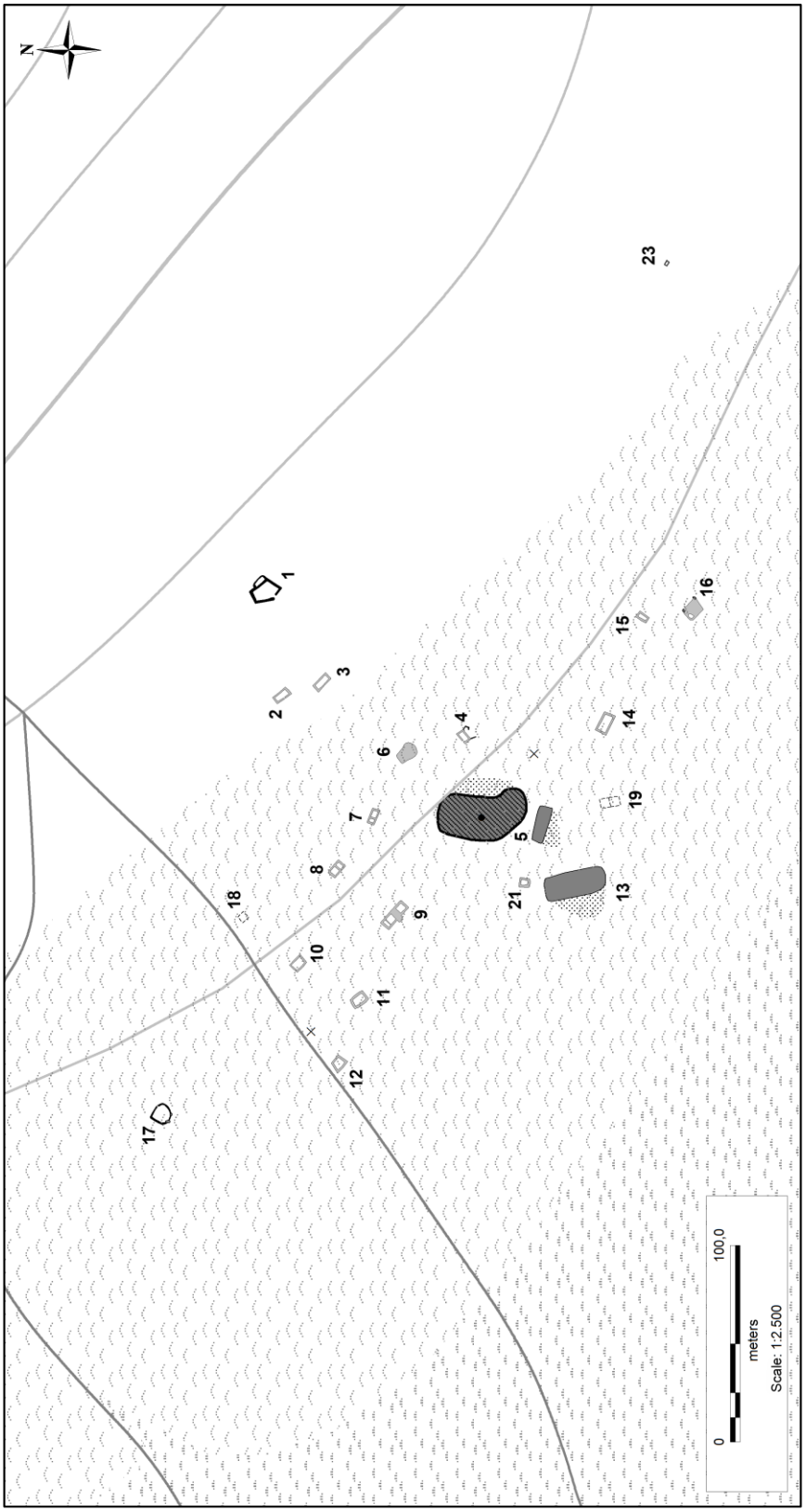
60V2-0IV-528



14 Ruins

Medium Farmstead

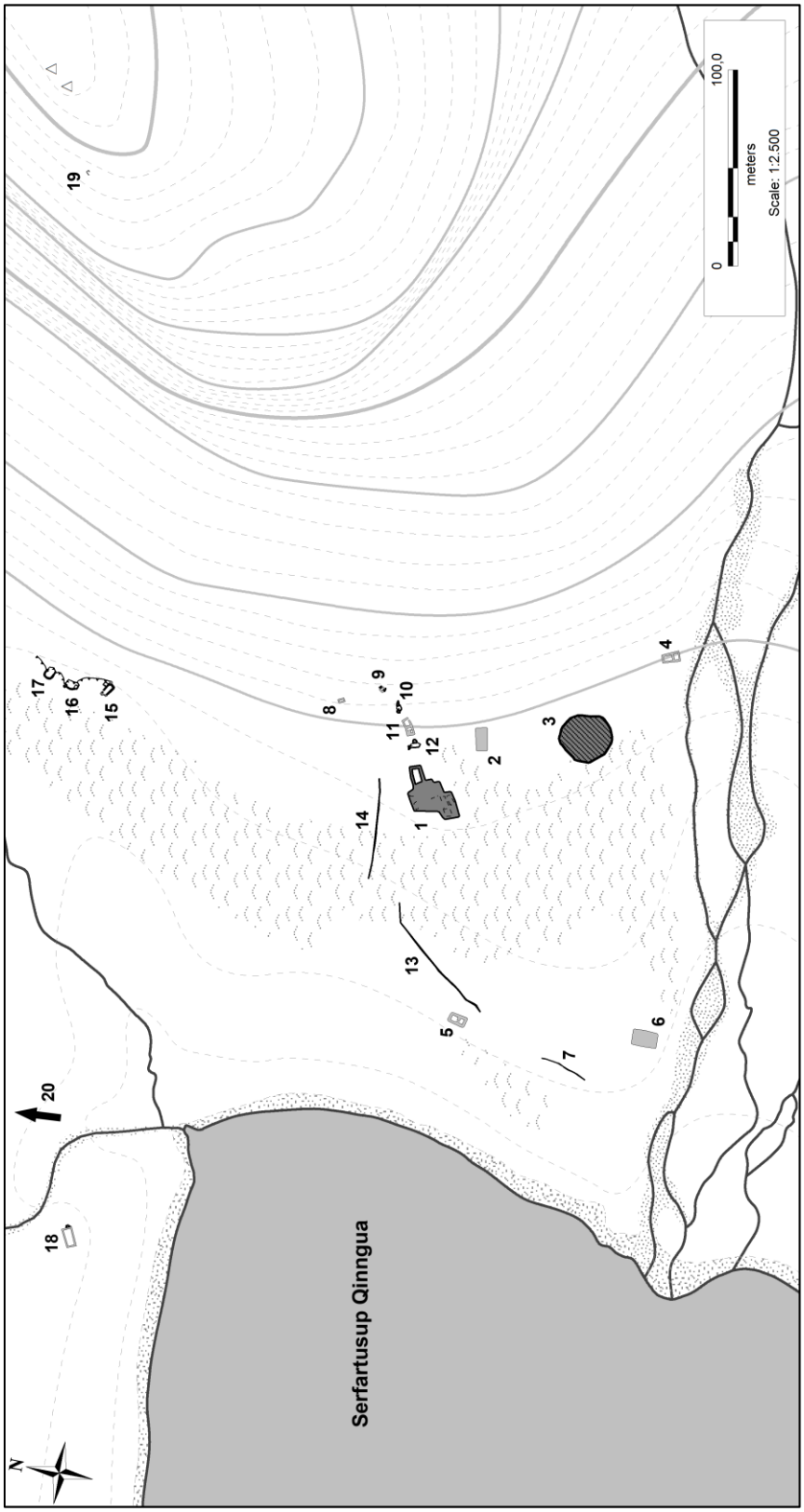
60V2-0IV-553



24 Ruins

Large Farmstead

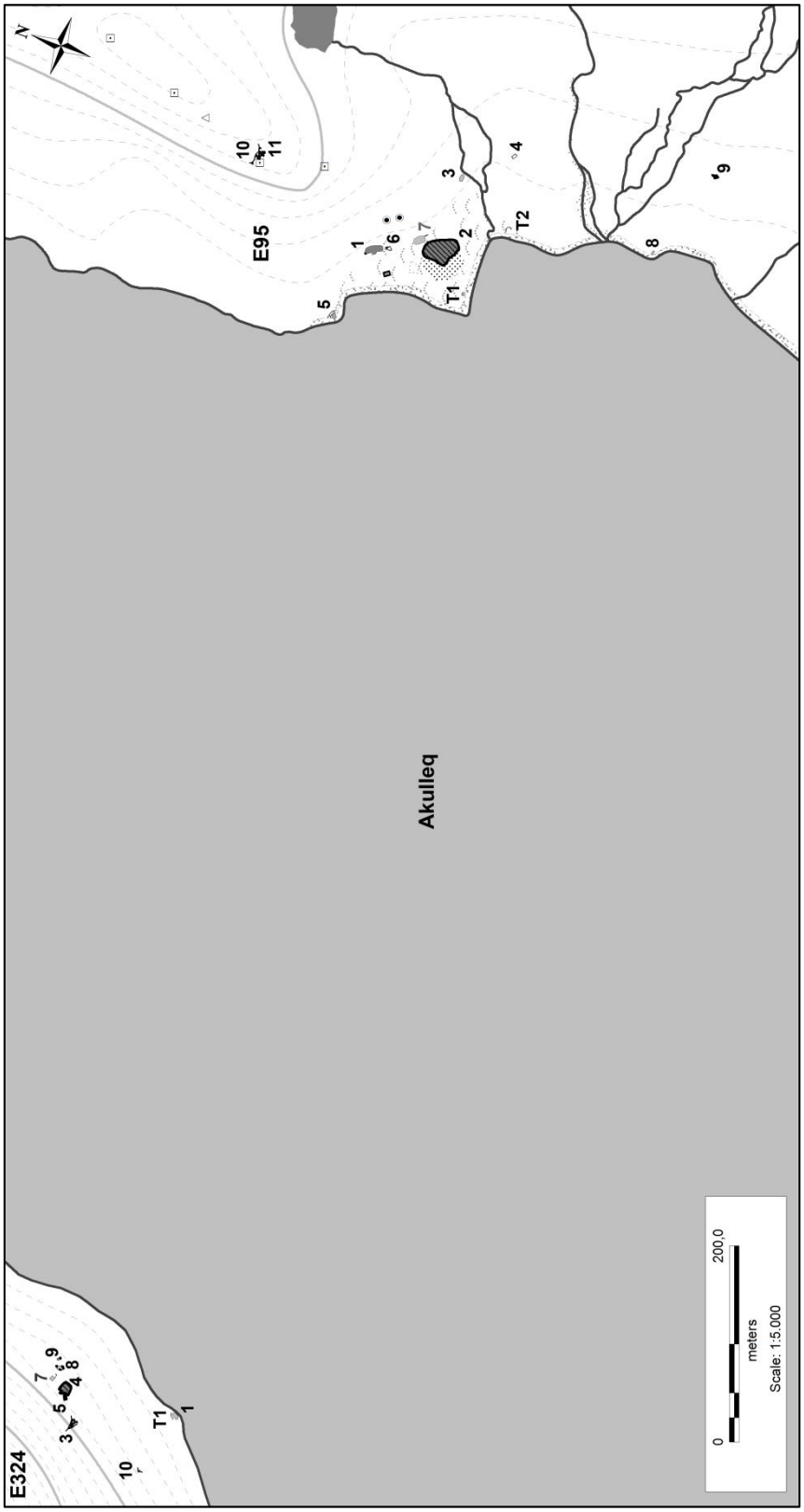
60V2-0IV-554



20 Ruins

Medium Farmstead

60V2-0IV-557

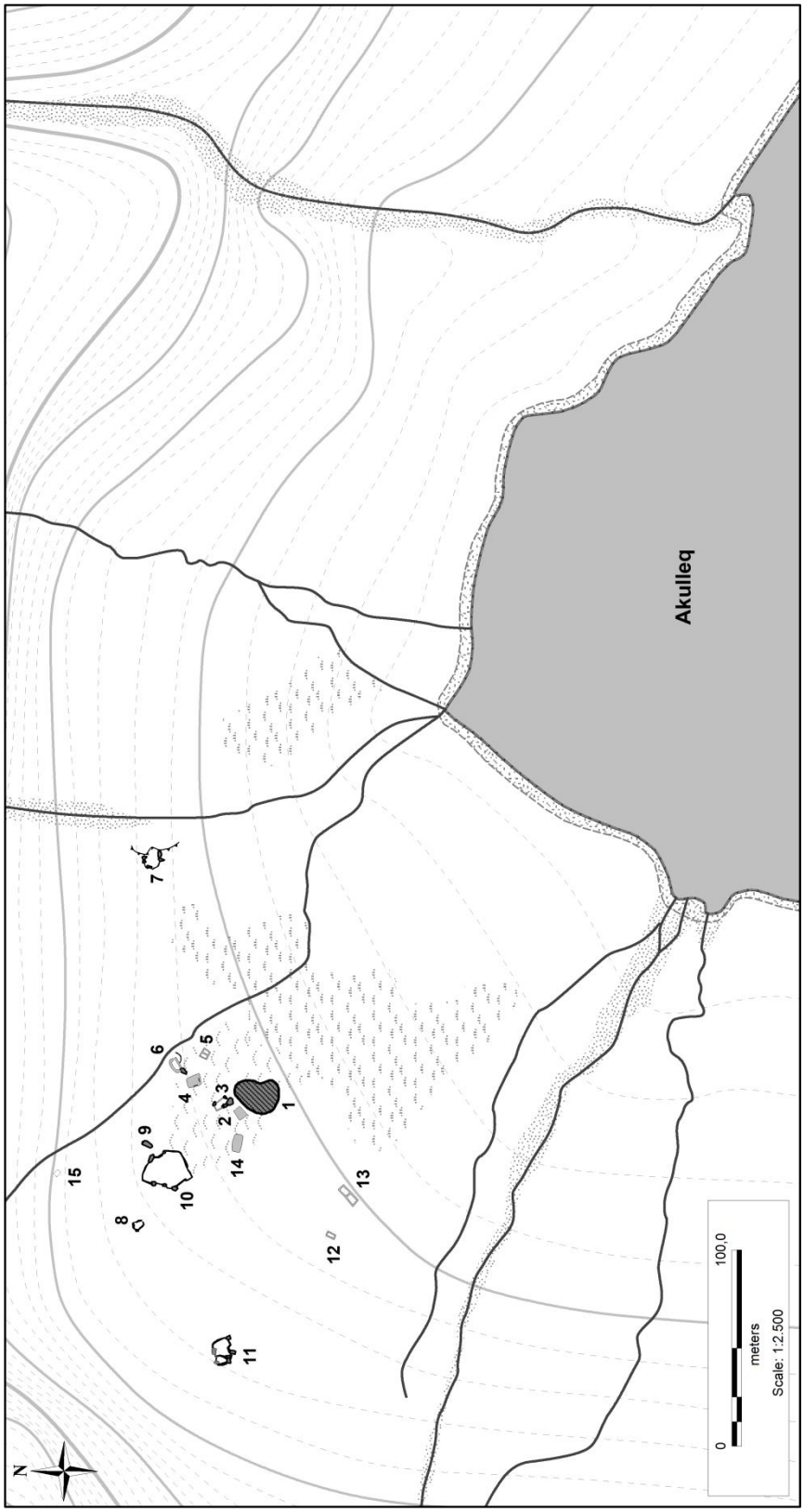


12 Ruins

Medium Farmstead

60V2-0IV-559

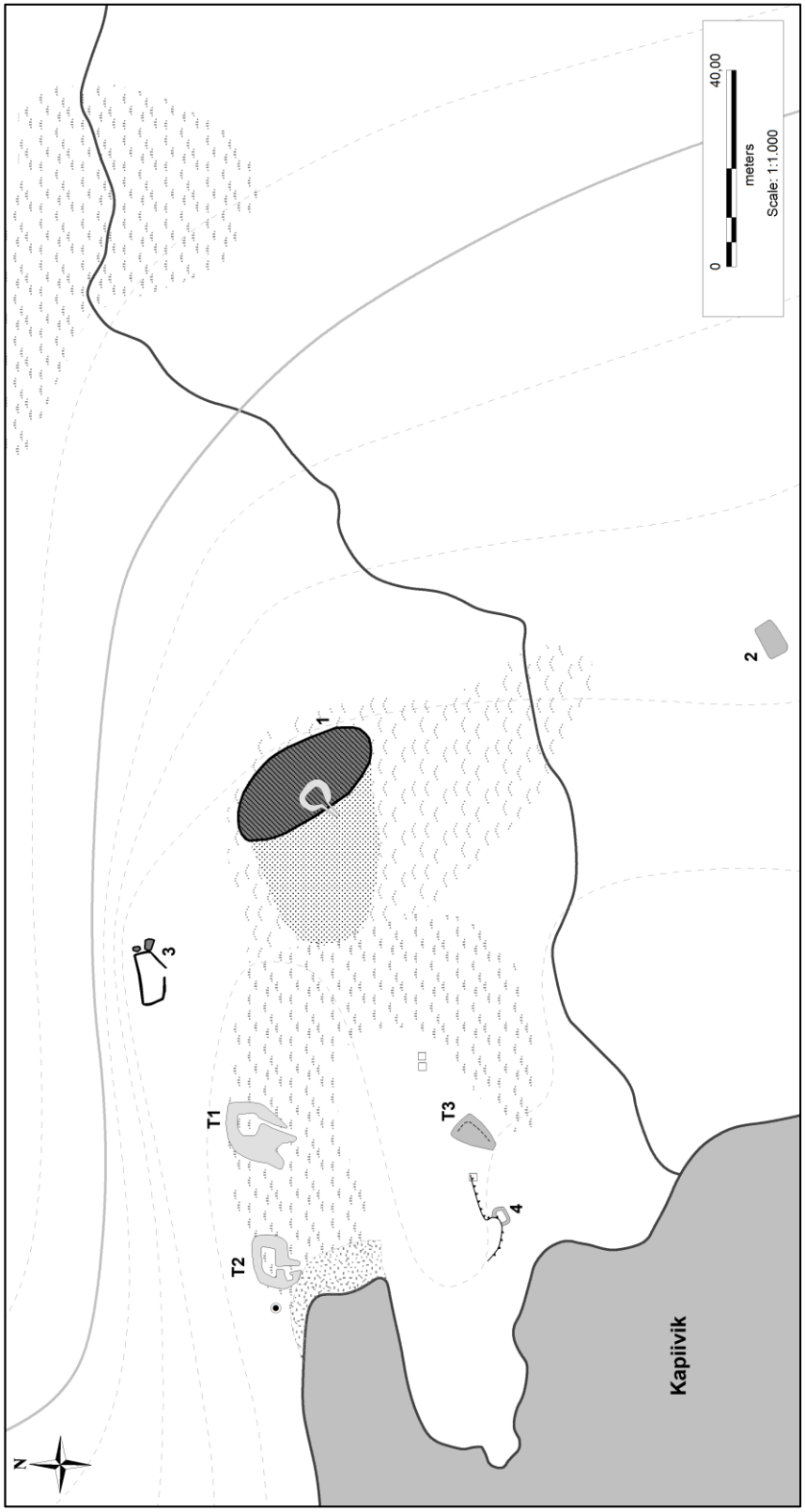
E95a **Akulliip Qinngua** **App.3.52**



16 Ruins

Small Farmstead

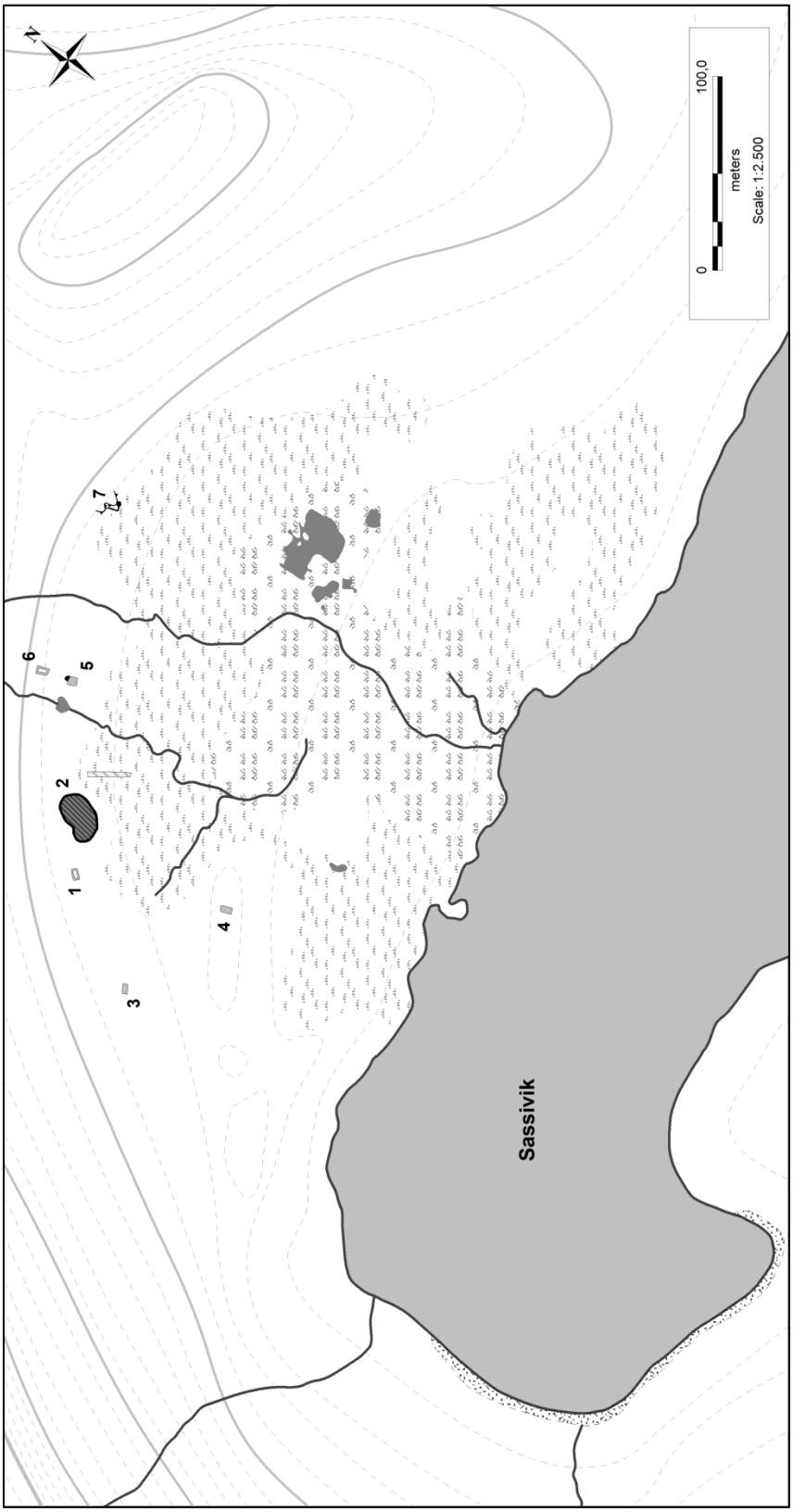
60V2-0IV-561



4 Ruins

Large complex shieling

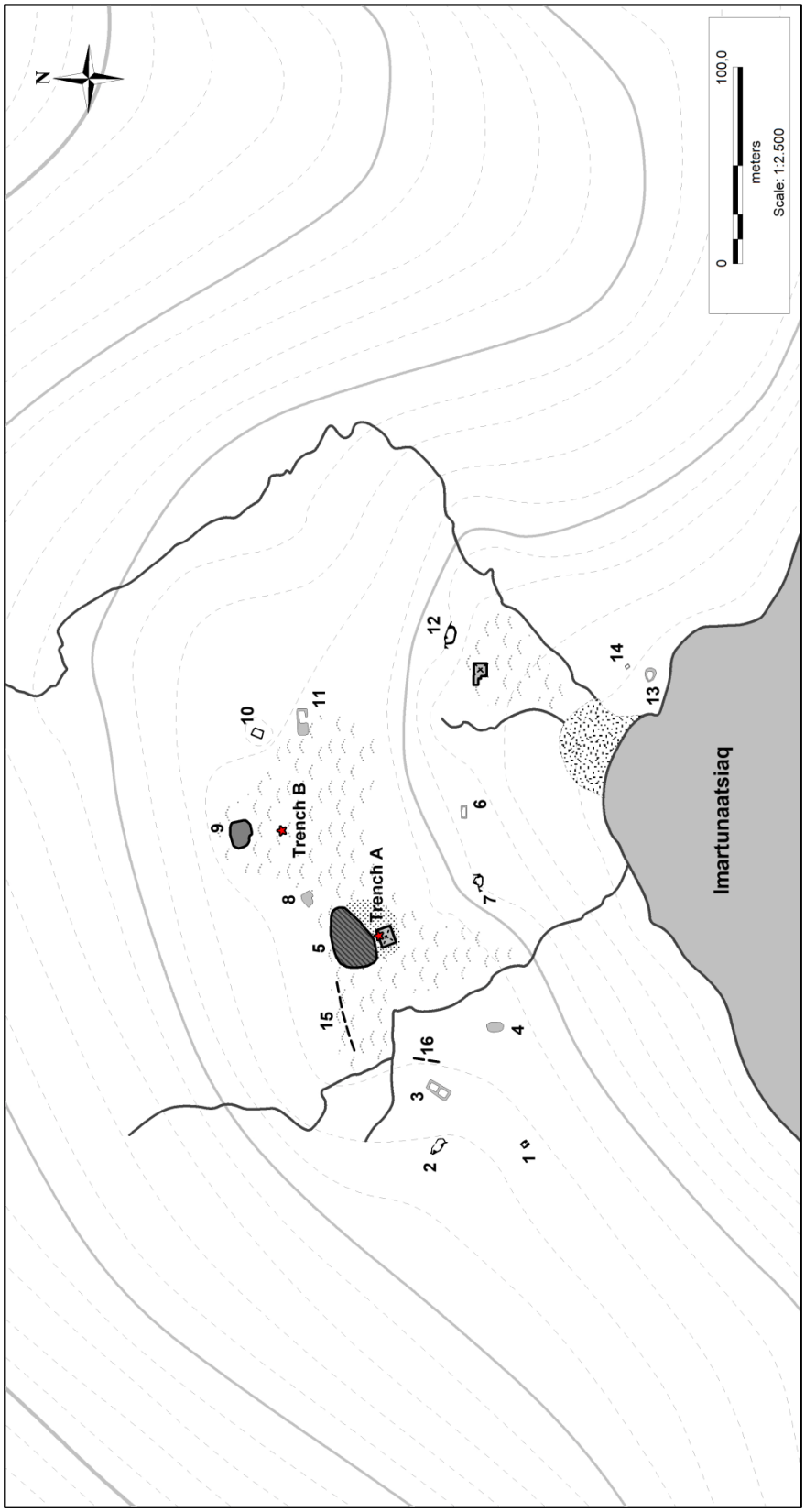
60V2-0IV-563



7 Ruins

Large complex shieling

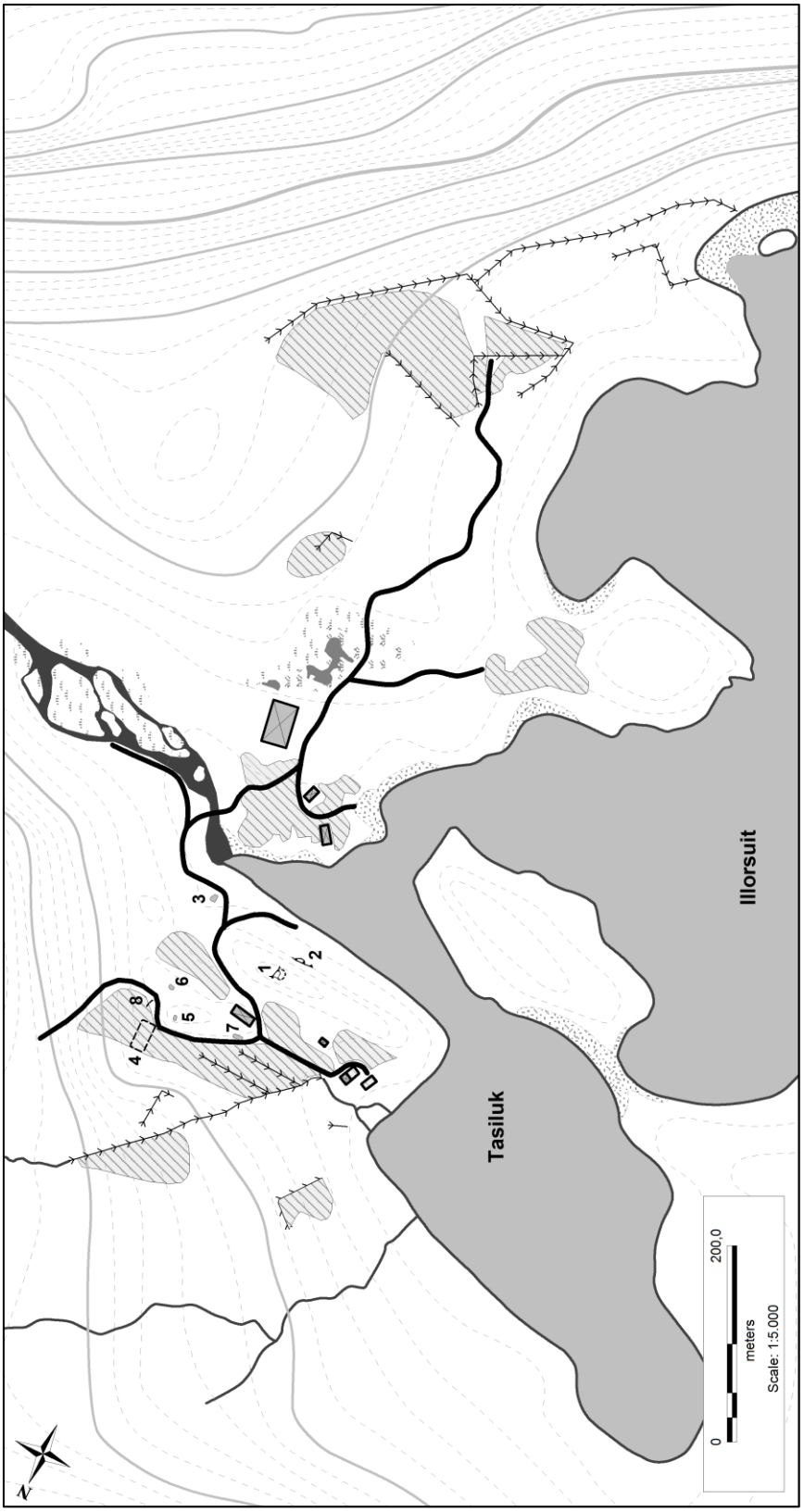
60V2-0IV-572



13 Ruins

Medium Farmstead

60V2-0IV-575



9 Ruins

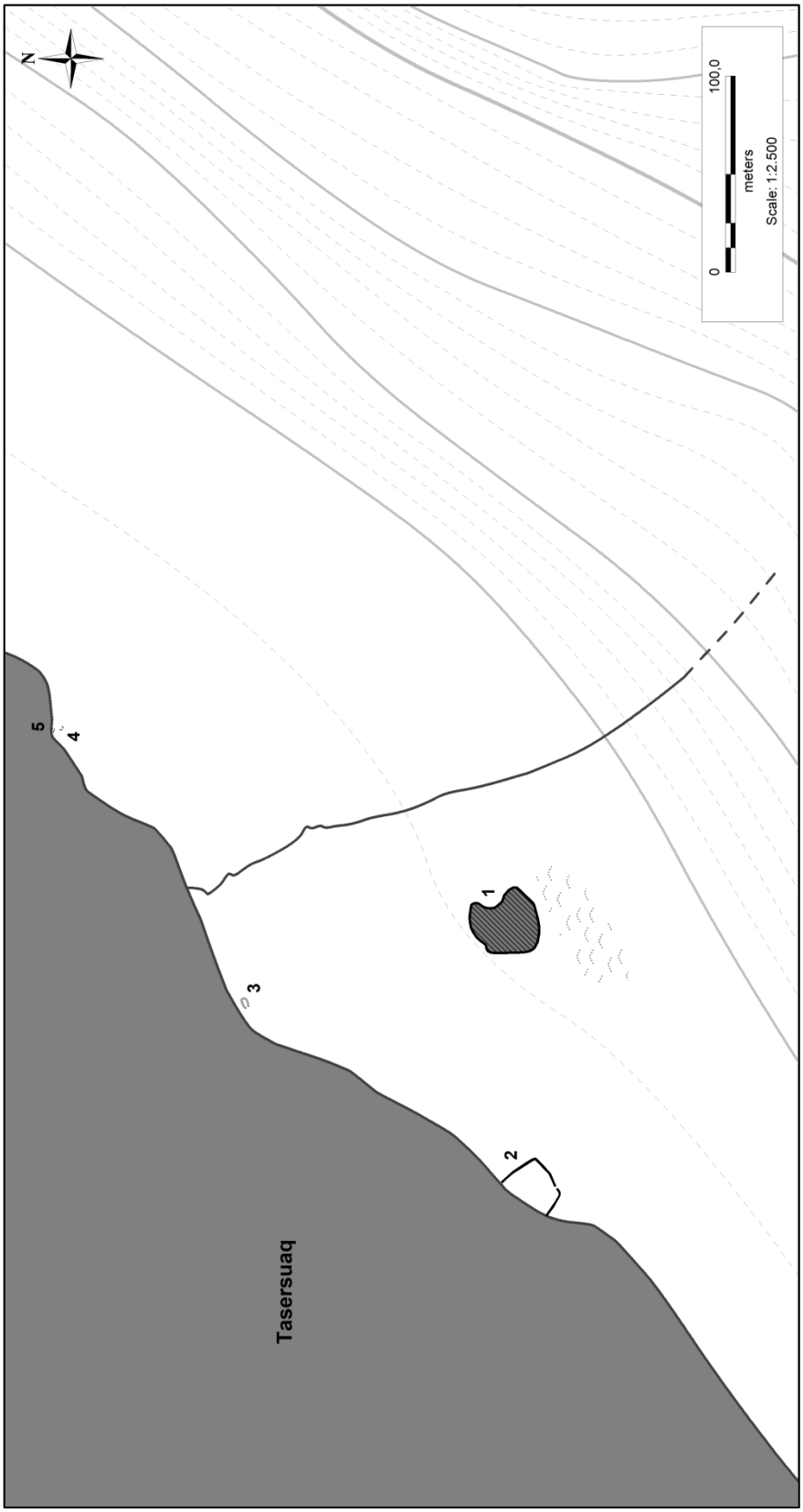
Small Farmstead

60V2-0IV-574

24 ruins

Medium Farmstead

60V2-0IV-590



4 Ruins

Medium Farmstead

60V2-0IV-591

7 Ruins

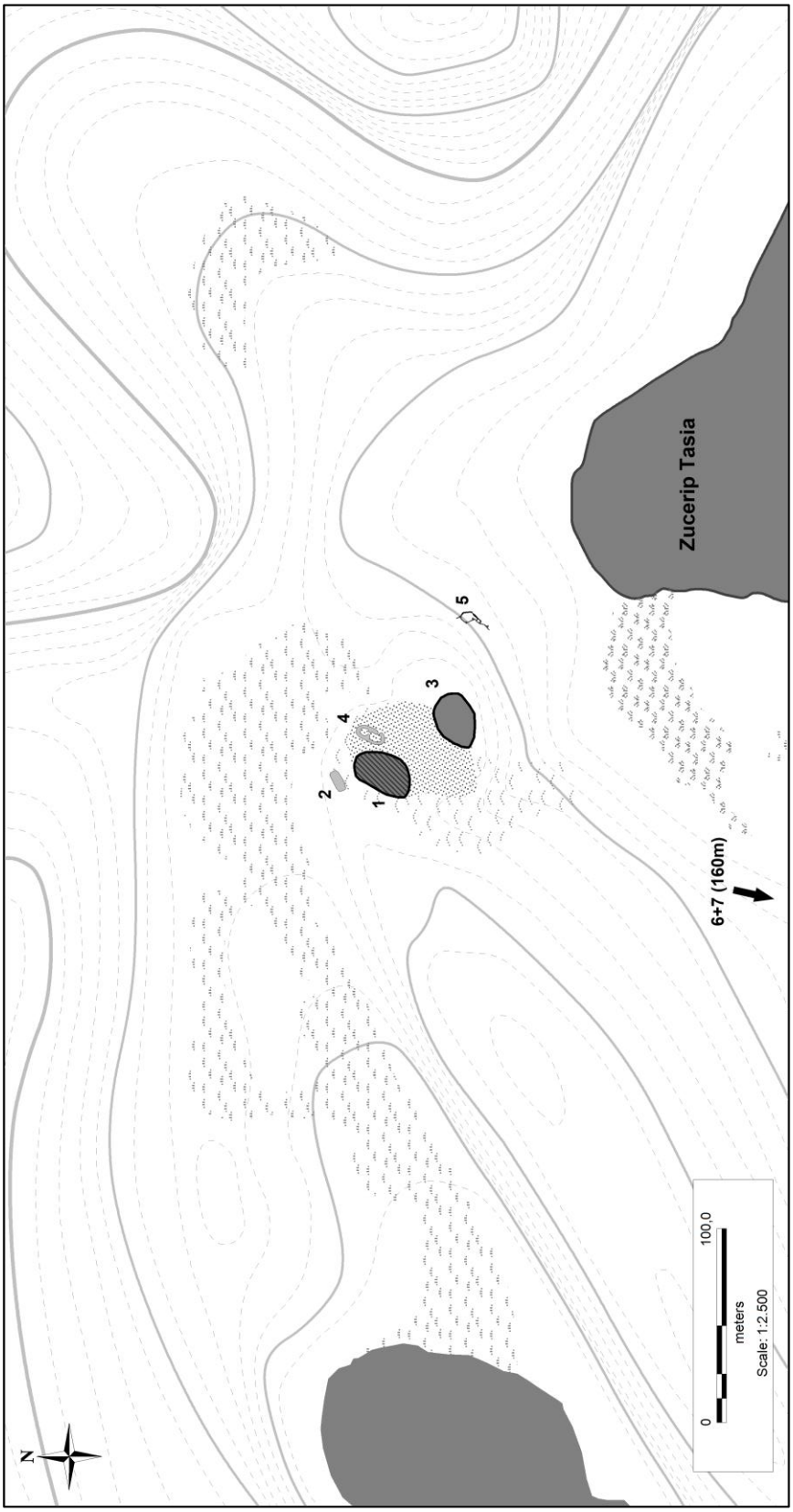
Small Farmstead

60V2-0IV-592

15 Ruins

Large complex shieling

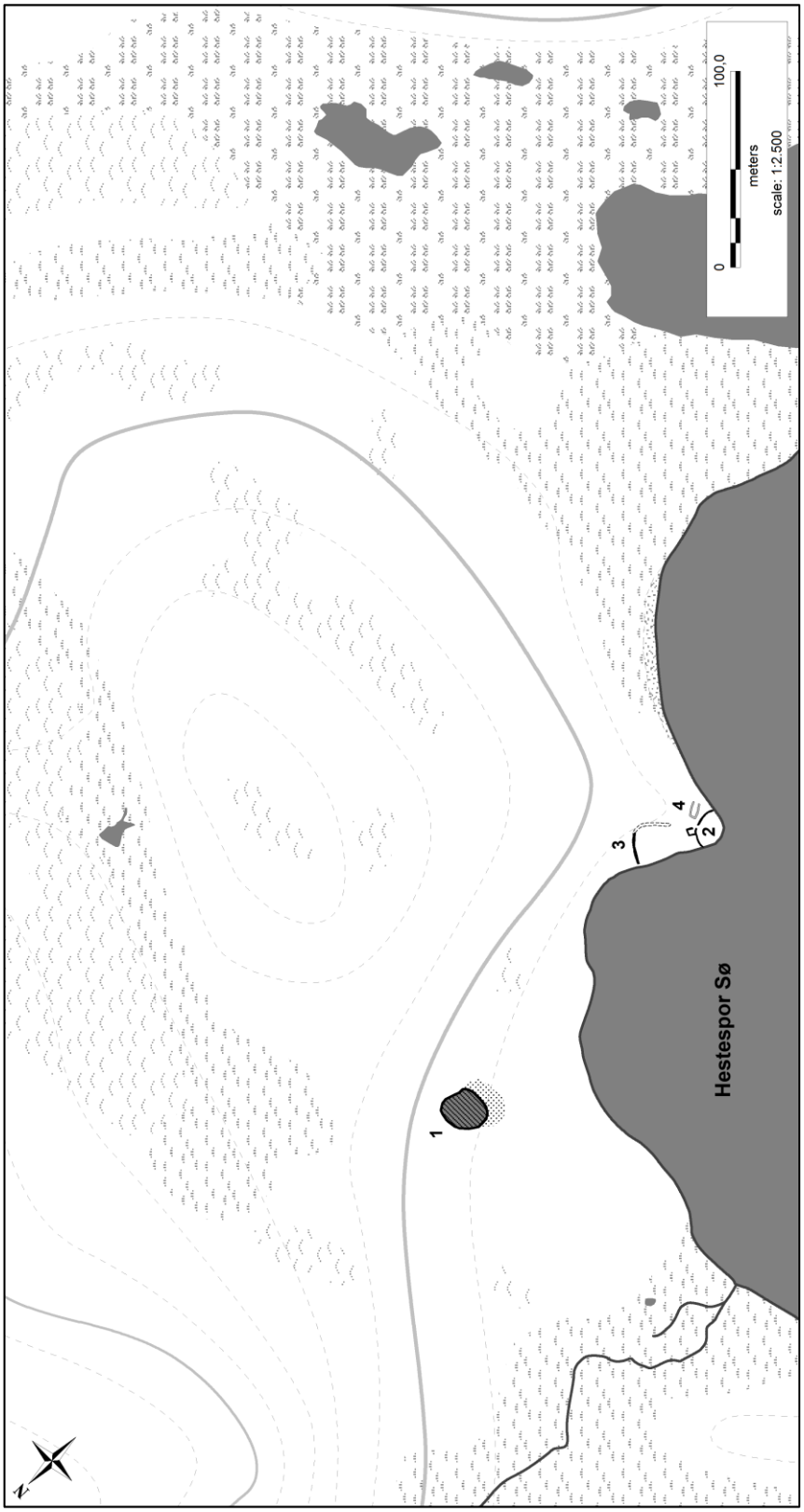
60V2-0IV-603



7 Ruins

Large complex shieling

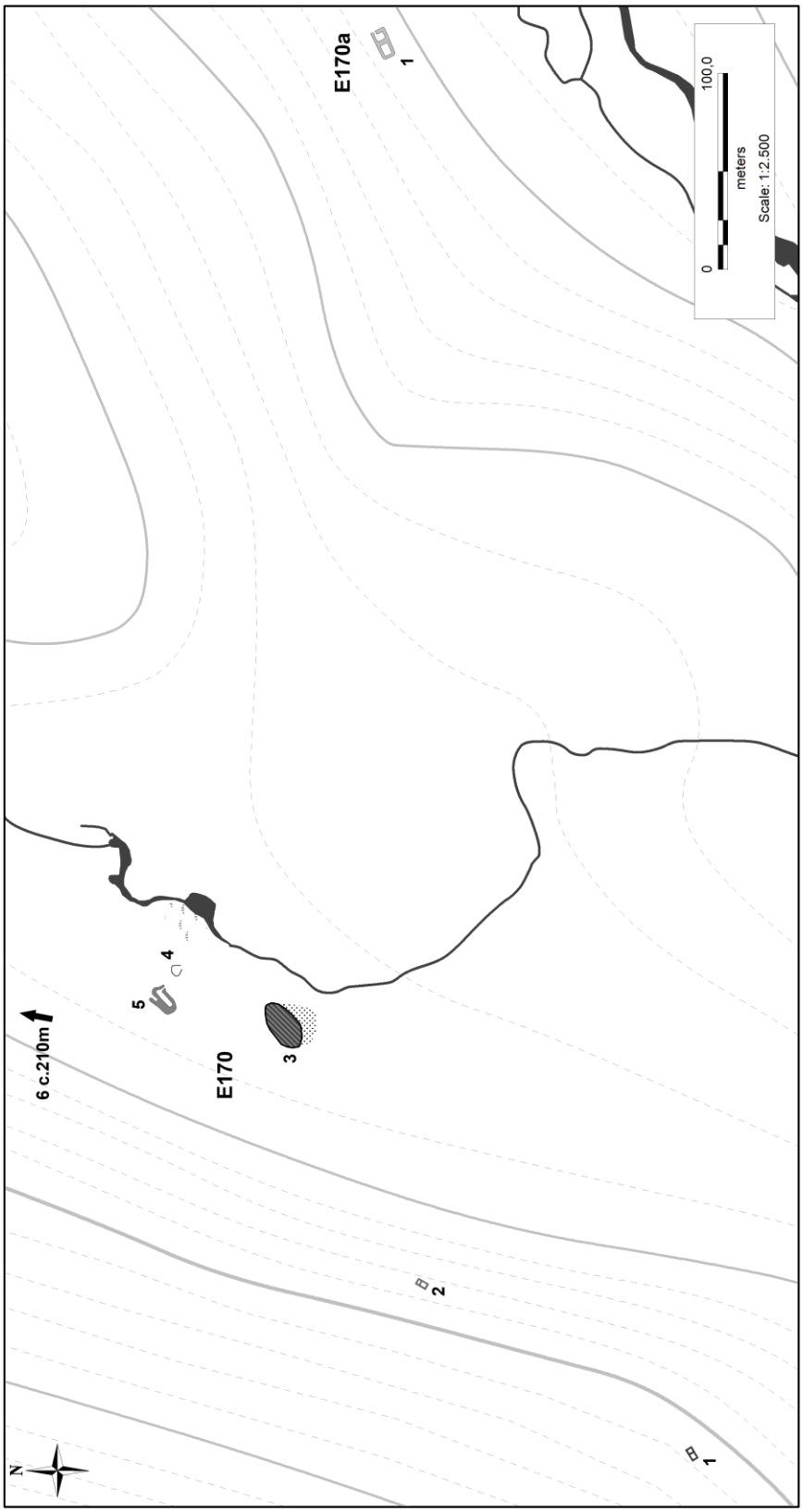
60V2-0IV-541



4 Ruins

Large complex shieling

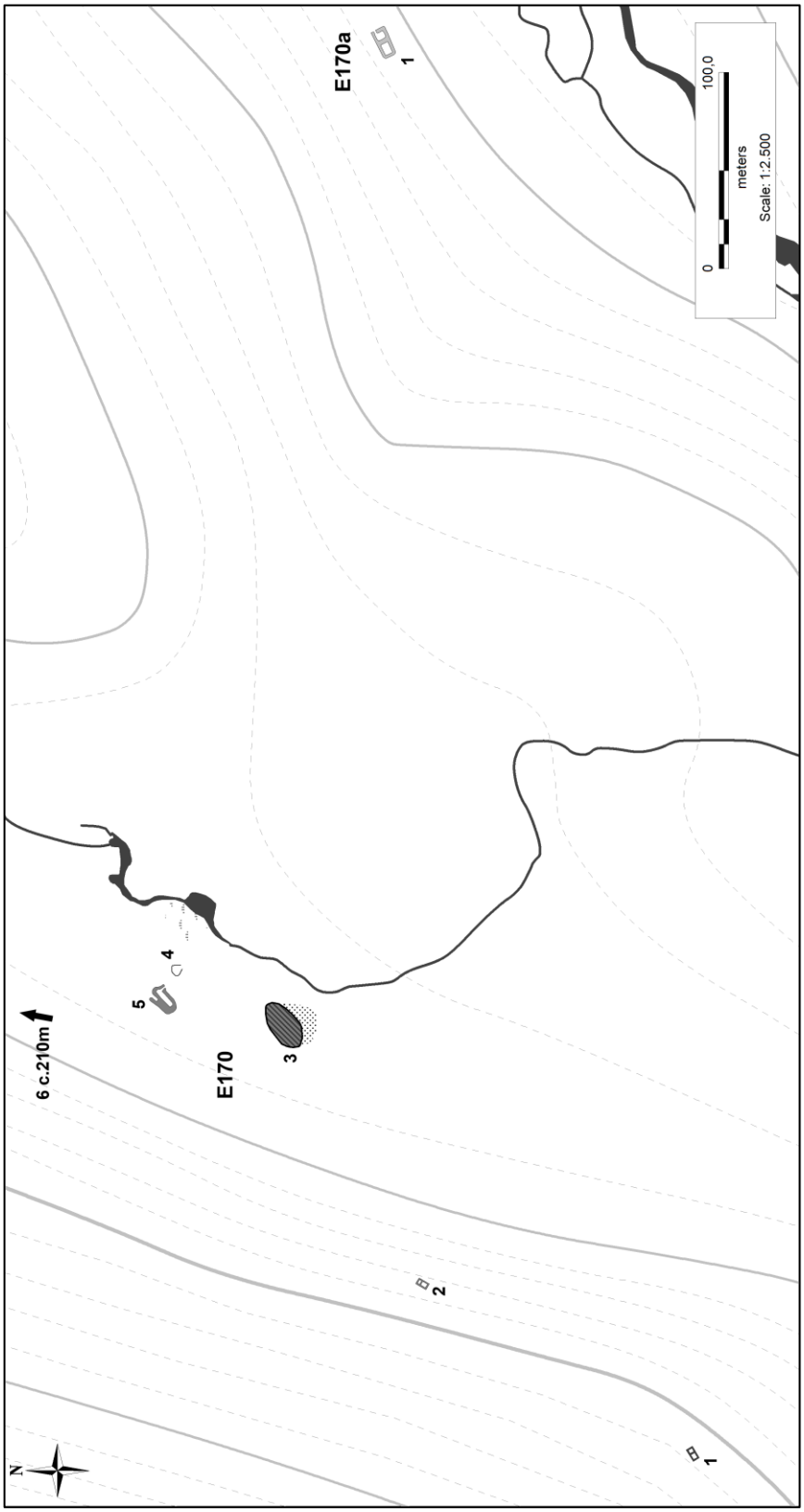
60V2-0IV-610



7 Ruins

Large complex shieling

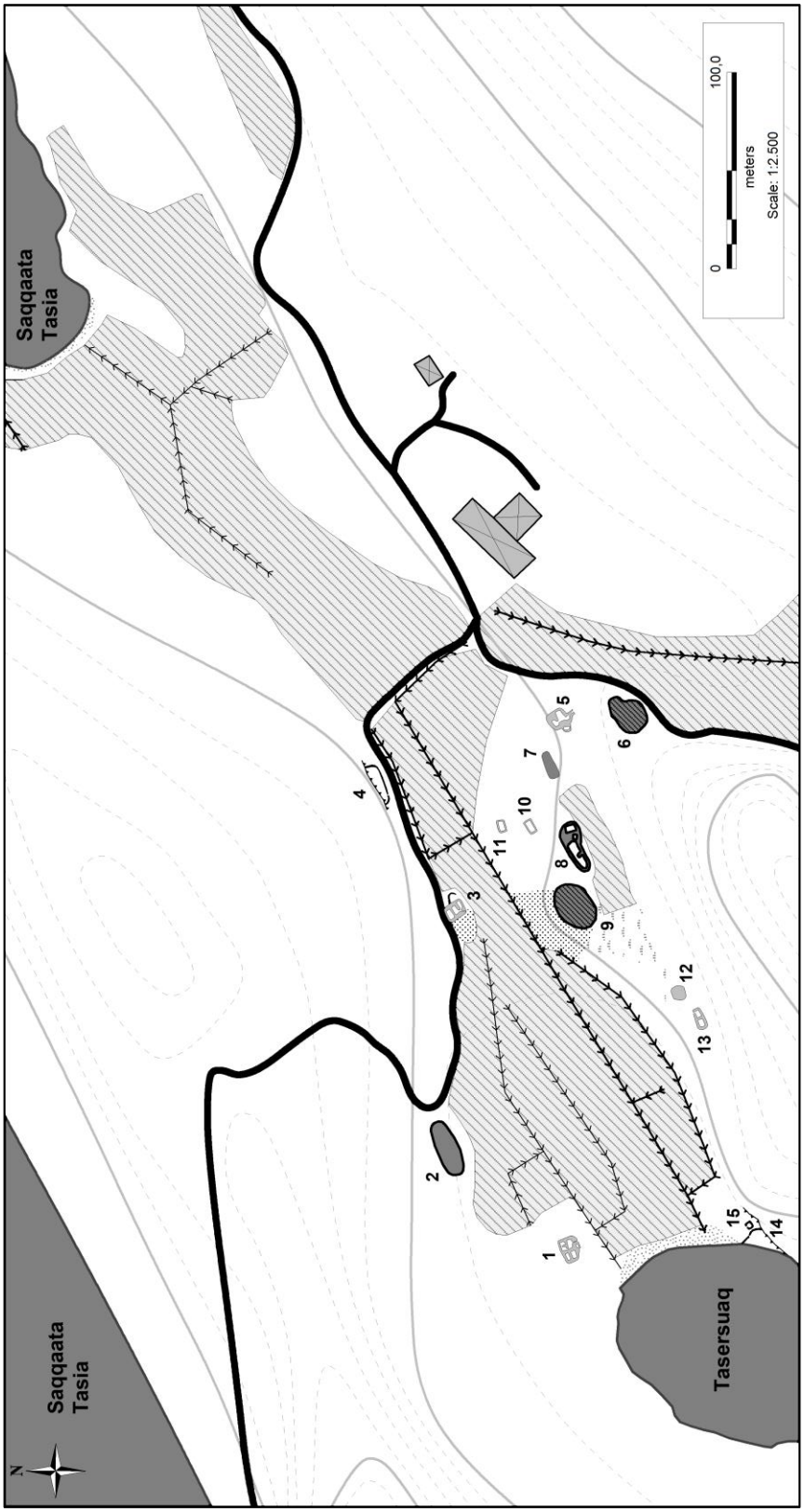
60V2-0IV-547



1 Ruin

Large complex shieling

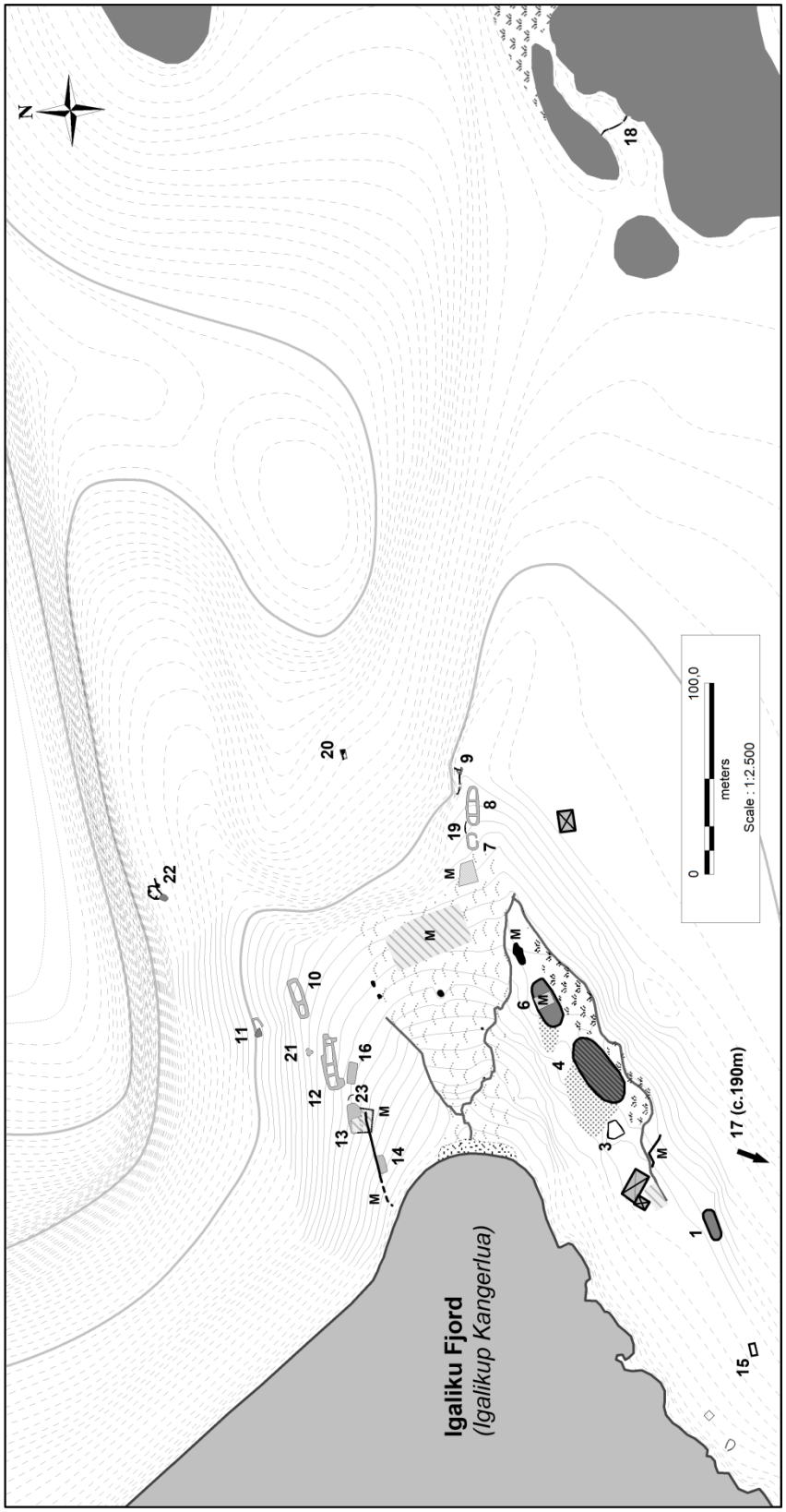
60V2-0IV-546



16 Ruins

Medium Farmstead

60V2-0IV-601



21 Ruins

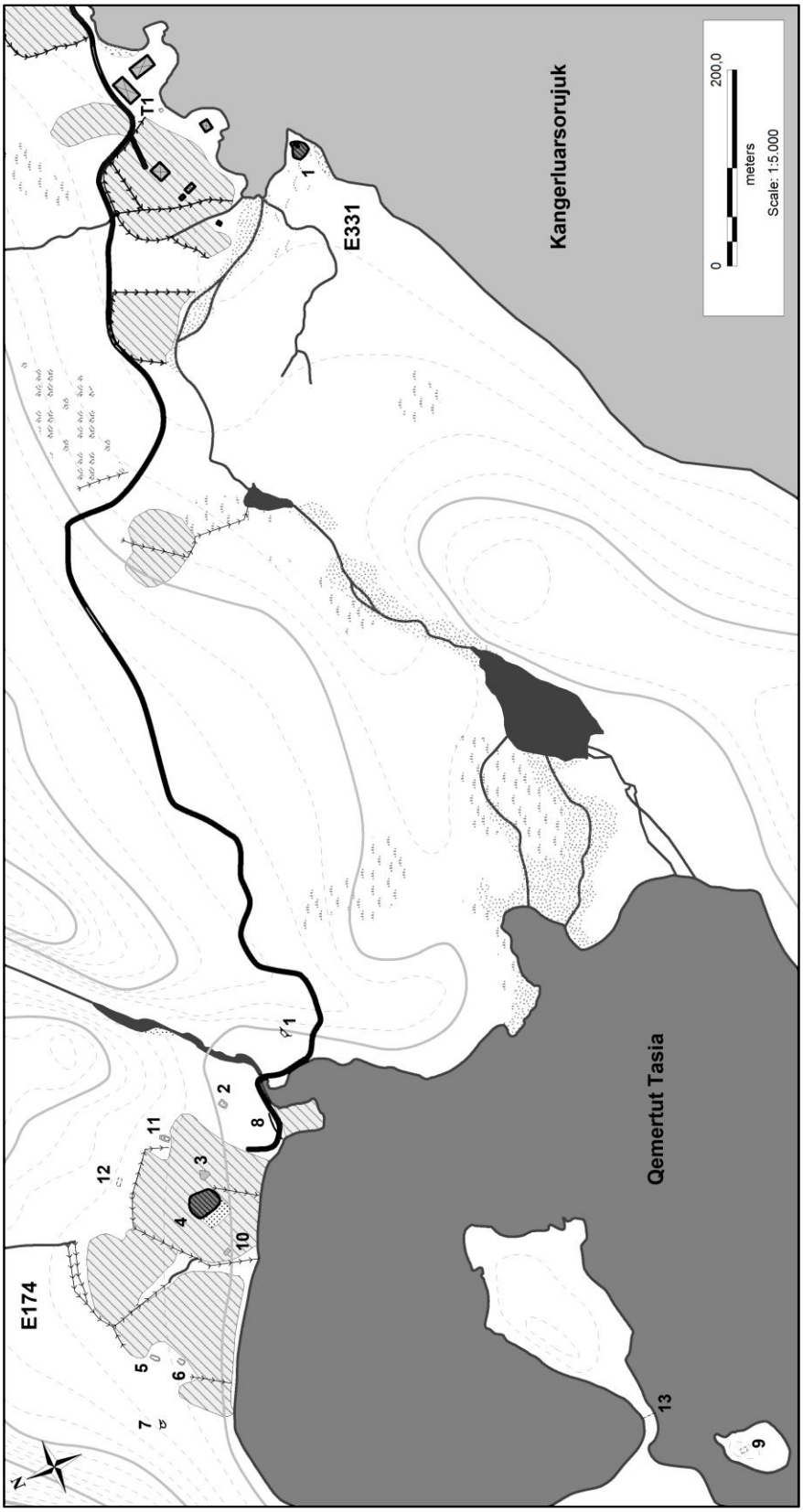
Medium Farmstead

60V2-0IV-593

11 Ruins

Large complex shieling

60V2-0IV-583

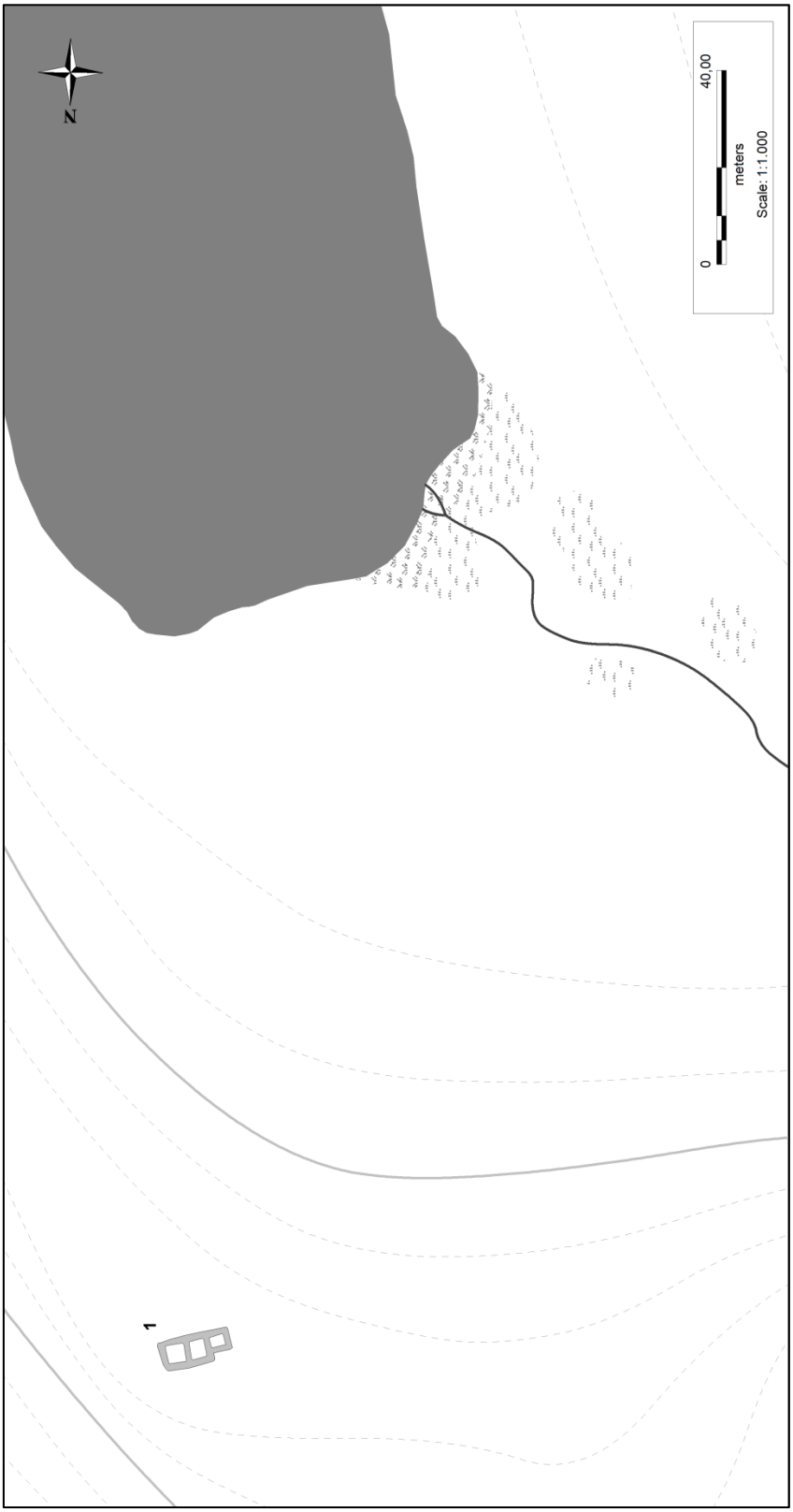


13 Ruins

Medium Farmstead

60V2-0IV-580

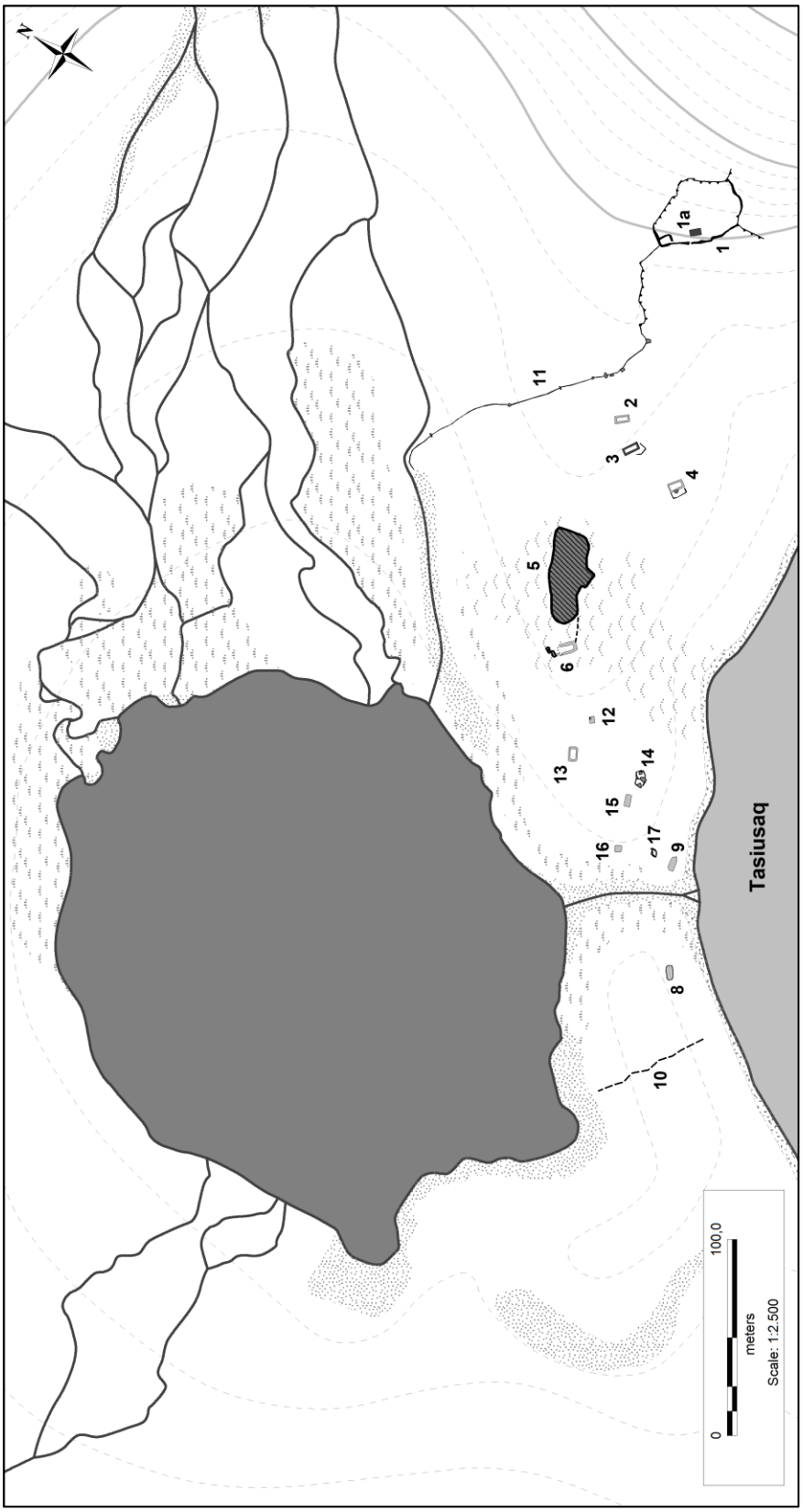
E175 **No place name** **App.3.69**



1 Ruin

Small complex shieling

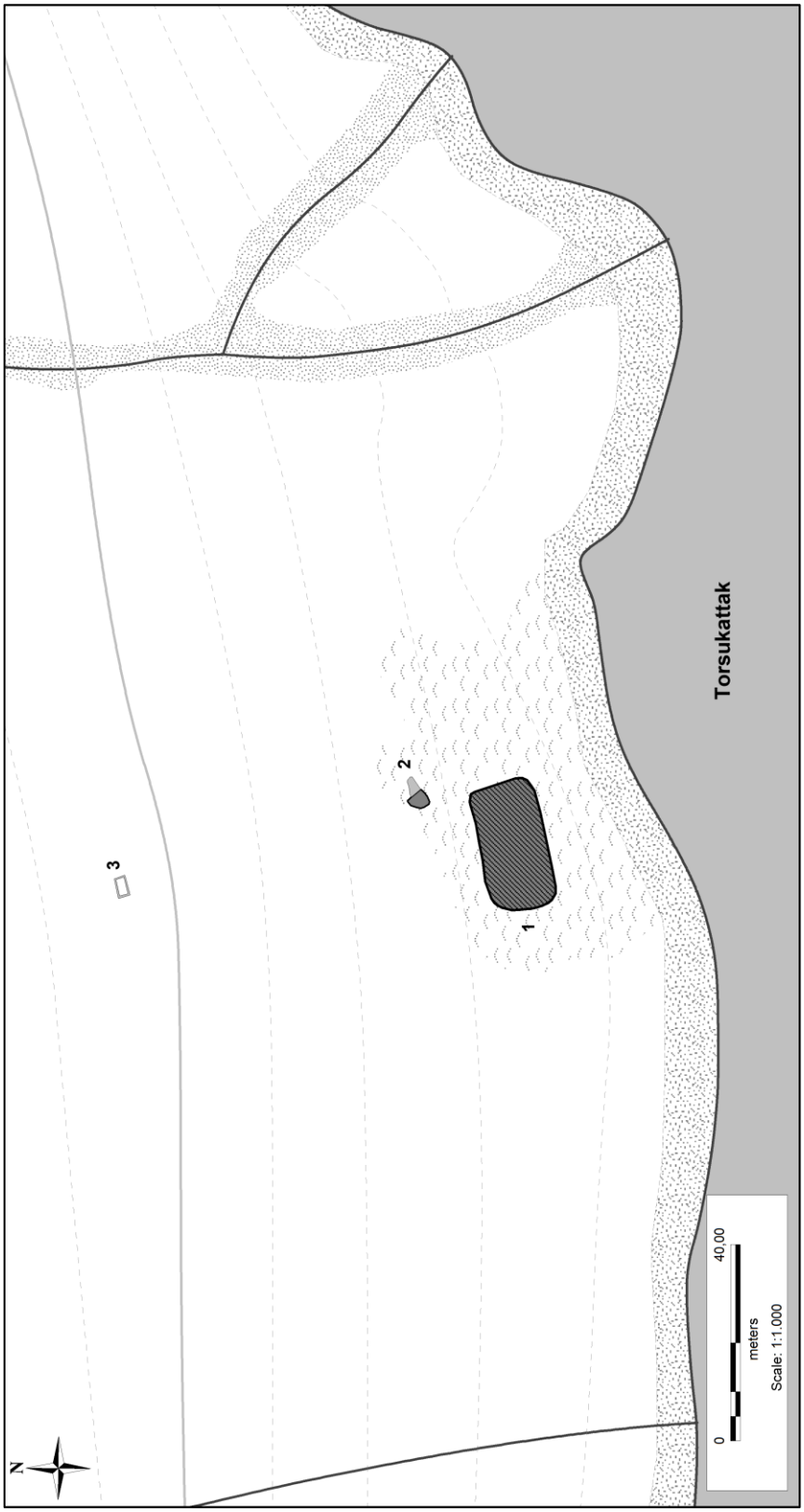
60V2-0IV-588



19 Ruins

Large Farmstead

60V2-0IV-569

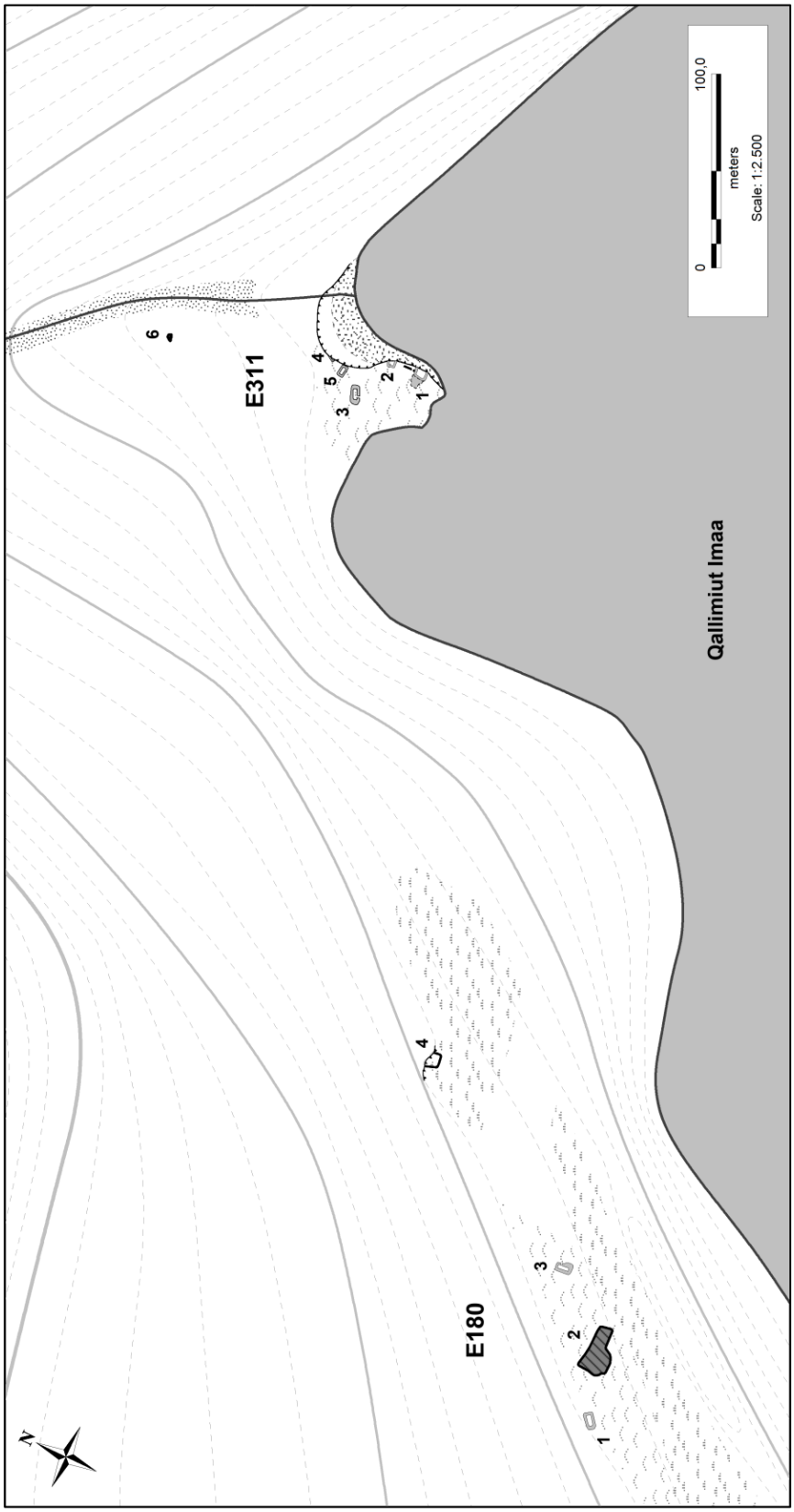


3 Ruins

Large complex shieling

60V2-0IV-568

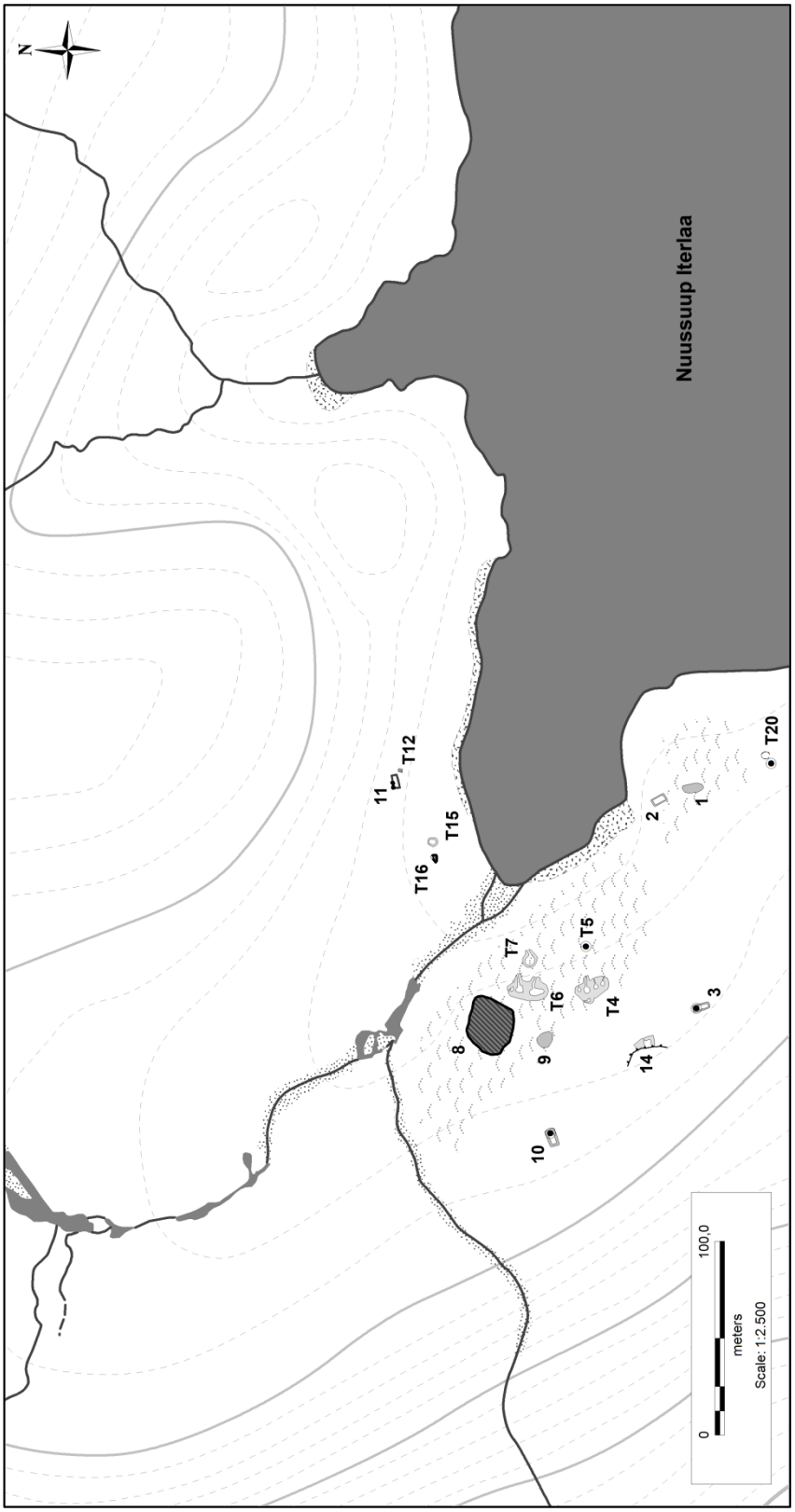
E180 **Qallimiut Imaa** **App.3.72**



4 Ruins

Large complex shieling

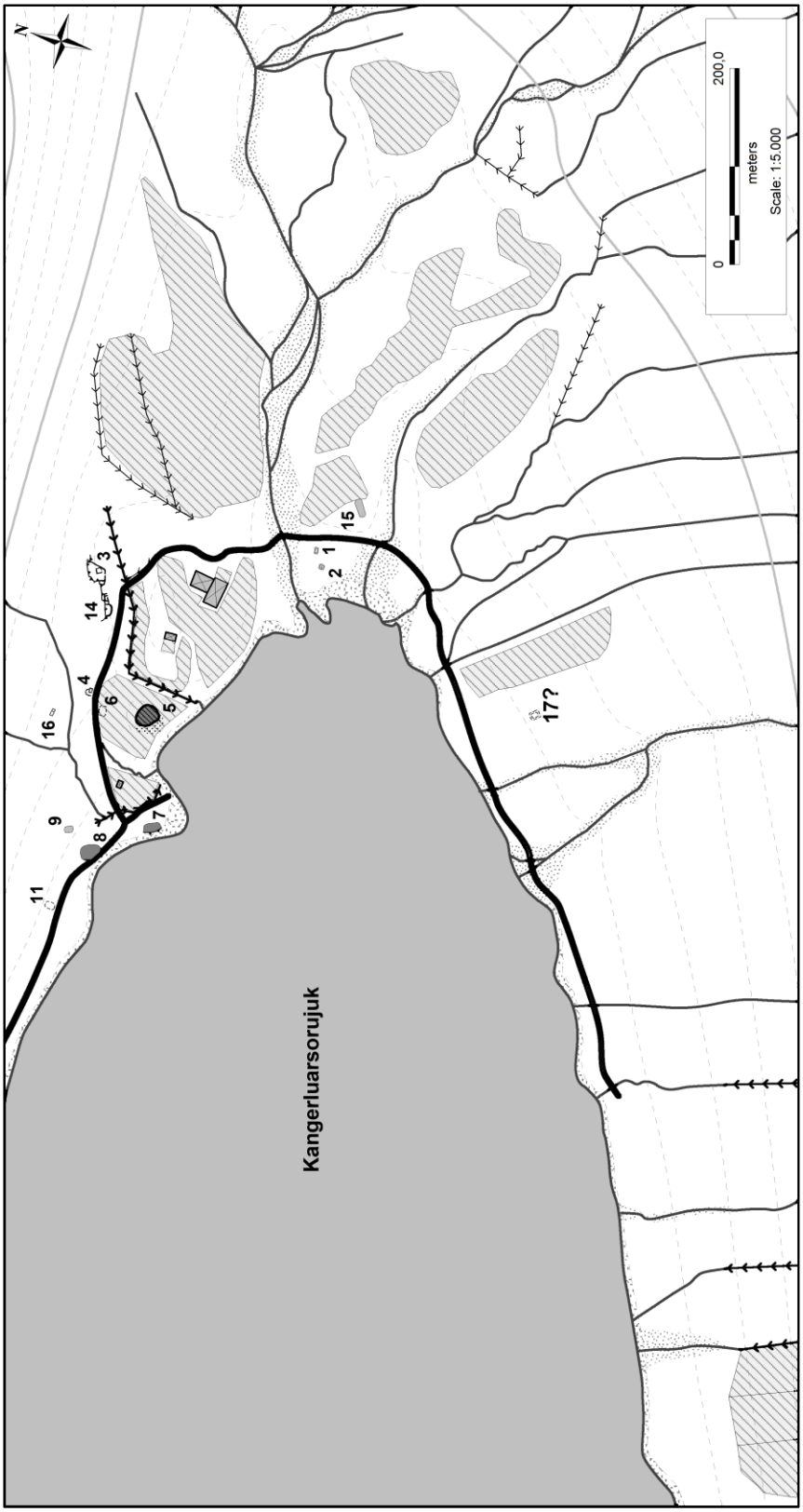
60V2-0IV-549



8 Ruins

Medium Farmstead

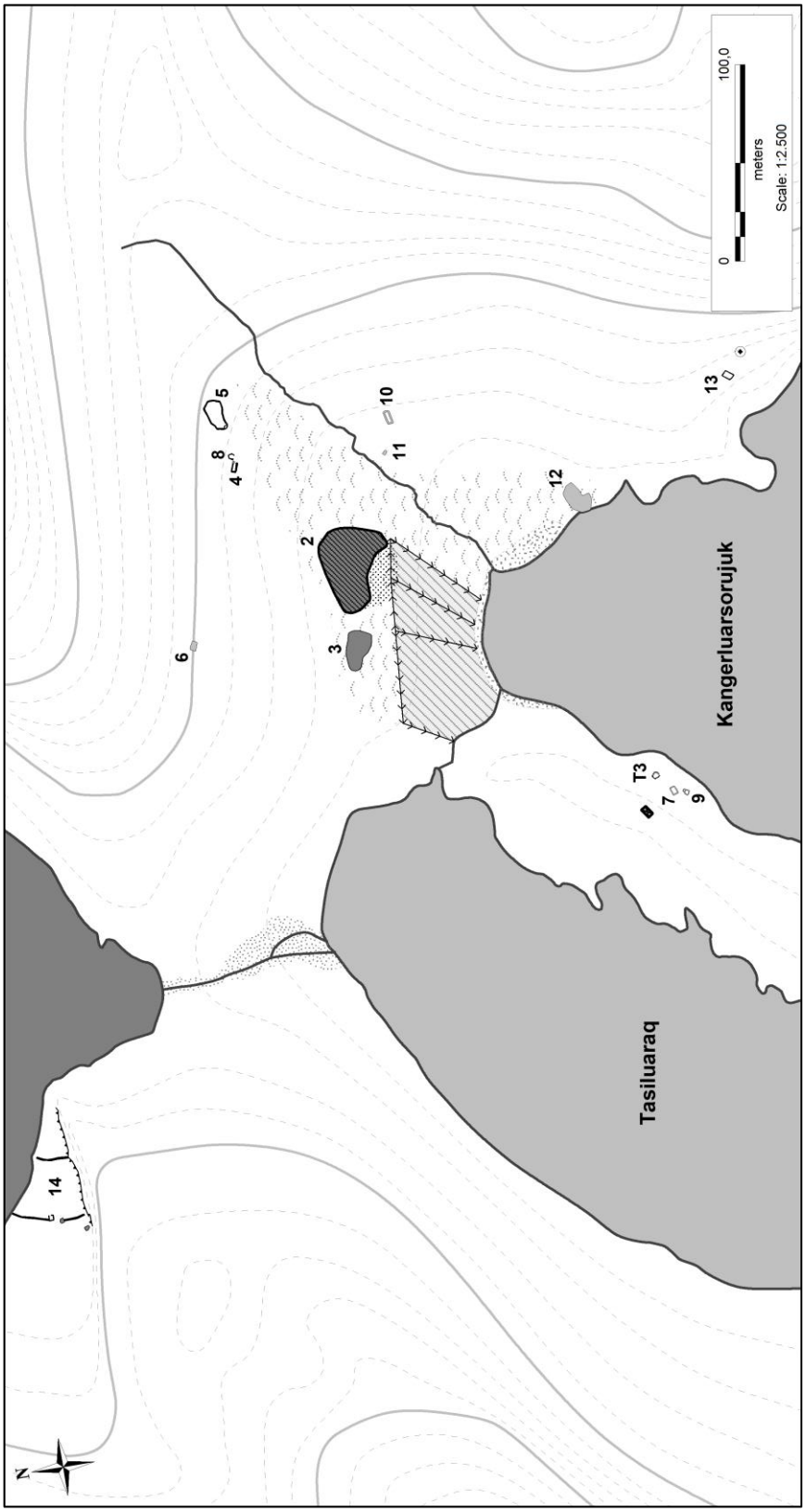
60V2-0IV-571



16 Ruins

Medium Farmstead

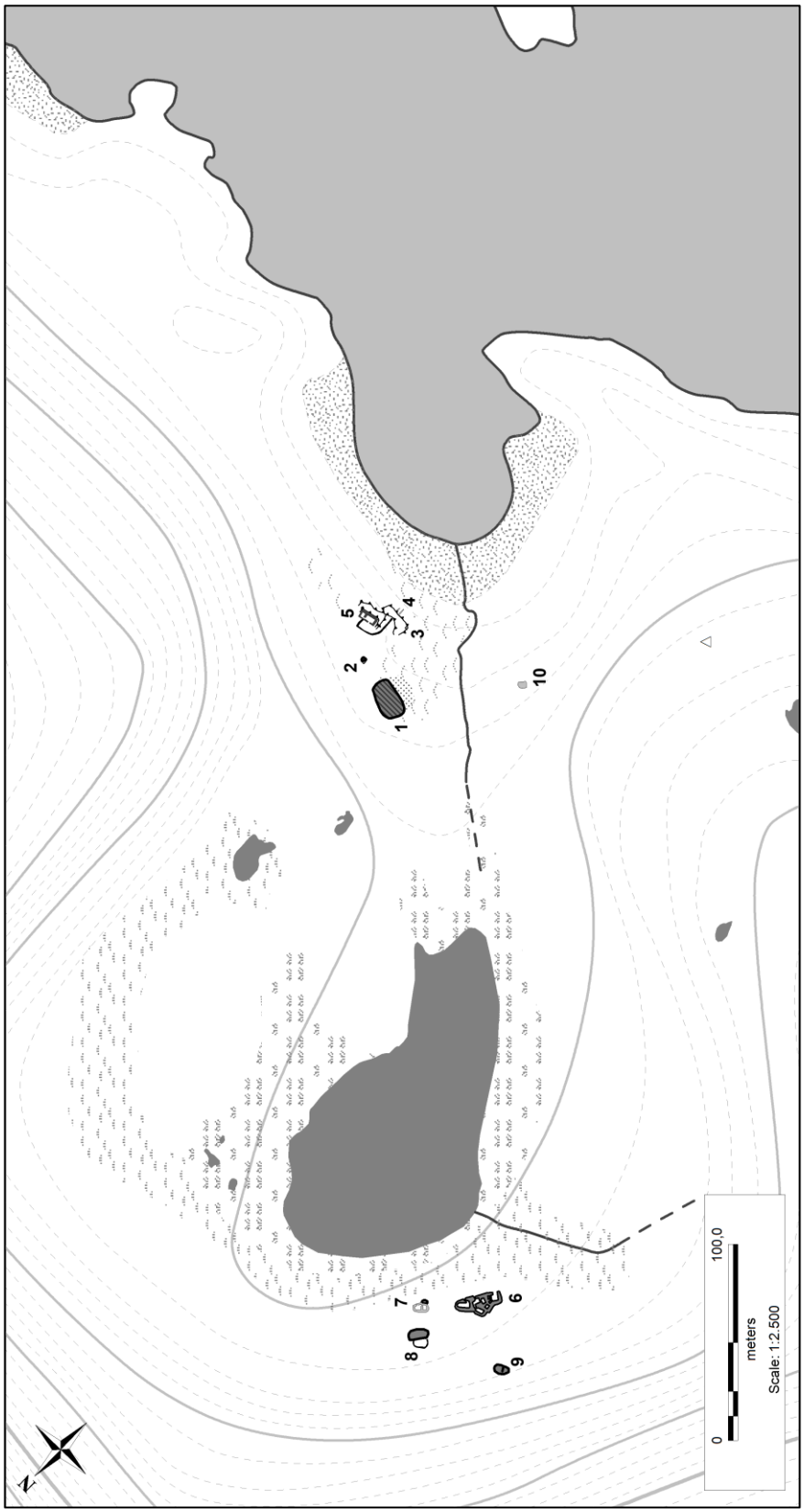
60V2-0IV-582



14 Ruins

Medium Farmstead

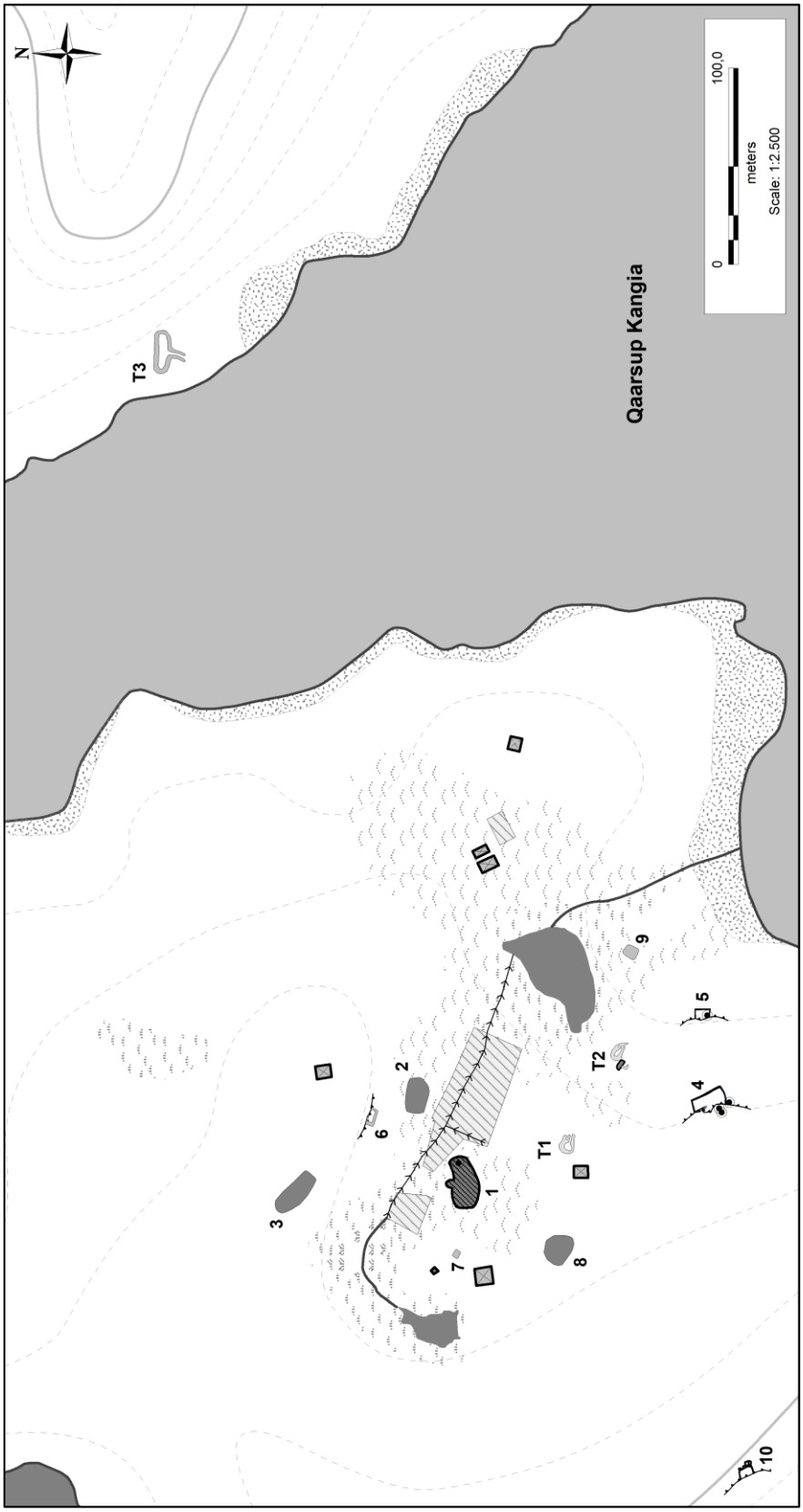
60V2-0IV-579



10 Ruins

Small Farmstead

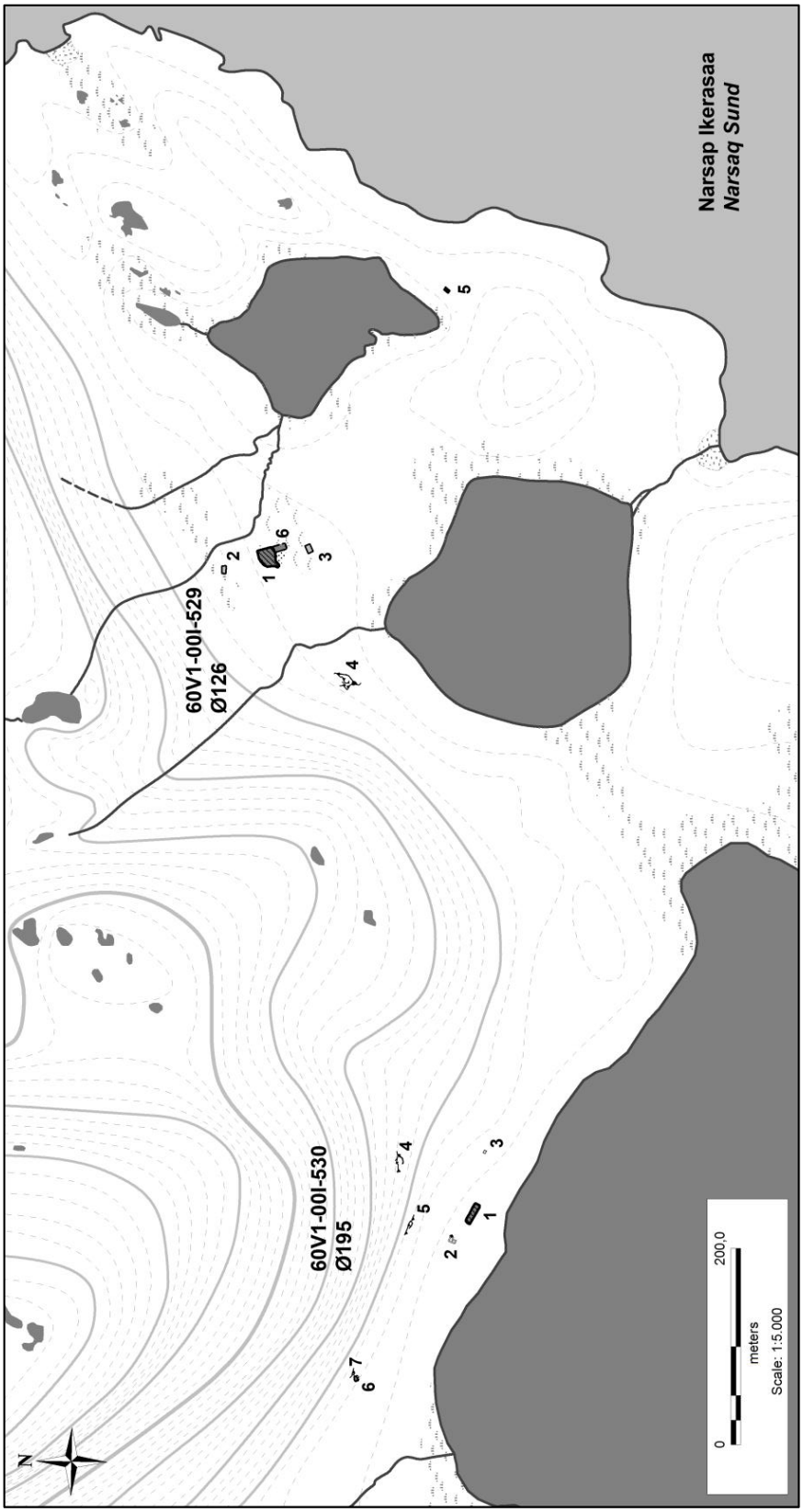
60V2-0IV-637



10 Ruins

Medium Farmstead

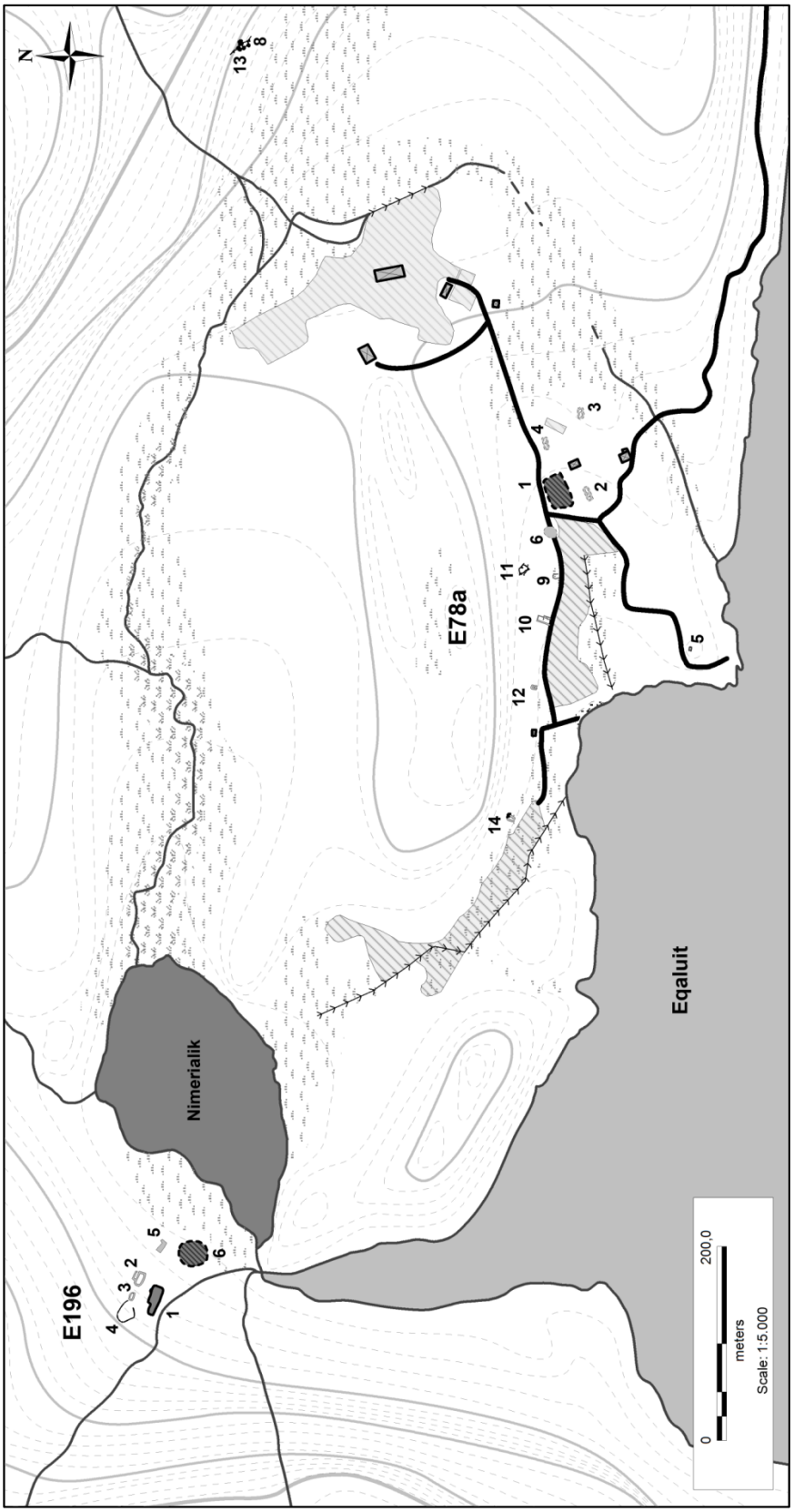
60V2-0IV-564



7 Ruins

Small complex shieling

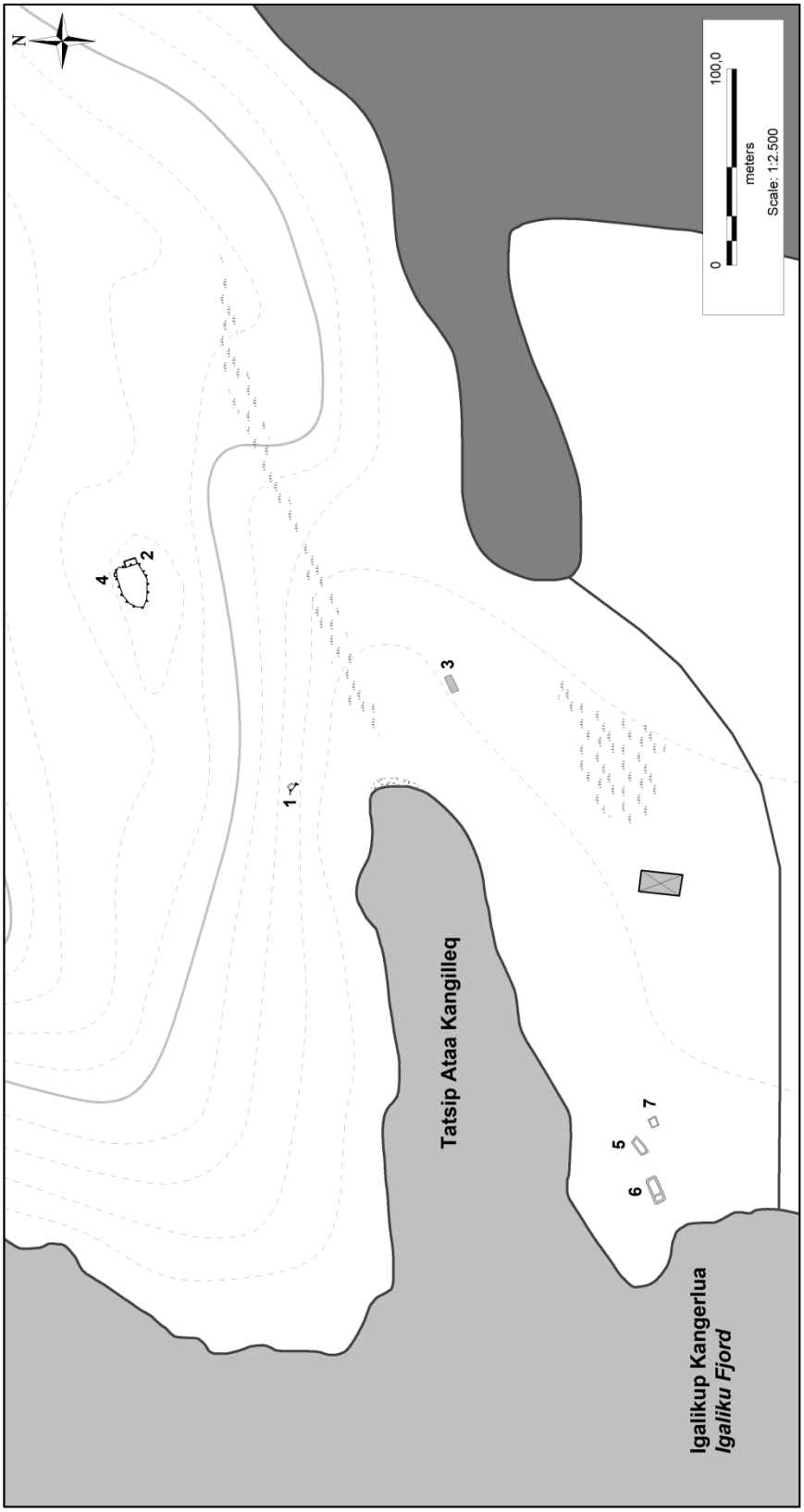
60V1-00I-530



6 Ruins

Medium Farmstead

60V2-0IV-587



7 Ruins

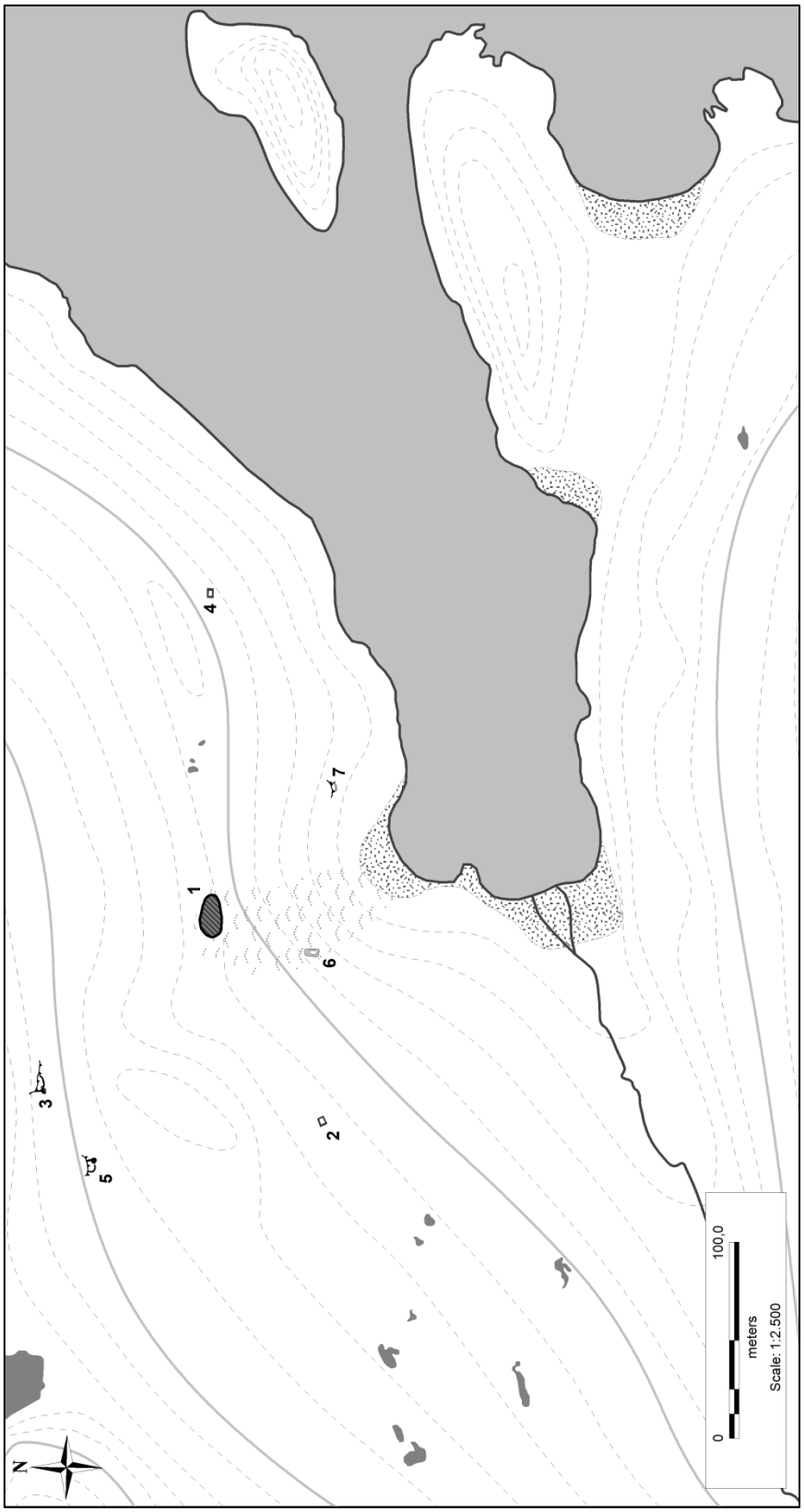
Forage shieling

60V2-0IV-594

1 Ruin

Small complex shieling

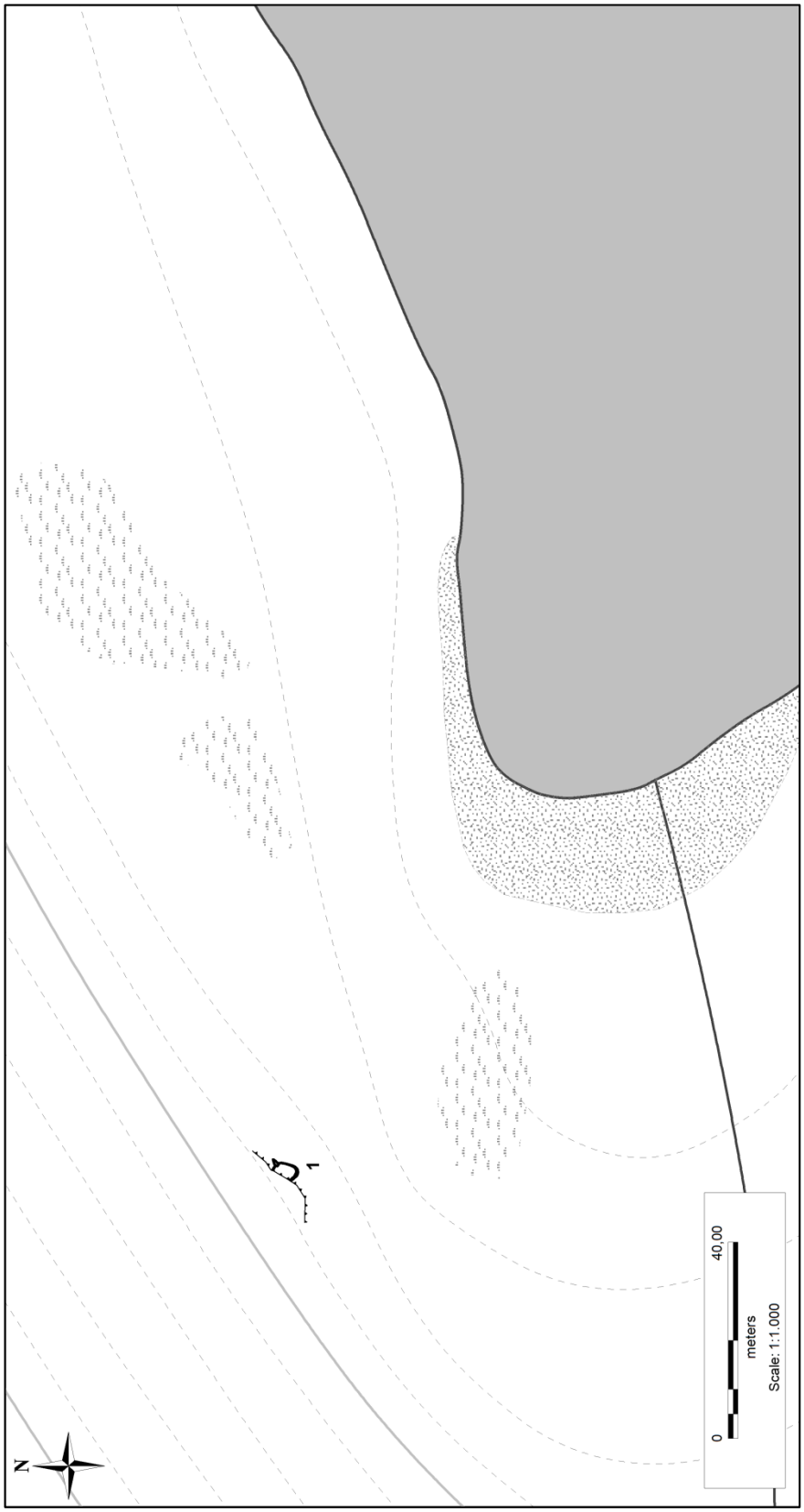
60V1-0IV-521



7 Ruins

Small complex shieling

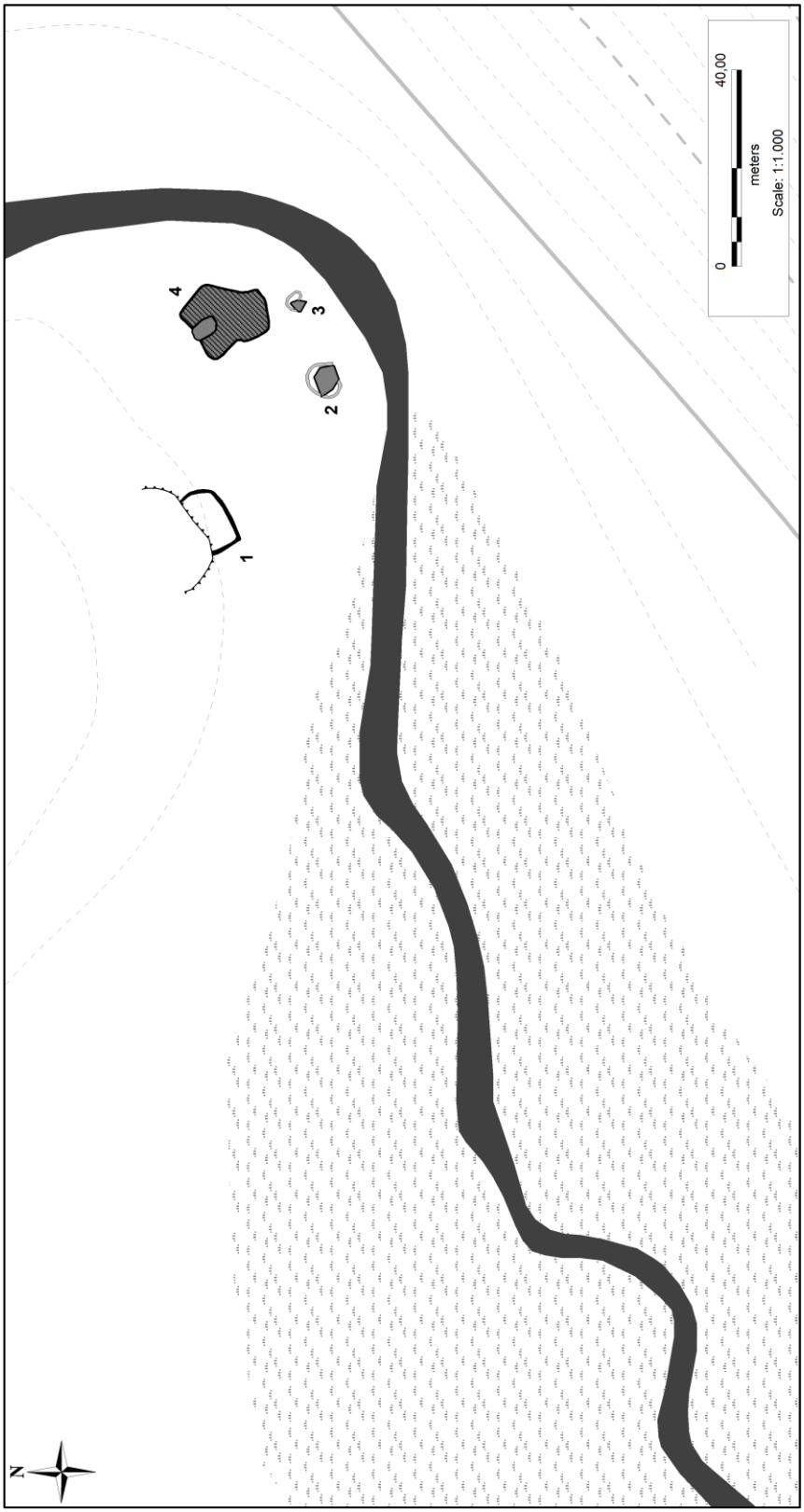
60V2-00I-502



1 Ruin

Milking station

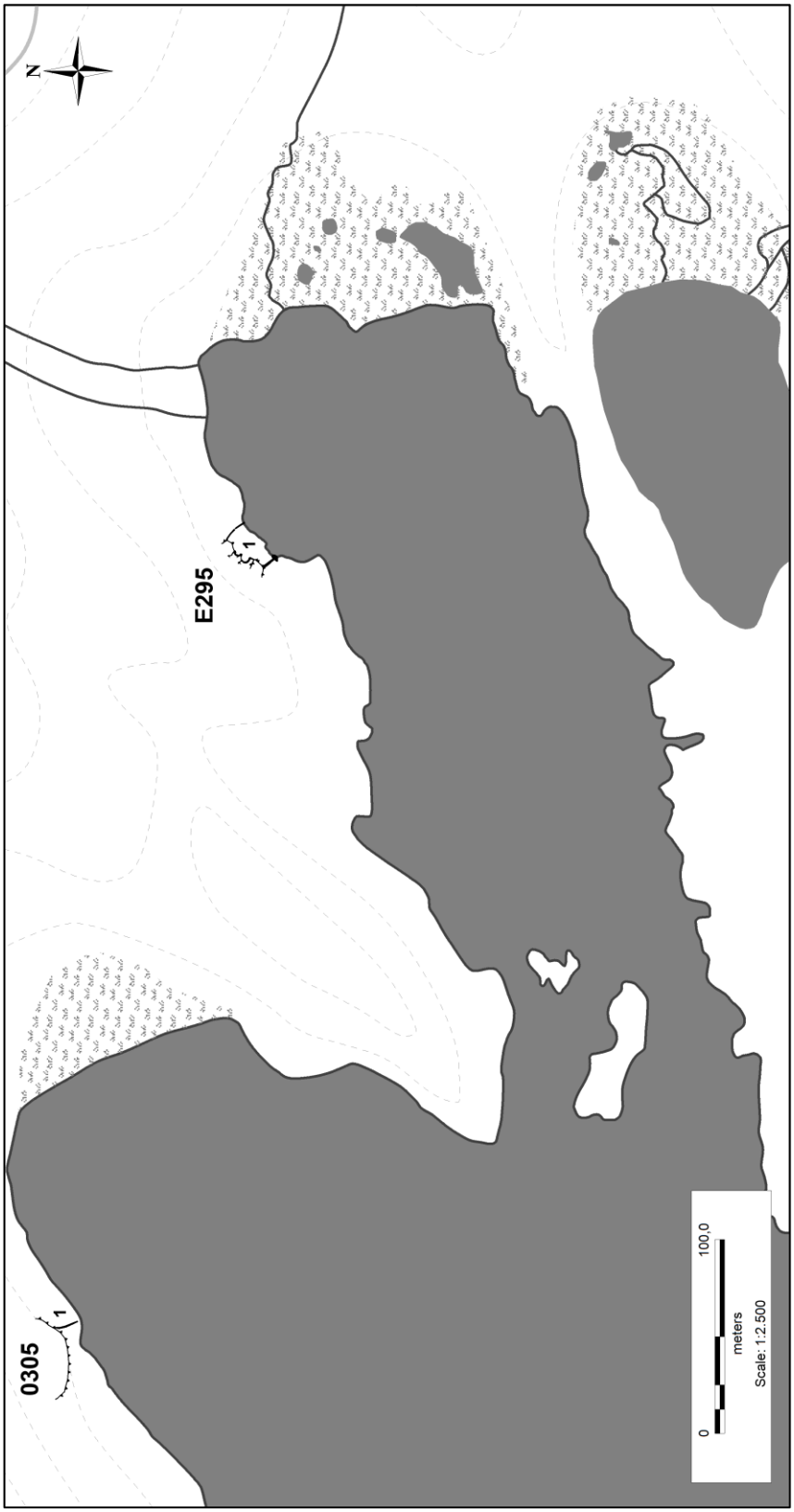
60V2-00I-501



4 Ruins

Small complex shieling

60V2-0IV-613

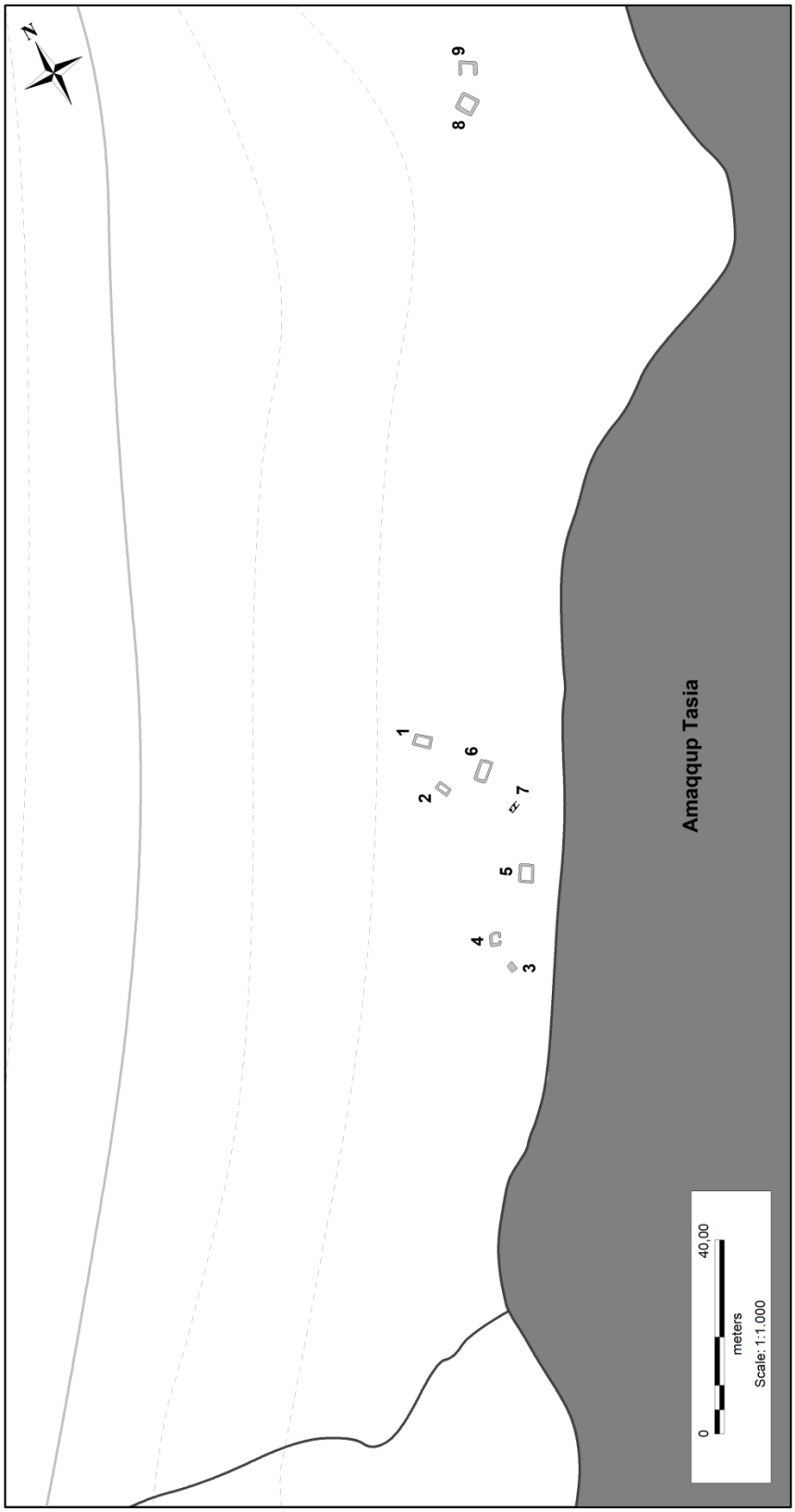


2 Ruins

Rétt

60V2-0IV-535

E296 **Amaqqup Tasia** **App.3.86**



8 Ruins

Large simple shieling

60V2-0IV-536

E297 **Amaqqup Tasia** **App.3.87**

1 Ruin

Herder's Hut/shelter

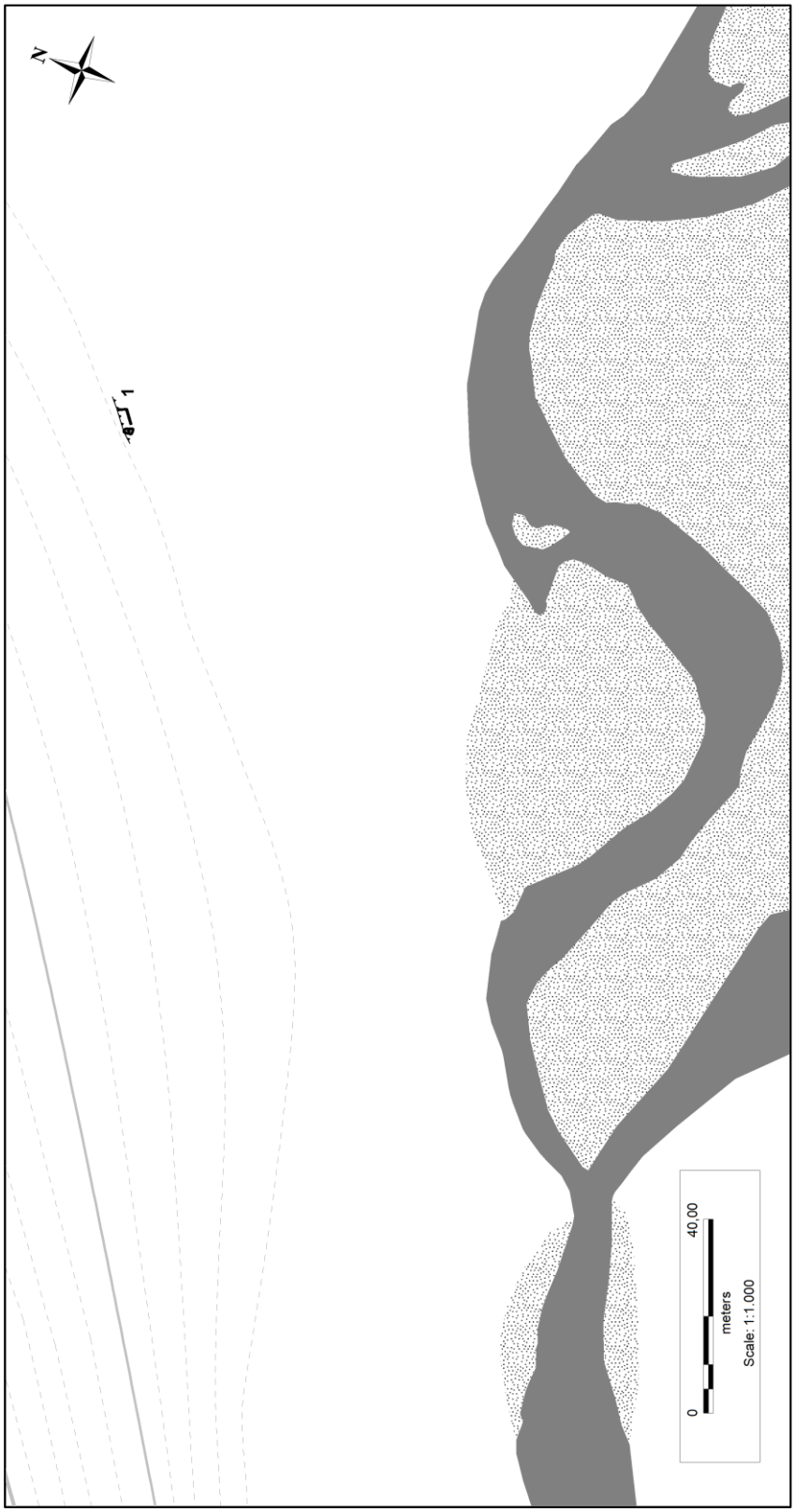
60V2-0IV-534

E298 **Petrusip Tasia** **App.3.88**

2 Ruins

Small complex shieling

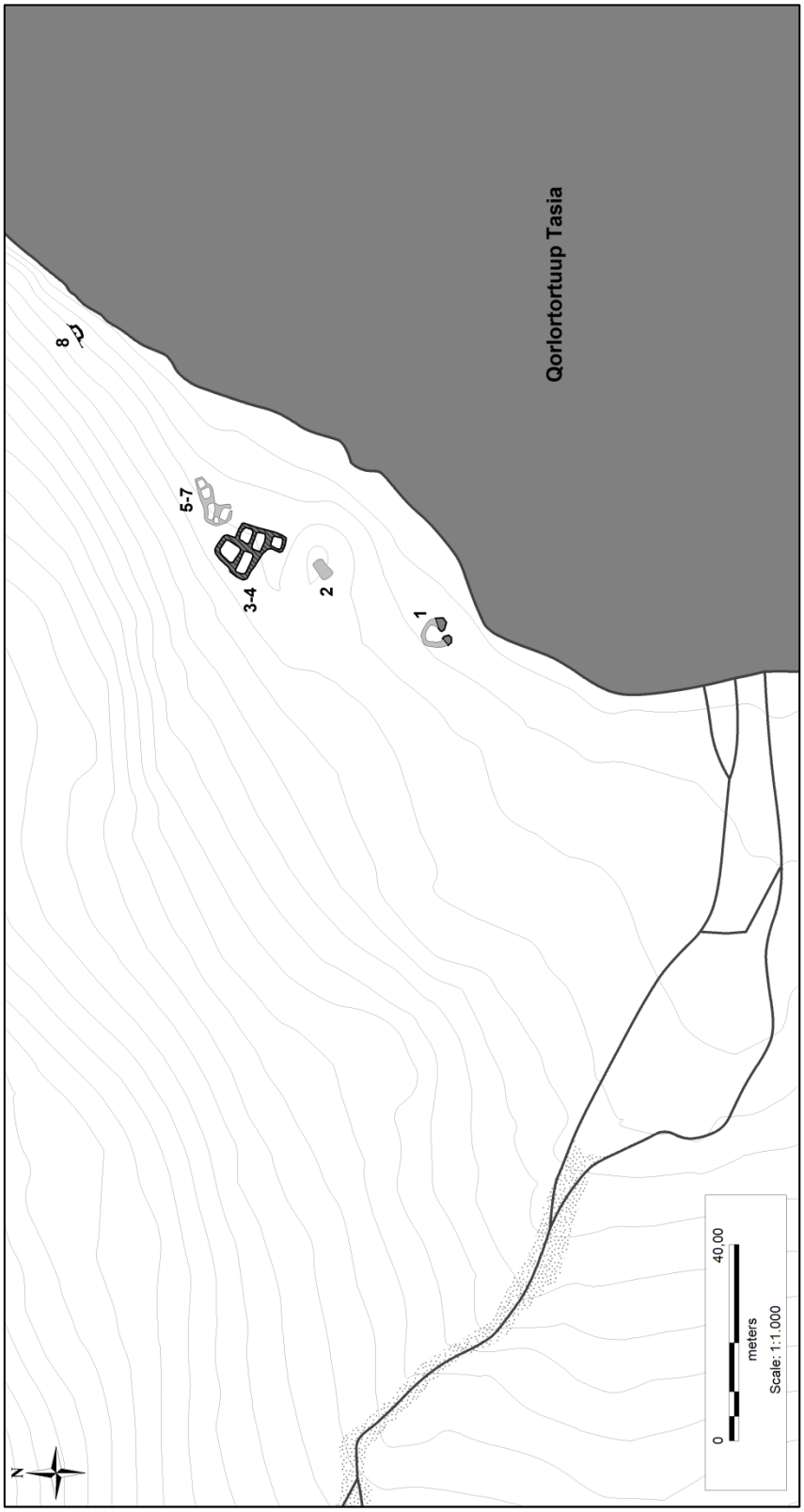
60V2-0IV-533



1 Ruin

Forage shieling

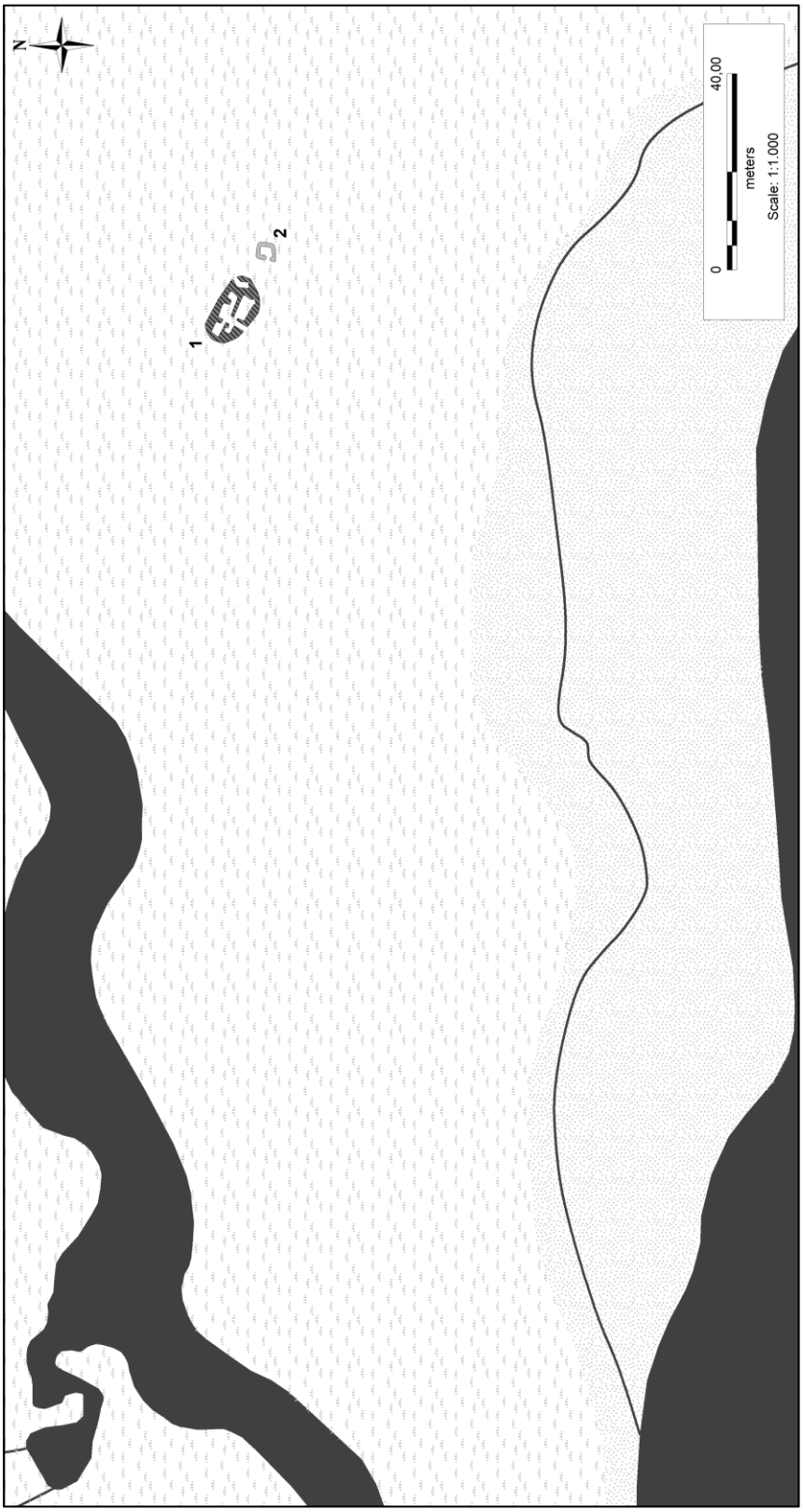
60V2-0IV-532



5 Ruins

Small complex shieling

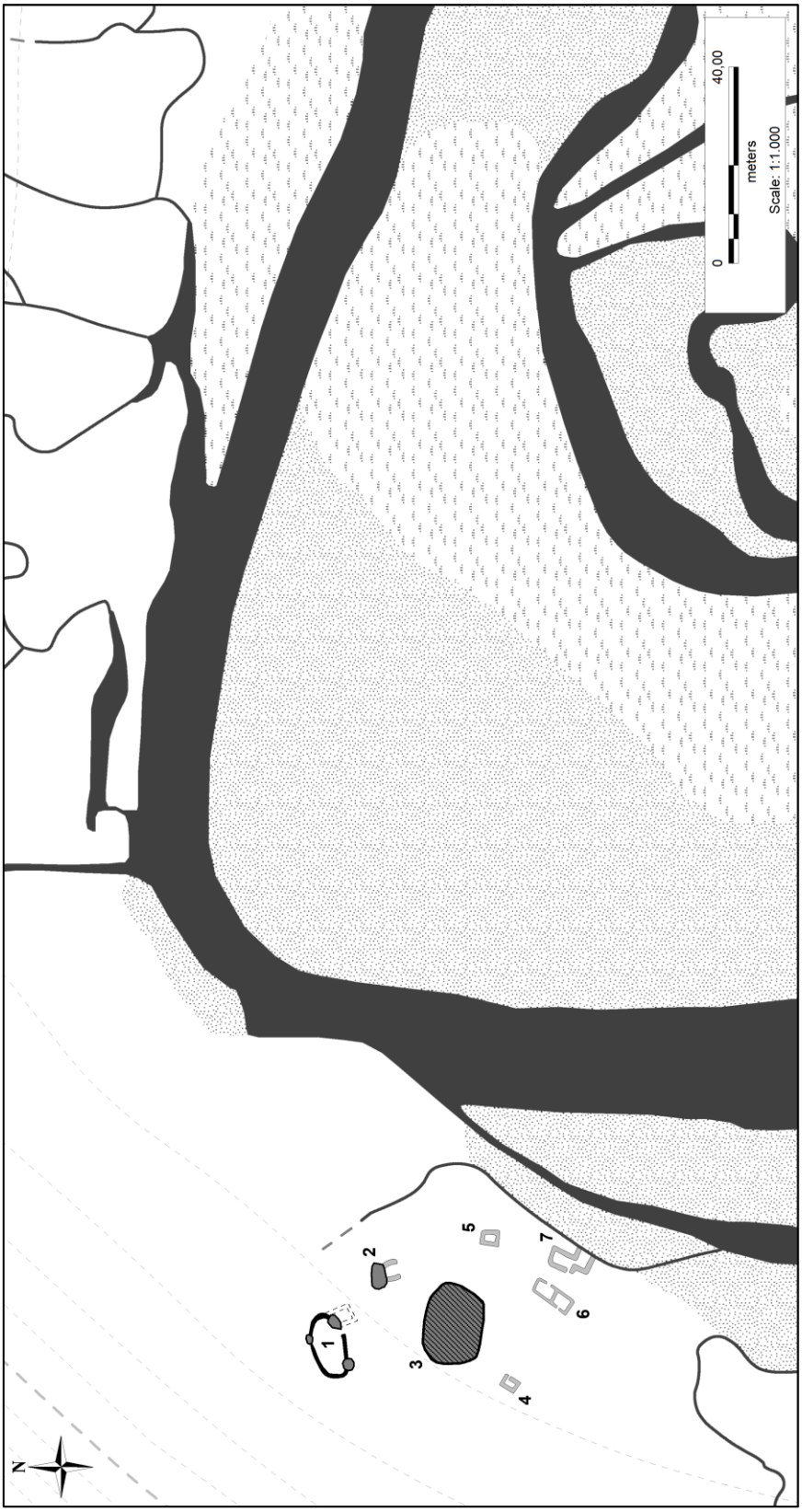
60V2-0IV-545



2 Ruins

Small complex shieling

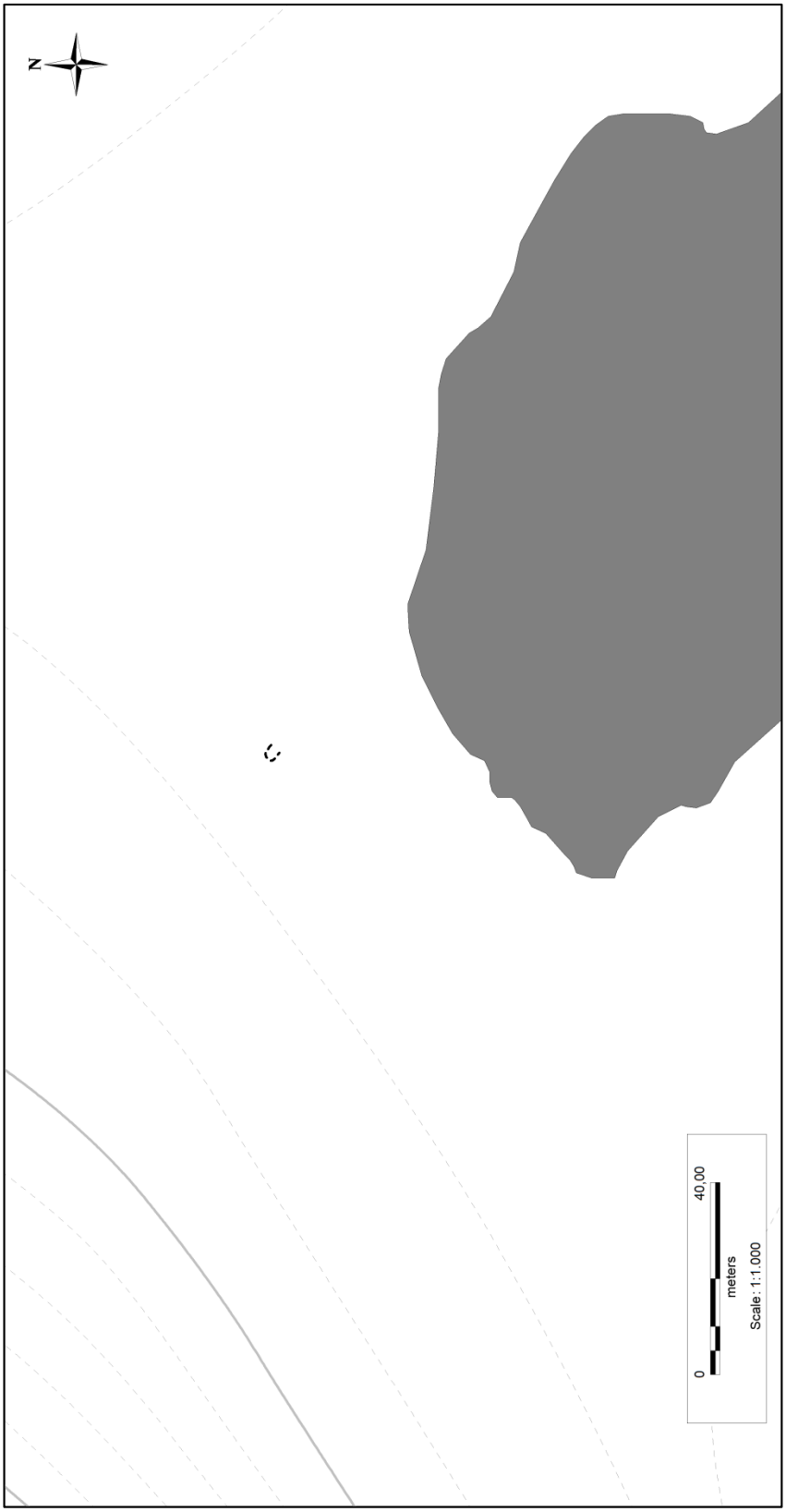
60V2-0IV-518



7 Ruins

Small complex shieling

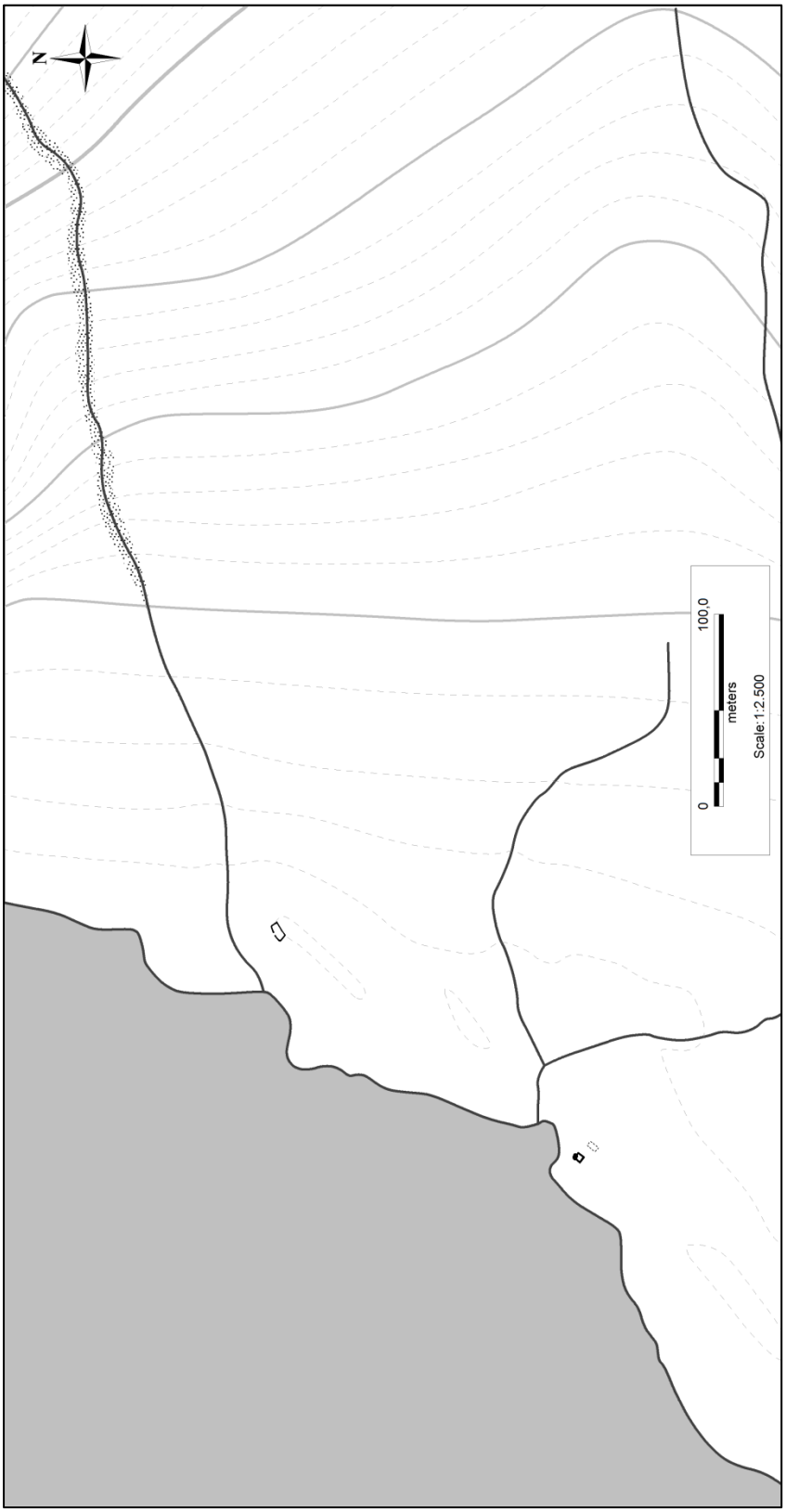
60V2-0IV-519



1 Ruin

Herder's Hut/shelter

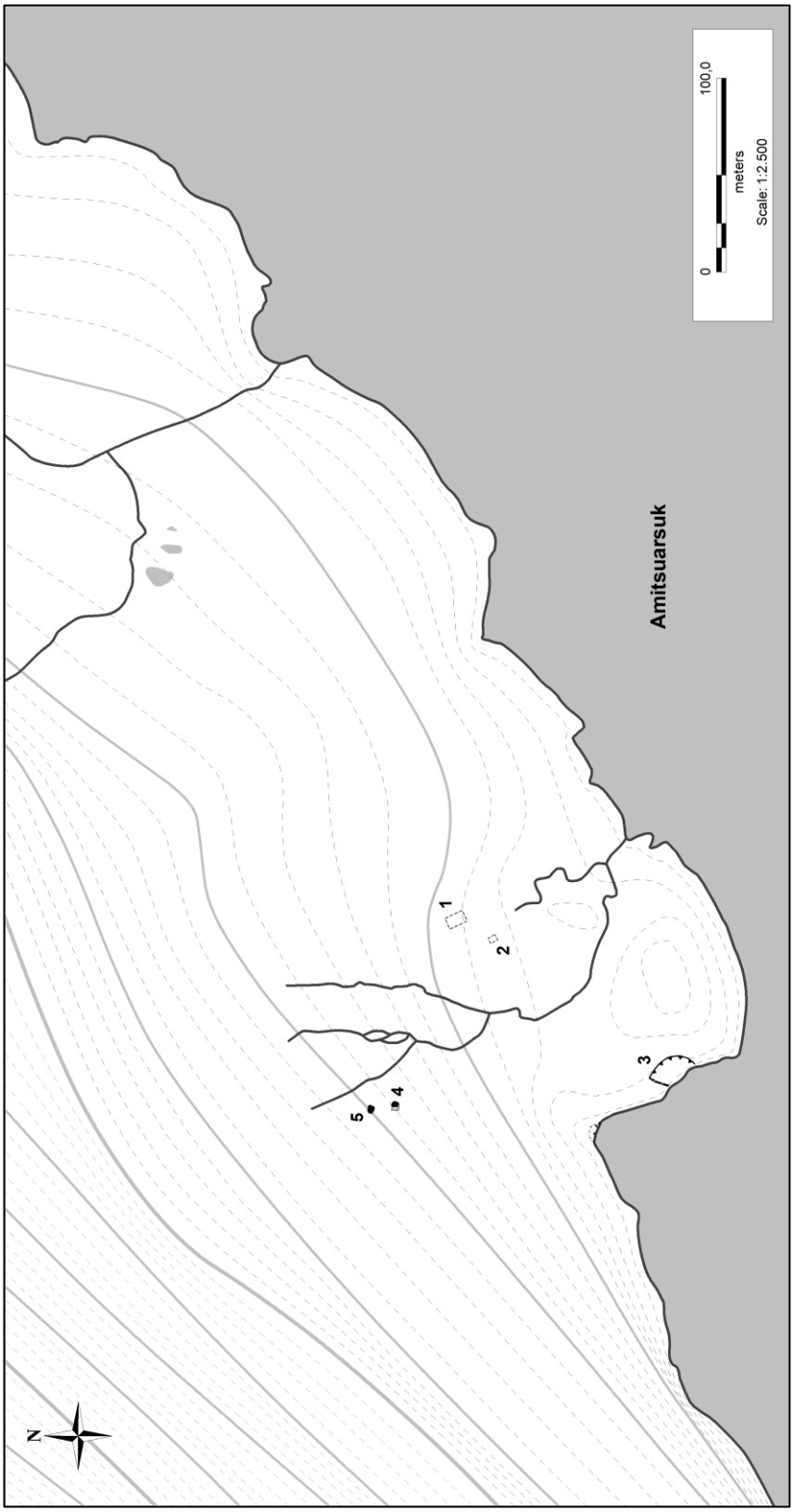
60V2-0IV-522



3 Ruins

Dairy shieling

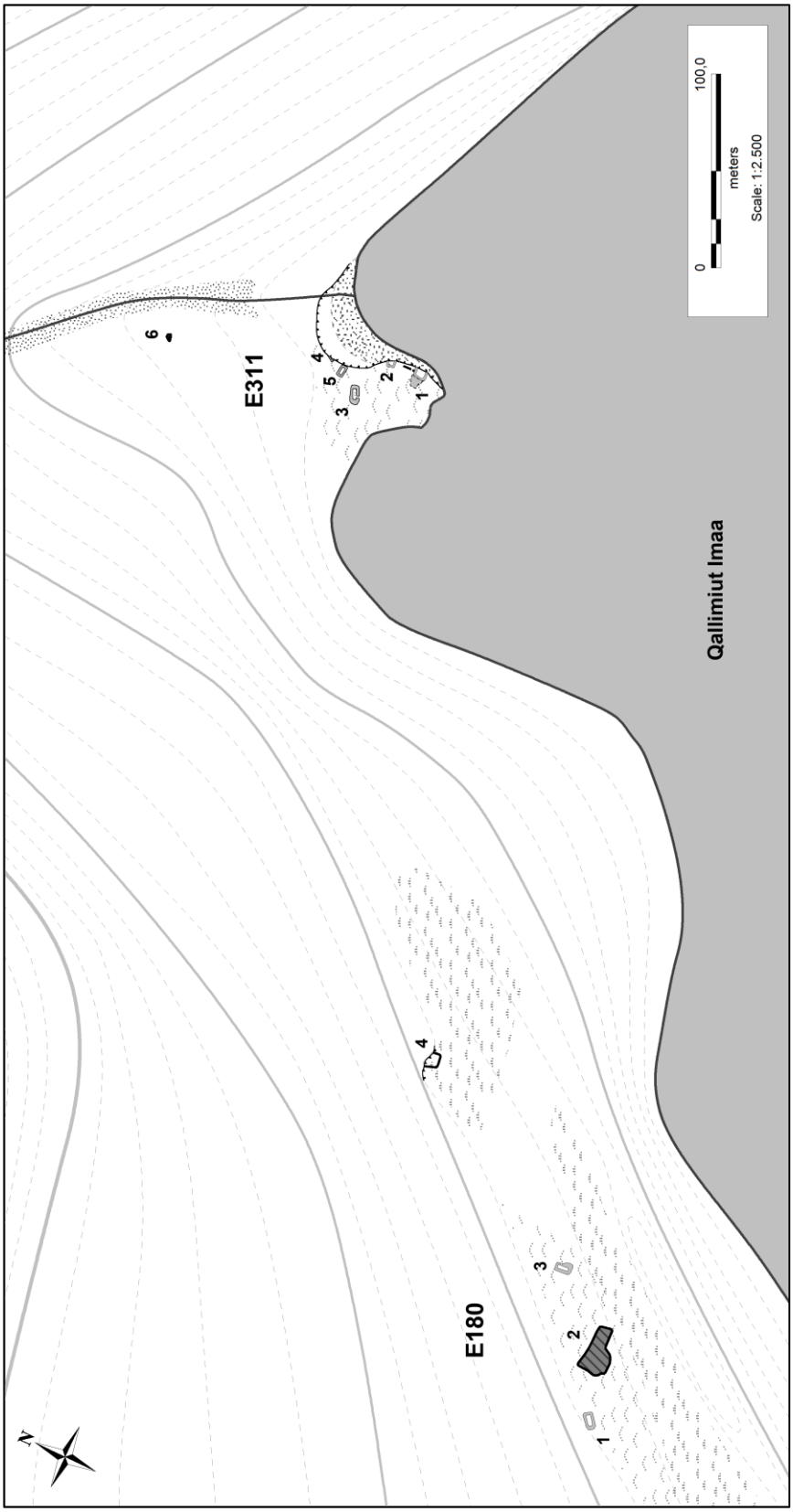
60V2-0IV-523



5 Ruins

Rétt

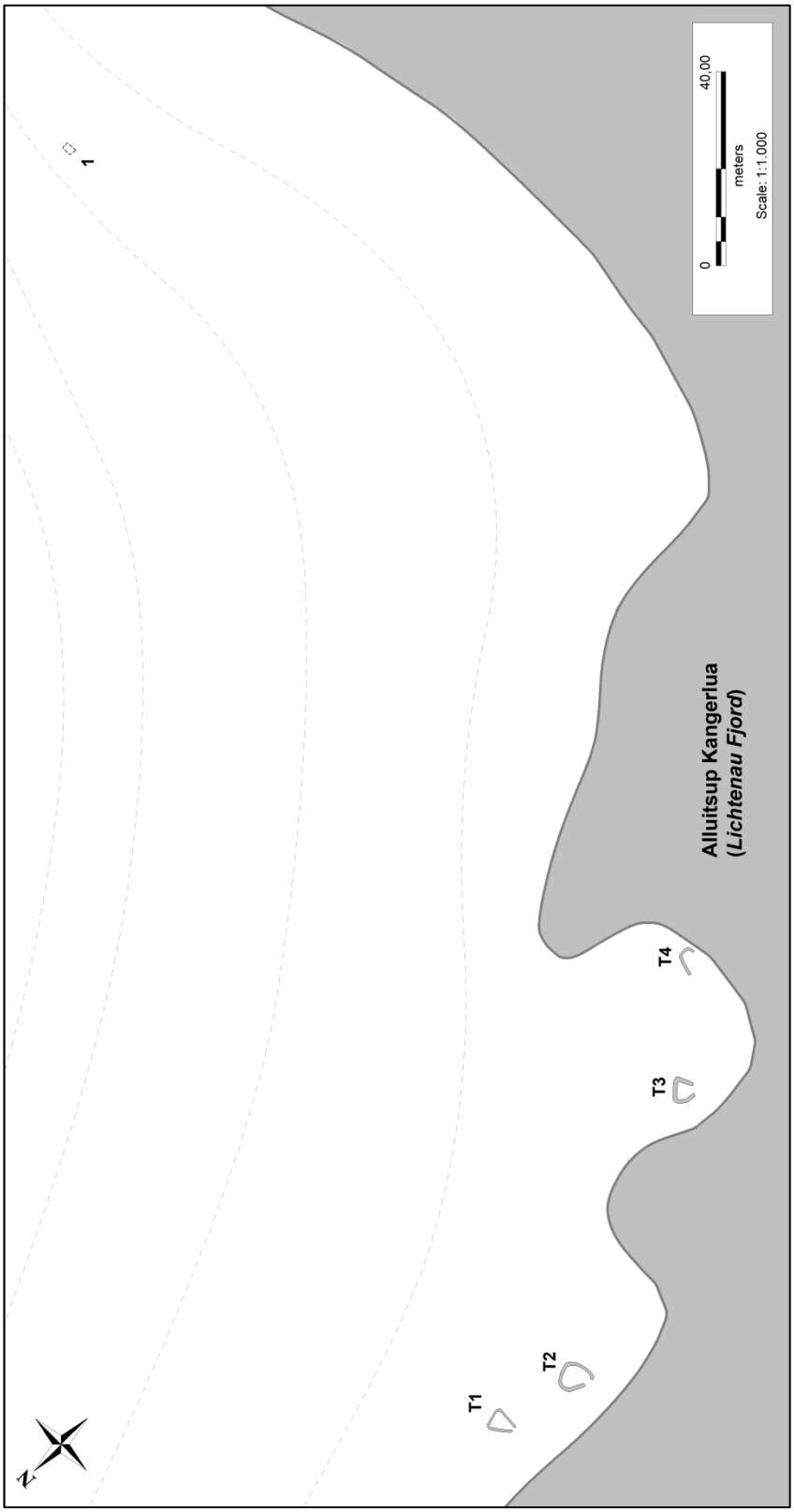
60V2-0IV-527



7 Ruins

Large complex shieling

60V2-0IV-548



3 Ruins

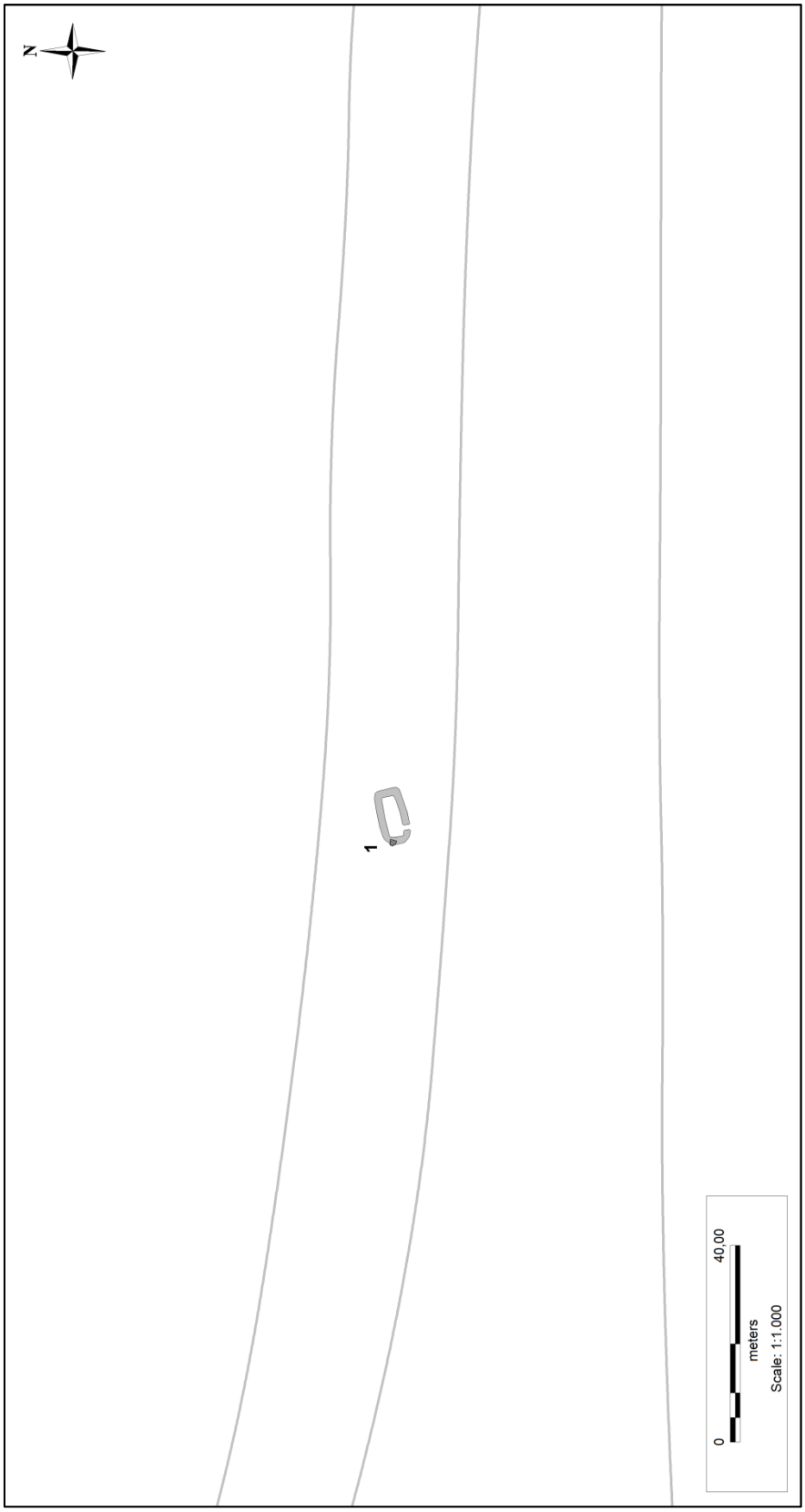
Large simple shieling

60V2-0IV-524

6 Ruins

Small complex shieling

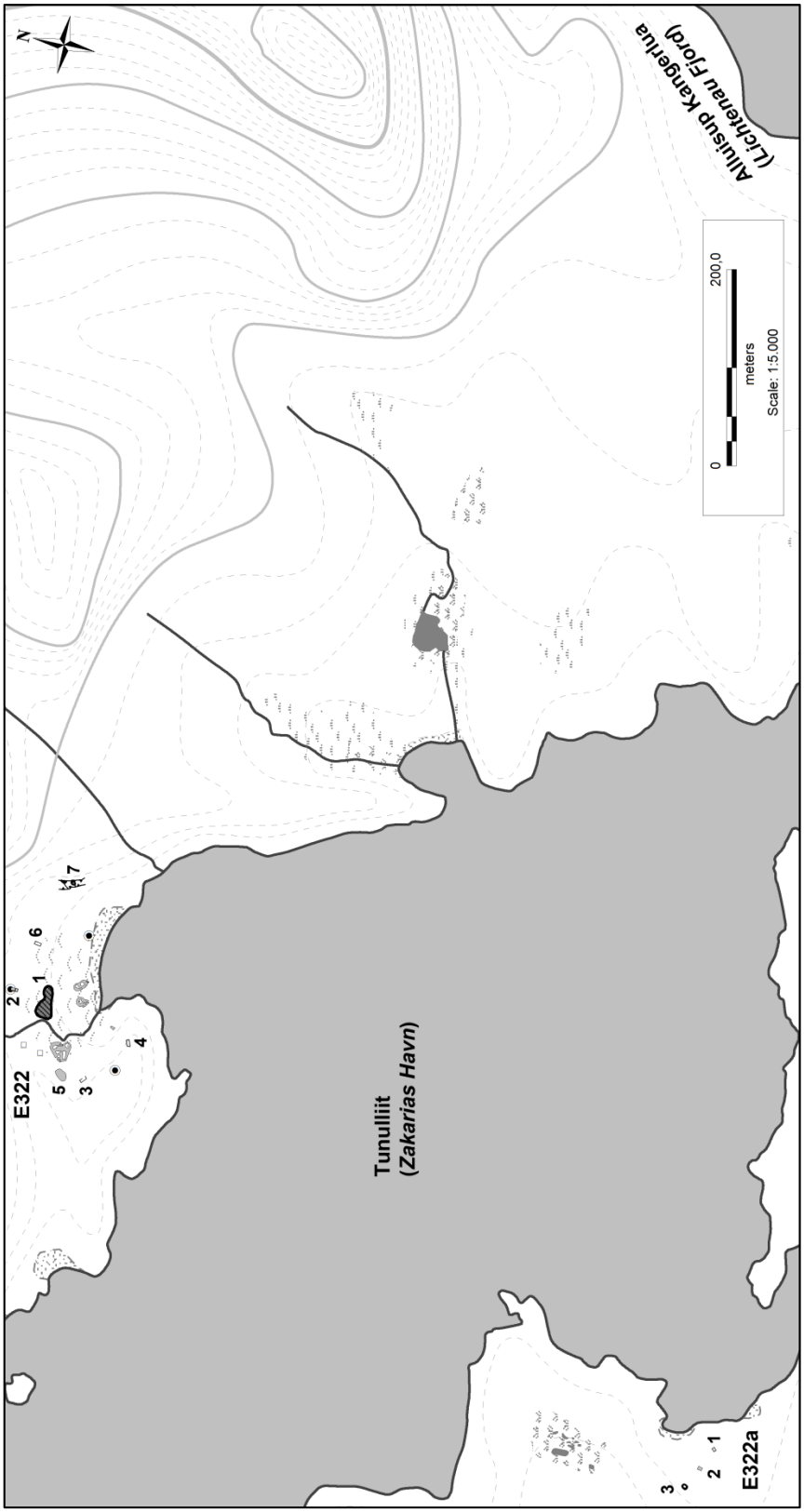
60V2-0IV-525



1 Ruin

Herder's Hut/shelter

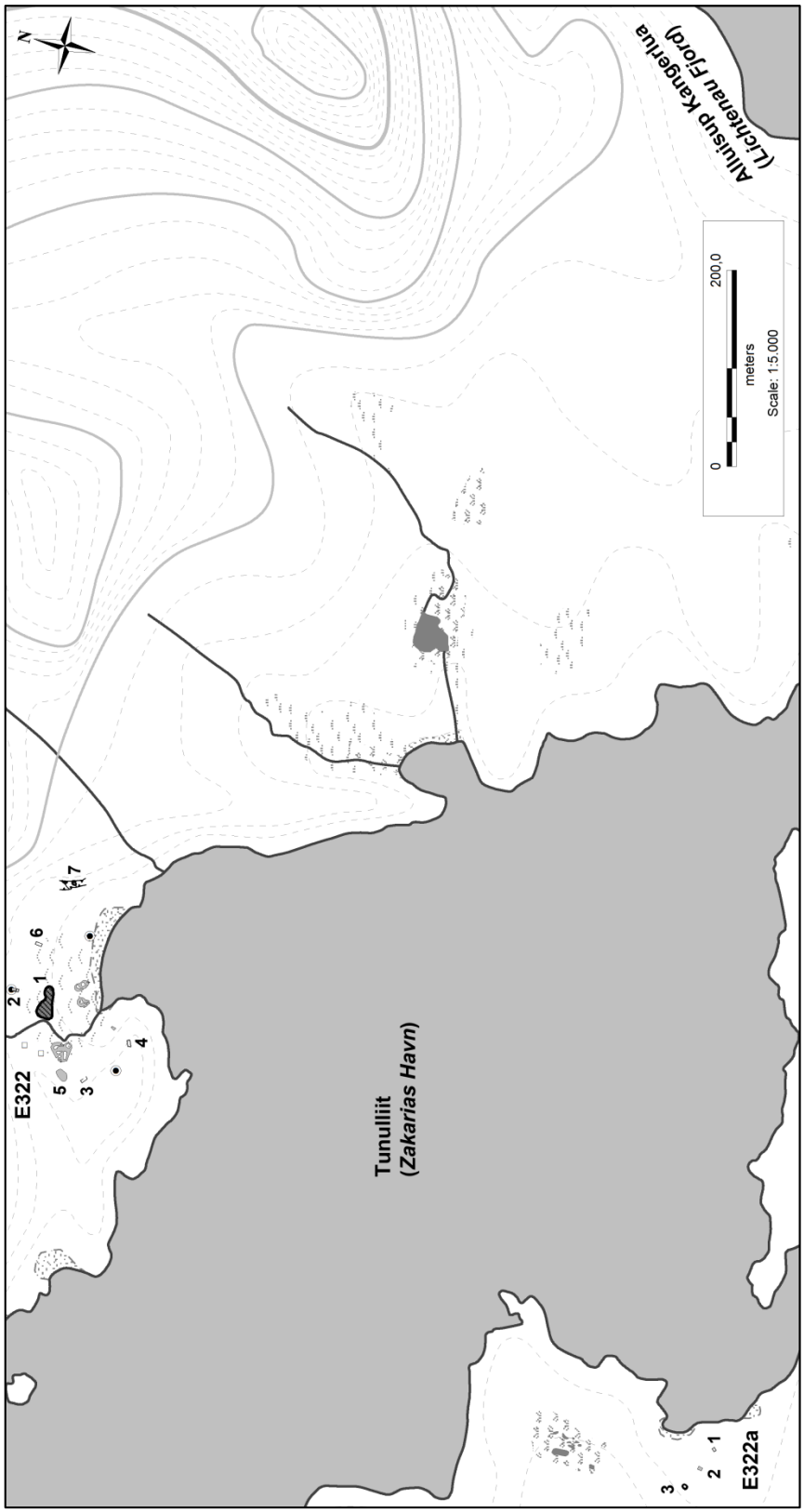
60V2-0IV-551



7 Ruins

Small Farmstead

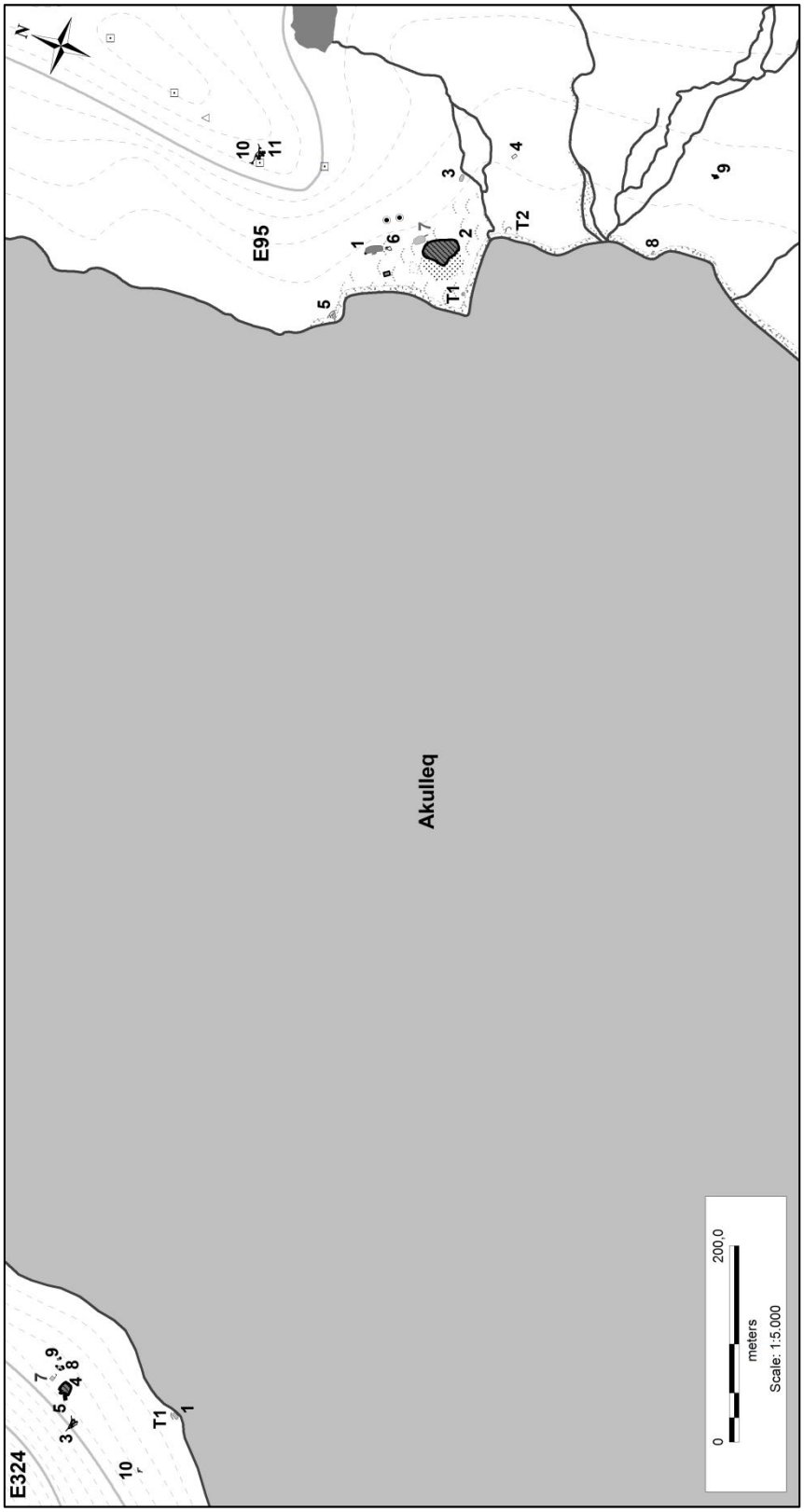
60V2-III-530



3 Ruins

Dairy Shieling

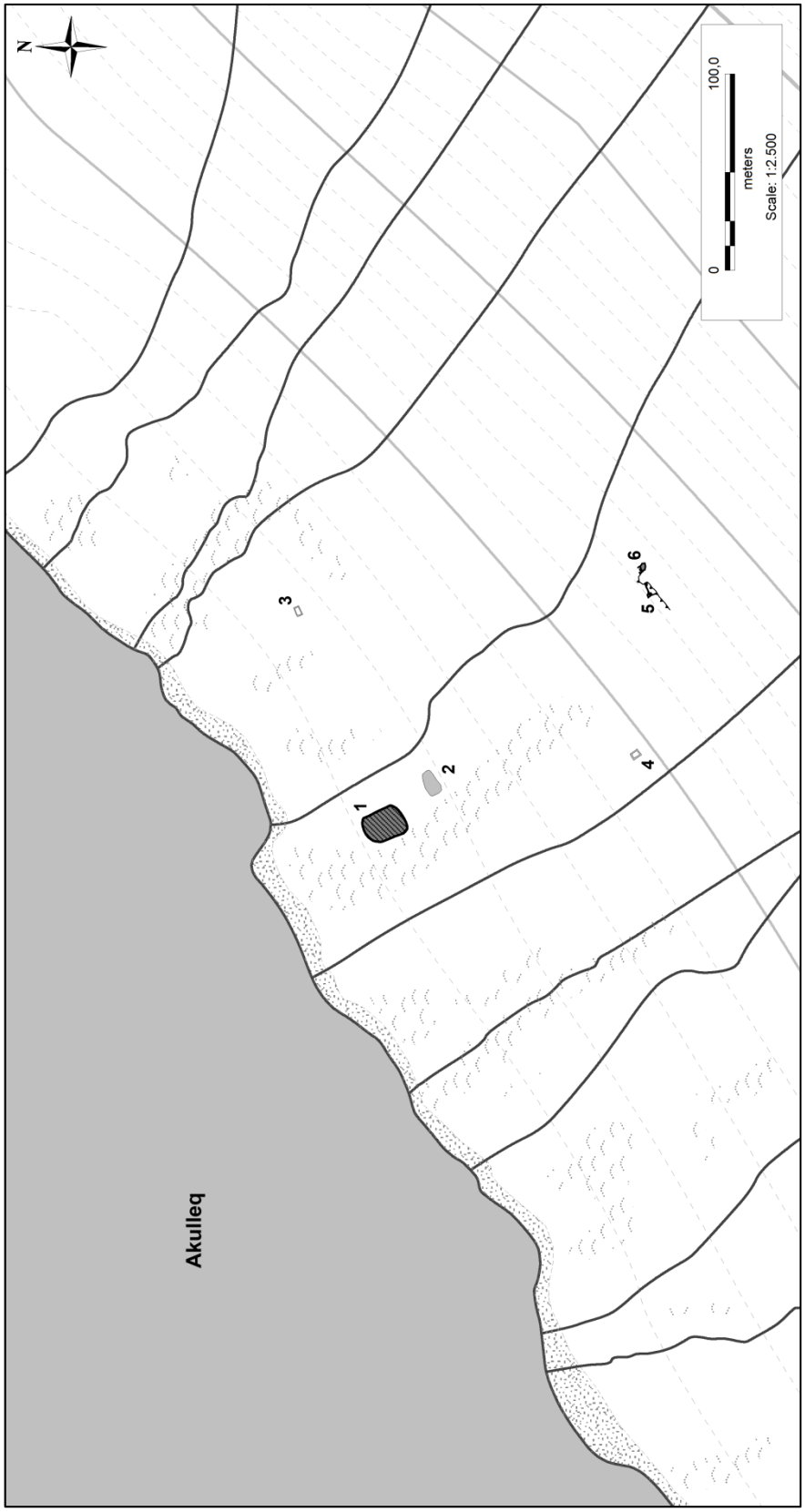
E324 **Qoornukasik Saqqarleq** **App.3.102**



9 Ruins

Small complex shieling

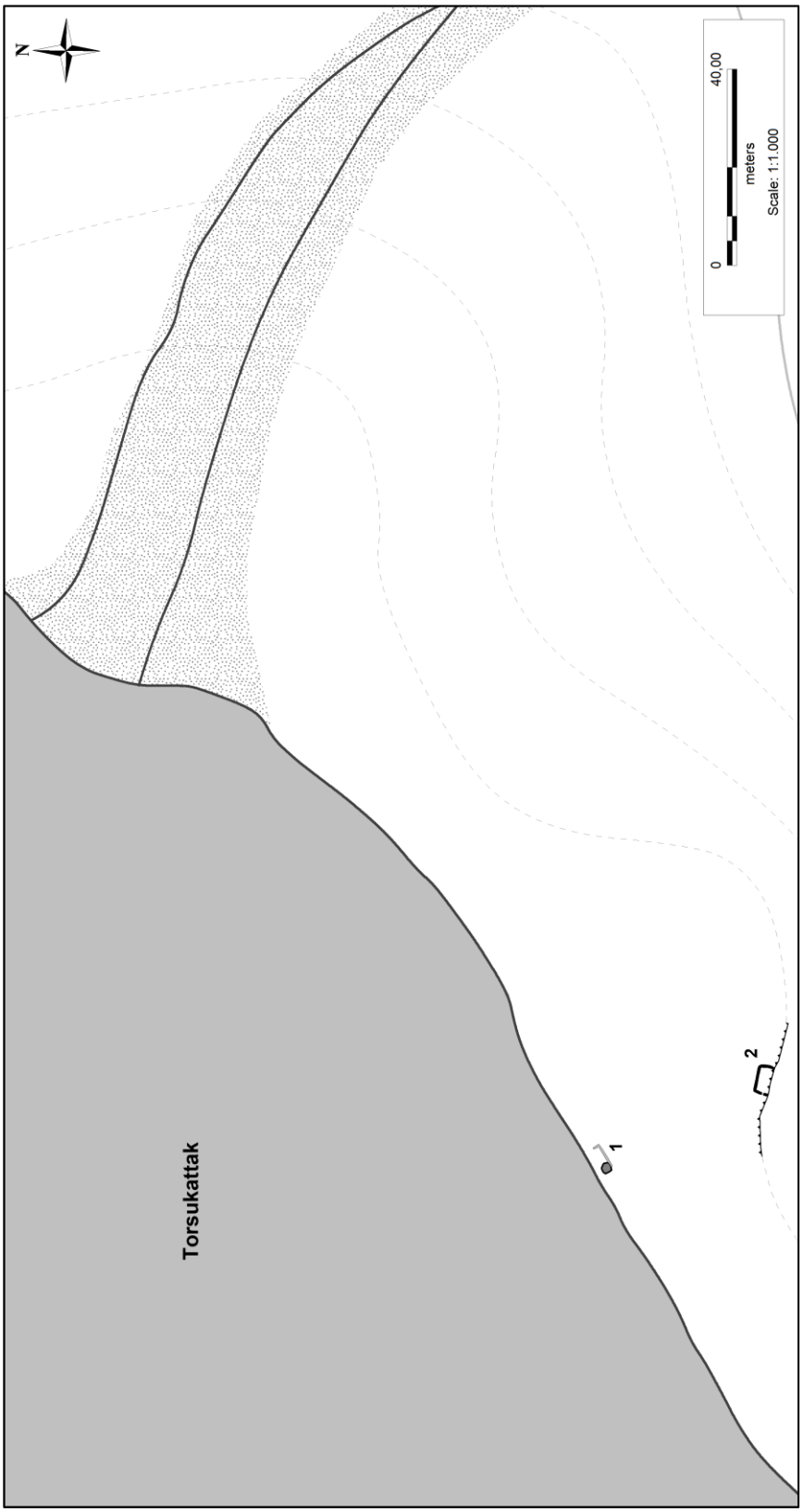
60V2-0IV-560



6 Ruins

Large complex shieling

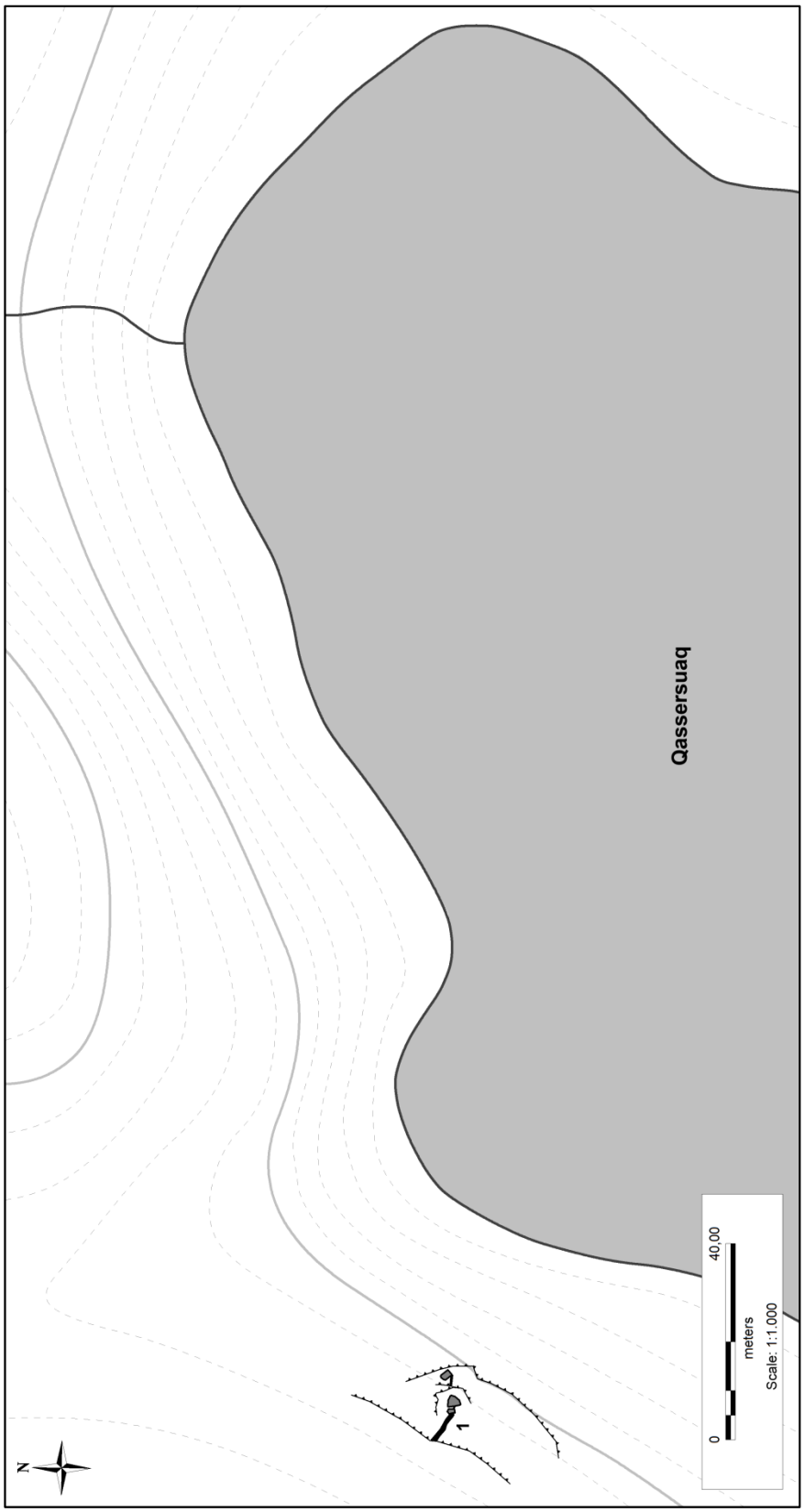
60V2-0IV-558



2 Ruins

Dairy shieling

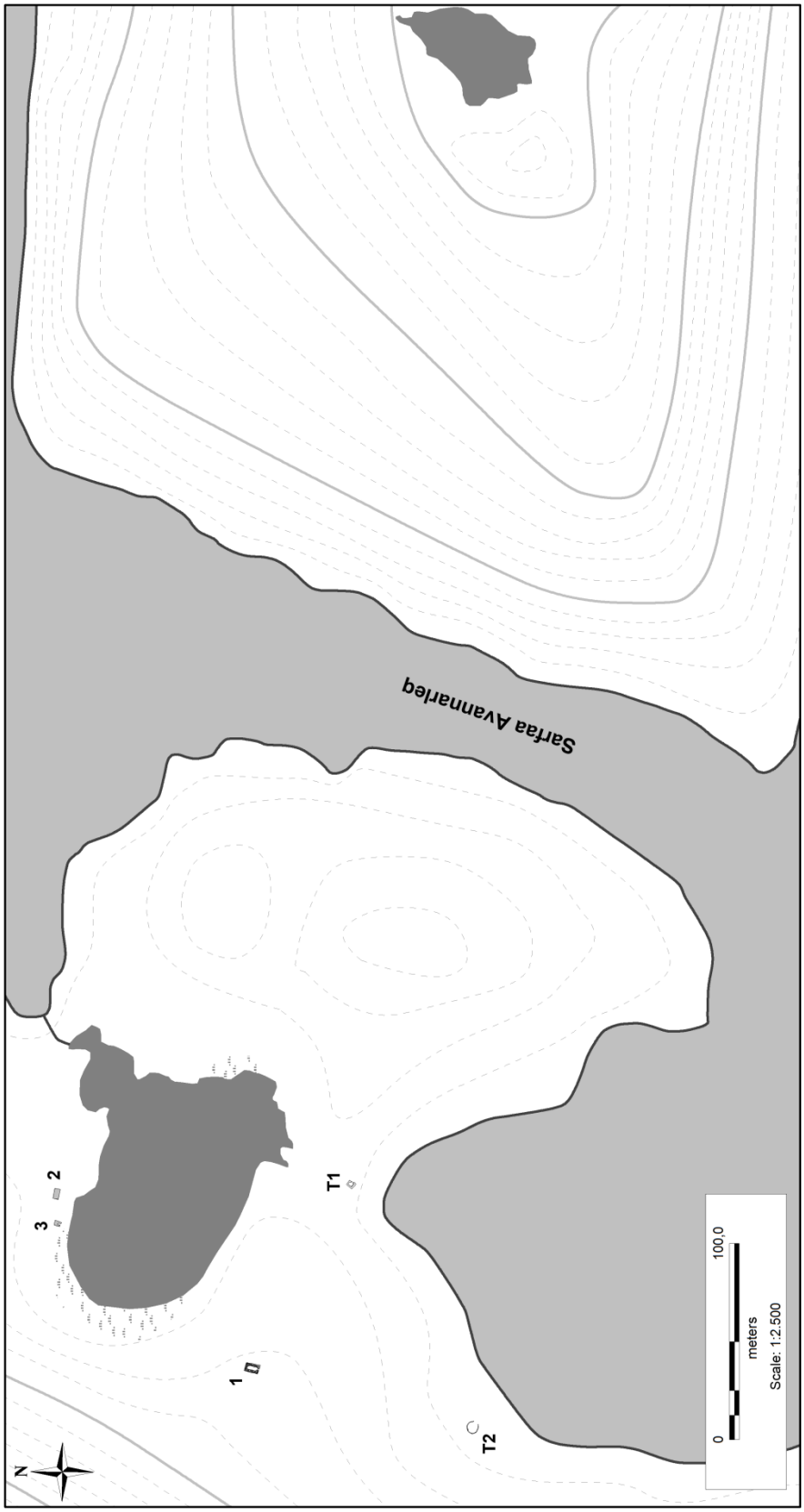
60V2-0IV-562



1 Ruin

Outfield Wall/dyke

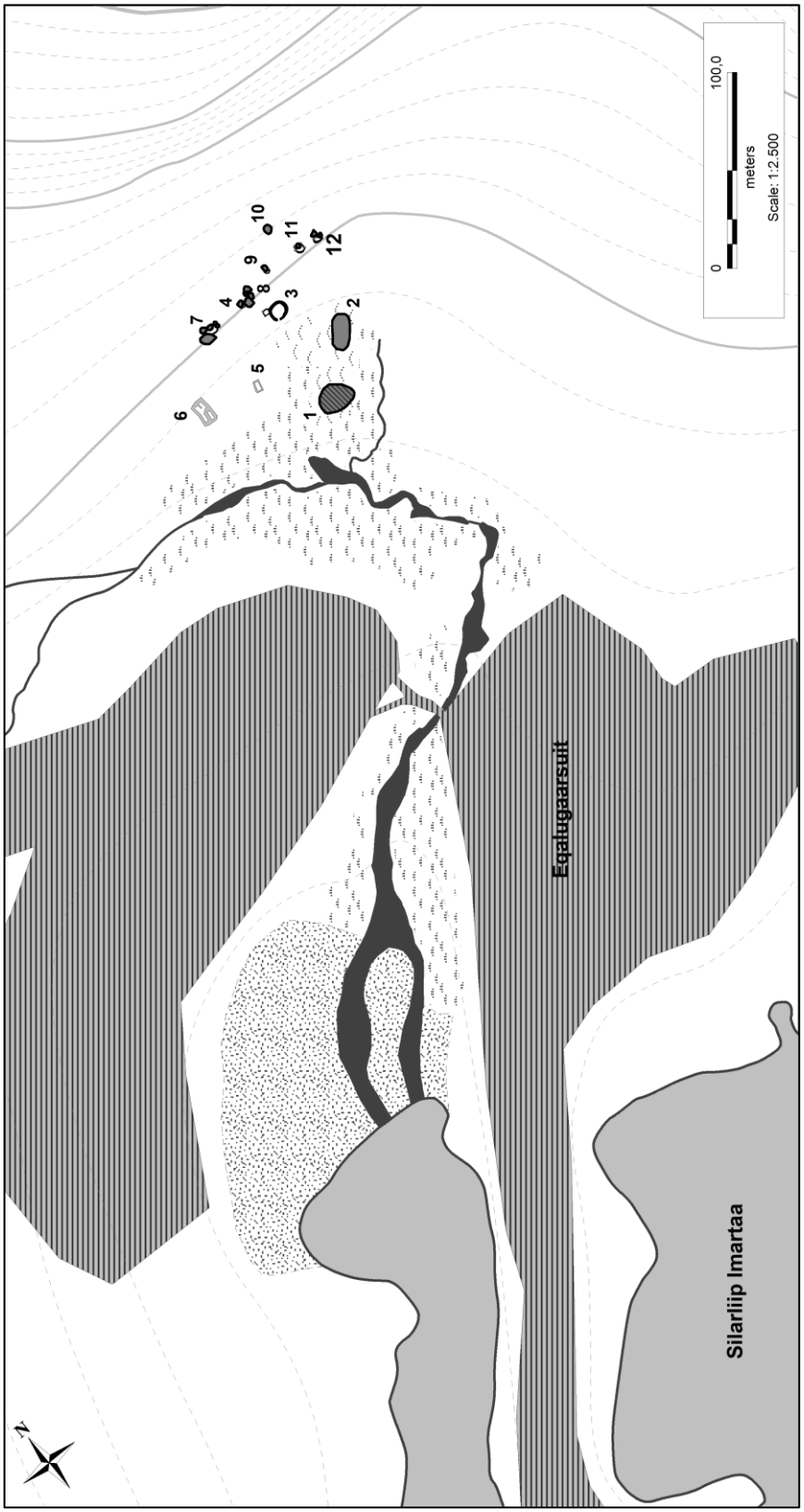
60V2-0IV-565



3 Ruins

Large simple shieling

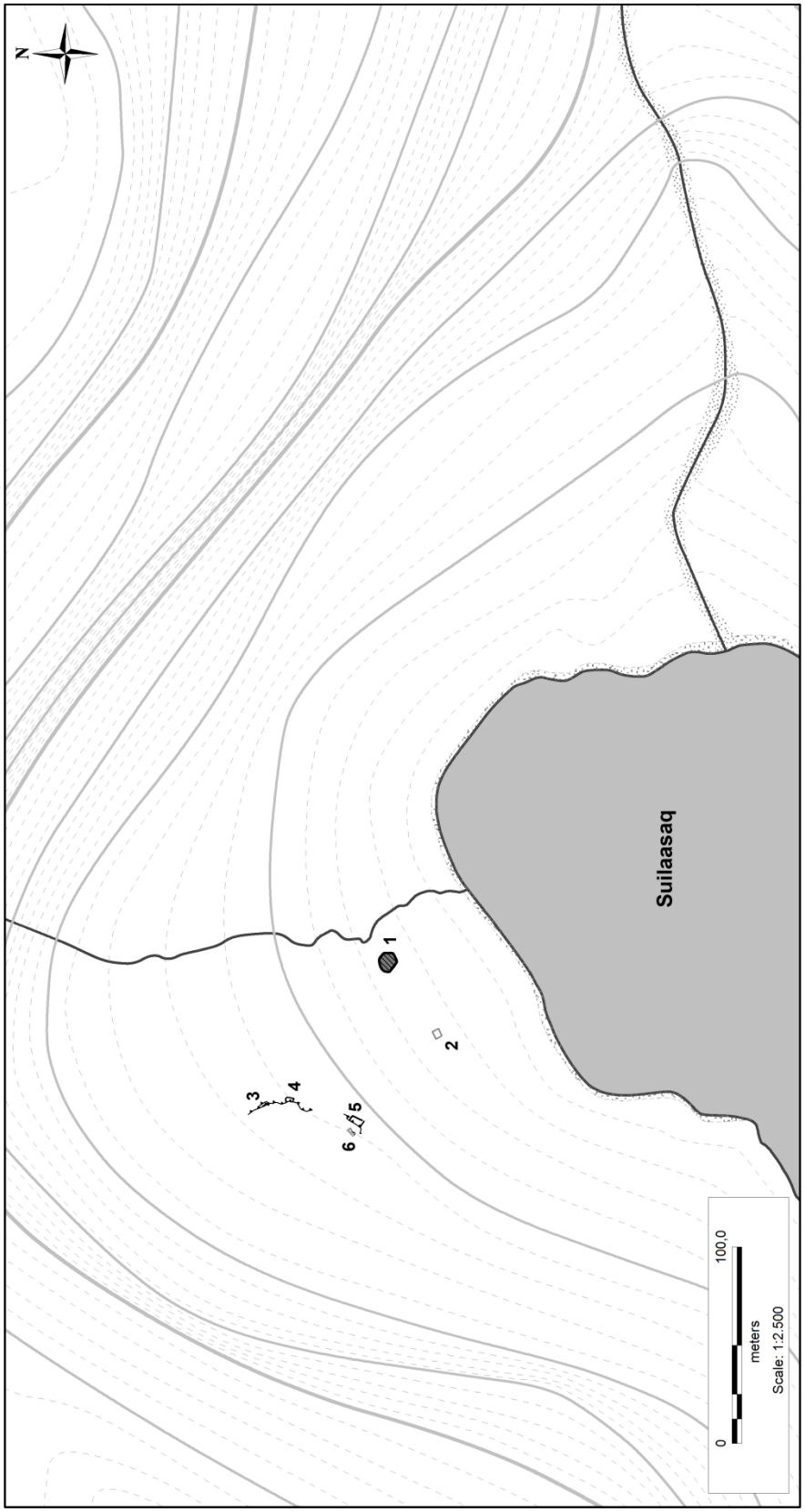
60V2-0IV-566



12 Ruins

Large complex shieling

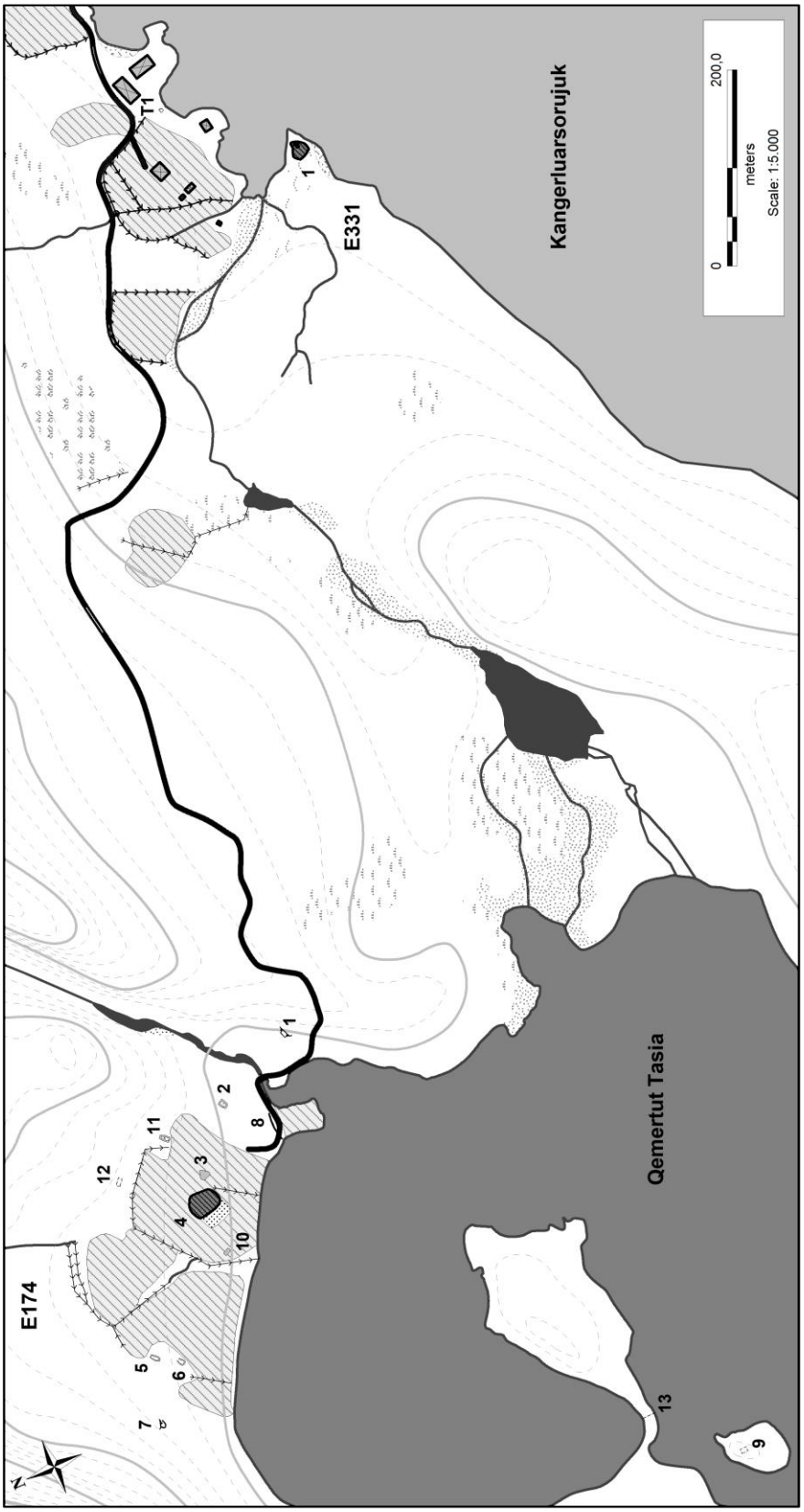
60V2-0IV-570



6 Ruins

Small complex shieling

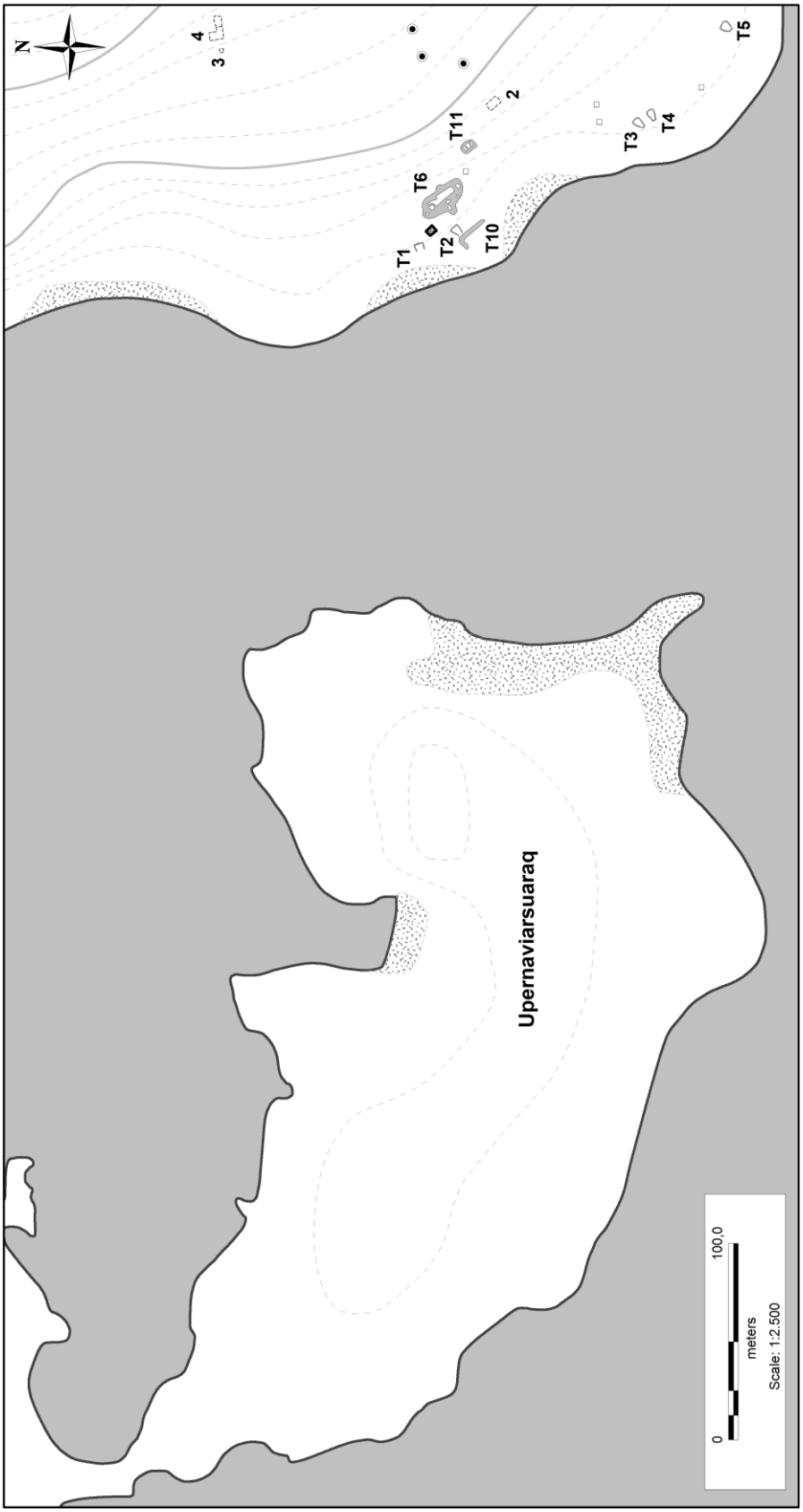
60V2-0IV-567



1 Ruin

Small complex shieling

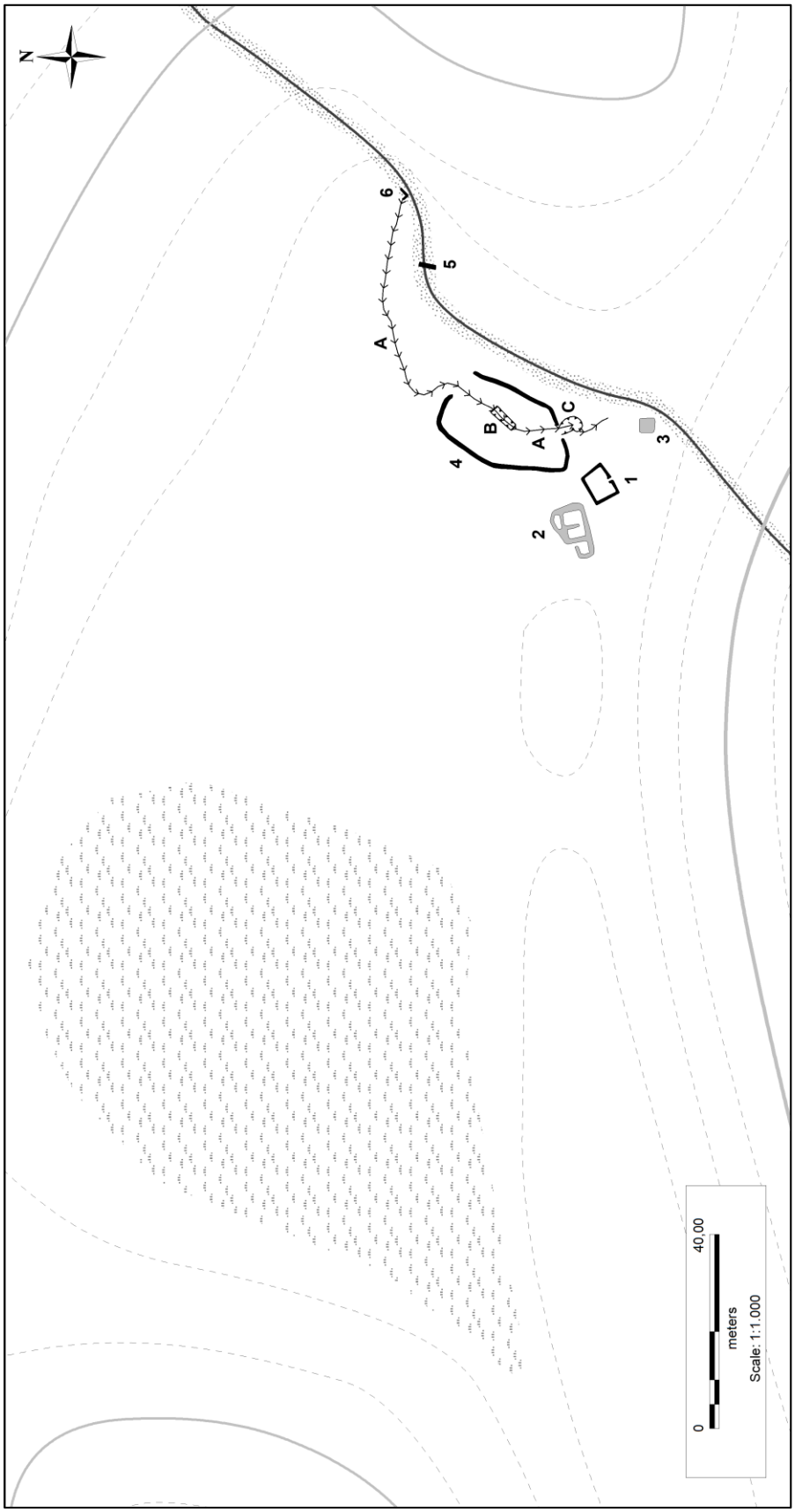
60V2-0IV-581



4 Ruins

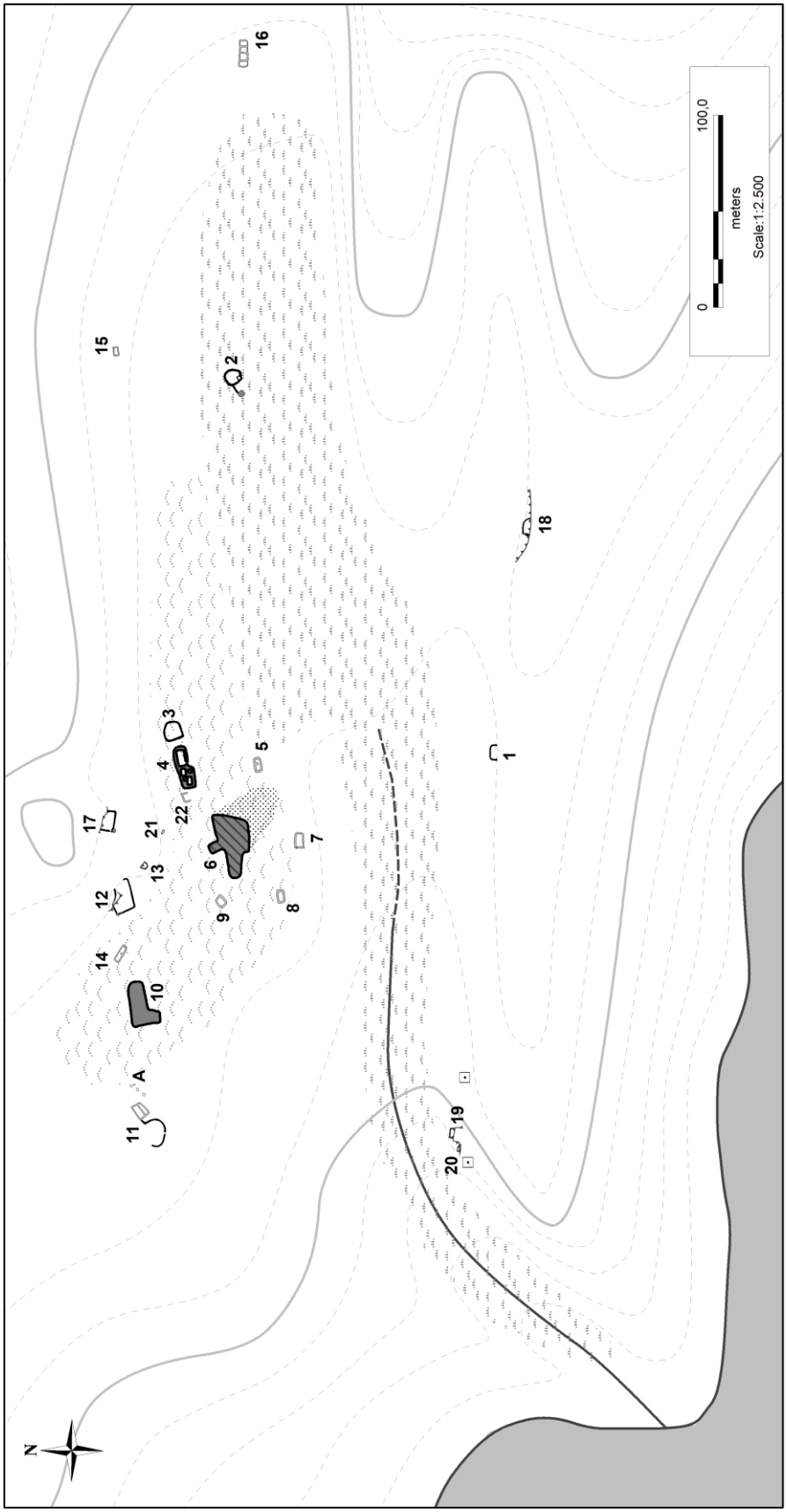
Dairy shieling

60V2-0IV-573



4 Ruins

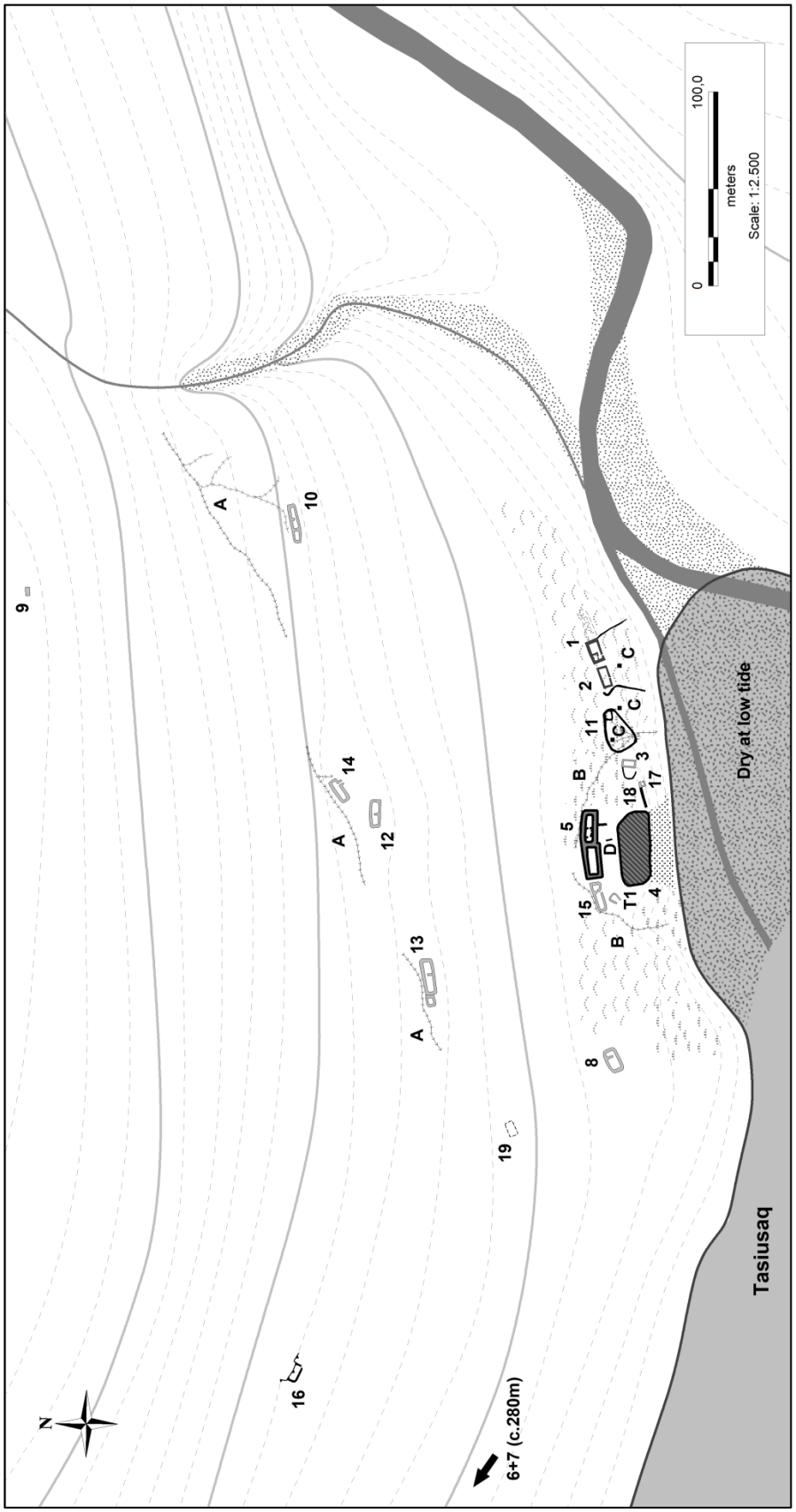
Small complex shieling



23 Ruins

Medium Farmstead

61V3-III-535



22 Ruins

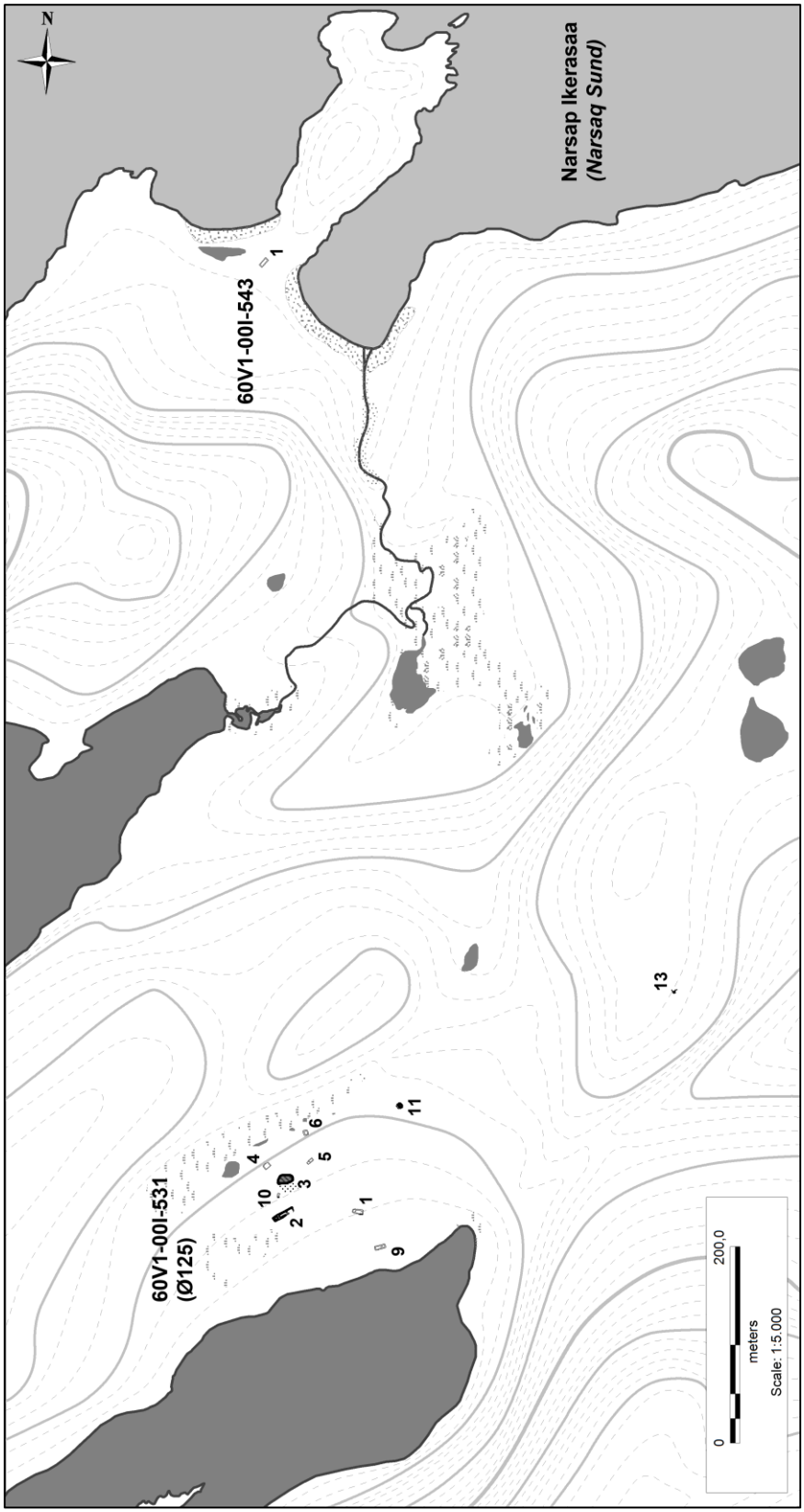
Manor

61V3-III-534

14 Ruins

Medium Farmstead

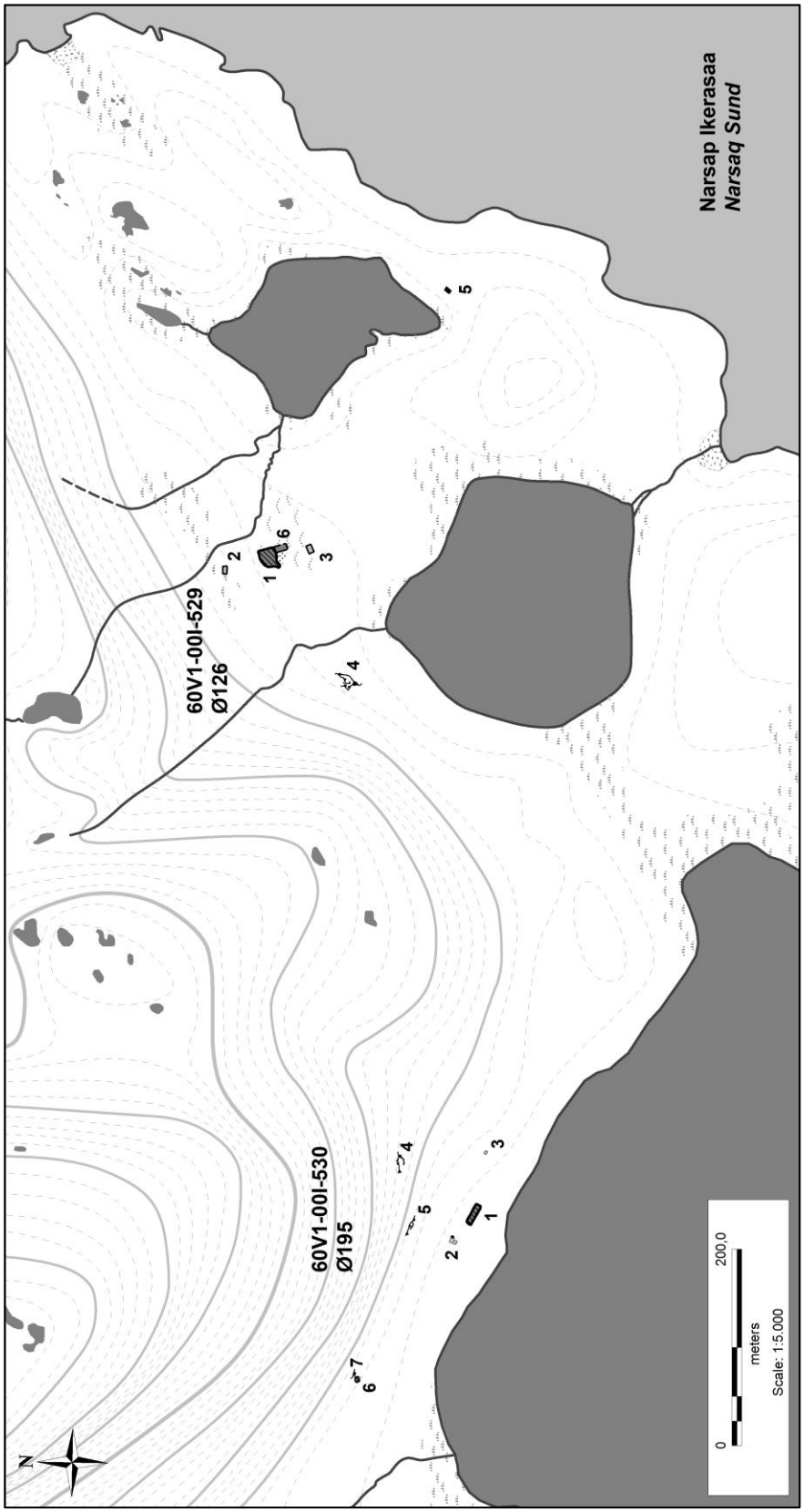
60V2-0IV-620



11 Ruins

Large complex shieling

60V1-00I-531



8 Ruins

Small Farmstead

60V1-00I-529