Marine Shielings in Medieval Norse Greenland

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Abstract. The Norse that settled Greenland between ca. AD 985 and 1450 were sedentary agropastoralists that combined farming with hunting and organized after a North Atlantic socioeconomic model. Research of the last 40 years has emphasized the great and increasing importance of marine resources for both the Greenland Norse local subsistence economy and long-distance trade. However, the archaeological sites and features associated with the marine economy have not been systematically investigated. This study reviews documentary records and archaeological site evidence of medieval Norse marine-resource use in Greenland on local to regional scales. Contextualizing this evidence within a locally adjusted, Arctic version of a general North Atlantic settlement and land-use model, and applying a formalized interpretational framework, the study implies the existence of at least four types of seasonally occupied, specialized satellite sites related to marine-resource use—sites that tentatively may be labeled "marine shielings." Marine shielings likely served to improve the expediency and safety of Norse marine-resource use on both Greenland's west and east coasts, where marine hunting appears to have been a frequent, specialized, and cooperative activity.

Around AD 1000, Norse farmer-hunters founded two settlements on Greenland's west coast (Fig. 1): the *Eystribyggð* (Eastern Settlement) in South Greenland and the smaller *Vestribyggð* (Western Settlement) in the Nuuk and Ameralik fjord systems (Arneborg 2004). These settlements formed complex systems of farmsteads and satellite sites with a total maximum population of 2000–3000 (Lynnerup 1998; Madsen 2014b). For ca. 450 years, the Norse Greenlanders successfully sustained this westernmost secluded Arctic node in European cultural and economic networks bridging half the world. However, for still unresolved reasons, the Norse settlements eventually declined and disappeared: the *Vestribyggð* before AD 1400 and the *Eystribyggð* by AD 1450 (Arneborg et al. 2012b).

Agropastoral, medieval Norse settlement was, as everywhere in the North Atlantic, organized around the production from and yearly upkeep of animal husbandry consisting of cattle, pig, sheep, goats. However, research of the last 40 years has emphasized the great importance of wild resources for the Greenland Norse subsistence and trade economy. Archaeofauna consistently display 40–85% wild species across all types of farmsteads, including those in the hinterland, and exhibit a clear trend of increasing percentages over

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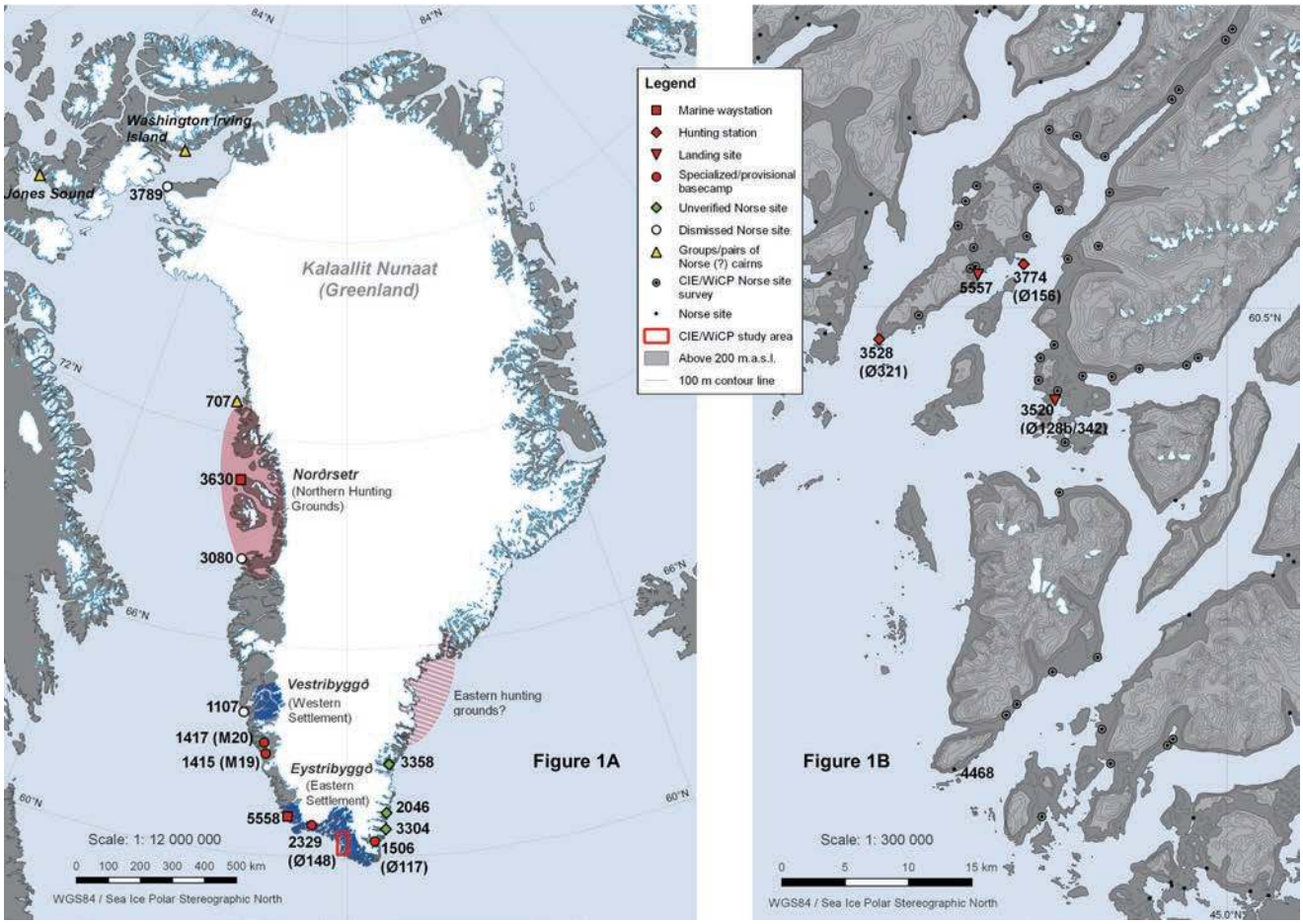

Figure 1. Maps showing Greenland (1A) and the Comparative Island Ecodynamics (CIE)/Winter is Coming Project (WiCP) study area (1B) with indications of Norse settlement and hunting areas, as well as Norse sites and marine-shieling types discussed in the text (map by the author).

time (e.g., Dugmore et al. 2009; McGovern 1985a; Ogilvie et al. 2009; Perdikaris and McGovern 2008; Smiarowski et al. 2017). Marine mammals, especially seal, greatly dominate the wild species. Isotopic analysis of Norse skeletons displays similar patterns with some late period individuals subsisting on up to 80% marine protein (Arneborg et al. 2008; Arneborg et al. 2012a). Marine mammals were also the backbone of the Norse trade economy: high-value, low-bulk walrus ivory and skin robes, narwhal tusks, and polar bear and seal furs were the main exports valuable enough to attract foreign merchants to Greenland's distant settlements (Dugmore et al. 2007; Roesdahl 2005; Star et al. 2018).

Predictably, Norse marine-resource use and voyages to distant hunting grounds have therefore attracted considerable scholarly attention (e.g., Arneborg 1998; Ingstad 1960; Keller 2010; Ljungqvist 2005; Magnusen 1827b; Meldgaard 1995; Nansen 1911; Perdikaris and McGovern 2008; Vebæk 1991; Wormskiold 1814). Recently, systematic harvesting of marine-mammal exports has even been proposed as a primary driver for Norse expansion to Greenland (Frei et al. 2015). However, while the existence of a few archaeological sites associated with marine-resource use has been suggested (e.g., Berglund 1973; McGovern 1979; Meldgaard 1995; Thorhallesen 1776), their placing, layouts, and various functionalities have not been systematically explored.

The present study contributes to the research of Greenland Norse marine-resource use by reviewing, categorizing, and discussing archaeological evidence of various types of specialized and temporary marine sites—marine shielings—inside and outside the Norse settlements in Greenland. The study builds on years of field observations but even more so on unanticipated spinoff results from the collaborating "Comparative Island Ecodynamics in the North Atlantic Project" (CIE, 2012–2016) and "Winter is Coming Project" (WiCP, 2016–2020)

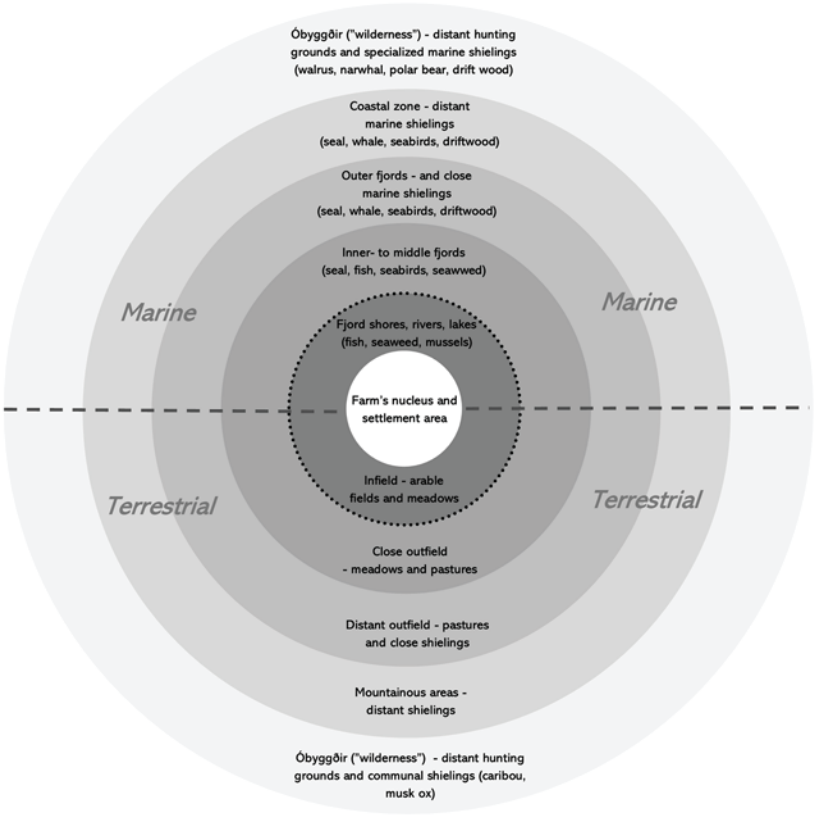

Figure 2. Conceptual Greenland Norse farm and land-/sea-resource use model (adapted from Øye 2013:Fig. 4). Besides the terrestrial resource zones suggested by Ingvild Øye, this model includes Greenland Norse marine-resource zones, the character of associated sites, and examples of the main marine resources harvested within these zones.

that study long-term human ecodynamics from the Viking Age to Early Modern North Atlantic and Greenland from superregional to site-level scales from opposite perspectives.

Greenland Norse Settlement Landscapes

The Norse *Eystribyggð* spanned the ~400 km ice-free area between Cape Farewell and up to ~62° latitude (Fig. 1). More than 560 Norse sites have, so far, been located in the *Eystribyggð* (Arneborg et al. 2012b), occupying the entire landscape from fjord shores to mountainous hinterlands, from the edge of the Ice Sheet to the outer fjords. However, only an estimated one to two-thirds of the sites were farmsteads (Madsen 2014b; Vésteinsson 2010), the rest being various types of satellite sites. The smaller *Vestribyggð*, with only ~105 registered sites, was located ~500 km to the north in the inner parts of the Nuuk- and Ameralik fjord systems (Fig. 1A) (Arneborg et al. 2012b; McGovern and Jordan 1982; Roussell 1941).

Following a North Atlantic model, farmsteads were the operational and legal centers of the notably hierarchical Norse communities in Greenland (Fig. 2). Situated in or on the edge of cultivated "infields," farmsteads were hubs for the accumulation, display, and consuming of terrestrial and marine produce, surplus, and wealth. Beyond the infield extended the "outfield." Occasionally translated as "wasteland," the outfield included resource areas of central importance to North Atlantic farms (e.g., Baug 2015; Blehr 2012; Church et al. 2016; Øye 2004, 2013). While much scholarly attention has focused on terrestrial outfield resources, Figure 2 has been adapted to local Arctic settings and conceptually suggests the matching importance of marine-resource zones in a Greenland Norse economy largely sustained by marine wildlife and resources. Whether dealing with resources in the terrestrial or marine environment, when distances from outfield resources to farmsteads became logistically impracticable, access and production were facilitated by satellite sites (i.e., shielings) (Fig. 2).

Norse Shielings: A Definition

Previously somewhat understudied, shieling or transhumance is today recognized as an ancient, central element of pastoral farming cultures all over the North Atlantic, Scandinavia, and Europe (e.g., Carrer et al. 2016; Cheape 1996; Kupiec and Milek 2014; Mahler 2007; Reinton 1961; Skrede 2005; Sveinbjarnardóttir 1991). In Norse Greenland too, the importance of terrestrial shieling has been emphasized (e.g., Albrethsen and Keller 1986; Bruun 1895; Guldager et al. 2002; Ledger et al. 2013; Madsen 2014b; Roussell 1941).

A "shieling" in this context should be defined as *a seasonal, task-specific production or logistic site*. "Seasonal" because shielings were temporarily occupied, but periodically revisited, often following a yearly rhythm; "task-specific" because shielings facilitated specialized activities; "production" because shielings enabled localized produce, processing, manufacture, or storage of foodstuffs, fodder, or wares that were eventually moved to sites of accumulation, consumption, or trade (farmsteads, markets, etc.); "or logistic" because shielings could also enable long-distance movement of people, animals, foodstuffs, and goods.

This shieling definition allows for the inclusion of almost any type of seasonally occupied, specialized farming or nonfarming satellite site. Admittedly, such an open definition is somewhat at variance with the typical use of the term shieling, which is both conceptually and historically—and whether in a North Atlantic, Scandinavian, or European context—normally associated with agropastoral transhumance (e.g., Albrethsen and Keller 1986; Reinton 1961; Svensson 2015). The reasons for upsetting this convention are several, but primarily to stress the point that the marine category of satellite sites should, at least as a starting point, be considered on par with their terrestrial counterparts: whether terrestrial or marine, shielings were a subset to "mother farmsteads" and had to draw on the same labor force and fit within their scheduling of seasonal activities—a schedule not necessarily strictly determined by the seasonality of the farming cycle, especially not in Norse Greenland where marine resources of key importance were mostly present or accessible during short seasonal windows. Also, earlier studies have demonstrated that in Greenland, even shielings associated with agropastoral activities could have a different spatial organization than elsewhere in the North Atlantic.

An open definition allows for local adaptation, changing, or multifunctionality of shielings, while at the same time avoiding to draw direct parallels with the historical or ethnographic phenomenon (Svensson 2015). In fact, earlier studies have demonstrated that in Greenland, even shielings associated with agropastoral activities could have different spatial organization than the widespread practice of lowland to highland/inland transhumance and instead reflected a horizontal movement of people and animal husbandry to pastures spread out along the fjord coasts (i.e., horizontal transhumance) (Madsen 2014a,b). Also, the only historical example of an Old Norse *-setr* or *-setur* place name—the likely origins of English word "shieling"(Foster 2018)—from medieval Greenland refers to an area in the high Arctic (see Fig. 1A) far beyond the Norse settlements and any potential agropastoral activity. A few other examples of nonagropastoral *-setur* place names also exist from elsewhere in the North Atlantic (Foster 2018). Shielings, whether terrestrial or marine, were undoubtedly legally organized and managed within the same socioeconomic framework of kin-based ownership, shareholding, or tenure and thereby equal parts of what comprised the entirety of North Atlantic medieval farms (Fig. 2) (Madsen 2014b; Vésteinsson et al. 2002; Øye 2005)—farms that were everywhere heavily dependent on extensive resources in the outfield or, in Greenland, beyond.

Greenland's *Óbyggðir*

The *Eystribyggð* and *Vestribyggð* occupied small, environmentally constrained subarctic landscape niches that allowed pastoral farming. Beyond lay thousands of kilometers of low to high arctic coastal areas, where most of Greenland's marine wildlife is located (Fig. 1A and 2) (Born and Böcher 2001). Most of the marine species and resources that provided the Norse with key household provisions—common/harbor seal, harp seal, hooded seal, seabirds, and driftwood (e.g., Enghoff 2003; McGovern 1985a; McGovern et al. 1996; Møhl 1982)—could be found in the coastal outfield near the settlements (Fig. 2). In contrast, cash-crop marine species could only be hunted in the *óbyggðir* (ON pl. "unsettlements") (Grove 2009), a term used by medieval authors to designate the remote coastal "wilderness" far north and east of the settlements (Fig. 1A and 2). Whether or not a medieval landscape category, perhaps even with legal implications, *óbyggðir* here signifies the entirety of Norse resource areas and hunting grounds beyond the settlements.

Marine Hunting in the Medieval Written Record

Medieval written sources on the Greenland Norse are few and fragmentary (e.g., Grove 2009; Halldórsson 1978; Ogilvie 1991) and descriptions

of Norse marine hunting even scarcer. The mid-13th-century Norwegian text *Konungs skuggsjá* (King's Mirror) provides one principal list of Norse marine exports of walrus tusks, walrus robes, and sealskins (Larson 1917). These exports are repeated in a papal letter of AD 1282 (Anderson 1906) and indirectly by medieval tax lists from the royal trade port of Bergen (Helle 1982). Only two texts contain any additional information on Norse hunting activities in Greenland's *óbyggðir*: Björn Jónsson of Skarðsá's *Grænlandsannáll* (Greenland Annals) concerning hunting activities in the *Norðrsetr* (Northern Hunting Grounds) and Ívarr Bárðarson's *A Description of Greenland* on hunting in East Greenland. Unsurprisingly, these texts have been repeatedly mined for evidence (e.g., Gad 1965; Graah 1832; Ingstad 1960; Keller 2010; Ljungqvist 2005; McGovern 1985b; Nansen 1911; Seaver 1996; Wormskiold 1814) and are here revisited only to contextualize the archaeological evidence.

Björn Jónsson's *Greenland Annals*: Norðrsetr

The so-called *Greenland Annals* are thought to have been compiled by Jón lærði Guðmundsson (1574–1658) in 1623, but the passages on Norðrsetr survive in a revised copy by Björn Jónsson of Skarðsá (1574–1655) from ca. 1643 (Halldórsson 1978). Geographically, Norðrsetr has long since been identified as the Disko Bay and Upernavik region (e.g., Arneborg 1998; Wormskiold 1814). The three passages on the Norðrsetr hunt in the *Greenland Annals* likely reflect a combination of knowledge from earlier medieval sources and contemporary Icelandic lore on Norse Greenland (Grove 2009; Halldórsson 1978; Jones 1986; Jónsson 1899; Seaver 1996):

One passage states that:

> The Greenlanders regularly need to undertake northbound sea voyages to the uninhabited parts [*óbyggðum*] of the land's northern end, or peninsula, both for lumber, hunting and fishing [aflabragða]: it is called *Greipum* and *Króksfjarðarheiði*. It is a very long sea voyage (translated by Orri Vésteinsson after Halldórsson 1978:49–50).[1]

Under the heading of "About the People of the Northern Hunting Grounds [*Norðursetufólk*] in Greenland" (translated by Orri Vésteinsson after Halldórsson 1978:55), a second passage provides additional information:

> All the wealthy farmers [*stórbændur*] in Greenland had large ships and vessels built to send to the Northern Hunting Grounds [*Norðursetu*] to procure all kinds of hunting [*afla*] and hewed timbers [*telgdum viðum*] . . . They went there mostly for seal fat because the seal hunting was altogether better there than at home in the settlements. Melted seal fat was poured into skin containers [*húðkeipa*] and hung up to be cured by the wind in drying sheds [útihjöllum]. . . . The *Norðursetumenn* had their camps [*búðir*], or huts [*skála*], both in *Greipum* and some in *Króksfjarðarheiði* (Halldórsson 1978:55).

A final, third passage in the "Greenland Annals" simply states that "*Norðurseta*"—a verbal form—could also signify the period of hunting in *Greipum* and *Króksfjarðarheiði* (Halldórsson 1978:50).

Ívarr Bárðarson's *Description of Greenland*: East Greenland

Ívarr Bárðarson's *Description of Greenland* from the later 14th century is generally considered a less problematic text (Halldórsson 1978; Jónsson 1930; Mathers 2009) but only concerns hunting activities in East Greenland. The account begins far east of Eystribyggð in the uninhabited Bærefiord, of which is stated:

> There run also countless whales in the fjord, and there is never a lack of fish there; and in the fjord there are whalers, hunting by common whaling rights but with the bishop's permission; this fjord belongs to the cathedral (Mathers 2009:71).

A couple of fjords overlay "a harbor called Fimbuder (Finsbúðir)" and even further up the coast was "a large island, called Kaarsøø. Here there are usually hunters looking for polar bears; they must have the bishop's permission as the game belongs to the cathedral" (Mathers 2009:71).

First, it should be noted that Bárðarson's reference to "whales" (and "whalers") and "fish" is potentially misleading, as he could have meant walrus and seal or all of the above. Medieval inconsistency in species terminology is quite common. Second, the extent of the bishop's properties should perhaps not be overestimated: being a subordinate cleric's report to church authorities in Norway, Bárðarson's account could reflect some measure of embellishment or idealism. Neither is it clear exactly what was meant with the term "belong" (i.e., land ownership, use, or tax rights?) (Keller 1990). In any case, the hunting grounds in East Greenland were valuable enough to lay claim to, whether by intent or in praxis.

Finally, considering the considerable detail of Bárðarson's fjord and church property listing, it is surprising that the *Norðrsetr* is not mentioned. In fact, it is even stated that no one who valued their life would sail far north of *Vestribyggð*" (Mathers 2009 translation after Bárðarson 135–137). Could this indicate that the Norse in the *Eystribyggð* had abandoned hunting in *Norðrsetr* at this time and only hunted on the geographically closer east

coast? The date of Bárðarson's description at least corresponds with the increase of Thule culture presence in the Melville Bay and Disko Bay areas (Gulløv 2016).

Summary Discussion of the Medieval Written Record

Disregarding details of uncertain meaning and geographic location, distilling these medieval accounts add several perspectives to the character of Norse marine hunting in the *óbyggðir*:

1. Marine hunting in both *Norðrsetr* and on the east coast appears to have been frequent, probably an annual activity (McGovern 1985a). This recurrence is implied by the place name *Norðrsetr* itself, which translates directly as the "northern places (of temporary occupation)" or even the "northern shieling" (Bugge 1914; Ingstad 1960; Nansen 1911).
2. Marine hunting seems to have been undertaken by specialist hunters and crews (i.e., "*Norðursetufólk*," "*Norðursetumenn*," "whalers," and "polar bear hunters"). At least, this would theoretically appear a plausible arrangement as the expediency and safety of arctic marine hunting required highly developed skills and local environmental knowledge.
3. Marine-hunting expeditions and crews were apparently organized or sponsored by wealthy farmers (i.e., *stórbændur*) owning ships with regional range and some cargo capacity (i.e., large ships and vessels). Again, this appears a quite plausible setup considering the distances to marine-hunting grounds. In West Greenland, large walrus populations are found north of 65° latitude with main summer haul-outs in the Disko Bay area (Born et al. 1994), whereas narwhal summering grounds are located in Melville Bay and Inglefield Bredning (Heide-Jørgensen et al. 2010) (i.e., 1,600–1,800 km north of *Eystribyggð* and 500–1,300 km of *Vestribyggð*) (Fig. 1A). In East Greenland, walrus and narwhale summering grounds are historically found mainly in the large fjords above 64° latitude, around 480 km north of Cape Farewell (Dietz et al. 1994; Heide-Jørgensen et al. 2010; Witting and Born 2005).
4. Marine hunting in the *óbyggðir* appears to have been motivated not only by marine cash crops but could also have provided a steady supply of animal protein and oil from walrus, whale, seal, and polar bear, as well as driftwood and seal tar. This scenario seems repeated in the *King's Mirror*, which states that apart from domestic animals, the Norse Greenlanders subsisted on "the flesh of various kinds of game, such as reindeer, whales, seals, and bears" (Larson 1917:145). However, as there is little driftwood above 66° latitude on Greenland's west coast (Gulløv 2016), the *Greenland Annals'* reference to it as an important *Norðrsetr* resource is clearly misinformed. However, driftwood is plentiful below 66° latitude, as well as on the east coast, and could have been collected and used for ballast while traveling to and from the hunting grounds.
5. Specific laws and use rights appear to have applied to marine-hunting grounds in the *óbyggðir* ("common whaling rights" by the "bishop's permission"). A concern with legal conditions in the *óbyggðir* is notable in a passage in *Hákonar saga Hákonarsonar* from the 1260s, where it was decreed that the King of Norway was to be compensated for all murders, on both Norwegians and Greenlanders, and whether committed in the settlements or *Norðrsetr* (Bugge 1914).
6. Marine hunting was logistically supported by features in the *óbyggðir* that facilitated both temporary habitation (i.e., booths or houses in *Greipum* and *Króksfjarðarheiði*, *Finsbúðir* in East Greenland) and specialized buildings (i.e., drying sheds)—essentially, various types of marine shielings. Other written sources mention a *Karlsbúðir*, located in the north (Jónsson 1899; Wormskiold 1814), and famous *Leifsbúðir* in *Vínland*, possibly the site of L'Anse aux Meadows, Newfoundland (Fig. 25).

An Interpretational Framework for Greenland Norse Architecture

Greenland's cultural landscapes are remarkable in that they preserve near complete, fossilized Norse settlement landscapes representing some 450 years of occupation. The good state of preservation extends to many singular Norse features, or ruins, making it possible to surface-record accurate dimensions and architectural details. This visibility is a rarely auspicious archaeological situation in a North Atlantic, where sites have often been in continuous use at least since the Viking Age (e.g., Arge et al. 2005; Bolender et al. 2011; Bruun 1928b; Vésteinsson et al. 2002).

However, while many archaeological site surveys have reported ruin dimensions and architectural details (e.g., Albrethsen and Arneborg 2004; Guldager et al. 2002; Krogh et al. 1980), few studies have used the observations systematically (see, however, Bruun 1895; Krogh 1982; Roussell 1941). Building on methodology developed

during the Vatnahverfi Project 2005–2014 (Madsen 2014b), and refined during the WiCP/CIE field campaigns from 2013–present, this section outlines a developing interpretational framework for surface identification of Norse ruin and site functionalities based on systematic observation of following parameters: building dimensions, materials, and orientation; micro-topographical setting, as well as local to regional location and resource access. Because several of these parameters are self-explanatory or described for the individual sites, only those of unfamiliar or particular meaning, and listed in tables 1–3, are explained in the following subsections.

Norse Building Materials

The building materials used by the Norse Greenlanders were turf, stone, and wood. The first two materials could be procured locally, whereas large buildings timbers had to be retrieved from the coastal outfield, locally or regionally, in the form of driftwood (Fig. 2). Each building material had certain properties, and shortcomings, and careful selection and combination materials determined the buildings' functional capacities.

Table 1 presents a functional classification scheme for Norse building-material types as observable during surface surveys. The scheme draws partly on field observations, partly on a great range of North Atlantic architectural studies: from studies on Norse building customs in Greenland (e.g., Albrethsen 1982; Albrethsen and Ólafsson 1998; Arneborg 2004; Bruun 1895; Bruun 1928b; Krogh 1982; Roussell 1936; Roussell 1941; Vebæk 1943), North Atlantic archaeological or ethnographic parallels (e.g., Berson 2002; Bruun 1897; Bruun 1928a; Gestsson 1986; Griffiths and Harrison 2011; Jim 2017; Matras 2005; Skre 1996; Small 1967; Stummann Hansen 2013; Thorsteinsson 1982), and reconstructive or experimental archaeology (e.g., Guðmundsson and Ágústsson 2006; van Hoof and van Dijken 2008). Admittedly, some observations in the interpretation scheme (Table 1) are inferential and highly qualitative. However, this is of limited concern since its purpose is not such much to provide definite categories, as it is to make explicit the interpretive process.

Summarizing the information in Table 1, turf walls had insulating properties—the thicker, the more insulating—were wind, water, and moisture impermeable, and therefore turf was the principal material in habitation buildings for human and animals. However, especially in arctic Greenland, where grassland is scarce and vegetation recovery extremely slow (Forbes 2015), turf was not an inexhaustible resource. As a result, the unworked stone was used extensively as a protective and stabilizing element in turf buildings, as well as in pure stone architecture, when buildings were required to be ventilated, cool, dry, and stable. Wooden buildings also appear to have existed (Krogh 1976, 1982; Madsen 2014b) but are not considered further here.

Microtopographical Setting

The functional advantages and shortcomings of various Norse building materials were enhanced or diminished through the careful and intentional use of, and adjustment to, key microtopographical features: structure building ground; building/site wind and sunlight exposure or shelter/shade; and boat-landing conditions.

Building Ground

Not to be confused with "building foundation," "building ground" refers to the natural surface on which a building was raised. To keep structure interiors dry, the Norse always situated their buildings on drained ground. However, two basic functional properties of these drained surfaces should be observed: a) soil had heat retaining, or at least minimally heat-draining, properties and was the preferred building ground for insulated (cold-period) habitation buildings; whereas b) bedrock/cliff enabled easy water runoff but also caused major heat drain. It was, therefore, unsuited for cold-period habitation and instead preferred in buildings that had no heat requirements or needed to be kept cool (e.g., food and equipment stores).

Building/Site Wind and Sunlight Exposure or Shelter/Shade

A critical microtopographic feature intentionally selected for was wind and sun exposure or shelter/shade: a) in buildings or sites serving human or livestock habitation, insulating or heat retaining properties were enhanced by selecting for sheltered and sunny locations; whereas, b) buildings or sites that needed to be kept cool and/or ventilated were situated to ensure maximum wind exposure and/or shade (Madsen 2014b).

This classification scheme applies a four-category classification of wind exposure/-shelter where a building/site is considered (tables 2 and 3): a) "fully exposed" if open to winds from all directions; b) "exposed" if open to prevalent winds from two or three cardinal directions and situated to increase wind exposure (e.g., built at high elevation when lower locations were optional); c) "partly sheltered" if protected from prevalent winds from two cardinal directions and situated to reduce wind exposure (e.g., placed under a cliff or hill); d) "very sheltered" if protected from winds

Table 1. Summarized classification scheme for the functional interpretation of archaeological surface remains of Greenland Norse architecture, which is applied to the individual ruins of marine shielings in present study. In addition to describing the type and original built of building walls, the table outlines the surface appearance of ruins and basic functional characteristics of each wall and building-material types.

Wall type and build	Wall/building material type description	Ruin surface appearance in the field	Functional properties
Type 1: Turf wall (and roofing)	Wall built of turf blocks, directly on the ground or, more commonly, on a single- or double row stone foundation of one or a couple of courses, often with some soil/rubble/ turf filling. Wall width(s) normally >0.80 m.	*Well preserved*: grassy banks tracing the original feature wall lines; or, where the turf has disintegrated, as a distinct stone foundation of one or a couple of courses, and with no surrounding collapse stone. *Collapsed*: grassy, uneven (farm) mounds or low hummocks. No or very few visible collapse stone.	Heat insulating, water, wind, and moisture impermeable. Built for cold-period (or year-round) human and animal habitation.
Type 2: Turf/stone wall	Wall built in relatively regular, alternating layers of turf blocks and stones, raised on (rarely) single- or (often) double row stone foundation of one or a couple of courses. Wall width(s) normally ~0.6–1.0 m.	*Well preserved*: easily traceable walls of stones set in turf and often preserved in several courses. *Collapsed*: indistinct stone wall lines, sporadically standing a few courses high, and raised on single- or double-row stone foundations; or as grassy (farm) mounds or low hummocks many protruding stones. Considerable amounts of visible collapse stone.	Turf is economical and stable, but less heat insulating and water, wind, and moisture impermeable than Type 1 walls. Built for seasonal warm-period human and year-round animal habitation.
Type 3: Dry-stone walls	*Can be separated on following subtypes*:		
3a. Freestanding single-skin dry-stone wall	Dry-stone walls built in often somewhat irregular courses/layers, at times with thin interlaying turf mats and turf wall superstructure, either directly on the ground or on a single row stone foundation. Wall width(s) normally 0.5–8.0 m.	*Well preserved*: distinct stone walls, often including natural boulders or cliffs, and preserved in several, often irregular, courses. *Collapsed*: indistinct, but identifiable walls of collapse stone, most sliding or tumbling down the stones, boulders or cliffs in the foundation. Some to considerable amounts of visible collapse stone.	Expediently and easily procured building materials, partly sheltering, but heat draining. Used in pens, dikes, and other freestanding enclosure walls (e.g., pens, rock shelters, etc.).

Table 1. *(Continued)*

Wall type and build	Wall/building material type description	Ruin surface appearance in the field	Functional properties
3b. Dry-stone wall facing	Dry-stone wall built in mostly regular courses/ layers with no adhesive or, alternatively, with thin interlaying turf mats, against and to support/ protect the interior or/ and exterior of a turf wall (Type 1 or 2). Wall width(s) normally ~0.4–6.0 m.	*Well preserved*: distinct stone walls in several regular courses lining a Type 1 or 2 turf wall. *Collapsed*: more or less indistinct stone wall lines leaning against turfy banks, sporadically standing a few courses high, and inward/outward sliding collapse stone. Considerable visible collapse stone, most on one side of turf bank.	Expediently and easily procured building materials, wind- and water protective and durable. Built for protection of insulating turf walls (i.e., increased stability and durability of human and animal habitation buildings).
3c. Roof-supporting dry-stone double-skin wall (double dike)	Dry-stone double-skin wall built mostly in regular courses/layers with no adhesive, and at least one of the following traits: i) alternating thicker and thinner courses; ii) larger stones in the lower courses; iii) heavy foundation and, especially, corner stones; iv) stone wedges/pinning to level uneven stones in the courses; v) hearting with small to medium sized stones Wall width(s) normally ~0.8–1.0 m.	*Well preserved*: distinct double-skin walls standing almost intact (see description) with few surrounding collapse stone. *Collapsed*: faintly observable double-row wall foundations or lines standing up to a few stone courses high and surrounded by great amounts of collapse stone.	Expediently and easily procured building materials, ventilated and cool, highly stable and durable. Built for airdrying and storage. Occasionally used in freestanding boundaries or enclosure walls.
3d. Roof-supporting drystone double-skin wall with (double dike) fill or hearting	Dry-stone walls with all the elements of Type 3c, but with fill/hearting of the double-skin wall with small stones and rubble, occasionally some turf lumps, soil or gravel. Wall width(s) normally ~0.8–1.2 m.	*Well preserved*: distinct double-skin walls standing almost intact (see description). *Collapsed*: faintly observable double-row wall foundations or lines standing up to a few stone courses high and surrounded by great amounts of collapse stone.	Expediently and easily procured building materials, somewhat ventilated and water impermeable, cool, highly stable and durable. Built for storage.

(Continued)

Table 1. *(Continued)*

Wall type and build	Wall/building material type description	Ruin surface appearance in the field	Functional properties
3e. Protective dry-stone (and turf) wall with fill or hearting	Similar to Type 3d or with alternating courses of stone and thinner turf mats. Occasionally built to the height of the inner, roof-supporting wall, but more often with a superstructure of pure turf wall (Type 1).	Same as Type 3d, but with considerably less collapse stone, often spilling outwards from the building.	Built as a weather protective, water- and wind-impermeable casing of/shell for a wooden inner structure/building.
4: Wooden wall	Wooden wall raised on single row dry-stone foundation/sill. Wall width(s) normally 0.3–0.5 m.	Visible as single row dry-stone foundations with no surrounding collapse stones.	Ventilated. Built for airdrying and storage.

from three or four cardinal directions and built at low elevation. Sunlight exposure is classified by noting directional angles of received, unobstructed sunlight. Both parameters are preferably observed in the field, but can—at least on site level—be reconstructed from high to medium precision elevation models, in the present study using the Polar Geospatial Center's ArcticDEM 2-m digital elevation model (Porter et al. 2018; www.pgc.umn.edu/data/arcticdem/).

Boat-Landing Conditions

"Boat-landing conditions" summarizes a qualitative assessment of the ease of approaching and anchoring or beaching a boat at a site. Boat-landing conditions are described as a) "good" when a natural harbor offers easy an approach and sheltered anchoring or beaching conditions; b) "average" when a landing site is usable but unsuited for anchoring or beaching under certain wind or wave conditions; and, c) "poor" when approaching, anchoring, or beaching at a site is difficult or impracticable. The assessment assumes that the boat is small, flat bottomed, and light enough for a small crew to carry or drag onto land. At visited sites, this assessment is experienced based; otherwise, it is based on prior descriptions.

Norse Marine Shielings in Greenland

This section presents 17 sites in Greenland that have–directly or inferentially–been suggested or confirmed as related to Norse marine-shieling activities. Five sites are located within the CIE/WiCP study area (Fig. 1B), while the remainder are examples of Norse sites either occupying environmental and geographic settings that preclude pastoral farming (above 66° latitude and on Greenland's eastern coast) or are in the far periphery of the main settlement areas (i.e., Greenland's *óbyggðir*) (Fig. 1A).

The sample only includes sites that been revisited by archaeologists or experienced observers and where documentation exists in published literature or the archives of the Danish and Greenland National Museums. Sites are numbered with the current Nunatta Katersugaasivia Allagaateqarfialu (Greenland National Museum and Archives) heritage number (NKAH no.), as well as the old numbering system (Ø, V, or M numbers for the eastern, western, and middle settlements, respectively) applicable to Norse sites registered before 1982. Descriptions of site setting and resource access are based on either observation, prior descriptions, or simply on environmental setting (i.e., coastal versus inner fjord). Due to great local variability and lacking evidence, site descriptions do not systematically consider relative sea-level rise. However, it is noted that relative sea-level change over the last 1,000 years is estimated to range between 0.5 and 4 m in southwestern and southern Greenland (Long et al. 2012; Mikkelsen et al. 2008).

While the discussed sample of sites is evidently not complete, it does represent the most-likely examples of sites with nonfarming functionality (i.e., potential marine shielings). To the author's knowledge, this is the first time such

Table 2. Listing of feature-level functional observation criteria discussed in the text and applied to the 19 individual Norse ruins considered in present study, as well as three comparable features at L'Anse aux Meadows, Newfoundland (LAM Hall A, D, and F). Observation criteria include: feature dimensions and wall width(s) (showing variation and average); wall and building materials identified using the classification scheme in Table 1; number of identified rooms; orientation of buildings (if applicable); wind exposure; and building ground.

Site no.	Ruin length (m)	Ruin width (m)	Wall width(s) (m)	Wall/building materials	No. rooms	Building orientation	Ruin exposure	Building ground
NKAH 3789	2.7	2.2	0.4–0.6	Type 3a dry-stone wall	2	SW/NE	Partly exposed	Soil/bedrock
NKAH 3630	4.4	4.4	1.1–1.8 (1.5)	Type 3c dry-stone wall	1	n/a	Fully exposed	Bedrock
NKAH 3080	10.0	10.0	1.0	Type 1 or 2 turf or turf/stone wall?	4	n/a	Partly sheltered	?
NKAH 1107	4.0	1.7	0.4–0.5 (0.45)	Type 3a dry-stone wall	1–2	NNE/SSW	Partly sheltered	Bedrock
NKAH 1417 Ruin a	13.5	5.0	1.3	Type 1 turf wall (on multicourse stone foundation) or Type 2 turf and stone wall?	1?	NW/SE	Partly sheltered	Soil
NKAH 1417 Ruin b	20.0	6.5	1.3	Type 1 turf wall (on multicourse stone foundation) or Type 2 turf and stone wall?	(at least) 4	SW/NE	Partly sheltered	Soil
NKAH 1415	18.9	6.3	1.6	Type 1 turf wall on stone foundation	1?	N/S	Sheltered	Soil
NKAH 5558	3.8	3.7	0.8–1.2 (1.0)	Type 3c dry-stone wall	1	n/a	Fully exposed	Bedrock
NKAH 2329	15.0	12.0	—	Type 2 turf and stone wall?	?	?	Partly sheltered	Soil
NKAH 3528	5.5	3.8	0.5–0.9 (0.7)	Type 1 double-row stone foundation for turf (or stone) superstructure	2	NW/SE	Partly sheltered	Bedrock
NKAH 5557	4.4	2.9	0.8–0.9 (0.9)	Type 3d dry-stone wall with fill	1	E/W	Sheltered	Soil

(Continued)

Table 2. *(Continued)*

Site no.	Ruin length (m)	Ruin width (m)	Wall width(s) (m)	Wall/building materials	No. rooms	Building orientation	Ruin exposure	Building ground
NKAH 3774 Ruin 1	7.2	4.8	1.0–1.2 (1.1)	Type 3d dry-stone wall with fill	1	N/S	Sheltered	Soil
NKAH 3774 Ruin 2	8.0	4.7	1.0–1.4 (1.2)	Type 1 double-row stone foundation for turf superstructure	1	WSW/ENE	Partly sheltered	Soil
NKAH 3520	> 5.0	4.1	0.9	Type 3d dry-stone wall with fill	1	E/W	Partly exposed	Bedrock
NKAH 4468	22.0	10,5	1.1–1.5 (1.3)	Type 1 turf wall	(at least) 5	SW/NE	Sheltered	Soil
NKAH 1506	28.0	9.0	1.0	Type 1 turf wall	(at least) 3	E/W	Sheltered	Soil
NKAH 3304	5.0	4.0	—	Type 2 turf and stone wall or Type 3 dry stone wall?	?	?	?	—
NKAH 2046	7.0	5.0	—	Type 2 turf and stone wall or Type 3 dry stone wall?	?	?	?	Soil
NKAH 3358	10.0	9.0	—	Type 2 turf and stone wall	—	n/a	Sheltered	Soil
LAM, Hall A	29.0	9.4	1.6–2.5 (2.1)	Turf	4	NE/SW	—	Soil
LAM, Hall D	20.2	8.0	1.1–1.6 (1.4)	Turf	3	NNE/SSW	—	Soil
LAM, Hall F	25.5	16.0	1.3–2.1 (1.7)	Turf	6	NNE/SSW	—	Soil

Table 3. Listing of site-level functional observation criteria discussed in the text and applied to the 17 Norse sites considered in the present study and discussed in the text. Noted in the table is the presence/absence of midden, as well as other deposits where sites have been test excavated; site-level wind and sunlight exposure versus shelter/shade; and site landing conditions. Also, site interpretations shown in Figure 1A and B are summarized with tentative indication of orientation towards marine or terrestrial resources.

NKAH no.	Midden	Refuse or other cultural deposits	Wind exposure	Sunlight exposure	Landing conditions	Site interpretation
3789	No	("flint" blade)	Exposed	SW–NE	?	Hunting shelter or cabin? Not Norse
3630	No	Some shell, mussels, bone, one worked bone artifact	Fully exposed	Full	Good*	Norse marine waystation
3080	No	Arrowheads, spoons, harpoon pieces, one wooden doll	Partly sheltered	SE–SW	Good	Thule culture or Inuit winter house, not Norse
1107	No	?	Partly sheltered	Full	Poor	Inuit shooting blind or shelter? Not Norse
1417	No	No	Partly sheltered	SE-SW	Good	Norse specialized or provisional base camp, terrestrial?
1415	No	Bits of charcoal	Sheltered	N, SW	Good	Norse specialized or provisional base camp, terrestrial?
5558	No	?	Exposed	Full	Good	Norse marine waystation
2329	No	?	Partly sheltered	NE-SW	?	Norse specialized or provisional base camp, terrestrial?
3528	No	Charcoal, piece of (window?) glass	Partly sheltered	S-NW	Average	Norse marine-hunting station?
5557	No	?	Sheltered	NE-S, W	Average	Norse landing site
3774	No	A bird bone (upper layer), pieces of charcoal (lower layer)	Sheltered	NE-SE	Good	Norse marine-hunting station
3520	No	?	Partly exposed	NE-SW	Average	Norse landing site
4468	No	A few flecks of charcoal	Sheltered	NE-SW	Good	Norse specialized or provisional base camp, marine?
1506	No	?	Sheltered	E-W	?	Norse specialized or provisional base camp, marine
3304	No	?	?	?	?	Norse? Marine waystation or hunting station?
2046	No	?	?	?	Good?	Norse? Marine waystation or hunting station?
3358	No	Burned bone, charcoal, one piece of steatite	Sheltered	ENE-SW	Good	Norse? specialized or provisional base camp, marine?

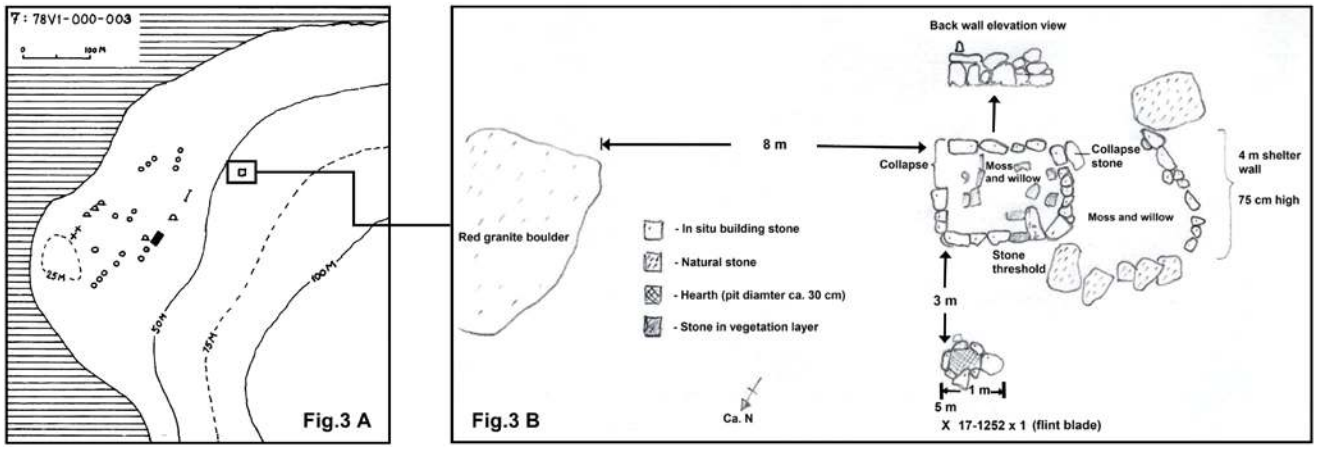

Figure 3. A. Site sketch overview plan of Late Dorset, Thule culture, and suggested Norse features (indicated) at NKAH 3789, Inglefield Land (modified after Appelt et al. 1998:Fig. 1). B. Detailed sketch plan of the suggested Norse feature at NKAH 3789 (modified after Torben Diklev 1993, with permission).

types of Norse sites areas have been presented collectively. The extent and detail of individual site documentation are of course highly variable, and not all the previously-outlined observation parameters can be described for all sites.

Possible Norse Marine Shielings above 66° Latitude

NKHA 3789, Inglefield Land, 78° Latitude

NKAH 3789 includes one suggested Norse ruin situated 30–60 meters above sea level (masl) and ~150–160 m northeast of a raised beach with Paleo-Inuit and Thule culture features, 2 km east of Littleton Island, Inglefield Land (Fig. 1A and 3). Published prior site descriptions are in Appelt et al. (1998) and Gulløv (1997). Additional information for this study include descriptions by Hans Lange, Greenland National Museum and Archives, and David Qaavigaq (personal communication 2018), who both inspected the site in 1993, 1996, and 1997; a sketch site plan made in 1993 (Fig. 3B) by Torben Diklev (personal communication 2018), former head of Qaanaaq Museum; and two clear, but low, resolution, photos taken by archaeologist Hans Kapel in 1996 (personal communication 2019).

Some authors describe the feature as a small, square stone house "more Norse-like than similar structures from West Greenland" (Appelt et al. 1998:139). However, Diklev's sketch site plan (Fig. 3B), which Kapel's photos confirm to be very accurate, and field notes show a slightly more complex, two-part feature—its mostly square, eastern half with inside dimensions of 2.2–2.7 m. This estimate matches the description of Lange and Qaavigaq that the feature was certainly no larger than 3 × 3 m. Both photos and sketch plan (Fig. 3B) show this part of the feature to have Type 3a dry-stone walls (Table 1) approximately 40–60 cm wide and of somewhat irregular built with no stone wedges or pinning to stabilize the courses. The western half of the feature, which Diklev describes as a shelter wall (Fig. 3B), appears of similar build but in more irregular courses. The photos show hardly any collapse stone apart from what is seen in the sketch plan (Fig. 3B), suggesting that the walls never stood higher than their present 50–80 cm. The building ground is a thin layer of soil on gravel or bedrock.

Based on the combined site documentation evidence and observation criteria (Table 2), the feature can almost certainly be dismissed as Norse. In Norse architecture, Type 3a single-skin dry-stone walls are only used in unroofed structures (i.e., pens, boundary walls, or shelter walls in simple rockshelters for animal husbandry, herders, or hunters). The fairly wind-exposed setting of the NKAH 3789's feature, its heat draining building ground, and low dry-stone walls seems to exclude such function, nor could it have served winter habitation without an inner insulating construction. The type of open-air hearth depicted in Diklev's site plan just north of the feature is not normal for sites of Norse origin and the discovery of a nearby "flint blade" (Fig. 3B)—more likely some local crystalline stone material—suggests that it could be an atypical Paleo-Inuit or Thule culture, if not a later historical Inuit or European feature.

NKAH 707, Kingittorsuaq, Upernaviarsuk, 73° Latitude

In 1824, a small runestone was found on top (~300 masl) of the steep-sided barren Kingittorsuaq

Figure 4. A recent photograph of the three collapsed cairns (NKAH 707) on top of Kingittorsuaq Island, where the famous Norse runestone was found in 1824 (photographed by Mikkel Myrup in 2009).

island, approximately 20 km north of Upernavik (Figs. 1A and 4) (Magnusen 1827a). The runestone has been dated to the mid-13th century and bears a concise inscription: "Erlingr Sighvatrs son carved and Bjarni Þorðr's son and Eindrið Oddr's son, constructed these cairns the Saturday before Rogation Day (April 24), and . . ." (Ihmer 2017:243).

An 1825 inspection of the find site confirmed the existence of three cairns—all collapsed, one larger and two smaller—together forming a triangle, which was likely built while the island served as a temporary lookout for Norse on one of their summer hunting voyages (Magnusen 1827b). Published 1950 photos show the cairns in a severe state of collapse (Rosenkrantz 1967b:Fig. 3–5), but 2004 photos reveal little recent change (Fig. 4). NKAH 707 should possibly be grouped with other examples of groups or pairs of cairns raised on islands: on Washington Irving Island, Kane Basin (McCullough and Schledermann 2009; Schledermann 2000), and in Jones Sound, Ellesmere Island (Isachsen and Isachsen 1932).

Although not a marine shieling by present definition, the Kingittorsuaq runestone is central in that it presently provides the northernmost confirmed evidence of Norse activities in Greenland (i.e., perhaps even the northern extent of *Norðrsetr*). Importantly, the precise date of the raising of the cairns to April 24. Arneborg (2004) places Norse hunters in the region at such early time in the year that they could have overwintered in the vicinity or at least somewhere in the *Norðrsetr* (Nansen 1911). This timing would, as implied by the medieval written record, suggest the existence of Norse habitation sites in the northern parts of Greenland's *óbyggðir*.

NKHA 3630 ("The Bear Trap"), Pullassuaq, Nuussuaq, 70° Latitude

This likely Norse site includes a single ruin located on the seaward, exposed western tip of the Nuussuaq Peninsula's, northern Disko Bay (Fig. 1A, 5, and 6). While most scholars have agreed on the ruin's Norse origin, several functional interpretations have been offered: a polar bear trap (e.g., Egede 1740; Giesecke 1910; Pingel 1833; Steenstrup 1893); a provisional "cooler" for a deceased Norse hunter (Rosenkrantz 1967a); some form of house (Magnusen 1827b); a hunting cabin (Ingstad 1960); a storehouse for walrus and narwhal tusks (Ljungqvist 2005; Meldgaard 1965, 1995); or a chapel for Norse hunters in the *óbyggðir* (Meldgaard 1965).

The ruin is almost perfectly square with external measurements of ~4.4 × 4.4 m, Type 3c (Table 1) dry-stone double walls 1.10–1.78 m wide, and preserved to a height of ~1.6 m (Fig. 5 and 6). Considerable amounts of collapse stone are visible in an early perspective drawing (Steenstrup 1893:Fig. 1), supporting the estimate that the walls originally stood the height of a person (Meldgaard 1995). A narrow doorway leads into a room only 1.15–1.20 m wide. Unspecified "clearing" of this room in 1878 produced finds of some mussels and snails, bone of seal and caribou, and a single 13 cm-long tapered bone with a row of holes, assumed to be of Inuit make (Steenstrup 1893). A second "clearing" inside and outside the ruin in 1953 produced no finds (Meldgaard 1995). The two latest ruin survey plans show the ruin interior to have a narrow platform, although this is described as a small natural shelf (Fig. 5) (Meldgaard 1995; Rosenkrantz 1967a).

While lacking datable material or artifacts, NKAH 3630's Norse origin can be established with confidence based on architectural details that feature all characteristics distinct of Norse Type 3c dry-stone architecture (Table 1, Fig. 5 and 6). The ruin's clear resemblance to Norse dry-stone buildings—storehouses or *skemmur*—in the settlements has also previously been noted (Ljungqvist 2005; Meldgaard 1995; Steenstrup 1893). The combination of mussels, shells, and bones found during the 1878 clearing of the room is suggestive of deposits left by seabirds and foxes, although the pointed Inuit object remains puzzling. Inuit reuse of the feature, perhaps as a depot or cache, could be an explanation (Thule culture winter settlement NKAH 5085 lies just to the south). Based on its architectural traits and microtopographic setting, the "Bear Trap" is here interpreted as a Norse storehouse built to keep ventilated, dry, and cool whatever was stockpiled inside (i.e., a type of marine shieling of designated *marine waystations* in Table 3).

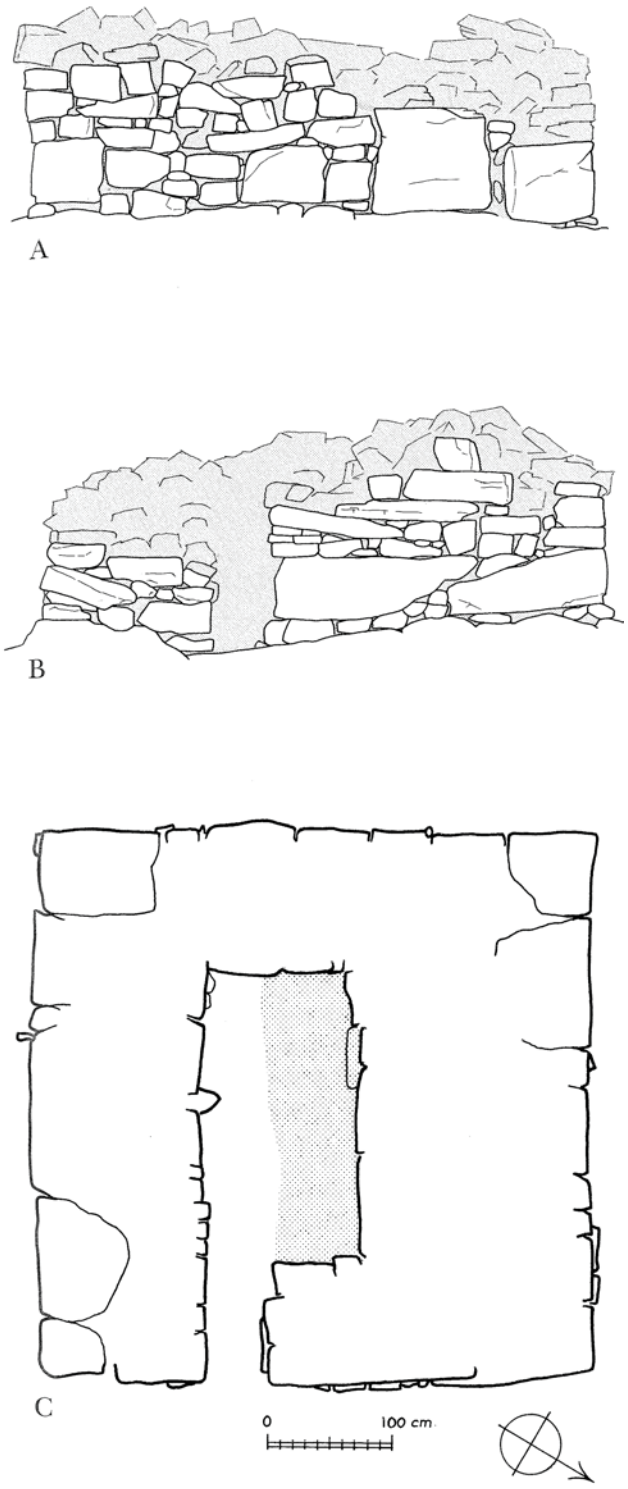

Figure 5. Detailed sketch plan of "The Bear Trap," NKAH 3630, Nuussuaq from the 1953 investigation and "clearing" of the ruin. The slightly raised natural "platform" in the northern inside half of the room is indicated (after Meldgaard 1995:Fig. e6).

Figure 6. A recent photograph of "The Bear Trap," NKAH 3630, Nuussuaq, looking northeast along the coast. Noticeable are the massive corner foundation stones and the small "stone wedges or pinnings." Both architectural features are characteristic of Norse building customs (photographed by Bo Albrethsen, 2012).

NKAH 3080, Innalik, 68° Latitude

The site includes one proposed Norse ruin located on the southwestern tip Innalik, a small island in a coastal archipelago facing the Davis Strait southwest of Disko Bay (Fig. 1A). Prior published descriptions are Bjørgmose (1967) and Petersen (1979).

The suggested Norse feature is described as having multiple rooms, external measurements of ~10 × 10 m, and turf walls ~1 m wide (Fig. 7). The ruin was shovel tested by Innalik local P. Sandgreen in the 1960s, who unearthed bones, a pair of bone spoons, arrowheads, fishhooks, harpoon parts, and a carved wooden figure resembling a hooded Norseman (Bjørgmose 1967; Petersen 1979).

The described artifact assembly from NKAH 3080 is clearly of later historical Inuit origin, and while the wooden doll may portray a Norseman, similar figurines have been found over a wide geographical area, mostly in Thule culture contexts (e.g., Gulløv 2008b; Sutherland 2000). Revisiting the published feature sketch plan (Fig. 7), NKAH 3080 appears to be a late Thule culture–early historical type Inuit winter house with cooking niches along a cold trap passage and not a Norse feature.

Norse Marine Shielings in West and South Greenland below 66° Latitude

NKAH 1107, Mitsimmavissuaq, Nuuk Fjord, 70° Latitude

The site includes one suggested Norse ruin located on the southern tip of Mitsimmavissuaq, an islet in

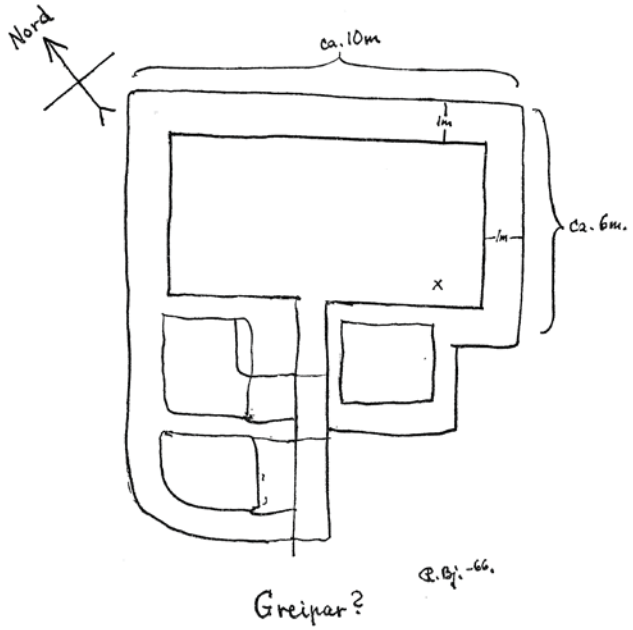

Figure 7. Rough sketch plan of the suggested Norse feature at NKAH 3080, Innalik, indicating (marked with x) where a carved wooden figure resembling a Norseman was found (after Bjørgmose 1967:91). Here, the feature is interpreted as a Thule culture or later Inuit winter house, partly because of the feature's layout that includes a long (cold-trap) passage with adjoining niches.

the coastal archipelago off the mouth of the Nuuk Fjord system (Fig. 1A). The ruin lies on a plateau only some 7 masl (Fig. 8) and is sheltered and little visible from all directions except if approached from the open Davis Strait to the southwest. Prior published descriptions are Berglund (1973), Gulløv (1983), and McGovern (1979). The author had the opportunity to survey the site on November 3, 2017.

The ruin appears roughly rectangular with external measurements of ~4.0 × 1.7 m and is fairly collapsed (Fig. 8 and 9). The southern end, however, preserves "a chamber" (or gable) built as single-skin (Type 3a) dry-stone wall, only ~40–50 cm wide, made from flattish stones stacked with no apparent order up to 12 intact courses high (~1 m). This stonework was never stable enough to support a roof, and neither is there enough surrounding collapse stone for the walls ever to have stood much higher.

Because of distance, sparse vegetation, and lack of substantial freshwater sources, terrestrial shieling use of Mitsimmavissuaq islet is inconceivable. Instead, the feature has been suggested as a Norse marine shieling related to the rich coastal wildlife (e.g., a *skemma,* Gulløv 1983), perhaps as a depot for storing seabirds and marine mammals in connection with outer fjord provisioning or travels to the *Norðrsetr* (Berglund 1973), or even

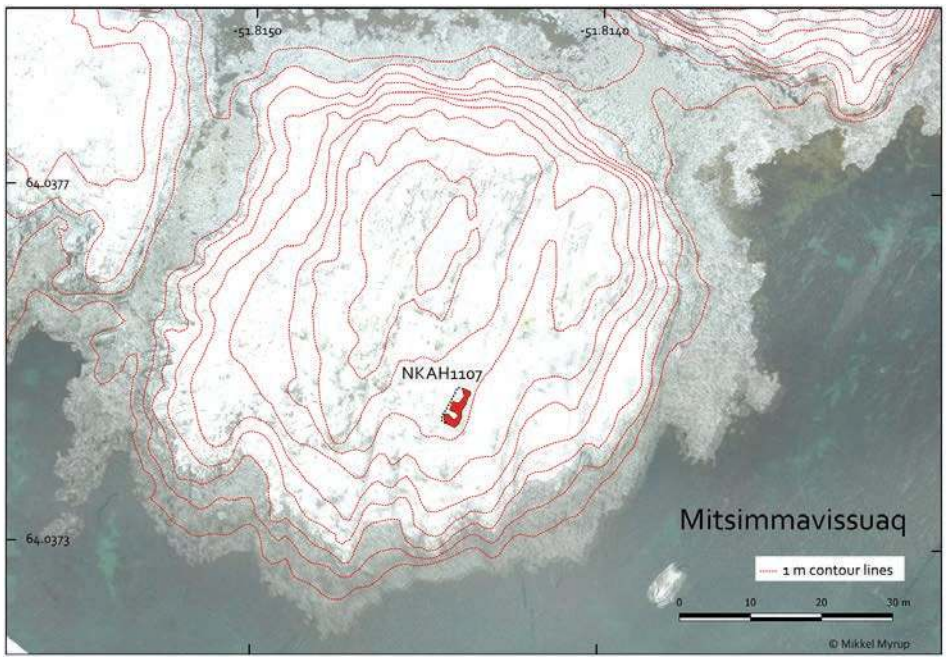

Figure 8. Detail survey plan of the suggested Norse feature at NKAH 1107, Mitsimmavissuaq (figure created by Mikkel Myrup, 2018).

Figure 9. A recent image of the suggested Norse feature at NKAH 1107, Mitsimmavissuaq, looking southwest. In the upper right, skerries at the edge of the open Davis Strait are visible (photographed by the author in 2017).

a marine-hunting station (McGovern 1979). However, the feature's architectural character and microtopographic setting (see Table 1 and 2) suggest that it was not Norse but more likely a shooting blind or shelter (Inuit origin?) (Gulløv 1983), possibly superimposing and reusing elements of an older turf-and-stone built, non-Norse feature.

NKAH 1417 (M20), Naajaat, Qeqertarsuatsiaat Kangerluat, 63° Latitude:

The site includes four Norse ruins occupying a reasonably sheltered small plain at the foot of ~500–600 m high mountains in Qeqertarsuatsiaat Kangerluat (Fiskenæs Fjord, Fig. 1A). Prior site descriptions used here are Albrethsen and Arneborg (2004), Bruun (1918), and Pingel (1832).

The larger two Norse ruins (Fig. 10), ruins *a* and *b* are both described as rectangular, Ruin *a* externally measures ~13.5 × 5.0 m and Ruin *b* ~20.0 × 6.5 m (Table 2). An 1829 survey describes the walls as poorly preserved (Pingel 1832:103), whereas 1903 fieldnotes mention walls made of "stone and some turf" in Ruin *b* preserved to a height of up to ~1.1 m (Albrethsen and Arneborg 2004:72). A perspective drawing from the same survey displays walls standing to below knee height (Bruun 1918:Fig. 36). The combined evidence suggests that both buildings had Type 1 walls raised on multicourse stone foundations (Table 2), which is supported by 1952 ruin sketches (Albrethsen and Arneborg 2004:Fig. 124 and 125). Ruin *a* had two entrances on its northern wall, while Ruin *b* had only one entrance on its southern wall, several internal divisions or rooms, as well as an annex to the north. 1829 and 1952 test excavations inside and outside the features

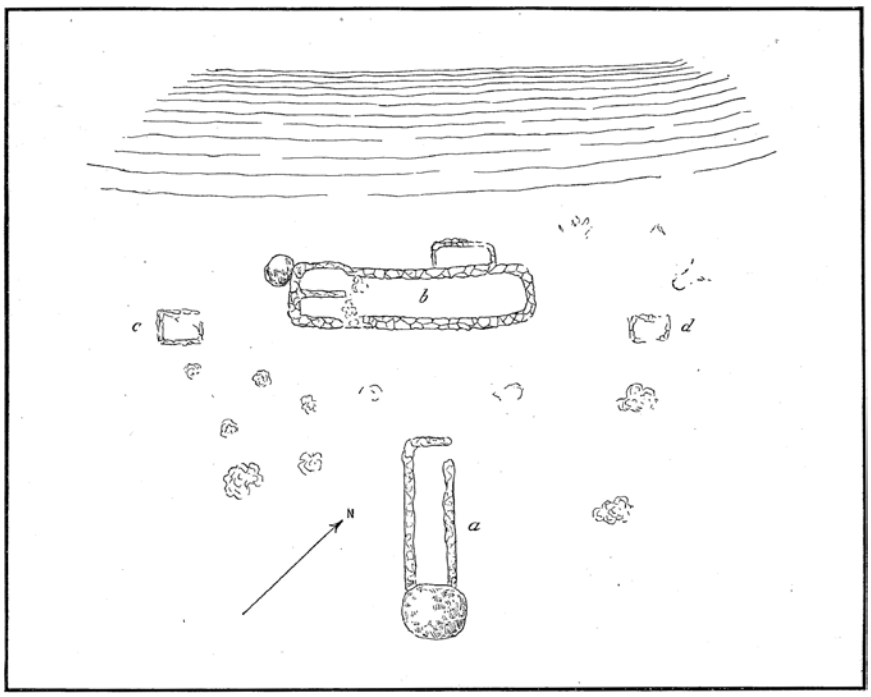

Figure 10. Site sketch overview plan of Norse site NKAH 1417 (M20), Naajaat. Ruins *a* and *b* are described and discussed in detail in the text (after Bruun 1917:Fig. 35).

revealed no finds or cultural deposits (Albrethsen and Arneborg 2004; Pingel 1832).

Surrounded by poor, shrub-dominated pastureland (Bruun 1918; Pingel 1832), and counting only four ruins with no trace of a home field, midden, or other cultural deposits, Bruun (1918:108) was surely correct in observing that NKAH 1417 was never a Norse farmstead proper. Instead, he suggested that the site was a "terrestrial" summer shieling and interpreted all four features as sheep and goat pens. However, the nearest known Norse farmsteads are NKAH 1416 at ~86 km to the north and NKAH 458 at ~185 km to the south. In contrast, normal maximum farm-to-shieling distances in the outer fjord *Eystribyggð* are ~10 km (Madsen 2014b:Table 7.2). Thus, it must seem highly improbable that the Norse should have ferried livestock—and based on the size of the assumed pens in quite considerable number—such long distances to poor-quality pasturelands.

The slight possibility exists that NKAH 1416 was a satellite to a still-undiscovered, nearby farmstead or that the site served to round up free-roaming sheep and goats. However, considering the insulating build of the walls of Ruin *a* and *b* (Table 2), the site is more plausibly interpreted as either as a short-lived attempt at establishing a remote farmstead or a temporary habitation for a group of people (i.e., a specialized or provisional basecamp in the *óbyggðir*). Resources in NKAH 1416's environs include good caribou-hunting grounds, char rivers, a large seagull colony on an island ~3 km southwest, and nearby spring ice-edge hunting for ringed seal (Bruun 1918).

NKAH 1415 (M19), Eqaluit, Allumersat (Bjørnesund), 62° Latitude

NKAH 1415 (M19) includes three to six Norse ruins occupying a sheltered, but somewhat shaded, setting at the head of an inlet by a bend of the Allumersat Fjord (Fig. 1A and 11). Prior site investigations used here are Albrethsen and Arneborg (2004), Bruun (1918), Jensen (1879), and Pingel (1833).

The largest ruin is described as rectangular with external measurements of 18.9 × 6.3 m, with (Type 1, Table 1) turfs walls ~1.6 m wide and preserved to a height of ~0.6 m. Two entrances were on the long eastern wall, but no room divisions were observed. Further, two to five ruins may have existed in the surroundings, but only two have been confirmed (Bruun 1918). Unspecified 1838 and 1878 excavations both inside and outside the main feature ruin only yielded some charcoal (Jensen 1879; Pingel 1833).

NKAH 1415 is interpreted as a specialized or provisional basecamp for Norse mariners or hunters in the *óbyggðir* on the same criteria as NKAH 1416: great distance to nearest farmstead; poor-quality pastureland (Bruun 1918; Pingel 1833); few recorded buildings, at least one of them of a size and built to facilitate habitation, including cold-period (Table 2), for several people; absence a home field or a midden area; and with only very slight cultural deposits.

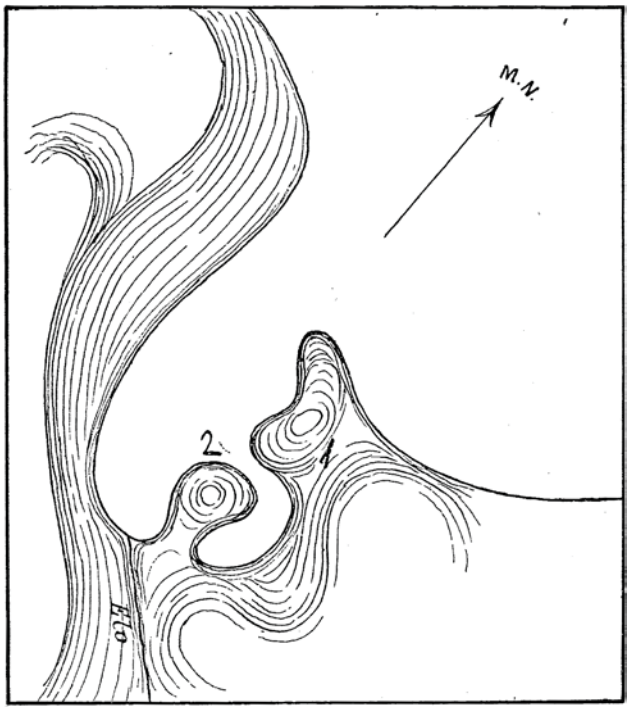

Figure 11. Site sketch plan overview plan of Norse site NKAH 1415 (M19), Eqaluit. No. 1 shows the setting of the Norse ruins described in the text; No. 2 a Thule culture or later Inuit summer fishing camp (after Bruun 1917:Fig. 39)

NKAH 5558, Qajartalik, Arsuk, 61° Latitude

The site includes one probable Norse ruin sited on an exposed plateau on the eastern side of the small and barren island Qajartalik (~0.2 km^2), which is separated from the mainland by a strait ~800 m wide (Fig. 1A and 12). The site was reported to the author by geologists from the Geological Survey of Denmark and Greenland (Karsten Secher, personal communication 2009) and has not been published before, although a nearby Thule culture winter settlement (NKAH 472) is recorded (Fig. 12) (Albrethsen et al. 1990). The below description is based on photos and Google Earth satellite imagery.

The ruin appears square of shape with estimated external measurements of ~3.8 × 3.7 m, dry-stone walls ~0.8–1.2 m wide, and featuring all the characteristics of Norse Type 3c stone architecture, including heavy cornerstones in three corners

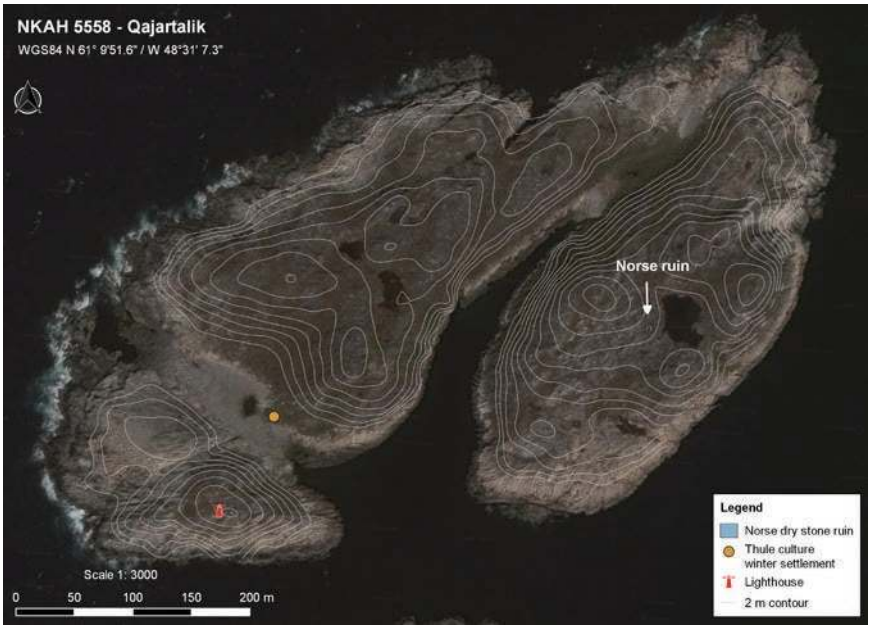

Figure 12. Site overview plan on Google Earth satellite imagery (V. 7.1.8.3036, November 8, 2015, DigitalGlobe 2019. http://www.earth.google.com) of Norse site NKAH 5558, Qajartalik. The plan also shows the location of a nearby Thule culture winter settlement and the modern, unmanned lighthouse (figure compiled by the author).

(Table 1; Fig. 13). The walls appear preserved to a height of ~1.5 m (9–10 courses), and substantial amounts of surrounding collapse stone suggest that they would originally have stood higher. A narrow doorway is located on the middle of the buildings southern wall, with a threshold raised slightly above the bedrock floor so that one steps down into the interior. Another unusual detail is what appears a small opening or window on the wall opposing the doorway.

Displaying the architectural characteristics of all Type 3c dry-stone wall (Table 1), NKAH 5558 most likely represents the remains of a Norse building, although a later historical European origin cannot be excluded. The building's wall material and building ground preclude prolonged cold-period habitation (Table 1 and 2). These factors, combined with a very wind exposed setting and nearby excellent landing conditions (Fig. 12; Table 2 and 3), suggest that the site could have been a marine waystation similar to NKAH 3630, if not a seasonal (summer-half of the year) marine-hunting station to Norse farmstead NKAH 440 (M11) ~3.7 km east or to the wider local Norse community in the area.

Figure 13. A recent image of the Norse ruin at NKAH 5558, Qajartalik, looking southeast. Note the fairly large building and cornerstones and use of "stone wedges" to level the wall's courses, all of which are architectural features characteristic of Norse building customs (photographed by Karsten Secher, 2009).

NKAH 2329 (Ø148), Ilorru, Itillinguaq, 61° Latitude

The site includes one or two Norse ruins located on a stony hillock beneath a steeply sloping mountain hinterland (300–400 masl) on the northern side of the Itillinguaq Fjord, about halfway between the Eastern and Middle settlements (Fig. 1A). Prior site investigations were undertaken by Nørlund (1921).

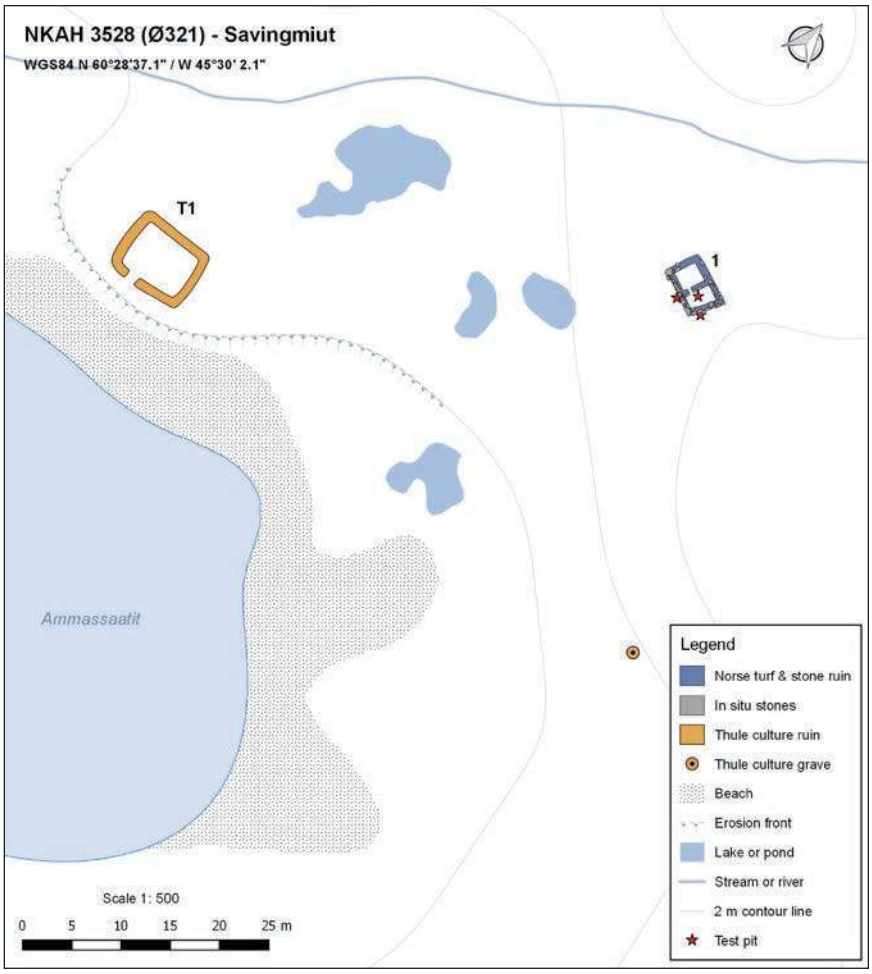

Figure 14. Site survey plan of NKAH 3528 (Ø321), Savingmiut, with indications of the possible Norse ruin and a later Thule culture winter house and smaller features, as well as the location of test pits excavated during the 2017 CIE/WiCP field campaign (figure created by the author).

The main feature—probably the remains of a dwelling—is described as completely collapsed, measuring ~15 × 12 m, and built of turf and stone. Another possible ruin was observed ~15 m southwest. Minor unspecified test excavation produced "no results of any value" (Nørlund 1921).

The poor quality of surrounding pastureland, lack of outbuildings, home field, midden or other cultural deposits exclude that NKAH 2329 was a farmstead. However, as also noted by Nørlund (1921), the site seems located too far away from the nearest farmstead—NKAH 2311 ~24 km to the east—to be a terrestrial shieling, which led him to suggest that site could have been the "refuge of a lawless person or the like." More likely the site functioned as a specialized/provisional basecamp like NKAH 1415 and 1417, with which it shares general geographic setting, resource access, and layout.

NKAH 3528 (Ø321), Savingmiut, Akuliarutsit, 60° Latitude

The site includes one suggested Norse ruin situated on a small rocky outcrop by a bay on the northern side of the tip of the peninsula between the Alluitsup- and Uunartup Kangerlua (Fig. 1B and 14). A nearby Thule culture winter house and many associated stone features will not be discussed here. NKAH 3528 was located by local school teacher Ove Bak in 1971 (Bak 1972) but not revisited by archaeologists until during the CIE/WiCP 2015 and 2017 field campaigns. In 2015, the ruin was DGPS-surveyed and surface recorded; in 2017, three 0.5-×-0.5-m trenches—one inside and two outside the ruin—were excavated (Fig. 14).

The supposed Norse feature is rectangular with external measurements of 5.5 × 3.8 m, divided into two rooms, and with a well-preserved

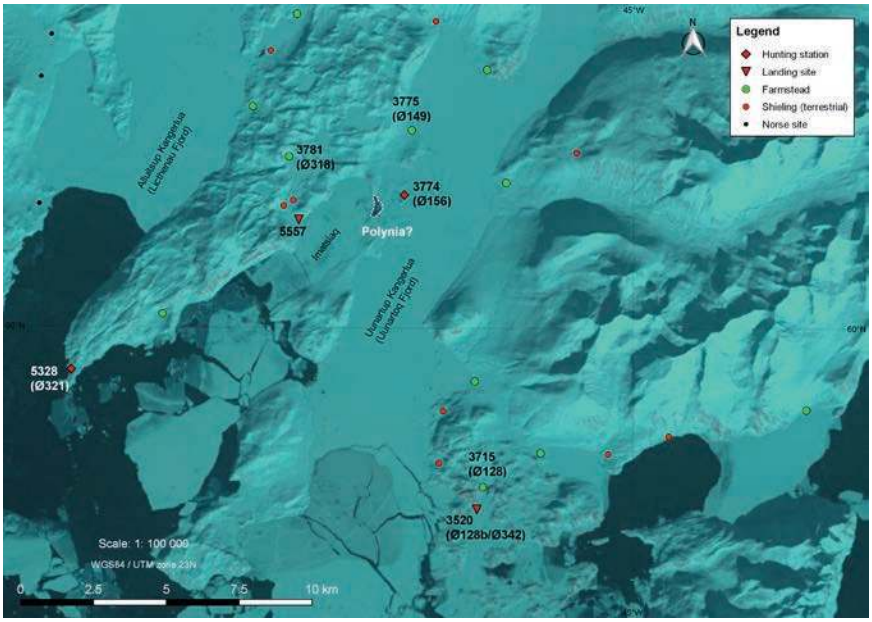

Figure 15. Wintertime (March 27, 1993) LT05 Landsat satellite imagery (credit: U.S. Geological Survey, USGS. https://landsatlook.usgs.gov/viewer.html) of the middle CIE/WiCP study area with indication of marine shielings, farmsteads, and terrestrial shielings, as well a possible small polynya near NKAH 3774 (Ø156). Farmsteads mentioned in the text are numbered.

Type 2 wall double-row stone foundation (Table 1) ~0.5–0.9 m wide. Limited amounts of collapse stones are seen, the ruin's western half having wider walls and more collapse stone than the eastern half. The stonework is made from angular, medium-sized stones and does not appear distinctly Norse, which raises a concern also voiced by Bak (1972) that it could be a ruin of a later historical building?

The three test pits excavated in 2017 (Fig. 14) all revealed very shallow (<20 cm) stratigraphies with hardly any cultural inclusions. However, in the easternmost test pit, a thin horizon with a few bits of charcoal was observed just above the bedrock. Charcoal samples from this layer were speciated as pine and heather (Susan Ramsay, personal communication 2017) but an attempt to date the latter sample (SUERC-77463) came back with a fraction value indicative of nuclear era (post-AD 1950) (i.e., would seem a later disturbance). A piece of window glass in another test pit also implies some recent activities.

If NKAH 3528 is a Norse site, a terrestrial shieling function is disqualified by its setting on the very sparsely vegetated and much wind exposed Akuliarutsit headland that projects out into open ocean and, in spring and summer, floes of drift ice. Contrariwise, this setting at the strong-current cross-over between two fjords (Fig. 1B and 15) sustains very rich marine wildlife. With Type 2 insulating turf-and-stone walls and a sheltered setting, the building must have facilitated habitation, although the bedrock building ground, limited wall widths, and thin cultural deposits preclude prolonged (cold-period) occupancy. Instead, NKAH 3528 could have been a temporarily occupied marine-hunting station, perhaps under Norse farmstead NKAH 3525 (Ø157) ~4 km to the north or serving a couple of farms in the fjords. Alternatively, the feature is the remains of a late historical sod-and-stone house.

NKAH 5557, Kuuk, Uunartup Kangerlua, 60° Latitude

The site includes one sheltered Norse ruin cut slightly into a gravel shelf just above the shore and at the foot of gently sloping low mountains (100 masl) on the northern side of the Imatsiaq Strait, about one third into the Uunartup Kangerlua (Fig. 1B, 15, and 16). The site was located by Bak (1972a) in 1967–1968 but not subsequently revisited until the CIE/WiCP 2015 field campaign, during which the ruin was DGPS-surveyed and surface recorded. Nearby Inuit summer-camp features are not discussed here.

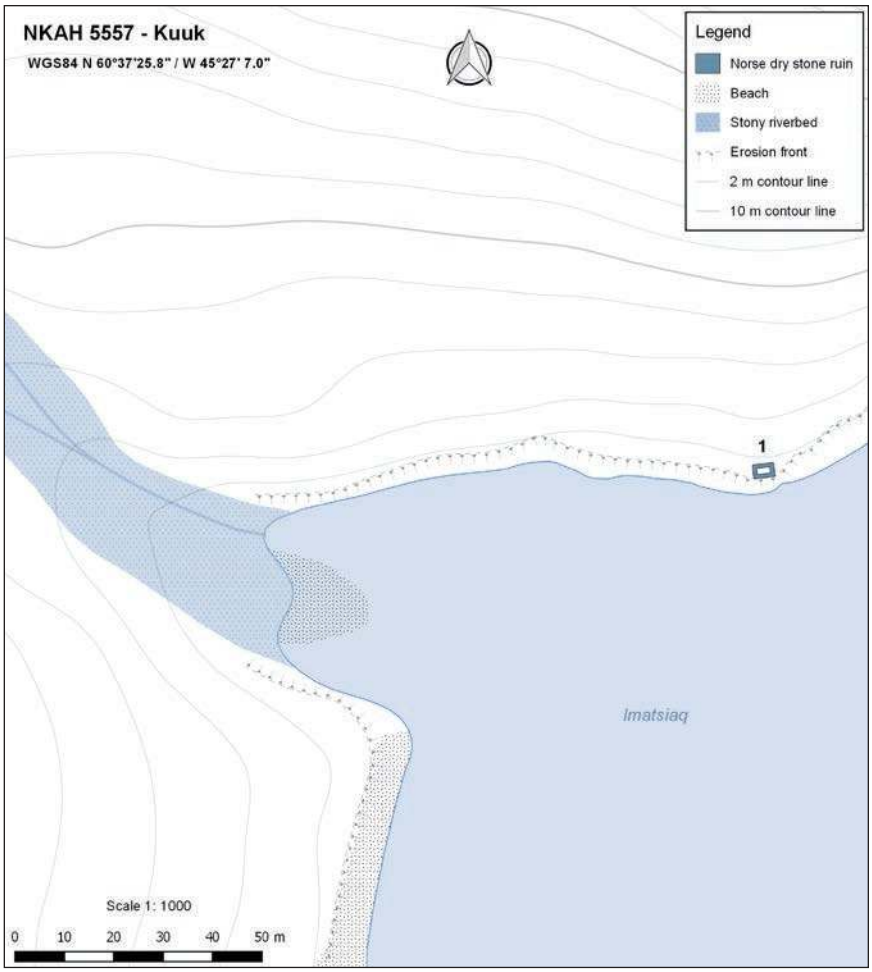

Figure 16. Site survey plan of NKAH 5557, Kuuk, with indications of the Norse ruin and nearby Kuuk River (map created by the author).

The ruin is rectangular with external dimensions of ~4.4 × 2.9 m (Fig. 16). Although heavily collapsed, it is still possible to observe Type 3d (Table 1) double stone walls ~0.8–0.9 m wide, made from large rounded stones, and with a heavy northwest cornerstone. The western gable is still preserved to a height of ~1 m (three to four courses). Large numbers of collapsed stone imply that it was a building raised completely in dry stone.

NKAH 5557 was probably a satellite to the sizable NKAH 3781 farmstead located ~2 km inland to the north (Fig. 15). With a dry-stone build, located near fjord but still in a fairly sheltered setting, neither habitation nor ventilation was the primary function of the building (Table 2 and 3) (i.e., it is unlikely to have served terrestrial shieling functions). Instead, it is suggested that NKAH 5557 was a sturdy and dry storage structure for tools and equipment used by the fjord (i.e., a marine-landing site to farmstead NKAH 3781).

NKAH 3774 (Ø156), Qajartalik, Uunartup Kangerlua

NKAH 3774 includes two Norse ruins located on the northern tip of the small island Qajartalik (~0.7 km^2) about halfway into, and on the western side of, the Uunartup Kangerlua (Fig. 1B and 15). Both features lie just above a small stony beach, the extremely sheltered and partly shaded Ruin 1 being dug slightly into a gravel surface against a low vertical cliff, whereas Ruin 2 lies on a more exposed gravel terrace just 20 m northwest (Fig. 17), where it receives both more wind and sunlight. Prior site descriptions are Bak (1972) and Vebæk (1968). NKAH 3774 was visited twice during the CIE/WiCP field campaigns: in 2015,

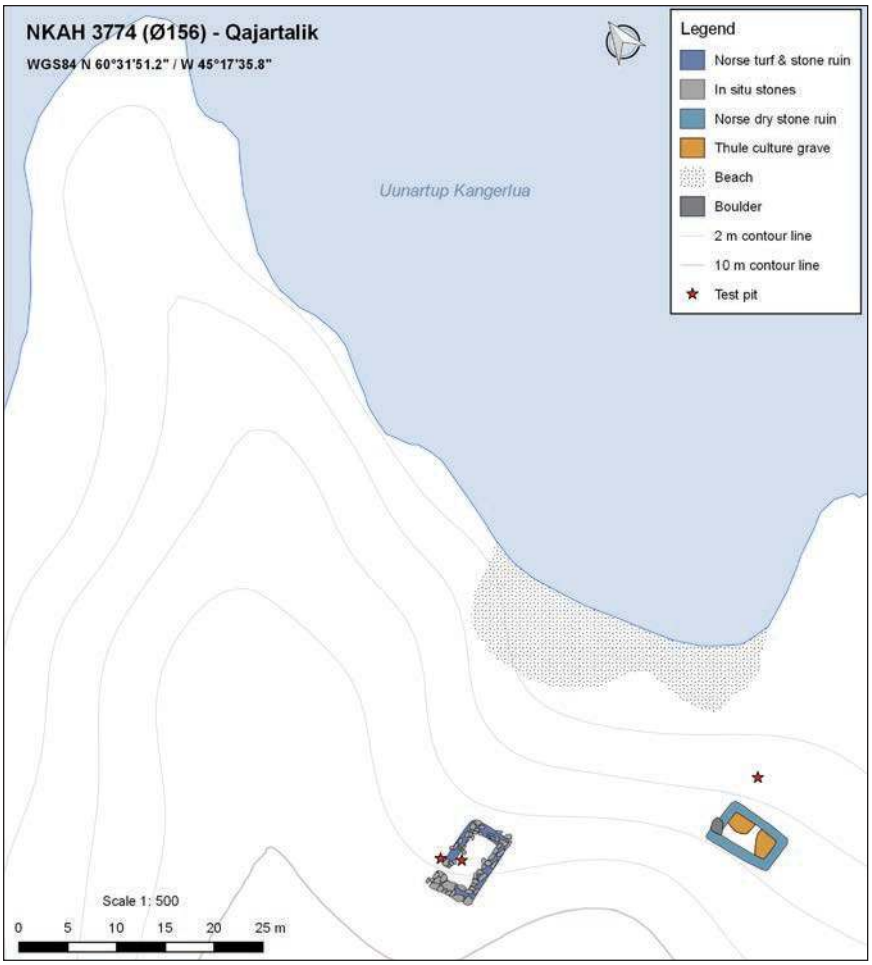

Figure 17. Site survey plan of NKAH 3774 (Ø156), Qajartalik, showing the two Norse ruins, Inuit graves inside Ruin 1, as well as the location of test pits excavated during the 2017 CIE/WiCP field campaign (map created by author).

the ruins were DGPS-surveyed and surface recorded; in 2017, three 0.5-×-0.5-m trenches—one inside and two outside the ruin—were excavated (Fig. 17).

Both ruins are well-preserved, rectangular, of similar size (Fig. 17) but of very unlike build: Ruin 1 measures ~7.4 × 4.8 externally and has Type 3d double dry-stone walls ~0.9–1.2 m wide (Table 1 and 2), preserved to a height of ~1.2 m (four heavy courses), and with massive cornerstones. Judging from the amount of collapse stone—part of which has been reused to construct Thule culture burials inside the feature—Ruin 1 originally had walls standing at least 1.5 m high. Ruin 2 has external measurements of ~8.0 × 4.7 and Type 1 walls (Table 1 and 2) preserved as an almost intact double-row stone foundation ~1.0–1.4 m wide in one to two courses. A doorway ~0.6 m wide is in the ruin's northwestern corner. Hardly any collapse stone is visible but neither is turf or grass, and the wall's turf superstructure thus appears to have completely disintegrated.

The three test pits excavated in 2017 (Fig. 17) all revealed very shallow (~15–30 cm) stratigraphies with few cultural inclusions. However, in one test pit, a thin vegetation horizon with three pieces of charcoal was discovered just above natural gravel. The charcoal sample was speciated as pine (Susan Ramsay, personal communication 2017). Although clearly driftwood, one sample (SUERC-77462) was dated to exclude a recent origin of the features perhaps, yielding a calibrated age (OxCal v4.3.2., IntCal 13 atmospheric curve) of AD 1222–1280 (2σ), confirming the sites Norse origin.

Noting Qajartalik's extremely poor grazing potential and lacking freshwater sources, it is suggested that NKAH 3374 was a Norse marine-hunting station, where the insulated turf building (Ruin 2) facilitated temporary, including

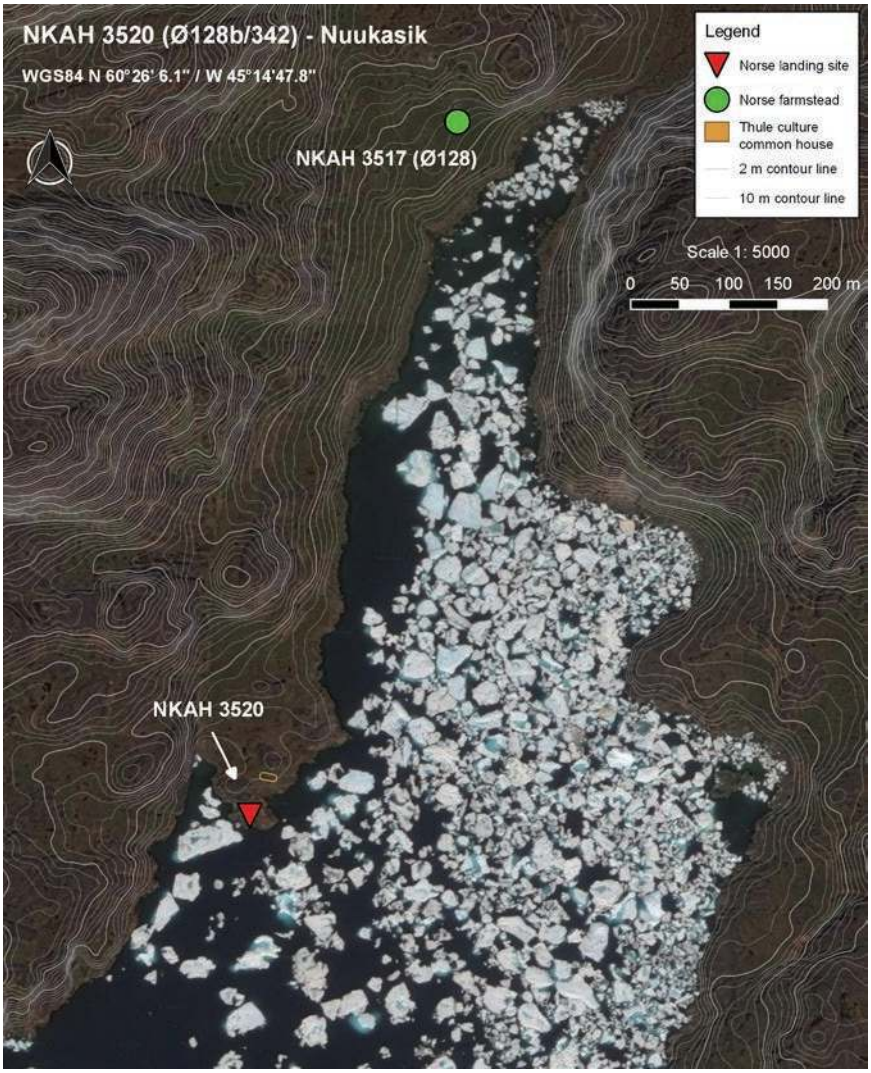

Figure 18. Site survey plan on Google Earth satellite imagery (V. 7.1.8.3036, July 2. 2014, DigitalGlobe 2019. http://www.earth.google.com) of NKAH 3520 (Ø128b/Ø342), Nuukasik, with indications of the nearby Norse farmstead NKAH 3717, the later Inuit settlement of Qunnermiut. As seen in the imagery, drift ice clutters the inlet with the farmstead and settlement, making NKAH 3520 a more optimal landing site.

cold-period, habitation for hunters, while the sheltered stone building (Ruin 1) served as marine tool and equipment store (Table 2 and 3). Qajartalik is part of an ice barrier at the head of the Imatsiaq Basin, where masses of summer drift ice is trapped and creates a cold microenvironment rich in seal and today still serving as favored summer hunting grounds for local Inuit from the Alluitsup Paa settlement. During the winter half of the year, the marine shieling may have served to ease hunting from the fjord's ice edge or by a nearby small polynya indicated by satellite imagery (Fig. 15).

NKAH 3520 (Ø128b/Ø342), Nuukasik, Qunnermiut Ikerasaat, 60° Latitude

NKAH 3520 includes one Norse ruin located on a spit of bedrock on the western shore of the sheltered basin Qunnermiut Ikerasaat between the fjords of Uunartup Kangerlua and Sermilik (Figure 1B, 18). Prior site investigations are Albrethsen (1971) and Bak (1972) The site was DGPS-surveyed and surface recorded during the 2014 WiCP/CIE field campaign (Fig. 18 and 19). Nearby Thule culture features will not be discussed here.

Figure 19. Photo looking southeast towards the small outcrop with the ruins of landing site NKAH (Ø128b/Ø342) and the remains of a dinghy once used by local Inuit from the nearby settlement of Qunnermiut (photographed by the author in 2014).

The Norse ruin is highly disturbed by a recent stone and concrete Inuit boathouse (Fig. 19) but can be partly reconstructed from the remaining foundations combined with 1971 photographs from the Danish National Museum archives. The Norse feature was a rectangular building with external dimensions of ~4.2 m by at least 5 m and a heavy double-row Type 3d wall foundation, measuring ~0.9 m wide and preserved in one course (Table 1–2). Collapsed stone lying around the cliff and reused in the later Inuit boathouses supports that it was originally a dry-stone building.

NKAH 3520's ruin is interpreted as a marine tool-and-equipment store (i.e., a site serving as a landing site to nearby Norse farmstead (NKAH 3517 (Ø128)) situated ~700 m north, where there are also the considerable remains from the Thule culture and the later Inuit settlement of Qunnermiut—a testimony to the rich marine wildlife of the area. However, as the narrow and shallow inlet by Qunnermiut itself is liable to freeze or get clocked by drift ice, both the Norse and later Inuit site was placed to ensure better access to open fjord waters (Fig. 18 and 19).

NKAH 4468, Kangeq, Sermersooq, 60° Latitude

NKAH 4468 includes one certain and two or three possible Norse ruins located on a sheltered, gravelly terrace at the foot of steep mountains on the southern tip of Sermersooq Island (Fig. 1B and 20). A prior site description was made by Raahauge et al. (2002). The two or three possible Norse features are to be located by a Thule and later Inuit settlement (NKAH 3611) ~700 m to the west but were not noticed during other surveys (Bak 1971; Mathiassen and Holtved 1936). Neither were they found during the 2016 WiCP/CIE field campaign, at which time Ruin 1 was DGPS-surveyed and surface recorded, and three test pits excavated (Fig. 20).

The fair-sized Ruin 1 is rectangular with external measurements of ~22.0 × 10.5 m and well-preserved ~1.1–1.5 m wide Type 1 turf walls (Table 1 and 2) that outline at least seven rooms: three central rooms lie in a linear arrangement with additional rooms added to both sides (Fig. 19). Three 2016 test pits revealed no traces of midden deposits or manuring of a possible home-field area.

Situated in very poor pastureland without home field, midden deposits, or adjacent outbuildings, but presenting a heavily insulated, sizable building, NKAH 4468 is interpreted as a Norse specialized/provisional basecamp for a group of people, who most likely were hunting crews engaged in seasonal hunting on migratory seal species that pass close to the tip of Sermersooq. The richness of this marine environment is attested by the nearby Thule and later-Inuit site of Kangeq (NKAH 4468), which even today serves as an important Inuit marine-hunting camp.

Norse Marine Shielings in East Greenland

NKAH 1506 (Ø117), "Rolf's Ruin," Narsaq, Kangerlussuatsiaq (Lindenow Fjord), 60° Latitude

NKAH 1506 includes one, perhaps two, Norse ruins located ~16 km into, and on the northern side of, the 60 km-long deep Narsaq, Kangerlussuatsiaq in East Greenland (Fig. 1A and 21). The larger ruin occupies a fairly sheltered setting on the upper edge of a gravelly plain at the foot of a mountain slope ~100 m from the shore, while a small animal pen is located a bit higher on the slope. Prior investigations at the site include Bendixen (1929), Brodbeck (1882), Giesecke (1825), Holm (1889), Mathiassen (1936), and Nørlund (1932a,b), as well as notes and a photo from a nonscientific expedition in 1982 (Andersen 1982:271, 2006).

The main ruin is described as rectangular with external measurements of ~28 × 9 m and with Type 1 turf walls preserved only as ~1.0 m wide foundation of extremely heavy foundation stones (Table 1 and 2) (Andersen 2006:271; Nørlund 1932b). Existing survey plans display the ruin as divided on at least three rooms and heavily disturbed by later Thule culture winter houses (Fig. 22) (Bendixen 1929:167).

Bendixen (1929) was undoubtedly right in concluding NKAH was not a farmstead but rather

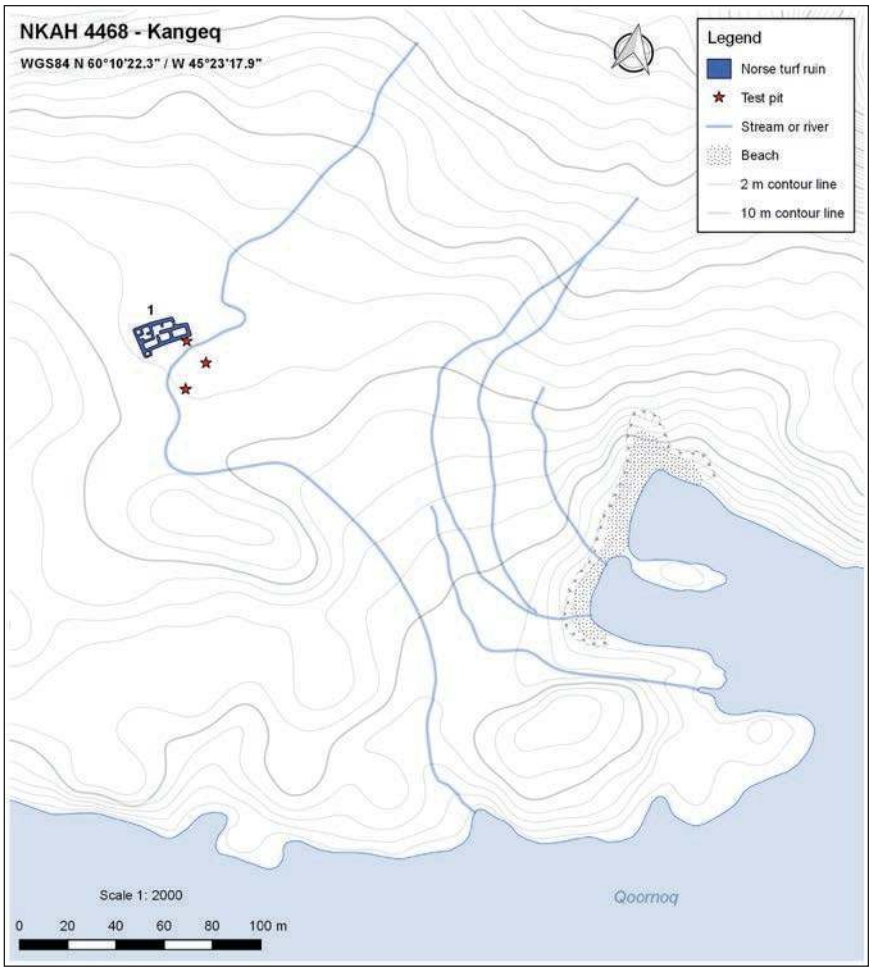

Figure 20. Site survey plan of NKAH 4468, Kangeq, showing the Norse ruin, as well as the location of test pits excavated during the 2017 CIE/WiCP field campaign (map created by the author).

some form of temporary site, an interpretation that is supported based on the site's remoteness; lack of outbuildings, a home field, and midden or refuse deposits; and poor-quality pastureland. Being a sizable feature, with thick Type 1 insulating walls, the building could have served as a specialized/provisional marine basecamp used by Norse hunting crews during their trips to Greenland's east coast. The presence of a single sheep pen need not conflict with such an interpretation, as they could have easily brought a few sheep/goats on the seasonal but probably months-long hunting trips.

NKAH 3304, Iluillup Qeqertaa, Iluileq (Dannell Fjord), 60° Latitude:

NKAH 3304 includes one unconfirmed Norse ruin that lies among Thule and later-Inuit features by a bay on the southern side of the small island of Iluillup Qeqertaa (0.19 km^2), which sits in an archipelago at the mouth of the fjord Iluileq (Fig. 1A). Prior site descriptions include Gulløv (1999), Holm (1889), and Mathiassen (1936), but only Andersen (1982) reports the possible Norse feature.

The ruin is described as a rectangular feature with measurements of ~5.0 × 4.0 m, built of very large stones, and heavily overgrown with willow (Table 2) (Andersen 1982). Despite an intensive surface search, no tools were found.

Lacking plans or photos, the proposed Norse ruin on Iluillup Qeqertaa must, for now, be regarded as highly doubtful, and it is alarming that only Andersen (1982 has reported this, apparently rather substantial, feature. If indeed a Norse feature, the size and build of the ruin would imply functionality as a seasonally occupied hunting station or a marine waystation, which could explain

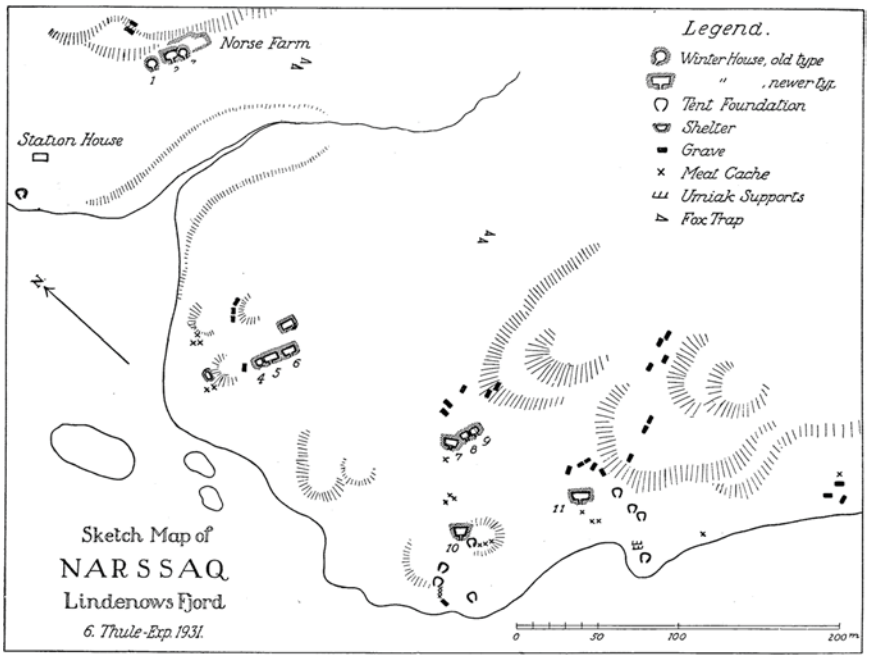

Figure 21. Site sketch overview plan of the Narsaq plain with Norse site NKAH 1506 (Ø117)—"Rolf's ruin"—and Thule culture site NKAH 1941 (after Mathiassen 1936:Fig. 1).

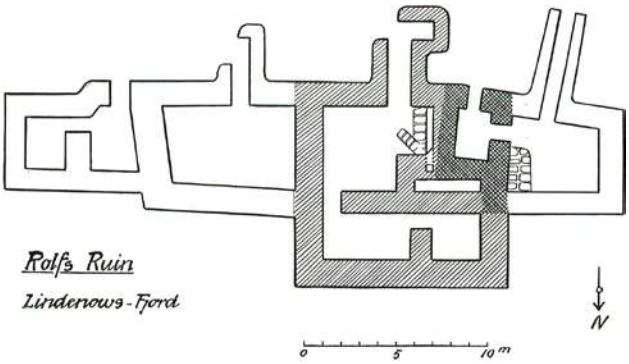

Figure 22. Previously unpublished sketch survey plan of the main Norse ruin at NKAH 1506 (Ø117) based on an original, coarser sketch in Poul Nørlund's field diary (1932:23), both found in the archives of the National Museum of Denmark.

the site's setting in the outermost fjord at the edge of the open ocean and drift-ice floe.

NKAH 2046, Avaqqat, Avaqqat Kangerluat, 61° Latitude:

The site includes one suggested Norse ruin located at the head of an inlet on the northern side of the Karrat promontory by the mouth of Avaqqat Kangerluat (Fig. 1A), where good natural sheltered harbors and tent sites are mentioned (Holm 1889:174). However, the only existing record on the Norse ruin is from Andersen (1982). A later attempt to relocate the ruin did not manage to reach the site (Gulløv 1999).

The suggested Norse ruin is described as a "very old feature" measuring 7 × 5 m (Table 2), clearly rectangular of shape, and built of large stones, with one long side somewhat collapsed. Intensive surface search produced no artifacts (Andersen 1982). Unfortunately, no plan of the site has been published, but a photograph from Andersen's (1982:6) report shows a grassy surface with a large heap of collapsed medium-sized stone surrounding a central feature of somewhat larger stones, some of which are obviously lying in courses.

While NKAH 2046's possible Norse ruin certainly does not look to be of Thule culture or later Inuit origin, there is a chance that it could be the remnants of a later historical European building: a canon was found on a site (NKAH 3320) on the southern side of the Karrat headland, probably left behind by a marooned 18th-century whaling crew (Graah 1832:77). However, if the ruin is Norse, the large amount of collapsed medium-sized stones suggests that it was not a cold-period habitation building but perhaps a small marine-hunting station or waystation.

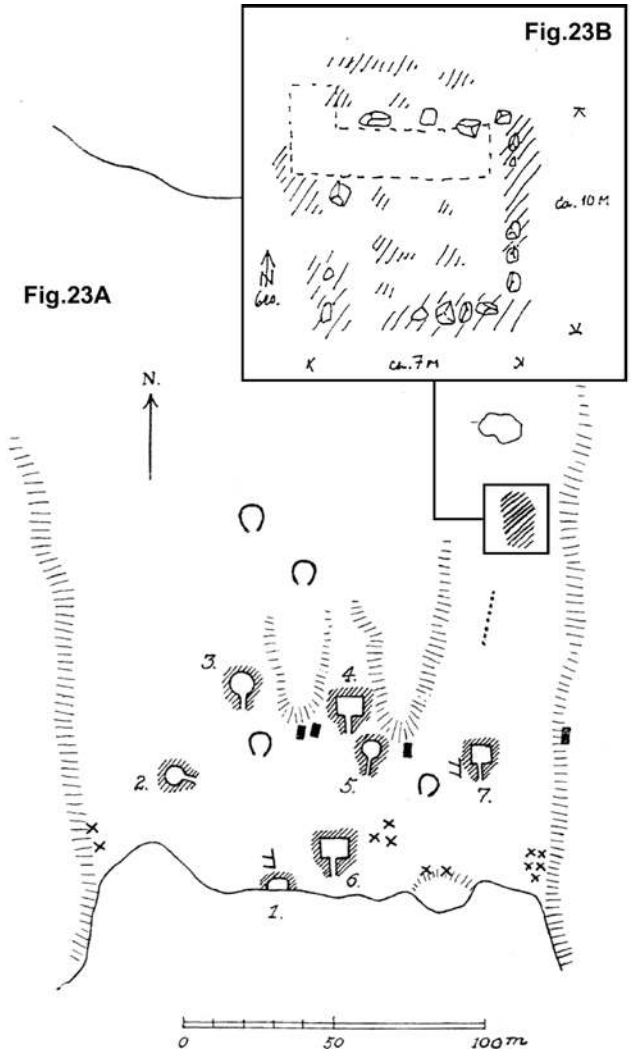

Figure 23. A. Site sketch overview plan of NKAH 3358, Timmiarmiut, showing the Thule culture settlement features and an indication of the possible Norse ruin test excavated by Nørlund in 1932 (after Mathiassen 1936:Fig. 13). B. Detailed sketch plan of the possible Norse ruin with indication of individual stones and the trench excavated by Nørlund in 1932 (after Gulløv 1999:23).

NKAH 3358, Timmiarmiut, Timmiarmiit Kangertivat, 62° Latitude:

The site includes one possible Norse ruin placed near some Thule culture and later Inuit features on a narrow isthmus below a steep bird cliff about one third into the Timmiarmiit Kangertivat (fjord) (Fig. 1A and 23). Prior site descriptions are by Graah (1832), Gulløv (1999), Holm (1889), Mathiassen (1932, 1936), and Nørlund 1932a).

The ruin is described as a low, uneven, and grass-covered hummock, measuring ~10.0–11.5 × 9.0 m (Table 2), littered with largish stones of varied size and shape. Some of these stones appear to form lines along the edges of the hummock (Fig. 23B), which was disturbed by a cache in the northeastern corner (Mathiassen 1932). Unspecified test excavation led the latter archaeologist to interpret it as a natural feature, an opinion shared by Gulløv (1999).

However, Norse archaeologist Poul Nørlund had also carried out test excavation of the feature in 1932 and that same year wrote of the results in a letter to Knud Rasmussen:

> I, therefore, settled with excavating a trench in the northern side of the ruin, where there were refuse layers. Among the refuse was lots of stone and turf lumps, which thus have been the building material (the stones were in part rather large). I found quite a bit of charcoal and especially—at a depth of ~75 cm—a great number of charred bones. . . . I also found a small sherd of a soapstone vessel (author's translation of Nørlund 1932a:2).

Nørlund's (1932b:30–35) field notes contain a similar brief description of the investigation, although he there adds that there was also some disturbance and activity by the later Thule occupants. Whether Norse or not, Nørlund's brief description rules out that the feature should be natural.

The Timmiarmiut region was historically an important maritime logistic nodal point because the environs of this fjord offered the first hospitable, vegetated, and ice-free lands after an almost 200 km stretch of rugged and glaciated coastline from Kangerlussuatsiaq (Lindenow Fjord) (Graah 1832; Holm 1889; Mathiassen 1936). The region also offered some of the best marine-hunting grounds on Greenland's east coast, which prior supported a fairly dense Inuit population. Large seabird colonies and steatite sources were also found there (Graah 1832). Based on this setting, and the description of the possible Norse ruin, the site appears a likely candidate for a second Norse specialized/provisional basecamp in East Greenland. Timmiarmiut was also one of the sites recurrently suggested when 19th-century European explorers asked local Inuit about the possible existence of Norse sites in East Greenland.[2]

Discussion of the Archaeological Evidence on Norse Marine Shielings

This survey of possible Norse marine shielings in Greenland is clearly hampered by the varied level of detail in site records, a lack of excavations, and the small number of sites. Reviewing the 17 sites examined here (Table 3), three can be dismissed as not Norse (NKAH 1107, 3080, and 3789), four sites are highly uncertain Norse (NKAH 2046, 3304,

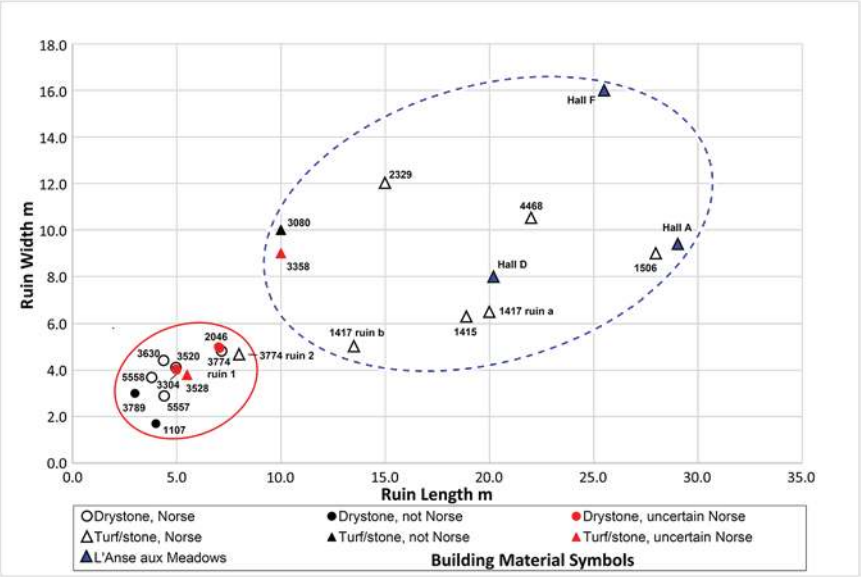

Figure 24. Plot of lengths, widths, and building materials (see Table 2) of the Norse ruins considered as possible marine shielings in Greenland, as well as three comparable features from L'Anse aux Meadows, Newfoundland. The two main clusters of dry-stone and turf/stone buildings are highlighted by red (solid) and blue (dashed) ellipses, respectively; other plot details are discussed in the text.

3358, and 3528), three sites appear to be shielings with a multipurpose, more-terrestrial orientation (NKAH 1415, 1417, and 2139), leaving eight sites that appear distinctly Norse marine shielings (NKAH 1506, 3529, 3520, 3630, 3774, 4468, 5558, and 5557).

The few examples of verified Norse marine shielings is in itself a cause for concern, and several explanations must be considered:

1. That the extent and regularity of Norse hunting in the *óbyggðir* was less than implied by the medieval written and zooarchaeological evidence;
2. That Norse marine shielings have not been systematically searched for, or in the wrong places;
3. Third, when tentatively identified outside the settlement areas, potential Norse sites are submitted to more critical demands for verification;
4. They are hidden under later Thule culture features. The present author believes all but the first of these factors to be in play and that Norse marine shielings are underrepresented, especially within the settlement areas.

At the same time, however, considering the small Norse population, it should also be emphasized that the scale the marine hunting in the *óbyggðir* was probably never great. Most likely, no more than a handful of crews were ever working simultaneously, returning to the same few sites year after year.

General Trends

Figure 24 plots the dimensions of the 22 ruins considered here, as well as their main building material (Table 2), including three Norse dwellings at L'Anse aux Meadows, Newfoundland. There are two discernible clusters: first, a cluster of mostly dry-stone ruins of fairly uniform size; second, a more variable cluster of larger turf/stone buildings. Two non-Norse dry-stone ruins (NKAH 1107 and 3789, black dots in Fig. 24) plot as faint outliers to the confirmed Norse dry-stone cluster, whereas uncertain dry-stone ruins (red dots in Fig. 24) overlap, perhaps adding credibility to their interpretation as Norse? In the set of turf/stone ruins, there are two outliers: NKAH 3528's uncertain Norse ruin and NKAH 3774's Norse Ruin 2 (red- and white-filled triangles in Fig. 24, respectively). Both are suggested as periodic marine-hunting stations, because of their relatively thin walls and only partly sheltered setting (Table 2 and 3). Otherwise, Fig. 24 mainly shows the greater dimensional variability the turf/stone ruins, probably reflecting their greater functional variability, also implied by their multiroom layouts (Table 2).

Reviewing Table 2, there is a good correlation between ruin details and the functional classification scheme (Table 1): Type 1 or 2 turf or turf/stone buildings have slightly wider walls than Type 3 dry-stone buildings (i.e., reflecting the former's insulating properties). This correlation is also supported by building ground and wind-exposure settings, where all but one (NKAH 3528) Type 1 or 2 turf or turf/stone buildings occupy sheltered or partly sheltered, less heat draining soil surfaces (Table 2). For added heating, turf and turf/stone buildings are usually orientated to maximize sunlight exposure of one longwall (Roussell 1941).

In contrast, Type 3 dry-stone buildings are found on both soil and bedrock surfaces, and in sheltered to fully exposed settings, mirroring the previously described functional variation within the set. For instance, the two Type 3c dry-stone buildings (NKAH 3630 and 5558) sit on bedrock surfaces in fully wind-exposed terrain (Table 2) (i.e., for maximized ventilation and cooling), whereas the Type 3d dry-stone buildings occupy more-sheltered settings, on soil or bedrock surfaces (i.e., ventilation was not a primary factor in their placing).

Observed irregularities in the set can owe equally to flaws in the classification scheme (Table 1), the inclusion of non-Norse buildings, and differences in the archaeological surface recording of often dilapidated Norse ruins. One of the most noticeable outliers on several observation criteria is NKAH 3528's uncertain Norse ruin, which is the only turf or turf/stone building with combined small dimensions, thin walls, and bedrock building ground (Table 2), adding to the already-noted concern that it could be a later historical feature. NKAH 1415's Ruin 1 stands out from the other turf and stone/turf buildings with its north-south orientation, but this may have more to do with the unusual shaded site setting (Table 3), which points strongly to the periodic or provisional character of the site.

Table 3 summarizes the key site observation parameters for the 17 Norse sites investigated, as well as their suggested functional interpretation: all sites are characterized by absence of homefields, middens, or other substantial cultural deposits; sites facilitating human cold-period habitation occupied a sheltered and sunny settings with good to average landing conditions; and sites that were more periodically occupied, NKAH 3774 and problematic NKAH 3528, as well as shaded NKAH 1415, were apparently less oriented for maximum sunlight exposure. The only site to appear truly anomalous with poor landing conditions is NKAH's 1107, one of the sites dismissed as being Norse.

Norse Marine Shieling Types

Combining ruin and site selection criteria with geographical setting and resource access, at least four types of Norse marine shielings can be tentatively identified:

Marine waystations (NKAH 3630, 5558, and perhaps 3304) are interpreted as food (and equipment?) stores placed at advantageous and visible points along main Norse sea routes, functioning simultaneously as maritime nodal points, landmarks, depots, and safe harbors. With Type 3c dry-stone walls, bedrock building grounds, and wind-exposed settings (Table 2 and 3), the associated buildings must have served to keep ventilated, dry, and cool whatever was stockpiled inside (i.e., long-term storage and curing of foodstuffs or other organic materials). While these organic materials could have been walrus and narwhal tusks as suggested by some authors (Appelt and Gulløv 2009; Meldgaard 1995), it seems somewhat questionable that Norse hunters would have abandoned their valued bounty for any length of time considering the possible presence of competing crews and, from at least the 13th century, numerous Thule culture groups (Appelt and Gulløv 2009). At any rate, the two convincing Norse sites are topographically positioned in such a way that ships taking a near-coast, inner-skerries route along the coast would inevitably pass by them.

To the author's knowledge, there are no direct North Atlantic parallels to such marine waystations, but they functionally compare to maritime transit systems with fixed "landing places" known from Viking Age and Medieval Scandinavia, which also served to increase expedient and safe sea travels and trade (e.g., Jørgensen 2009; Sindbæk 2009; Wickler 2016b). Strategic laying out of food depots, although after a less substantial and fixed system, also made possible many early European expeditions in the Arctic (e.g., Graah 1832; Holm 1889). However, for Norse marine waystations to work effectively, they would have to be positioned in a chain along the coasts, which cannot be confirmed with only two or three presently identified sites. Given the distinct geographic and topographic setting of NKAH 3630 and 5558, they do indicate where new marine waystations could be discovered.

Landing sites (NKAH 3520 and 5557) are interpreted as stores for marine tools and equipment (e.g., nets, rope, oars, sails, tar, and the like) placed where landing boats were convenient and often as satellites to farmsteads that did have easy access to open fjord waters (Table 3). The two identified examples both present buildings with thick

Type 3d dry-stone walls (Table 1 and 2) and both are sited on drained surface very close to the fjord. Since ventilation was clearly not a primary concern (Table 2), they were rather buildings meant to keep tools and equipment dry and secure, their heavy construction and wall infilling possibly being a measure to counter their exposure to storms and sea spray.

Marine-hunting stations (NKAH 3774 and perhaps NKAH 2046 and 3528) are interpreted as such because they present habitation buildings surrounded by exceedingly poor pastureland but good access to marine resources. Judging from their small dimensions, such hunting stations are likely to have served a single farm, at most a couple, on a periodic basis, including cold periods. The only confirmed Norse example, NKAH 3774, includes both a habitation building and a marine tool-and-equipment store, while the other two consist of single habitation buildings. The closest North Atlantic parallel to such hunting stations are probably houses on small fishing stations- or camps found in both Iceland and Norway, where farmers would stay seasonally to fish, and perhaps hunt whales (Amundsen et al. 2005; Edvardsson 2005; Edvardsson 2010; Wickler 2016a).

Specialized/provisional basecamps (NKAH 1415, 1417, 1506, 2139, 4468, and perhaps 2329 and 3358) are designated so because they could be either fixed basecamps to where groups of Norse travelers or hunters returned on seasonal basis, or reflect single or short-lived events (e.g., failed attempts to establish farmsteads or buildings for overwintering marooned crews). They stand out from the marine-hunting stations by presenting more substantial and insulated buildings (Table 2; Fig. 24). For obvious reasons, specialized/provisional basecamps are mainly found in the *óbyggðir* and, in contrast to the other marine shielings, are located somewhat into the fjords, perhaps to access a range of both marine and terrestrial resources. This situation, of course, makes any functional distinction between marine or terrestrial basecamp functions problematic, but also largely inconsequential, as they could serve both as geographically fixed seasonal or provisional, including winter-period, safe havens for Norse travelers or hunters. However, NKAH 4468 and the possible Norse ruin at NKAH 3358 do seem to have a clear marine orientation (i.e., may have served as marine-hunting camps for sizable crews).

In terms of the interpretation and characteristics of the specialized/provisional basecamps, the L'Anse aux Meadows site (Fig. 25), Newfoundland, provides a pertinent archaeological parallel (Ingstad 1977; Wallace 1991, 2003, 2006). Birgitta Wallace (2003:11) has convincingly argued that the site was a Norse "highly specialized, non-farming settlement," more specifically "a specialized [winter] basecamp for further exploration and a gateway to resources" (Wallace 2009:118) in North America, and that the site could be synonymous with the *Leifsbuðir* of the Sagas.

This premise effectively makes L'Anse aux Meadows the most thoroughly excavated, dated (late 10–11th centuries AD), and inventoried archaeological example of a Greenland Norse shieling within the proposed category of specialized/provisional basecamps. Summarizing key points made by Wallace (2003, 2006, 2009), such specialized (winter) camps may be characterized by: a) an atypical, and isolated, geographic setting; b) thick-walled, turf-insulated, multiroom living quarters for groups of people (Fig. 25, Hall A, D, and F); c) absence of livestock and buildings, and only few specialized outbuildings (Fig. 25, Houses B, C, E, and G and Furnace Hut); d) deposition of few personal or household items; and e) very slight cultural, floor, and midden deposits—an observation also noted by Svensson (2015:295)—suggestive of short occupation period and/or specialized onsite activities. These key characteristics appear to apply to all the examples of specialized/provisional basecamps presented above, and the similarity between NKAH 4468 and Hall F at L'Anse aux Meadows is striking (Fig. 19 and 25).

Whether or not L'Anse aux Meadows is synonymous with *Leifsbuðir* of the medieval written record, it raises the possibility that the Old Norse "*buðir*" (booths) place-names could, in fact, refer to such types of specialized/provisional basecamps. Other examples of *buðir* in Greenland have mainly been discussed in the context "*thing*" (assembly) sites (e.g., Bruun 1895; Clemmensen 1911; Gulløv 2008a; Nørlund and Stenberger 1934) as known both historically and archaeologically from Iceland (e.g., Byock 2002; Harrison et al. 2008; Mehler 2015; Vésteinsson 2013). However, based on this analysis, *buðir* should—as suggested elsewhere—perhaps rather signify any type of temporary or seasonal "lodging for travelers, seafarers, fishermen, or hunters" (Magnusen 1827b:326) in the context of medieval Norse Greenland.

To conclude, the aim of this study is clearly not to provide any definite model for the development, organization, and practices of marine-resource use in Norse Greenland, but rather to direct attention towards understudied archaeological aspects of the marine economy and how these aspects may be approached in terms of new interpretational frameworks. Regrettably, the scope of the article does not allow for any lengthy consideration of the study's wider implications,

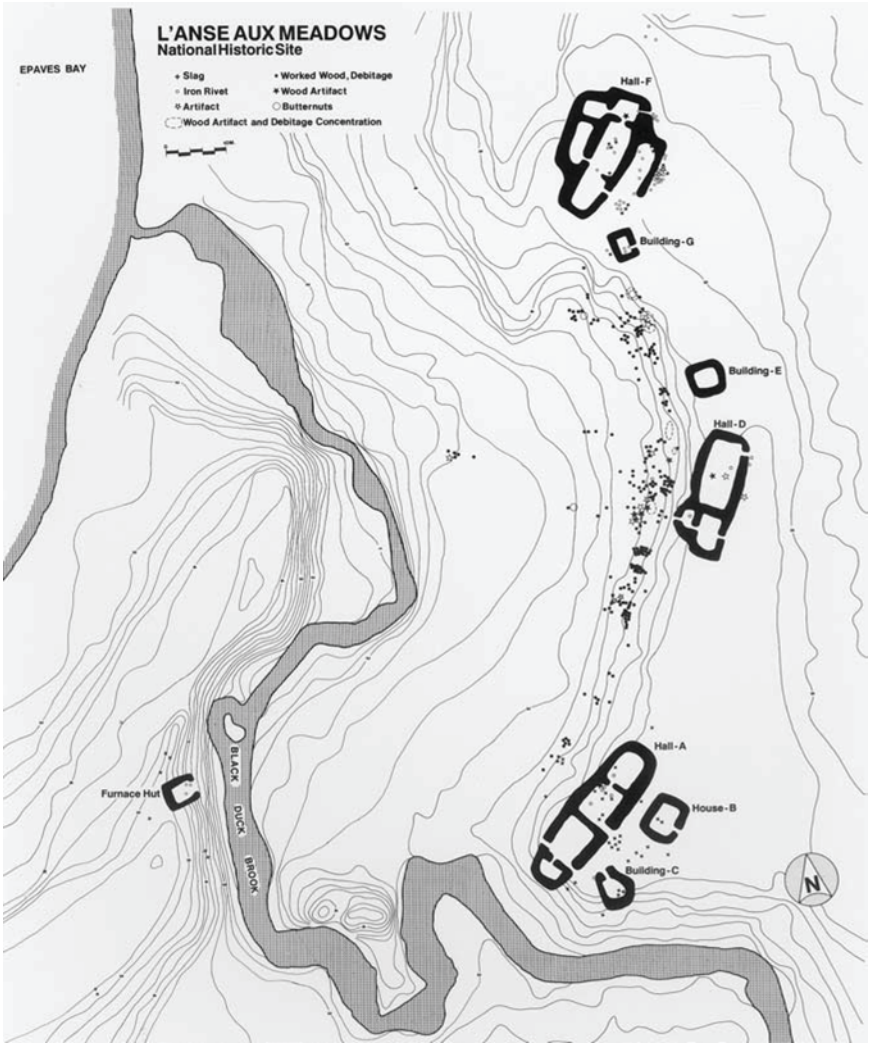

Figure 25. Site plan of the Norse settlement at L'Anse aux Meadows (after Wallace 2003:Fig. 2). Note the similarity of Hall F with NKAH 4468 (see Fig. 19).

for instance: What was the scale and extent of marine-resource use and hunting voyages? How did it align with the tasks and organization of the agropastoral economy? How did it affect the gendered labor division and scheduling? Neither is it possible here to provide a lengthy or formal comparison with marine sites and features in other North Atlantic areas, not only because of the sheer volume of evidence to consider, but also because the archaeological evidence from the latter regions is most often framed and interpreted within historical and ethnographic—and in many places still on-going—traditions and terminologies that simply lack from Norse Greenland. However, the concept of "marine shielings" could perhaps serve as an overlying archaeological category to more broadly discuss and compare understudied marine sites with different functions and designations, but similar importance and wider implications, across the North Atlantic.

Conclusion

Research of the last 40 years has demonstrated beyond doubt the great importance of marine resources in both the subsistence and trade economy of the medieval Norse that settled in Greenland from ca. AD 980–1450. A succinct review of medieval written evidence implies that Norse marine-resource exploitation in both North and East Greenland was frequent; undertaken by specialized crews that were organized and sponsored by wealthy, boat-owning elite farmers; to provide both cash crops and subsistence resources for the settlement areas; and logistically supported by specialized sites and buildings outside the main

settlement areas and near the distant hunting grounds.

While the available evidence thus points to the existence of sites and features associated with marine-resource exploitation, little related archaeological evidence has been identified, and neither have systematic investigations been many. The present study is an attempt to improve this situation. Introducing a systematic interpretational framework for functional identification of Norse building surface remains and applying it to 17 suggested or confirmed Norse sites with an atypical or isolated geographical setting, evidence of at least four different types of marine shielings can be tentatively suggested:

- Marine waystations: served as geographically fixed food and equipment depots and stop-overs along near-coast sea routes between the settlement areas and distant hunting grounds.
- Hunting stations: specialized satellite sites situated to improve access to marine-mammal wildlife to farmsteads inside and outside the Norse settlement areas.
- Landing sites: worked as marine-equipment stores offering advantageous boat landing to inland farmsteads or those with poor access to open fjord waters.
- Specialized/provisional basecamps: provided fixed, temporary quarters and havens for small groups of travelers, seafarers, or hunters, either on a regular seasonal basis or during critical events of marooning, being stopped by adverse environmental conditions. It is furthermore suggested that the specialized/provisional sites are the archaeological equivalent of the *buðir* (booths) that feature in the medieval written record on Norse Greenland.

While admittedly the presented sample of Norse sites is small and incomplete, and the interpretations of these sites are significantly hampered by lacking excavations and dates, the study suggests that Norse marine shielings are heavily underrepresented and attempts to offer some guidelines as to how to identify and categorize new marine shielings among existing sites, as well possibly where new similar sites could be located in the future.

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Endnotes

1. The translation to English of the presented passages from Björn Jónsson's *Grænlandsannáll* was carried out by Prof. Orri Vésteinsson, University of Iceland, on May 4, 2018, at the personal request of the author.

2. The Norse archives of the National Museum of Denmark, Dept. of Middle Ages, Renaissance and Numismatics contain a folder with various early and largely unnamed accounts of possible Norse sites in East Greenland.

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