RANNSÓKNASKÝRSLUR FERÐAMÁLADEILDAR HÁSKÓLANS Á HÓLUM

Preliminary Report 2021: Geophysics, Coring, and Excavations at Hólar; Geophysics at Kálfsstaðir

Guðný Zoëga and John M. Steinberg

HJALTADALUR ARCHAEOLOGICAL SETTLEMENT PROJECT

HH 2022/7

Photo on front page – Justin Malcolm Starting Test Pit 17 at Hólar

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Kathryn Catlin designed the scheme for displaying coring data for her dissertation work. Unless otherwise noted, the underlying data such as elevation land type are based on data from Landmælingar Íslands (the National Land Survey of Iceland). Images and data are used based on the terms of the License for National Land Survey of Iceland free data (https://www.lmi.is/is/moya/page/licence-for-national-land-survey-of-iceland-free-data). Aerial photographs, unless otherwise noted, are from Loftmyndir ehf. and in accordance with the educational license. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the individuals and institutions who support this work. Products, data, or instruments mentioned should not be construed as an endorsement.

Hólar University

Hólar University is located at Hólar in Hjaltadalur, North Iceland. For over 700 years Hólar was one of Iceland´s two episcopal sees and an important power base in North Iceland. The first school in Hólar was founded at the establishment of the bishopric in 1106 AD. It was renamed Hólar Agricultural College in 1882 and became Hólar University in 2007. Hólar offers education centered on rural communities and specializes in three areas: aquaculture, equine science, and rural tourism. Hólar houses the Center for the history of the Icelandic horse, Hólar Cathedral, and the turf house Nýibær.

Fiske Center for Archaeological Research

The Andrew Fiske Memorial Center for Archaeological Research at the University of Massachusetts Boston was established in 1999 through the generosity of the late Alice Fiske and her family as a living memorial to her late husband Andrew. As an international leader in interdisciplinary research, the Fiske Center promotes a vision of archaeology as a multi-faceted, theoretically rigorous field that integrates a variety of analytical perspectives into its studies of the cultural and biological dimensions of colonization, urbanization, and industrialization that have occurred over the past one thousand years in the Americas and the Atlantic World. As part of a public university, the Fiske Center maintains a program of local archaeology with a special emphasis on research that meets the needs of cities, towns, and Tribal Nations in New England and the greater Northeast. The Fiske Center also seeks to understand the local as part of a broader Atlantic World.

Hjaltadalur Archaeological Survey Project - HASP

The Hjaltadalur Archaeological Survey Project seeks to determine if Hólar, the historically important site of the northern bishopric, rose to political and religious primacy due to the conditions created during the initial settlement of Iceland around A.D. 870, or if it arose as part of a fundamental social reorganization associated with the later institutionalization of Christianity. Through a program of soil coring, geophysics, and test excavation, the project will chronicle the changing site size and relative importance of Hólar and its neighboring 20 farms. This will allow us to determine if the institutionalization of Christianity in the valley of Hjaltadalur was directly dependent on the conditions of the initial settlement, or if it was an outcome of the placement of the bishopric at an otherwise ordinary farm.

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Útdáttur (Icelandic Summary)

Sumarið 2021 fór fram fornleifarannsókn á Hólum i Hjaltadal í tengslum við verkefnið Hjaltadalur Archaeological Settlement Project (HASP). Um var að ræða fyrsta rannsóknarár af þremur. Nokkrar fornleifarannsóknir hafa farið fram á Hólum og má helsta nefna Hólarannsóknina. Tilgangur verkefnisins er að kanna elstu byggð og byggðaþróun á Hólum og í Hjaltadal og bera saman við sambærilegar rannsóknir sem farið hafa fram í Skagafirði undanfarin 20 ár. Rannsóknin var í formi borkjarnatöku og gerð könnunarskurða í öskuhauga. Hólar eru ekki auðveldir viðureignar þar sem þar hefur verið byggt á sama svæðinu allt frá upphafi og því víðtækar byggingaleifar. Auk þess var á Hólum rekinn bændaskóli þar sem gerðar voru tilraunir með ýmsar jarðvinnsluaðferðir. Frumniðurstöður rannsóknarinnar benda þó til að fyrir 1100 hafi umfang bæjar ekki verið stærra en gengur og gerist í Skagafirði en breyting verður þar á eftir stofnun biskupsstólsins 1106. Milli 1104 og 1300 er umfang býlisins nokkru meira en á stærstu samtíða bæjum sem rannsakaðir hafa verið. Umfangið virðist þó minnka eftir 1300. Einnig voru gerðar jarðsjármælingar á meintu virki á Hólum og í túni á Kálfsstöðum þar sem heimildir eru um kirkjugarð. Óyggjandi niðurstöður fengust ekki úr rannsókn virkisins en hringlaga kirkjugarður og kirkja fundust í túni á Kálfsstöðum. Þær minjar verða rannsakaðar frekar sumarið 2022.

Abstract

This report outlines the 2021 work at Hólar in Hjaltadalur as part of the Hjaltadalur Archaeological Survey Project (HASP). The results of soil coring suggest that the farmstead of Hólar is the most extensive farmstead measured using this method in the area of Skagafjörður. After over 1200 cores and 17 excavations (6 of which were part of the 2021 research), there are still no confirmed pre-1104 cultural deposits at Hólar. This difficulty in identifying the pre-1104 domestic occupation implies that Viking Age Hólar was probably not large. The Hólar farmstead domestic space seems to be tightly defined and constrained rather than having small isolated domestic deposits spread all over the landscape.

Introduction

The original Hólar farmstead lay in the northwestern part of the current Hólar estate (Figure 1). The site is located on the northern slope in the valley of Hjaltadalur, a scree-lined glacial valley in the east of Skagafjörður, North Iceland. The farm becomes a bishopric in 1106. The goal of this research is to estimate the size of Hólar and how it changes over time. The project specifically targets three periods: pre-1104, 1104-1300, and post-1300. The project employs coring, geophysics, and small test trenches into midden and other non-structural deposits.

There is a substantial literature on Hólar and the most recent summary can be found in Pálsson (2014). Hólar has also been the subject of extensive archaeological work. An archaeological surface survey was conducted by Gunnarsdóttir in 1999. In 2000 Steinberg and Daniels (2001) conducted some preliminary survey work which included 7 test trenches.

Following that, the site of the Hólar bishopric was subject to extensive excavation during the 2002-6 Hólar Project under the direction of Ragnheiður Traustadóttir (Traustadóttir *et al.* 2003; Hellqvist *et al.* 2004; Traustadóttir *et al.* 2004; Traustadóttir *et al.* 2005; Carter 2010; Traustadóttir *et al.* 2011; Hellqvist *et al.* 2020). Some of the results from this substantial work have not been finalized. The bishoprics' printing press, as well as unusual 12th-century structures were examined. Under one of these buildings are the remains of what appeared to be a Viking Age structure (Traustadóttir 2009). This is still to be confirmed by radiocarbon dates or tephrochronology.

The report details the results of the 2021 fieldwork at Hólar, with additional discussion of a small geophysical survey at the farm Kálfsstaðir, which will be surveyed during the 2022 field season. The tephra layer assignments in this report are subject to revision based on the forthcoming report from Magnús Sigurgeirsson.

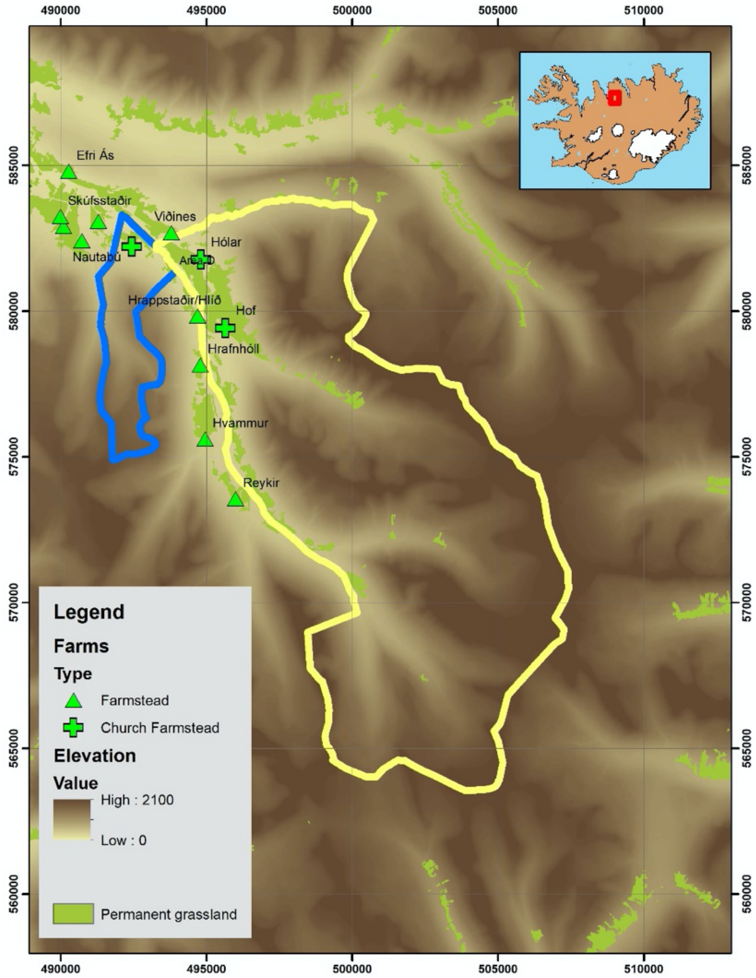

Figure 1. Map of Hjaltadalur, showing Hólar modern farm boundaries in yellow (which contains Hof) and Kálfsstaðir in blue.

Geology and tephra in Hjaltadalur

The geology of the Hjaltadalur region is characterized by flows of Upper Tertiary basic and intermediate extrusive basalts (Feuillet *et al.* 2012) interbedded with weak pulverized red vesicular basaltic strata (Decaulne *et al.* 2016). The area was deglaciated by 6100 yr cal.BP and then subject to uplift (Cossart *et al.* 2014). Hjaltadalur is a large scree-lined glacial valley with several distinct ecological zones corresponding to both highland and midland elevations. The midland areas are characterized by organic-rich soils and iron, while highland areas have drier soils and dwarf birch forests (Carter 2010). Carter (2010) suggests that Hjaltadalur is naturally sheltered by large mountain ranges resulting in a slow rate of erosion.

The natural stratigraphy of the near-surface of the region consists of rapidly formed sediment and soil with intermixed tephra layers, along with gravel layers and lenses of glacial origin. The soil is a brown andosol that derives from aeolian sediments of volcanic origin but is not the direct product of eruptions (Arnalds *et al.* 1995; Arnalds 2004, 2008). The andosol is non-cohesive but has an extremely high water-retention capacity (Arnalds 2008).

The Hjaltadalur Archaeological Survey Project relies heavily on tephra layers preserved in the soil. Skagafjörður has an early tephra sequence that allows for a fine-grained chronology of the changes in early settlement patterns (Larsen *et al.* 2002). While tephra deposition can vary over small distances (Davies *et al.* 2010) the basic tephra sequence is found throughout Skagafjörður and allows for a common dating system among farms and farmsteads (Þórarinsson 1977). The geologist and tephra specialist Magnús Sigurgeirsson oversaw the analysis of tephra for the project.

- Historic:
  - Hekla A.D. 1766. A black tephra usually found in turf or in the upper 10 cm of the soil sequence (Þórarinsson 1967; Kirkbride and Dugmore 2006)
  - Hekla A.D. 1300: A gray-blue to dark black tephra ((Larsen 1984; Sveinbjarnardóttir 1992; Larsen *et al.* 1999; Larsen *et al.* 2001; Larsen *et al.* 2002)
  - Hekla A.D. 1104 (H1). This white or yellowish-white tephra is the most consistent in Skagafjörður (Eiriksson *et al.* 2000) and is readily identifiable in both natural and cultural stratigraphic sequences.
- Landnám sequence (LNS):
  - Vj~1000 tephra. A blue to bluish-black layer whose source has not been determined but is likely to be either from a Grímsvötn and/or Veiðivötn eruption dated to approximately A.D. 1000 (Sigurgeirsson (Sigurgeirsson 2001). The layer was first suggested in two undergraduate theses (Ólafsson 1985; Jónsson 2005) and it has been proposed that this layer may be found in other areas (Aldred and Sigurgeirsson 2005; Lárusdóttir *et al.* 2012). Preliminary analysis of the composition of volcanic glass shards by scanning electron microprobe (SEM) has identified a mixture of shards from both volcanic sources.
  - "Landnám" or "settlement" layer (LNL, LTL, also designated as 871). The layer is so-named for its association with the earliest settlements in Iceland (Dugmore and Newton 2012)) and is dated to A.D. 871 ±2, (Grönvold *et al.* 1995)(Grönvold *et al.* 1995), but could be dated to A.D. 877±4 (Zielinski *et al.* 1997; Schmid *et al.* 2017). The tephra originates from the Vatnaöldur fissure swarm associated with the Torfajökull and Bárðarbunga volcanos. In general, this layer consists of two distinct tephras—an olive-green tephra overlying a white tephra. However, in Skagafjörður, only the green portion is present (cf. Hallsdóttir 1987). In many cases, this layer and surrounding layers of the LNS are tightly spaced in a brown organic-rich soil matrix associated with the environmental changes of colonization.
  - Black tephra below the LNL (K600). The earliest tephra in this sequence is a dark black layer probably from the Katla volcano but is not well dated (Wastegard *et al.* 2003).
- Prehistoric:
  - Hekla 3 (H3). A thick (generally 2-3 cm) white or whitish-yellow tephra dating to about 950 B.C. (Dugmore *et al.* 1995).
  - Hekla 4 (H4). A thick (generally 1-3 cm) white or yellowish-white tephra dating to about 2300 B.C. (Eiriksson *et al.* 2000).

Deposits are then periodized using these tephras (and AMS dates when available) in a sequence of date ranges. These ranges are not applied to tephra layers (which are given a single date). In the absence of a tephra layer, the latest date range is applied.

Farmstead stratigraphy

Chronological phasing of farmstead sizes primarily relies on two tephra layers: the white Hekla AD 1104 (H1) and the dark Hekla AD 1300. These layers are the ones most commonly found in cores and are often the easiest to identify of the historical tephras. H1 is presented twice as often as Hekla A.D. 1300. Using these tephra layers to date cultural deposits allows for the chronological phasing of farmstead sizes and for farmstead sizes to be compared across contemporary temporal horizons. Their presence also allows for the identification of changes in the size of individual farmsteads. Other tephra layers are used to help identify the overall stratigraphic sequence in the soil cores and to associate specific layers with historical periods. Deposits categorized by these temporal phases are based on whether or not they contained evidence of cultural material. The resulting chronology allows for the estimation of farmstead size for three primary periods:

- Pre-AD 1104
- AD 1104-1300
- Post-AD 1300

Short history of early Hólar

According to documentary sources, Hólar lies within the original land of the settlement farm Hof. Hólar is not mentioned in the *Book of settlements (Landnámabók)* (*Íslensk fornrit I,* 1986), which recounts the details of the initial settlement of Iceland and the land claims staked by the approximately 400 settlers starting in around A.D 870 (Smith 1995). According to Landnámabók, the first settler in the region was Sleitu-Björn Hróarsson whose extensive land claim was later subdivided roughly into fourths (Sleitu-Björn at Sleitu-Bjarnastaðir, Öndóttur at Viðvík, Kolbeinn somewhere in Kolbeinsdalur, and Hjalti at Hof in Hjaltadalur, Figure 2). Hjalti Þórðarson who took possession of the valley of Hjaltadalur was an influential and wealthy chief and his settlement farm, Hof, lay just south of Hólar. The general assumption has been that Hólar took over from Hof at some point in the 10th century as the main farm in Hjaltadalur, but no written sources throw light on how or when that happened.

The Saga of bishop Jón Ögmundarson contains the first mention of a church at Hólar. The church builder was Oxi Hjaltason, and in a footnote, the saga's editors (Sigurðsson and Vigfússon 1858, 163) suggest that the church may have been built around AD 1050 and that Oxi was the grandson of Hjalti the settler at Hof. According to the saga, Oxi´s church was the largest in Iceland: a richly furnished timber structure with a lead-lined roof. That splendid church burned down and was replaced by a second pre-bishopric Hólar church.

A bishopric was established at Hólar in 1106. According to bishop Jóns saga, Hólar was the private farm property of priest Illugi Bjarnason, the only person in North Iceland willing to donate his farm (patrimony) to the Church to house the bishop's seat (Cormack 2000). No explanation is made of his generosity, other than it was for the glory of God and advancement of the Church (Sigurðsson and Vifgússon 1858), although he may have had another farm to retire to (Vésteinsson 2000, 35). The first bishop at Hólar, Jón Ögmundarson (1052-1123), was not from North Iceland. He was a student of the first bishop at Skálholt, Ísleifur Gissurarson, and was appointed to manage Hólar by the second bishop, Ísleifur's son, Gissur. Bishop Jón had a new church built at Hólar and established a school.

In 1388 about 70 people were working at Hólar—on the same scale as the other bishopric at Skálholt (Júlíusson 2010). The first land registry (from 1714) (Magnússon and Vídalín 1930, 218), was recorded about the time Hólar began to fall from its zenith, states that Hólar owned 179 farmsteads in Skagafjörður worth over 4000 hundreds

In 1824 Benedikt Vigfússon purchased the Hólar estate which had been deteriorating and lost the see in 1801. He started to rehabilitate the property. In 1857 an early map or túnakort of Hólar was made**.** Coring and excavation locations have been superimposed on this map (Figure 3 and Figure 4) In 1860 Vigfússon had the Nýibær turf house constructed.

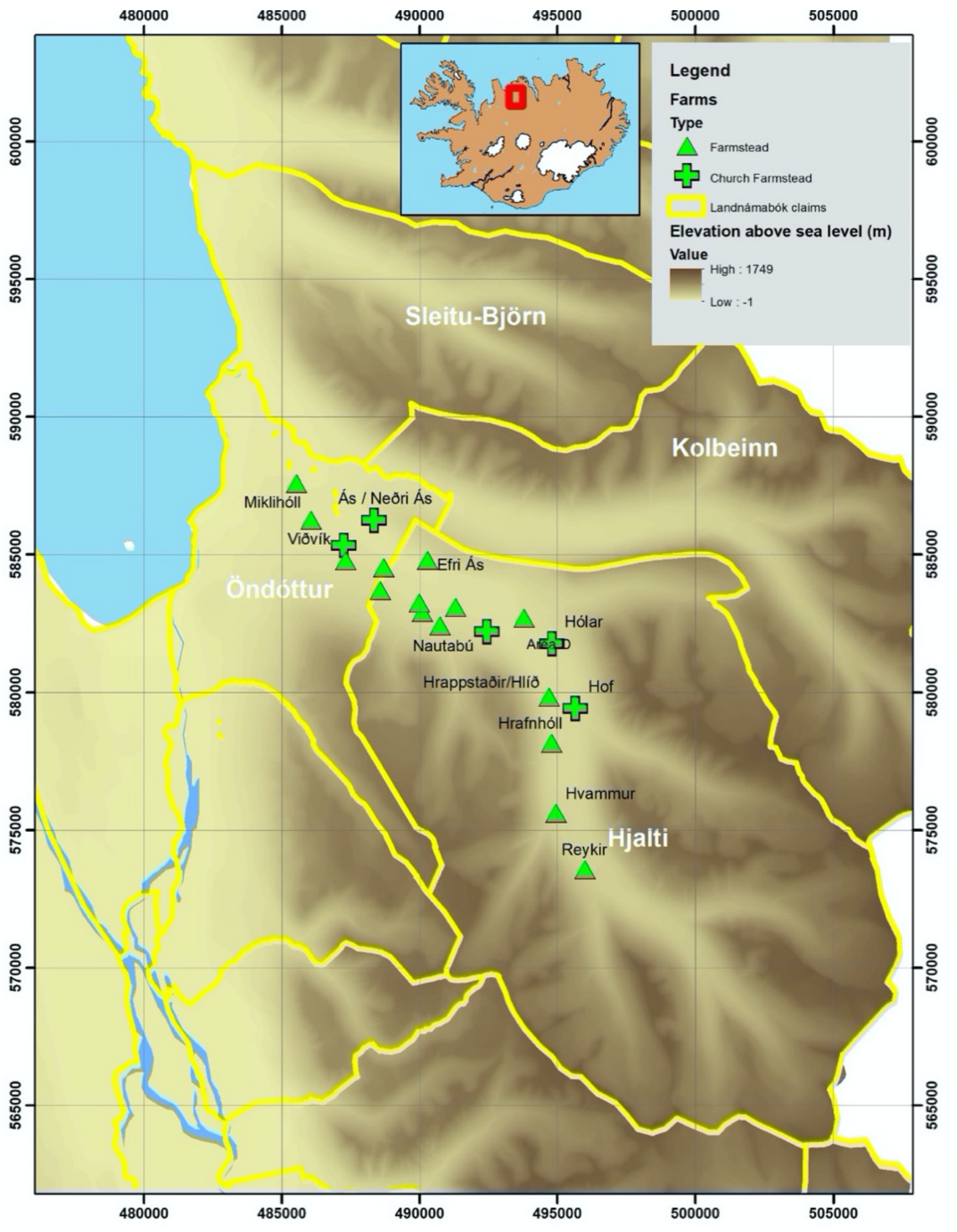

Figure 2. Outlines of original land claims from *Landnámabók*. The subdivision of Sleitu-Björn's claim (Kolbeinn, Hjalti and Öndóttur) is indicated. Farmsteads along Hjaltidal are represented by triangles and farmsteads with churches by crosses.

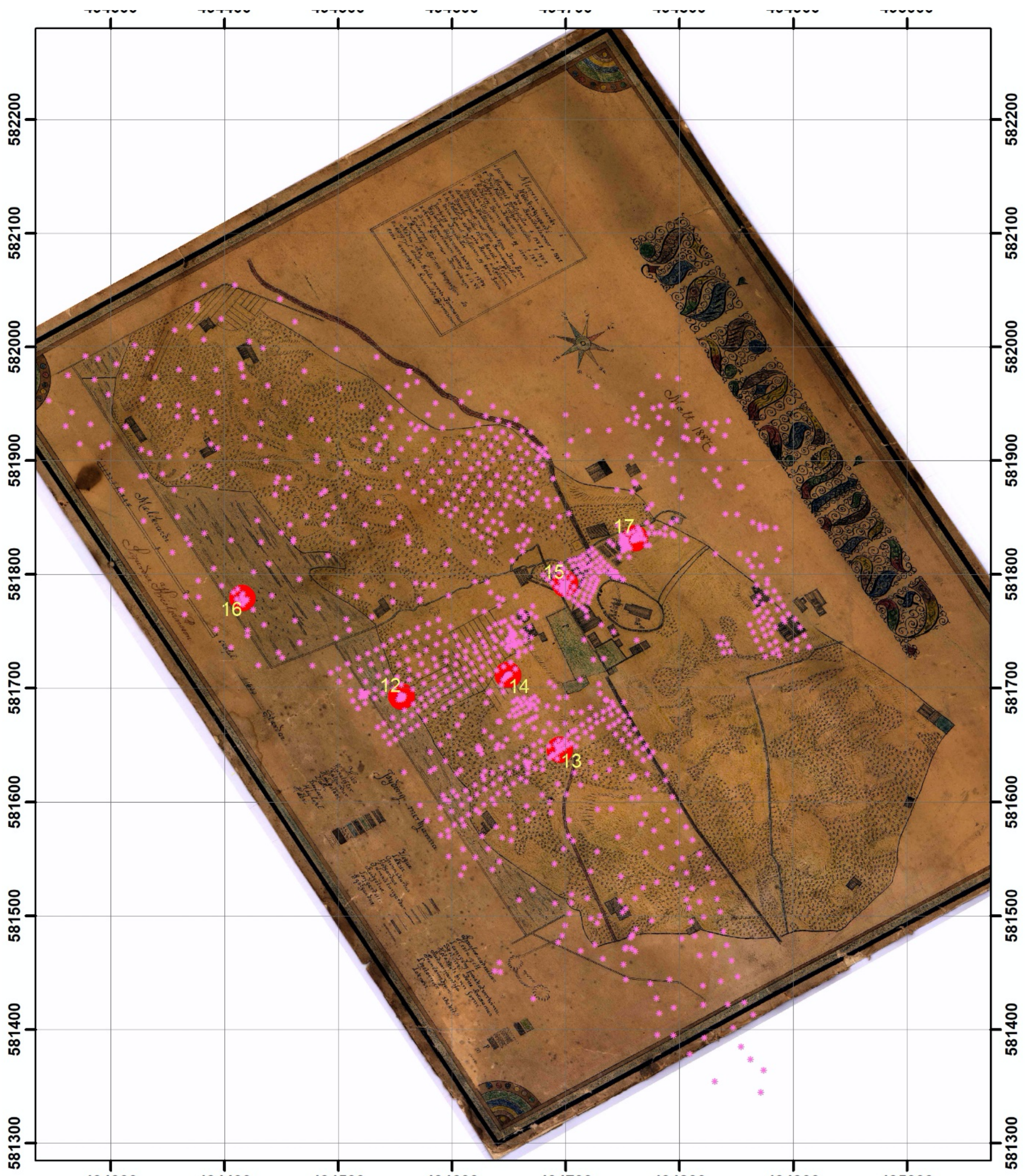

Figure 3. Georeferenced 1857 túnakort map. With 2021 cores (pink) and 2021 test pits (red) superimposed.

Figure 4. A close-up of georeferenced 1857 túnakort map with 2021 cores (pink) and 2021 test pits (red). superimposed

Previous excavations at Hólar

Prior to the 2021 test excavations, eleven other excavations had been conducted around Hólar. In 2000, 7 test trenches were excavated (Steinberg and Daniels 2001) generally around the periphery (Figure 5). These test pits (TP) were labeled 1-7. The Hólar Project placed four more excavations, termed Area A, D, F and H and expanded the earlier TP5 as Area E. (Traustadóttir *et al.* 2003; Hellqvist *et al.* 2004; Traustadóttir *et al.* 2004; Traustadóttir *et al.* 2005; Carter 2010; Traustadóttir *et al.* 2011; Hellqvist *et al.* 2020). In Area E, Traustadóttir (2009) has proposed that there is a Viking Age structure.

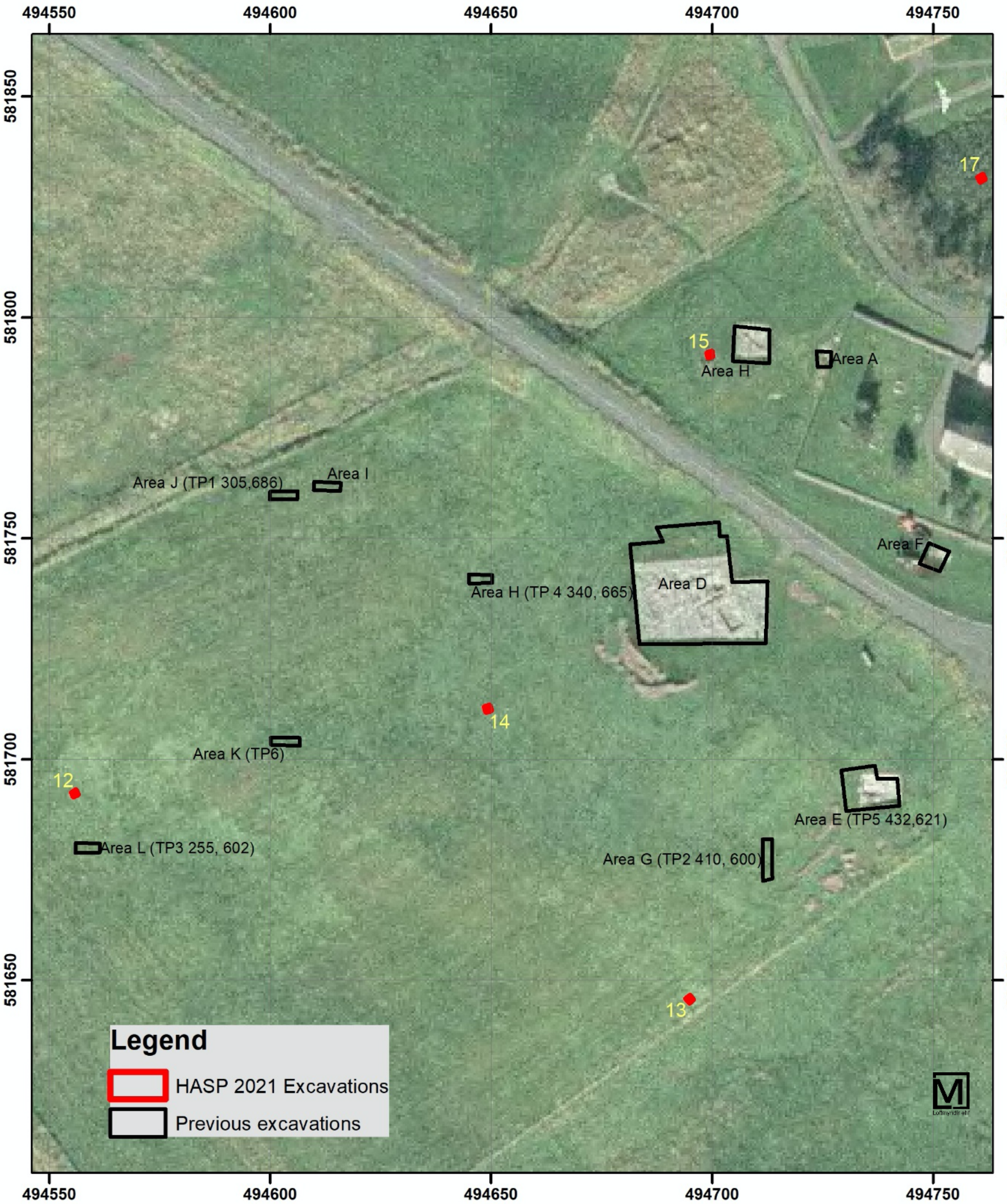

Figure 5. Previous excavations at Hólar (in black) and 2021 excavations (in red).

Land Surveying and establishment of grids

All land-survey data were collected based on the ISN93 coordinate system. Core locations were determined in several ways. For only a few cores that were taken at widely spaced intervals and away from potential occupation sites, the internal GPS receiver in the iPads that were used to record the coring data was used.

Within Hólar, most cores were collected on a 10 x 10 m paced grid. The cores were initially located with the internal iPad GPS and then refined with a HiPer SR DGPS corrected with the IceCORS network (https://www.lmi.is/is/maelingar/icecors). Similarly, judgmentally placed cores were originally located with an iPad and then refined by a Topcon HiPer SR to improve upon the accuracy of the locational data.

For the geophysical surveys, flags were established every 10-20 m across the geophysical grid using the HiPer SR DGPS corrected with the IceCORS network. Tapes were then pulled from these established flags and secondary flags placed every 5 m around the borders of the grid. Fiducial lines of colored flags were placed every 5 to 10 m, perpendicular to the direction of the transects with 1 m spacing.

Coring

During the 2021 field season, 1246 cores were taken at Hólar (Figure 6). There were 110 (8.8%) cores that had midden deposits within them. Seven cores at Hólar contained floor deposits. There were 146 (11.7%) cores that contained low-density cultural deposits (LDC) and 117 (9.4%) that contained turf deposits. Many cores contained multiple types of deposits, but overall, 518 (41.6%) of the cores contained some sort of cultural deposit.

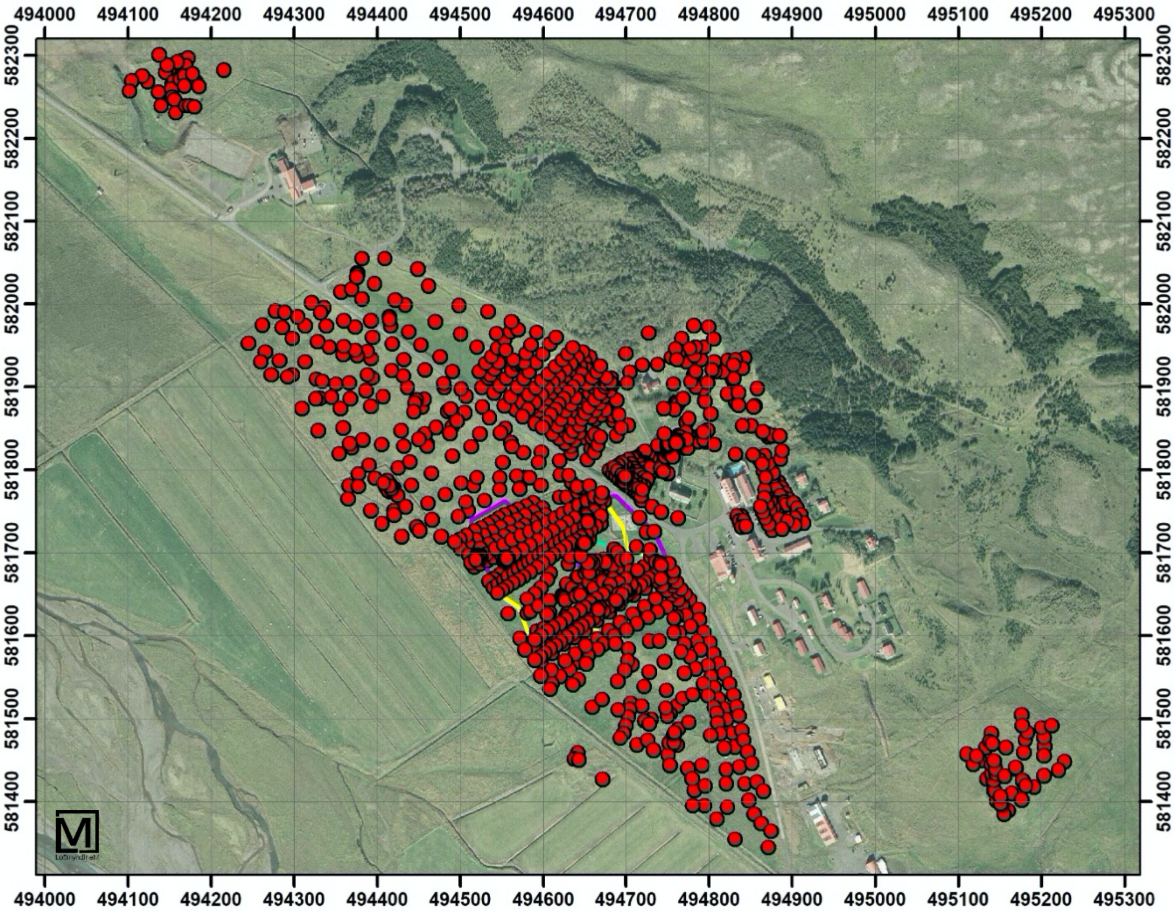

Figure 6. Core locations at Hólar

As for tephra layers, 5 cores contained an in situ 1766 tephra (0.4%), which is usually very difficult to identify in cores (e.g., of the 1,993 total cores taken at Hof and Hólar in the 2021 field season, 16 (0.8%) contained in situ 1766 tephra). There were 38 (3.1%) cores that contained an in situ 1300 tephra layer. In situ H1 tephra was relatively abundant, appearing in 237 (19.0%) cores. The prehistoric H3 tephra was the most commonly identified. It appeared in 464 (37.2%) cores, while the H4 tephra appeared in 128 (2.2%). Ten (0.8%) cores encountered an in situ dark tephra between the H1 and the LNL. This was identified in the field as the “1000” layer. Finally, 35 (2.8%) cores were found to contain an in situ LNL and

26 (2.1%) contained the LNS, which appeared as a dark distinct mixed layer (no cores contained both the LNL and LNS).

Tephra preservation, regardless of the presence of cultural layers, has a broad distribution across Hólar. Good tephra preservation indicates that identification of cultural remains is possible and the areas have integrity. The absence of cultural deposits in areas of good tephra preservation is strong negative evidence for the absence of settlement in those areas with good tephra preservation. At Holar, for H1, the preservation is generally good (Figure 7) and outstanding for H3 (Figure 8).

This good tephra preservation is also evident at the two outlying areas of Hólar investigated with cores. The separate walled sites of Kollugerði (northwest) and Geitagerði (southeast) were each investigated with a series of cores. Like the main area of Hólar, these areas had good tephra preservation. However, no cultural remains from any time period were identified in any of the cores in these separate areas. Pálsson (2011, 186) had suggested the possibility of settlement in these two outlying areas, but no evidence was found of that. These areas might, as their names suggest, be dedicated to keeping of sheep and goats.

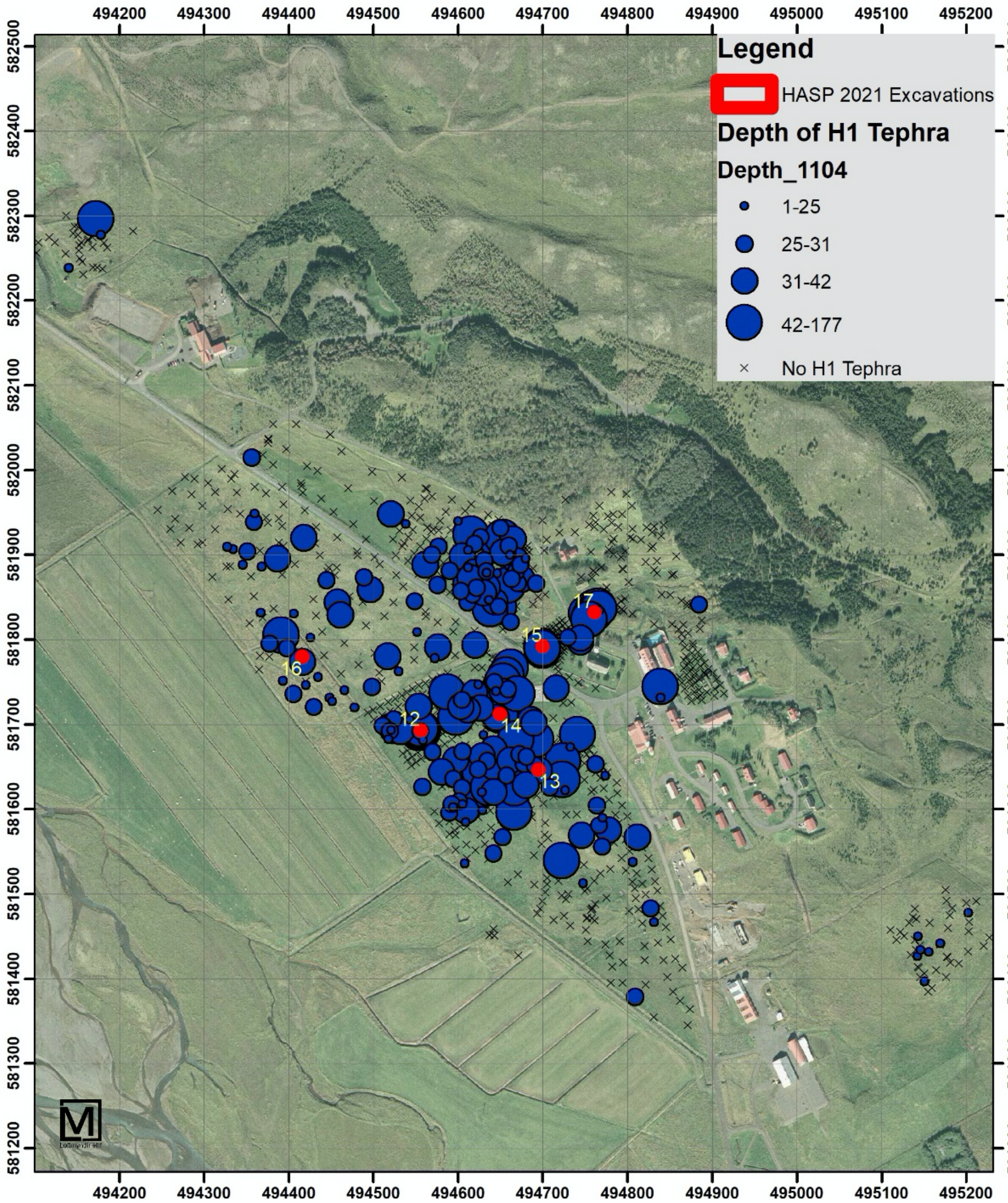

Figure 7. Cores with H1 (regardless of cultural layer presence)

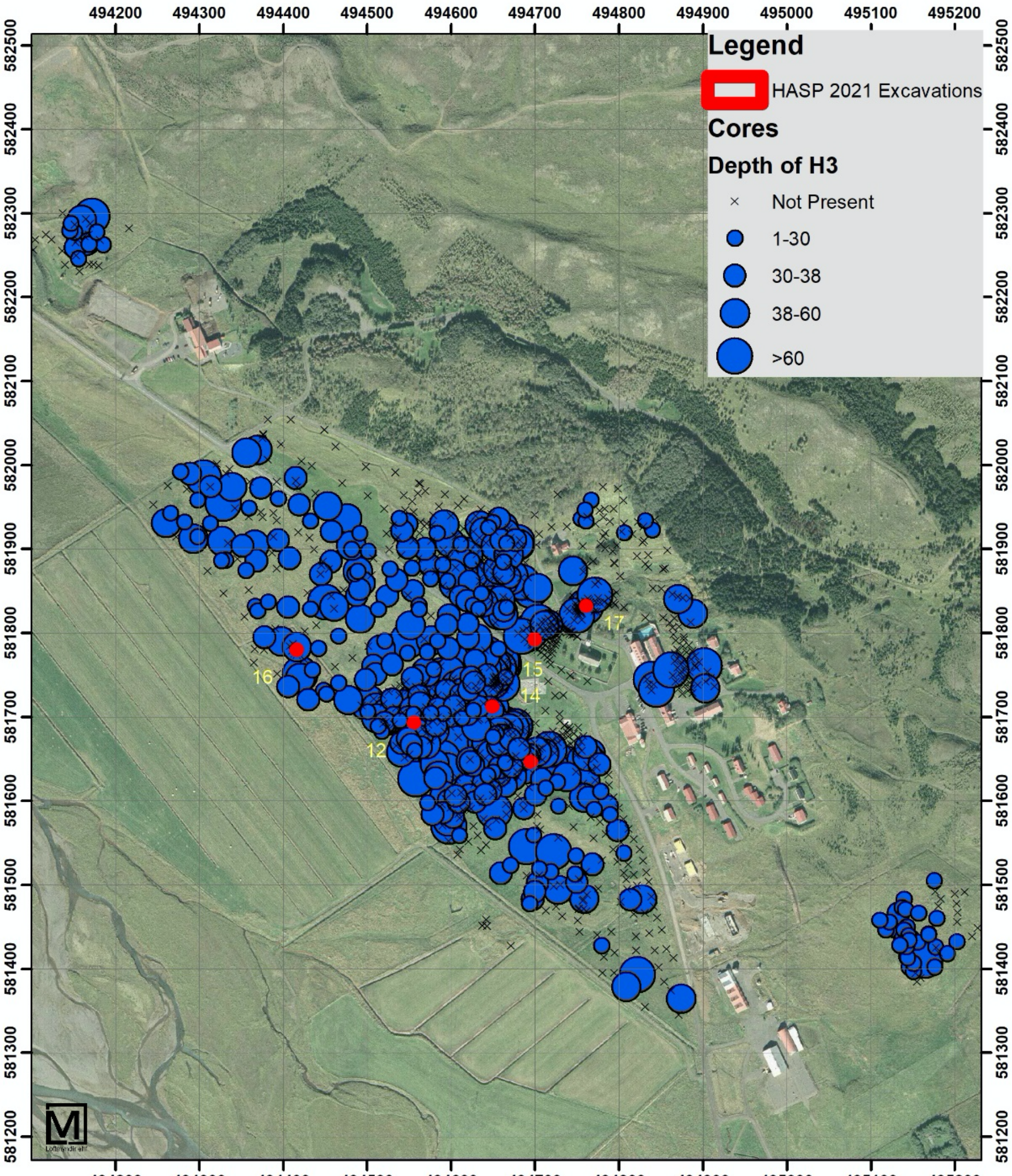

Figure 8. Cores with H3 (regardless of cultural layer presence)

Excavations

Six test pits were excavated at Hólar during the 2021 field season (Figure 9). The goal was to place the excavations in locations where both midden deposits and in situ tephra layers were present. This would allow for the temporal estimation of abandonment and occupation sequences at the site. The H1 tephra—and its interface with midden deposits—was specifically targeted. Unfortunately, no H1 tephra was confirmed in any of the 2021 test pits at Hólar. The 2021 test pit numbers start at 12 to avoid confusion with earlier test pits, excavated as part of other projects (Figure 5).

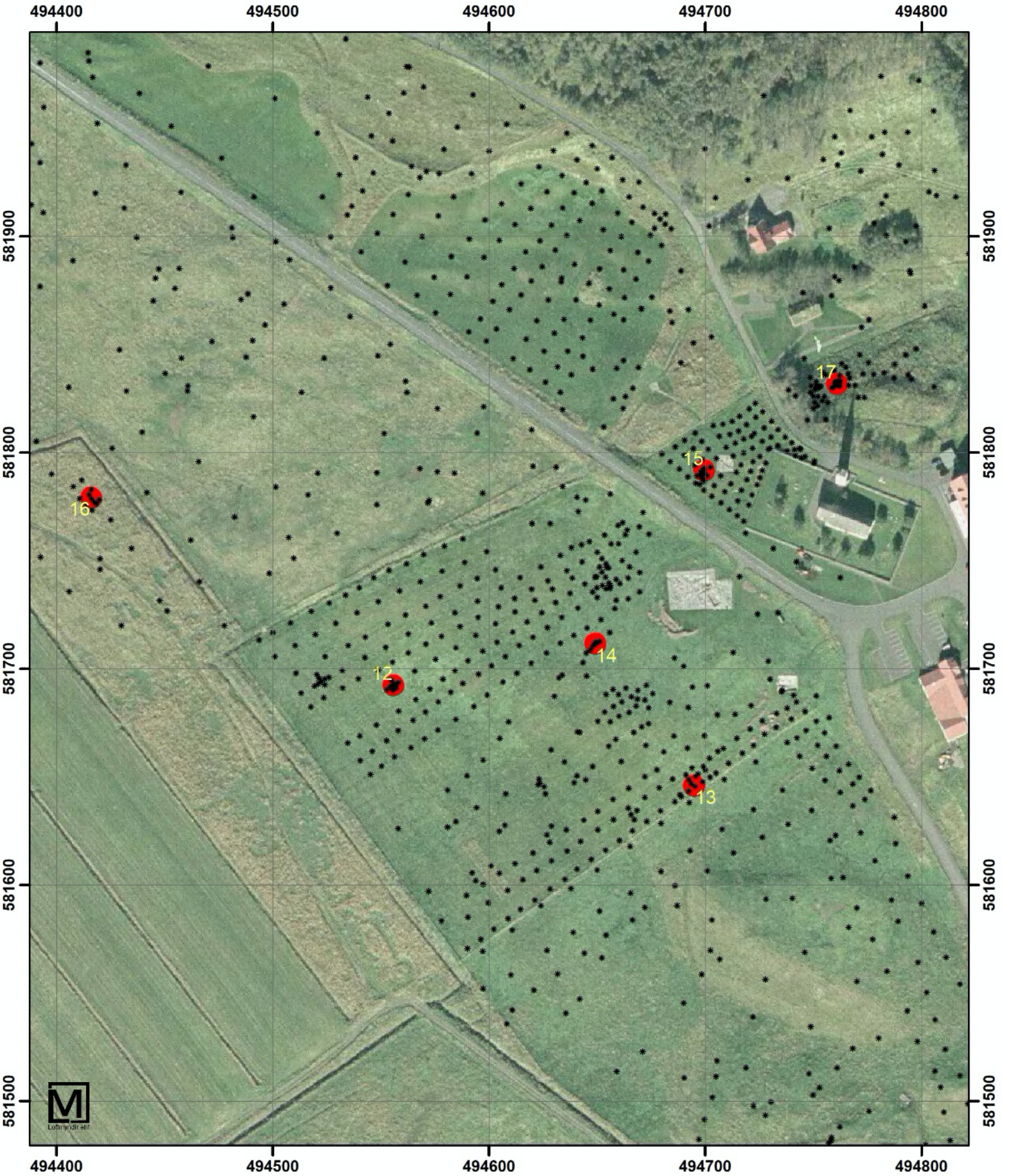

Figure 9. 2021 Test pit locations at Hólar (in red) with cores represented by black dots.

Test Pit 12

Test pit 12 was placed based on a series of cores that appeared to present LDC above the AD 1104 tephra layer and midden below the 1104 tephra layer (cores 211422, 211423, 211364, and211485). In the cores immediately around these central cores, midden and LDC were present (Figure 10) but no tephra layers were identified. The 1104 tephra layer appeared to be about 60 cm below ground surface (bgs) in the few cores where present. The cores in the TP12 area all had bog deposits at the bottom of the sequence.

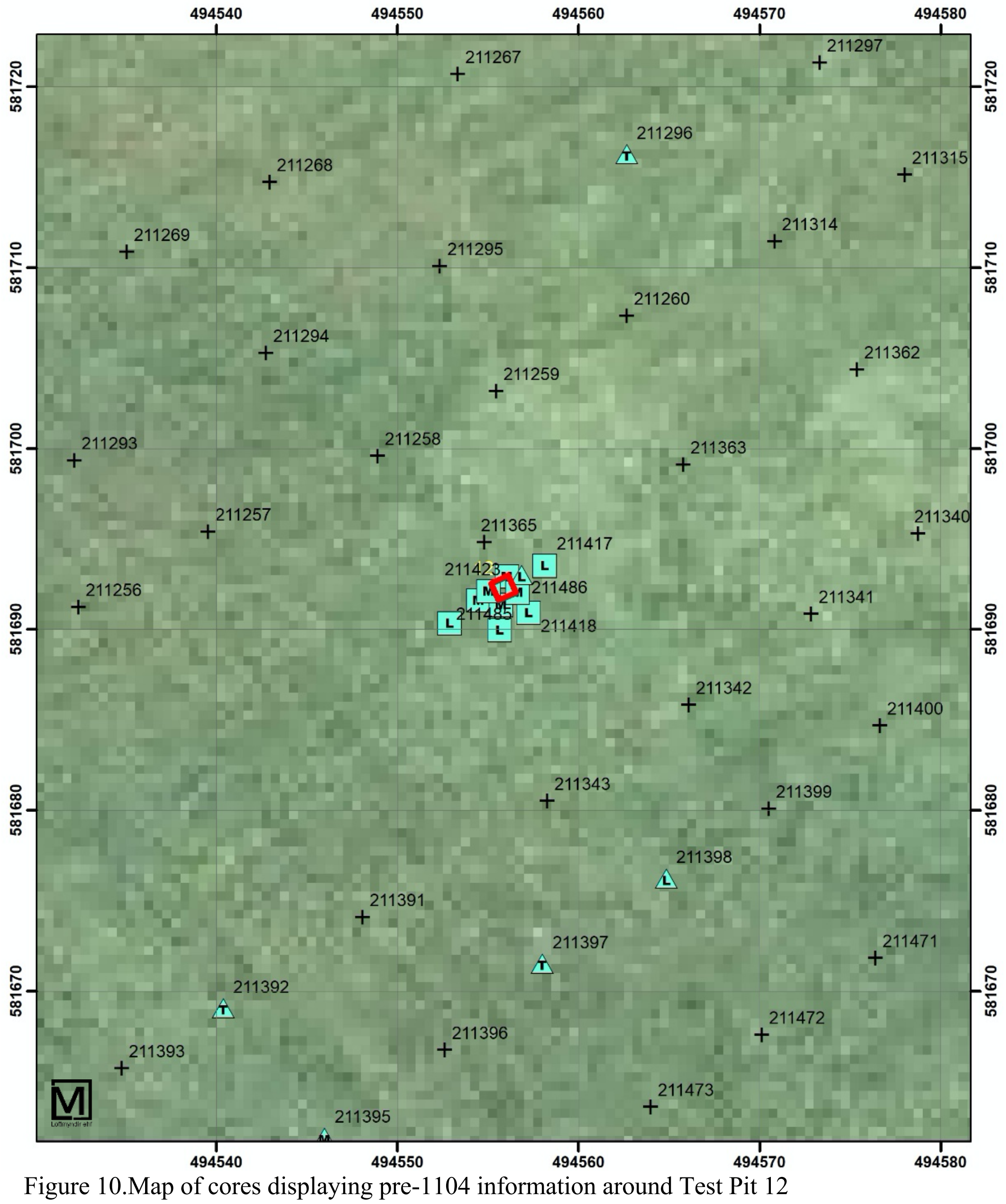

Figure 10.Map of cores displaying pre-1104 information around Test Pit 12

The general sequence (Figure 11) is a root mat and a disturbed layer [101 and102] on top of a low-density cultural deposit [103-107] with a small bit of 1300 tephra towards the top of the LDC deposit. A midden deposit [108-111] is on top of a deposit of white diatoms [112].

The diatoms were on top of a natural bog deposit with some LNL tephra. The bog deposit rested on an H3 that appeared to be deposited when the area was in a wetland bog.

The [101-102] contexts have been assigned a post-1766 date since they appear to be disturbed. The [103-104] LDC has been assigned to the 1300-1766 period. Conservatively, the rest of the LDC and Midden sequence [105-111] has been assigned to the 1104-1300 period. No other tephra was present (other than the H3) to use as an indication of the dating of the lower cultural layers. The diatoms [113] have been tentatively assigned to the prehistoric period. Test pit 12 represents an area of midden and later LDC that was deposited over a bog and later became dry land. There are no other cores with potential pre-1104 deposits in the area. Thus, TP12 confirms the several cores around the area with turf and LDC from the 1104-1300 and post-1300 periods (Figure 30 and Figure 31). This area was not part of a pre-1104 Hólar but rather part of the post-1104 substantial expansion of the site.

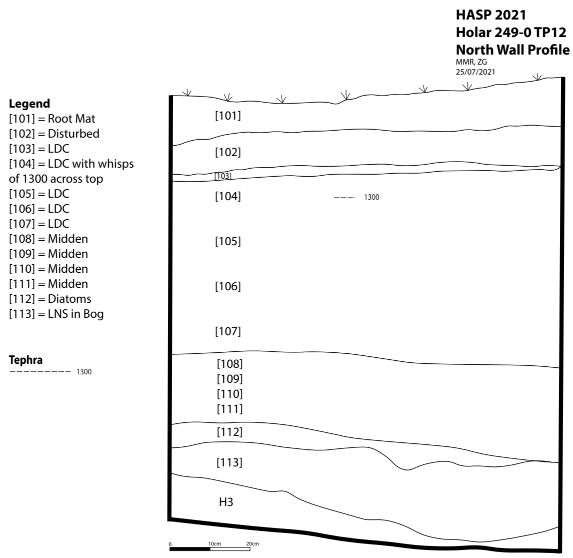

Figure 11. Left: drawn profile of test pit 12. Right: photograph of the west wall profile

Test Pit 13

Test pit 13 was placed based on a series of cores, most notably, 210820 which presented with a substantial 60 cm midden on rocks with an H1 tephra in the middle of the midden. Most of the surrounding cores had refusal at about 90 cm bgs at what appeared to be rocks. Only two of the cores had 1104 and one (210724) appeared to have an LNL at 30 just above H3. The layer that was initially identified as the LNL tephra turned out to be the 1300 tephra and no H1 was identified in the test pit.

The top root mat is assigned to the modern period [101] and the midden above the what appears to be a 1766 tephra [115-117] is also assigned to that period (Figure 14). It is assumed that the LDC deposit below the 1766 tephra [118] is sometime just before 1766 so it is assigned to the 1300-1766 window. These later deposits are directly on top of the prehistoric H3 deposits. This sequence suggests that there is not good preservation in this area of earlier deposits. That is, any early deposits (e.g., pre-1104) have been removed from this area. That being said, there is good negative evidence, in the form of tephra preservation (Figure 7 and Figure 8) to the southwest to suggest that TP13 is close to the southern edge of the Hólar farmstead area (Figure 28).

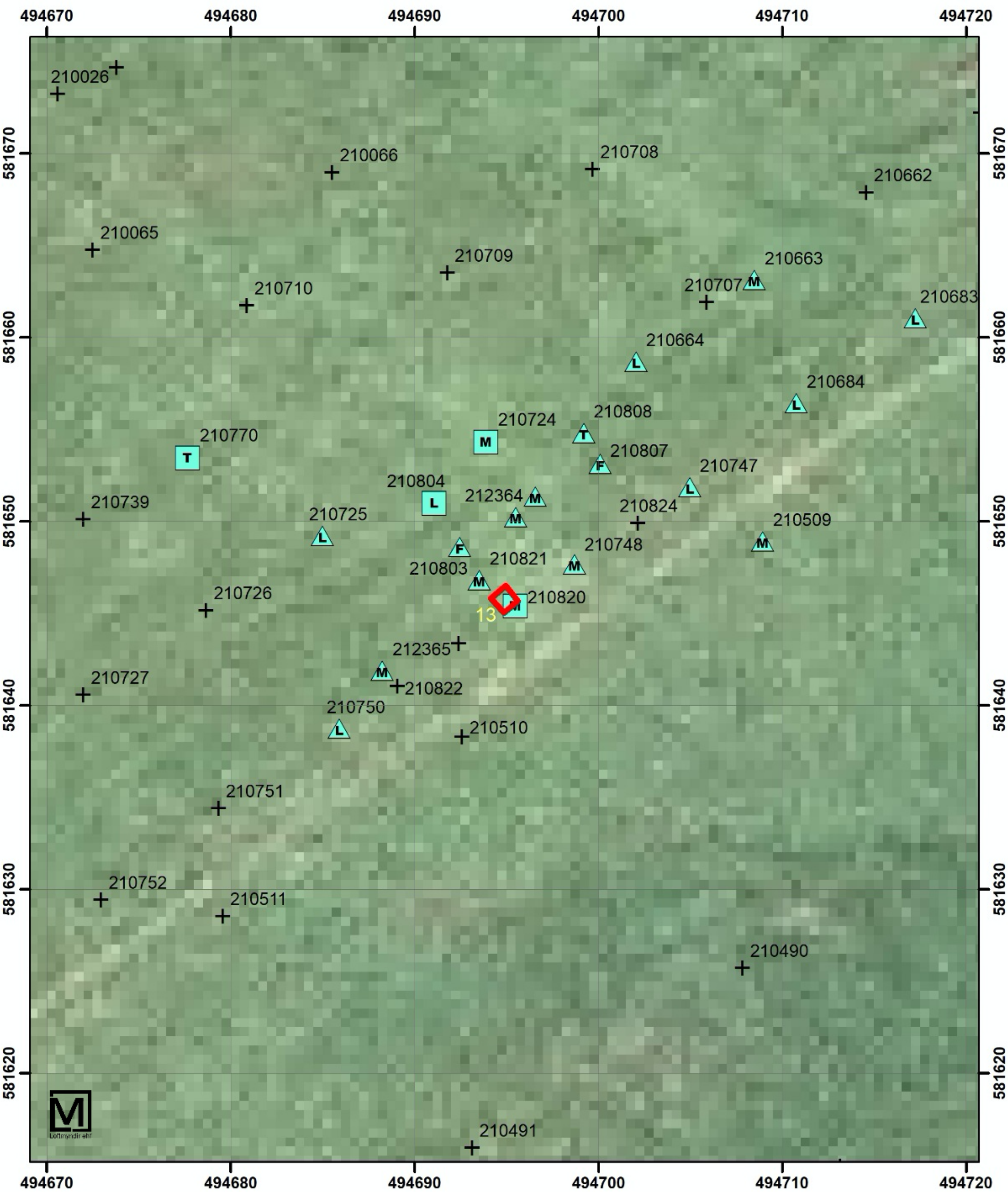

Figure 12.Map of cores displaying pre-1104 information around Test Pit 13

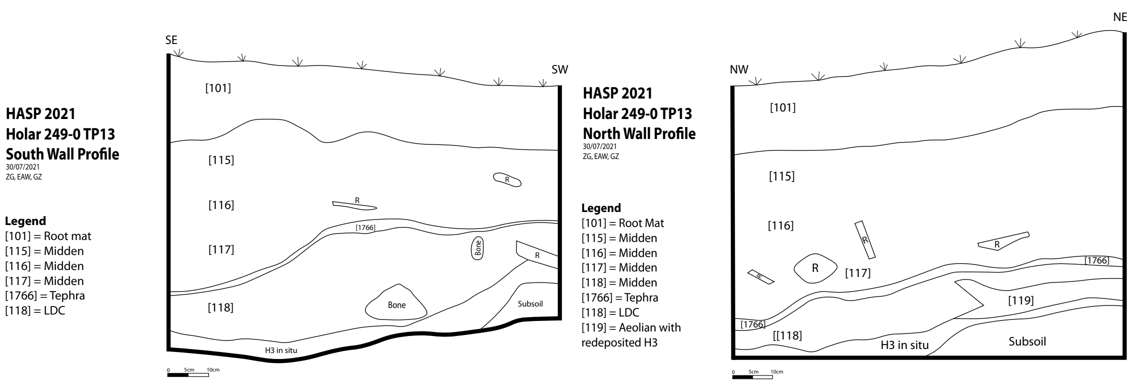

Figure 13. Drawn Profile of TP13. Right: south wall and left: North wall.

Figure 14. Photo of the top of context 117 in TP13

Test Pit 14

Test pit 14 was placed based on a series of cores with midden and one 6 cm wide Eijkelkamp core (211687) that presented alternating midden and LDC from 40-126 cm bgs with H1 at 77 cm bgs (Figure 15 and Figure 16). This H1 tephra has not been confirmed and TP14 did not reach that depth.

The general sequence (Figure 17) is a modern root mat [101] and disturbed layer [130] on top of a midden [131]. This midden was over a thin layer of turf [132] that is probably part of the wall (Figure 18) associated with the stone wall foundation [134]. Adjacent to the wall was a hearth [135] and associated ash midden [133]. No tephra layers were identified in any of the deposits. Because the test pit encountered structural remains (Figure 18) it was terminated at this level.

It appears that core 211687 slid through the structure rocks and possibly into earlier midden deposits below the uncovered structure. Based on the coring, we believe this unsampled midden may be pre-1104, but further research is necessary. Based only on the coring, the wall, hearth, and midden deposits have been assigned to the 1104-1766 period (Table 2).

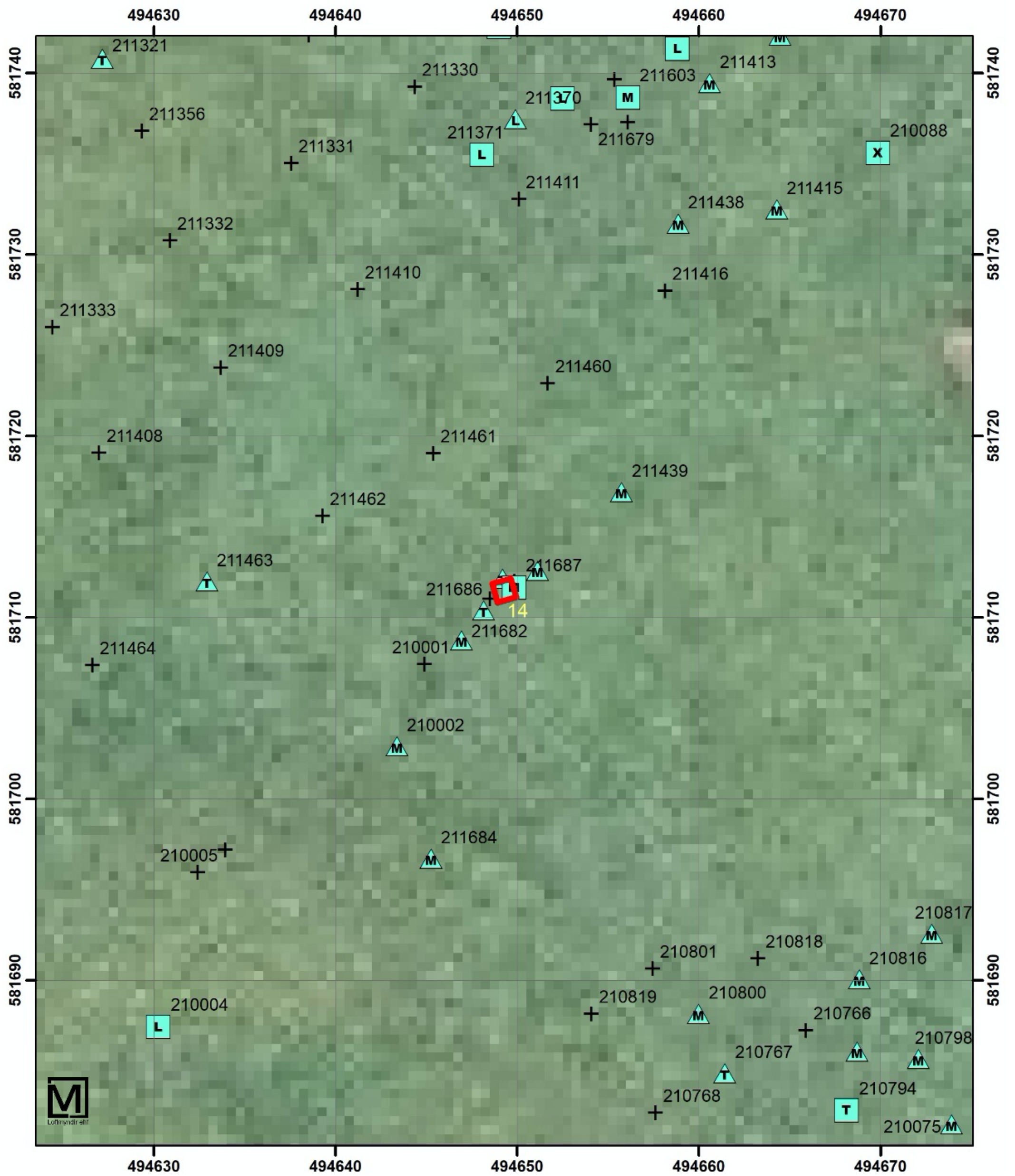

Figure 15.Map of cores displaying pre-1104 information around Test Pit 14

Figure 16. Photo of core 211687

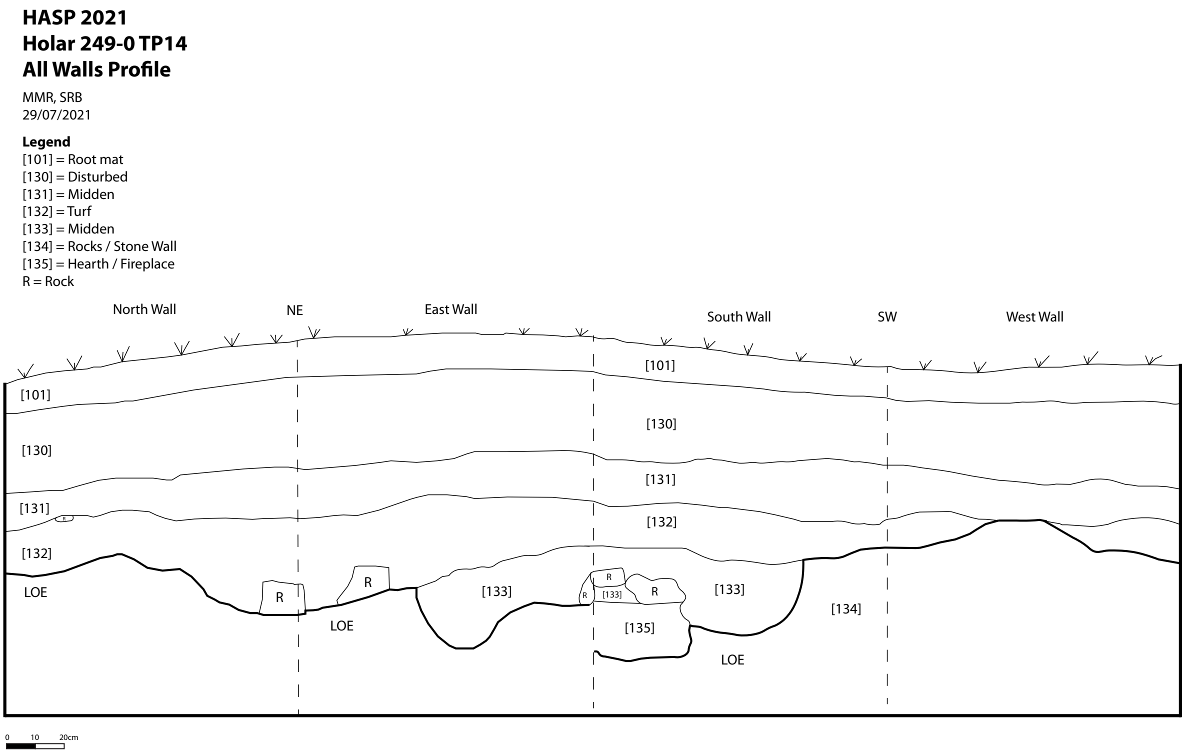

Figure 17. Drawn profile of all walls of TP 14.

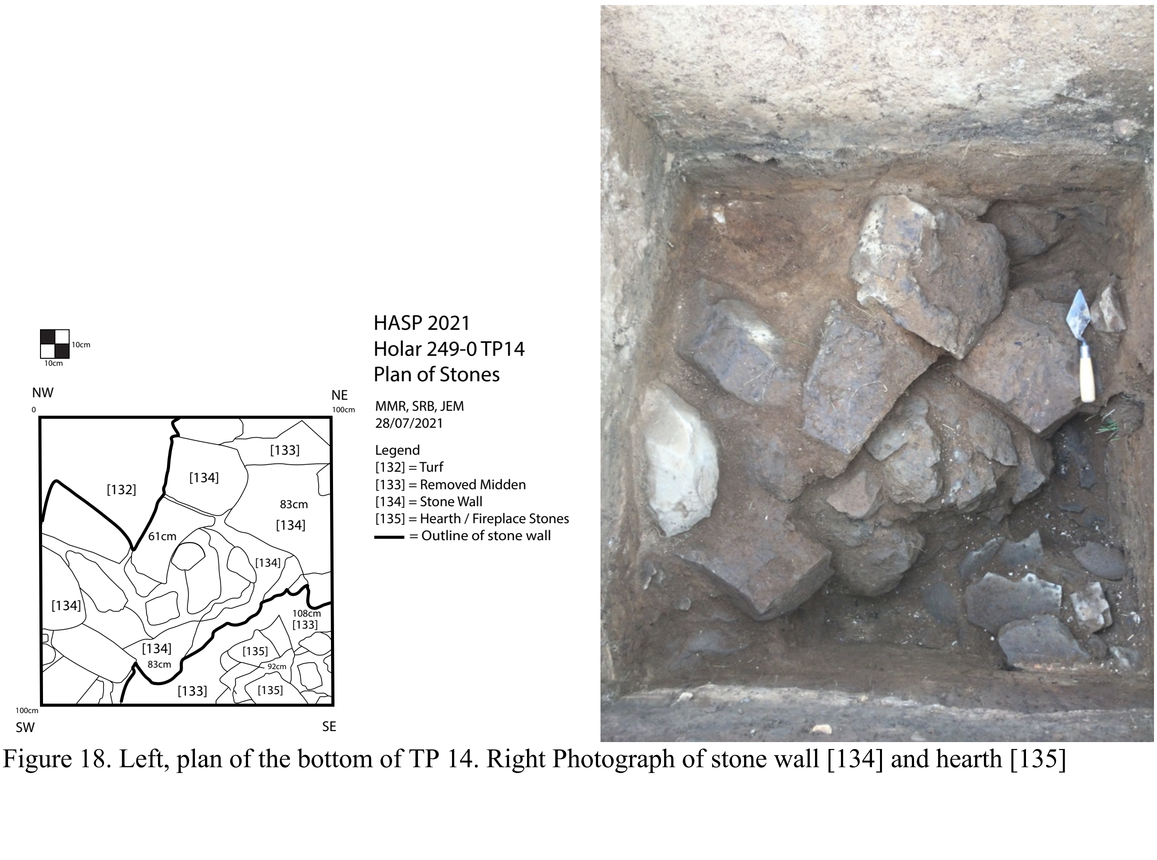

Figure 18. Left, plan of the bottom of TP 14. Right Photograph of stone wall [134] and hearth [135]

Test Pit 15

Test pit 15 was placed based on coring and preliminary results from earlier unreported excavations in Area H (Figure 5) just to the northeast. Initial coring with the JMC backsaver indicated a substantial midden deposit consistent with the Area H excavations to the northeast of this area (Figure 19). Further coring with the 6 cm Eijkelkamp (cores 212425, 212426 and 212421) suggested alternating midden and LDC with H1 at about 135 cm bgs. The area today is very wet, and the soil is waterlogged starting at about 1 m bgs. During excavation and coring, the water table appeared to be encountered at about 2 m bgs. The test pit is just 25 m from the Gvendarbrunnur well, which was reconstructed in 1955. Test Pit 15 was dug well beyond the depths where the H1 was identified in the cores so that tephra identification has not been confirmed (Figure 20).

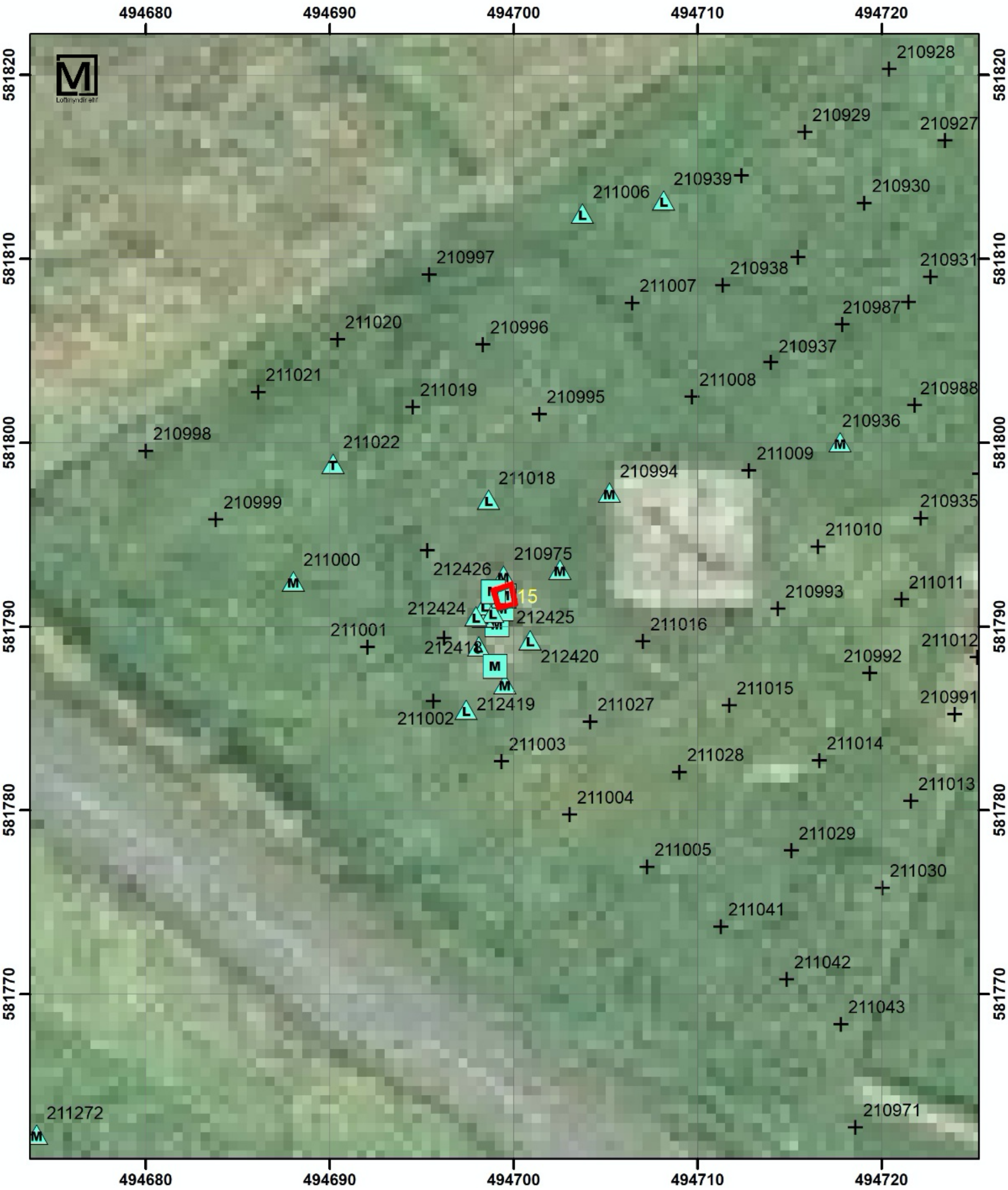

Figure 19.Map of cores displaying pre-1104 information around Test Pit 15

The general sequence is modern and disturbed midden, on top of a 13th and 14th-century bog, which formed on top of an earlier midden deposit which seems to overly more structural deposits that are difficult to interpret since they are below the water table. The test pit was stopped about 30 cm below the water table, still within cultural deposits. The sequence starts with a root mat [101] and a substantial disturbed deposit with glass and ceramics [136]. Below these recent layers, a series of alternating LDC and midden deposits [137, 138, 139, 140] were encountered. These deposits rested on a distinct bright peat ash layer [141]. Below the ash layer, the deposit changes and becomes bog [142-146]. Within that bog is a 40 cm long 0.3 cm thick well preserved 1300 tephra identified between [145] and [146]. There does not seem to be any structure or cuts in the [142-146] deposits, so it is characterized as bog rather than turf. This implies that the area was not used, even for ash and trash deposition around 1300, and bog deposits may have formed naturally during that time. At the bottom of the bog, in the south part of the excavation, there are a series of stones below the bog. In the north of the unit, towards the well, there is a sequence of alternating midden and bog deposits [147, 148, 149, and150] which seem to be intertwined with a smithy which was difficult to excavate because of the water at that depth.

The temporal understanding of the TP 15 sequences is based on the artifacts in [136] and the 1300 tephra. The 101 and [136] layers are assigned to the post-1766 period, as they are recently disturbed. The sequence from [137-145] has been assigned to the 1300-1766 period and the [146]-[151] sequence has been assigned to the 1104-1300 period as they are relatively continuous immediately below the 1300 tephra and no H1 was observed. There still may be earlier deposits to be encountered below the limit of excavation.

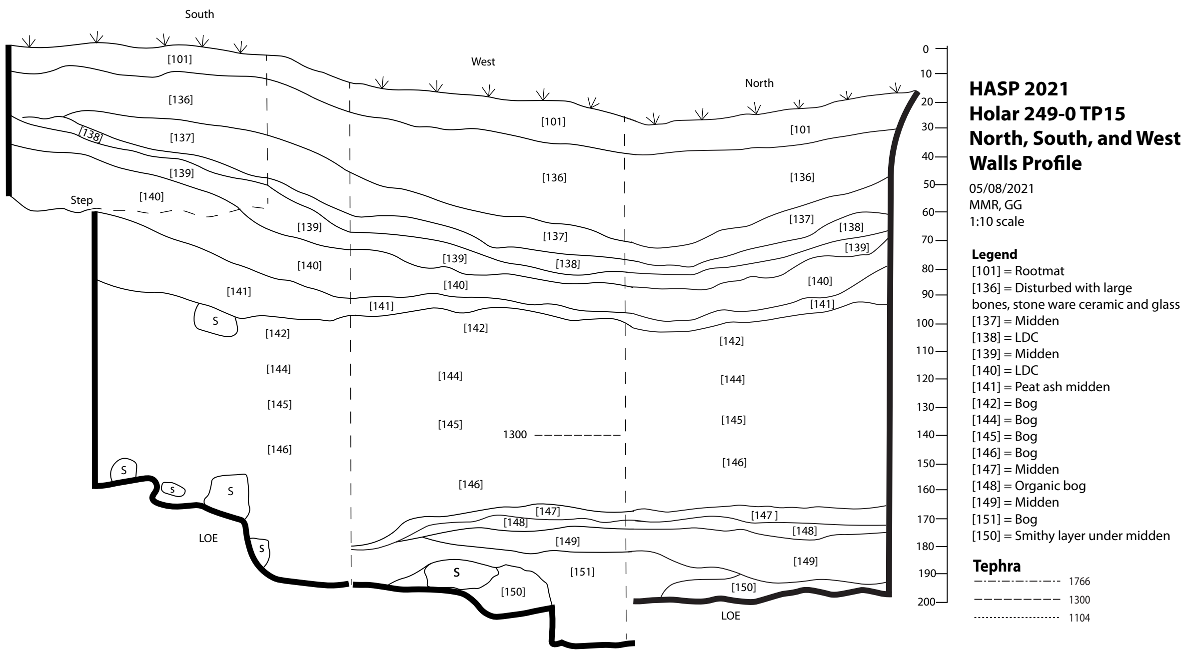

Figure 20.Drawn profile of Test Pit 15

Test Pit 16

Test pit 16 was placed, based on cores with midden that was identified far away from the main area of Hólar (Figure 21 and Figure 22). In particular, core 211583 presented 33 cm of midden and LDC below a very shallow H1 (12 cm bgs) identified in a bog deposit. The test pit revealed that the tephra was in a turf layer above a small compact LDC deposit [162] (Figure 23) that was essentially confined to the test pit. The turf above [161] has the H1 embedded in it, so the entire sequence is attributed to the 1104-1766 period. This is clearly a very small isolated burned area that was used only for a short time and is not part of the Hólar farmstead area.

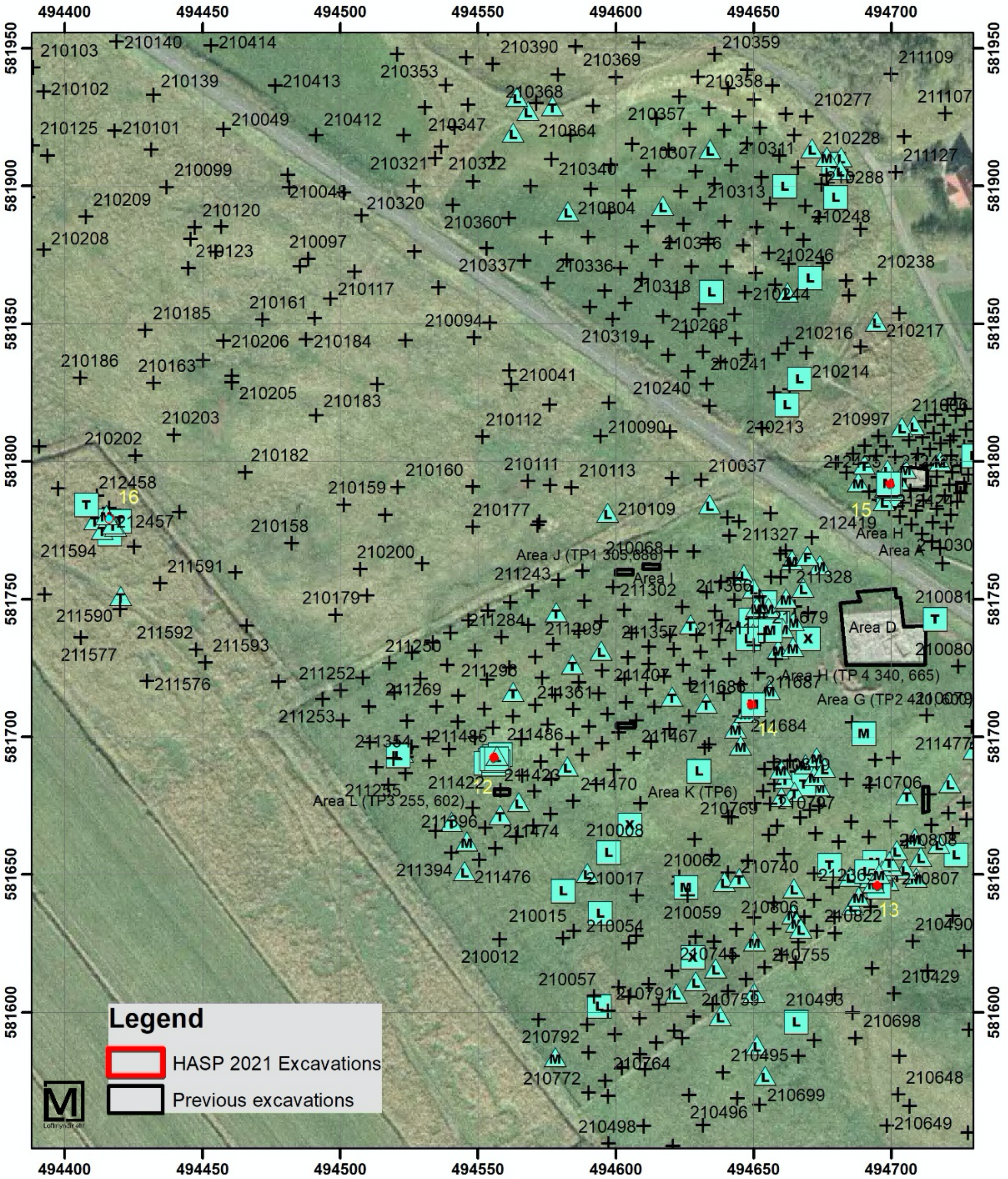

Figure 21. Map of cores displaying pre-1104 information with Test Pit 16 at the western edge, TP16 is more than 100 m away from the main Hólar cultural deposits.

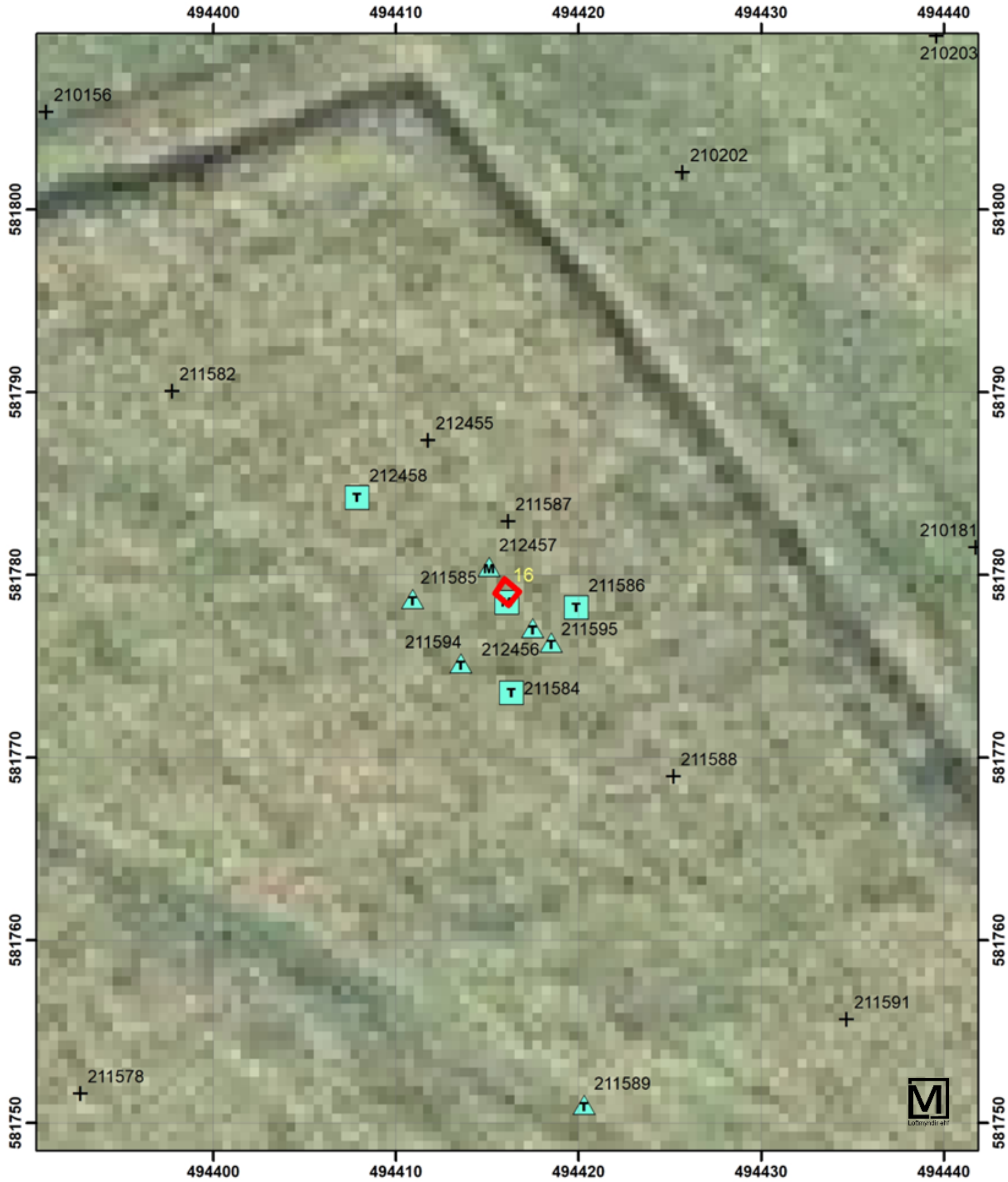

Figure 22.Close-up map of cores displaying pre-1104 information around Test Pit 16

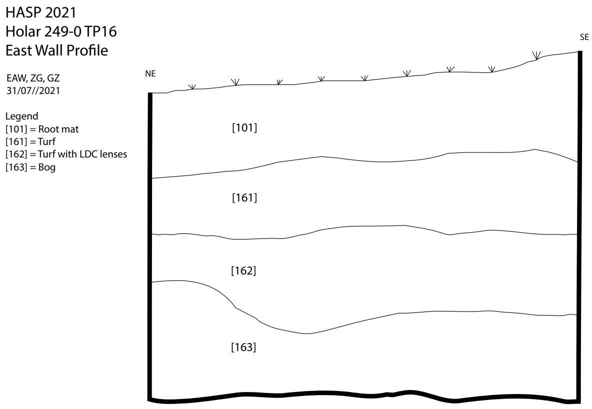

Figure 23. Drawn profile of east wall of TP16.

Test Pit 17

Test pit 17 was placed based on the results of cores in hopes of avoiding a series of buildings and schoolhouses indicated on the 1857 túnakort (Figure 24). Several cores indicated pre-1104 cultural deposits (Figure 25) but the sequence was very inconsistent from core to core. In particular, core 212451 indicated a small bit of midden under an H1 that presented at 118 cm bgs. Conversely, core 212464 presented LDC above an H1 at 99 cm.

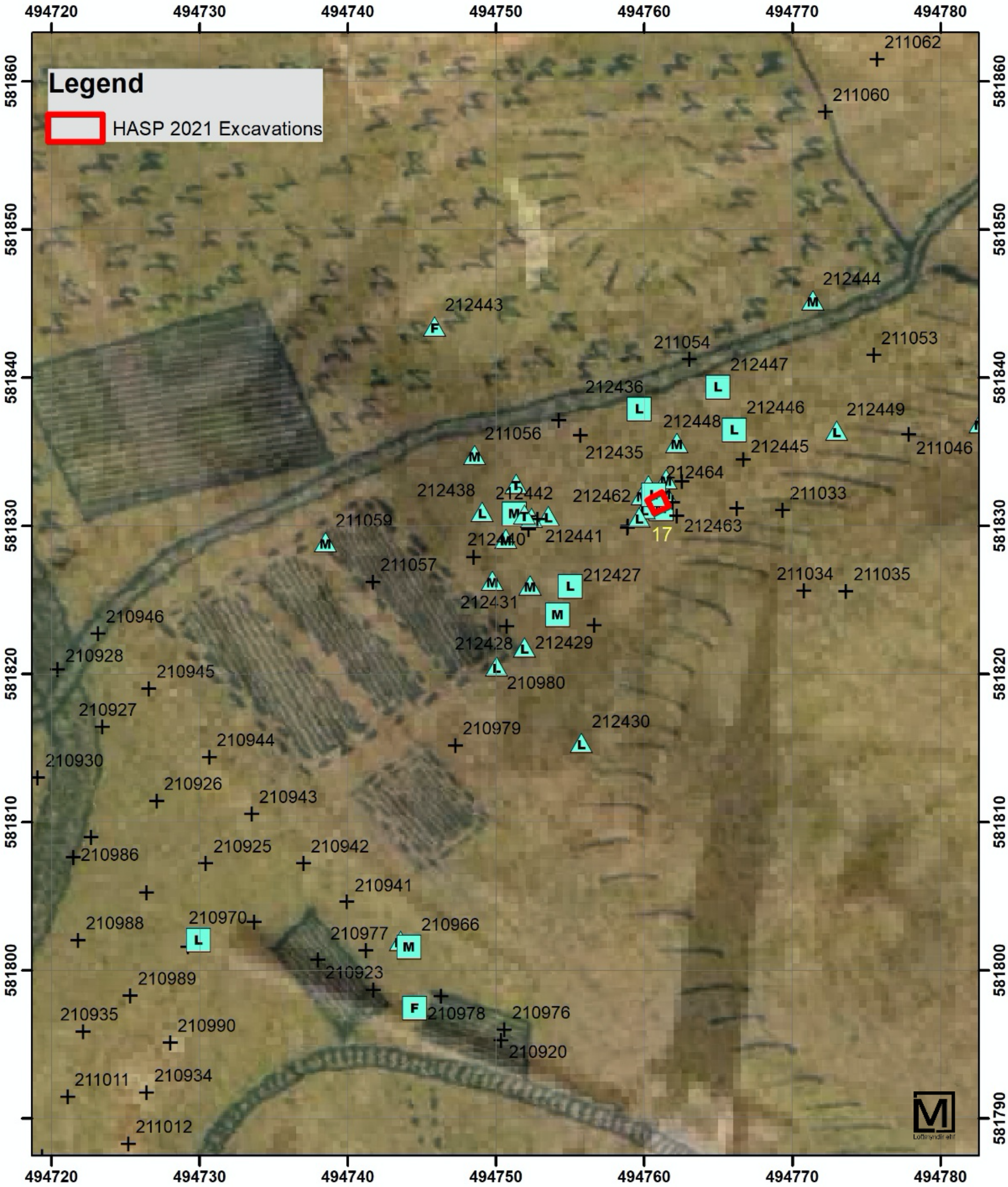

Figure 24. Cores with pre-1104 information and TP 17 superimposed on georeferenced 1857 túnakort

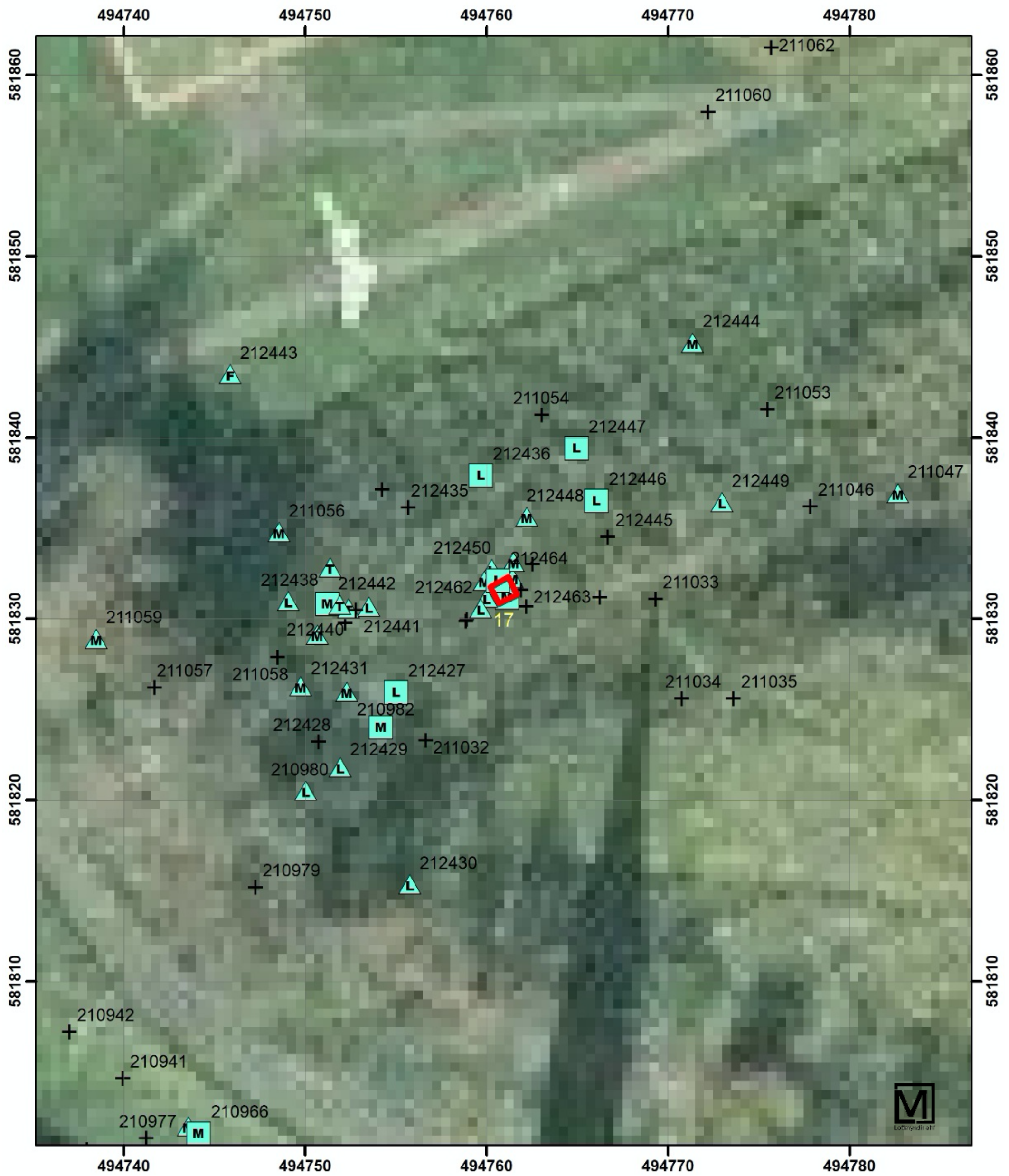

Figure 25.Map of cores displaying pre-1104 information around Test Pit 17

The general sequence (Figure 26) starts with a root mat [101] and a substantial disturbed layer [175]. The whole deposit seems to be capped by a 4-8 cm thick aeolian layer [176]. There is then an LDC layer [177-179] resting on a thin gravel layer [180]. There may have been bits of the 1104 tephra layer between [177] and [178] (Figure 27) but not enough to securely date any layers. The test pit is adjacent to the Bæjarlækurinn stream and this may be the result of flooding or detritus from the stream or erosion from the possible fort above the test pit. This gravel may also indicate some disturbance and truncation of the deposits. The gravel rests on an uneven and incomplete turf layer [181] that is on top of an LDC [182 and183] and very thin distinct midden [184]. The midden is on top of a thin aeolian layer [185] on top of gravel [186].

While the sequence may have some integrity, it is very disturbed and difficult to interpret. Thus, only the top layers have been assigned a time period (Table 2). The rest of the deposit may be very recent or have some antiquity. More research in this area is necessary to finalize an interpretation.

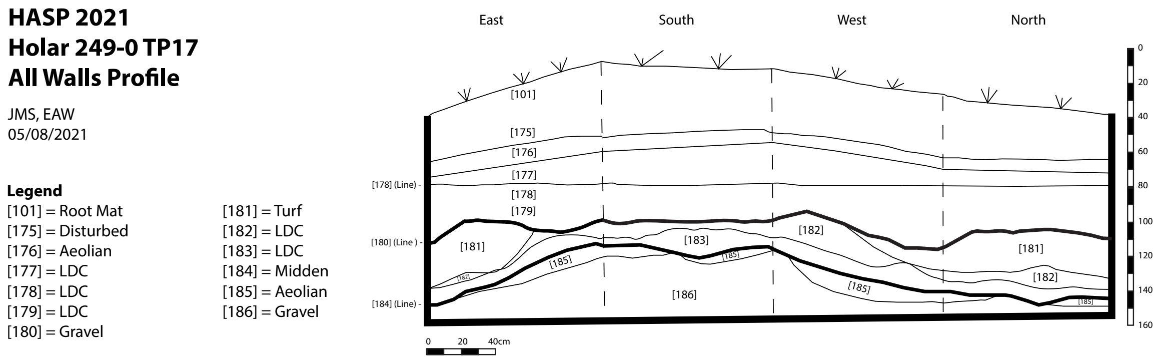

Figure 26. Drawn profile of TP17.

Figure 27. Left: photo of south profile and top of LDC [183] layer. Right: photo of potential 1104 at top of [178]

Estimation of farm size

For this first attempt at estimating the sizes of the Hólar farmstead, the parameters have been very conservative. This means that the 30 m rule (Appendix A, p.43) has been strictly enforced, which has caused the areas of each of the three time periods (Pre-1104, 1104-1300, and Post-1300) to be subdivided into three separate periods (Table 1). When these areas are summed, the overall area of Hólar while large, is comparable to sites on Hegranes such as post-1300 Helluland at 19,400 m^2 and 1104-1300 Ás, which was 16,940 m^2. That being said, 1104-1300 Hólar is the largest farmstead area that has been estimated using this method and this estimate is very conservative.

Table 1. Farm mounds sizes. Area is in square meters, centroids are in ISNET93. The boundaries of these areas are depicted on the following maps in different colors.

Date	Area	Centroid East	Centroid North
Pre-1104	1164.8	494667	581698
Pre-1104	466.4	494740	581683
Pre-1104	201.9	494740	581802
Pre-1104	**1833.1**		
1104-1300	20322.6	494623	581679
1104-1300	433.9	494702	581800
1104-1300	600.3	494756	581834
1104-1300	**21356.8**		
Post-1300	531.8	494704	581802
Post-1300	608.2	494756	581834
Post-1300	18006.9	494639	581708
Post-1300	**19146.9**		

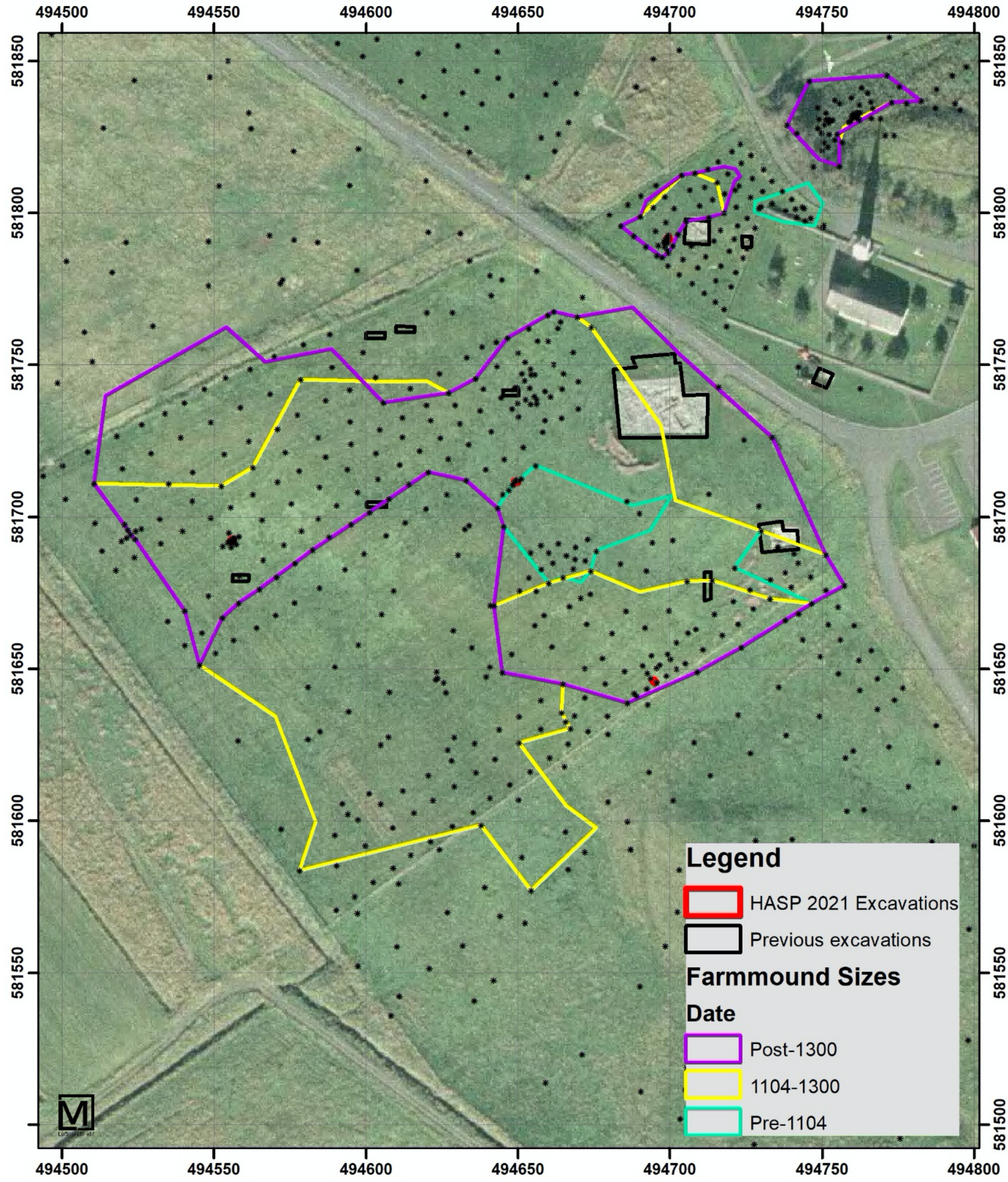

Figure 28. Farmstead areas from all three time periods superimposed on orthophoto

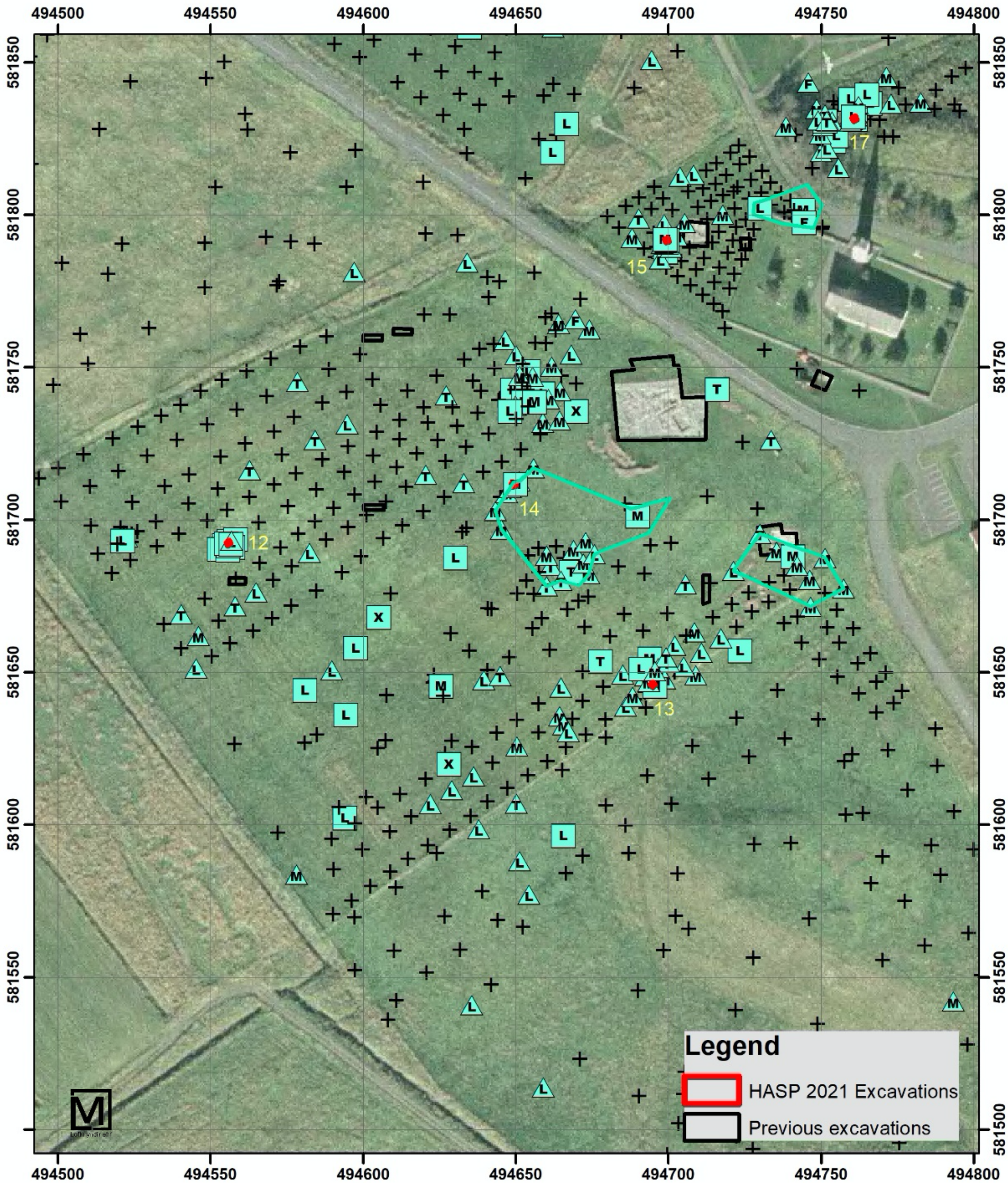

Figure 29. Farmstead areas with cores displaying codes for cultural material dating to the pre-1104 period

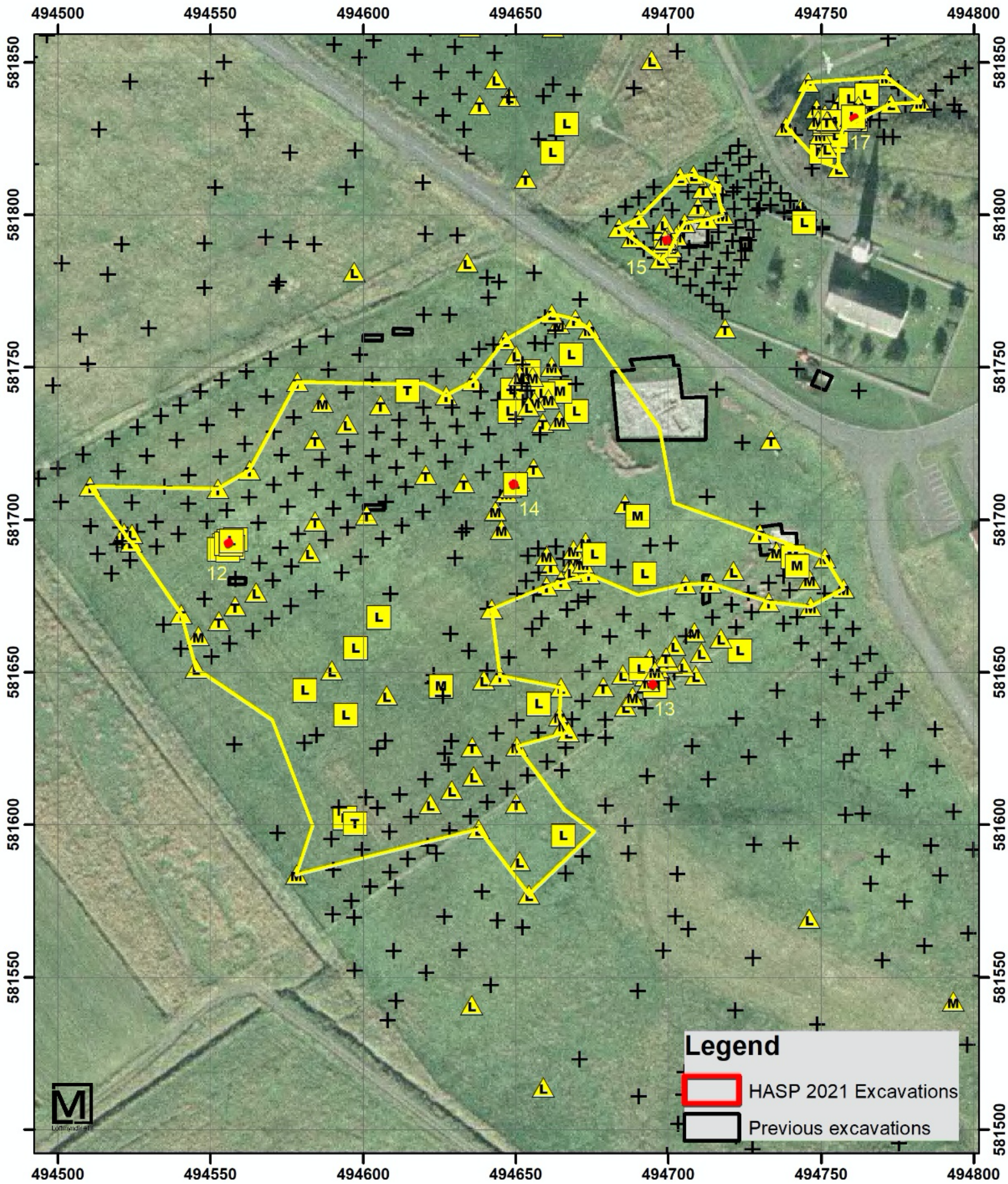

Figure 30. Farmstead areas with cores with cultural material dating from 1104-1300.

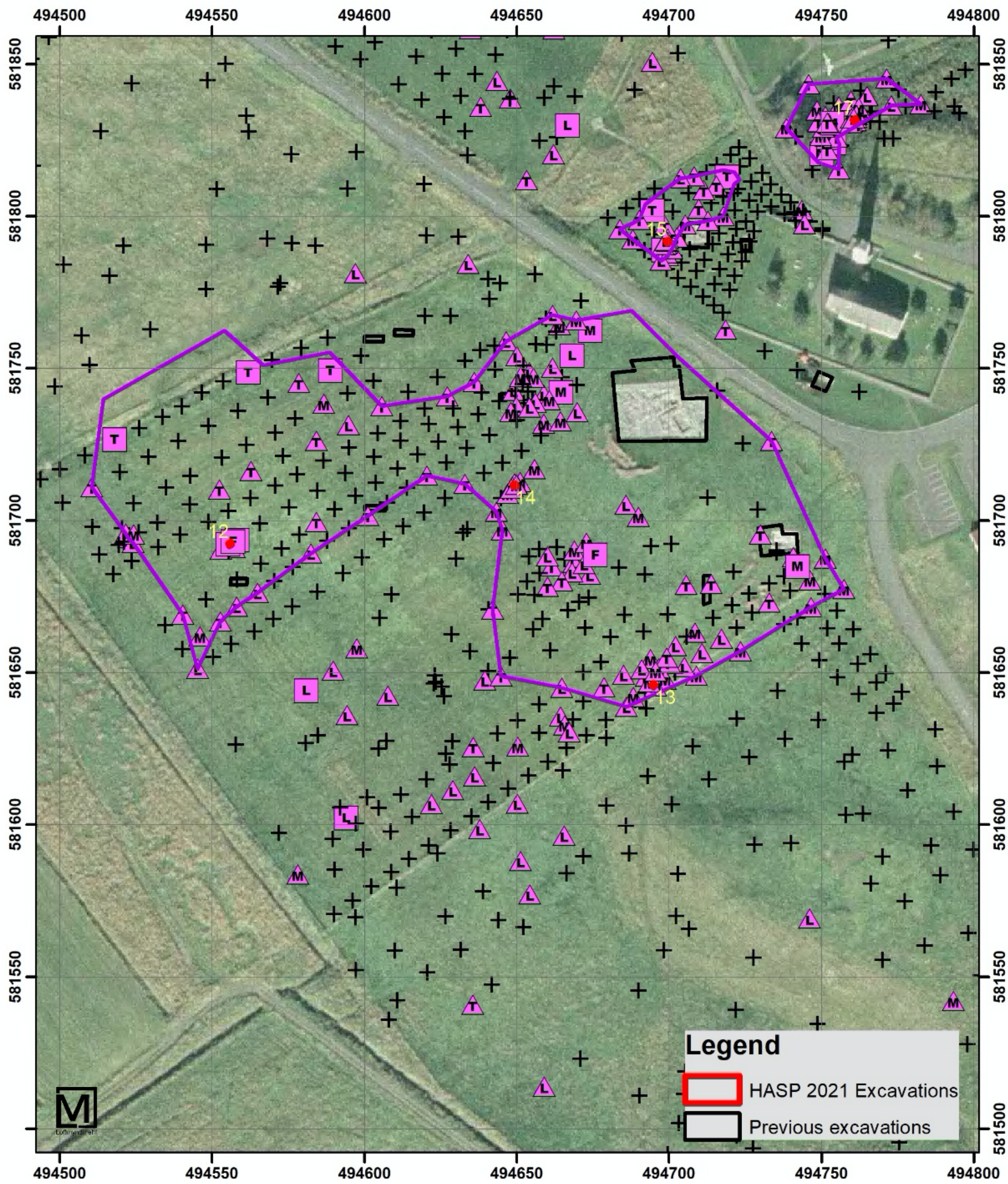

Figure 31. Farmstead areas with cores with cultural material dating to the post-1300 period.

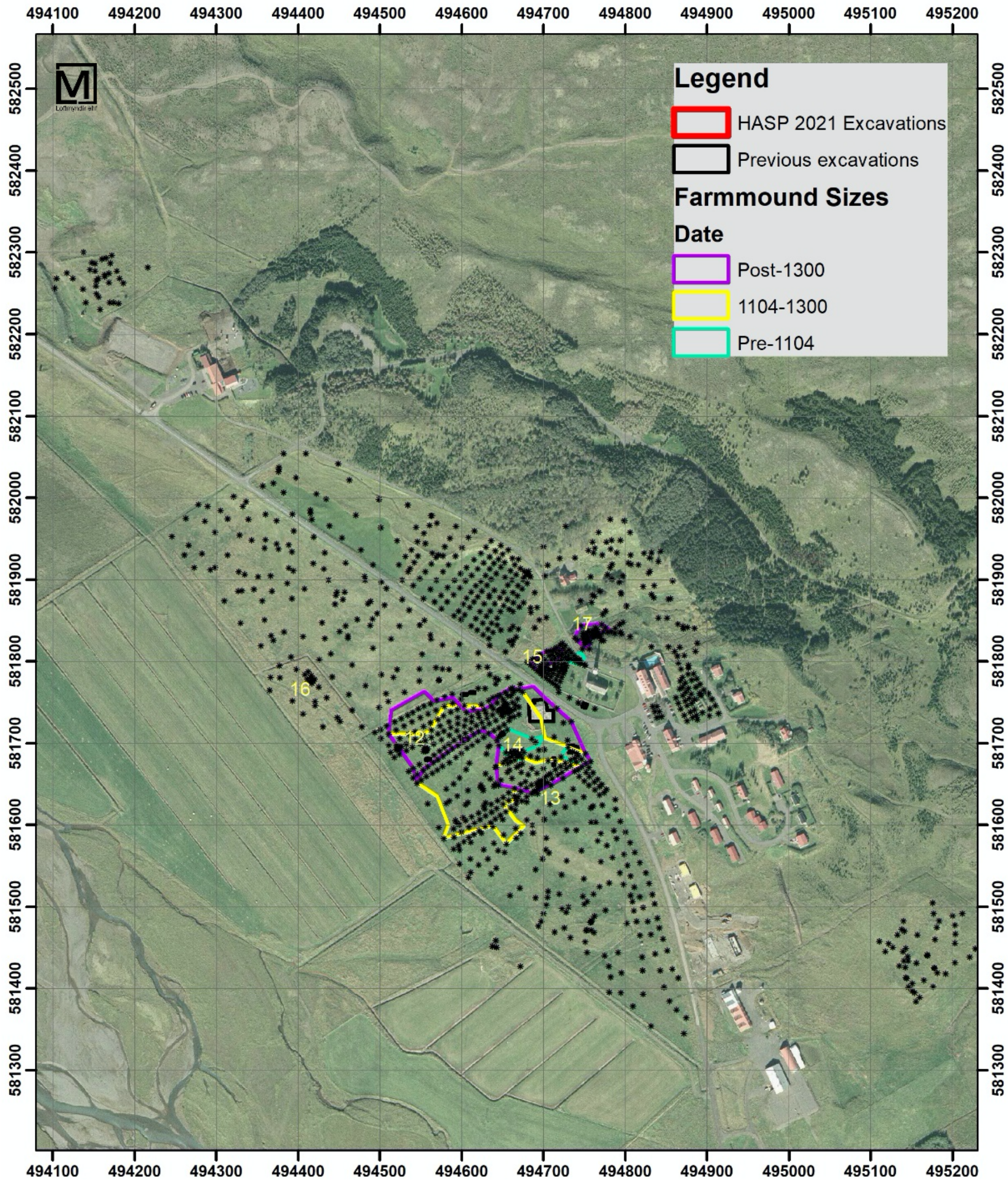

Figure 32. cores (dots with farm mounds areas for all of Hólar

Geophysics

Two conductivity surveys were conducted during the 2021 field season. The first at a presumed fort at Hólar and the second over the potential church at the farm of Kálfsstaðir (Ísaksson 2008) on the other side of the valley. Both with the CMD Mini with transect spacing at 0.5 m and station spacing between 5 and 7cm. Transects were walked unidirectionally. Bulk conductivity (Con) and In-phase (IP) point data were visualized using ArcGIS 10.8 employing the natural neighbor technique. For a short summary of conductivity, see Appendix D –Geophysics on p. 54. Additional data sets not described in the main body of this report are also found there. For details on the establishment of grids, see p. 8

Conductivity at Hólar

The CMD survey over a small area of the fort yielded poor results that are difficult to interpret. Transects were walked from south to north using fiducial rows every 5 m. The IP3 map (Figure 33) shows blue high ppt at the northern end that corresponds to the steep drop-off. The low ppt areas that spread out from that northern area may indicate some sort of structure.

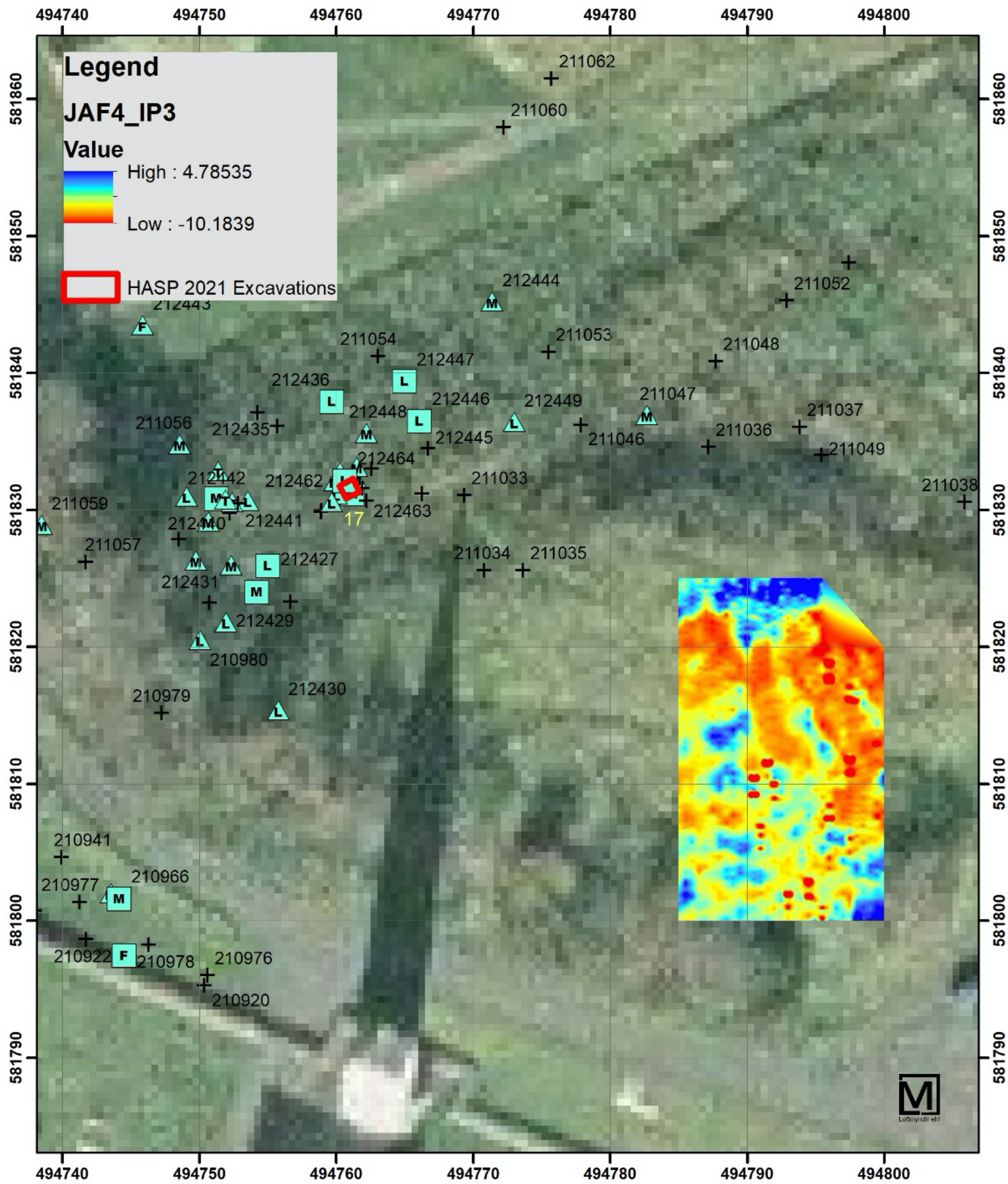

Figure 33. IP3 at Hólar superimposed on air photo with the 2021excavations and cores presenting the pre-1104 information.

The Con 3 component (Figure 34) does not indicate any of the structure found in the IP 3 component but does have a high conductivity area that may correspond to the tunnel/path line drawn on the 1857 túnakort map.

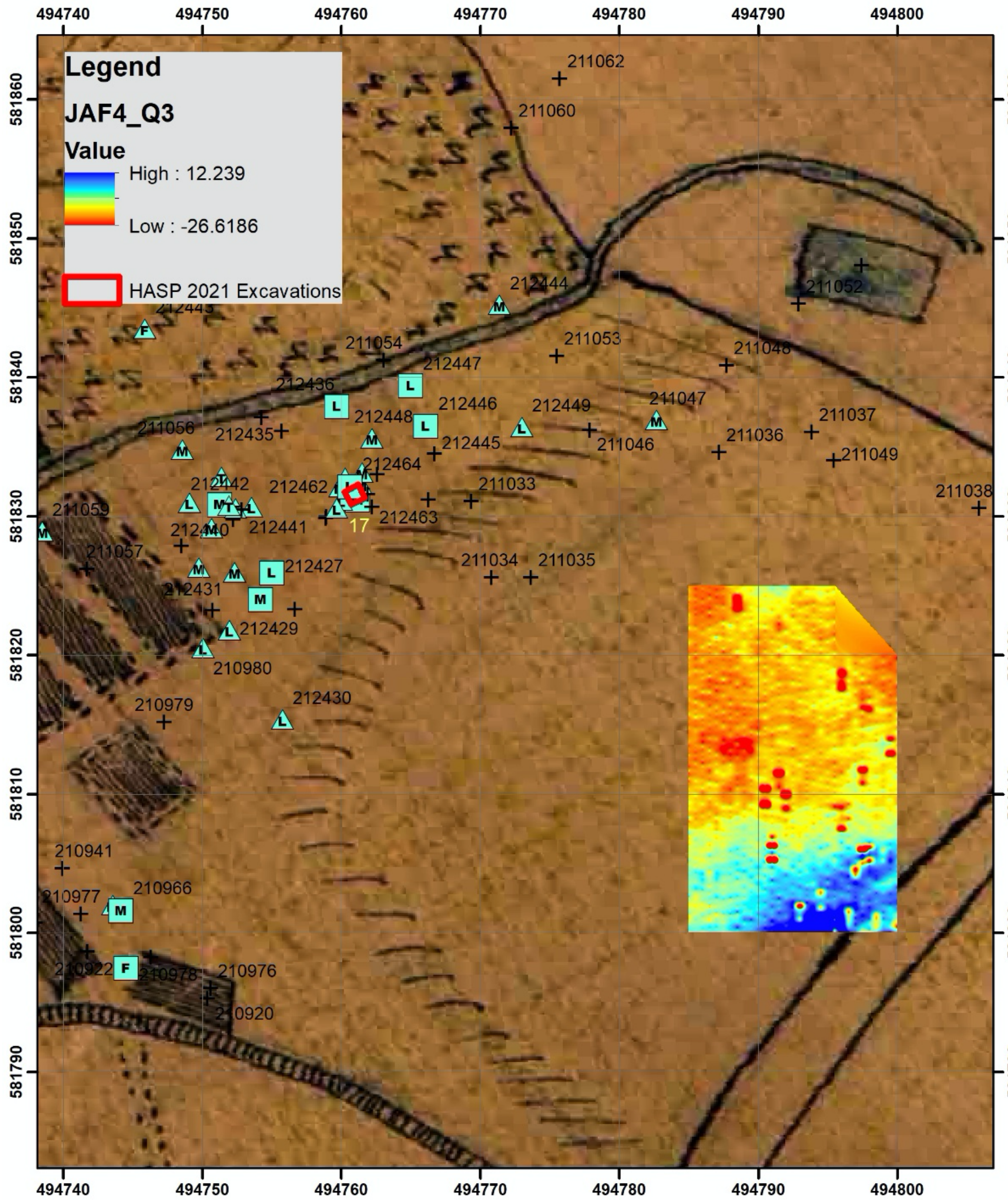

Figure 34. Con 3 superimposed on the 1857 túnakort map with the 2021excavations and cores presenting the pre-1104 information.

Geophysics at Kálfsstaðir

The CMD survey over a small area of the potential church yielded outstanding results. Transects were walked from north to south using fiducial rows every 5 m. Due to land leveling, there are no visible surface features (Figure 35) in the area that Ísaksson (2008) suggested as the location of the church (Figure 36).

The bulk conductivity data is dominated by water and electric utility lines (Figure 37) that run from the house to the barn. Even with those strong utility signals, there is a suggestion of a round structure that the western water line bisects (the electrical line is the eastern anomaly).

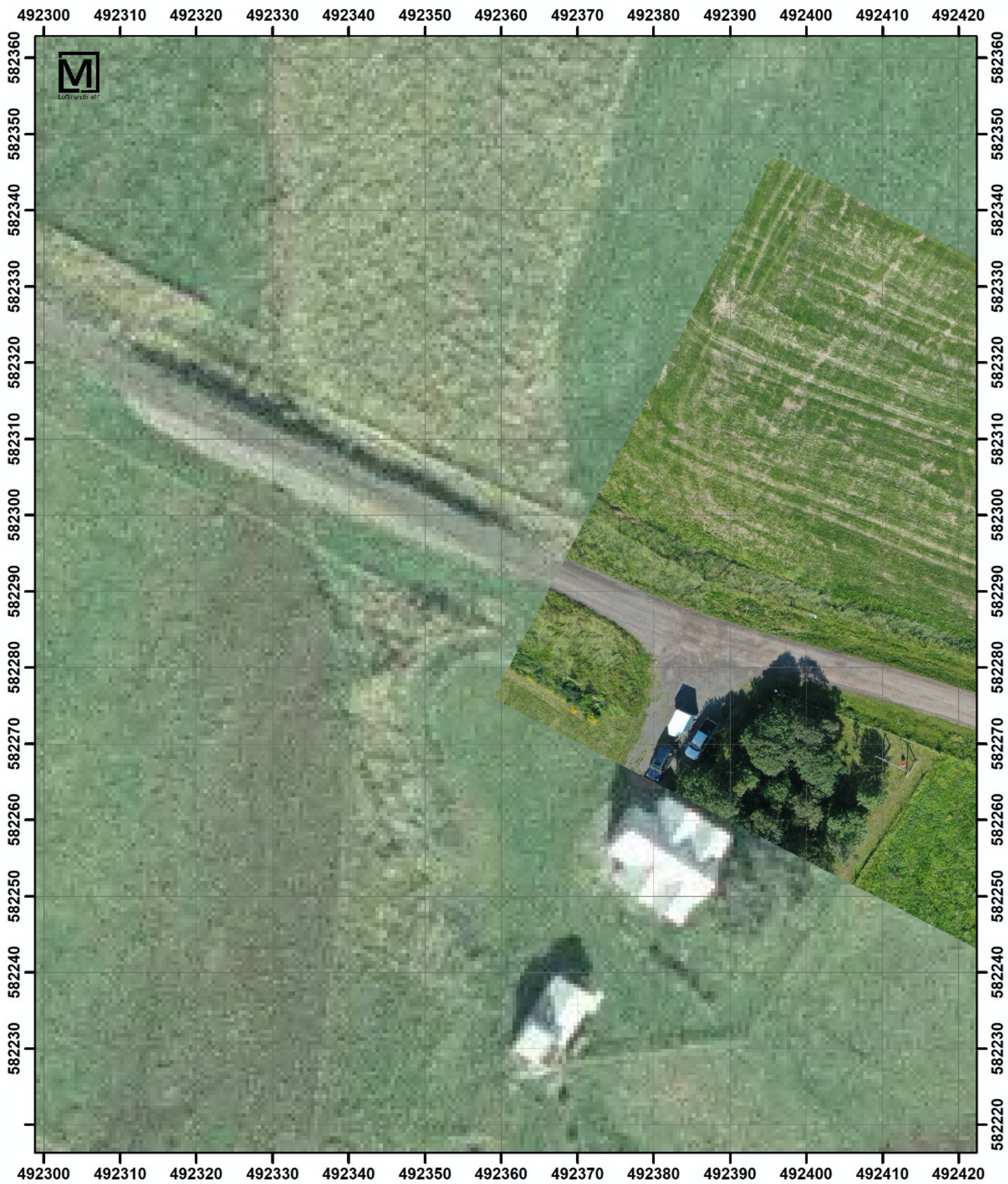

Figure 35.Drown air photo (right) of Kálfsstaðir air with the area of geophysical investigation.

Figure 36. Drone Air photo of Kálfsstaðir (right)with the map from Ísaksson (2008) showing ash midden and church georeferenced.

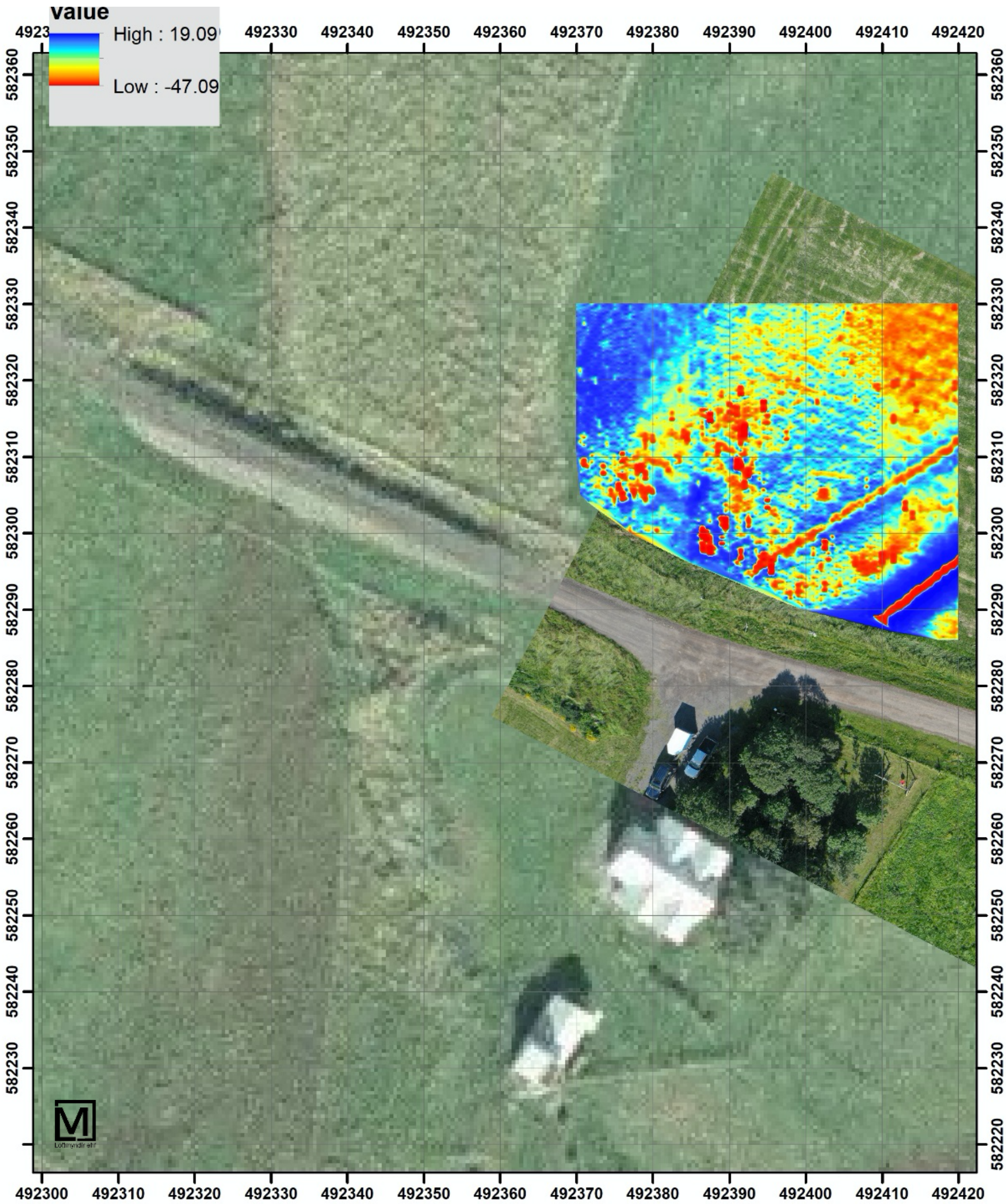

Figure 37. CMD IP3 at Kálfsstaðir superimposed on drone air photo (right).

The IP component is not as sensitive to the utility lines and an obvious low ppt readings forms a circle (yellow, orange, and red) about 18 m in diameter with a high ppt (blue) square in the center. This series of anomalies clearly corresponds to the Ísaksson map with the probable church shifted 10 m to the east from Ísaksson's proposed location (Figure 39). Interestingly, the IP2 component (Figure 48), which comes from the region slightly closer to the surface shows a larger circle. This may indicate a different churchyard configuration at a later time period.

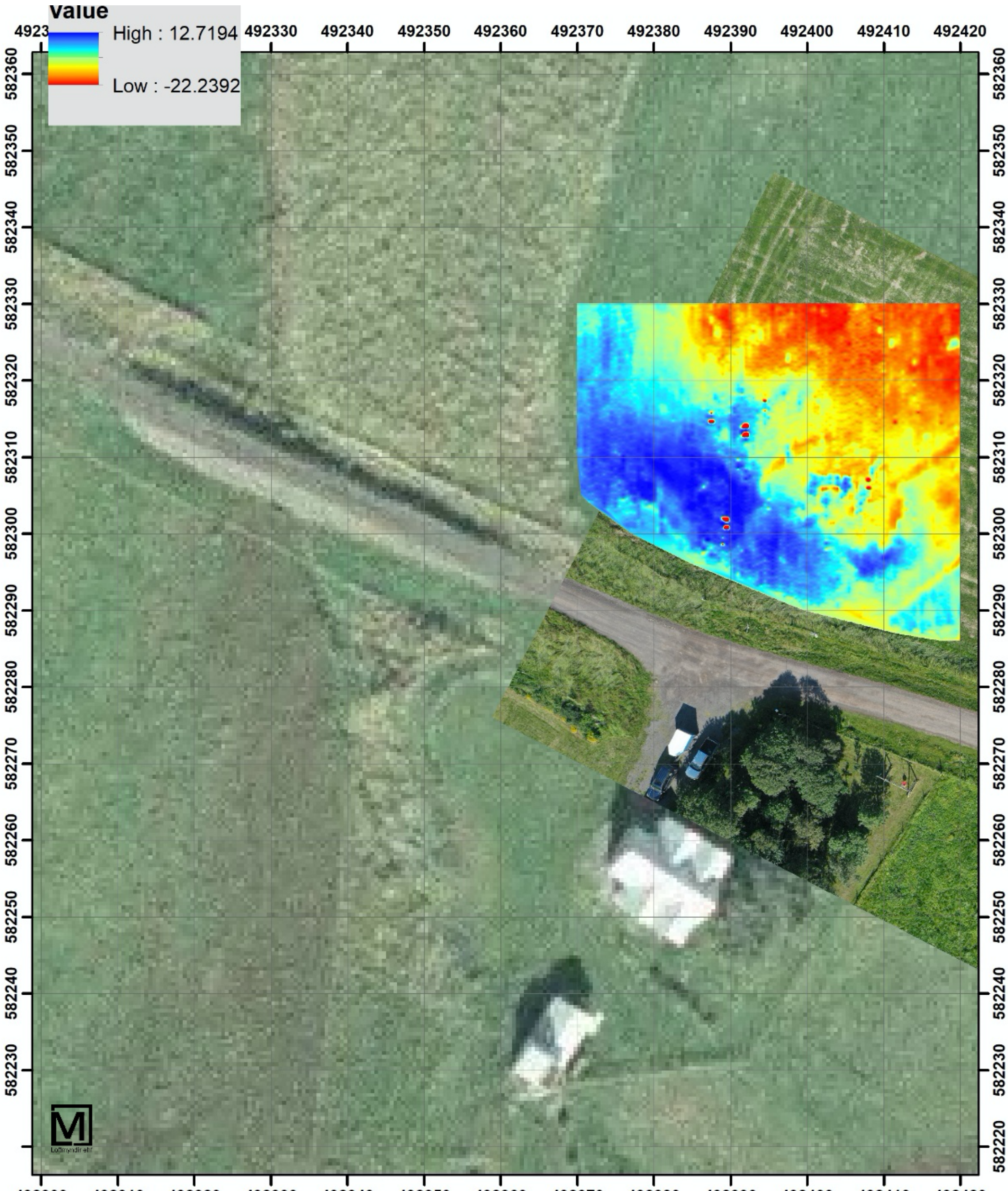

Figure 38. Air photo of Kálfsstaðir with the IP3 component superimposed.

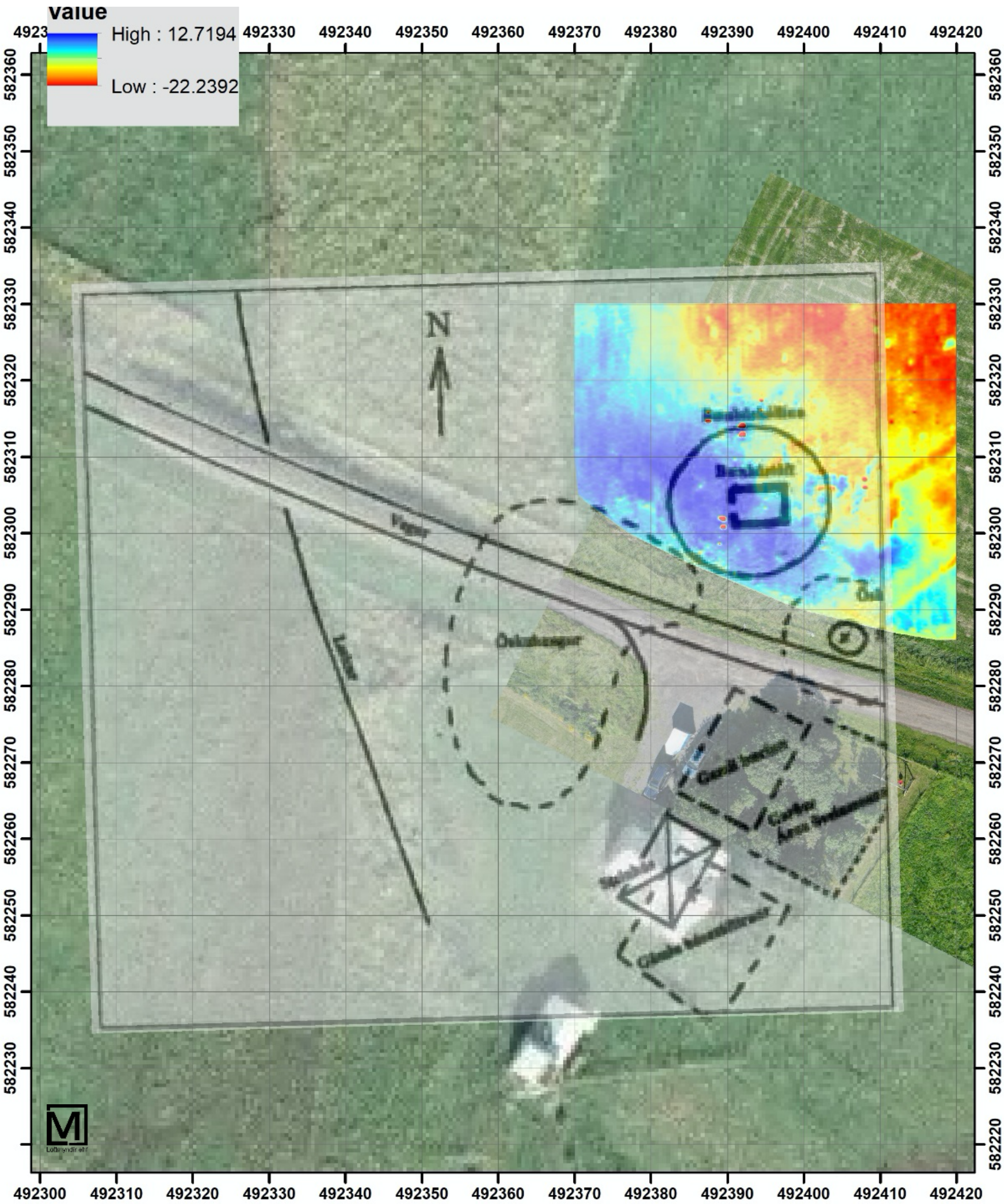

Figure 39. Drone air photo of Kálfsstaðir (right) with the IP3 component and Ísaksson's map superimposed.

Conclusion

The size of pre-1104 Hólar is a very rough and conservative estimate. With this current measurement, Hólar—between 1104-1300—is the largest farmstead from any time period that has been measured in Skagafjörður using the techniques employed here, at 21,360 m^2 (Table 1). Hólar from 1104-1300 is on the order of 40% larger than other continuously occupied contemporary farmsteads and 15% larger than the largest farmstead measured, until now (1104-1300 Helluland at 17,630 m^2). The substantial area of 1104-1300 Hólar is an important discovery.

Even with over 1,200 cores and 17 excavations, there are no excavation confirmed pre-1104 cultural deposits. Three areas of potential pre-1104 cultural deposits have been identified (Figure 29) and further work is necessary to try and confirm the presence of a Viking Age farmstead in any or all of these locations. While this work does not confirm the location of the earliest Hólar farmstead, it does outline where this farmstead is not. Extensive coring and good preservation of tephra show that there are no obvious small deposits of household trash dotted across the Hólar landscape. Even the named walled sites of Kollugerði and Geitagerði outside the main area of Hólar do not have domestic deposits. The living area of the farmstead is tightly constrained to the outlined areas (e.g., Figure 30 and Figure 31). This is another important discovery—that Hólar is constrained and surrounded by relatively large areas empty of domestic remains.

Finally, while this work does not tell us much about pre-1104 Hólar, it does tell us that the Viking Age farmstead was not large, when compared to other Viking Age Icelandic farmsteads and does not appear to be outside the bounds of the later Hólar farmsteads. If these preliminary results are reliable, Hólar reaches its largest size between AD 1104 and 1300, at the time of the establishment and early development of the Hólar bishopric. As always, more research is necessary.

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Appendix A - The protocol used for the HASP coring and test-trenching project

To determine the location and area of farmstead deposits, the results of cores were divided into three simple categories: "yes," "no," and "maybe" for each of the three temporal periods based on the presence of cultural material above or below specific tephra layers (Steinberg *et al.* 2016). Small and infrequent anthropogenic inclusions in soils – such as ash, charcoal, and bone – are common near farmsteads and other activity areas. These are good indicators that an activity area or domestic site may be nearby, but we do not count infrequent inclusions as contributing to the areal extent of the farmstead. Higher concentrations of anthropogenic inclusions, midden deposits, turf, and floors are included in farm mound deposits. These deposits are listed in the "category" column in the coring (e.g., Appendix E – 2021 Coring Data, p. 59) list and the class column in the context list (Table 2).

The first step in determining a "yes," "no," or "maybe" was to check if there were any in situ primary tephra layers (1766, 1300, or H1) present in the core. If none of these tephra layers were present, then all time periods were listed as "maybe". This procedure was also followed if any pre-H1 tephra layers (ex. H3 and H4) were present below the deepest cultural deposit in the core. The deposit type listed as "maybe" for each time period depended on how many total farmstead deposits were present in the core and their relative stratigraphic location. If there were 3 different deposit classes, they were listed in stratigraphic order with the deepest deposit corresponding to the pre-1104 time period, the middle deposit listed for 1104-1300, and the latest deposit for post-1300. If there was only one deposit, it was listed as "maybe" in all three time periods. If there were two deposits, the deepest one was listed for pre-1104 and the latest was listed for post-1300. For deposit classes, floor and midden were prioritized for 1104-1300, and if there was no floor or midden, the deepest deposit was listed for this time period. If there were more than three deposits, the deepest was listed for pre-1104 and the latest for post-1300. The deposit for 1104-1300 was assigned based on descending priority: Floor, midden, cultural layer, LDC, turf.

If there were in situ primary tephra layers present, the method was slightly different. For the pre-1104 time period, a deposit was assigned as "yes" if it extended through an in situ H1 layer, started below one, or extended through any deeper tephra, such as the LNL, H3, or H4. If there were multiple cultural deposits that could be listed as "yes", priority was given to midden or floor. If none of the deposits were midden or floor, the deposit type was listed as "mixed". A "no" was assigned for this time period if there were no deposits deeper than an in situ H1 layer. A deposit was listed as "maybe" if H1 was missing but the deposit was determined in association with another tephra, such as 1766, 1300. The absence of the H1 in a context of a cultural deposit is mostly because it was not preserved or the core did not penetrate deeply enough to encounter it (i.e., refusal within more recent deposits). In this case it was unclear whether the deposit would have extended below H1. A "maybe" was also given if H1 was missing and a deposit ended at the exact depth of a tephra layer below H1 but did not extend through it. If there were multiple deposits that could be listed as "maybe" the deepest one was selected for this time period.

For the 1104-1300 time period, a deposit was assigned as "yes" if it extended through the H1 layer or the 1300 layer or was located between these two in-situ layers without overlapping either one. If there were multiple cultural deposits that could be listed as "yes", priority was first given to the one that physically overlapped with the H1 or 1300, and then floor followed by midden. If no floor or midden were present, any combination of deposits was listed as "mixed". A "no" was assigned for this time period if there were no cultural deposits above the H1 tephra, or none extending through or existing between an in situ 1300 and H1. A deposit was listed as "maybe" if it existed above an in situ H1 with no 1300 present, or if there was no H1 present, but the deposit was determined in association with another tephra layer. A "maybe" was also given if there was no 1300 layer and a cultural deposit ended at the exact depth of an in situ H1 but did not extend through it. If there were multiple cultural deposits that could be listed as "maybe" the middle one was prioritized. However, if there were only two potential deposits, and therefore no middle, the earlier deposit was selected. Finally, if there was a greater even number of potential deposits (and thus no middle deposit), floor was prioritized, followed by midden, cultural layer, LDC, and turf.

For the post-1300 time period, a deposit was assigned as "yes" if it extended through the 1300 tephra layer, started and ended above it, or extended through a later tephra, such as 1766. If there were multiple deposits that could be listed as "yes" priority was given to midden and floor, and if none of the deposits were midden or floor the deposit type was listed as "mixed". A "no" was assigned for this time period if no farmstead deposit existed after the 1300 layer. A deposit was listed as "maybe" if there was no in situ 1300 layer, but the deposit was identified in association with another tephra. If multiple deposit types could be listed as "maybe", the latest one was selected.

For the purposes of the coring survey, farmstead or farm mound class deposit categories include:

- Turf deposits: any evidence for a turf structure, including collapsed or leveled turf, are considered evidence of farm buildings. The organic content and percentage of soil in turf deposits is variable. Sometimes tephra layers are present in turf, which represents a special case, as the tephra can provide a terminus post quem (TPQ) date for the deposit. As a rule, the turf must always postdate the tephra layer incorporated within it. This can lead to some specific situations. For example, a turf deposit containing a 1300 tephra layer is assigned a "yes" for the post-1300 time period if there are no other farmstead deposits above 1300 that would take priority. All other time periods are assigned according to the rules for in-situ tephra outlined above. If turf with H1 in it is the only farmstead deposit, and no in-situ tephra are present, a "no" is assigned for the pre-1104 time period, and the turf is assigned as "maybe" for both later time periods. If there is turf with H1 as the oldest deposit, a "no" is assigned for the pre-1104 time period, and the other time periods are assigned according to the rules for in-situ tephra outlined above. Finally, if there is turf with H1 in it as the only farmstead deposit, but there is also an in situ 1300 layer above the turf, the turf deposit is listed as "yes" for the 1104-1300 time period.
- Low-density cultural layers (LDC): defined by anthropogenic inclusions amounting to 10-50% of the soil matrix. These are assumed to result from indistinct and extensive depositional events that suggest regular activity typical of farmsteads or other farm production areas. Sometimes this deposit has a "mixed" character.
- Middens: defined by anthropogenic inclusions amounting to more than 50% of the soil matrix that suggest the regular deposition of household or production area waste. Middens are the result of distinct and intensive depositional events associated with purposeful disposal. In both LDC and Midden layers that are punctuated by tephra layers, for purposes of farm mound dating, the deposits are assumed to be continuous, occurring immediately before and after the date of the tephra deposition. For example, in a midden deposit with only H1 present, surrounded on either side by midden, both "Pre 1104, and "1104-1300" would be positive ("yes") while "Post-A.D. 1300" would be "maybe."
- Floor: characterized by dense, compacted, and/or greasy cultural layers indicative of floors, extramural activity areas, or areas of intense deposition of organic materials.

Sometimes floors are distinct fine-grained black ash. These floor deposits are often thin but are very distinct.

A coring shapefile was generated with a 3 layered symbology (one layer for each time period) where each core displayed a specific color for each time period, a specific shape for "yes", "no" or "maybe" within each time period, and a specific letter referencing the type of farmstead deposit in that time period. For a farmstead to be defined, for a specific time period at least one core had to have some confirmed evidence of human burning or other unambiguous evidence of human occupation that would be distinct from an animal-only outbuilding. More specifically, a farmstead perimeter for a specific time period was defined starting in a location where some confirmed evidence ("yes") of midden was found, whether from a single core or an excavation profile. The perimeter was then extended out to neighboring cores with farmstead deposits and was plotted halfway between a "yes" and "no" core, or on a "maybe" core. The continuous area within the perimeter was calculated to produce the maximum possible area of a farmstead.

Most cores with farmstead deposits are clustered together allowing for the definition of a single contiguous farmstead area. However, isolated areas with multiple cores containing farmstead deposits that are some distance removed from the main farmstead area are often identified in the coring. Generally, cores with farmstead deposits that were less than 30 meters from the main farmstead area were included within the farmstead perimeter. However, because of the complexity of the site, there were exceptions to this rule. The boundary could be stopped within 30 meters of other cores if there was a justified reason, such as a line of interstitial cores with no farmstead deposits but good preservation (ex. intact 1104). The farmstead boundary should encompass areas of cores with confirmed midden or floor, so single isolated cores or groups of multiple cores within 30 meters of the main farmstead area without confirmed midden or floor were generally not included unless they were interstitial between two areas of cores with confirmed midden or floor.

Groups of multiple cores with farmstead deposits located further than 30 meters from the main farmstead area were considered separate islands if at least one core had a confirmed midden or floor deposit. Single isolated cores with farmstead deposits or isolated areas of turf or LCD, without nearby midden, floor, or distinct cultural deposits, were not defined as farmstead islands. Separate enclosing boundaries were generated for islands that had sterile interstitial areas of more than 30 m from the main farmstead area. The area of these isolated islands was then added to the area of the main farmstead. Isolated farmstead deposits beyond 100 meters from the main farmstead are counted as separate named farmstead areas.

The coring data was also used to generate a point shapefile showing the percentage of disturbed deposits in each core. This was accomplished by dividing the combined thickness of any disturbed deposits within the core by the end depth of the core. Any large continuous areas of disturbance were identified and delineated by polygons in ArcMap, as these areas can impact the ability to accurately define the farmstead boundary.

Appendix B – 2021 Excavation data

Table 2. Context list

Test Pit	Context	Class	Description	Date range
TP12	101	Root Mat	Root mat	1766-Present
TP12	102	Disturbed	Disturbed	1766-Present
TP12	103	Low Density Cultural Deposit	LDC above whips of 1300	1300-1766
TP12	104	Low Density Cultural Deposit	LDC with whips of 1300 across top and through	1300-1766
TP12	105	Low Density Cultural Deposit	LDC	1104-1300
TP12	106	Low Density Cultural Deposit	LDC with much more charcoal and bone	1104-1300
TP12	107	Low Density Cultural Deposit	LDC	1104-1300
TP12	108	Midden	Midden	1104-1300
TP12	109	Midden	Midden	1104-1300
TP12	110	Midden	Midden	1104-1300
TP12	111	Midden	Midden	1104-1300
TP12	112	Bog	Diatomaceous layer on landnam in bog	Prehistoric
TP12	113	Bog	Landnam bog	Prehistoric
TP13	101	Root Mat	Root mat	1104-1766
TP13	115	Midden	Midden	1766-Present
TP13	116	Midden	Midden	1766-Present
TP13	117	Midden	Midden with possible LNL/LNS or 1000 underneath	1766-Present
TP13	118	Low Density Cultural Deposit	LDC	1104-1300
TP13	119	Aeolian Deposit	Aeolian with redeposited H3 on east side of unit	Prehistoric
TP13	1766	Tephra	Black tephra at interface between 117 and 118 (1766 tephra)	1766-Present
TP14	101	Root Mat	Root mat	1766-Present
TP14	130	Disturbed	Disturbed	1766-Present
TP14	131	Midden	Top midden	1104-1766
TP14	132	Turf	Turf below first midden on stones	1104-1766
TP14	133	Midden	Midden below turf	1104-1766
TP14	134	Stone	Stone wall	1104-1766
TP14	135	Stone	Hearth/fireplace in se corner of unit, adjacent to wall	1104-1766
TP15	101	Root Mat	Rootmat	1766-Present
TP15	136	Disturbed	Disturbed with large bones, stone ware ceramic and glass	1766-Present
TP15	137	Midden	Midden	1300-1766
TP15	138	Low Density Cultural Deposit	LDC between middens	1300-1766
TP15	139	Midden	midden	1300-1766
TP15	140	Low Density Cultural Deposit	LDC	1300-1766
TP15	141	Midden	Peat ash midden	1300-1766
TP15	142	Bog	Bog under midden	1300-1766
TP15	143	Stone	Schist stone in the bog	1300-1766
TP15	144	Bog	Bog under 1300	1300-1766
TP15	145	Bog	Bog	1300-1766
TP15	146	Bog	Bog	1104-1300
TP15	147	Midden	Midden	1104-1300
TP15	148	Bog	Organic bog under first midden	1104-1300
TP15	149	Midden	Midden	1104-1300
TP15	150	Smithy	Smithy layer under midden, full or rocks, slag, iron gravel and bone	1104-1300
TP15	151		Bog overlaying cxt 150	1104-1300
TP16	101		Top, root mat	1766-Present
TP16	161		Turf	1104-1766
TP16	162		Turf with LDC lenses	1104-1766
TP16	163		Bog	Prehistoric
TP17	101	Excavation	Rootmat	1766-Present
TP17	175	Disturbed	Disturbed	1766-Present
TP17	176		Aeolian	Unknown
TP17	177		LDC	Unknown
TP17	178		LDC	Unknown
TP17	179		LDC on gravel	Unknown
TP17	180		Gravel layer	Unknown
TP17	181		Turf collapse	Unknown
TP17	182		LDC	Unknown
TP17	183		LDC	Unknown
TP17	184		Midden	Unknown
TP17	185		Aeolian	Unknown
TP17	186		Gravel	Unknown

Table 3. Preliminary Find list

Farm	Excavation	Context	Find #	Material Type	Object type	Count	Description
Hólar	TP12	104	1	Metal	Unknown	2	Silver?
Hólar	TP12	104	2	Glass		1	Green glass
Hólar	TP12	105	3	Metal	Unknown	1	Button or rivet
Hólar	TP12	105	4	Metal	Unknown	2	Silver slag?
Hólar	TP12	106	5	Ceramic		1	Whiteware
Hólar	TP12	107	6	Ceramic		1	
Hólar	TP12	110	7	Metal	Unknown	1	Iron
Hólar	TP13	115	1	Metal			
Hólar	TP13	115	2	Metal	Unknown		
Hólar	TP13	116	3	Metal	Nail	1	
Hólar	TP15	137	1	Metal	Nail	2	Iron
Hólar	TP15	137	2	Mixed			Mix of glass and other items
Hólar	TP15	138	3	Metal	Nail	1	Iron
Hólar	TP15	139	4	Glass	Bead	1	Amber and misc
Hólar	TP15	139	5	Metal	Nail	2	Iron
Hólar	TP15	139	6	Stone		1	Loom weight
Hólar	TP15	140	7	Metal	Unknown	1	Copper decor on cloth
Hólar	TP15	140	9	Metal	Nail	10	Iron
Hólar	TP15	141	11	Metal		1	Crucible
Hólar	TP15	141	14	Ceramic		1	Fireplace mantle stone, tin glazed?
Hólar	TP15	142	12	Stone	Stone, round	1	White pebble and wood
Hólar	TP15	143	13	Stone			Schist stone
Hólar	TP15	146	16	Stone			Misc
Hólar	TP15	146	17	Stone			Green stone
Hólar	TP15	147	18	Stone		1	Cut red stone
Hólar	TP17	180	4	Metal	Pin		Small pin with nail
Hólar	TP17	182	6	Metal	Nail	2	Iron
Hólar	TP17	183	7	Iron	Hook	1	Iron hook

Table 4. Preliminary Sample list

Excavation	Context	Type	Sample #
TP12	103	Flotation	1
TP12	104	Flotation	2
TP12	104	Bone, Animal	3
TP12	105	Flotation	4
TP12	105	Flotation	5
TP12	105	Bone, Animal	6
TP12	106	Flotation	7
TP12	106	Bone, Animal	8
TP12	107	Flotation	9
TP12	107	Bone, Animal	10
TP12	108	Flotation	11
TP12	108	Bone, Animal	12
TP12	109	Flotation	13
TP12	109	Bone, Animal	14
TP12	110	Flotation	15
TP12	110	Bone, Animal	16
TP12	111	Flotation	17
TP12	111	Bone, Animal	18
TP12	111	Flotation	19
TP12	112	Flotation	20
TP12	112	Bone, Animal	21

Excavation	Context	Type	Sample #
TP12	113	Flotation	22
TP13	115	Bone, Animal	1
TP13	115	Flotation	2
TP13	116	Flotation	3
TP13	117	Flotation	4
TP13	117	Flotation	5
TP13	117	Flotation	6
TP13	118	Flotation	8
TP13	118	Bone, Animal	9
TP13	118	Bone, Animal	10
TP13	119	Flotation	11
TP13	119	Bone, Animal	12
TP13	1766	Flotation	7
TP14	131	Flotation	1
TP14	133	Flotation	2
TP14	133	Bone, Animal	3
TP14	133	Flotation	4
TP14	133	Flotation	5
TP15	137	Flotation	1
TP15	137	Bone, Animal	2
TP15	138	Bone, Animal	3
TP15	139	Flotation	4
TP15	139	Bone, Animal	5
TP15	140	Bone, Animal	6
TP15	141	Flotation	7
TP15	141	Bone, Animal	8
TP15	141	Flotation	9
TP15	142	Flotation	10
TP15	144	Flotation	11
TP15	144	Bone, Animal	12
TP15	145	Flotation	13
TP15	145	Bone, Animal	14
TP15	146	Flotation	16
TP15	147	Flotation	17
TP15	147	Bone, Animal	18
TP15	147	Flotation	19
TP15	147	Wood	23
TP15	148	Flotation	20
TP15	149	Flotation	21
TP15	149	Flotation	22
TP15	149	Flotation	23
TP15	149	Bone, Animal	24
TP15	149	Bone, Animal	25
TP15	149	Wood	26
TP15	149	Flotation	27
TP16	162	Flotation	1
TP16	162	Bone, Animal	2
TP17	175	Bone, Animal	1

Excavation	Context	Type	Sample #
TP17	176	Flotation	2
TP17	176	Flotation	3
TP17	177	Flotation	4
TP17	177	Bone, Animal	5
TP17	178	Flotation	6
TP17	178	Bone, Animal	7
TP17	178	Slag	8
TP17	179	Flotation	9
TP17	179	Bone, Animal	10
TP17	179	Slag	11
TP17	180	Flotation	12
TP17	180	Bone, Animal	13
TP17	181	Flotation	14
TP17	181	Flotation	15
TP17	182	Flotation	16
TP17	183	Flotation	17
TP17	184	Flotation	18
TP17	184	Flotation	19
TP17	185	Flotation	20

Appendix C – 2021 Excavation Harris matrices

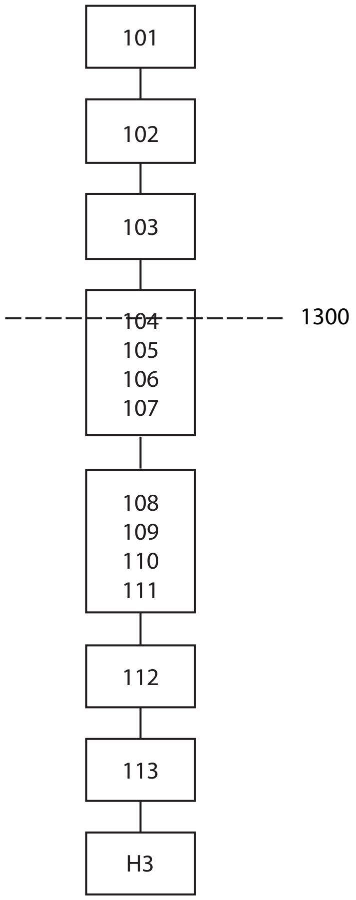

Figure 40.Harris Matrix of Test Pit 12

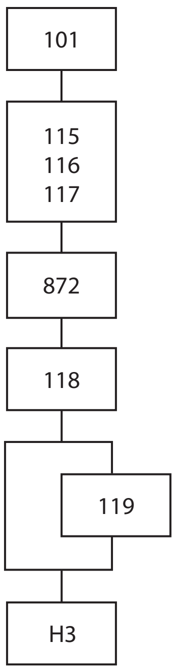

Figure 41.Harris Matrix of Test Pit 13

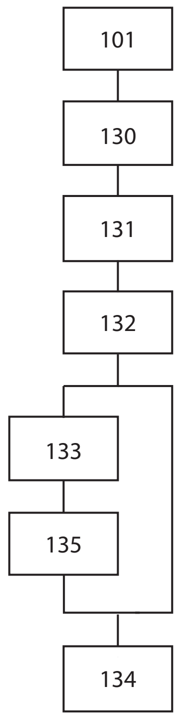

Figure 42.Harris Matrix of Test Pit 14

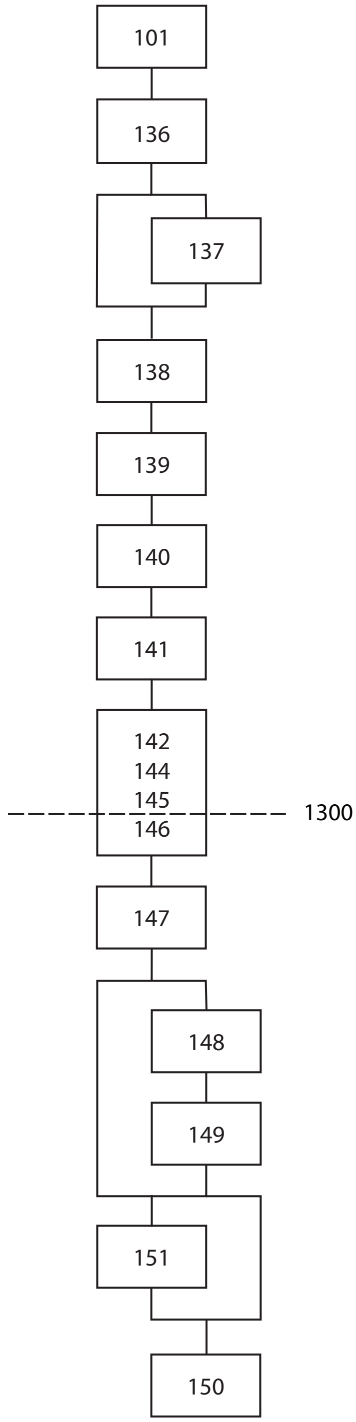

Figure 43.Harris Matrix of Test Pit 15

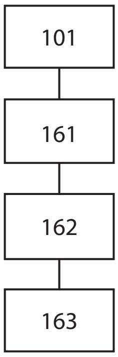

Figure 44.Harris Matrix of Test Pit 16

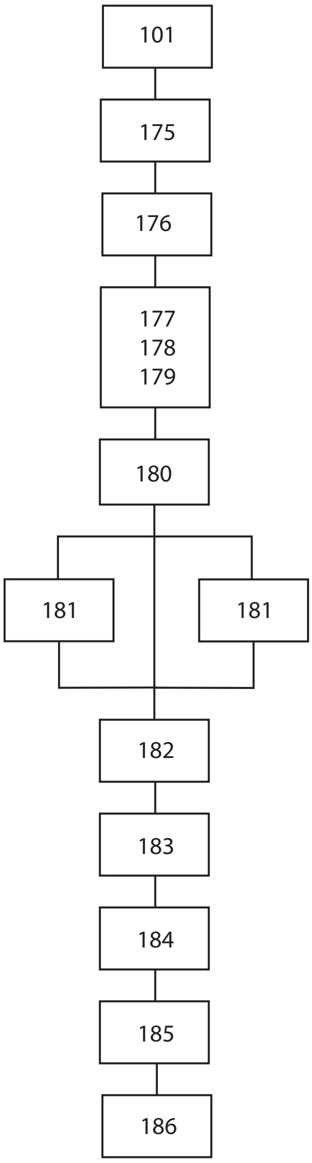

Figure 45.Harris Matrix of Test Pit 17

Appendix D –Geophysics

Electromagnetic Principles

Conductivity or the frequency-domain electromagnetic (FDEM) method is an active non-destructive geophysical method that is used to obtain shallow subsurface information. In the EM method, a time-varying magnetic field is generated by driving an alternating current through a loop. Eddy currents flow within any conductive material beneath the area of investigation. The eddy currents generate their own magnetic fields such that at any point in space, the total magnetic field is the superposition of the primary field due to the source current and secondary fields due to the eddy currents. By discriminating between primary and secondary fields, variations in the EM properties of the ground can be discerned.

EM instruments measure both out-of-phase (quadrature or Con) and in-phase (IP) components of the induced magnetic fields. The former is a measure of the bulk apparent ground conductivity; the latter is related to magnetic susceptibility and is particularly sensitive to the presence of metallic objects. Bulk apparent ground conductivity reflects true conductivity when the subsurface is homogeneous and isotropic, which is rarely the case in practice. For heterogeneous conditions, it represents an integrated effect of the all the conductivity within the volume of ground being sensed. It does not, however, represent an average conductivity and in fact can be lower or higher than the lowest or highest subsurface conductivities, respectively. A lateral variation in the components is indicative of lateral changes in properties. The conductivity is particularly sensitive to fluid content and dissolved salts or ions. Accordingly, wet sands, clays and materials with high ion content generally have high bulk apparent ground conductivity; dry sands and crystalline rocks have low bulk apparent ground conductivity.

Ideally, EM surveys are conducted in archaeological investigations to find conductive targets in resistive environments such as middens and rammed-earthed walls. Although more subtle and difficult to detect, resistive targets such as buried stone walls and foundations can also be detected through EM surveying. The FDEM surveys were conducted using a GF Instruments' CMD Mini-Explorer. The CMD Mini, like the larger CMD explorer operates at 30 kHz over three separate dipole lengths. By increasing dipole length, a greater volume and depth of soil can be sensed. The CMD Mini Explorer has a single transmitter located at one end of the unit and three separate receivers located at dipole lengths of 0.32, 0.71 and 1.18 m which provide depths of interrogation of approximately 0.5, 1.0 and 1.8 m, respectively, relative to the level of the sensors. For the 2021 CMD Mini survey, the unit was operated in the vertical dipole mode with the boom carried at foot level oriented parallel to the direction of the transects. Con3 and IP3 images correspond to the deepest level of integration.

Additional geophysical results from Hólar

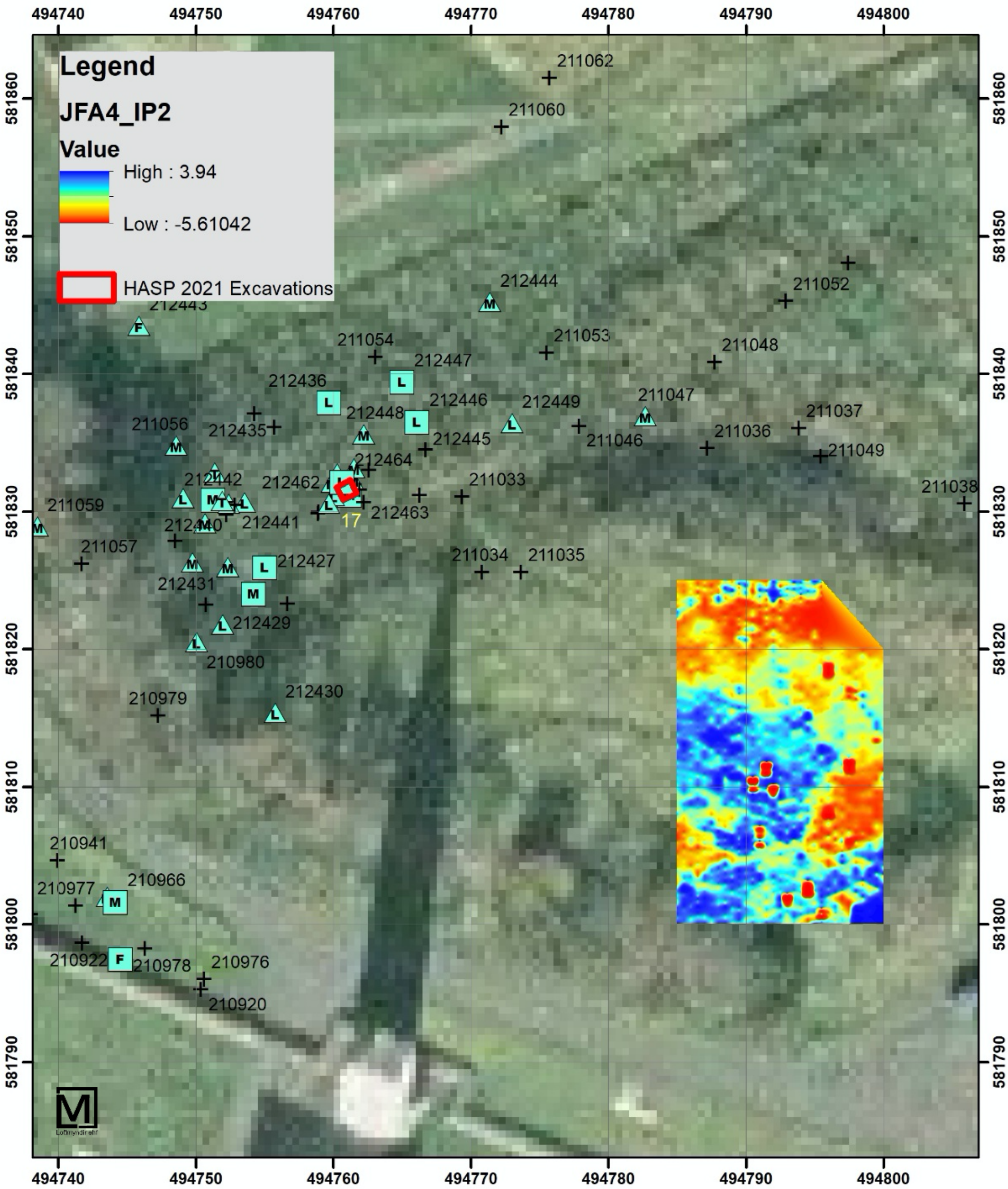

Figure 46. IP 2 superimposed on Air Photo, with pre-1104 cores

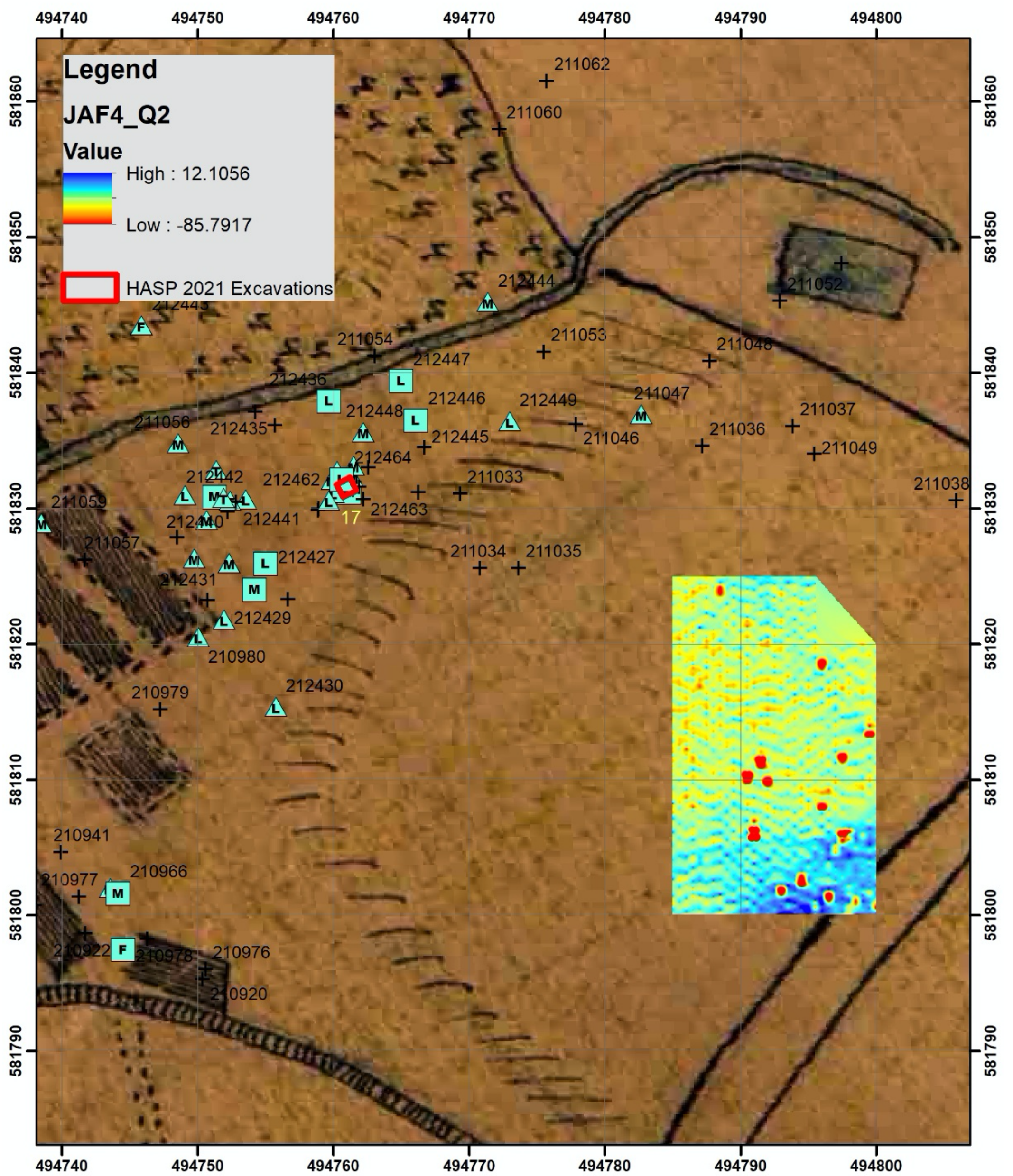

Figure 47. CMD Con 2 take on the Holar Fort superimposed on 1857 túnakort, with information from pre-1104 cores

Additional geophysical results from Kálfsstaðir

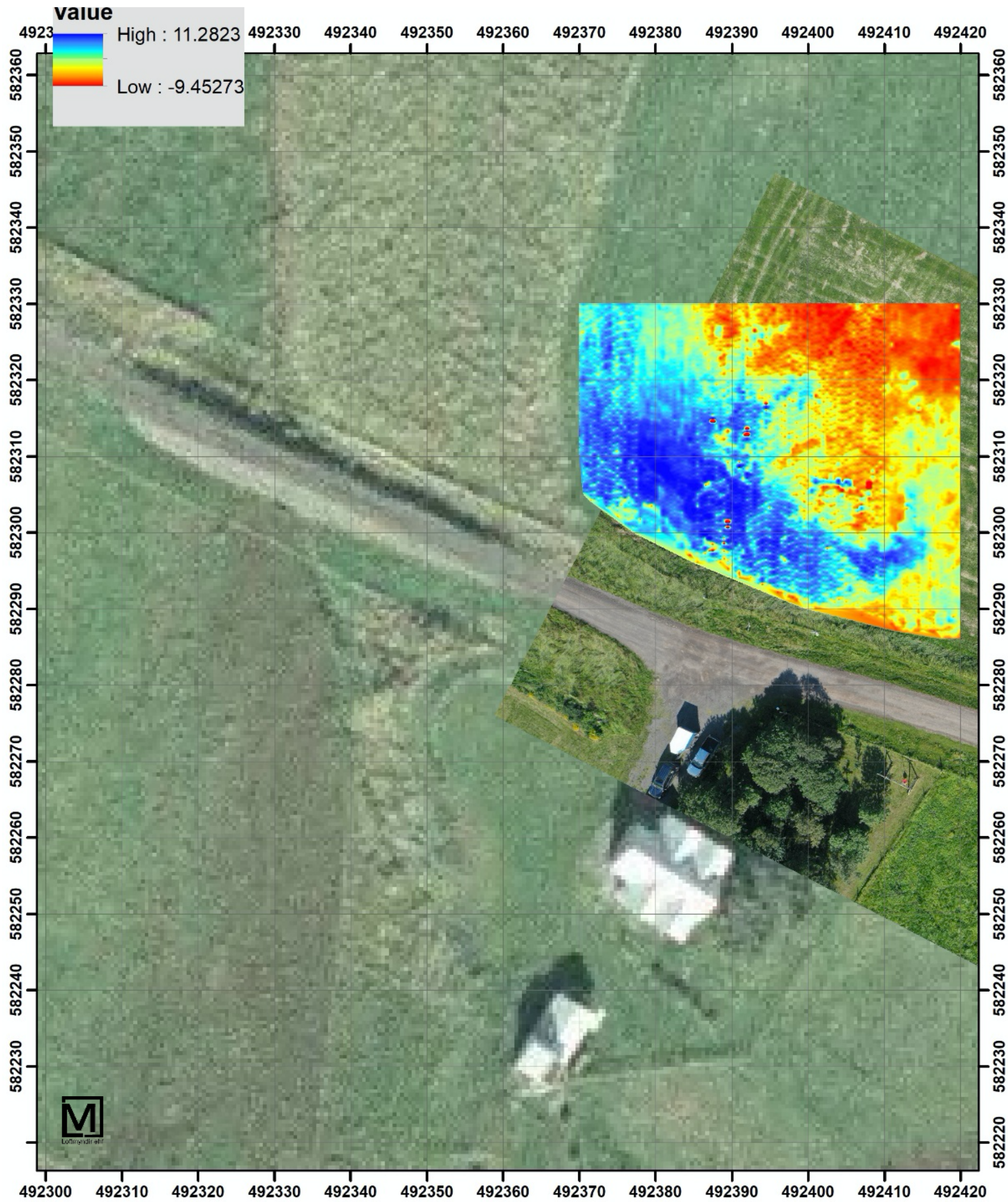

Figure 48. IP 2 at Kálfsstaðir superimposed on drone air photo.

Figure 49. Con 2 at Kálfsstaðir superimposed on drone air photo.

Appendix E – 2021 Coring Data

The coring data is permanently archived and publicly available from http://www.fiskecenter.umb.edu/HASP/HASP_2021_core_data.zip or https://arcticdata.io/catalog/portals/hasp where it can be downloaded. Blank cells or cells with N/A indicate that the researcher did not fill in the data or that there was an instrument failure and only partial data was retained. The comma-separated value (CSV) files use UTF-8 encoding. There are three tables: coring locations, core layers, and core tephra. The tables should be joined by the Core_ID field.

Data set 1 Coring locations

The location of each core taken as part of archaeological work. Coordinates are in ISN 93 - Lambert 1993.

Fields

Core_ID: Unique identification code for each core. Usually consisting of a farm number (and place), the year recorded, and a sequential number

Place: Name of place on a farm. if the place and farm are the same, it usually indicates that cores were taken on and around the main visible farm mound.

Jonsbok_ID: A unique number of a modern farmstead in Skagafjörður.

Place_ID: A sequential number for a sub-location on a farmstead. Corresponds to Place

Farm: A sequential number for a sub-location on a farmstead. Corresponds to Place

ISN93_East: Coordinate in ISNET93. ISNET93 (or ISN93) is the reference coordinates of GPS measurements for Iceland

ISN93_North: Coordinate in ISNET93. ISNET93 (or ISN93) is the reference coordinates of GPS measurements for Iceland

Date: Date core recorded

Full_core: If the full depth of the JMC backsaver core (1.2 m) was reached

End_depth: Depth of core below ground surface

Arch_Initials: Initials of the archaeologist who placed the core

Comments: Any notes about core

Core: Sequential core number

Data set 2: Core layers

Each layer (natural and cultural) from the core taken as part of archaeological work. Layers from a single core form a sequence.

Fields

Core_ID: Unique identification code for each core. Usually consisting of a farm number (and place), the year recorded, and a sequential number

Category: Description of layer

Top_depth: Depth of top of the layer below ground surface

Bottom_depth: Depth of bottom of the layer below ground surface

Inorganic_inclusions: Gravel, tephra, or other inorganic inclusions in layer

Organic_inclusions: Organic inclusions (e.g., bone) in layer

Tephra_in_turf: List of tephra, if the identified layer is identified in building turf (Only necessary if identified layer category is turf.)

Description: Any notes on layer

Core: Sequential core number

Data set 3: core tephra

Each tephra layer from the core taken as part of archaeological work. Tephra layers from a single core form a sequence.

Fields

Core_ID: Unique identification code for each core. Usually consisting of a farm number (and place), the year recorded, and a sequential number

Tephra: Tephra layer - sometimes date (e.g. AD 1300) or tephra layer (e.g., H1)

Depth: Depth below ground surface

Thickness: Thickness of the tephra layer

Description: Notes on tephra

Scheme for display of coring information