Interim Report
of the
Skagafjörður Archaeological Settlement Survey

2001

By

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Additional copies of this report and other reports, as well as all the raw data, including remote sensing; soil science; artifact catalogues; and trench plans, profiles and photographs; can be downloaded from http://sass.ioa.ucla.edu

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Note to Readers

This an interim report on the majority of the activities of the Skagafjörður Archaeological Settlement Survey (SASS) during the summer of 2001. As it is an interim report, it is incomplete and unpolished. It is also, we believe, a substantial step forward for Icelandic Archaeology. Over the course of a 36 day field season, the 18 members of the SASS team developed and refined a series of techniques, methods, and approaches to identify and assess low visibility or deeply buried turf structures.

This report has several substantial and important omissions. The is no bibliography, or acknowledgments. Tara Carter's MA thesis on soil texture in not included and Doug Bolender's Ph.D. work on phosphate testing is only partially included. There are also two separate reports, only partially included here: an assessment of geophysical surveying by Brian Damiata and an honors thesis on the power auger by Nilka Dabare. These reports, as well as all the EM-31 data, most of the trench photos and profiles, can be obtained from the SASS website (http://sass.ioa.ucla.edu). Updated versions of this report, future reports, Doug and Tara's work, and publications can also be found there.

Introduction

Our proposed work in Iceland entails a survey of 26 farms in five areas. The goal of the fieldwork is: 1) to estimate the size, number, and structure of farm buildings; 2) to date those buildings using the extraordinary sequence of dated volcanic ash layers preserved in the soil and incorporated into the turf architecture; and 3) to measure the economic potential of the associated land. The goals of the analysis of the survey project are to outline the timing of changes in density and organizational structure of farmsteads and to associate those changes with the economic potential of the immediate environment. This analysis will allow us to begin to answer questions about the advantages of being the first to settle a landscape, the importance of farm economic potential to political success, and the changing ratio of land and labor to the fall of the chiefly and manorial systems. This framework will allow us to better understand the relationship between environment and farm organization over the known political changes.

Skagafjörður has received a soil deposition sequence that is ideal for preserving tephra layers and early structures. In general, as one moves down slope, there is less erosion and more soil deposition. The more erosion, the better preserved early horizons will be. Húnaflói, Skagafjörður, and Eyjafjörður have the same basic depositional and tephra history (Guðbergsson 1996). In Skagafjörður erosion and deposition were comparatively active during the settlement and therefore the LNL is infrequently preserved. On the other hand, the 1104 layer is almost always preserved. Furthermore, the soil depositional sequence is ideal for the proposed remote sensing equipment (EM-31) as there has been on average 43 cm deposited since 1104 and 50-70 cm since the settlement (Guðbergsson 1975).

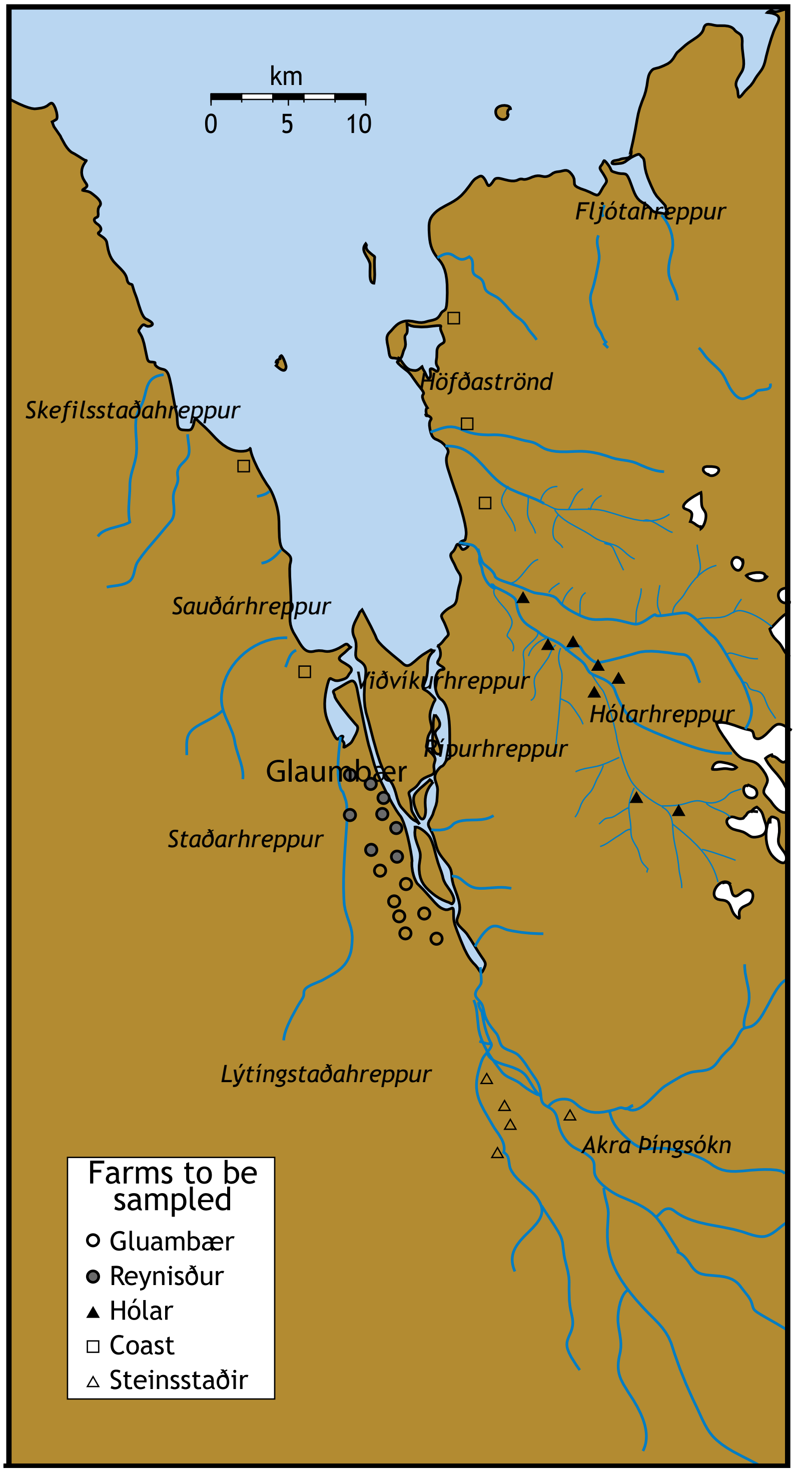


Figure 1. Skagafjörður, showing locations of farms to be sampled.

Methods

UTM Grid

The National Imagery and Mapping Agency (NIMA, formerly the Defense Mapping Agency) adopted a special grid for military use throughout the world called the Universal Transverse Mercator (UTM) grid. In this grid, the world is divided into 60 north-south zones, each covering a strip 6° wide in longitude. These zones are numbered consecutively beginning with Zone 1, between 180° and 174° west longitude, and progressing eastward to Zone 60, between 174° and 180° east longitude. In each zone, coordinates are measured north and east in meters. The northing values are measured continuously from zero at the Equator, in a northerly direction. A central meridian through the middle of each 6° zone is assigned an easting value of 500,000 meters; grid values to the west of this central meridian are less than 500,000; to the east, more than 500,000.

Our work employed the UTM grid system as augmented by Steinberg (1997). The primary units of analysis are 50 x 50 m survey "blocks." These blocks are assigned UTM coordinates based on their southwest corner, for example 0463855 East, 6305350 North (500000-463855 = 36145 m from the Meridian). As in a normal UTM system (Cole 1992), the measurements in our nested UTM system are based on metric Cartesian coordinates (UTM grid zone 27). All units for collection and analysis of data and artifacts are provenienced at their southwestern corner. As the analytical units become larger, the number of digits in their provenience becomes smaller. For example, the coordinates of the block, have 6 digits (e.g., E 046750, N 710450). The provenience of the excavation unit is calculated to 7 digits (e.g., 0467567, 7104567). Soil samples and features are calculated to the decimeter (04675678, 71045678), and point provenienced artifacts or radiocarbon samples are calculated to the centimeter (046756789, 710456789). While excavating, a level, elevation or depth is added to the Nested UTM coordinate, so that no two units have the same designation (e.g., 0467567, 7104567, 10).

The advantages of adopting the nested UTM System are threefold. First, the recording system is immediately compatible with many other recording systems (Hansen 1992). It has the potential to be a worldwide standardized system of recording artifactual data. Second, the system allows for comparisons across different data sets simply by removing digits to the place of the appropriate analytical unit of analysis. For example, point provenienced artifacts can be analyzed with their appropriate excavation unit simply by removing the last two digits. Finally, nested UTM squares are easy to computerize. The simplicity and universal nature of the nested UTM System makes it easily adaptable on excavation and survey projects of all scales.

All sites investigated in the Mosfell Valley were first grided by scanning the basic quad map and superimposing a block grid of hectare and 50x50 lines. Datums were set where identifiable landscape makers intersected grid lines. A color system of flags (orange for ha, yellow for 50x50, white for 10x10, and red for 2) was placed at the southwest corner of each nested unit. All units are aligned UTM grid north, which in Mosfell is 0fl 47' west of true north.

Surface Survey

The following is the suggested procedure to be followed when a new site (structure foundation, wall/walls, stone scatter, etc.) is encountered during SASS surface surveying in future seasons.

1. Assign next available Waypoint record in GPS to site. Each assigned Waypoint number is recorded in the GPS memory along with the longitude, latitude, altitude, and UTM data on the GPS at the time of assignment (500 Waypoint numbers available).

2. Record the following data for the new Waypoint on a new page in field notes:
a. Waypoint number assigned to site.
b. Longitude and latitude (Recorded in degrees/minutes/seconds).
c. UTM bearings
3. Establish the North-South axis of the site based on true North compass bearing.
4. Take an overall photograph of the site from south towards north along the established North-South axis.
5. Record photograph I,D. number on the appropriate Site page in field notes and in the Photo Log Book.
6. Prepare a field sketch of the site on assigned page of field log including the following data where possible:
a. Wall lengths end-to-end along centerline.
b. Wall thickness at corners and midpoints at top and bottom
c. Wall heights at corners and midpoints.
d. Openings in wall, location and width.
e. All visible larger stones or stone spreads associated with site.
f. Indicate the North bearing relative to sketched site data.
7. Record in narrative any special characteristics of structure, materials encountered, etc.
8. If more than one structure is involved place each on sketch in its relative position to the others and record Step 6 data for each individually.
9. Determine what additional photographs should be taken to illustrate details of site. Record the I.D. number of each photo taken in the Photo Log Book and indicate on the field sketch the I.D. number and location from which each additional photo was taken.
10. At close of the day prepare a summary by site of all the sites recorded for the day including their assigned Waypoint number, UTM transects, and I.D. numbers of all photographs taken to record their particular content.

Remote Prospection

EM-31 & EM-38

The EM 31- MK2 is an updated version of the standard EM 31, with which we had great success in 1999. The MK2 incorporates the data logger into the control console, which can be removed for easy data handling, or hand carried during the survey. Real-time logging is available by connecting a computer directly to the RS-232 output port on the front panel. The EM 31-MK2 maps any subsurface feature associated with changes in the ground conductivity using a patented electromagnetic inductive technique that makes the measurements without electrodes or ground contact. With this inductive method, surveys are readily carried out in all regions including those of high surface resistivity such as sand, gravel, and asphalt. The effective depth of exploration is about six meters, making it ideal for archaeology.

Following Bevan (1983) we used a grid spacing of 2 m. While it is possible to do both EM and magnetic prospection with the same machine (e.g., the EM-38, Tabbagh 1984, 1986:580), the ability to measure conductivity at a greater depth argued for the EM-31 in Iceland (*cf.* Rapp and Hill 1998:188). The EM-31 is not usually recommended for archaeological investigations (Clark 1990). The long (4m) boom, makes for a relatively coarse (0.8m) resolution, but excellent depth (about 3 m, depending on conditions). All readings are of apparent ground conductivity using the quadrature component. Negative numbers in the survey data are due to the height and surrounding conductivity at which the instrument was calibrated. While the readings (including negative numbers) are not absolute conductivity readings, the distance between any two numbers is consistent (i.e., a conductivity change of 3 millisiemens is a constant difference, even between sites).

The goal of the survey was to identify buried turf walls, which are slightly resistive linear targets. As it turns out, natural conductivity changes in most fields in Iceland are as strong or stronger than most human-induced changes; but the natural changes typically take place over greater distances. Therefore, we looked for the high-low-high anisotropic readings series described by Tabbagh (1985:221) as characteristic buried linear targets (see also Clark 1990: 37; Panissod, Lajarthe and Tabbagh 1997 and Scollar et al. 1990: 322). The pattern, of high conductivity immediately surrounding low conductivity linear anomalies is somewhat common in archaeological surveys (e.g., Ladefoged et al. 1995; Kvamme 1999; Wynn and Sherwood 1984:202), but rarely used as a signature of human activity in and of itself. Because of the apparent anisotropy of the electrical readings around linear resistive targets (different readings in different directions) smoothing algorithms tend to obscure these sudden shifts.

It was expected that the turf wall-eolian soil would produce small changes over a very short distance. Therefore, we were interested in analyzing the change in apparent conductivity readings as well as in the values themselves. There are several methods for displaying the slope of spatial readings (e.g., the spatial analyst package of Arc View GIS [Ormsby and Alvi 1999]). There are also a series of algorithms to highlight contrasts once the data is displayed (e.g., Ladefoged et al. 1995; Lück and Eisenrich 1999; Hageman and Bennett 2000). What we wanted was a standard method that would highlight the greatest change, even over the general trend, so as to easily identify the high-low-high anisotropic pattern. Therefore, we settled on a relatively simple procedure whereby every reading was compared to the surrounding 8 readings and assigned the maximum change. Following Tabbagh's (1985:221) suggestion, this is termed the *maximum apparent conductivity contrast*.

The conductivity contrast is the maximum change between a reading and the surrounding 8 readings divided by the distance. The conductivity is usually measured in millisiemens/m and maximum change in apparent conductivity is measured in millisiemens/m^2. Viewing the conductivity data as the contrast, compact areas of rapid change become apparent. Rather than showing areas with different conductivity, the conductivity contrast shows interfaces where conductivity changes rapidly over a few meters. This means that a high-low-high combination, which would be almost invisible in the conductivity graph, becomes dramatic in a conductivity contrast graph. On the other hand, substantial changes over tens of meters are completely invisible in the conductivity contrast graph.

Remote sensing display

The range of readings used in displaying remote sensing data can be a determinant in the identification of anomalies (Zhurbin and Malyugin 1998). All scales for magnetic gradient, conductivity, and conductivity contrast were created with a basic box-and-whisker algorithm in which the display range does not extend to the extreme readings. That is, the scales cover the box-and-whisker portions of the range (Table 1). The upper end of the display scale was set to the median plus the sum of quartile 3 and 1.5 times the interquartile range. The lower end of the scales ranges from the median down to the sum of quartile 2 and 1.5 times the interquartile range. Colors or shades of gray for the scales were determined by:

$$x - lw/wr = c \tag{1}$$

where *x* is reading, *lw* is the lower whisker, *wr* is the whisker range and *c* is the color or shade of gray. The spectrum for each graph is the total length of the interquartile range plus the two whiskers. This range is spread over 60 different colors or shades of gray. It should be noted that because of the dramatic differences between the base readings at different sites, colors or shades of gray from one site to the next are not comparable.

The Graphs were created in SYSTAT 5.0 for the Macintosh. The colors on the maps use a wavelength scale (nanometers) from 400 (purple) to 700 (red), in which each increment is an increase of 5. The lower whisker is 400 and the upper whisker is 700. Gray scale maps use a corresponding scale of 0-100% with 60 increments of gray, with each stop increasing by 1.66%. Magnetic gradient, raw conductivity scores and the maximum difference in conductivity were converted using the following equation:

$$(\frac{(c - lw)}{wr} \bullet 300) + 400 \qquad (2)$$

Where c is the conductivity (or the maximum difference in conductivity), lw is the lower whisker, and wr is the whisker range.[1] Readings smaller than the lower whisker are purple and readings greater than the upper whisker are dark red (for similar shortenings see Ladefoged et al. 1995). In accordance with identifying our turf wall-eolian soil interface, this scale emphasizes variation with the main reading range.

Table 1. EM-31 site conductivity statistics.

Grid	Readings	Conductivity			Conductivity Differential		
		Lower Whisker	Median	Upper Whisker	Lower Whisker	Median	Upper Whisker
Hólar UTM 1	711	5.8	10.1	14.5	-3.4	0.7	4.7
Hólar Offset 31	1126	5.0	10.5	16.1	-4.2	0.5	5.2
Holar south	91	6.5	10.9	15.3	-4.8	-0.9	3.0
Hof A	2246	4.8	6.4	8.1	-1.1	0.1	1.3
Holar 2	23890	7.3	10.9	14.5	-1.4	-0.1	1.1
Rey 2	10478	4.1	10.7	17.3	-1.6	-0.1	1.4
Hof 8	2592	7.3	11.2	15.1	-4.6	-0.6	3.4
GG	14630	-7.3	11.2	29.7			
GB1	17844	4.4	8.0	11.6	-1.1	-0.1	1.0
GB2	5435	4.0	11.2	18.4	-1.2	-0.2	0.9
SS1	3349	3.9	14.1	24.3	-1.6	-0.1	1.4

Syscal Kid

The Syscal Kid is especially designed for shallow resistivity imaging. The Switch 24 features an internal switching board supporting 24 electrodes. Two cable strings with 12 electrode take outs each are connected to the back of the meter. The included software automatically performs roll-along surveys, which are quickly completed, even with a single operator.

Resistivity and conductivity

There is a general correlation between resistivity and conductivity. The strongest is found by taking the natural log of both readings from a depth of 1.56 m (Figure 2). However, broad general trends can be observed with single comparisons (Figure 3)

[1] The actual equation used in SYSTAT to generate the colors is:

((int(((*c*-*lw*)/*wr*)*60))*5)+400

Where int is an integer. This method rounds the output to the nearest 5.0.

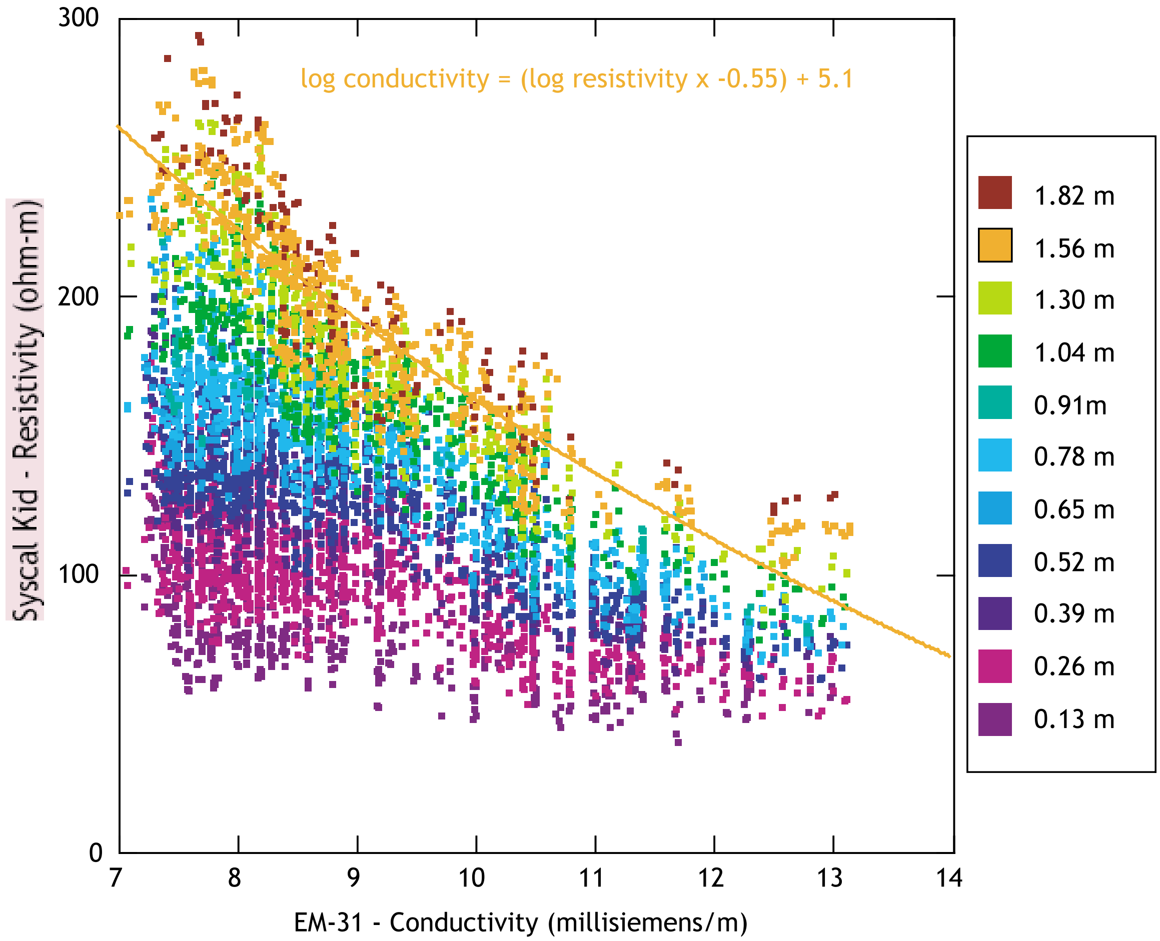


Figure 2. Correlation of conductivity with resistivity at various depths. The strongest correlation is found at 1.56 m BGS.

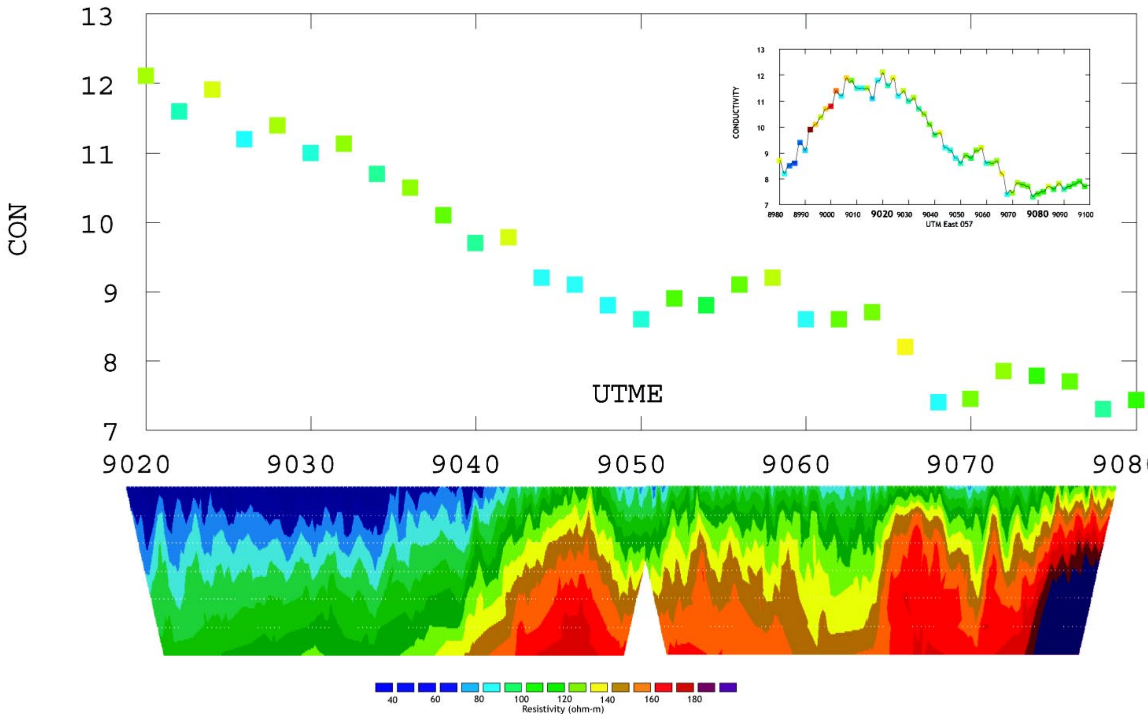


Figure 3 The conductivity of line 570 at Glaumbær.

Line 570

Sub surface Survey

Auger

The Little Beaver MDL-8H Auger, which weighs 167 lbs., features an 8 HP Honda motor and 10" pneumatic wheels. It can provide fast, clean holes in seconds for soil sampling.

The operation of coring and augering has and continues to, have a great impact in archaeological excavations. Archaeologists such as James A. Ford and his team used auguring during the 1930's into the 1950's (Stein 1986: 506-509), in establishing the stratigraphic relationships between cultural and natural deposits and to determine the site extent or depth of subsurface strata (Canti and Meddens 1998: 97). From around the 1970's onwards augering and coring continues to be used extensively in the United States, particularly in Cultural Resource Management (CRM) archaeology (Schuldenrein 1991: 132-134; Canti and Meddens 1998:98). Most of these early augering implements were the "screw-type" auger, (Stein 1986: 507), while modern hydraulic augers such as The Eiijelkamp System can reach depths up to 7 meters (Canti and Meddens 1998:98). Our research in Iceland employed a unique bore drill that, as will be demonstrated, was invaluable to the research project. This paper will attempt to examine the importance as well as the many uses of the power auger in Icelandic archaeology.

The auger was used for the following aspects of the survey presented below. In initial site survey, as a complementary tool for the geophysical equipment, and the soil core in depositional analysis. In addition to the explicit uses mentioned and elaborated on below the following implicit considerations should also be noted: the financial aspect and valuable time saved by this method, for not having to trench and backfill anomalies identified as possible cultural features until investigated and confirmed by the auger team data.

Initial site survey – During the initial site survey of an area the auger was used to identify the nature of surface features and anomalies. The initial identification helped to determine tephra sequences. It also identified of the remote sensing equipment could be employed in these fields for maximum results. For example in fields that contained bog concentrations the remote sensing equipment would not work. The depth and diameter of the auger holes provided cross sections of the sub surface anomalies that greatly enhanced the understanding and interpretation of these features. Also, equally importantly, the use of the auger helped to identify if the subsurface had been disturbed by recent agricultural practices such as bulldozing which would either be taken into account by the geophysical teams or depending on the extent of the sub soil disturbance completely abandoned as part of the survey area.

Complementary tool for the geophysical survey equipment- this aspect of the auger proved to be the most important use in the survey, and hence is given greater elaboration here. The power auger helped to either complement or negate the conductivity and resistivity readings with regards to subsurface anomalies. The nature of the conductivity and resistivity readings make it necessary to ground truth specific anomalous reading. Remote sensing data indicates both positive and negative readings. Positive readings indicate probable archaeological features while negative readings are "suspicious" surface features. The remote sensing indicates only potential anomalies and cannot distinguish between natural and cultural features. During the survey at the farm of Reynistaður, remote sensing proved ineffective due to a series of underground cables, overhead power lines and a grounded power transformer that offset the readings in the geophysical equipment. Therefore, the auger was, in effect, the only tool that was useful here in locating subsurface features, and determining the nature of surface features. The auger in this respect, proved a fast and efficient tool providing the necessary subsurface exposure for accurate analysis, interpretation and further investigation.

Soil Science

The soil sampling and analysis on the project are directed at identifying the initial natural conditions and subsequent anthropogenic alteration of land at the survey farm sites. The research is primarily focused on evaluating variation in the creation, maintenance, and intensification of homefield (*tún*) areas among related farms of different social and economic statuses. The end goal for each farm is a reconstruction of variation in: (1) the distribution of natural resources at farm settlement and the subsequent alteration to that distribution resulting from the subdivision of farm lands into new farm allotments; and (2) the alteration of those natural endowments through investment in land and production by dating changing size and enrichment in the homefields associated with each farm. This information will be used to analyze how: (1) land division, especially into different status farms, affected the distribution of natural resources of new farms; (2) variation in land and status effected decisions on production and investment at farms; and (3) subsequent changes in status effected household investment in land and production.

Four groups of related farms, developing from early land claims and subsequent subdivisions, have been chosen for investigation. The establishment of new households had a significant impact on the original farm, reducing available resources and/or providing rents and possible labor. By investigating clusters of related farms alternatives to direct land intensification can be evaluated. Farm groups were chosen based on a combination of the history of the farms and the preservation of buried soil horizons and tephra layers. Each cluster comprises a variety of farms: initial independent farms and later independent and dependent subdivisions. Most of the farms were later incorporated as church properties, either directly under Hólar or a local church (figure 1). Five farms were sampled during the 2001 field season. The remaining farms are scheduled for investigation during the summer of 2002.

FARM NUMBER	FARM	HREPPUR
SK-063	Reynistaður	Staðahreppur
SK-064	Geitagerði	Staðahreppur
SK-111	Glaumbær	Seyluhreppur
SK-249	Hólar	Hólahreppur
SK-250	Hof	Hólahreppur

Table 2. Soil sampling strategy for the 2001-2002 field seasons.

Farm Groups	Farm Status	Old Value (hð.)	Homefield in 1850 (ha.)	#Cores (Samples)	First Reference	Notes
Glaumbær	land claim	90	8	66 (237)	11th c.	Church farm
Halldórsstaðir	subdivision	20	2		1238 AD	Owned by Hólar, 1388 -
Elivogar	subdivision	20	2		1378 AD	Abandoned 1939 –
Mikligarður	sub-farm	20	3		18th c.	Owned by Glaumbær
Ja_ar	sub-farm	5	1		16th c.	Owned by Glaumbær
Me_alheimur	sub-farm	-	-		16th c.	Owned by Glaumbær; abandoned 1701
Stóra-Seyla	land claim	60	5		1255 AD	Church farm; abandoned 1972 –
Torfgarður	subdivision	15	1		1388	Owned by Hólar, 1388 -; abandoned <1753, 1964 -
Brautarholt	sub-farm	10	2		17th c.	Owned by Stóra-Seyla
Grófargil	sub-farm	20	4		1406 AD	Owned by Stóra-Seyla; independent in 1508
Melkot	sub-farm	-	-		1406 AD	Owned by Stóra-Seyla ; intermittent occupation, 18th – 20th c.; abandoned 1914
Reynistaður	land claim	80	7	72 (203)	settlement	Church farm; Ásbirninga farm in Sturlunga Age
Melur	subdivision	20	-		14th c.	Owned by Reynistaður 1446-1843
Hóltsmúli	subdivision	40	4		1446 AD	Owned by Reynistaður 1446-1915
Hafsteinstaðir	subdivision	40	4		1259 AD	Owned by Reynistaður 1295-1889
Geitagerði	sub-farm	10	3	22 (66)	17th c.	Owned by Reynistaður
Hvammskot	sub-farm	-			1295 AD	Owned by Reynistaður 1295-1843; intermittent occupation, 15th– 20th c.; abandoned 1709 -
Hólar	independent	108	-	42 (112)	11th c.	Bishopric; originally established from Hof
Hof	sub-farm	48	-	47 (119)	settlement	Originally independent; later dependency of Hólar
Nautabú	subdivision	20	-		settlement	Owned by Hólar, 1388 -
Kálfsstaðir	subdivision	50	-		13th c.	Owned by Hólar, 1388 -
Hlið	subdivision	30	-		16th c.	Church farm
			TOTALS	249 (737)		

Soil Sampling Procedure

Sampling areas were defined based on the location of traditional/pre-industrial homefields as described in 19th c. records and early 20 th c. field maps. Due to demographic expansion beginning in the 19th century and the introduction of modern farming techniques, these areas are likely to incompass the area of the original medieval field systems. By their very nature, homefields represent a valuable physical resource and are unlikely to change location over time. Where available, place-name and written records have been used to investigate additional areas of possible intensification at each farm.

Soiling sampling was done on a rectilinear grid at 25-meter intervals. In some areas smaller intervals were used to more exactly resolve variation in enrichment and land-use, for example the area around the long house at Hof. Samples were also taken from assessment trenches and from off-site areas to establish sterile soil phosphate levels. Coring grids were based on the same UTM aligned grids that were used for other remote sensing and geological investigations on the project. Soil samples were collected using an Oakfield hand core with a peat coring tube. The 1_" diameter coring tube (compared to the standard 13/16") reduces soil compression and better preserves soil stratigraphy. It is also easier to identify soil horizons, tephra layers, and cultural material such as buried turf and carbon, in the larger core. The 21" core allows for a 1-meter soil core to be removed in two sections, which was sufficient in almost all cases to reach sterile soil. There was concern that soil from upper horizons might contaminate samples from second core sections in the same hole. However, the consistently low P levels in sterile soils below Hekla 3 (c. 2900 BP) and Hekla 4 (c. 4500 BP) tephra layers, identified in lower core sections, indicate that soil mixing from upper horizons was minimal. Soil profiles from core sections were recorded in the field, noting soil type, inclusions, and the presence of any tephra layers. A comparison of soil horizon depths between direct measurement in auger holes and extracted cores indicates that in-core soil compression was minimal and that soil profile depths based on coring closely correspond with actual soil stratigraphy. Samples were taken from the soil cores based on natural stratigraphy. Large undifferentiated soil horizons (generally greater than 20 cm) were broken into arbitrary levels and multiple samples were taken. Samples were labeled and stored separately for analysis.

Phosphate

Phosphate testing is the simplest way to measure organic enrichment, especially manuring, in archaeological contexts. Soil phosphate analysis was used as the primary tool for identifying and evaluating enriched agricultural soils supplemented by additional tests. Phosphate is added to the soil from manuring and other forms of organic enrichment. A portion of the phosphate forms inorganic compounds in the soil that are not available for plant consumption. These compounds build up over time in the soil creating a durable marker of investment. I want to stress that the objective of this research is to reconstruct long-term patterns of labor investments at various farms and not to estimate specific hay yields at any given point in time. The methods outlined below are designed to define homefield areas, evaluate the relative amount of labor invested in homefields over time, and provide a rough comparison of investment among farms.

Preliminary investigations into agricultural investment and homefield reconstruction began in the summer of 1998 and continued in 1999 in conjunction with the Mosfell Archaeological Project (Steinberg and Byock 2000). An inexpensive and simple field test for available soil phosphate was used (Eidt 1973). The test produces a qualitative measure of available soil phosphate, on a scale of 0-5, which can be used to identify, and roughly map areas of high phosphorus enrichment, such as homefields, for detailed sampling and more precise quantitative testing. The tests were successful in identifying areas of intensive anthropogenic soil enrichment such as homefields (Bolender 1999; Bolender and Steinberg 1999). The same methods were employed during the 2001 summer season. Extensive soil sampling and analysis was performed at a five farm sites and the qualitative phosphate tests were augmented with a more robust quantitative method (Mehlich 1978; Terry et al. 2000).

The Mehlich-based phosphate test was adapted from a soil testing kit produced by the Hach Company in Loveland, CO. Soil samples were air-dried and sieved through a 2 mm screen to remove concretions, small rocks, and obvious organic matter. Two grams of soil were then mixed with 25 mL of extractant and shaken for 5 minutes. The extracted soil solution was then filtered and stored for analysis. In a separate test tube, 10 mL of solution were mixed with the contents of the PhosVer 3 reagent packet. After a 2 minute reaction time, the solution was transferred to a sample cell and the concentration read on a DR/850 portable colorimeter at 880 nm. Results were recorded in both the calibrated mg/L and as light transference.

During the 2001 field season it was determined that qualitative phosphate testing (Eidt 1973) was not consistent enough to accurately reconstruct homefield extent or stratigraphic variation in enrichment. Preliminary analysis with the quantitative test (Mehlich 1978; Terry et al. 2000) had excellent results (figure 6 and 7). The Mehlich-based field test is relatively simple and cheap to perform and can be used to assess large areas for enrichment while still being precise enough to show horizontal and vertical variation in phosphorus enrichment. However, these tests still need to be correlated with absolute phosphorus values to determine what fraction of soil phosphate is being extracted and what other factors may be affecting the retention and extraction of phosphate agricultural horizons.

Icelandic andisols have special chemical properties that affect phosphate retention and extraction and require detailed analysis to precisely quantify organic enrichment (Ãrnalds 1990). A subset of soil samples will be subject to further analysis to quantify variation in the nature and intensity of enrichment. A strong acid extraction will be used with a multi-elemental ICP-AES analysis to obtain total phosphate values as well as 31 additional elements (Middleton and Price 1996). Total phosphate tests constitute an important check on the accuracy of partial extraction procedures and the possible degradation of the signal over time due to an increasing portion of phosphate being tightly bonded in mineralized compounds (Eidt 1977, 1984; Lillios 1992). The additional elemental analyses provide alternative markers for geo-chemical enrichment (Entwistle et al. 2000) and will trace variation in soil composition, such as iron, aluminum, and calcium, which may affect the mineralization and extraction of phosphates. Soil pH, which may affect phosphate levels, will also be tested (Simpson 1997).

The preliminary results presented here suggest that relict agricultural deposits can be mapped based on phosphate analysis at Icelandic farms and that in well-preserved soil horizons, especially with intact tephra layers, stratigraphic reconstructions of variation in field size and the intensity of organic enrichment are possible. Homefields, and the economic investment that they represent, are an important part of the archaeological record at farm sites. Many relict field systems are damaged, however their large extent means that some portion of preserved field is present at many farms. Soil cores and test excavation trenches can investigate these with minimal damage to the overall archaeological deposit. Relict field systems are also resilient to many forms of modern agriculture such as the excavation of drainage ditches and, in deeper deposits, shallow plowing as these only disrupt a small portion of the overall deposit or only the upper layers of soil, which generally have been altered already by the introduction of modern fertilizers. Deep plowing and the movement of large amounts of soil to level modern agricultural fields are a significant danger to these archaeological deposits, as they can destroy entire relict field systems.

The results are based on a preliminary analysis of core profiles and soil samples from individual farms investigated during the 2001 summer field season. The results are tentative and subject to change based on additional geo-chemical analysis and integration with other archaeological data from the sites.

Paleoethnobotany

The Norse Vikings practiced an agrarian economy in which plants provided fuel, food, building materials as well as summer graze and winter fodder for livestock. Thus, macrobotanical remains—those carbonized, desiccated, or waterlogged plant parts that can be identified under low-power magnification—recovered from archaeological contexts should offer vital information concerning the economic status of the farms in question. Unfortunately, very few macrobotanical studies have been conducted in Iceland (cf. Zutter 1989, 1992, 1997, 1999, 2000). This is most likely due to a perception by Icelandic archaeologists that the intense freeze/thaw conditions prevent macroremains from preserving in archaeological deposits.

In order to determine if macroremains are in fact preserved in archaeological deposits in the valley of Skagafjörður, a macrobotanical analysis was carried out during the SASS 2001 field season. This report addresses issues concerning the sampling, extraction, and processing of sediment samples recovered during this first season and presents suggestions and recommendations for future research of a similar nature. Subsequent reports will discuss the qualitative and quantitative results of the analysis.

Sampling

After turf structures had been located using remote sensing techniques, trenches were dug so as to allow characterization and dating (via tephra layers) of the structures. Column samples as well as point samples were taken from these exposed profiles (see Table 1). All deposit types exposed in the profiles were sampled (e.g., midden, turf, ash and charcoal lenses). Additionally, a riverbank cut at Reynisstaður exposed a midden deposit that was capped by tephra layers. A point sample was taken from this profile.

At least two liters of sediment was taken from each location unless the context prevented a sample of that minimum size. This sample size proved to be more than sufficient (see below). The samples were not screened or preprocessed in any way prior to flotation. Column samples were taken from stratigraphic levels that correlated with those of the excavations or, if no stratigraphy was visible, arbitrary 20 cm intervals. Point samples were taken from discrete deposits. Both column and point sample locations were noted on profile drawings. Profiles were cleaned from the top down and sampled from the bottom up so as to prevent contamination. A cleaned trowel was used to collect samples and care was taken to prevent cross contamination between contexts. Samples were tagged with detailed provenience information and bagged in heavy duty (4 mil) plastic zip lock bags of appropriate size.

Extraction

Flotation is the most common process whereby macrobotanical remains are concentrated and recovered from archaeological sediments. Although there is variation in the construction and operation of flotation systems, they are all based on the same principle: when archaeological sediments are placed in water, the dense sediment sinks and buoyant plant remains float and are recovered.

Due to the remoteness of the survey area, the lack of necessary supplies, and the inaccessibility of running water, a manual system was employed. Sediment samples collected in the field were brought back to the field laboratory and manually floated using the decanting procedure (Pearsall 1989). After the volume of a sediment sample was measured, it was poured into a 10 gallon bucket containing water. The sample was agitated so as to allow plant material to float to the surface where it is then decanted into chiffon netting (0.02 mm mesh). This portion forms the light fraction, which is hung to dry for at least 24 hours. Sediment remaining in the bucket was poured into a 1.0 mm mesh sieve. This yields a heavy fraction, which is dried on paper and saved for future analysis. All heavy fractions were examined for the presence of carbonized plant material.

Sorting

All dried light fractions were sifted through a series of nested sieves (2.00, 1.00, and 0.50 mm), yielding four size fractions (>2.00 mm, 2.00-1.00 mm, 1.00-0.50 mm, and <0.50 mm) in preparation for sorting. The light fraction is divided as such for two reasons. First, it is easier to sort material of similar size, given the shallow depth of field of the incident light binocular microscope (10-40x) employed. Second, it allows the analyst to selectively remove distinct materials from each fraction. In this analysis, carbonized and uncarbonized wood, carbonized peat aggregates, uncarbonized masses of stems and leaves, and carbonized amorphous material are only removed from the >2.00 mm fraction and weighed. Seeds and seed fragments are removed from all size fractions. The <0.50 mm fraction is considered residue and is quickly scanned for whole seeds. A representative sample of uncarbonized insect parts is removed from the samples as well. *Selaginella selaginoides* (lesser clubmoss) megaspores, uncarbonized peat moss, and suspected fungal sclerotia are noted but not removed.

In temperate environments, plant material generally decomposes in a relatively short period of time after deposition. Therefore, uncarbonized plant remains usually represent contamination by modern vegetation (Keepax 1977; Lopinot and Brussell 1982; Minnis 1978, 1981). However, a number of deeply buried deposits (≥2 m), capped by tephra layers, yielded considerable amounts of uncarbonized seeds. Given the lack of burrowing rodents in Iceland, it is unlikely that these seeds have been introduced into these deposits. Zutter (1999) considered only charred and degraded plant material as being old while items that appeared fresh as being modern. She found that midden deposits preserved uncarbonized plant material whereas the superficial strata of other contexts contained contamination from modern vegetation (Zutter, pers. comm.). I suspect that a high concentration of peat in some of the deposits has produced aseptic conditions allowing the preservation of uncarbonized plant remains. Some of the uncarbonized seeds recovered are clearly modern contaminates, such as the recent alien *Chenopodium album* L. (lamb's quarters) that was recovered from a point sample taken from the upper levels of a trench at Hólar (Sample 17). Since many of the recovered seeds, such as *Stellaria media* (L.) Vill. (common chickweed) are weedy annuals, their cultural significance must be interpreted carefully. It is clear that the consideration of uncarbonized plant remains will have to be evaluated on a sample by sample basis.

To date, 75% of the samples have been sorted. Thus, qualitative and quantitative comments are of a preliminary nature. The botanical nomenclature used here follows Kristinsson (1987). In addition to the other taxa mentioned, both carbonized and uncarbonized seeds of at least four different species of *Carex* (sedge) have been recovered. The presence of a perigynium on a number of the uncarbonized specimens many allow identification to the species level. Other seeds thus far identified, in carbonized or uncarbonized form, include: *Hippuris vulgaris* L. (mare's-tail), *Ranunculus* sp. (buttercup), *Rumex* sp. (sorrel), *Vaccinium* sp. (cranberry, bilberry), and *Viola* sp. (violet),. Two unknown Poaceae (grass) seeds have also been recovered, one of which compares favorable with *Hordeum vulgare* (barley) although the carbonized specimens are highly distorted. A cursory examination of the uncarbonized wood shows most of it to be *Pinus* sp. (pine) whereas all the carbonized wood recovered thus far appears to be *Betula* sp. (birch). Uncarbonized wood and bark of birch has also been recovered.

The large size of many of the light fractions has resulted in the need to conduct tallies (counting but not pulling of seeds). Some samples have yielded seed densities near 500 seeds/liter. Most of these seeds are uncarbonized, but from deep, undisturbed midden deposits. In the future, sub-sampling of the light fractions may be necessary, even for samples less than 2 liters in size.

Recommendations

Sampling. Since the inclusion and interpretation of uncarbonized macrobotanical remains is by no means straight forward, farmhouses abandoned during historic times and present-day farmyard sites need to be sampled. A present-day farm that uses traditional methods of haying and foddering their animals should have its barn floor, fresh hay, feeding trough, and barn refuse deposits sampled. Similar structures and deposits, and turf walls themselves, for a farm that was abandoned during historic times should also be samples. These farm samples, along with modern control samples, will allow structure types to be associated with specific plant assemblages and indicate which taxa are likely to be modern contamination.

Midden samples have yielded the highest diversity and greatest density of seeds and wood (both uncarbonized and carbonized) of all contexts thus far examined. Surprisingly, samples designated as turf wall in the field have yielded very few botanical remains. Again, an examination of the walls of historic turf structures should indicate their botanical components. Samples of dried, compressed peat should also be collected and subjected to different heating regimes so as to determine its morphology when carbonized or burned to ash.

Extraction. The lack of running water made the flotation of the sediment samples very difficult and time consuming. A relatively large amount of material became waterlogged and had to be removed from the wet screened heavy fraction. A siphon is typically used to remove any botanical material that has become waterlogged and remains submerged (Gumerman and Umemoto 1987). Unfortunately, a siphon can only be used with mechanical flotation device that possess an insert screen which allows sediment (sludge) to be cleared from the heavy fraction (Watson 1976). Every effort should be made to acquire a source of running water for floatation, even if a mechanical flotation device is not employed.

Sorting. At this time, only 75% of the samples have been sorted. All of the light fractions are being examined in their entirety and no sub-sampling has been carried out. As mentioned above, a number of the samples contain a rather large amount of uncarbonized plant material, most of which is modern contamination. In the future, adjustments to the sampling procedure (i.e., vary sample volumes by context) should make the examination of light fractions more manageable.

Table 3. Provenience Information for the Analyzed Soil Samples from the Skagafjörður Archaeological Settlement Survey (SASS) project.

Sample Number	Site	UTM East	UTM North	Depth (cm)*	Volume (liters)	Location	Sample Type
27	Glaumbær	0569035.2-035.4	7277589.4	14-30	3.4	south wall	column sample
26	Glaumbær	0569035.2-035.4	7277589.4	30-43	3.4	south wall	column sample
25	Glaumbær	0569035.2-035.4	7277589.4	43-55	2.3	south wall	column sample
24	Glaumbær	0569035.2-035.4	7277589.4	55-76	4.4	south wall	column sample
4	Hof	5872352-352.2	7289570.5	0-20	5.2	north wall, midden	column sample
5	Hof	5872352-352.2	7289570.5	20-40	5.2	north wall, midden	column sample
6	Hof	5872352-352.2	7289570.5	40-60	5.8	north wall, midden	column sample
13	Hólar	0586343.2-343.4	7291666	0-42	5.4	north wall	column sample
12	Hólar	0586343.2-343.4	7291666	42-62	4.7	north wall	column sample
11	Hólar	0586343.2-343.4	7291666	62-74	3.7	north wall	column sample
10	Hólar	0586343.2-343.4	7291666	74-80	1.4	north wall	column sample
9	Hólar	0586343.2-343.4	7291666	80.1	4.4	north wall, dark soil	column sample
16	Hólar	586409.5	7291601-601.2	35-57	5.4	east wall, central bulk	column sample
15	Hólar	586409.5	7291601-601.2	57-62	1.5	east wall, central bulk	column sample
14	Hólar	586409.5	7291601-601.2	62-80	3.5	east wall, central bulk	column sample
17	Hólar	0586318.6-319.2		29-52	5.5	north wall	point sample
23	Hólar	0586433.8-434.0	7291622	0-25	3.7	north wall	column sample
22	Hólar	0586433.8-434.0	7291622	25-57	5	north wall	column sample
21	Hólar	0586433.8-434.0	7291622	57-77	3.8	north wall	column sample
20	Hólar	0586433.8-434.0	7291622	77-85	1.8	north wall	column sample
19	Hólar	0586433.8-434.0	7291622	85-95	1.7	north wall	column sample
18	Hólar	0586433.8-434.0	7291622	95-120	3.6	north wall	column sample
1	Reynisstaður	566016	7282250	100	4.6	south wall, rock feature	point sample
2	Reynisstaður	566016	7282250	48-77	5.1	south wall, turf layer	point sample
3	Reynisstaður	566016	7282250	77-92	6.1	south wall, pit below turf	point sample
7	Reynisstaður			78-100	4.6	river cut behind church,	point sample
8	Reynisstaður	566016	7282530	78	3.1	south wall, organic layer	point sample

* below ground surface.

Tephra Chronology

The tephra-chronology is based on field observations made on 27-28 July and 22 August 2001 at the research sites in Skagafjörður. Compilation of data on tephra layers in the Skagafjörður region has already been made by Sigurgeirsson (2000). The identification of individual tephra layers is based on previous studies on tephra layers in North Iceland (Thorarinsson 1967, Gudbergsson 1975, Larsen & Thorarinsson 1978, Ólafsson 1985, Sveinbjarnardóttir 1992, Einarsson 1995, Sigurgeirsson 1998, 1999, 2000).

The following are the main tephra layers of the Skagafjörður region:

1. The Settlement Tephra Layer (Icel.: Landnámslag; LNL). Formed in 870-880 AD (Grönvold et al. 1995, Zielinski et al. 1997). According to the isopach map its thickness in Skagafjörður is less than 0.5 cm. In North-Iceland the LNL is solely dark colored (olive-green), not two-colored as in SW-Iceland, and therefore not easily identified in the field (Larsen 1984). The distribution of the LNL in N-Iceland has not yet been mapped in detail. Closely spaced to the LNL there are usually 2-3 other basaltic tephra layers.
2. Dark colored, basaltic tephra layer formed in ~1000 AD. Its source is in the Veidivotn-Dyngjuháls volcanic system. Available data on this layer are limited (Ólafsson 1985, Sveinbjarnardóttir 1992). Based on unpublished data (MÁS) the V~1000 tephra layer is traceable from the Skagafjörður region westwards to the Hrútafjordur area.
3. Light colored tephra layer formed in the Hekla eruption of 1104 AD. According to isopach map its thickness in the Skagafjörður region is approximately 0.5 cm (Thorarinsson 1967, Larsen & Thorarinsson 1978).
4. Dark colored tephra layer formed in the Hekla eruption of 1300 AD (Thorarinsson 1967). Detailed isopach map is not available but the axis of maximum thickness lies towards the North.
5. Dark colored tephra layer formed in the Hekla eruption of 1766 AD (Thorarinsson 1967). Detailed isopach map is not available.

Microscopic examination

Most of the tephra layers identified in the field were sampled for further studies. With the aid of binocular microscope it is possible to characterize individual tephra layers in a simple manner and then simplifying its identification. The most important characteristics used to identify tephra layers are color of the glass, texture of glass shards, proportions of different components and grain size characteristics.

In few instances the measuring of refractive indices was applied. This method allows an easy estimate of the SiO2 (silica) content of glass shards, as the refractive indices are primarily controlled by the SiO2 content (Fisher & Schmincke 1984). Populations of different SiO2 content are rather easily discriminated with this method, which can be of great importance. The presence of two or more glass populations being mixed together in a single tephra layer can easily be understood if two or more tephra producing eruptions occur at short intervals. This is a well known feature in Iceland as in major rifting episodes several different volcanic systems usually become active (Thorarinsson & Saemundsson 1980).

The main results of these examinations and measurements are the following:

1. Preliminary results indicate that the Hekla tephra layers H-1766 and H-1300 can be discriminated with the aid of the microscopy. The former layer is composed of dark brown highly vesicular glass shards (sideromelane), poorly sorted. With a minor fraction of red scoria (< 1%). Its main characteristic is its homogeneity, glass shards of mainly one type. The latter, H-1300, is mainly composed of poorly sorted grey-brown colored glass shards. Most characteristic are blocky nearly equant shapes. Dark colored inclusions in the glass is a common feature. This tephra has a larger fraction of red-colored scoria than the other. One of its most important identities is the occurrence of dark brown glass shards (~10 %). This tephra is not as homogeneous as H-1766, as it consist of more diverse components.
2. One of the most diagnostic features of the H-1300 tephra is the occurrence of dark brown glass shards, easily separated from the main glass type. When measuring

the refractive indices it emerged that the glass of the H-1300 tephra layer can be divided into two different classes, one of intermediate composition (SiO_2 of ~60 %) and another one of basaltic composition (SiO_2 of ~49 %). This indicates that H-1300 could be composed of tephra produced by two different sources. Chemical analysis of H-1300 from the Eyjafjordur region indicate that the intermediate tephra originate in Hekla volcanic system but the basaltic component in one of the volcanic systems capped by the Vatnajokull glacier, most probably the Grímsvotn volcanic system (MÁS, unpublished data). This is supported by the tephra studies of Ólafsson (1985) in Vesturdalur and Austurdalur south of the research area. The volcanic history of Grimsvotn and other volcanic systems beneath the Vatnajokull glacier is not known in detail before the early 14th century AD (Thorarinsson 1974).

3. The tephra of the V~1000 tephra layer, identified at Reynisstaður, is rather easily discriminated from the Hekla tephra with the aid of the microscope. The main component of this tephra is fine-grained olive-brown glass shards with sharp edges and its poorly sorted. Crystals are minor component, < 1 %.

Results

With the aid of microscopic examination of the sampled tephra layers in Skagafjörður a method to discriminate between the two Hekla tephra layers, H-1300 and H1766, was established. Also the V~1000 tephra layer is rather easily identified by the same method. The results of the tephra layer identification are presented in Figures 1 and 2.

One of the problems that was confronted in summer 2001 was the identification of tephra layers found in the two trial trenches at Hof in Hjaltadalur. In each of the trenches one dark colored tephra of historic time was encountered (Fig. 2). Based on field observations the Hekla tephra layers H-1300 and H-1766 were the most likely candidates. This assumption was supported by various physical characteristics observed in the field but as these tephra layers look very much alike more accurate methods must be applied. As mentioned earlier this problem could be solved with the aid of a microscope. As shown in Figure 2 the tephra in both the trial trenches are identified as the H-1300 tephra layer.

At Glaumbaer deposits of turf, peat ash and charcoal were capped by the H-1104 tephra, giving an age of pre 1104 AD.

At Reynisstadur the main part of the farm-mound was deposited after 1104 AD, as observed in a fine exposure NE of the church. In the trial trench located SV of the farm cultural layers were observed below the V~1000 tephra.

Recommendations

The work of this summer has shown that tephra layer identifications based solely on field observations can be misleading. They must be followed up by careful laboratory examination as well, e.g. microscopic examination, measuring of refractive index and in certain cases chemical analysis. As before the microscope appears to be a very powerful tool in characterizing and identifying tephra layers. In the light of earlier work it is appropriate to have access to microscope while working in the field.

Chemical analysis of some tephra layers in Skagafjordur with Scanning Electron Microprobe (SEM) is in process. The results will be available in a few weeks. This is a widely used method in identifying tephra layers, but requires access to SEM facilities and a lot of time. On the basis of their chemical composition it is possible to correlate tephra layers to their source volcanoes. These analyses will undoubtedly add a lot to the present knowledge on the tephra layers of the Skagafjordur region and will be of great importance to the coming archaeological work there.

Investigations

Hof 7-250

Hof was investigated first, in the 2001 season. UTM griding started on July 24 and work with the EM-38 started on July 25. The weather was cloudy and cold with light precipitation. Work with the EM-31 was done on July 27.

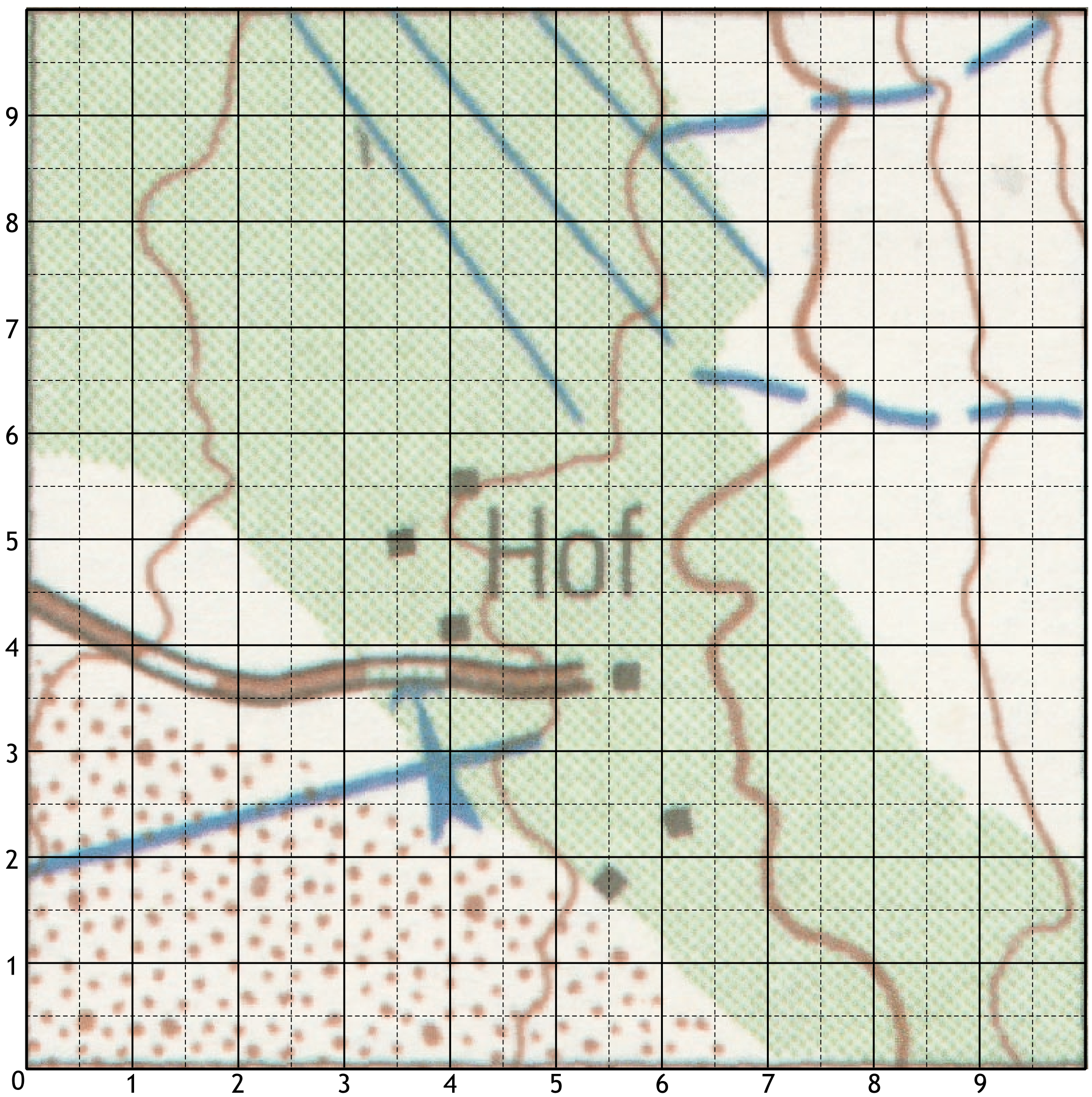


Figure 4. Kilometer 0587, 7289

Remote Sensing: EM-38

The EM-38 work is not yet complete. Because of the substantial effects of temperature on the EM-38 (Figure 5) the data must be re-calibrated. EM-38 data from Hof will be presented in the final report.

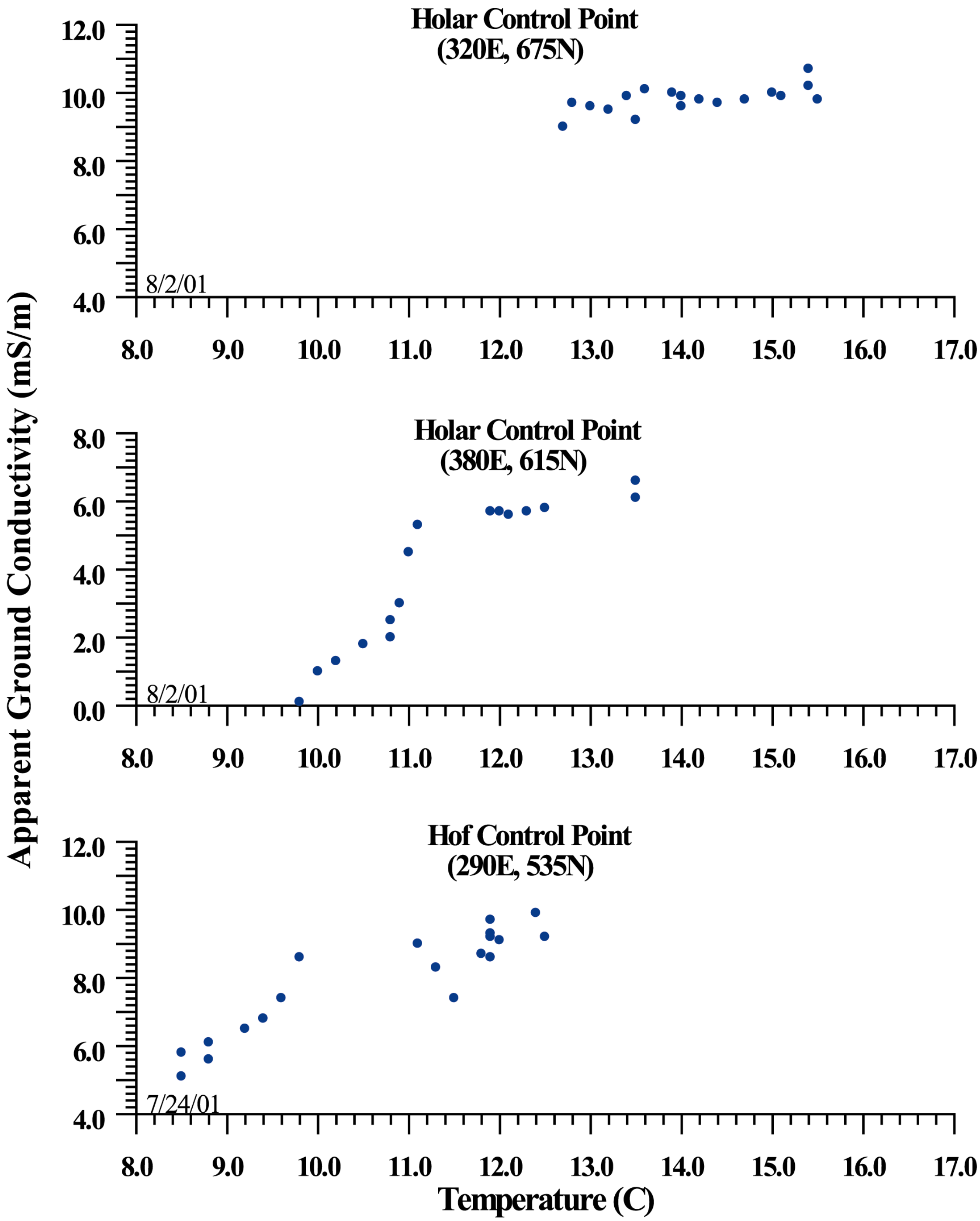


Figure 5. Apparent conductivity of the EM-38 against temperature at Hof.

Remote Sensing: EM-31

On July 27, 2246 readings were taken with the EM-31 at Hof in order to compare results with the EM-38 and to assess the readings over the location of a likely early long house (Gunnarsdóttir 1998). Readings were taken every meter. The northern part of the surveyed has relatively high conductivity and correspondingly deep soil. The southwestern area has substantial exposed rocks on the surface (Figure 6). The violet readings at the lower end of the conductivity spectrum at Hof are 4.8 ms/m, while the upper end, shown in red, is 8.1 ms/m These trends would appear to be natural, as there are no indications of dramatic changes associated with this trend (-1.1 to 1.3 ms/m, Figure 7). The results do show a classic high-low-high conductivity pattern through the long house (Figure 8).

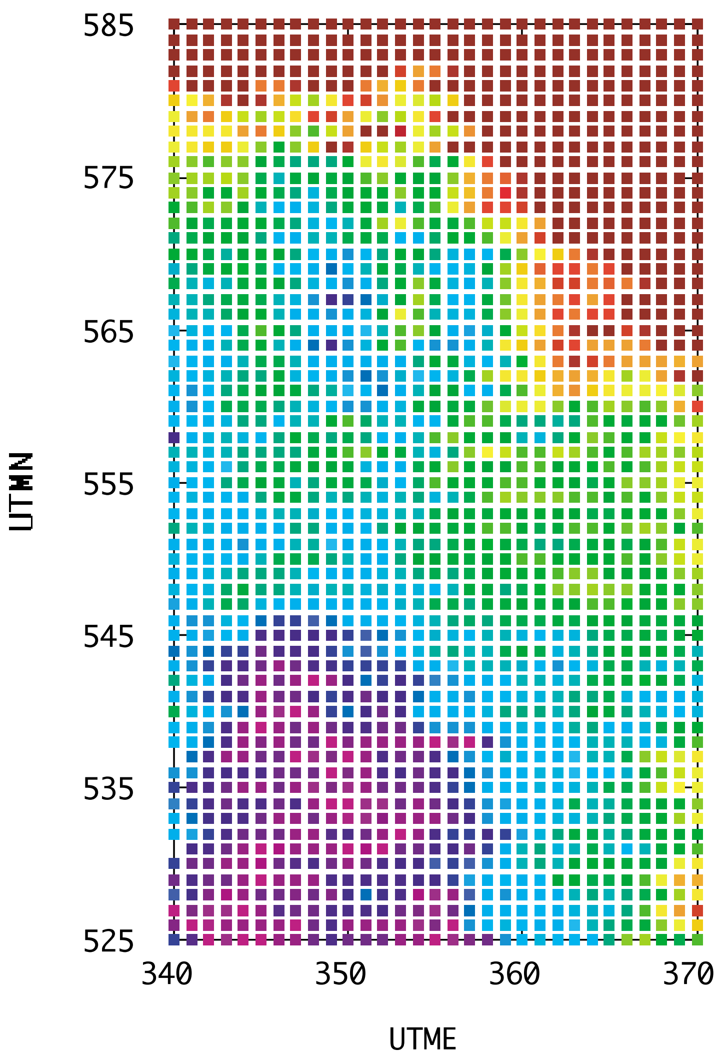


Figure 6. Conductivity map of Hof.

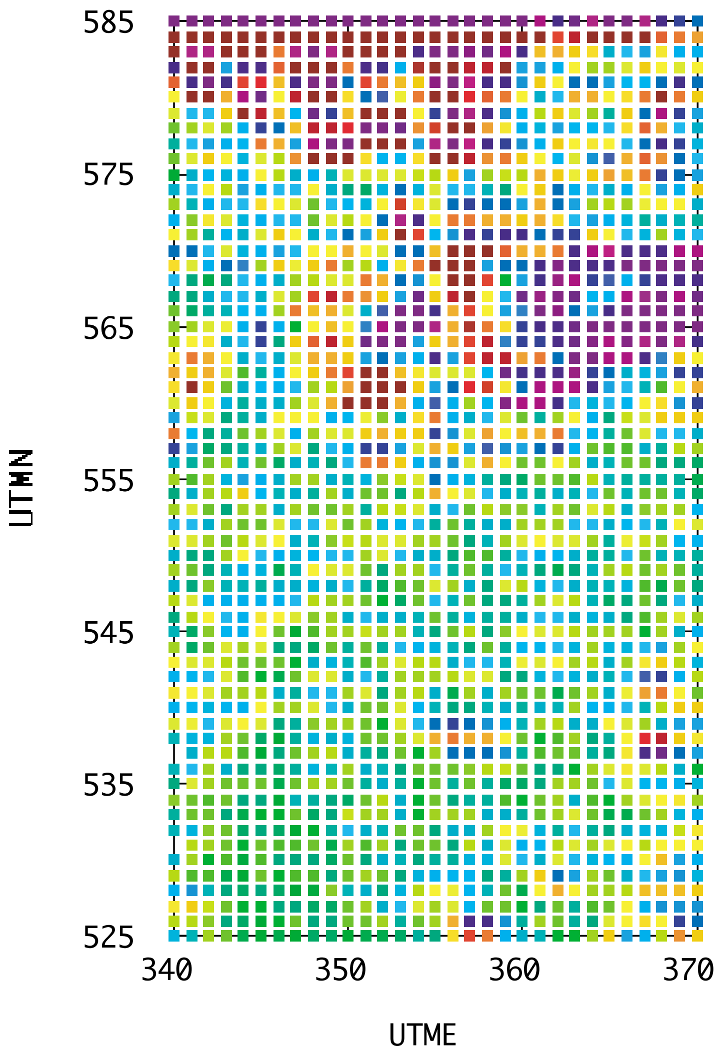


Figure 7. Conductivity contrast map (EM-31) of Hof.

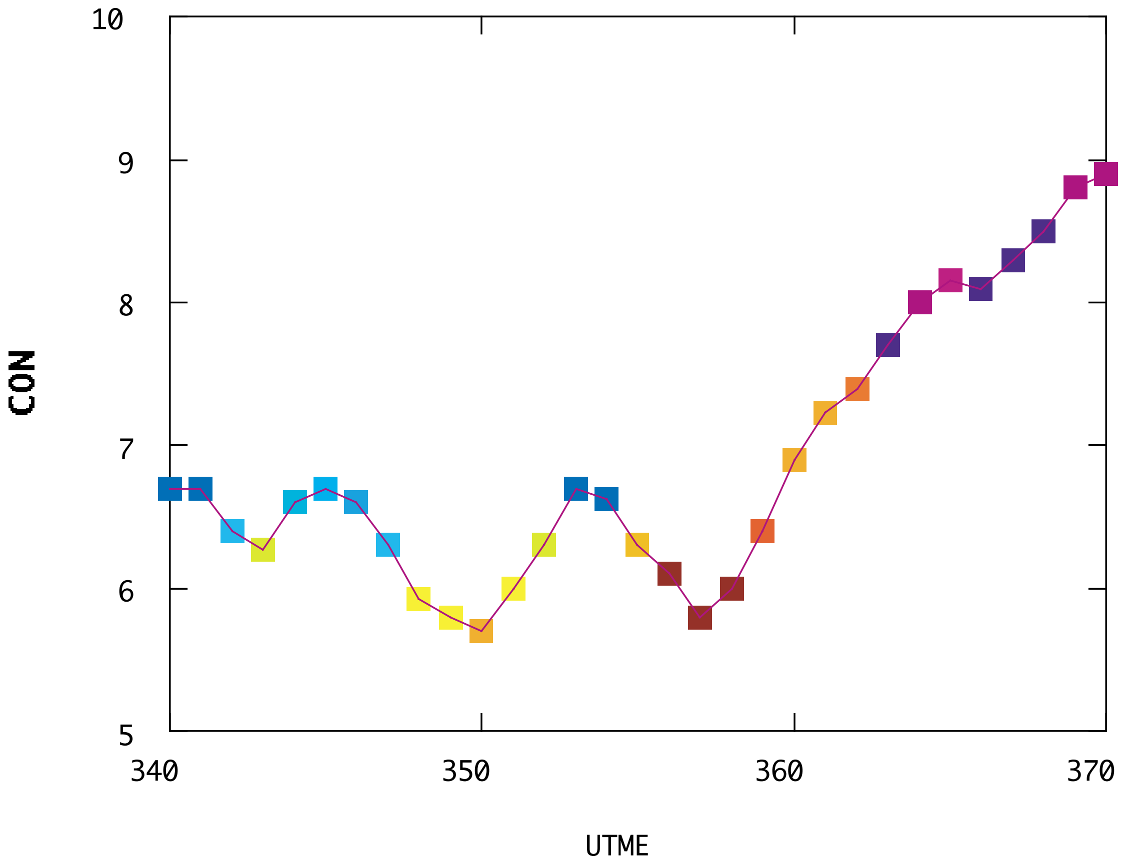


Figure 8. Conductivity profile of line N570 showing classic high-low-high pattern through decayed turf walls.

Trenches

Three trenches were excavated by hand at Hof. All of the trenches ran east-west and were 50 cm wide. All crosscut the surface remains of an identified early (pre H1) long house. These excavations confirm this interpretation.

344,588

Trench 1 extended 25 m from 344,588 to 370, 588. The south profile was drawn, as it contained a wider verity of stratigraphy. The evidence for a structure, this far north is scant, but suggestive. Most of the larger rocks, exposed in the profile, that make the little knoll top look like the outline of a longhouse are prehistoric, and predate H3. The H1 tephra layer is clearly in situ in most cases about 7-15 cm above H3.

The evidence that the large natural stones were used as foundation stones for a turf structure is corroborated only by the small organic fragments, found on either side of the long knoll (none in what would have been the center) resting on H3, below H1. Given the small depth of historic soil deposition seen in the profile, it is remarkable that H1 is preserved at all. Therefore, the preservation of these organic fragments is all that should be expected if this was a structure. If this was a structure, and the evidence is tentative, it is probably very early and very poorly preserved. Nonetheless, we are inclined, because of the organic lenses, we are inclined to designate this a structure.

345,570

Trench 2, also excavated by hand was 25 m long by 0.5m form 345-370 at 570 north. Again the south side was drawn. There is unambiguous evidence for a post 1300 structure. The trench seems to have cross cut the structure at almost 90°. The interior measurement is about 5 meters, from 355 to 350. The majority of turfs fell downhill, to either side of the structure with supervising little organic deposit in the center of the structure. A great many of the turfs have H1 in them. The structure seems to have been built sometime after 1300, as there is about 2-5 cm of aeolian sand between the bottom of the turf layer and the gray black of the 1300 layer. There is a while layer in situ, but it is unknown if it is H1 or H3. There is no evidence of any human activity before the post 1300 structure, but there is no natural sequence present that rules out that possibility. In the eastern third of the trench (bottom) a tremendous concentration of stones was uncovered. These appear to natural, possibly ice age in origin.

On the east side of the knoll, between E 355 and 358, a series of round stone with rough holes through them were excavated (). These appear to be loom weights. These stones were clearly outside, in an area of decreasing mixed turf thickness and are not associated with any other structure.

Figure 9. Possible loom weights from HO 345,570.

Soil Science

Sampling at Hof was conducted around the archaeological ruins to the north of the current farmhouses. The occupation in this area is poorly dated but may included activity during most periods of Icelandic history, from the settlement up to the present. Areas immediately adjacent to the ruins were sampled on a 10-meter grid to the east, south, and west. The field to the north was sampled on a 25-meter grid (figure 3). Areas to the south and west of the ruins show enriched soils based on the Eidt phosphate test. These samples require further, more detailed, analysis to determine if the enriched soil horizons can be associated with particular periods of occupation and land-use at the site. The areas to the east and north of the ruins are lower than the rest of the site and soil profiles show evidence for extensive erosion and deposition of material in the past.

Tephra layers Hekla 1300 and Hekla 1766 were identified superimposed with only thin layers of waterborne gravel and silt between them. Soil depths are inconsistent, varying from over 2 meters of soil to only a few centimeters above glacial deposits of rock and silt. Soil phosphate levels are generally low, suggesting that these areas were never used for intensive agriculture. However, a few areas with preserved soil profiles indicate that good soils for agriculture may have existed in the past but have been eroded resulting in the removal of the original soil deposits. The erosion and damage to possible field areas may have contributed to the early abandonment of the site and the re-occupation further south on better-protected lands.

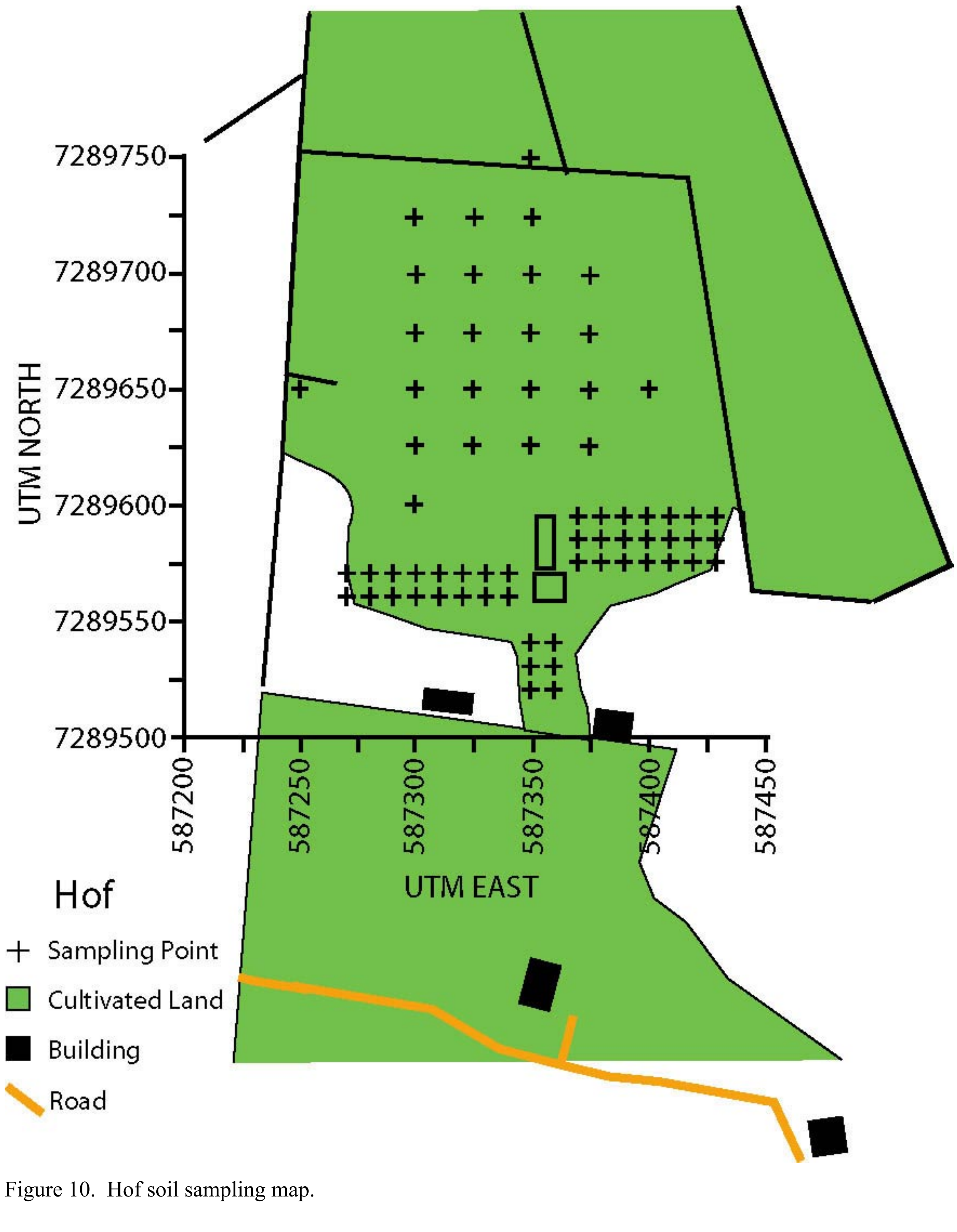


Figure 10. Hof soil sampling map.

Hólar 7-249

Work at Hólar was begun in anticipation of the larger Hólar Research Project. The goal of the survey and test excavations was to access the soil deposition and archaeological preservation. There are no visible ruins or structures on the surface of the filed. For the field surveyed, while historic soil deposition is relatively low, (10-50 cm), preservation is excellent because a 19th centaury midden was spread out over much of the archaeological remains.

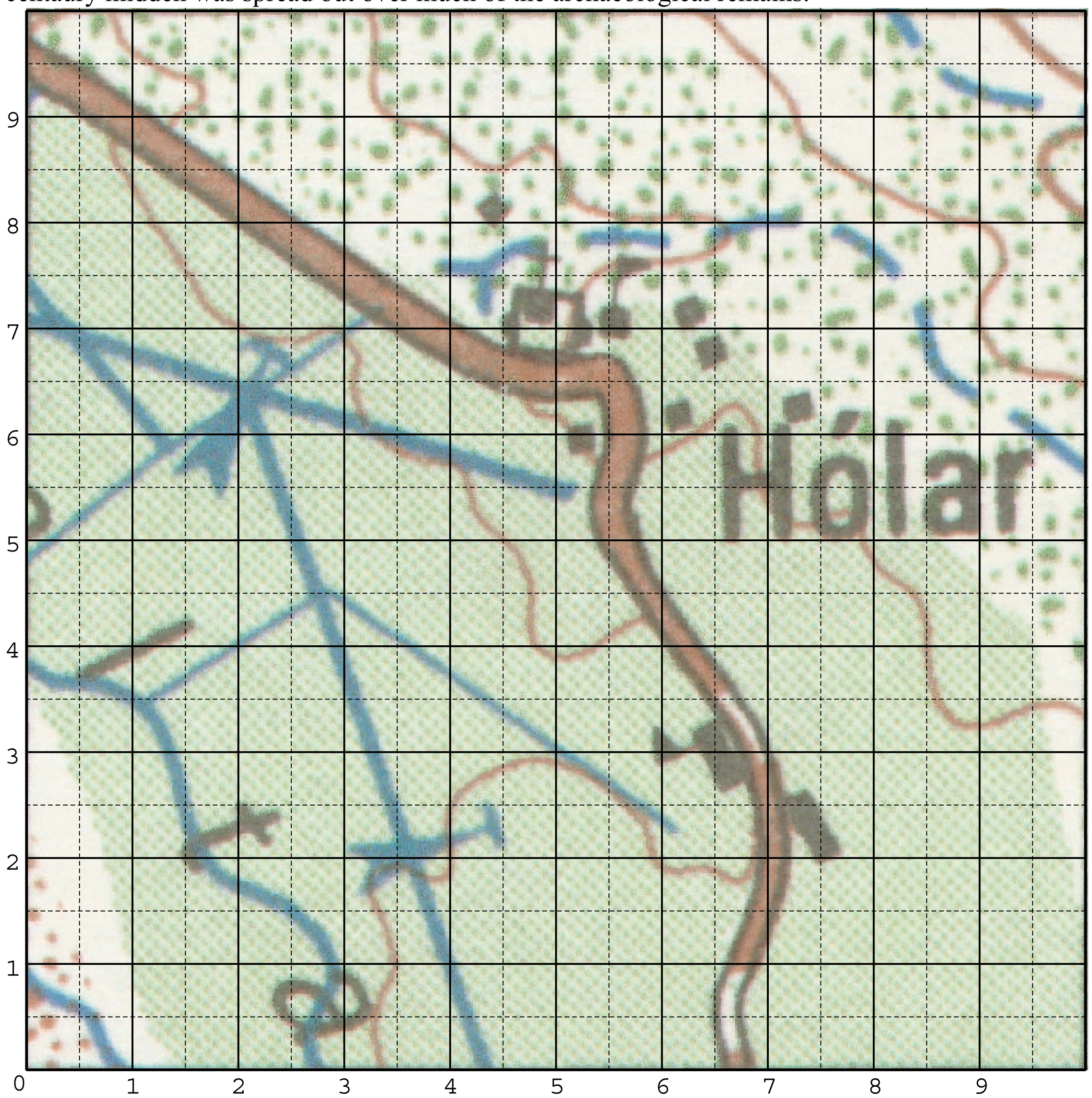


Figure 11. Kilometer 586,7291. The power line in the center of the map has recently been undergrounded and now runs close to the road.

Remote Sensing

UTM Grids were laid out on Hólar starting on July 25. Work with the EM-31 started on July 26. Surveying took place over 3 days with readings taken every meter. There was little precipitation during the survey. A small survey was also done west of the church to look for signs of a tunnel. No void spaces were identified. In general, the conductivity varies substantially, but smoothly over the area surveyed. In the north, and close to the road, the conductivity is higher, while in the southwest the conductivity is lower (Figure 12). These trends to not seem to correspond to any activity preserved under the surface of the filed.

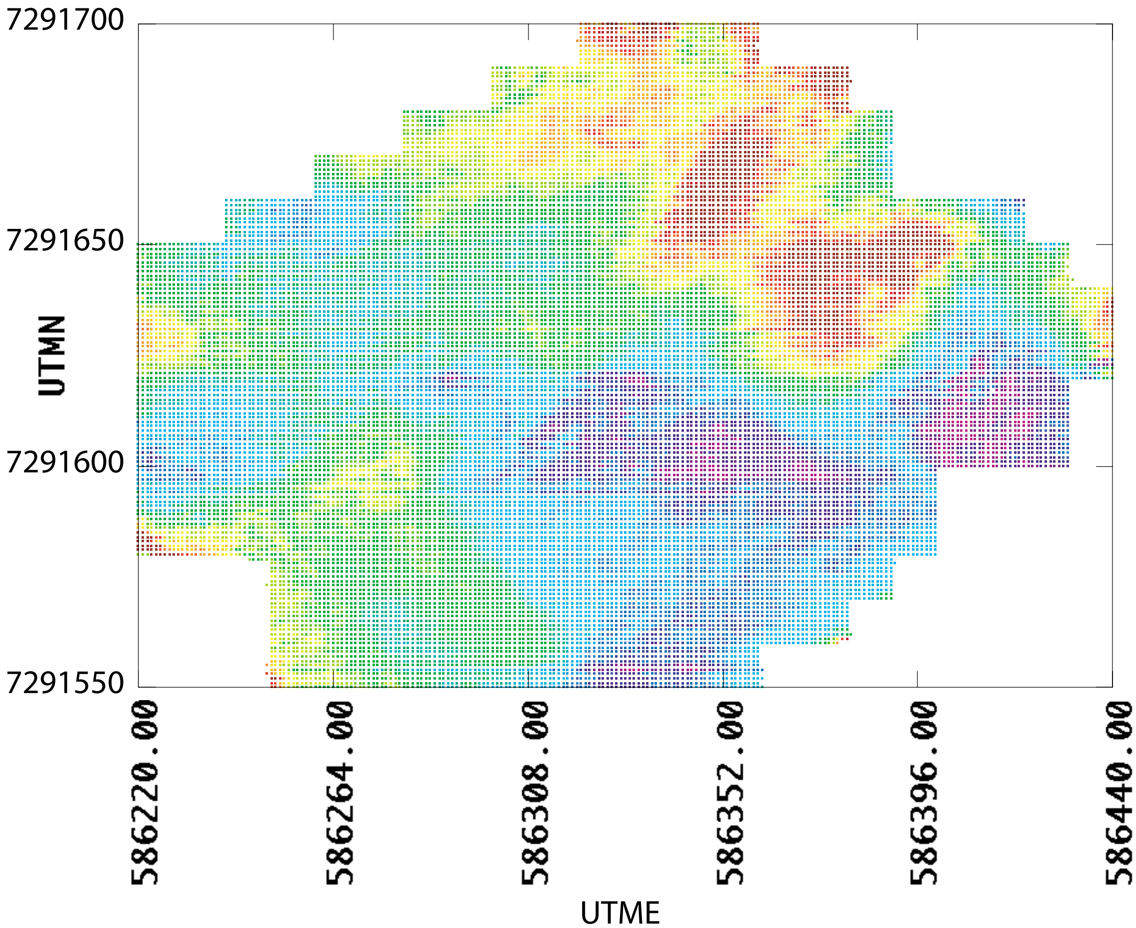


Figure 12. Conductivity map of the area surveyed at Hólar with the EM-31.

The conductivity contrast map (Figure 13) shows a number of interesting features, which have been confirmed by test trenches. The three east-west linear lines of alternating red-blue (550, 595, and 630) are due to the interface of different survey days. These are small offsets that can be post-processed out. They are not seen in the conductivity map (Figure 12). A series of similar northwest running lines can also be seen in the central portion of the survey area. Test trenches indicated these to be areas of midden edge or substantial thickening of the midden. They roughly correspond to areas with conductivity increases substantially. The large anomalies in the eastern area correspond to a series of well preserved substantial structures.

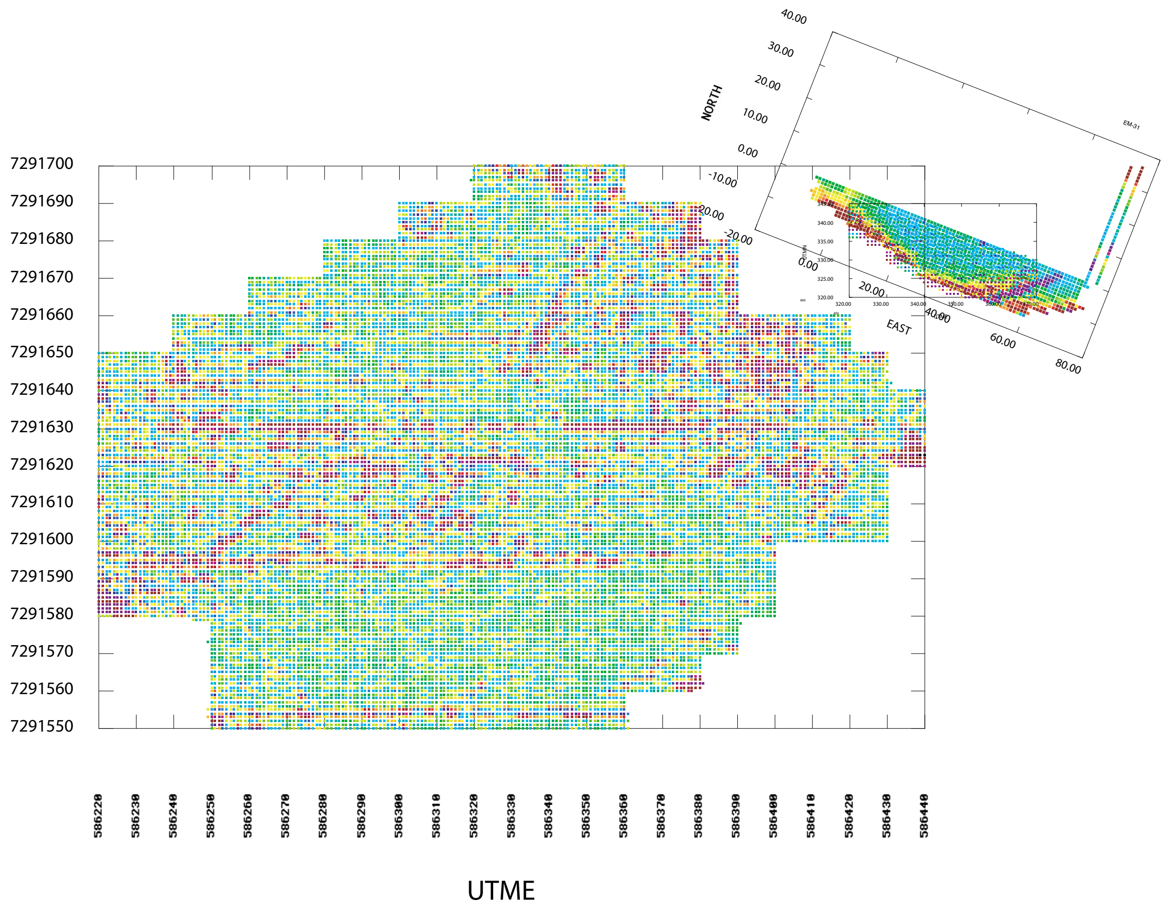


Figure 13. Map of conductivity contrast with inset of conductivity in the area just south of the church. The blue line running to the south east from the corner of the church is a old sewer line from the school. This pipe could not be traced on the other side of the road.

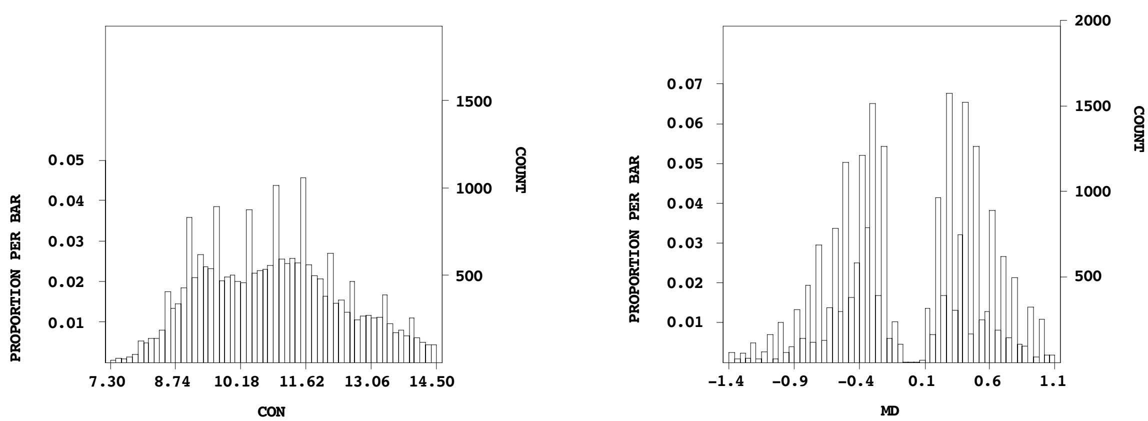


Figure 14. Histograms of conductivity (left) and conductivity contrast (right) from EM-31 readings at Hólar. The scales of the histograms correspond to the violet –red scales in Figure 12 and Figure 13 respectively.

Soil Science

The fields to the southwest and northwest of the church were sampled (Figure 15). Coring profiles revealed large amounts of scattered cultural material – bone, charcoal, and peat ash – throughout the soil horizons and widespread midden deposits in these areas. Cultural material was identified in over 80% of the core profiles, many with multiple layers of mixed cultural material and midden. Due to the concentration of cultural material and the obvious intensive land-use of this area in the past, it is difficult to distinguish areas of agricultural enrichment from other areas of human activity resulting in geo-chemical enrichment of soils. Distinguishing the areas and sequence of past land-use at the site will require extensive excavation and detailed coring to identify and distinguish buildings, cultural layers, and midden deposits from agricultural lands.

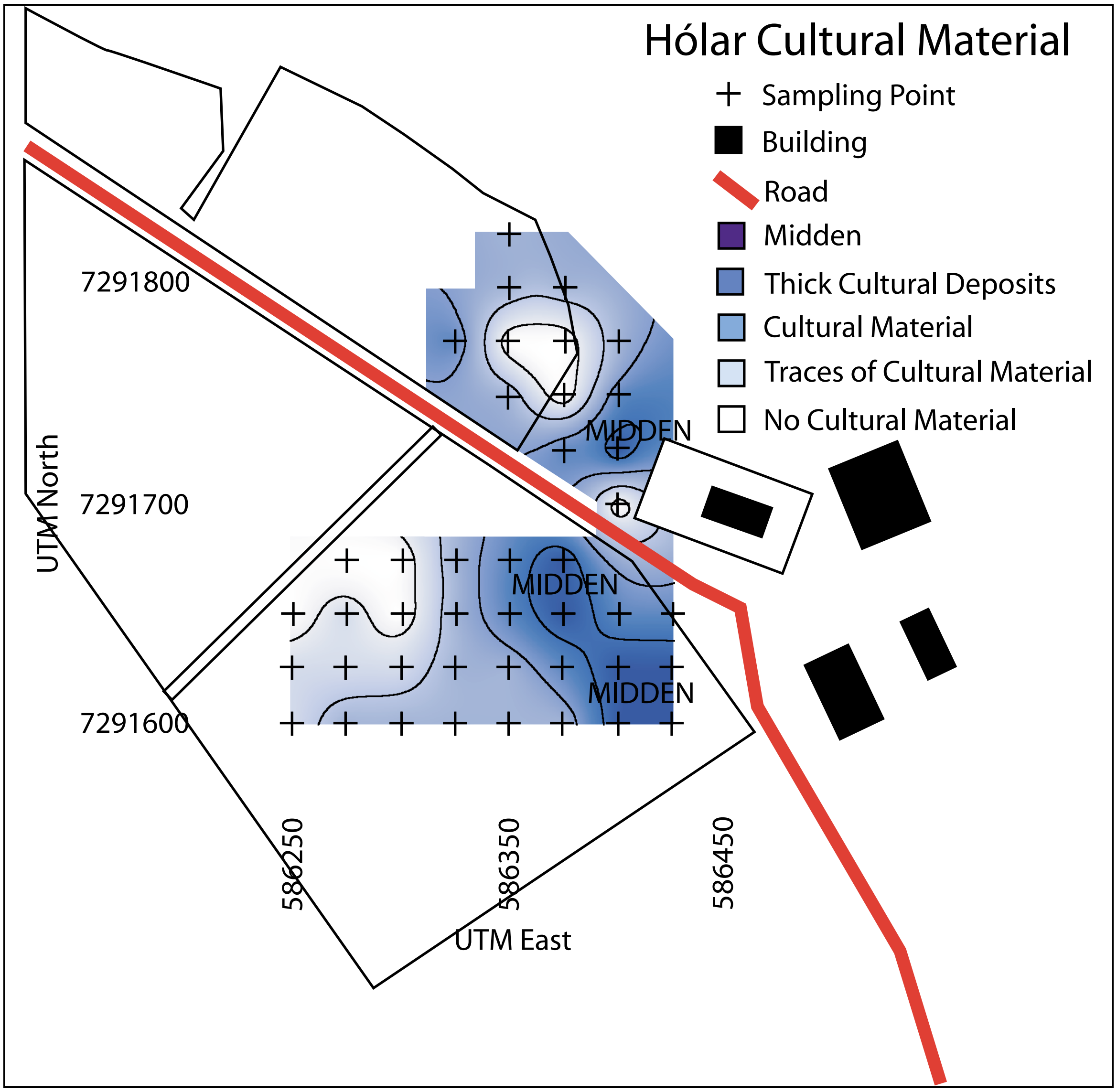


Figure 15. Estimated depth of midden at Hólar. Note that the modern road west of the church has been moved south since the drawing of the map in Figure 11.

Trenches.

Overall, the area seems to be morainic landscape covered by a 0.20-1.7 m of post ice age aeolian deposits. Very little evidence of H1 was found, while H3 was well preserved in places, but varied in depth substantially. There were no pre H1 structures encountered, but middens in trench 255,602 and the bottom of 432,621 may be contemporaneous with that tephra layer. Turfs with H1 in them were found in trenches 2, 340,665, and 5. The midden in trench 6 is from the 18th Century
It would appear that there is some pre H1 activity on this field, but no structures have been found to confirm this. Most trenches show substantial activity in the 12th Century especially in the eastern (upper) part of the field. It would appear that a substantial settlement restructuring took place about 1800 on the field.

255, 602

Trench 3 was a 5 m long hand excavated trench at the lower (west) end of the field. The trench was excavated to understand a linear anomaly running. It would appear that a thin midden layer at 255 (10 cm) that increases to 50 cm at about 257.5 is the cause of the anomaly. In the upper midden layer, a kaolin bead or pipe steam was found.

Figure 16. HO-13. Bead or pipe stem.

305, 686

Trench 1 was placed on a small ridge top because as it produced a substantial series of circular anomalies on the conductivity differential map. After 20 cm of sod was cut through revealing a sterile gravel and bolder deposit and excavation stopped. It would appear from the outside of the profile, that this used to be a slightly steeper knoll, who's top was bulldozed off—creating a ring of rocks that produced a circular, structure-like anomaly.

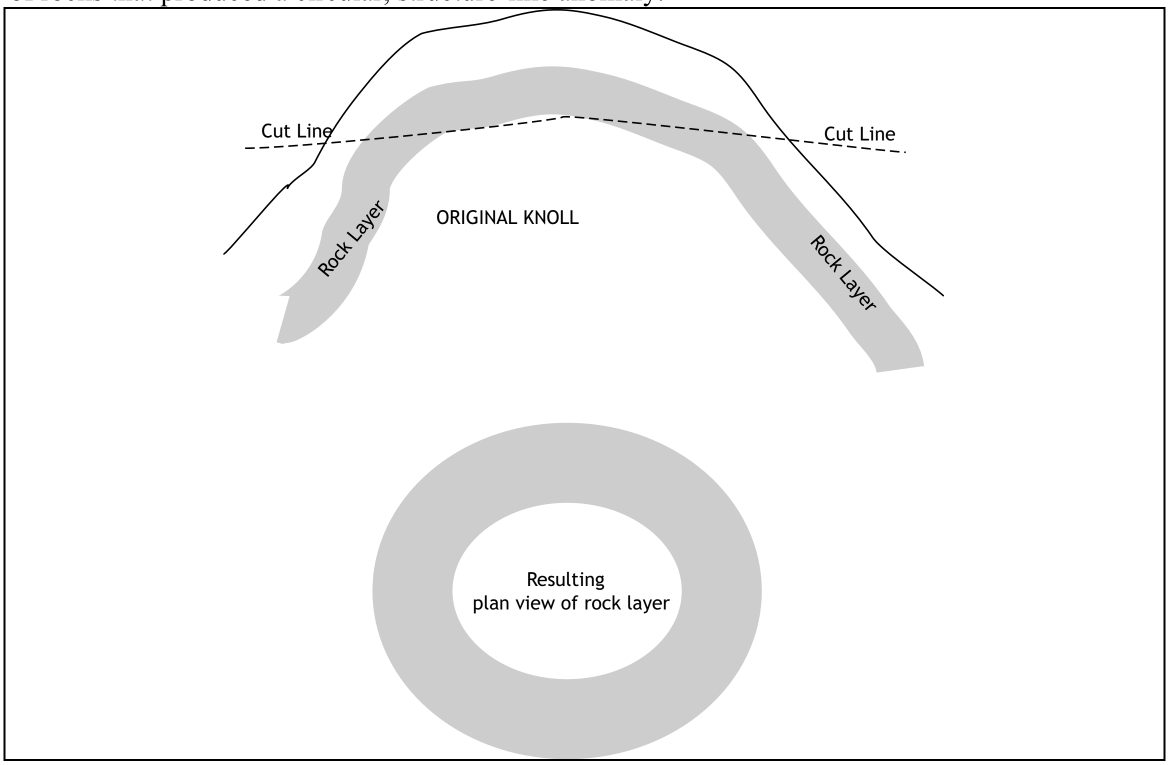


Figure 17. Scheme of probable origin of anomaly at HO 305, 686.

432,621

Trench 6 was placed to understand the series of anomalies in the center of the field. H 3 was well preserved at the bottom of the trench (45 cm) with a small layer of natural soil immediately above it. At 35 cm below the surface, a 7 cm layer of midden and irregular turfs with the 1104 enclosed in them. Above the midden layer is the 18th century midden.

340,665

Trench 4 was placed to intercept a north northwest running linear anomaly. At 340 the deposit was relatively sterile. Lower portion with a preserved H3 & H4 at 90 cm below the surface, which overlaid a gravel deposit. At 341.6 a cultural layer pinched in at 35 cm down by 342.8 they cultural layer was almost 20 cm thick. At 343.2 irregular turfs, one of which contained H1 were found. A column section for floatation was taken. At 343.2 for floatation and results will be forthcoming. Pinching in 8 cm below the turfs (75 cm below the surface) and just below the cultural layer is a thin layer with a possible preserved H1.

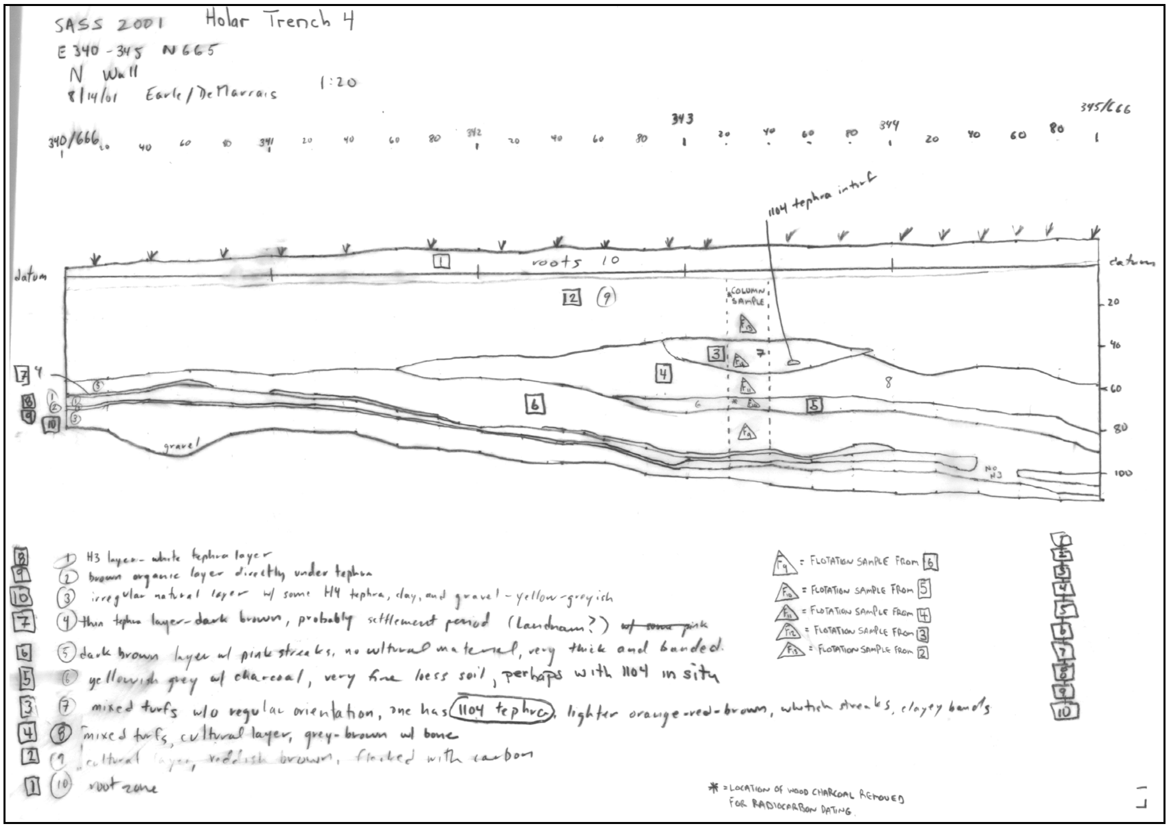


Figure 18. Profile of trench 340,665.

410, 600

Trench 2 was placed to intercept, moving north, a whole series of distinct anomalies (though not substantial enough to appear on the conductivity map). In the southern section of the trench, just below the root zone and extending down for 60 cm is a coarse undifferentiated midden soil. This deposit abuts a substantial turf wall at 611.5. The cross section of the turf wall cut at an 70° angle appears to be over 4 m thick and the oldest portion of the wall (in the south) has H1 abundantly mixed.

Figure 19. Beginning excavation

Figure 20. HO 410,600 during excavation.

Figure 21. Profile of HO 410,600.

Figure 22. Plan of HO 410,600

Figure 23. HO-81 Whetstone.

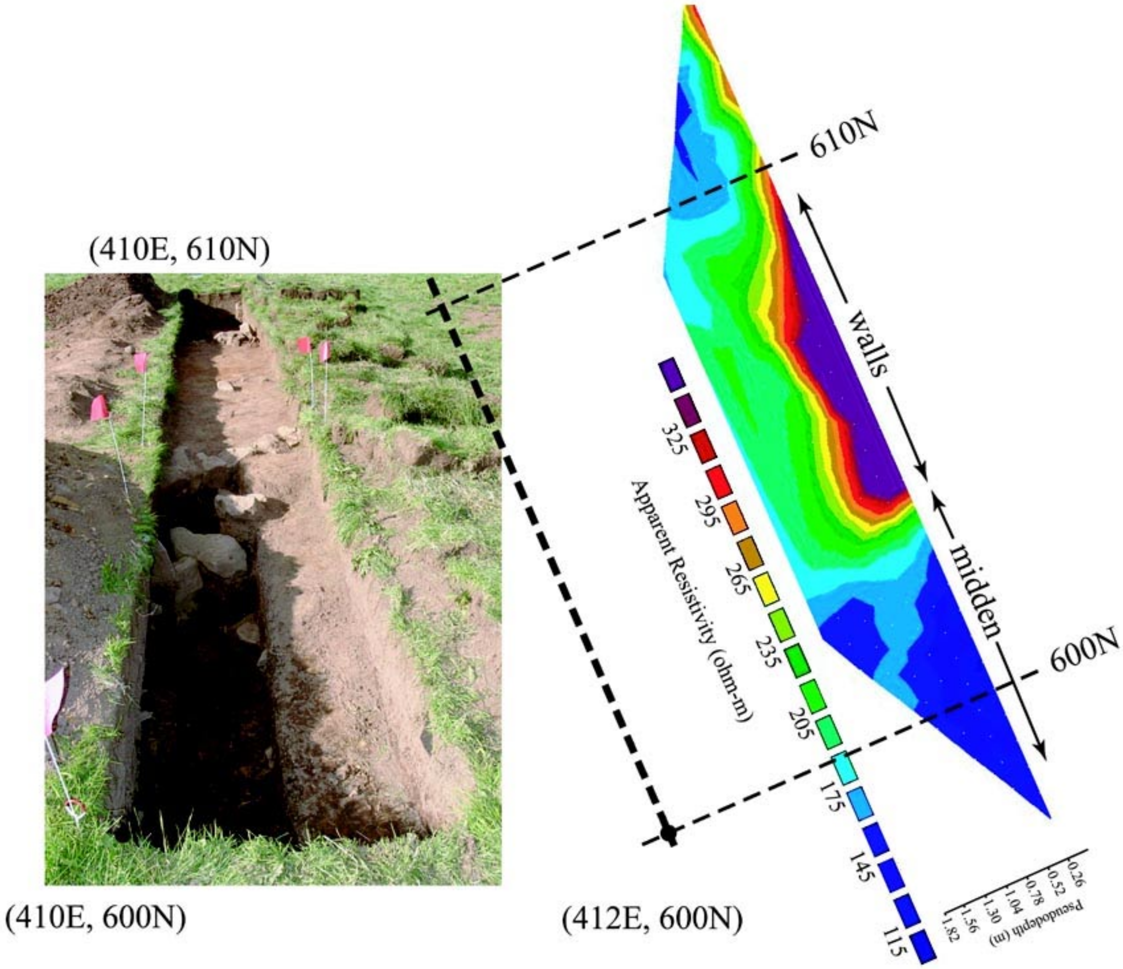
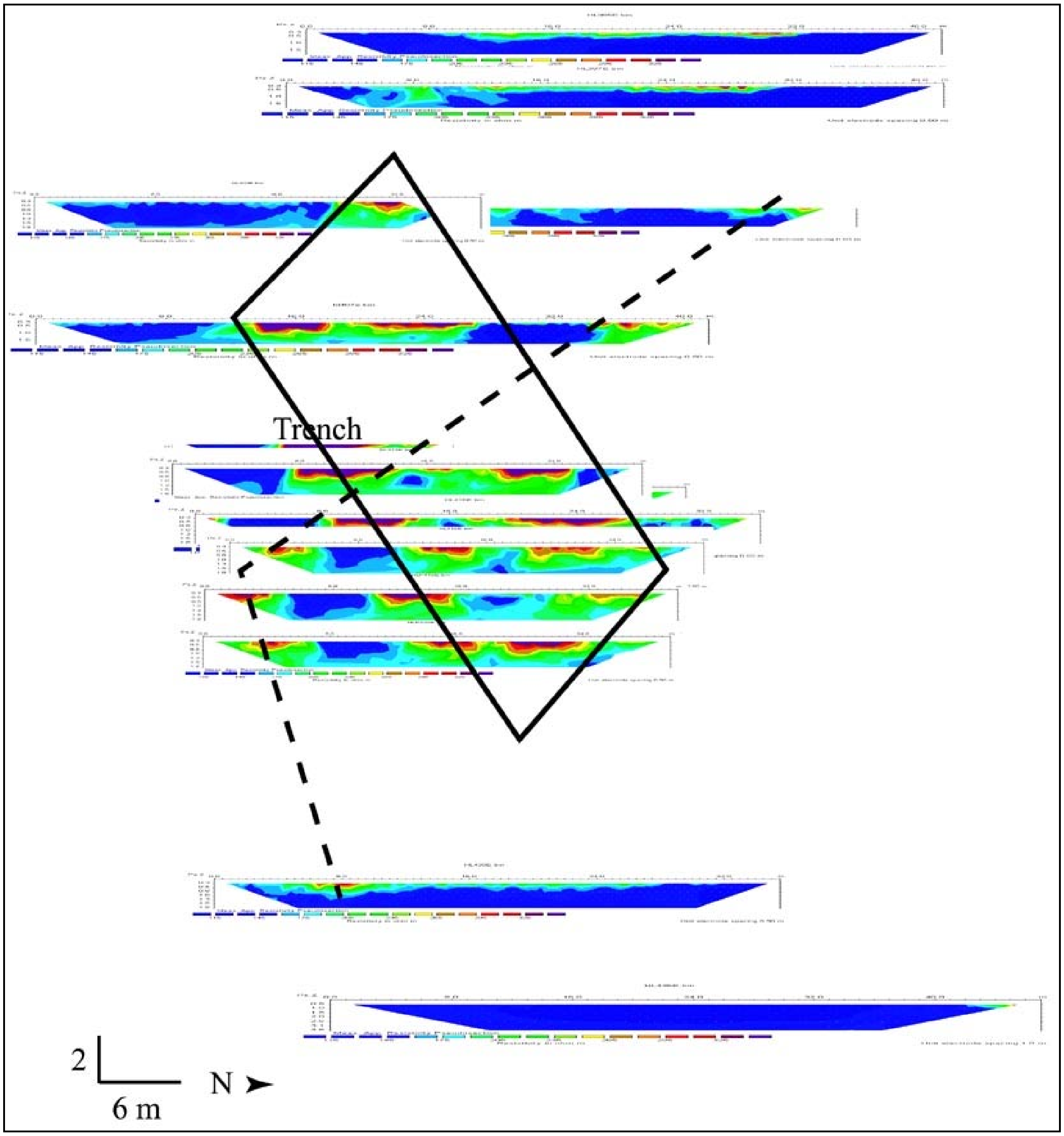


Figure 24.

Based on a series of Syscal Kid profiles, a general outline of the structure can be followed. The outline conforms the areas of high conductivity contrast seen in the EM-31 readings. The main walls in the trench could be



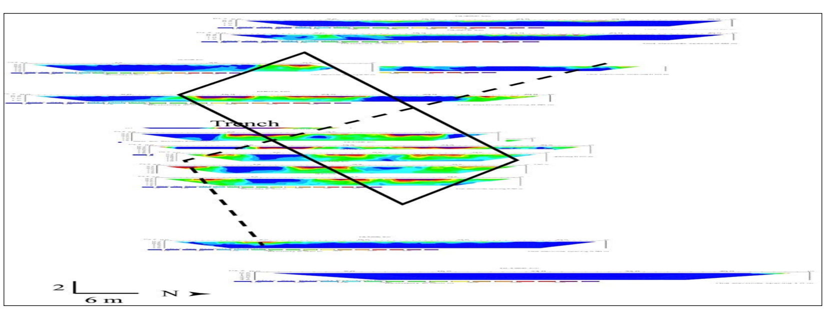


Figure 25. Top, outline of "Stake house" based on combination of trench excavation and Syscal Kid pseudo-profiles. Left, properly scaled outline of structure.

432, 621

Trench 5 was set to intercept a substantial negative spike in EM-31 readings, which was surrounded by an area of high contrast. A large negative spike is usually associated with ferrous metal. The trench was started in the east and at E 434.4 just 25 cm below the surface, a bucket was encountered. The trench was originally scheduled to be 5 m long, but when the bucket was encountered, the trench was stopped at three meters. The trench itself is a classic example of reverse stratigraphy, in which immediately under a very think root zone in a midden from about 1800, which overlies a early 20th Century midden (which contains the bucket). The trench slopes to the west, but much of the slope seems to be due to the 19th and 20th Century middens. Underneath and mixed with the lower midden are turfs, many of which contain H1. Below these turfs is a light gray compacted layer, probably a floor. Below the floor, is a thin midden with a stake hole driven into a much older low density midden, probably dating 1100-1500.

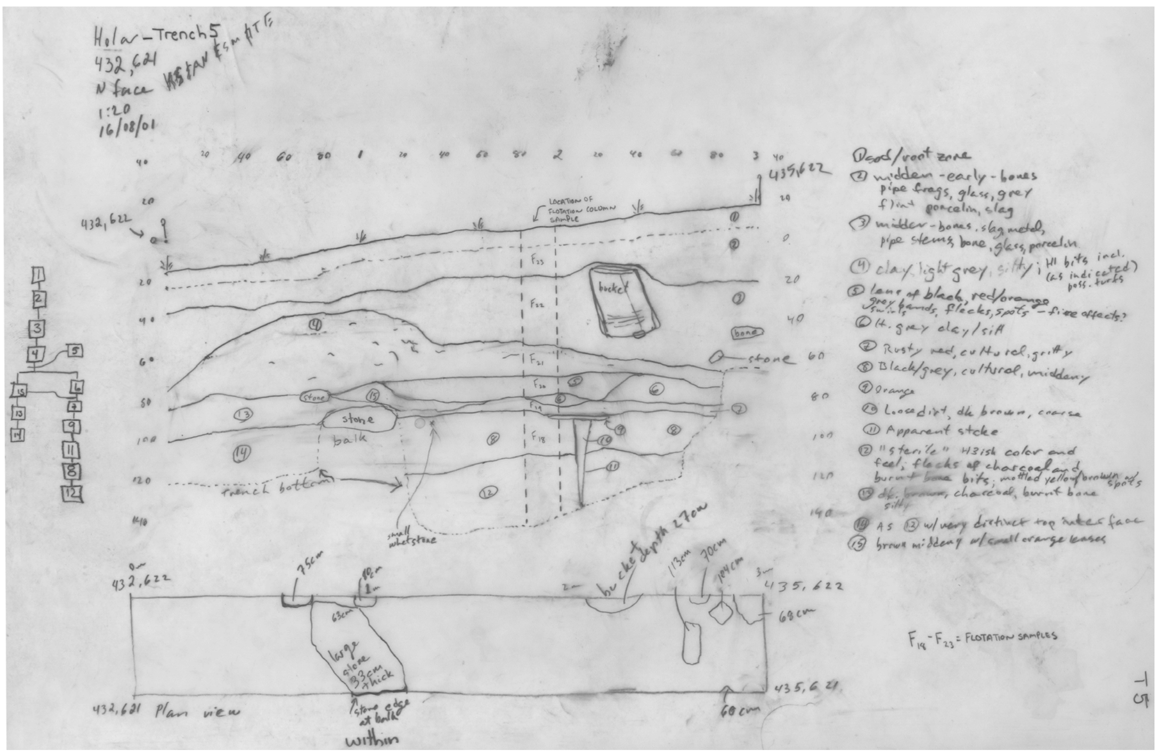


Figure 26. Profile of HO 432, 621.

Reynisstaður 3-63

Today, Reynisstaður is a dairy farm owned by Helgi Jóhann Sigurðsson. On July 26 a UTM grid was set up at Reynisstaður and power auger work began. Soon thereafter, surface survey and work with the Syscal Kid commenced. On July 31 surveying with the EM-31 began. Substantial problems were encountered at Reynisstaður with a powerline grounded at 056100,7282700, which made it impossible to use any of our equipment within 200 m of that point.

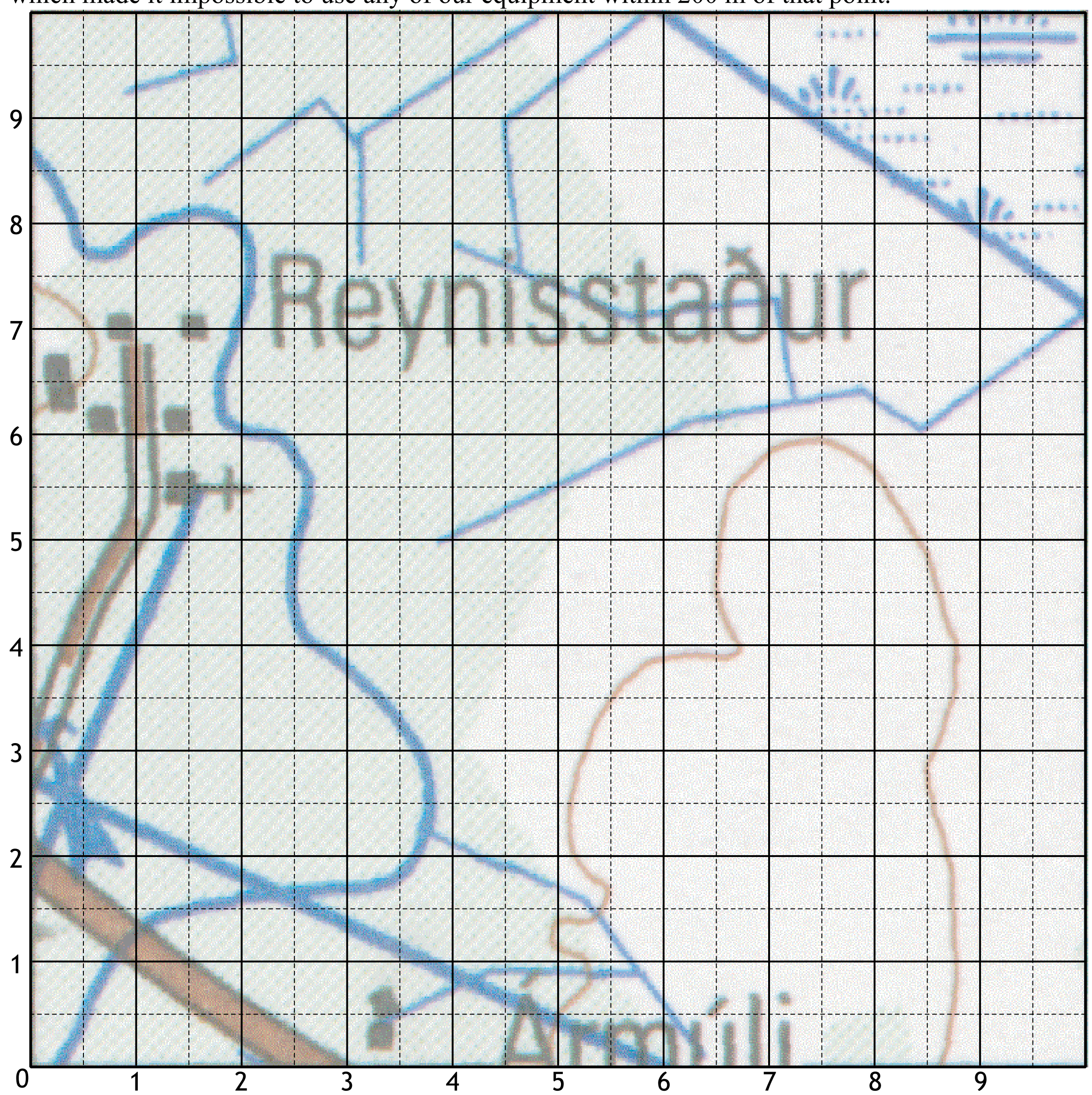


Figure 27. Kilometer 056, 7282. Note that the powerline running to the church now runs east of the road.

Near the main farm house, at 150, 700 the Sæmundará is cutting into a substantial and well preserved midden with possible settlement deposits. It is recommended that this midden, be mitigated as soon as possible as it is rapidly eroding into the stream.

Remote Sensing

The EM-31 survey was carried out over 3 days, starting on July 31. There was little precipitation over that period and the weather was sunny and warm. Over that time 10478 readings were take. A grounded powerline at 056100,7282700 made the EM-31 ineffective in the Northern portion of the farm. At the southern end of the surveyed area, a cable/telephone line as well as an overhead power line disturbed the readings substantially.

The overall conductivity change is dominated by relatively high conductivity areas in the south and west. The line in the south, running north west is the cable/telephone line. The conductivity contrast is dominated by the cable/telephone line as well as the overall broad changes in conductivity; probably do to old Sæmundará river beds, now filled in with alluvial soil. Trenches were placed in some of the small anomalies in the west, but no buried features were discovered. These anomalies may well be a result of the effects of the grounded transformer. Because of the rivierean geomorphology, the telephone/cable line, the overhead lines, and the grounded transformer, Electromagnetic survey proved difficult and largely unhelpful.

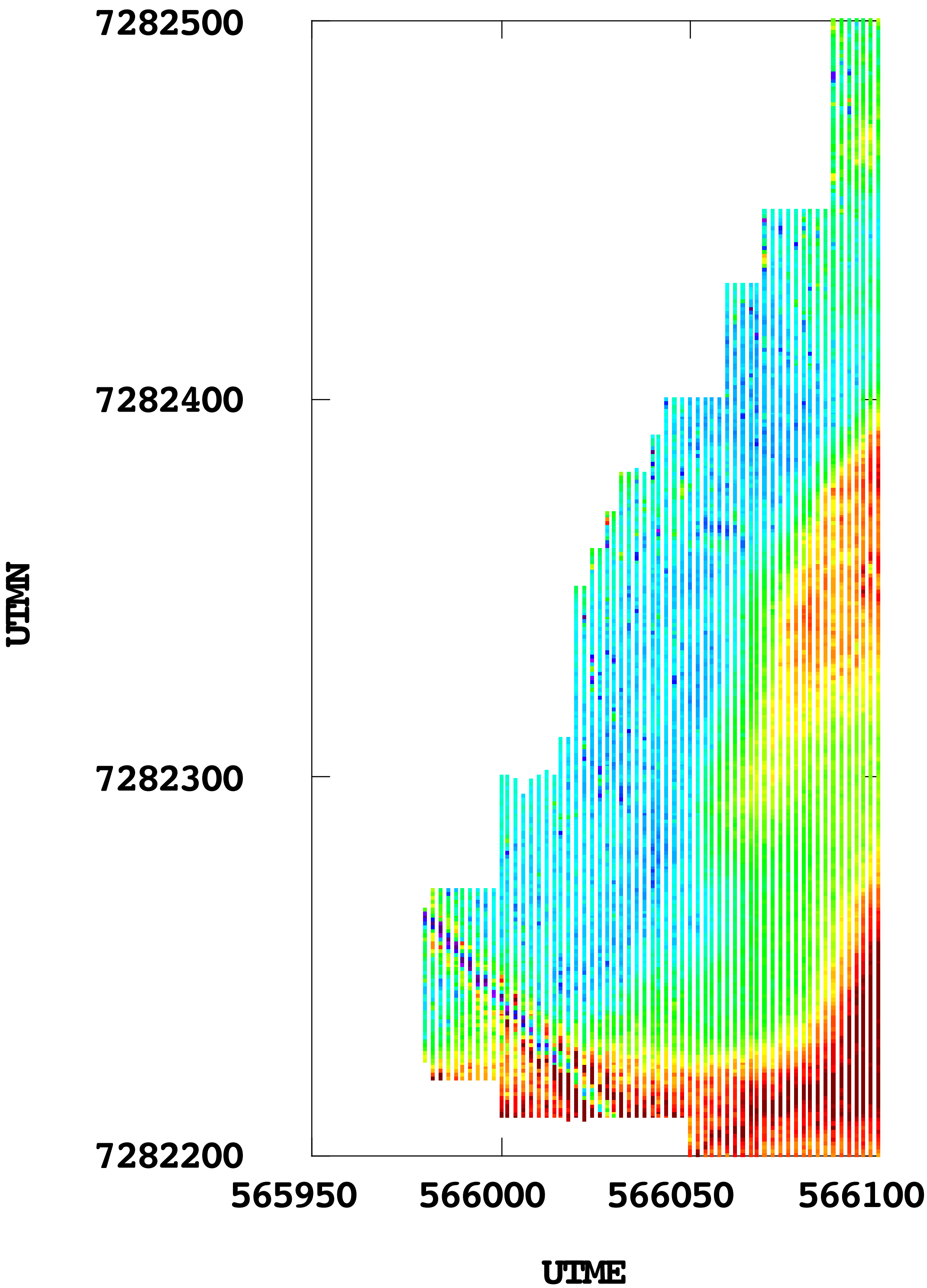


Figure 28. Conductivity map of Reynisstaður.

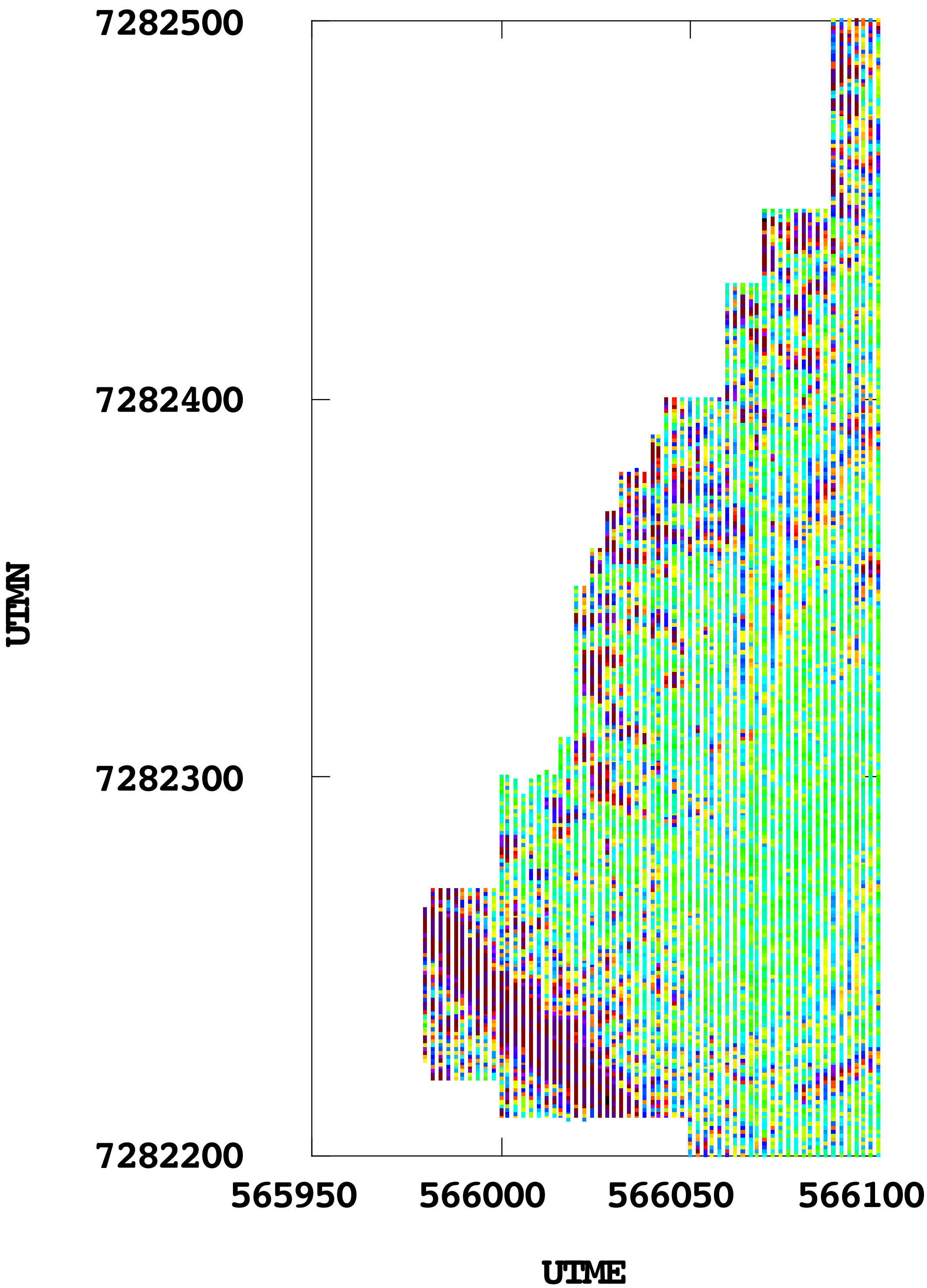


Figure 29. Conductivity contrast map of Reynisstaður.

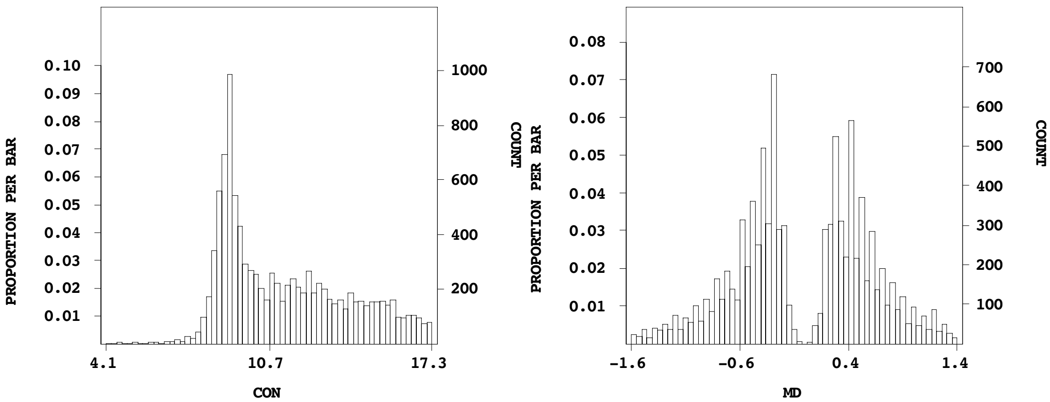


Figure 30. Histograms of conductivity (left) and conductivity contrast (right) from EM-31 readings at Reynisstaður. The scales of the histograms correspond to the violet –red scales in Figure 29 and Figure 30 respectively.

Structures

3-63-1
Klausturshóll – Clositer Hill/Possible Fortress

Location – UTM E 0566046, N 7282530 (Refer Grid B)
Latitude N 65° 39.37, Longitude W 19° 33.35
Taken at center of site area, point X on plot plan.

Description – Site area consists of a series of mounds and depressions in the northern portion while the southern portion slopes southeast steeply away from the mounds to the level of the surrounding fields. Total drop from top of mound to SE corner of site, is approximately 5 m. in a distance of 30 m., or approximately 15 degrees.

The mounded area at top of site consists of a large U-shaped mound approximately 20 m. wide and 15 m. long with the open end to the NE. Within this U-shaped area is a second smaller U-shaped mounded area approximately 4m. wide and 9 m. long with the open end to the NE. Both share the common northern wall while the smaller unit has a lower southern wall that melds into the northern wall at the base of the U-shape.

The center of the smaller mounded area has two distinct depressions, approximately 2m. long, 4 m. wide and 15 cm. deep.

Some possible pre-1104 occupation, primarily post-1104 with a substantial post-1766 component.

Site measurements – NE corner (A) to NW corner (B) 27.6 m., NW corner (B) to SW corner (C) 25.8 m. SW corner (C) to SE corner (D) 40.3 m., and SE corner (D) to NE corner (A) 40.3 m.

Measurements were taken from site corners to establish center point X, which is the approximate center of the mounds and depressions at the top of the site. NE corner to X 21m., NW corner to X 17.0 m., SW corner to X 20.5 m., and SE corner to X 36.4 m.

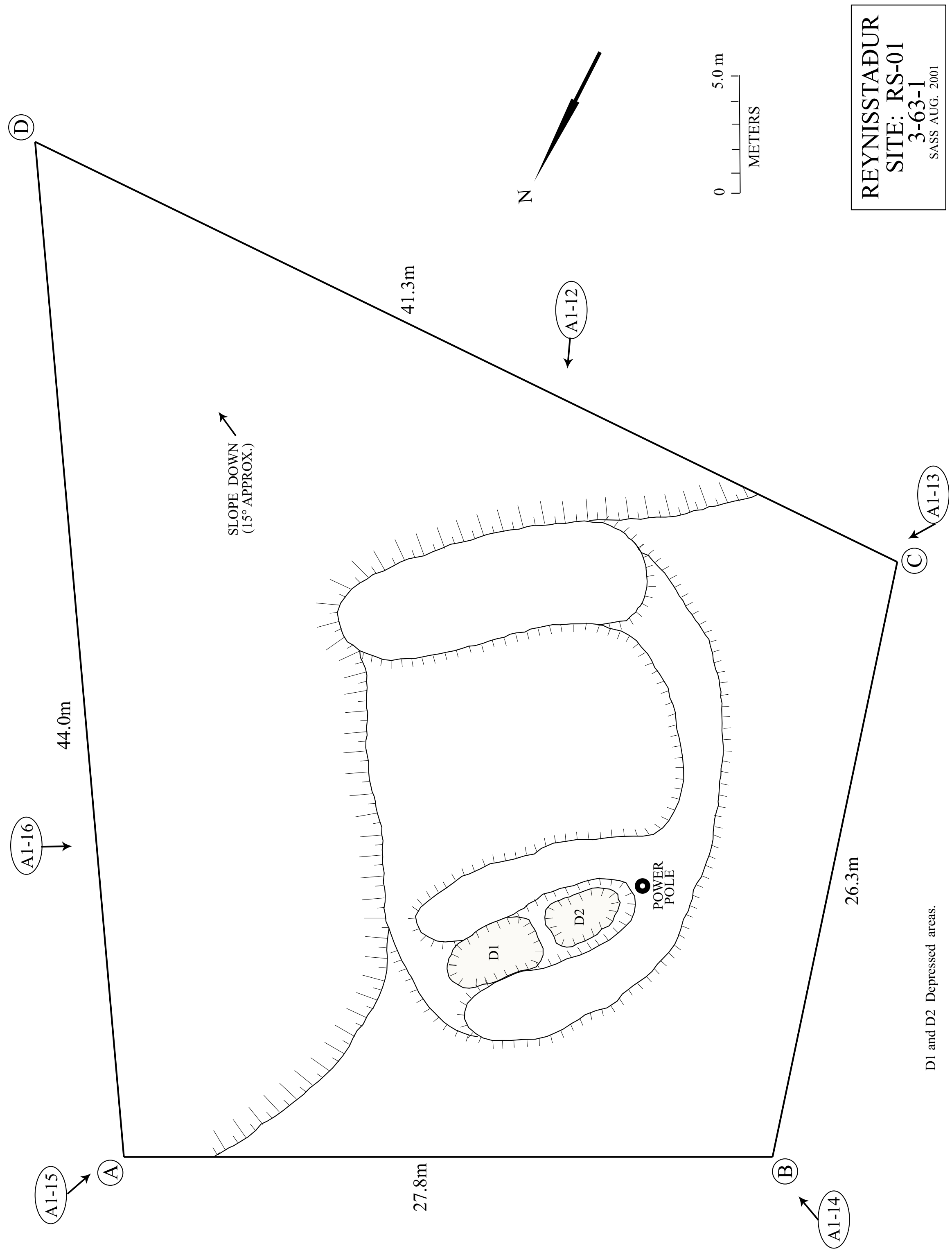
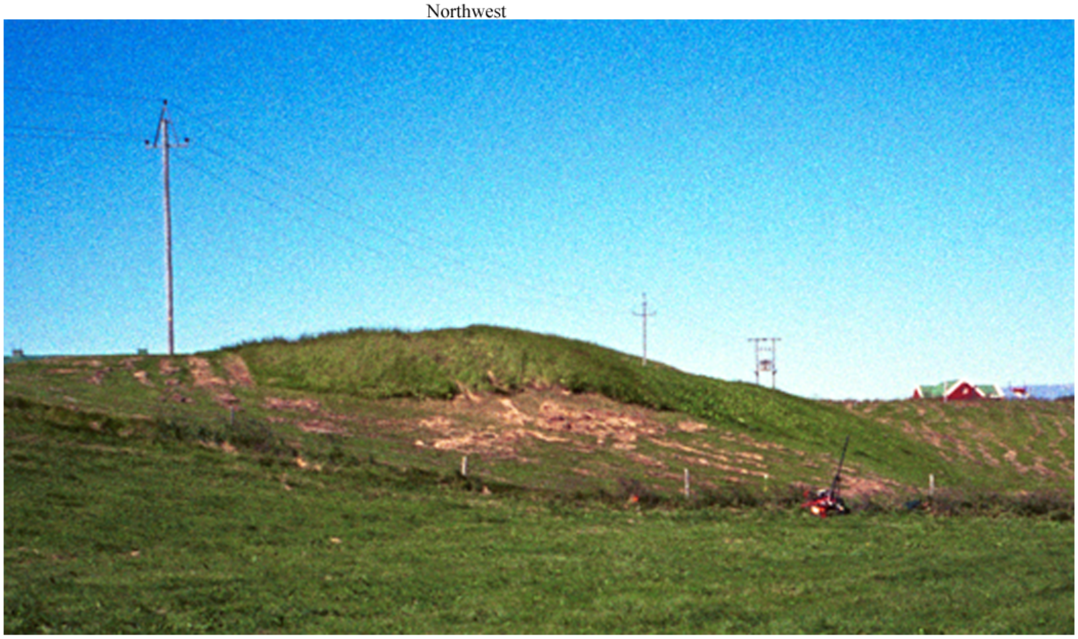


Figure 31. Surface survey plan of 3-63-1

REYNISSTAÐUR
SITE: RS-01
KLAUSTURSHÓLL
3-63-1

Northwest



A1-12

Northeast

A1-13

S.A.S.S. 2001

Figure 32. Photos of 3-63-1, A1-12 Taken from SE toward the N and A1-13 Taken from SW corner toward the NE

REYNISSTAÐUR
SITE: RS-01
KLAUSTURSHÓLL
3-63-1

Southeast

A1-14

South

A1-15

S.A.S.S. 2001

Figure 33. Photos of 3-63-1. A1-14 taken from NW corner toward the SE A1-15. Taken from NE corner toward the South

REYNISSTAÐUR
SITE: RS-01
KLAUSTURSHÓLL
3-63-1

A1-16

Figure 34. Photos of 3-63-1. A1-16 Taken from NE toward the SW

3-63-2
Fjárhús – Sheep Shed

Location – UTM E 0566058, N 7282373 (Refer Grid B)
Latitude N 65° 39.29, Longitude W 19° 33.83
Taken at point X on site sketch.

Description – Site is a mound located on fairly level grassy field. The highest point of the mound is located at the approximate center of its fairly flat top. This point is about 1.4 m. above surrounding field (Point X on site plan.). From the edges of this top area the sides slope down to the adjacent field’s level (Line Y on site plan.).

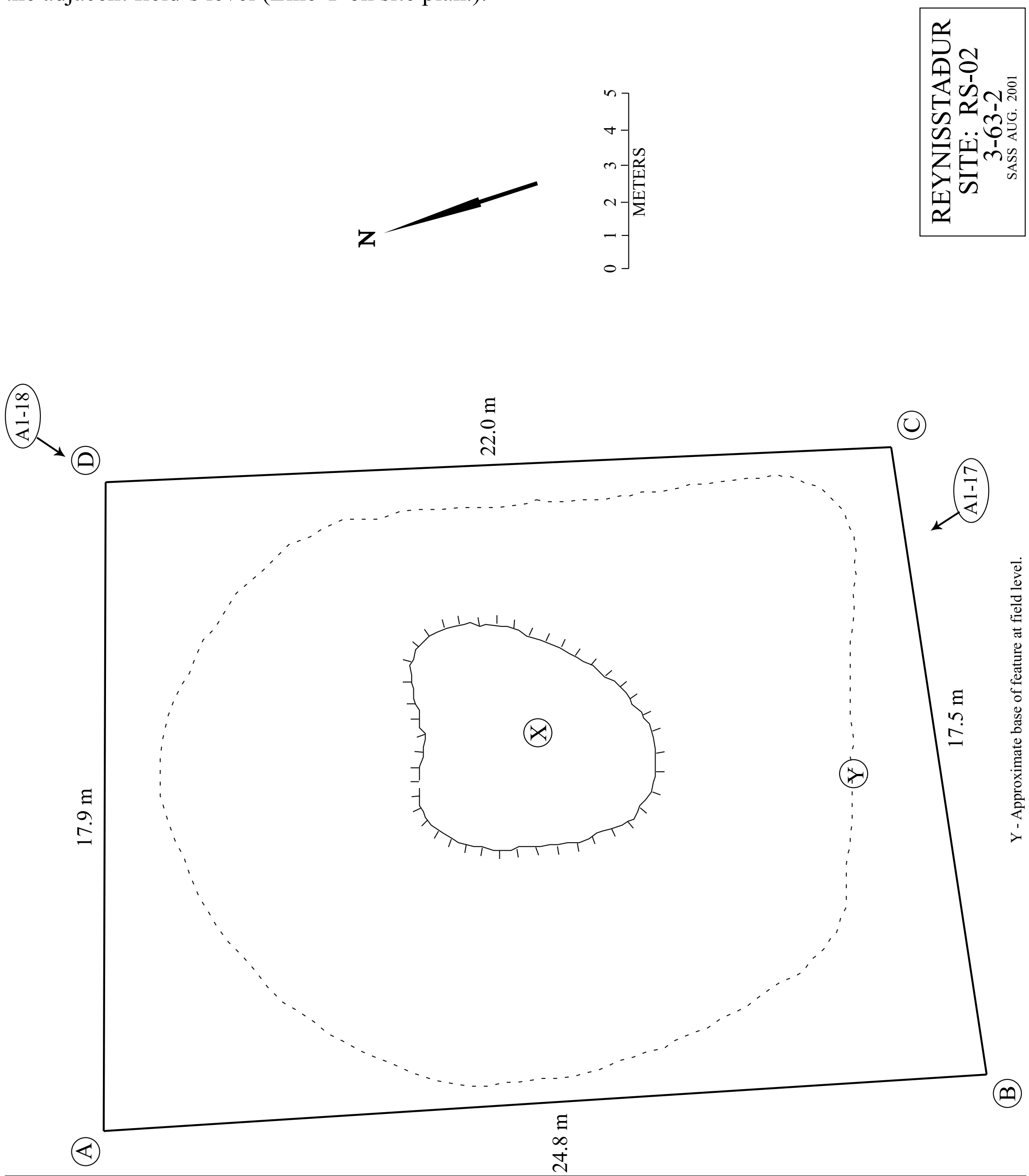


Figure 35. Surface survey plan of 3-63-2.

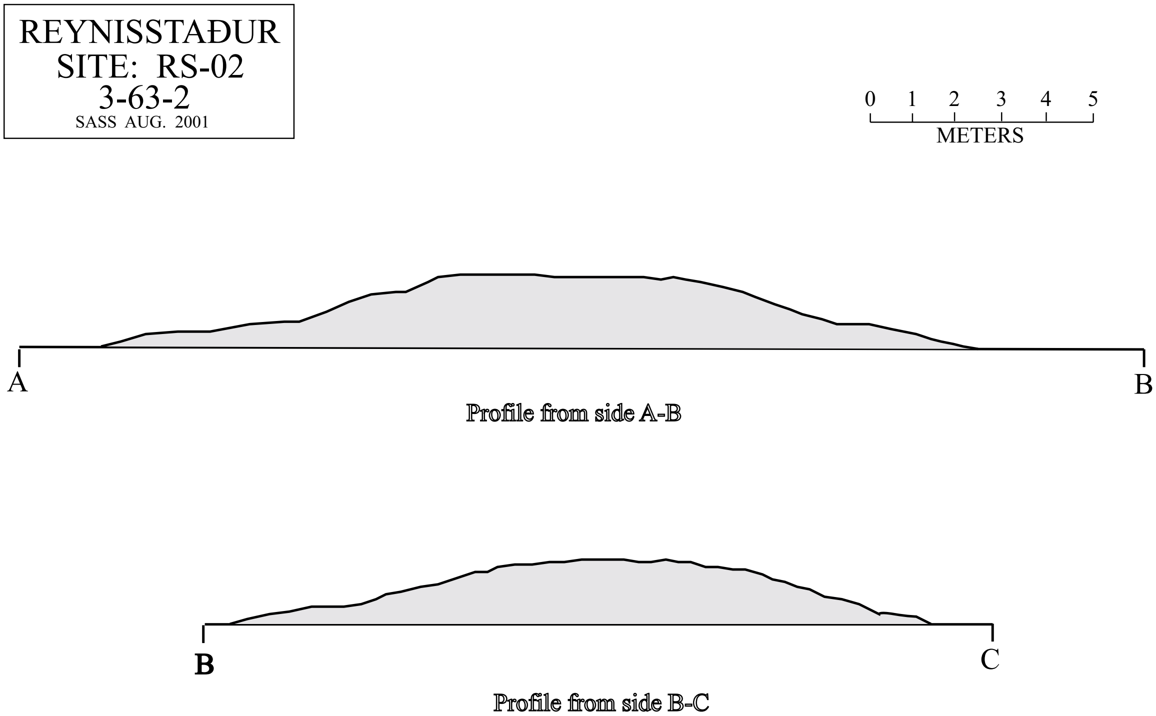


Figure 36. Surface survey 3-36-2 profile.

Site measurements –NW corner (A) to SW corner (B) 24.8 m., SW corner (B) to SE corner (C) 17.5 m., SE corner (C) to NE corner (D) 22 m., NE corner (D) to NW corner (A) 17.9 m.,and NW corner (A) diagonal to SE corner (C) 29 m..

Additional measurements to position X were NW corner (A) to X 16.3 m., SW corner (B) to X 15.7 m., SE corner (C) to X 12.7 m., and NE corner (D) to X 14 m.

REYNISSTAÐUR
SITE: RS-02
FJÁRHÚS
3-63-2

North

A1-17

Southwest

S.A.S.S. 2001

A1-18

Figure 37 Photos of 63-3-2. A1-17 Taken from SE corner toward North (Mag.). A1-18 Taken from NE corner toward SW corner

3-63-3.
Gamli Bærinn – Old Farm House, 1758

Location – UTM E0566147, N7282645 (Refer Grid B)
Latitude N 65° 39.43, Longitude W 19° 33.71
Taken at center of site area.

Description - Entire area covered with grass of 5 to 10 cm in height. The NE half of the site contained numerous small birch trees, with trunks of 15 to 25 cm in diameter, SW portion was clear of trees.

On the southern border of site was a reconstructed 'hall' of stone, wood, and turf possibly part of the original farmhouse. The north wall of the 'hall' was 1 m south of the site's southern side, was 8m in length and its NE corner was 2m west of site's SE corner.

Site area showed no surface irregularities that might suggest original house's location or possible configuration.

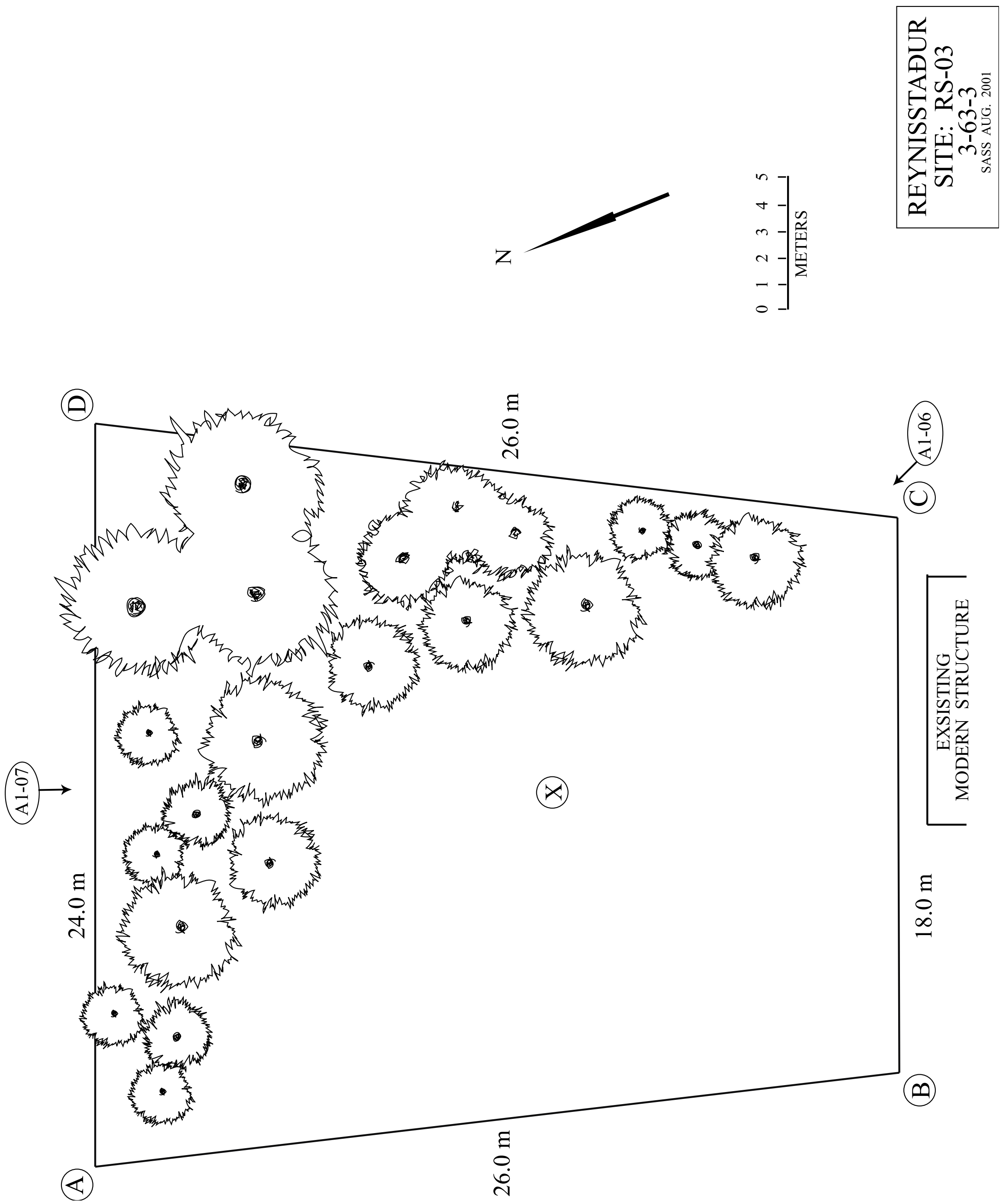


Figure 38. Surface survey plan of 3-63-3

Site measurements – NW corner (A) to SW corner (B) 26 m, SW corner (B) to SE corner (C) 18 m, SE corner (C) to NE corner (D) 26 m, NE corner (D) to NW corner (A) 24 m, and diagonal from SW corner (B) to NE corner (D) 33 m.

REYNISSTAÐUR
SITE: RS-03
3-63-3

North

A1-06

Southwest

A1-07

S.A.S.S. 2001

Figure 39. Surface Survey photo of 63-3-3. A1-6 Taken from SE corner toward North. A1-7 Taken from center of NW to NE boundary toward South

3-63-4
Göng – Tunnel ?

Location – UTM E 0566137, N 7282597 (Refer Grid B)
Latitude N 65° 39.41, Longitude W 19° 33.73
Taken at center of site area, point X on sketch.

Description – Site area lies to the East (behind) the new church and is divided by a hedge and fence running North to South at approximately the center of the area.

The area West of the fence-hedge is part of the cemetery that surrounds the church, containing one grave and a floodlight used to illuminate the church building.

The area East of the fence-hedge is grassy with a slightly depressed area East of hedge, which could indicate remains of a small structure, beyond the depression it slopes gently to the fence that borders the Southeast side of this area. Beyond this fence is a steep slope (45fl) down to a drainage ditch.

Approximately 5 m. beyond the South end of North-South fence, down the slope, is a metal pipe report ably marking the entrance to the tunnel (?). Subject tunnel possibly connected to the old church occupied part of the site area.

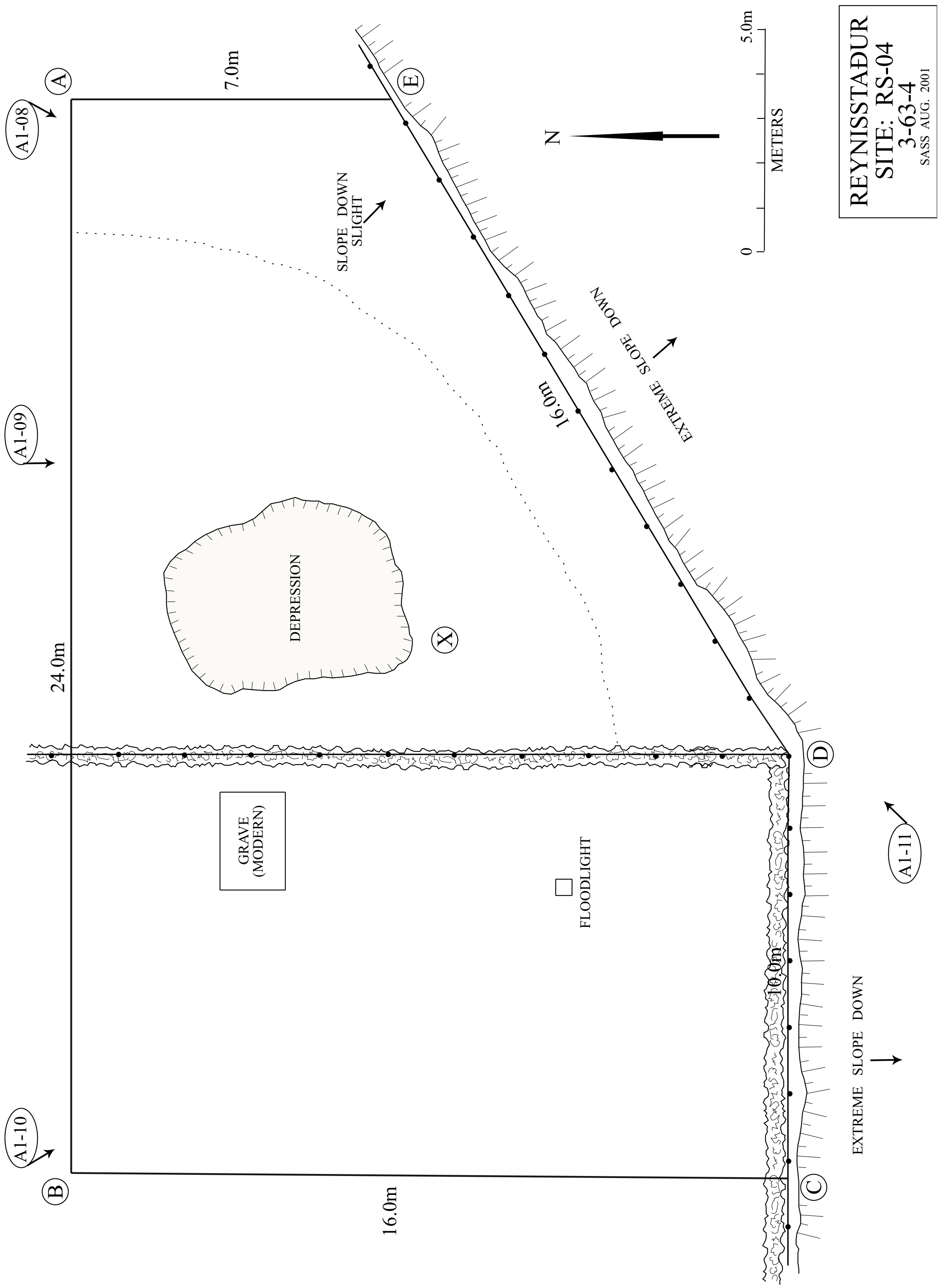


Figure 40. Surface Survey plan of 3-63-4.

Site measurements – NE corner (A) to NW corner (B) 24 m., NW corner (B) to SW corner (C) 16m., SW corner (C) due East 10 m. then Northeast 16 m. to SE corner (E), SE corner (E) to NE corner (A) 7 m.

REYNISSTAÐUR
SITE: RS-04
3-63-4

Southeast

A1-10

Northeast

A1-11

S.A.S.S. 2001

Figure 41. Surface Survey photos of 63-3-4.A1-08 Taken from NE corner toward the SW. A1-09 Taken from North boundary toward the South.

REYNISSTAÐUR
SITE: RS-04
3-63-4

Southwest

A1-08

South

A1-09

SASS 2001

Figure 42. Surface Survey photos of 63-3-4. A1-10 Taken from NW corner toward the SE. A1-11 Taken from South of Tunnel (?) entranc

3-63-6
Reynigerði – Former Farm House

Location – UTM E 0565865, N 7282133 (Refer Grid A)
Latitude N 65° 39.16, Longitude W 19° 34.09
Taken at center of site, point (X).

Description – Site situated on the edge of a flat grassy pasture sloping gently downward from west to east. Site is slightly elevated from surrounding field with a series of shallow depressions in the SE corner (C). From the NW corner (A) to approximately 2/3 of distance to the SE corner (C), indicated by line (Y), the surface of the site drops about 0.5 m., in the remaining 1/3 of the distance, indicated by line (Z), it drops an additional 0.5 m.. At the edge of this change in contour is a series of shallow depressions in the ground's surface.

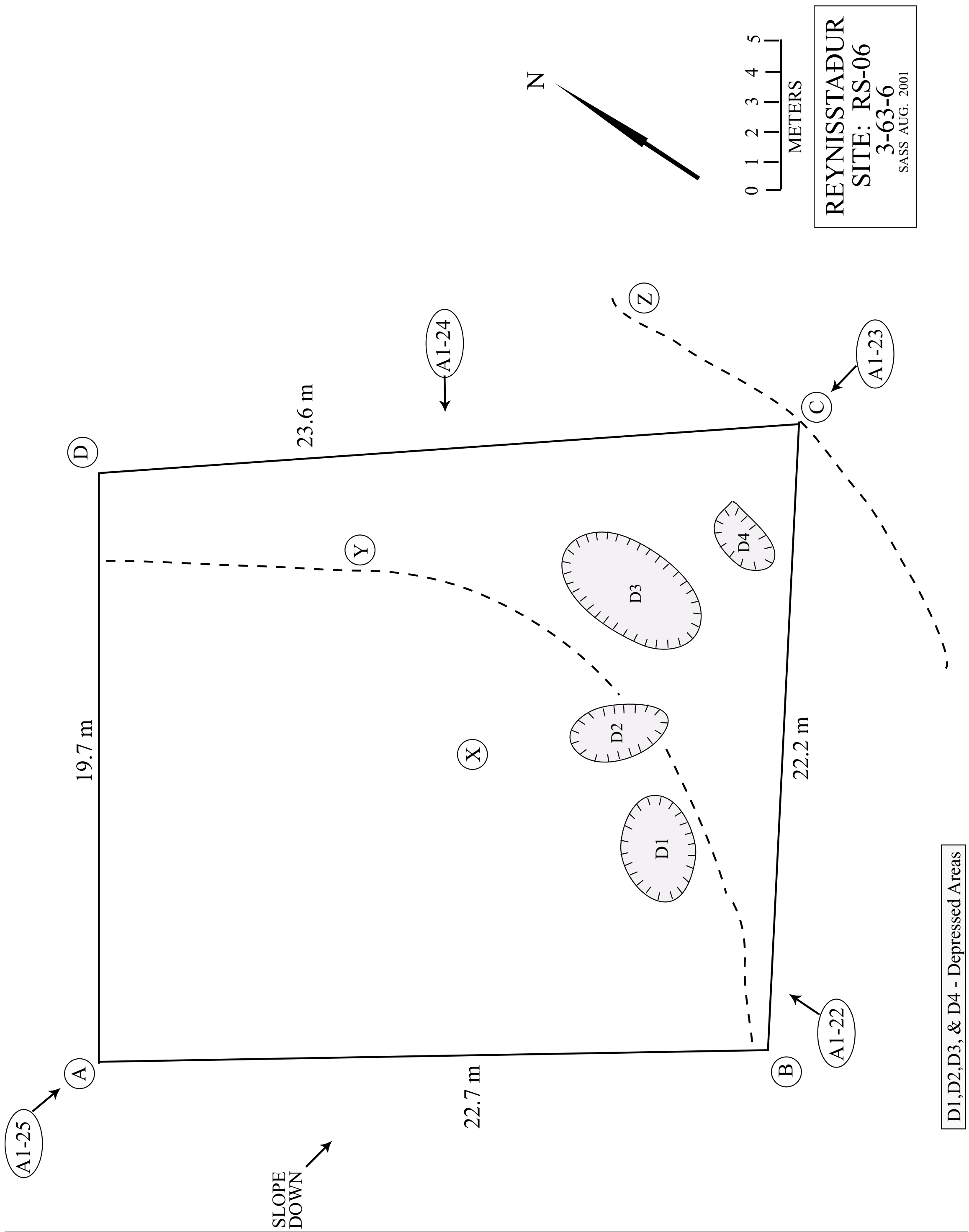


Figure 43. Surface survey plan of 3-63-6.

<u>Site dimensions</u> – NW corner (A) to SW corner (B) 22.7 m., SW corner (B) to SE corner (C) 22.2 m., SE corner (C) to NE corner (D) 23.6 m., and NE corner (D) to NW corner (A) 19.7 m..

Measurements to establish Point X, NW corner to X 16.4 m., SW corner to X 14.2 m., SE corner to X 15.6 m., and NE corner to X 15.7 m..

REYNISSAÐUR
SITE: RS-06
3-63-6

Southwest

A1-24

East

A1-25

Figure 44. Surface Survey phots of 3-63-6. A1-22 SW corner toward North. A1-23 SE corner toward the NW corner

REYNISSTAÐUR
SITE: RS-06
3-63-6

North

A1-22

West

A1-23

Figure 45. Surface photos of 3-63-6. A1-24 Center of eastside toward Southwest A1-25 NW corner toward the SE corner

3-63-7
Hvammshús-Former Farm House

Location – UTM E 0565814, N 7282225 (Refer Grid A)
Latitude N 65° 39.21, Longitude W 19° 34.15
Taken at center of site, point (X).

Description – The western half of site was covered with extremely dense tall grass (1 to 1.5 m.) preventing close detailed examination of the area. The eastern half extended into the pasture covered with short grass that was bounded by the dense grass area.

The eastern portion contained two depressed areas, oriented in a northwest to southeast direction and about eight meters apart. On the north edge of each depression, visible on the surface, was a row of stones running in the same northwest to southeast orientation. Four stones at the northern depression and three stones at the southern depression.

The site slopes in a northwest-to-southeast direction and is slightly elevated above the surface of the surrounding pasture.

Site measurements – SW corner (B) to SE corner (C) 17.7 m., SE corner (C) to NE corner (D) 20.1 m., NE corner (D) to NW corner (A) 17.3 m. Note due tall dense grass covering area the NW (A) corner to SW corner (B) measurement could not be obtained.

Measurements to establish point X are as follows, NW corner to X 15.1 m., SW corner to X 15.1 m., SE corner to X 13 m., and NE corner to X 12.6 m..

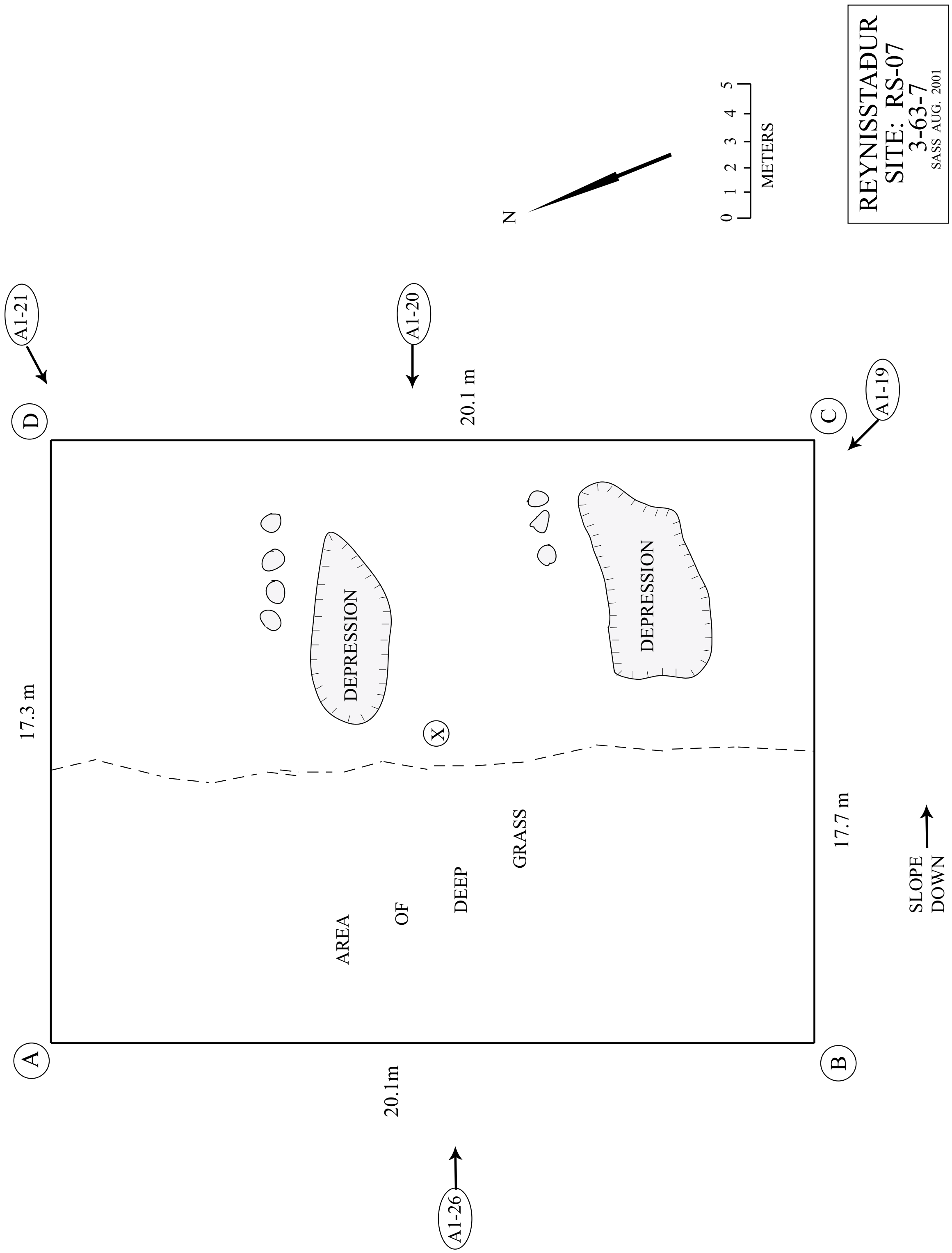


Figure 46. Surface survey plan of 3-63-7.

REYNISSTAÐUR
SITE: RS-07
3-63-7

Southwest

A1-21

East

A1-26

Figure 47. Surface survey photos of 3-63-7. A1-19 Taken from SE corner toward the North. A1-20 Taken from mid-point of East side toward the West

REYNISSTAÐUR
SITE: RS- 07
3-63-7

North

A1-19

West

A1-20

S.A.S.S. 2001

Figure 48. Surface survey photo of 3-63-7. A1-21 Taken from NE corner toward the Southwest. A1-26 Taken from beyond the mid-point of West side toward East

3-63-8
Melur – Farm House

Location – UTM E 0565760, N 7282005 (Refer Grid B)
Latitude N 65° 39.09, Longitude W 19° 34.23
Taken at SW corner (B)

Description – Site consists of a group of small mounds and depressions at the edge of a steep slope down into a small canyon. North side of site is adjacent to down slope. The site situated on a rolling pasture that slopes gently toward the south away from the canyon edge.

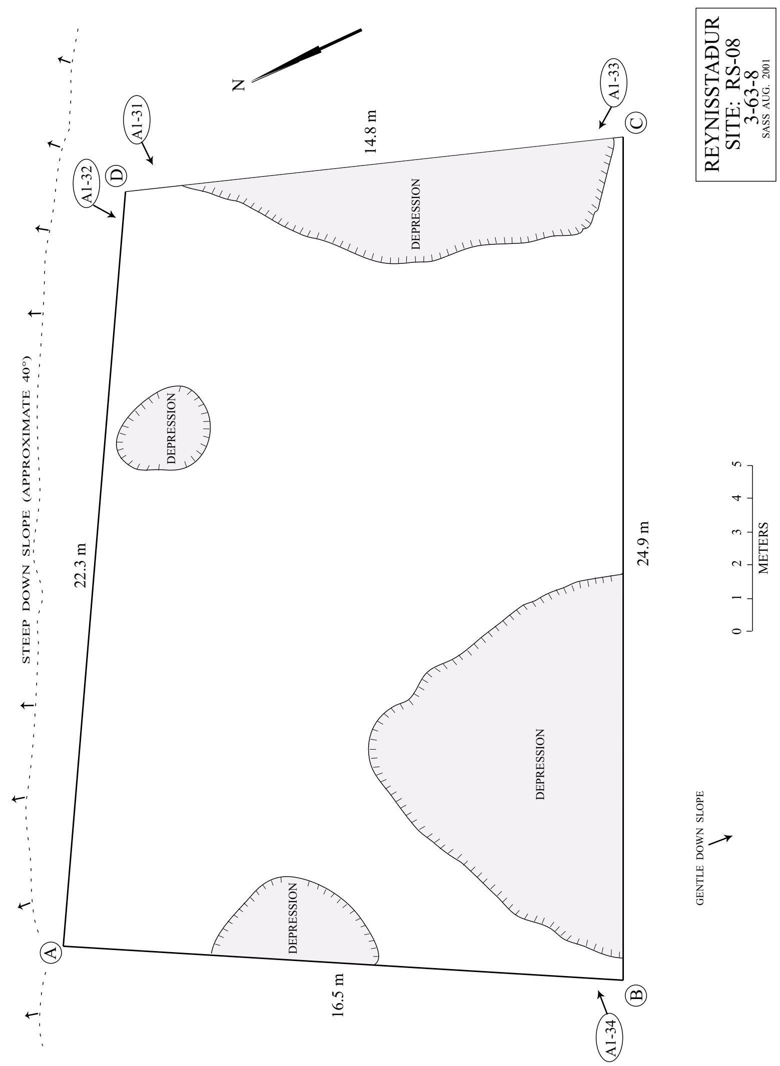


Figure 49. Surface survey plan of 3-63-8.

Site measurements – NW corner (A) to SW corner (B) 16.5 m, SW corner (B) to SE corner (C) 24.9 m, SE corner (C) to NE corner (D) 14.8 m, and NE corner (D) to NW corner (A) 22.3 m.

REYNISSTAÐUR
SITE: RS-08
3-63-8

West

A1-31

Southwest

A1-32

Figure 50. Surface survey photos of 3-63-8. 1-34 Taken from SW corner toward the NE. A1-32 Taken from NE corner toward the SE

REYENISSTAÐUR
SITE: RS-08
3-63-8

North Northwest

A1-33

North Northeast

A1-34

Figure 51. Surface photo of 3-63-8.A1-31 A1-33 Taken from SE corner toward the NW Taken from NE corner toward the South.

Ármuúl (RS 3-63)
AM-1 Grave/Hearth RS 3-63-01

Location – UTM E 0566341, N 7282010 (Refer Grid B)
Latitude N 65° 39.10, Longitude W 19° 33.46
Taken at SW corner (B)

Description – Site located in southeast corner of a corral, with the bare ground sloping downward gently toward the north. Distinguishing feature is the U-shaped arrangement of stones clearly visible on the surface, with the open end oriented in a southerly direction.
Test excavation revealed 1104 tephra mixed with stone coal.

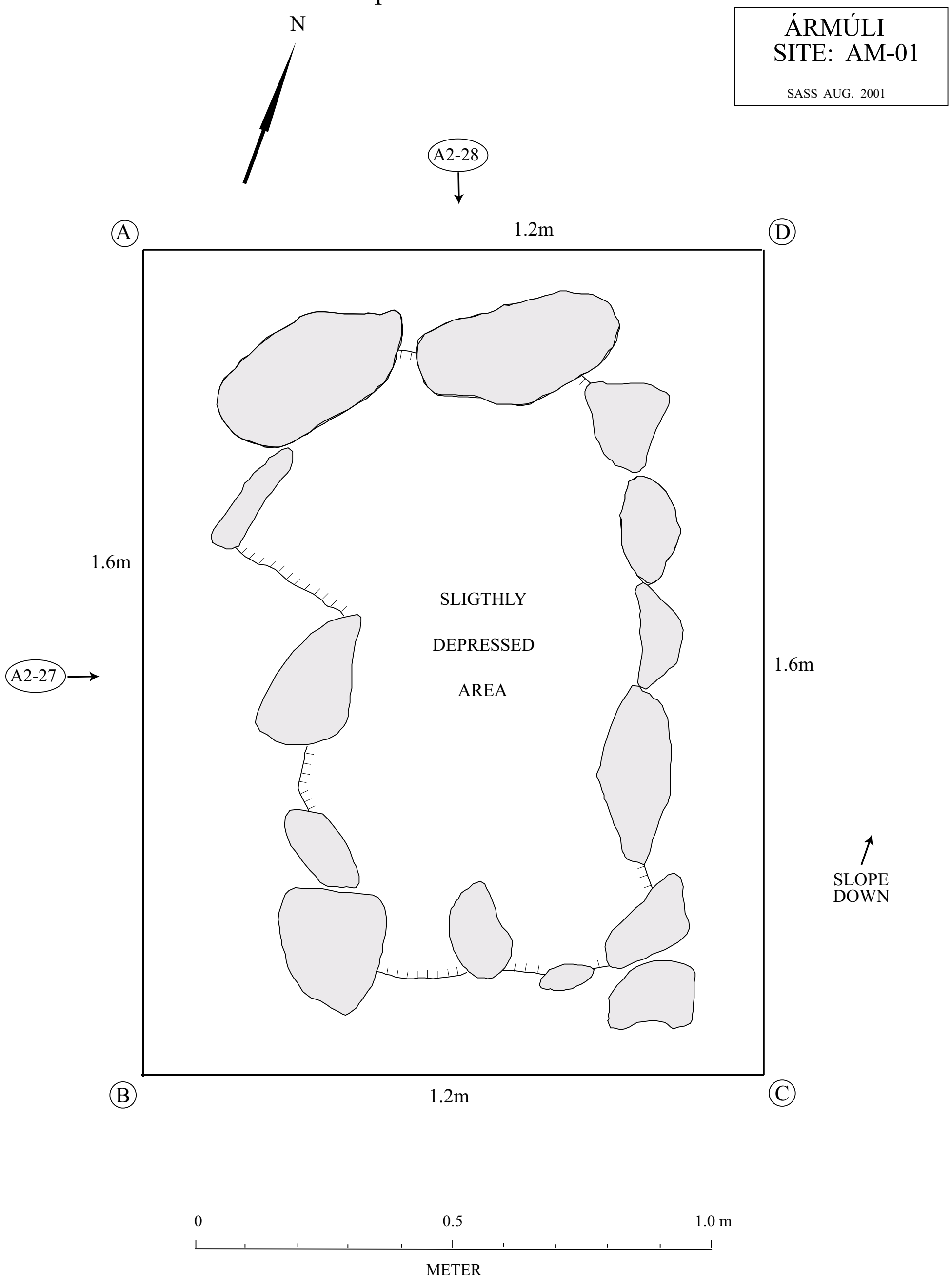


Figure 52

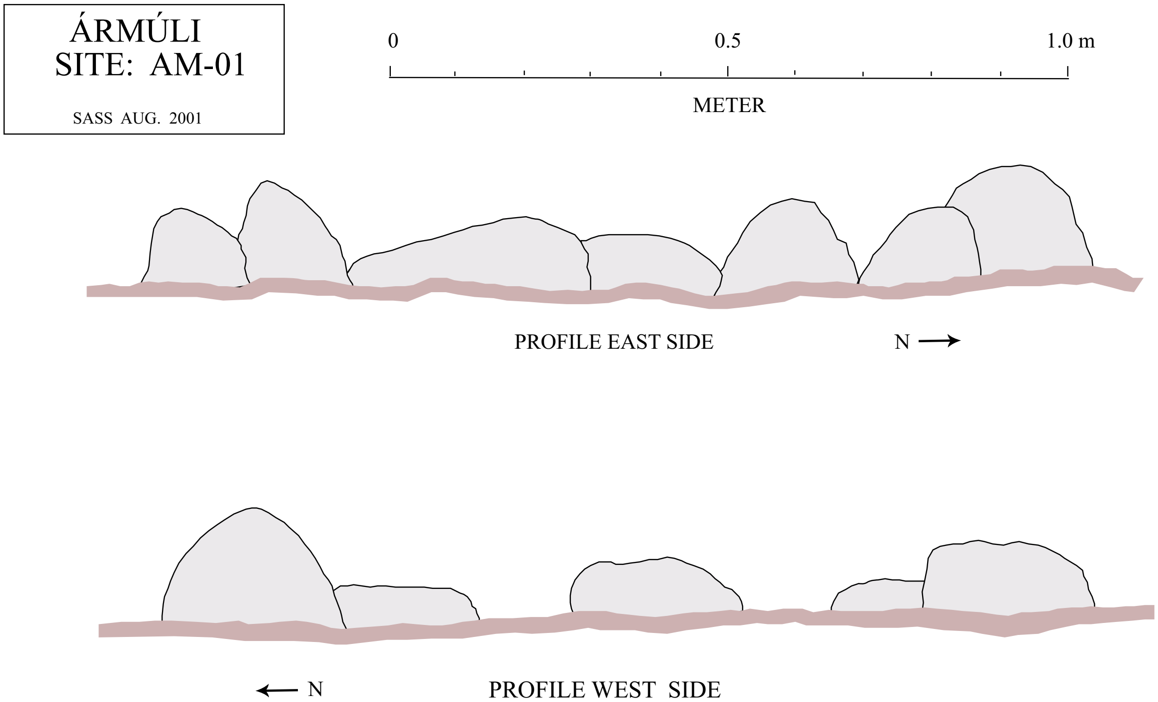


Figure 53

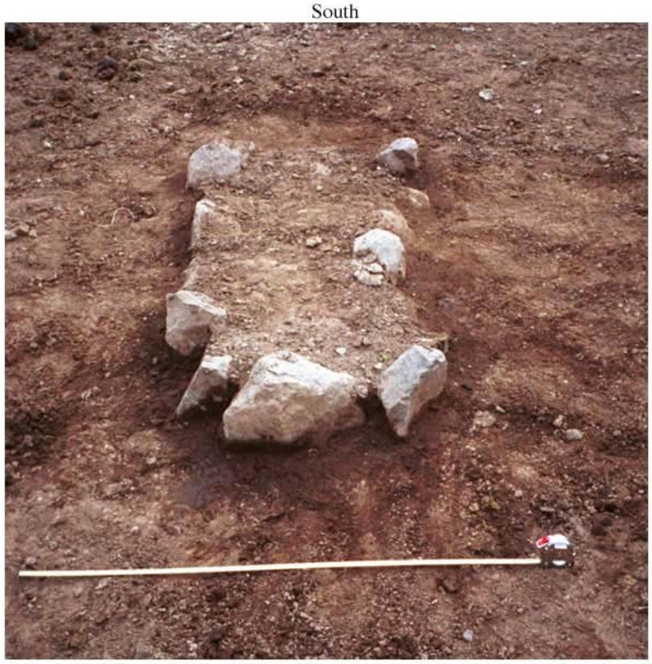
Site measurements – NW corner (A) to SW corner (B) 1.6m., SW corner (B) to SE corner (C) 1.2m., SE corner (C) to NE corner (D) 1.6m., and NE corner (D) to NW corner (A) 1.2m..

ÁRMÚLI
SITE: AM-01

East

A2-27

South



A2-28

Figure 54 Photo of Armuli,A2-27 Taken from center of west side toward the east. A2-28 Taken from center of north side toward the south

RS 3-63-102

Location – UTM E 0566150, N 7281953
Latitude N 65° 39.07, Longitude W 19° 33.73
Taken at SW corner (B)

Description – Site area generally level except for corner areas which are slightly raised; heavily overgrown with grass and weeds. Corner areas show extensive animal disturbance. No evidence of wall presence between corner areas.

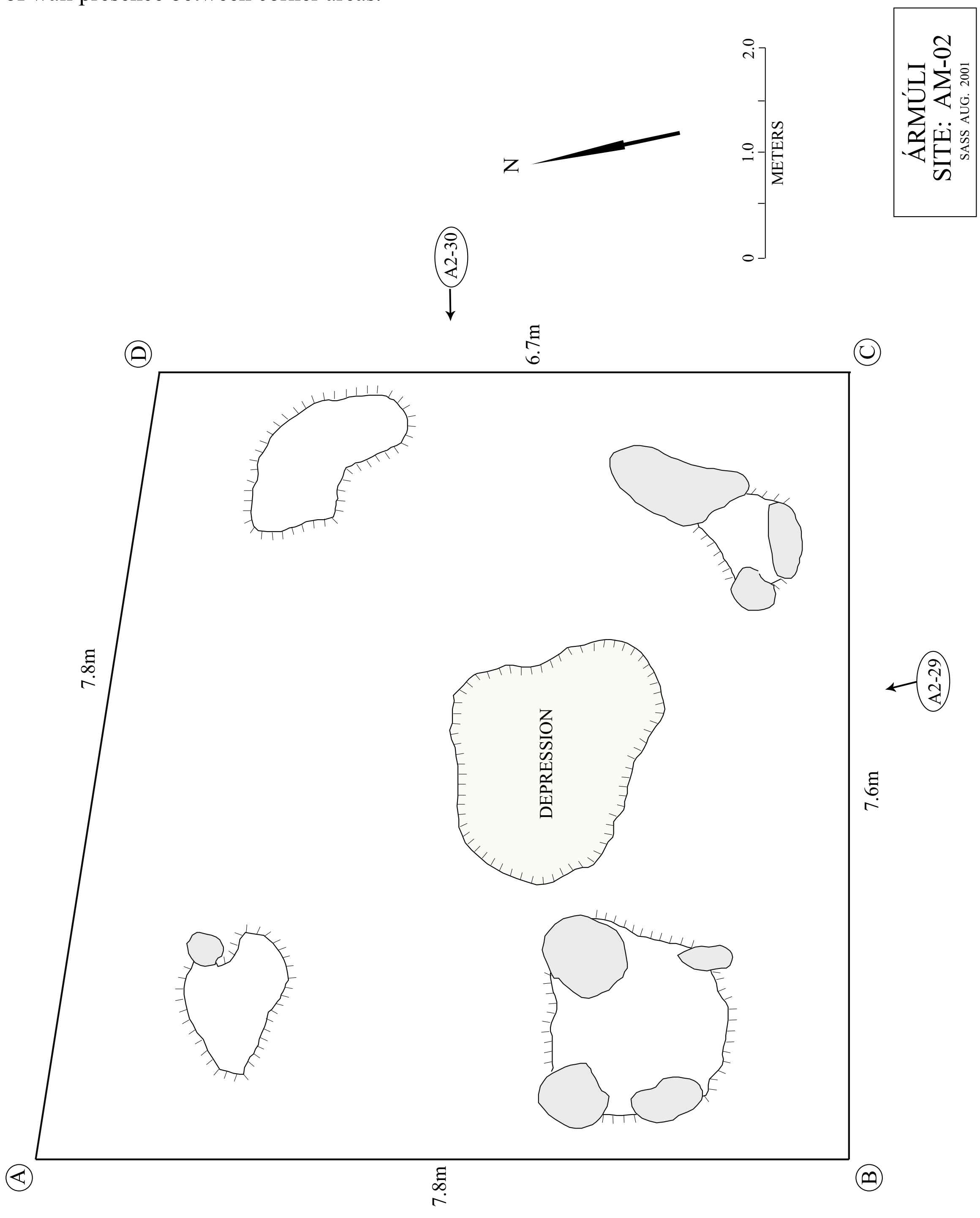


Figure 55. Plan of 3-63-102

Site measurements – NW corner(A) to SW corner (B) 7.8m., SW corner(B) to SE corner (C) 7.6m., SE corner (C) to NE corner (D) 6.7m., and NE corner (D) to NW corner (A) 7.8m..

Figure 56. Photos of AM 02 (3-63-102) A2-29 Center of southern side taken toward the north. A2-30 Center of eastern side taken toward the west.

Soil Science

Soils at Reynistaður show high levels of phosphate enrichment in the old homefield area based on preliminary qualitative tests (Figure 57). The imprecision of the qualitative test makes a stratigraphic reconstruction of variable soil enrichment impossible, however high values appear in all post-settlement horizons indicating that the area has been subject to intensive land-use since the initial occupation of the site. The highest values cluster around the identified older structures. High enrichment values extent for approximately 50-75 meters around these buildings, gradually decreasing to a level of modest enrichment in the rest of the field area. Further analysis is necessary to resolve the stratigraphic and spatial extent of these enriched deposits and their association with the architectural remains.

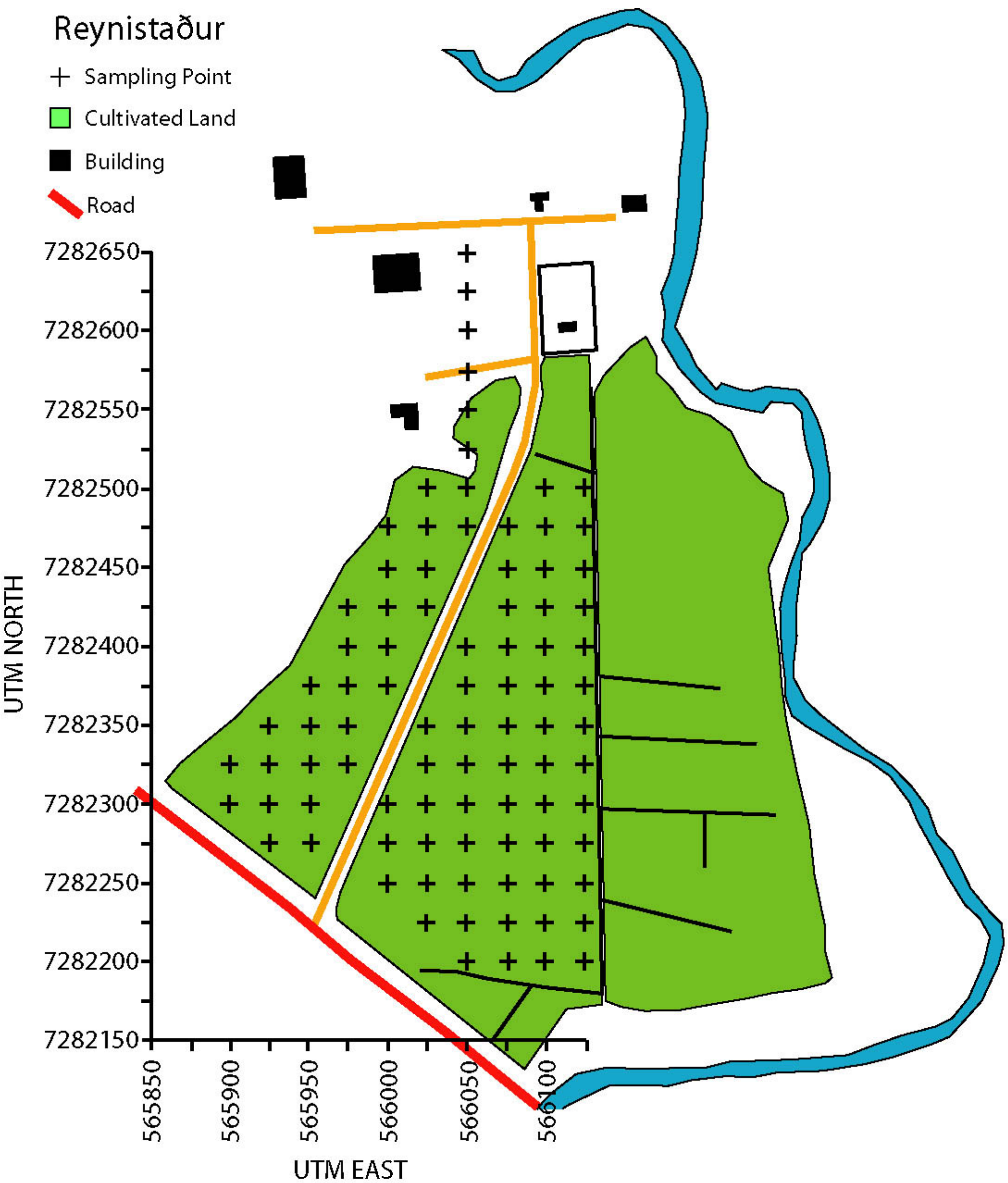


Figure 57. Reynisstaðir sampling area.

Trenches

Based primarily on the surface survey and partially on the remote sensing, 10 trenches were excavated by machine at Reynisstadur. Trenches 1,2, and 3 were excavated into 3-63-1. Most of the others were placed in anomalies that yielded relatively little. Trench 10 was placed in the center of a large hillock.

050,520 & 033,520 (Structure 3-63-1)

Trench 2, (050,520) cut into the steep outer wall of 3-63-1 indicated a substantial post H1 structure. This was confirmed by Trench 1 (033, 520) excavations, which show the same profile, only level. Both trenches were 5m long.

051,530 (Structure 3-63-1)

The relative simplicity of trenches 1 & 2 made the results of Trench 3 (051,530) surprising. Rather than the simple outer structure of a post H1 structure, Trench 3 reveled a complex and late (post 1766) deposit (Figure 59). It is unknown exactly what was bisected, but it would appear that we inadvertently excavated into a collapsed room deposit. Some iron slag was recovered as well as a series of animal bones. In the sidewall was a finely made comb (Figure 60).

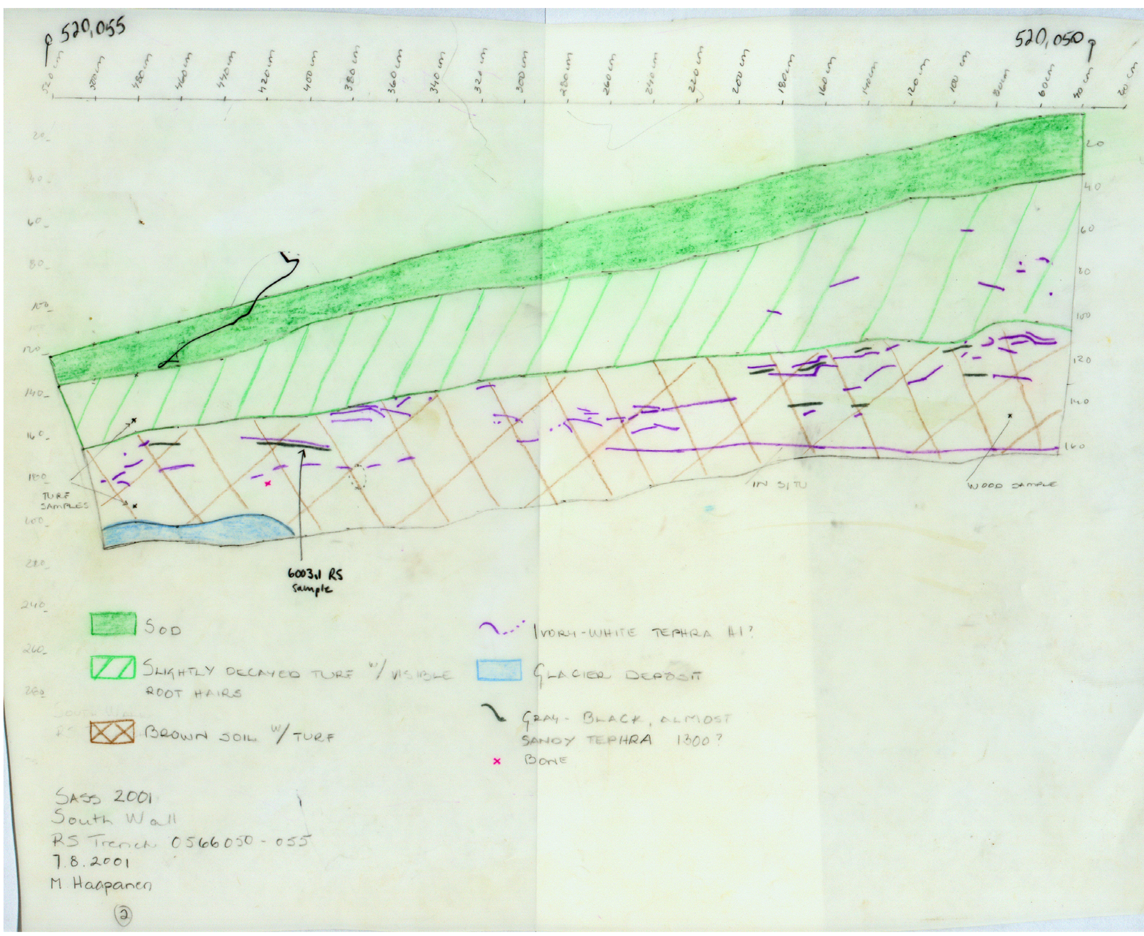


Figure 58. Profile of RS 050,520

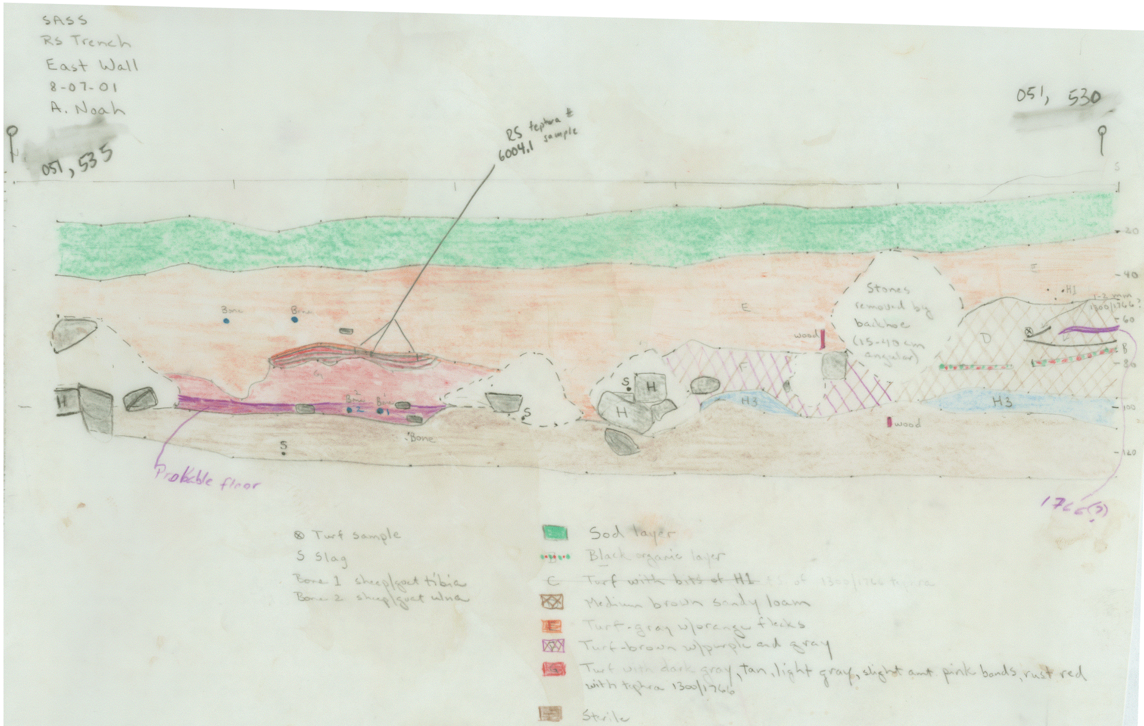


Figure 59. Profile of east wall of RS 051, 530.

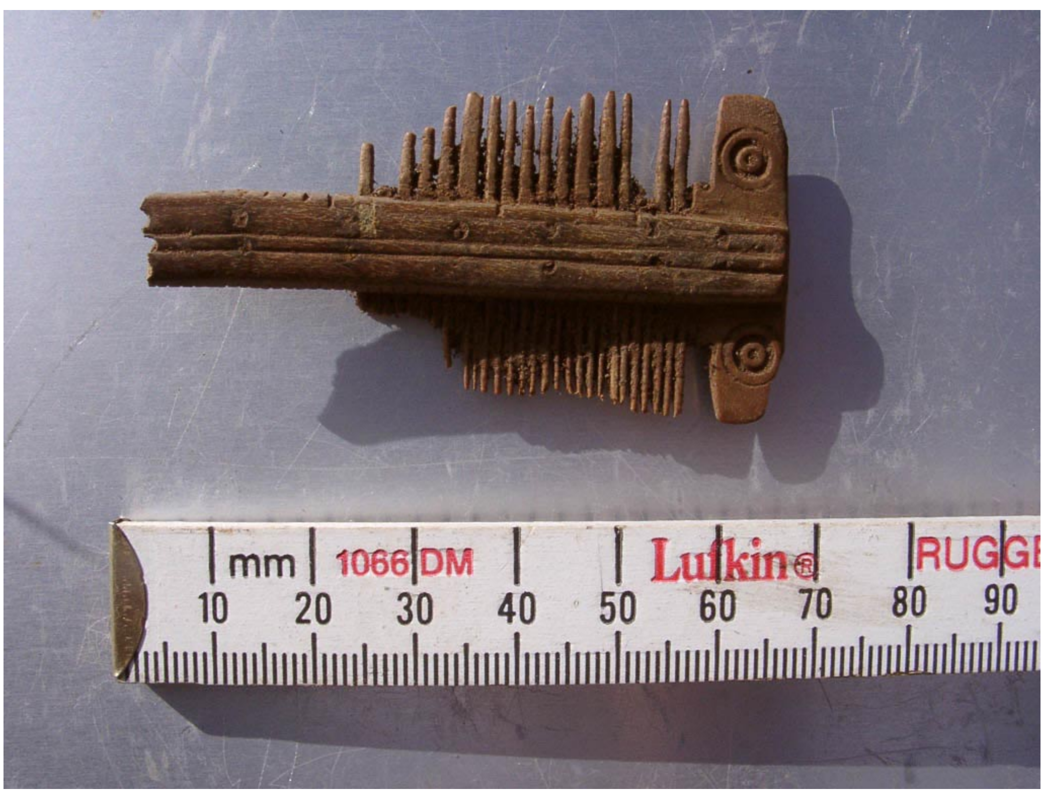


Figure 60. Comb found in sidewall of trench RS 051,530 at 532.7 about 1.03 m BGS.

052,375 & 064,360 (Structure 3-63-2)

Trench 6 (064,360) and Trench 7 (052,375) were excavated into the visible mound of the old sheep fold. The trenches were placed so as to intercept the areas of best preserved turf wall. The structure seems to have been build on level ground, although the cultural deposits now slope slightly downward toward the center of the visible mound. Although there are ephemeral traces of possible early activity, the majority of the mound seems to have been constructed well after H1, with turfs that contain that tephra. There seems to be relatively little soil above the fallen turfs.

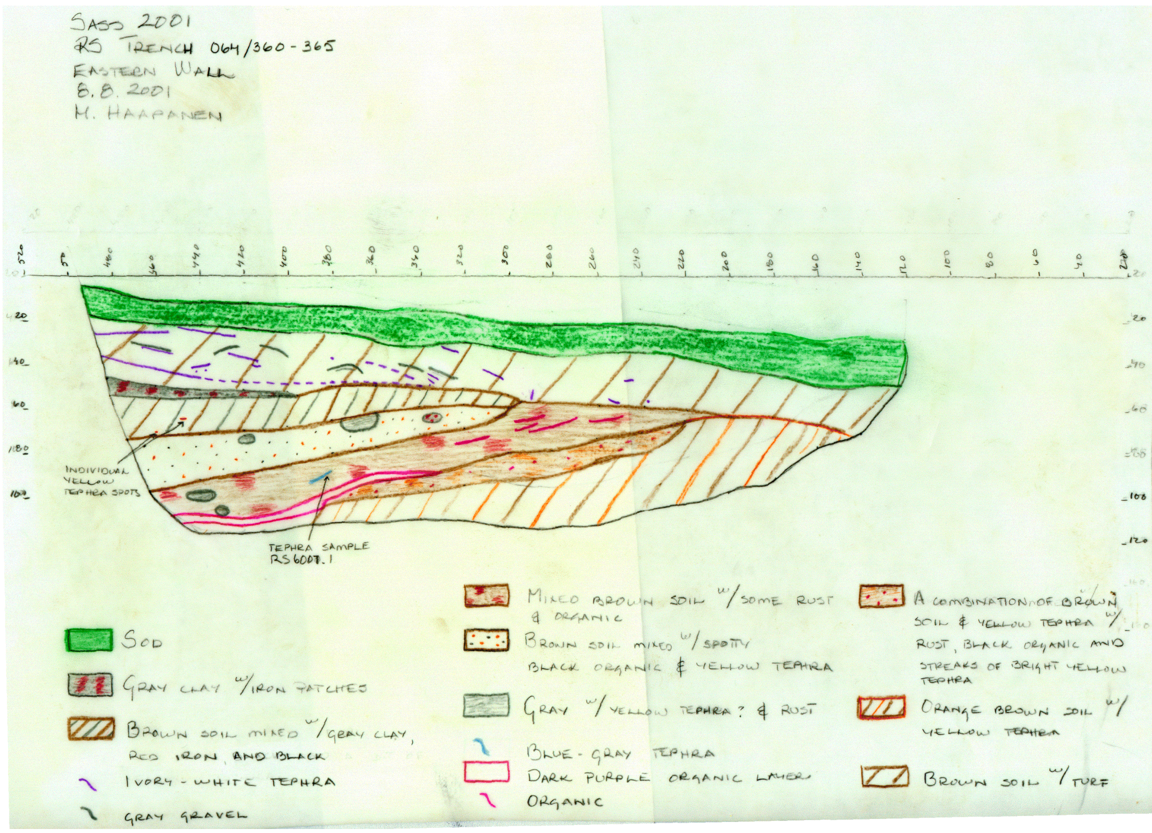


Figure 61. Profile of the east wall of RS 064,360.

010,225 (Structure 3-63-9)

This large hillock was not cataloged during the surface survey. The hillock seems to be artificial and seems to have been occupied relatively early, and then reoccupied. Sometime later. Because both the powerline and cable/telephone line cut the mound, to the southwest, there was no indication of this mound having any unusual properties. As part of the work of the Auger team, a routine hole was placed in the mound to assess the soil sequence. The depth of the cultural deposit was reviled in that auger bore hole. A 5 m trench (0.6 m wide) was then machined into the structure from 015,220 to 020,225. The trench was then extended by hand to 010,220. The trench was extended to access the depositional sequence and confirm in situ tephra layers.

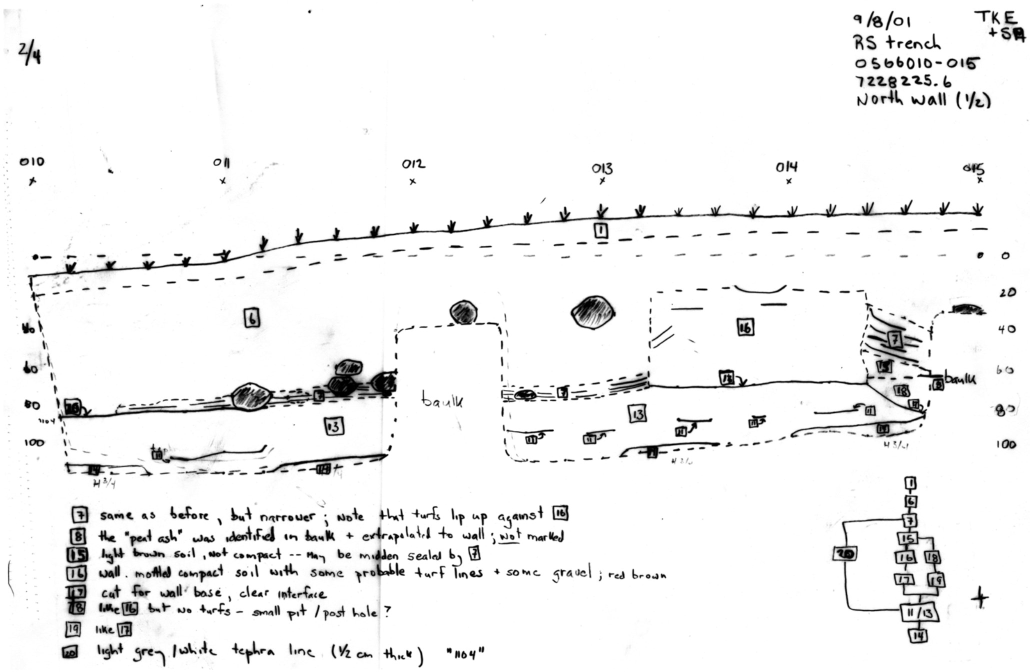


Figure 62. Eastern half of north wall profile of 10,225.

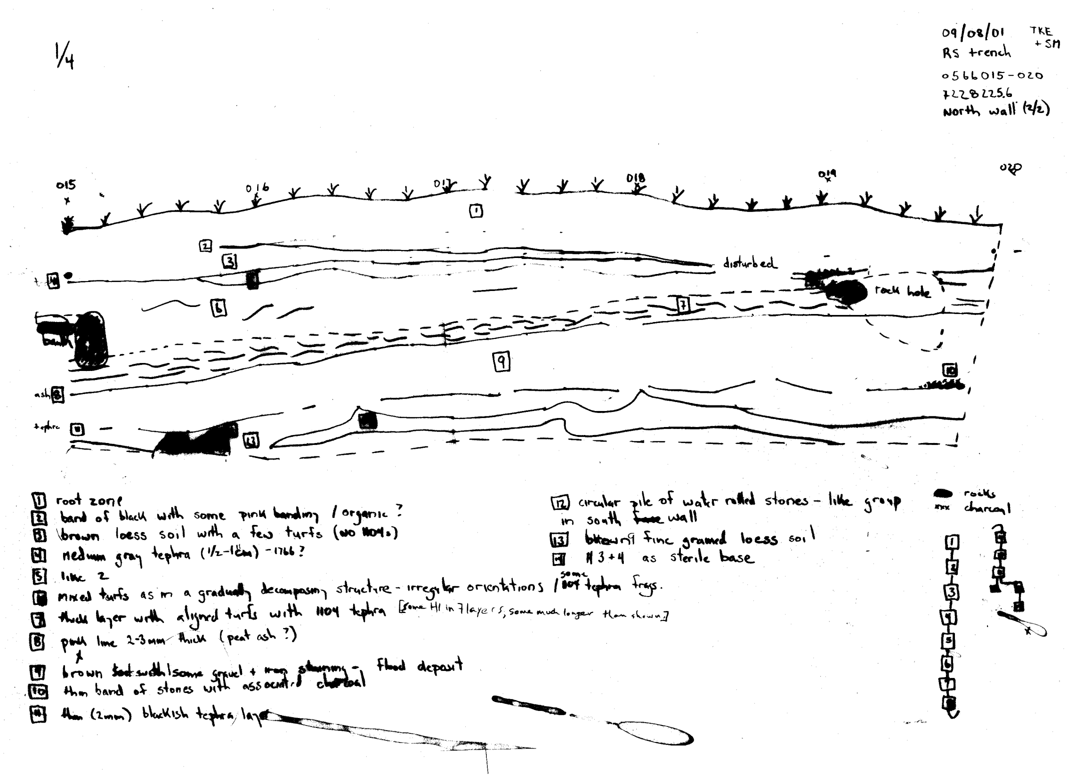


Figure 63. Western half of north wall profile of 010, 225.

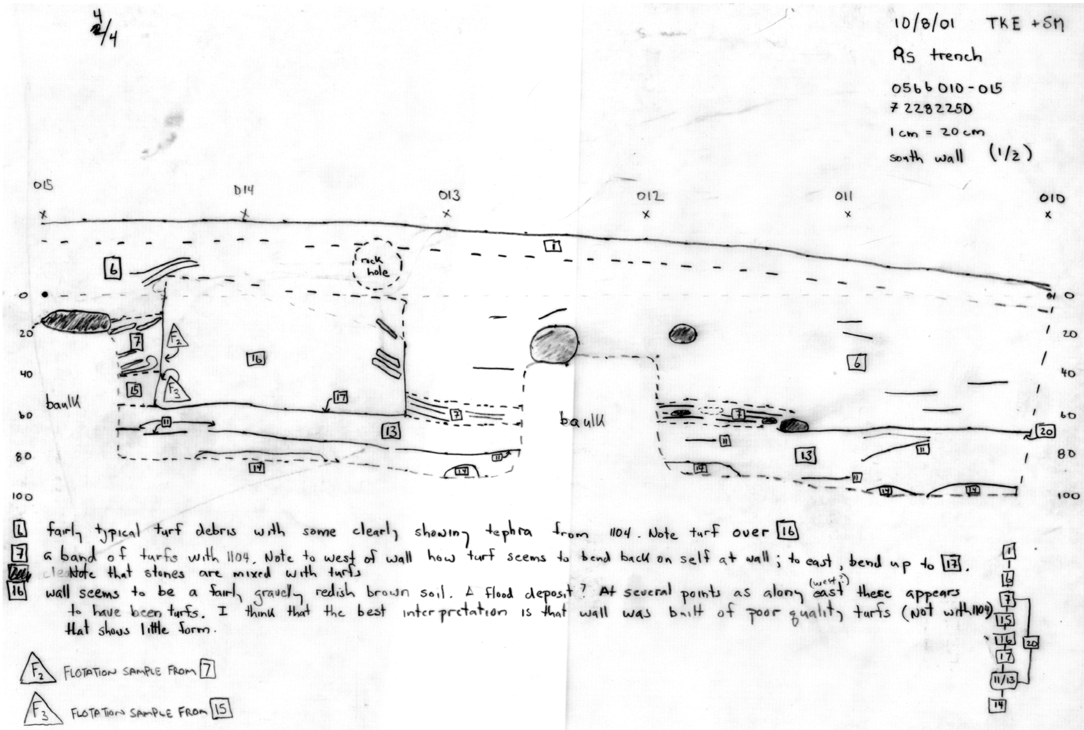


Figure 64. Western half of south wall profile of 010, 225

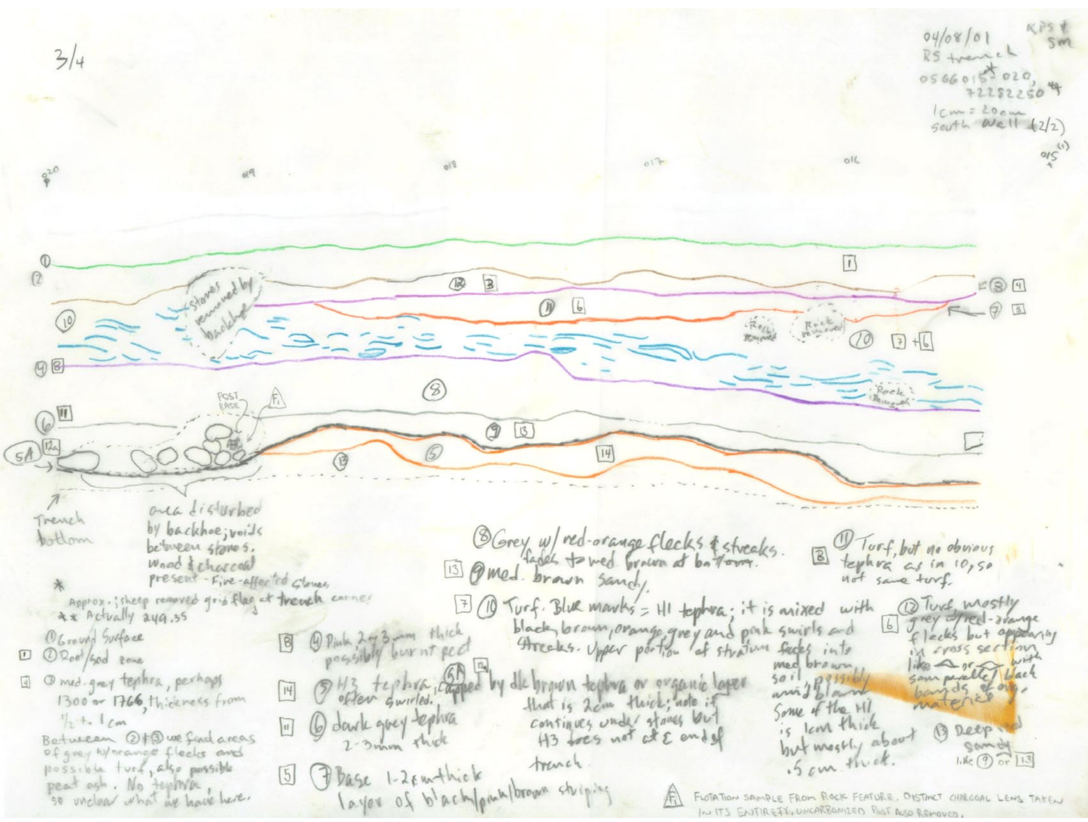


Figure 65. Eastern half of south wall profile of 010, 225

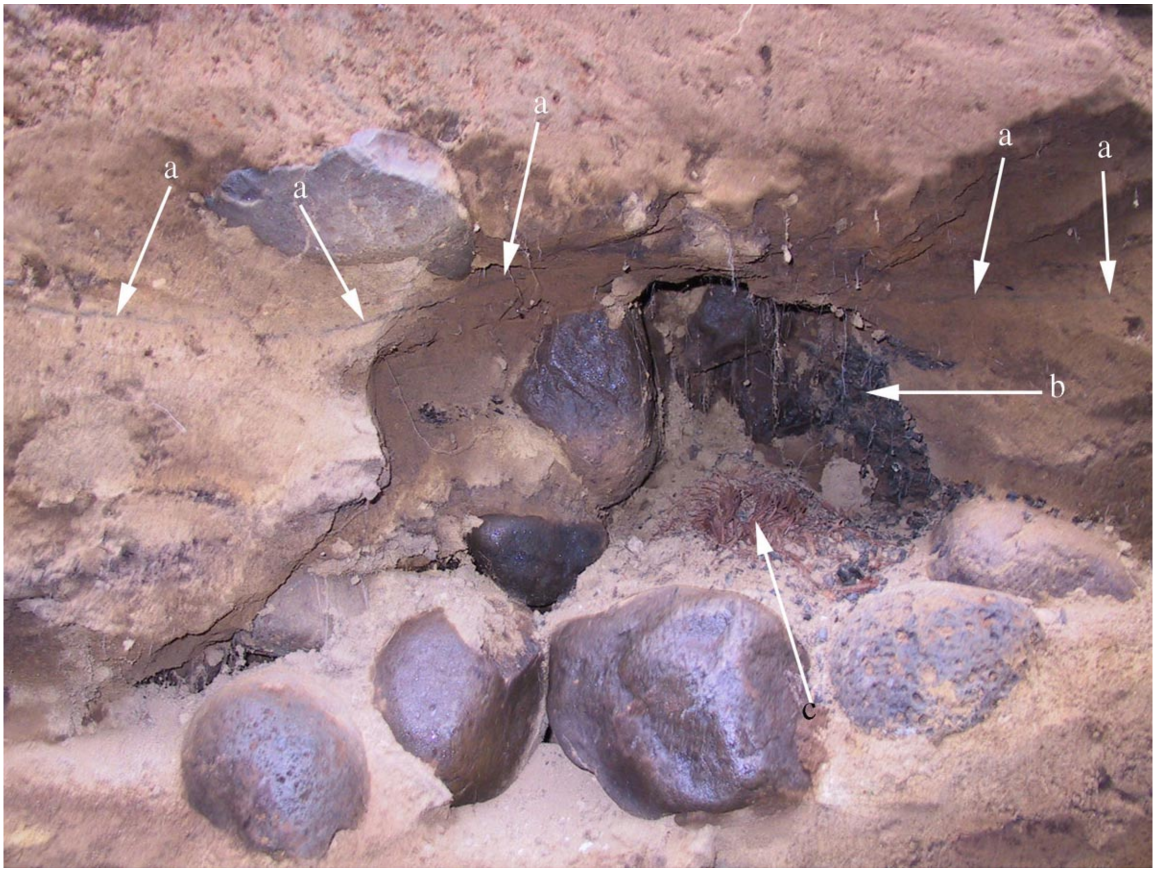


Figure 66. Hearth and pine post at 1.0 m BGS in south wall of 010,225,
(a: gray blue tephra layer, b: charcoal concentration, c: uncarbonized pine post)

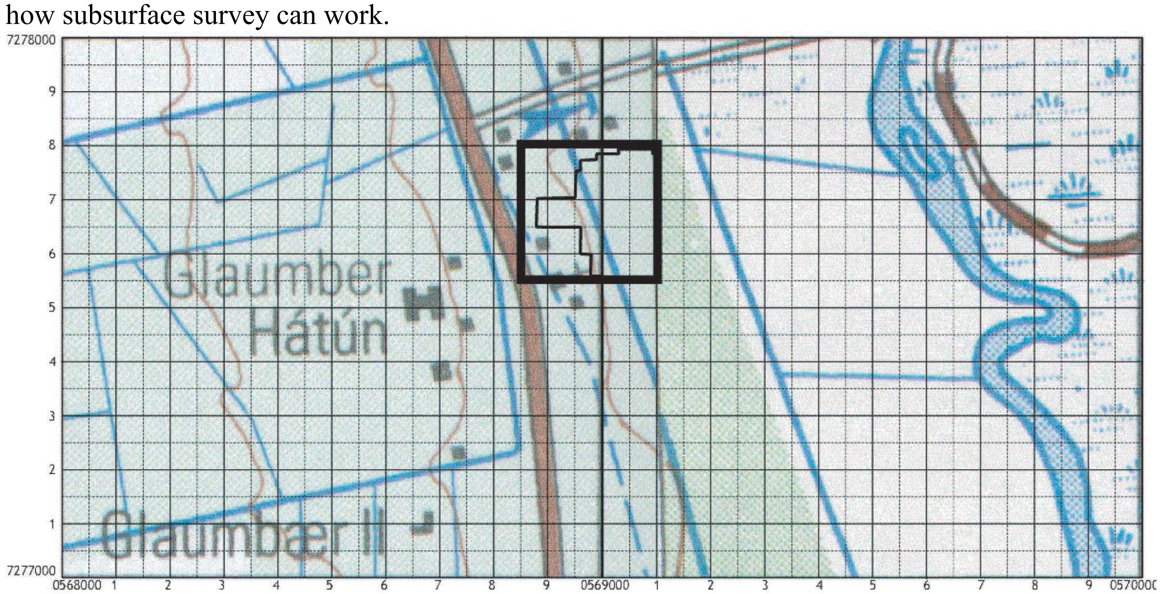
Figure 67. Outline of post impression and underlying foundation stones.

The earliest occupation is underneath an in-situ thin blue gray tephra layer that is either from 1000 or 1300. The evidence of this is found on the south wall where a small hearth with charred birch (submitted for AMS dating) with a fragmented pine post that seemed to rest on a series of stones was uncovered. This was uncovered 1.0 m below the surface at 019,250. The charcoal from the hearth has been floated. There is no other evidence of this early occupation.

After some period of abandonment, the site was reoccupied. There is a distinct possibility that an in situ H1 layer underlies this reoccupation. If that turns out to be the case, then the heath is pre 1000. If the layer is part of a large flat turf, then the hearth is probably pre-1300. Soon after the turfs with H1 or the layer itself is deposited, an earthen wall was constructed at 014. It is clear that turfs with H1 overlie this earth wall construction. These turfs with H1 must be part of a substantial structure, which accounts for most of the volume of the mound. On top of turfs with H1 is an in situ 1766 layer. Above this layer is evidence of a minor farm building.

Glaumbær 4-111

The UTM grid at Glaumbær was first set out on Aug 10 at which time surveying was begun with the EM-31. Glaumbær was the last site the team worked at and it is one of the best examples of how subsurface survey can work.



Kilometers 0588,7277 & 0589,7277 with areas surveyed outlined. Note that the church is not correctly identified. The powerline is shifted to the east of its actual location.

Surface Survey

Other than the well catalogued turf house museum, surface remains at Glaumbær are slight, usually consisting of a few shallow ridges (no more than 10-15 cm high) in a pattern that is difficult to interpret. In the 1950's much of the file was bulldozed to flatten it. More recently, the western half of the surveyed area was plowed.

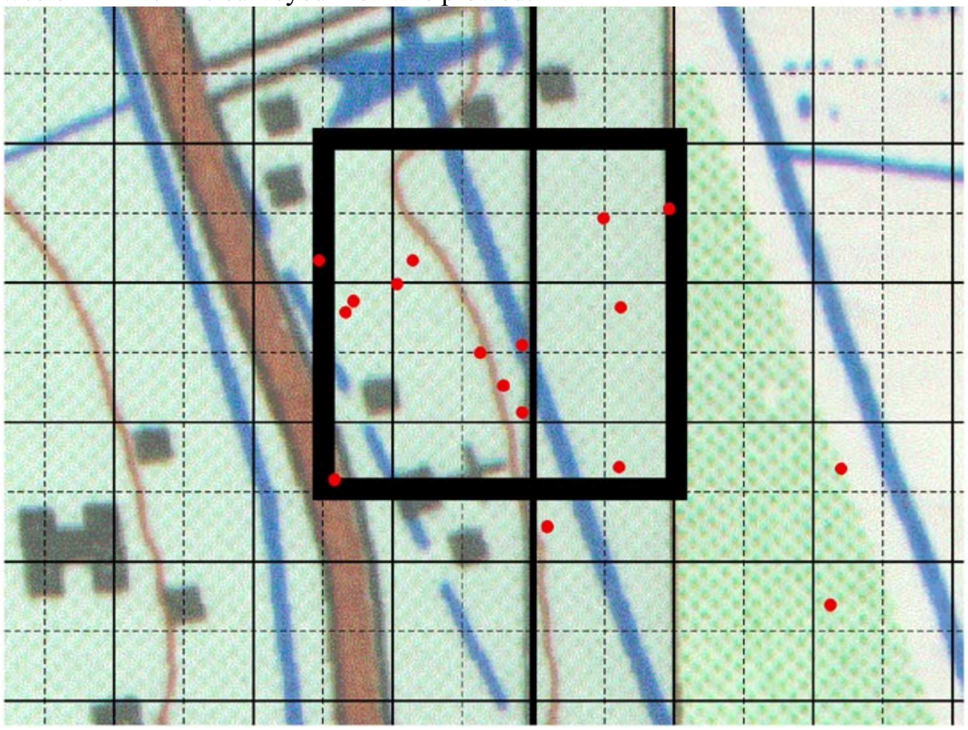


Figure 68. Map of Glaumbær showing identified surface features in red.

Remote Sensing: EM-31

Initially a single block from 9000,7550 to 9100,7700. The grid was later expanded to include the present map (Figure 69) of 17,844 readings. Over the survey there was light precipitation. The conductivity map shows a series of high areas, most notably in the west, northeast and south central. The majority of the central area is medium to low conductivity. The Western section of high conductivity seems to generally correspond to a substantial charcoal deposit, possibly a midden, and graves that may extend outside the current church wall. This area is displayed as one of substantial conductivity change in Figure 70. The areas in the northwest and south central correspond to areas high in silt, with substantial historic soil deposition. Neither of these areas are apparent on the conductivity contrast map (Figure 70).

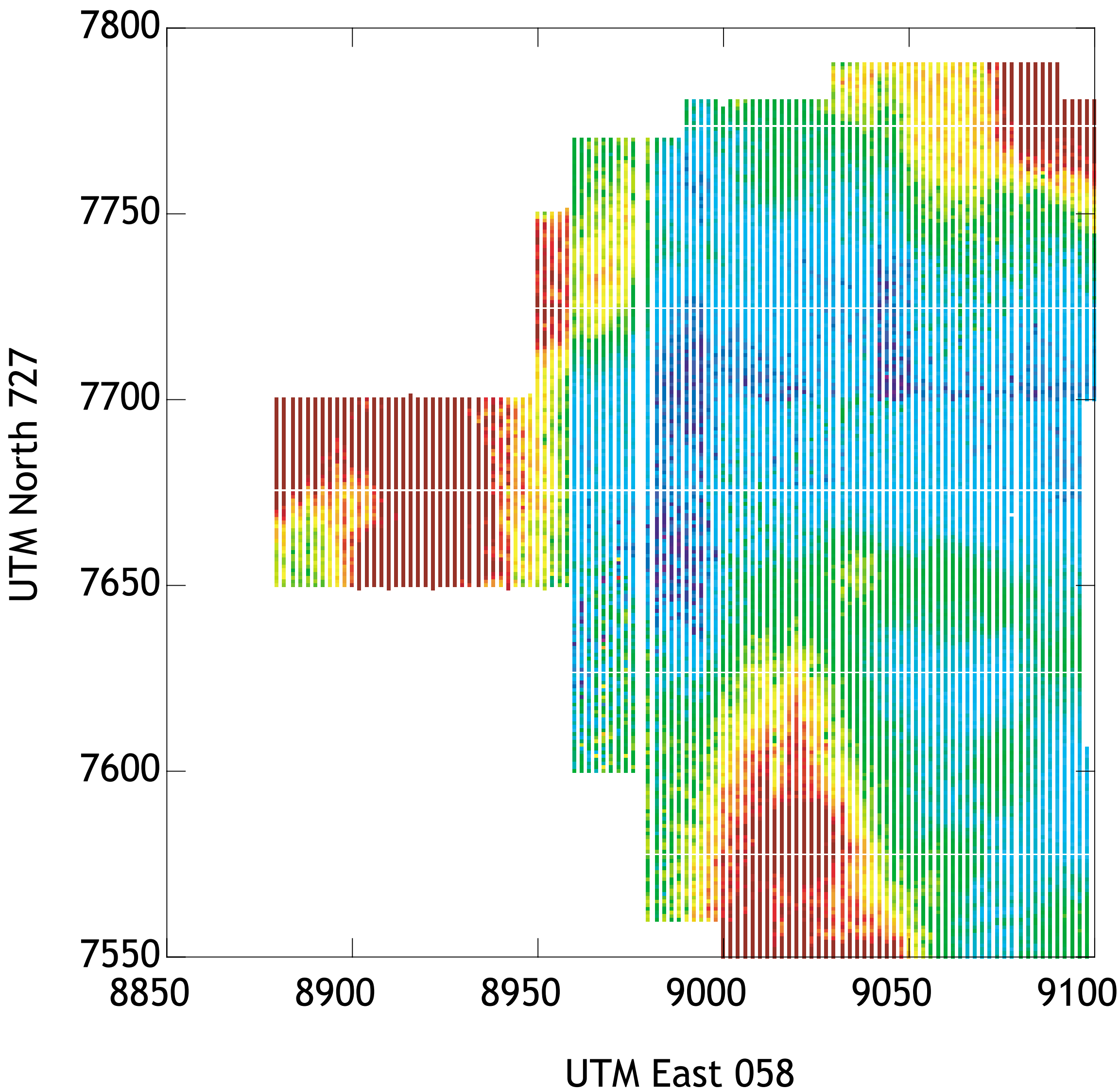


Figure 69. Conductivity map of Glaumbær.

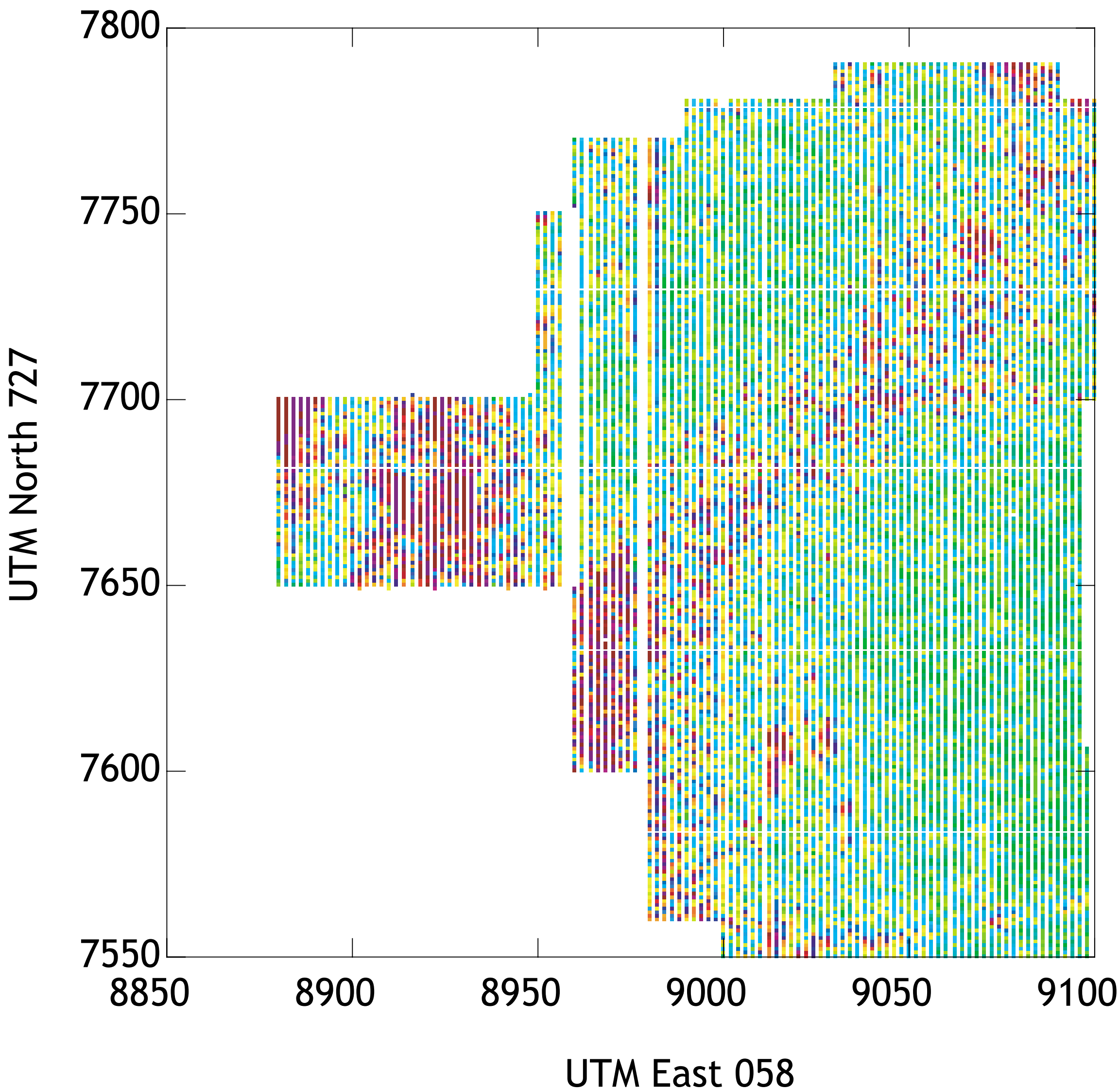


Figure 70. Map of maximum conductivity contrast at Glaumbær.

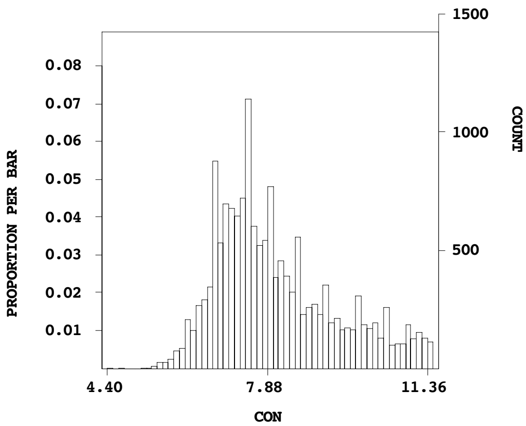


Figure 71. Histograms of conductivity (left) and conductivity contrast (right) from EM-31 readings at Reynisstaður. The scales of the histograms correspond to the violet –red scales in Figure 69 and Figure 70 respectively.

Auger

A series of anomalies was investigated with test trenches, cores and the power auger. These small excavations yielded a broad overview of the size and location of a substantial peat ash midden. Many of the auger holes also reveled preserved walls and wall fall. Based on these readings, a series of Syscal Kid profiles were put in.

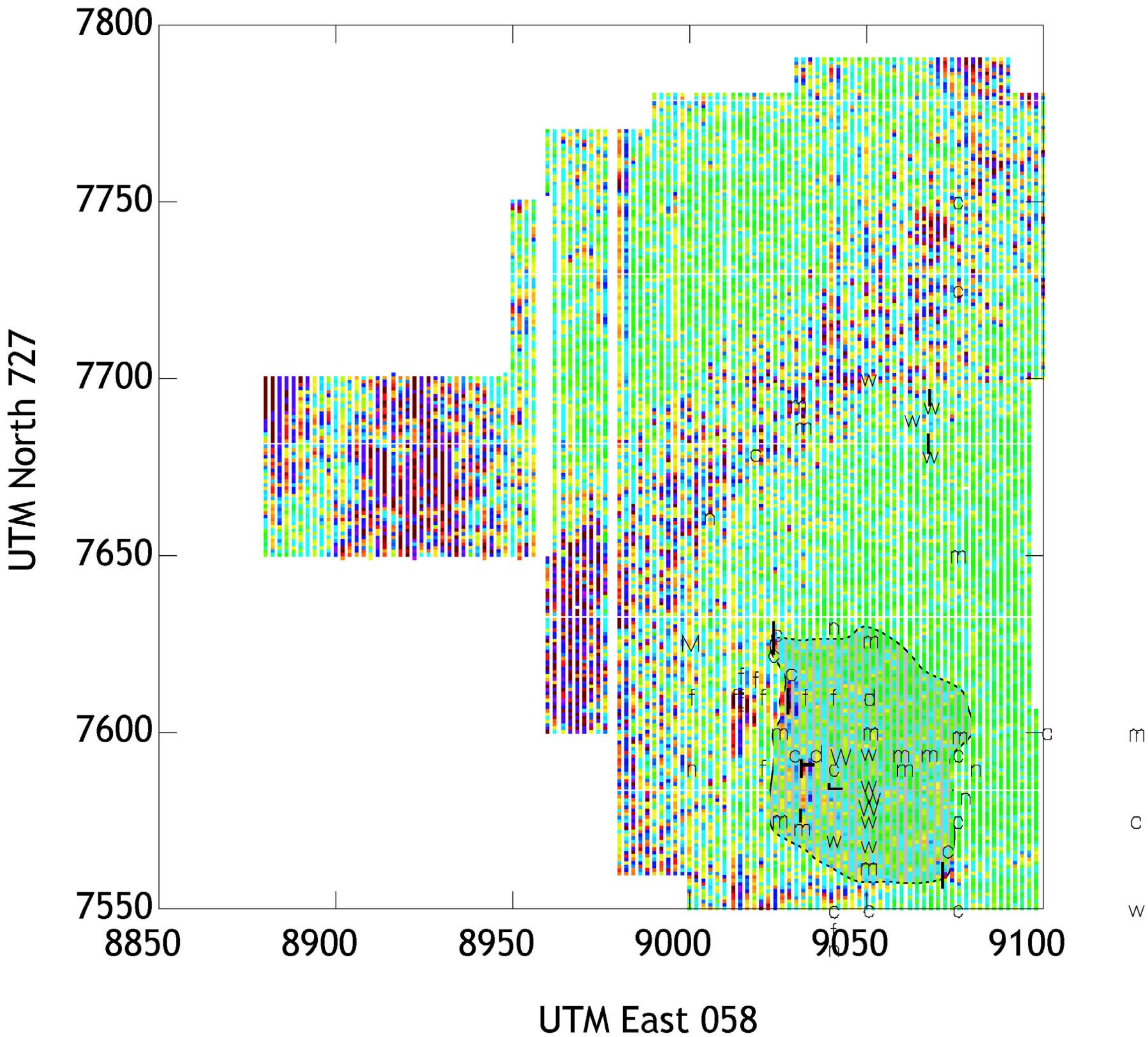


Figure 72. Auger and Core data superimposed on conductivity contrast.
Area of peat ash midden is outlined in gray. Core designations: n=nothing, m=midden, c=charcoal, w= wall W=well preserved wall, f=flooded deposit, d=ditch. Test trenches are shown in black.

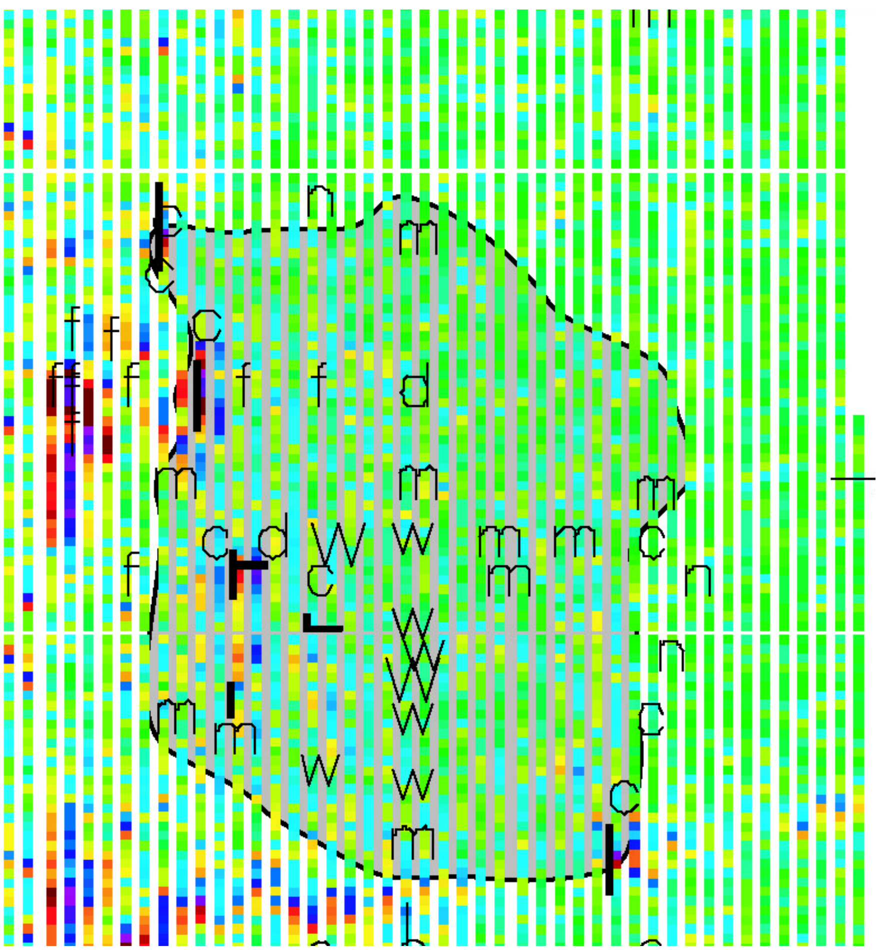


Figure 73. Detail of Figure 72.

Remote Sensing: Syscal Kit

The EM-31 readings consistently identified the midden/sterile interface in the western side of the well preserved walls identified with the auger. The machine did not identify the walls themselves however. Using the pseudo-profiles from the Syscal Kid, the midden wall interface is easily identified, the midden being low resistivity (blue), and the walls higher resistivity (red). This data, combined with the test trenches allows an stimulation of general outline of the structure.

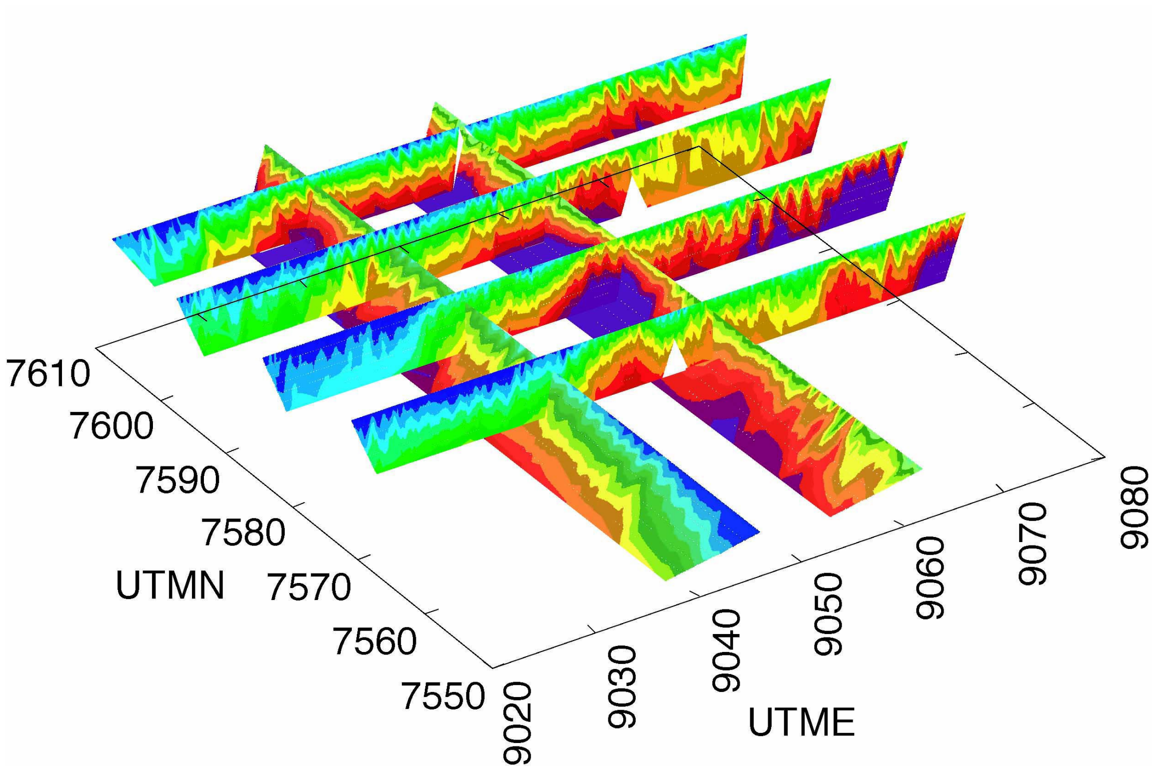


Figure 74. Fence diagram of Syscal kid pseudo-profiles from Glaumbær.

Test trenches

9067, 7692 & 9067,7678 (Structure 4-111-10)

Trenches 9067, 7692 and 9067,7678 were dug into the extramural deposits of two structures. Trench 9067,7678 reveled a relatively simple post 1300 structure and cultural layer. The more complicated trench, 9067, 7692 reveled two structures separated by an in situ 1300 layer. The bottom structure is constructed of turfs that contain H1.

9031,7586, & 9039,7584 ("T" trench in extramural deposit of Structure 4-111-20)

In the "T" trench a substantial peat ash midden was revealed, decreasing in thickness with increases in distance from the identified structure, but staying a fairly constant depth of 40 cm BGS. The interface that created the strong EM-31 anomaly, just in the middle of the "T" is complex. It appears that this location is where the high conductivity south central triangle begins. This high conductivity readings appears to be from a relatively shallow siltey deposit above H1, which has increasing thickness when moving away from the identified structure. This silty deposit is unusual at Glaumbær but quite common at Reynisstaður (Carter forthcoming). It would appear that the trench is contemporaneous with the silty deposit. The anomaly seems to have be created by the combination of the trench, and the interface between the cultural deposit and the silty deposit.

9040,7584 (Structure 4-111-20)

The location of the trench (E 9040.0/N 7585.8) was based on an anomaly identified in the initial EM-31 remote sensing survey at Glaumbær. An auger hole, followed by a small exploratory excavation trench revealed a well-preserved turf wall capped by in situ H. 1104 tephra. After consultation with the Museum at Glaumbær and the local National Museum representative, it was decided that the trench should be extended to determine whether the turf wall was associated with a preserved domestic structure. Additional resistivity profiles, auger and coring holes were placed to in an attempt to further define the location and extent of the buried structure associated with the wall. Based on these results, a hand-excavated trench (E 9044.3/E 7584.5) was extended approximately 4 meters to the east.

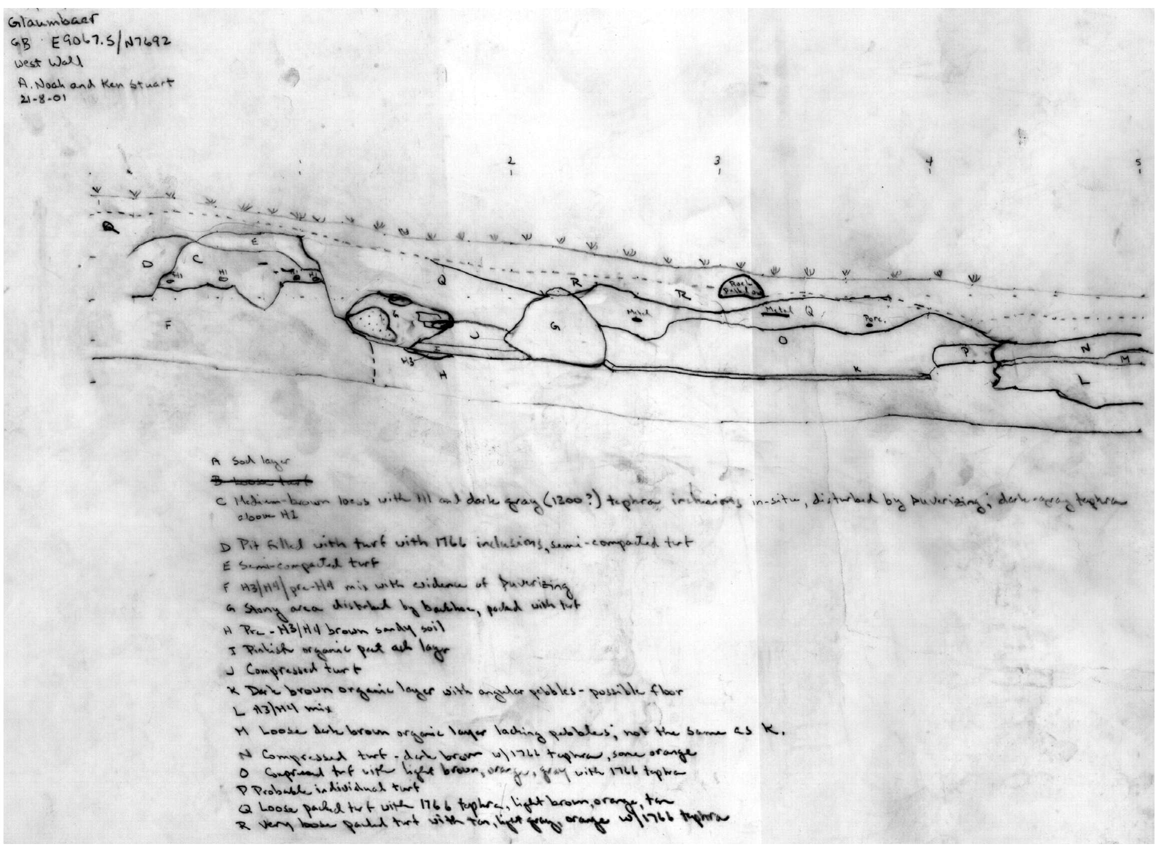


Figure 75. Profile of trench 9067, 7692

Figure 76. Photo of trench (right) and excavated material from trench with overlapping H1 deposits from 9031,7586. From the trench cuts into the lower pink peat ash midden.

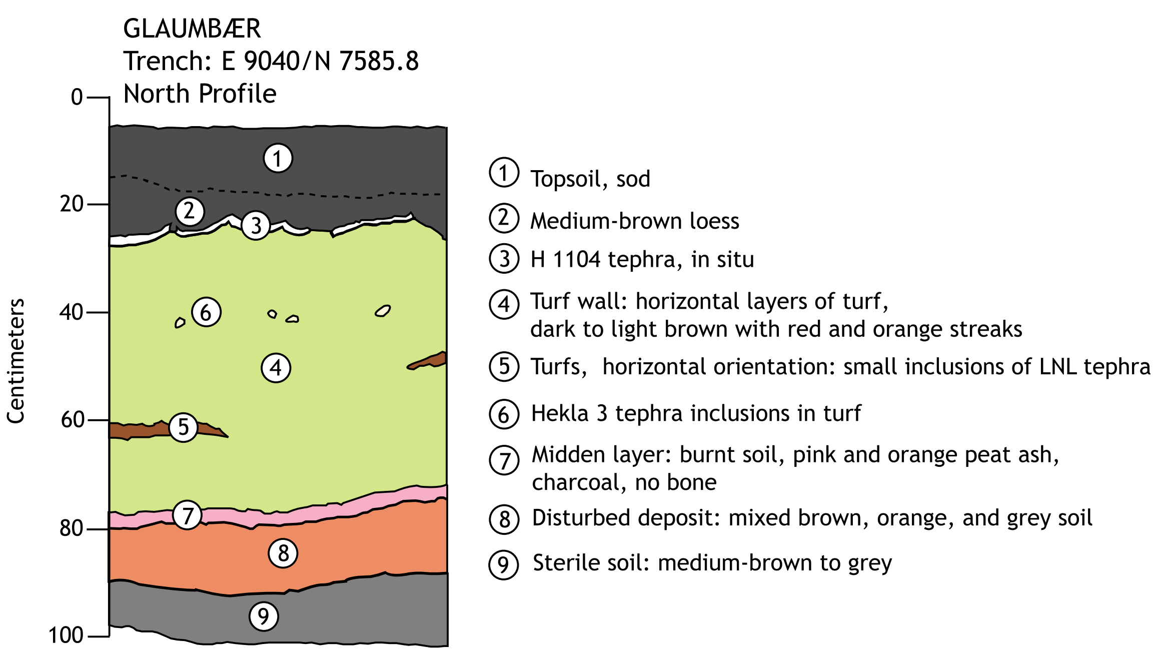


Figure 77. Profile of north wall of 9040,7585.

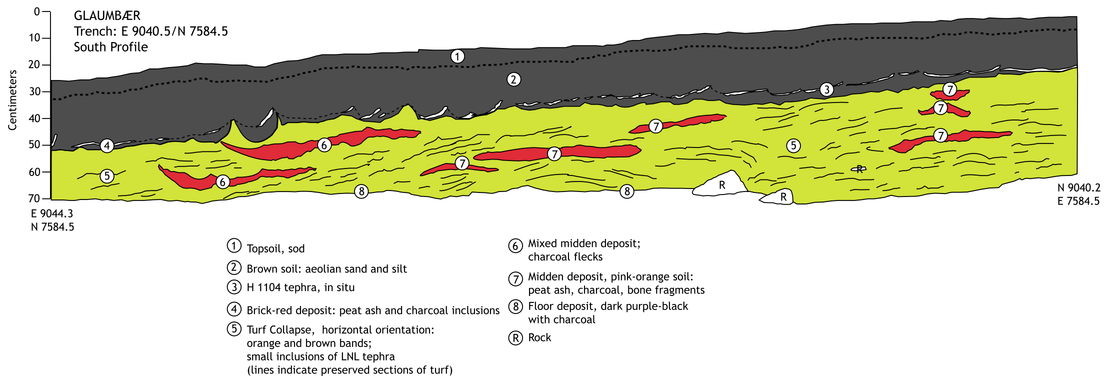


Figure 78. Profile of south wall of 9040,7584.

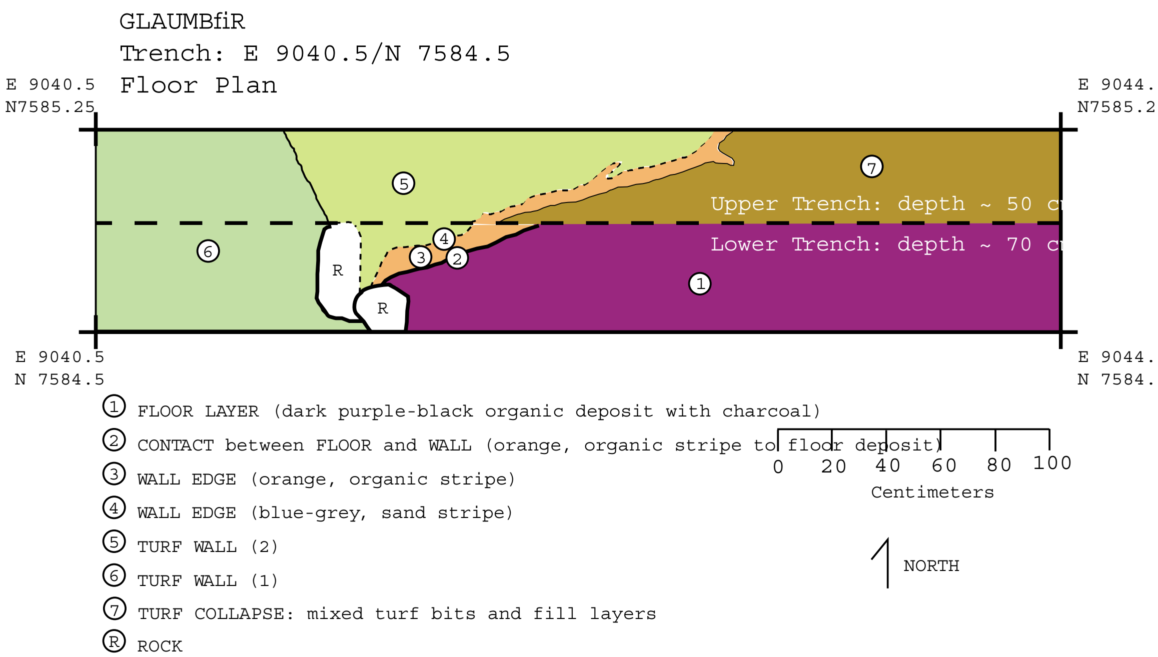


Figure 79. Plan of 9040,7584.

Figure 80 View of 9040,7584.from the west, looking east.

Excavation revealed well-preserved, in situ H. 1104 tephra capping the deposit. The tephra was broken further to the east in regular diagonal patterns, apparently where it fell on the uneven surface of building collapse. Immediately below the H. 1104 tephra was a layer of bright red, fire-altered soil with remnants of peat ash and charcoal. Underneath the tephra and peat ash were multiple layers of turf collapse and midden fill. An additional turf wall was identified running roughly NNE and intersecting with the original turf wall at approximately right angles. Beneath the turf collapse was a preserved domestic floor layer that was left unexcavated.

A medium brown-gray sterile soil underlies the anthropogenic layers (9). This layer blends to a disturbed layer of mixed brown, orange, and gray soil (8). It is difficult to determine if this disturbance is human induced or natural. Capping the disturbed soil but beneath the preserved wall is a layer of pink peat ash midden (7). This layer predates the construction of the building and is presumably associated with earlier domestic activity at the site. The section of building exposed in the trench may be a later extension or the midden may be associated with earlier occupation located in some unidentified part of the site. Resting immediately on the midden layer is a thick, well-preserved turf wall consisting of horizontal layers of brown, orange, and red degraded turf (4), with LNL tephra (5) and Hekla 3 tephra (6) inclusions in sections of turf. The preserved section of wall is over a meter wide and is preserved to a height of nearly 50 centimeters. The wall cannot be dated precisely. It was built sometime after the deposition of LNL and abandoned prior to the 1104 eruption of Hekla. The close stratigraphic relationship between the remains of the wall and the H. 1104 tephra suggests and 11th c. date. The entire wall is capped by in situ H1 tephra that fell after the building was collapsed and had been abandoned (3). There is no evidence for continued occupation or activity in the thin layer of soil preserved above the wall and H. 1104 layer (1; 2).

Excavation in the trench was ceased when the domestic floor layer was exposed (Plan, 1; Profile 8). It is uncertain if this floor represents the earliest activity in the area or if there are multiple floor layers associated with the part of the structure. The floor layer is made of semi-compacted purple-black soil with organic material and charcoal inclusions. It is continuous throughout the exposed area. It is closely bordered by two walls and does not appear to have been an area of intensive traffic or domestic activity, such as an entrance, aisle, or hearth area. Two turf walls (Plan 5 and 6) intersect in a near right angle and have stones associated with the foundation in the corner. There appears to have been little stone used in the wall construction and it is largely absent in the collapse layers next to the preserved wall. Wall 2 is preserved to approximately 50 centimeters (Plan 6). Wall 1 is more shallow with only approximately 20 centimeters well preserve (Plan 5). There is a distinct contact between the wall and the floor deposit (Plan 2, 3, and 4). The lower portion of the structure – walls and floor – is well preserved.

At some point this portion of the building was allowed was abandoned and allowed to fall into disrepair. There is a sequence of turf collapse and midden fill layers mixed in the interior of the building (Profile 5, 6, and 7). Layers of collapse rest immediately on the floor layer and suggest that it had little or no secondary use before the building began to collapse. Inter-mixed with the collapsed turf are lenses of pink ash and charcoal midden that appear to represent individual dumping episodes concurrent with the collapse of the building. It is difficult to estimate the period of time that the collapsing structure was used to dump trash. The small deposits suggest sporadic use. The entire collapsed deposit is capped by a brick-red layer of burnt soil, ash and charcoal (Profile 4). This appears to be distinct from the previous dumping episodes and took place on, as opposed to in, the collapsed structure. Apparently the area was being used in some manner after this section of the structure had been entirely abandoned. The burnt layer is immediately covered by a nearly continuous layer of H. 1104 tephra (Profile 3). The tephra is preserved in a flat layer over the remains of the collapsed walls but becomes broken and angled in regular patterns following the lines of the collapsed interior of the structure. There is no evidence of dumping or intensive land-use associated with the structure after 1104 AD, although the thin deposit (Profile 1 and 2) may represent deflation of later soil layers.

Soil Science

The old homefield at Glaumbær had the best-preserved soil stratigraphy and tephra sequence of the farms investigated during the 2001 field season and the site has been subject to more extensive quanitative testing. Soil cores produced well-preserved soil horizons and datable tephra layers in homefields areas. At Glaumbær, both soil phosphate and texture show dramatic changes in soil composition over short distances with the highest phosphate levels associated with good loams indicating well preserved soil horizons and the intensification of natural soils for agriculture. Enriched soils vary considerably in phosphate content but large-scale sampling clearly demarcates areas of medieval homefield enrichment from surrounding areas, which have similar values to sterile soils. Homefield areas and boundaries were determined based on evidence for soil enrichment compared with base-line phosphate levels determined from off-site samples (<0.30 P mg/L) (Figure 81). Agricultural horizons systematically vary in phosphate values indicating when soil enrichment began and change in the intensity of enrichment over time. Pre-occupation horizons show no evidence of enrichment. Following occupation, chemical enrichment becomes apparent in the soils hitting a peak of investment during the early medieval (c. 1104-1300 AD). After 1300 AD, enrichment begins to decline although in later periods, it becomes more regular, perhaps reflecting the introduction of modern farming techniques, plowing, and systematic fertilization in the 20th century (Figure 82).

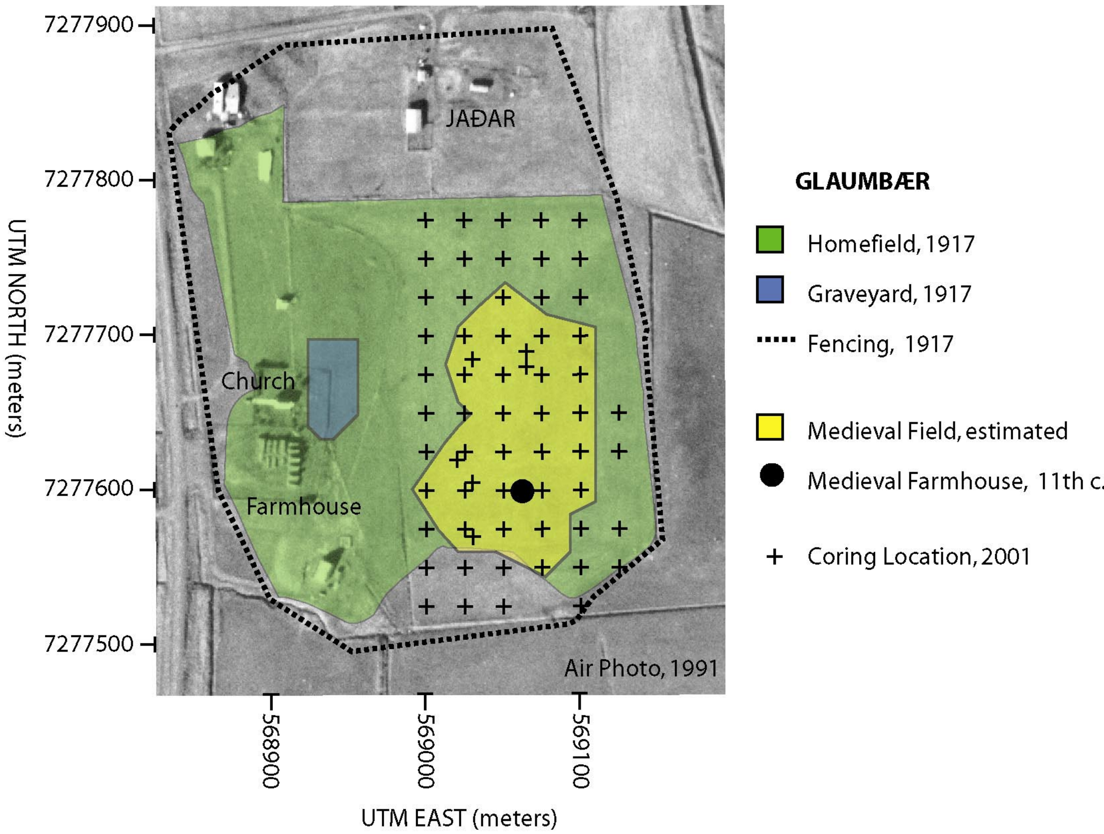


Figure 81. Preliminary Reconstruction of Medieval Homefield Boundaries

Medieval Field Boundaries	Mehlich P Mean (mg/L)	Mehlich P SD (mg/L)
Homefield (area of intensification)	0.84	0.58
Outfield (area without intensification)	0.26	0.06

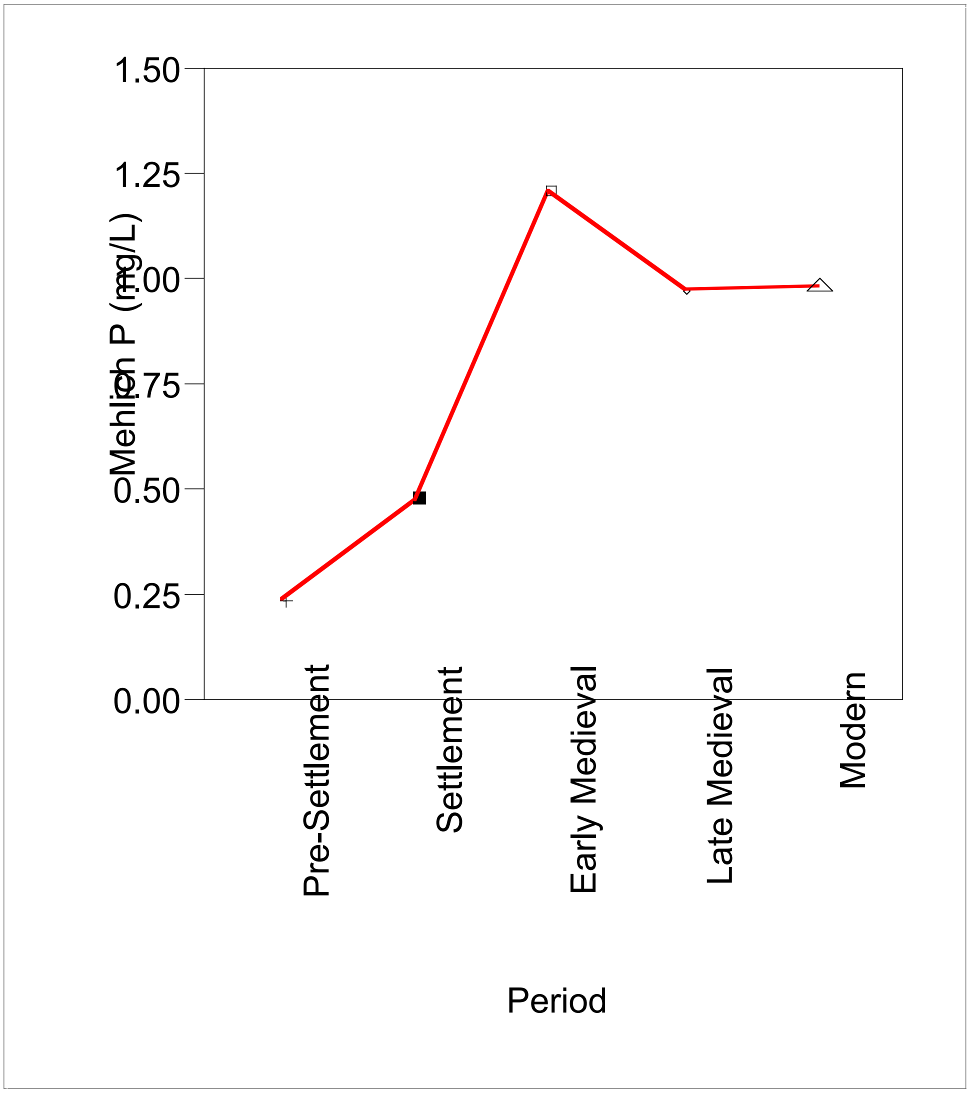


Figure 82. Preliminary Reconstruction of Diachronic Change in Homefield Enrichment

Period	Mehlich P Mean (mg/L)	Mehlich P SD (mg/L)
Modern (c. 1766 AD – present)	0.98	0.54
Late medieval (c. 1300-1766 AD)	0.97	0.68
Early medieval (c. 1104-1300 AD)	1.21	0.64
Settlement (870 – 1104 AD)	0.47	0.20
Pre-Settlement (<870 AD)	0.24	0.06

Interpretation of structure 4-111-20

By combining all the available date, we can begin to paint a picture of the sequence of events at the southern end of the surveyed field. It would appear that there is a thin but well preserved peat ash midden underlying the entire cultural sequence. We assume that this is associated with a structure, but as yet unidentified. It is possible that the resistive readings at 9075,7575 will be associated with that earlier structure. Sometime about the turn of the first millennium, a long house was constructed, possibly with an addition in the northwest. This structure is at least 27 m long and could be as long as 45 m, the southern is well defined, but the northern structure end is not yet certain. The structure seems to be 10-14 m wide from outer wall to outer wall. The structure seems to have been already abandoned by the time of H1, as it fell on turfs that had already fallen down. Soon after H1, the area immediately to the west of the structure seems to have received 5-30 cm of additional silty soil (not found in other areas of the field). Contemporaneously with this silty deposit, a ditch was dug, probably from the silty deposit, through the northern part of the structure. One would suppose that this ditch was used to drain the water that deposited the silty layer. There are at least two explanations for this sequence. The structure could have been abandoned, and the farm moved up hill to its present location, because of the flooding Héarðsvötn. Another sequence, that explains the limited silt deposit, is that the lower area was flooded on purpose, and drained on purpose to grow wetland plants such as gulstör. The midden, surrounding the old house, would have been spread around the area to increase fertility. The ditch, running north northeast would have assessed in draining the field for harvest. It is hoped that the planned excavations in 2002 will help us understand this site better.

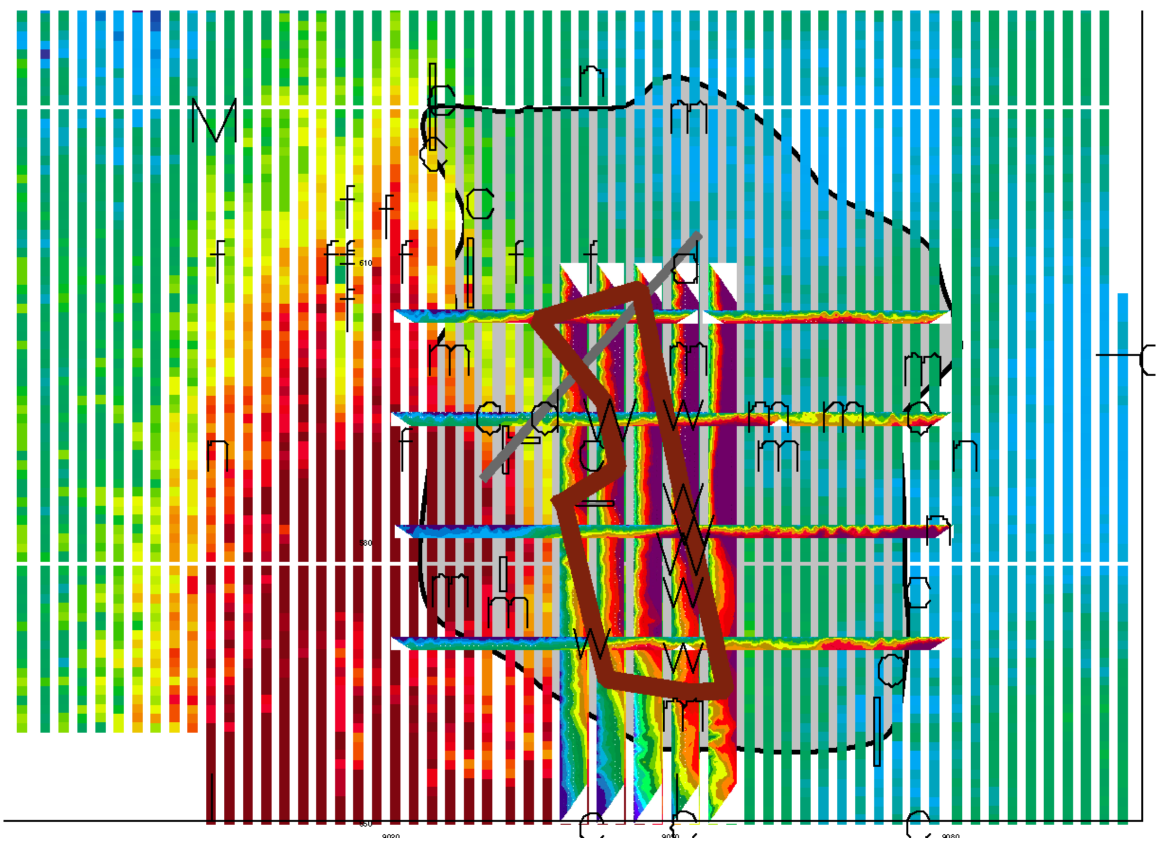


Figure 83. Glaumbær conductivity, Syscal Kid, auger, core, and trench data superimposed, with approximate outline of midden and structure

Artifact Catalogue