The application of shallow geophysics towards complete settlement patterns of Viking Age Iceland

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Introduction

Accurate settlement surveys are key for assessing, understanding, and explaining socio-economic changes that are played out on a landscape over time. Over the last 9 years the Skagafjordur Archaeological Settlement Survey (SASS) has developed a series of protocols involving coring, electromagnetic conductivity survey, resistivity, GPR, and test excavations to make an accurate assessment of the first few hundred years of Viking Age settlement in Northern Iceland. Because of the substantial and early land erosion and corresponding sediment deposition in Iceland, many of the first sites are completely buried. The lack of plowing and the scarcity of artifacts make these early sites almost impossible to identify using traditional survey methods. By employing shallow geophysics and coring, we have identified important sites that are not visible on the surface or in air photos.

Program

In an area of central Skagafjörður called Langholt we surveyed 23 modern farms. Over 9 years, starting in 2001 we cored at all of these. We put 1x1 test pits in all 14 of the visible farm mounds. We did geophysical investigations at 11 of the farms. Six farmstead middens were excavated with larger excavations (3x3m or greater) and we intensively excavated at 5 farms. This program yielded 6 significant sites in the region that were unknown and not visible on the surface. Two of these discovered sites were large (over 4,000 m^2) and relatively early in the settlement sequence. The program yielded a dynamic settlement pattern for 27 farmsteads during the Viking Age (between 870 & 1300 AD).

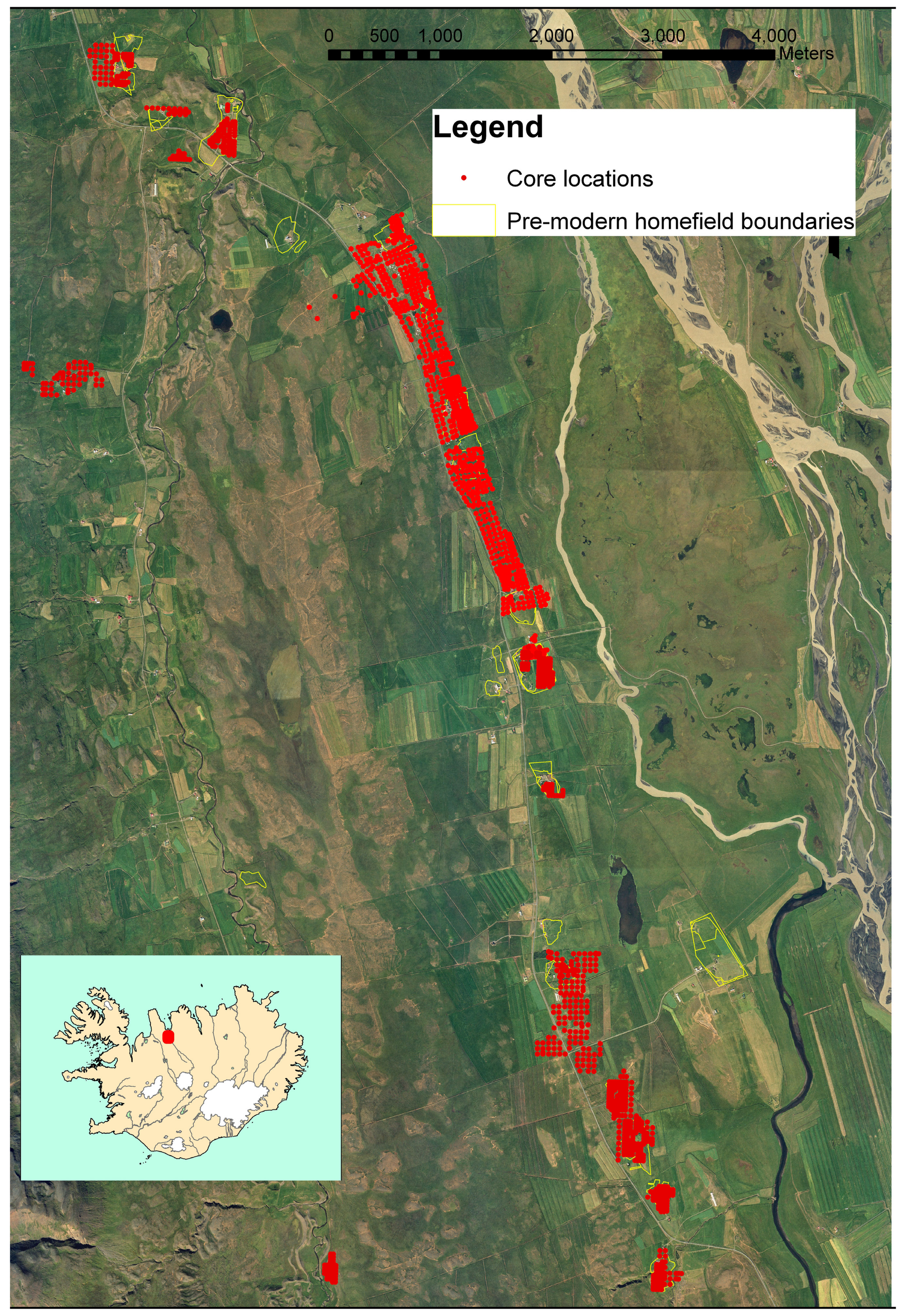

Figure 1. Core locations along Langholt in Skagafjörður in Northern Iceland. In yellow are the pre-modern hayfields.

Coring

Coring is used to identify areas where post settlement deposits are deep enough to cover and obscure turf structures. Using the volcanic tephra deposits, soil deposition rates across the landscape can be calculated. We have now cored over 2700 separate locations along 12 km of Langholt (approximately 0.4 km wide). Coring identified 11 locations, away from visible farm mounds, where preservation was good enough to warrant further investigation with shallow geophysics. Coring was also used to select locations for 1x1 test pits into the visible farm mounds.

Figure 2. Coring in Skagafjörður. Historic tephras include layers from AD 1766, 1300, 1104, ≈1000, & 870

Figure 3. Excavating a 1x1m test pit into the midden of a farmmound.

Test Pits & Intensive Midden Excavations

At all 14 farmmounds, 1x1 test pits were excavated to determine their earliest occupation dates. These test pits were placed in the deepest and oldest area of the midden as determined by coring. Paleoethnobotanical samples were taken from each distinct layer. Most of these farmmounds were dated using tephrachronology. At 7 of these farmmounds larger sections were excavated where substantial zooarchaeological samples were recovered.

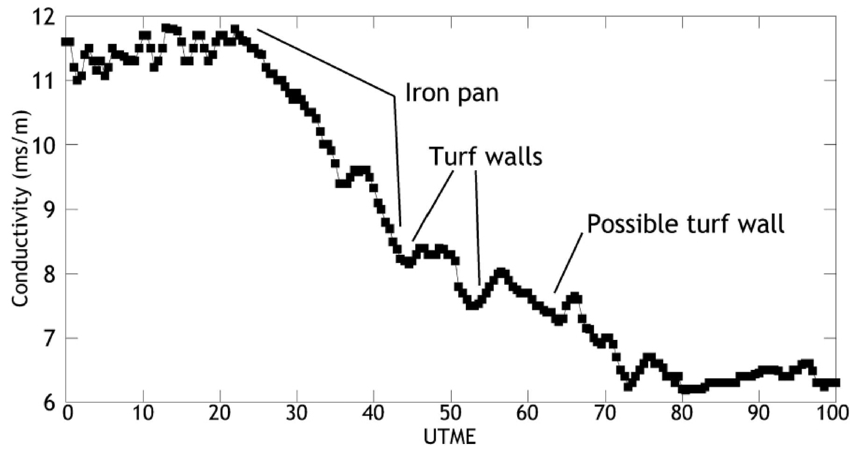

Figure 4. EM-31 conductivity transect at N 572 across Viking Age longhouse at Glaumbær.

Geophysics

Depending on conditions, we used conductivity, resistivity, and Ground Penetrating Radar (GPR) to identify specific settlement areas, building, walls, and other features. Shallow geophysics was used to guide excavations and to extend interpretations based on excavations.

Figure 5. Using the EM-31 at Glaumbær. The turf walls directly below the operator are preserved 60 cm high.

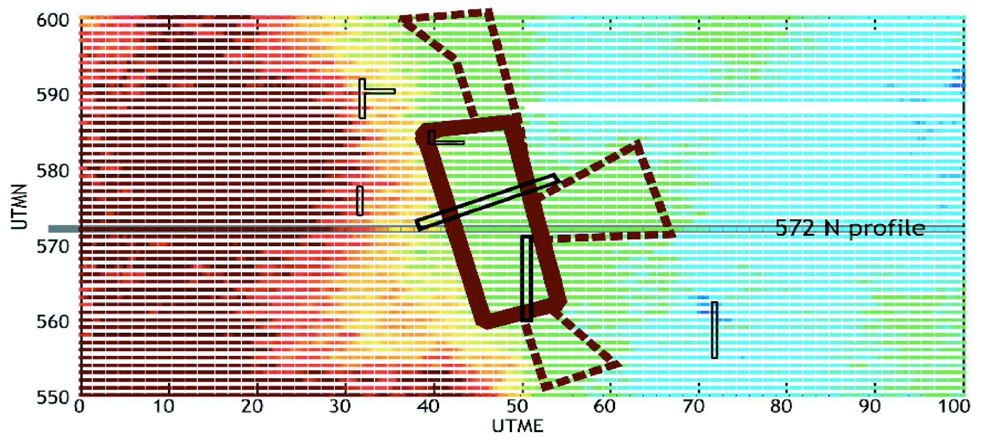

Figure 6. Conductivity map of Glaumbær, with N 572 transect highlighted. In brown are small resistive anomalies which correspond to a well-preserved wall.

Conductivity

Using a Geonics EM-31 conductivity meter we were able to identify specific settlement locations. In particular, substantial buried turf walls show up as patterned resistive anomalies. Conductivity readings can also be used to estimate the extent of cultural deposits. Conductivity does not depend on surface conditions and therefore can be used with minimal preparation. The EM-31 transects do not yield information about the depth of the anomalies.

Figure 7. Using the Syscal Kid 24 conductivity meter at Glaumbær.

Resistivity

Using the Syscal Kid 24 resistivity meter we were able to create a series of subsurface pseudo-profiles. These profiles allow us to specifically target features and specific depths and follow them over a variety of terrains. Resistivity was particularly good for identifying turf walls (resistive) around middens (conductive).

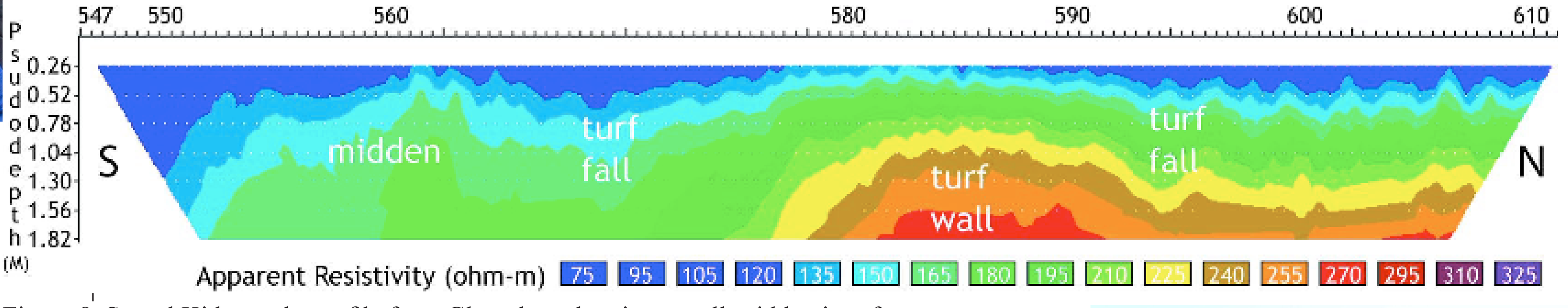

Figure 8. Syscal Kid pseudo-profile from Glaumbær showing a wall-midden interface.

Ground Penetrating Radar

We found that GPR energy was substantially dissipated and the readings more difficult to interpret when taken over the grass surfaces so common in Iceland. Therefore, we used a backhoe to de-sod large areas (eg 40x40m) in order to get better GPR readings. GPR profiles were sliced using GPR-Slice software. Sliced GPR images both guided excavations and the interpretations of the complex sites and the excavations helped to interpret multifaceted anomalies. Floors and rock foundations are hard (red) reflectors. When well preserved, walls can also be strong reflectors.

Figure 9. Using the Mala 500 MHz GPR antenna at Stóra Seyla after the sod was removed by a backhoe. Transect spacing of 20 cm yields very detailed GPR-Slice Images.

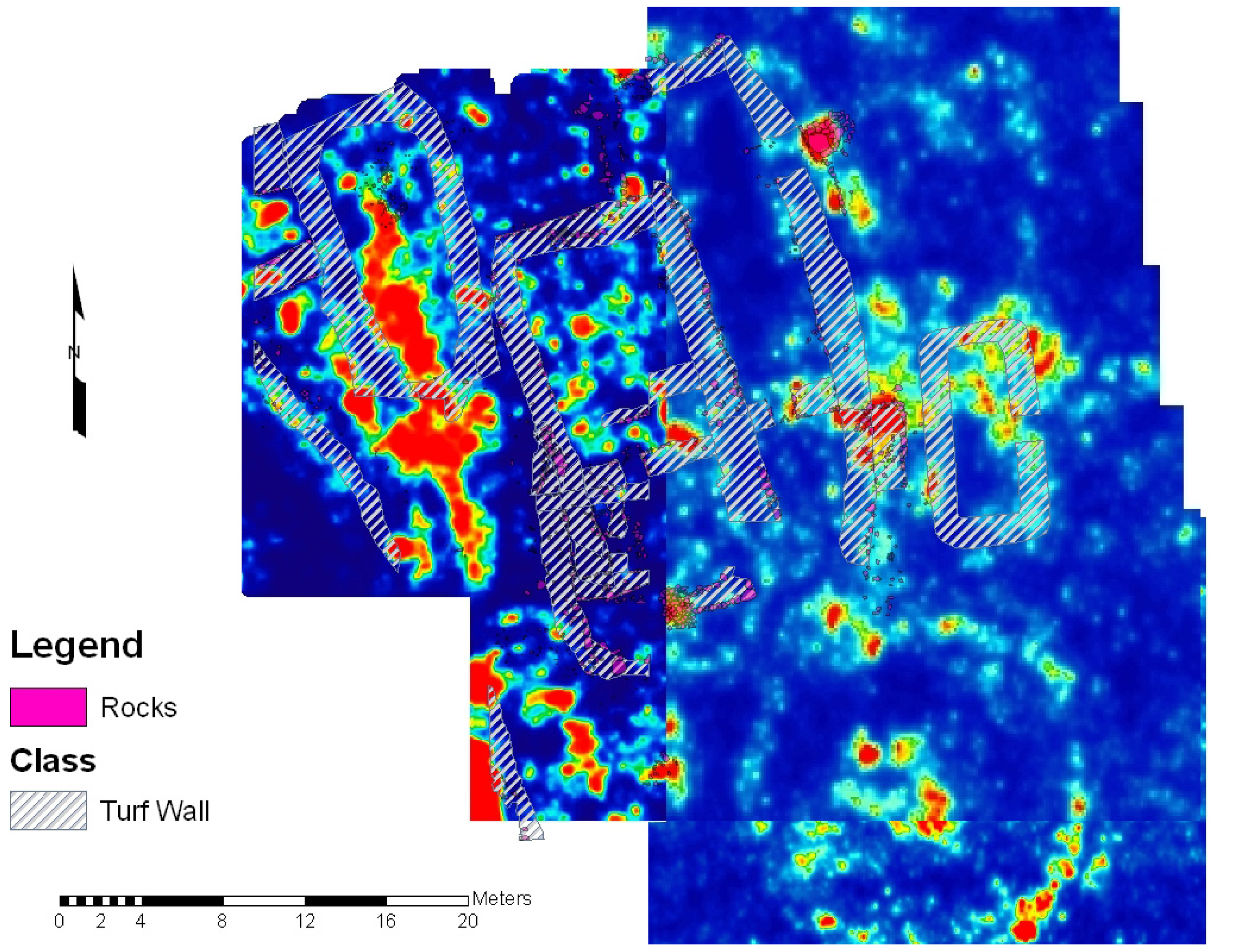

Figure 10. GPR-Slice composite image of 500 MHz GPR transects from 40cm below backhoed surface at Stóra Seyla. Excavated turf walls are highlighted. A distinct trampled floor is visible as a strong (red) reflector in the west. The 15m circle in the south is a churchyard with multiple graves and small chapel in the center.

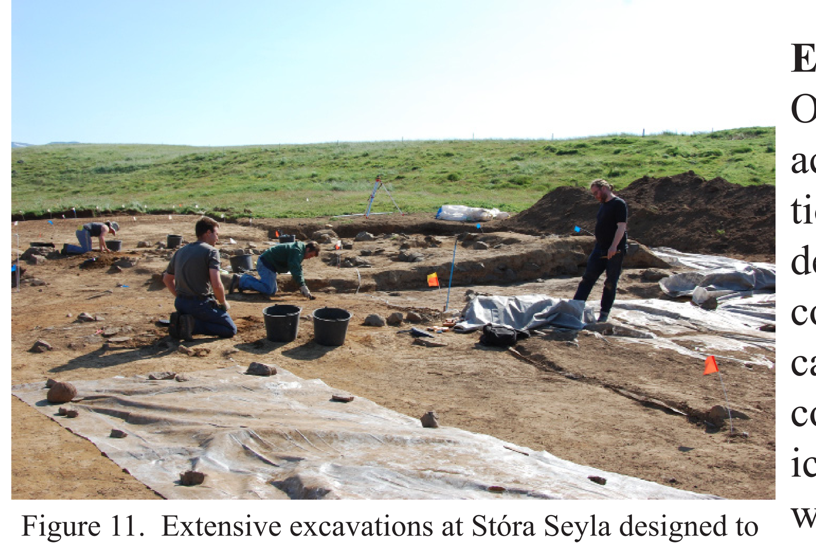

Figure 11. Extensive excavations at Stóra Seyla designed to expose the tops of turf walls

Excavation

Over the course of the project, we accomplished extensive excavations at five sites. Because of the detailed information gained from coring and geophysics, these excavations were done primarily to confirm and interpret the geophysics. Therefore the excavations were extremely shallow, designed to expose and confirm the tops of deposits. Floors and other deposits were only sampled, not excavated. Using GPR-Slice images, we were able to rapidly probe and interpret large, convoluted sites, fleshing out, with specific examples, the farmsteads that make up the settlement pattern.

Conclusion

Without this program of sub-surface investigation, the settlement pattern from Langholt in Skagafjörður would be profoundly flawed. The earliest components of two of the largest, and most powerful sites would not have been identified. The addition of these sites, as well as several smaller ones, to the Viking Age settlement pattern pushes back in time the development of inequality. The location of these buried sites suggests how property and land ownership played an important role in promoting social stratification.

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