TAP Field Report No. 2

Geophysical Survey at Housa Voe, Papa Stour, Shetland 2010

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TAP was launched in June 2010 and runs for three years. It is led by the Museum of Cultural History, University of Oslo (Dr Frode Iversen) and consists of individual projects based at the Centre for Nordic Studies (UHI Millennium Institute) at Orkney (Dr Alexandra Sanmark), the Department of Prehistory and Historical Archaeology, University of Vienna (Dr Natascha Mehler) and the Department of Archaeology, University of Durham (Dr Sarah Semple).

website: http://www.khm.uio.no/prosjekter/assembly_project/

cover illustration: aerial photograph of Housa Voe, Papa Stour (June 2010); DP 081495: Reproduced under licence. RCAHMS: The National Collection of Aerial Photography.

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Introduction

"The Assembly Project – Meeting-places in Northern Europe AD 400-1500 (TAP)" is an international collaborative research project on the role of assemblies, or things as they are called in Old Scandinavian, in the creation of collective identities and emergent kingdoms in medieval Northern Europe. The project aims to offer a large-scale study of thing sites in Viking age and medieval Scandinavia and those areas, which were colonized and settled by the Norse. The research questions are addressed via multi-disciplinary research, using archaeological, historical, geographical and ethnographical sources and methods.

The official start of TAP in June 2010 was marked by its first fieldwork campaign in Shetland. During a four-week campaign, three (supposed) assembly sites were subject to a geomagnetic survey, namely those of Tingwall, Dale (both on Mainland) and Housa Voe (Papa Stour) (*Illus. 1*). The island of Papa Stour hosts an archaeological structure said to be a thing site. Consequently, the site was included into TAP and the survey of thing sites of Shetland. Consent was granted under section 42 of the 1979 Ancient Monuments and Archaeological Areas Act for the magnetometer survey by Historic Scotland (Case ID 201001247).

Natascha Mehler acted as overall project director. The magnetometer survey was directed by Joris Coolen, with the assistance of Val Turner, Mathias Hensch, Frode Iversen, Natascha Mehler, Marie Ødegaard and Alexandra Sanmark. The present report summarizes the geophysical survey at Housa Voe, Papa Stour. The investigations on the other assembly sites are dealt with in separate reports.

Site location, topography and geology

The island of Papa Stour – the eight largest in the Shetland archipelago – is located a few kilometres west of Shetland mainland. Today, the island only has about fifteen regular residents, all of whom live in the Biggings, a dispersed settlement at the island's eastern end. Numerous croft ruins, deserted fields and planticrubs still recount the days when the population was larger, but even then the settlement was mainly restricted to the east which is unusually fertile due to underlying sandstone and basalt overlain by a deposit of wind-blown sand (Crawford 1999: 5f.).

Illustration 1 *Map of Sheltand with location of the surveyed sites. Data: ESRI, map by Joris Coolen.*

The sheltered bay of Housa Voe lies below the Biggings at the east side of Papa Stour. Its sandy beach offered a good landing place for boats in the past, and the ferry from West Burrafirth still uses this natural harbour. Housa Voe is home to an archaeological feature known for many years and referred to as "stone ring". The Housa Voe stone ring is located just above the beach at the central axis of the bay, about two hundred meters to the west of Skurdins (HU 1802 6032). The monument lies at the eastern side of a shallow and boggy depression, which runs across the peninsula in a N-S direction (*Illus. 2*).

Geologically, Papa Stour mostly consists of volcanic formations, predominantly rhyolithic lava and tuff. However, there are some minor outcrops of red sandstone belonging to the Melby Formation at the east side, and the Housa Voe "stone ring" lies at the edge of one of these. In most places around the "stone ring" the bedrock is covered by a layer of blown sand. At the time of our survey, in June 2010, the entire area was being used as pasture.

Illustration 2 *Aerial photograph of Housa Voe, Papa Stour, with location of the so-called stone ring (photo ref. no. DP081495: reproduced under licence. RCAHMS: The National Collection of Aerial Photography).*

Site description

Strictly speaking, the Housa Voe "stone ring" is not a ring but a horseshoe-shaped structure with an open end towards the East and a diameter of approximately 35m (*Illus. 3*). The structure is rather low and consists of closely spaced boulders of different sizes, the largest measuring about 0.5m in diameter. Some boulders are clearly visible at the surface (*Illus. 4*) but the northern part of the structure only consists of an earth bank, with no stones visible on the surface. Since this side faces the sea, the stones may have been covered by sand here. A few stones are also scattered inside of the earth bank (*Illus. 5*). The open side coincides with a modern beacon light, and some stones may have been removed during the construction of the beacon.

Historical and archaeological background

The House Voe "stone ring" is an enigmatic structure. There are no known historical documents referring to the "stone ring" and no written evidence of the structures use as assembly site. In fact, there is no written evidence for any thing meeting taking place at Papa Stour at all. No place-name refers to the structure and no similar monuments are known in Shetland.

Nevertheless, the so-called stone ring has been described as a possible thing site by the Royal Commission on the Ancient and Historic Monuments of Scotland who list the "stone ring" as an enclosure (Site Number HU16SE 24) (http://canmore.rcahms.gov.uk/en/site/258/details/papa+stour+housa+voe/). The entry records: "*The site is not obviously a stock enclosure or a field. Its survival in the middle of damp but fertile farmland and the associated traditions, including one recorded by Low (1773) of a*

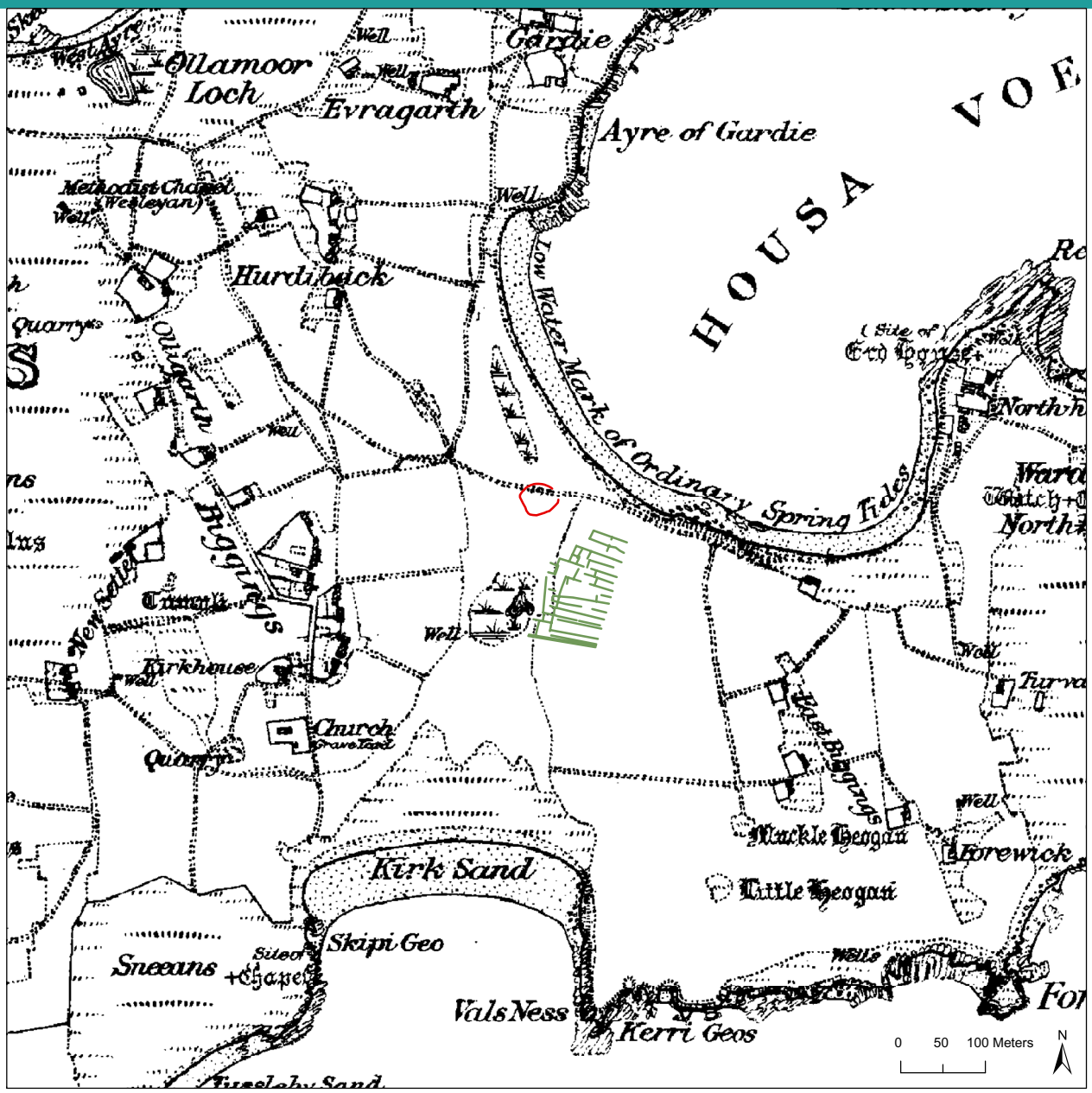

Illustration 3 *Part of the 1st edition of the Ordnance Survey six-inch-to-one-mile (1:10.560) map, surveyed in 1877 and published 1881, with the location of the so-called stone ring and the field system detected in the geomagnetic survey. The map shows a road leading past or through the stone circle. © Crown Copyright and Landmark Information Group Limited 2010. An Ordnance Survey/EDINA supplied service. All rights reserved 2010. Map created by Joris Coolen and Alexandra Sanmark.*

duel fought between two men, one called "Lord Terwill" (? Torcuil), may tend to support its popular interpretation as a "doom-ring", a place for local gatherings of a consultative and judicial nature during the Norse-medieval period. "[1]

Hence, the interpretation of the structure as an assembly site, possibly of Norse date, is solely based on local oral tradition, which, judging from the record of Low, goes back to the late 18th century at least. If it is a thing site, the structure would be situated rather close to the Norse *stofa* at the Biggings, an administrative centre of considerable political importance during the Norse period, which was excavated by Barbara E. Crawford between 1977 and 1990 (Crawford & Ballin Smith 1999).

Today the structure lies about 220m from the nearest road. The first editions of the Ordnance

[1] The reference Low 1773 refers to George Low, *A Tour through the Islands of Orkney and Schetland*, Kirkwall 1879. Low undertook his tour in 1774.

Illustration 4 *Stones of the structure at Housa Voe, visible at the surface (photograph by Natascha Mehler).*

Illustration 5 *The earth bank, forming the northern part of the structure, and some stones within the circle (photograph by Jill Campbell).*

Survey maps of Papa Stour from the late 19th century map show a road leading from the Biggings down to the beach. The road passed or even crossed the "stone ring" towards the cliffs called the Skurdins, where it then turned south towards a burnt mound called Muckle Heogan (see *Illus. 3*). The road must have fallen into disuse at the turn of the 20th century, since it does not appear on any of the O.S. maps produced after 1910.

Interestingly, none of the O.S. and older maps shows the structure, despite Low´s observations during the early 1770s (see above). The structure was probably not evident enough to be mapped, and not conceived as an archaeological feature.

Prior to our investigations the structure was first surveyed in the late 1970s by J. W. Allen, Department of Physics, University of St Andrews (Allen 1980). Allen´s survey included resistivity measurements and resulted in a plan of the visible remains of the structure.

In 1995 the structure of Housa Voe was scheduled by Historic Scotland (Index Nr. 6242) (http://data.historic-scotland.gov.uk/pls/htmldb/f?p=2300:35:3190568810249530::NO::P35_SELECTED_MONUMENT:6242). It is recorded that "*The monument is of national importance as a site of unproven nature with strong local traditions that it is a local thing-stead or gathering place of Norse date. Such sites are known of from saga literature but are seldom precisely located. The monument could produce dating evidence through excavation and analysis, and this could also examine its nature and identify any associated structures and deposits*."

Aims and objectives

Up to now, only a limited number of assembly sites have been subject to archaeological study in Northern Europe. As a result, the limited reference material makes it difficult to establish a typology of features that could be described as being characteristic of an assembly site.

As stated above, there is as yet neither written nor archaeological evidence for the function and age of the structure at Housa Voe. A geophysical survey alone is also unlikely to provide such evidence, but would help to clarify the monument's archaeological context. Thus, the main aim of the survey was to investigate the structure itself, and the likelihood of any associated archaeological features in or around it which might shed light on its history. With these problems in mind, a geophysical survey seemed the best way to initiate archaeological fieldwork at Housa Voe, as it has the advantages of being both extensive and non-destructive. The geophysical survey was also intended to form the basis for any further archaeological research at Housa Voe.

Methodology

Method of choice

Given the wide range of features, which could possibly be expected at Housa Voe, magnetometry seemed the most suitable prospection method. Magnetometry measures the strength and direction of the local magnetic field and human activity, in the form of archaeological features often causing anomalies in the magnetic

Illustration 6 *Overview of the surveyed area at Housa Voe, Papa Stour, overlain on the O.S. Map, hill shade and 10m-contour lines (© Crown Copyright/database right 2010. An Ordnance Survey/EDINA supplied service). Map created by Joris Coolen and Alexandra Sanmark.*

field of the earth. While resistivity and Ground Penetrating Radar (GPR) are mainly used to detect walls and other features that show a high structural contrast with the surrounding soil, magnetometry can also be used to detect pits, ditches, fire places etc.

Survey area

A total area of 3.3 hectares was surveyed on June 12th and 18th (*Illus. 6*). Due to fences running through the site, the spot had to be divided into several areas, each of which was oriented in the same direction as the respective field or the adjacent field boundary. To the north the survey area is confined by the beach and a bog to the south of the structure. However, since the areas are only spaced several meters apart, they will be discussed collectively.

Survey grid

The survey was carried out over a grid of 40m squares, set up in ESRI ArcMap with the extension Hawth's Analysis Tools[2]. The survey grid was staked out using a Leica differential GPS kindly provided by Val Turner of the Shetland Amenity Trust. In some cases, grid squares had to be slightly shortened to avoid obstacles.

Instrumentation

The survey utilised a multisensor fluxgate gradiometer system produced by Sensys (*Illus. 7*). We used five FGM-650B gradiometers mounted on a cart at 0.5m spacings. Samples were taken at 0.1m intervals and stored on a DLM-98 da-

[2] Available from http://www.spatialecology.com/htools/tooldesc.php (last access 22-7-2010).

talogger produced by Sensys. The Sensys gradiometer system uses a logarithmic measuring mode: measurements are taken continuously, and resampled to the set number of samples (grid length / sample interval) at the end of each line. The Sensys FGM650 gradiometers are similar to the better-known Förster FEREX fluxgate gradiometers, but the total range of the Sensys gradiometers is reduced to +/- 3000 nT. The two single-axis fluxgate sensors are 650mm apart, the resolution is 0.1 nT.

Data processing

The data were downloaded to a notebook using Sensys' own proprietary software MAGNETO®-ARCH, and subsequently exported for further processing in ArcheoSurveyor 2.5.4.0. Processing included destriping, destaggering and interpolating. Striping in the data was reduced by subtracting the median from each traverse. Obvious shifts between adjacent traverses, caused by the operator walking at irregular speed, were corrected by manually moving (parts of) the traverses. Finally, the data were interpolated across the traverses to a more regular grid size of 0.125 × 0.1m, and subsequently exported to and georeferenced in ESRI ArcMap.

Results

While the greatest part of the island of Papa Stour generally isn't very suitable for geomagnetic surveying, due to the prevailing igneous bedrock material, the sandstone bedrock at the site, covered by sandy soil, provides a homogenous magnetic background, so that very good results were achieved with this method (*Illus. 8*). The recorded values range from -603.5 to 707.1 nT, but most recordings lie within +/- 6 nT. The survey revealed a large number of discrete anomalies, some of which can be interpreted as archaeological features. Modern features visible in the survey data include an electricity cable (*Illus. 9a*), which runs from both sides towards the light beacon, large numbers of iron pieces (mainly pieces of iron wire) (*Illus. 9b*), the fences surrounding and dividing the survey area (*Illus. 9c*) and a number of drainage ditches in the western part of the survey area (*Illus. 9d*).

Generally, the eastern half of the survey area shows much more magnetic noise than the western part. This division corresponds with the higher and dryer area in the east, and the lower-lying wet part in the west. The difference in the magnetic background is caused by a dissimilar soil structure, although it may in part have been humanly modified, since the wet area was probably never ploughed. The many small positive anomalies distinguishing the eastern half of the survey area are caused by stones in the topsoil. The structure lies at the edge of this area, surrounded by wetland.

Illustration 7 *The Sensys multichannel fluxgate gradiometer system in use at Housa Voe, Papa Stour (photograph by Joris Coolen).*

The structure (*Illus. 9e*) appears very clearly as a series of closely spaced or overlapping, positive anomalies, with maximum values up to 58.2 nT (though mostly between 10 and 40 nT). The anomalies are caused by the induced magnetisation of the stones. The survey also revealed a number of stones buried under the sand bank north of the fence, which nowadays divides the structure. The stones seem to be less closely spaced on this side, but their identification is hampered by the many anomalies caused by ferrous objects in the northern field. The edge of the earth bank at the north side of the structure partly appears as a weak, positive anomaly, which is probably due to an accumulation of magnetised topsoil at the base of the bank. The survey reveals that the edge of the bank does not link up with the ring, but follows the latter at a distance of six to eight meters. The north-eastern part of the bank exhibits a high concentration of ferrous objects, possibly caused by ferrous stones or iron debris. Large numbers of red sandstone and volcanic stones were encountered near the beach during the survey, but a lot of iron wire fragments were

Illustration 8 *Greyscale plot of the enhanced geomagnetic survey data, stretched to +/- 1 standard deviation, overlain on the O.S. cadastral map (© Crown Copyright/database right 2010. An Ordnance Survey/EDINA supplied service). Map created by Joris Coolen and Alexandra Sanmark.*

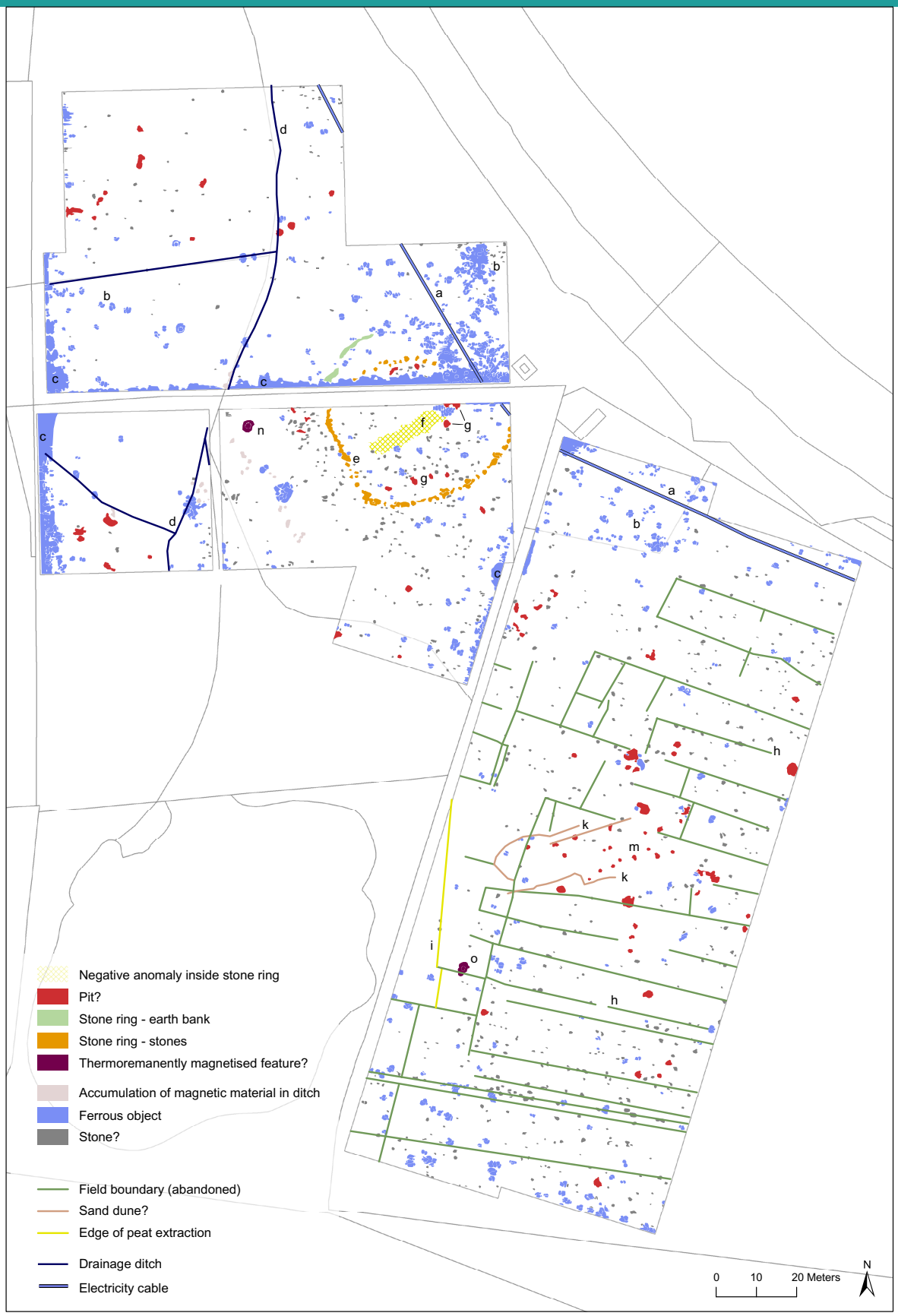

Illustration 9 *Interpretation of the geomagnetic survey, overlain on the O.S. cadastral map (© Crown Copyright/database right 2010. An Ordnance Survey/EDINA supplied service). Map created by Joris Coolen and Alexandra Sanmark.*

also found spread over the field in the northern part of the survey area.

Unfortunately, the area east of the structure could not be surveyed due to fences and the light beacon. Thus, we cannot give a definite answer as to whether the structure is open on this side. Yet, the survey clearly shows the irregular shape of the structure, which can be divided in three parts. The southern part describes an almost perfect arc with 30m radius for 42 meters (i.e. between one fourth and one fifth of a full circle of 6m diameter). The western side continues in a straight line of ca. 22m towards the northwest, while the northern side is circular again, but stronger curved than the opposite side. As far as it can be deduced from the survey, the northern part describes a circle with about 20m radius for at least 35m.

Apart from a large number of small anomalies caused by stones and ferrous debris, the survey revealed a remarkable negative anomaly inside the structure (*Illus. 9f*). Although the anomaly is neither very strong (min. -6.7 nT), nor sharply delineated, it appears to be rectangular, with edge lengths of 19 × 4-5m. It is SW-NE oriented, i.e. perpendicular to the straight part on the western side of the structure. It is not what the anomaly represents or indeed even if it is a man-made feature. It must be noted that similar negatively magnetised areas also emerge outside the structure and appear to be part of the geological background.

Dispersed through the interior of the structure are a number of positive anomalies with 1-2m diameter (*Illus. 9g*). Four of them are aligned at the southern edge of the structure, running more or less parallel to it. The anomalies seem to be rather large for single stones and are not as strongly magnetised as the stones of the structure. They may be tentatively interpreted as archaeological features, possibly pits, but it is not clear if they have any connection with the structure, since similar features appear in all parts of the survey area.

The south-eastern part of the survey area shows a rectangular pattern of linear anomalies, both positive and negative, which can be interpreted as a field system (*Illus. 9h*). The anomalies are caused by the earth banks and stone borders, which delineate the fields. The field boundaries are marked by neatly aligned, upright stone slabs, many of which still stand out from the field. The stone bordering led to the accumulation of sand carried by the wind, creating shallow earth banks. It seems unlikely that the slabs once formed the base of higher field walls.

The general orientation of the field system is WNW-ESE. Most fields are between 7.5 and 14m wide and very elongated, their eastern end lying outside the survey area. This type of elongated field is typical for the 19th century crofting period, when population density in Shetland reached its highest point. As *Illus. 3* shows, the elongated fields revealed by the geomagnetic survey run parallel to the coastal road, which is shown on 19th century maps and seems to have been abandoned around 1900. The field system is also portrayed on a cadastral map from 1846 (SRO RHP 83385) (*Illus. 10*).

A series of smaller, near-quadratic fields fills up the space between the bog and the elongated fields on the slope. Although the shape and size of these fields may indicate a much older age, most of them are aligned with the rectangular fields, so that we believe them to be contemporary. However, it is of course possible that the crofters re-used an ancient field system, which was still visible when they laid out their own fields.

The field system is partly cut off by a peat extraction pit in the south of the survey area (*Illus. 9i*). Near the centre of the eastern survey area, the field system is also disturbed by a series of elongated anomalies similar to those caused by the field boundaries (*Illus. 9k*). These anomalies correspond to a number of mounds. The mounds probably present natural sand dunes, but it cannot be excluded that they are man made. In any case, they clearly overlay the field system and must therefore be younger.

Furthermore, the survey revealed about eighty pit-like anomalies, some of which have already been discussed above. They also appear in and near the field system, but as in the case with the structure, there is no obvious connection between the pit-like anomalies and the abandoned fields. However, a concentration of possible pits can be seen around the mounds mentioned before, and some of them seem to be aligned in the same direction as the large mound, which diagonally overlays the field system (*Illus. 9m*). This in turn implies that the pit-like anomalies in this area also postdate the field system and might therefore be relatively young.

We would like to stress in this connection that the high magnetic susceptibility of the

Illustration 10 *Housa Voe on a cadastral map from 1846; courtesy of the National Archives of Scotland, SRO RHP 83385.*

stones at the site, as shown by the stones that form part of the structure or the field borders, does not allow for an objective differentiation between anomalies caused by large stones or pits with magnetised fillings.

Two features stand out because of their large negative "halo", which surrounds the strong positive anomalies. One of them is located about 20m to the west of the structure (*Illus. 9n*), the second one lies at the edge of one of the quadratic fields (*Illus. 9o*). They may be caused by thermoremanently magnetised features, or large ferrous objects.

Discussion

Among the many features revealed by the geomagnetic survey the so-called stone ring and the abandoned field-system to the southeast of it are probably the most striking. The survey indicates that the location of the structure was carefully chosen; it lies on a slight promontory on the north-east side of a wet depression. Although the site is only very slightly elevated above the surrounding wetland, the geomagnetic data clearly show the distinct soil conditions.

The survey has also given us a clearer picture of the structures outline, showing that it is actually less regularly shaped than has hitherto been perceived. While each of the different parts of the structure seems to be fairly regular in itself (circular respectively straight), it is obvious that the builders of the structure have not striven to create a perfect circle or square. Yet, the survey has not given any indication on the function of the structure. A large, rectangular, negative anomaly encountered near the centre of the structure is hard to interpret at present.

On the basis of the size, shape and orientation of the fields, the field system probably dates to the 19th century. Although the struc-

ture cannot be dated at present, Low´s description (see above) indicates that the structure dates back to at least the latter half of the 18th century. Therefore, there may be no direct connection between the field system and the so-called stone ring.

Furthermore, the survey has revealed a number of possible pits and two possibly thermoremanently magnetised features. They are likely to be archaeological features, but there is no clear connection neither with the "stone ring" nor the field system.

The interpretation of the structure is very difficult. It is certainly man-made but neither its date nor purpose are clear. The structure could be an enclosure of some kind. The nearby beach offers a good place to land a boat and the location of the structure also makes it a suitable place to gather animals, before transporting them to the main island. A wooden boat, which was probably used for animal transport in fairly recent times, still lies on the shore close to the structure (see *Illus. 7*). It could also be a pen, or *gart* in Shetland, to hold animals. An interpretation as enclosure for a garden seems unlikely due to its shape and the fact that the site is at some distance to the next farm and situated in wetland.

An interpretation as assembly site would solely be based on the local oral tradition and the more or less round appearing shape of the structure. The precise location of the structure at the central axis of the voe is striking (see *Illus. 3*). It provides an excellent view over the voe and in return any gathering taking place at the structure would have been visible from a great distance both from the sea and land.

However, a key question for the interpretation is: why should an island like Papa Stour have an assembly site? The administrative and judicial arrangement of the western part of Shetland in general is unclear. The island of Papa Stour would probably have been part of *Þvæitaþing*, the parish and administrative area believed to have been in the West of Shetland. However, *Þvæitaþing* is only mentioned in documents of the early 14th century (Smith 2009: 41f.) and no more information is available. Without doubt, Papa Stour is an important place during the Norse period of Shetland. In the late 13th century, while Papa Stour belonged to the crown of Norway, the Biggings was home of a ducal farmstead and seasonal residence of Thorvald Thoresson, also named Torvald of Shetland, ambassador of King Erik Magnusson of Norway (Crawford 1999: 30; Imsen 2002: 62).

Acknowledgements

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