

TAP Field Report No. 1



**Geophysical Survey at
Tingwall, 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 Tingwall valley (June 2010); courtesy of Dave Cowley, RCAHMS.

Contents	
Introduction	4
Site location, topography and geology	4
Historical and archaeological background	6
<i>Law Ting Holm</i>	7
The archaeology at Tingwall valley	9
<i>SMR 895: Standing Stone</i>	9
<i>SMR 899: Kirkasetter</i>	10
<i>SMR 900: Law Ting Holm</i>	11
<i>SMR 901: St Magnus' Church</i>	11
<i>SMR 906: Tingwall Glebe</i>	11
<i>SMR 908: Griesta</i>	11
<i>SMR 4746: Kirkasetter</i>	12
<i>SMR 4747: Kirkasetter</i>	12
<i>SMR 4748: North Setter</i>	12
<i>Gallow Hill</i>	12
Aims and objectives	13
Methodology	14
<i>Method of choice</i>	14
<i>Survey area</i>	15
<i>Survey grid</i>	15
<i>Instrumentation</i>	15
<i>Data processing</i>	15
Results	16
<i>General characteristics</i>	16
<i>Areas 1, 2 and 3</i>	18
<i>Area 4</i>	18
<i>Area 5</i>	18
<i>Area 6</i>	20
<i>Area 7</i>	22
<i>Area 8</i>	24
Discussion	26
Acknowledgements	27
References	28

Introduction

The Assembly Project – Meeting-places in Northern Europe AD 400-1500 (TAP) is an inter-national 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) (Fig. 1). Consent was granted under section 42 of the 1979 Act for the magnetometer survey by Historic Scotland (Case ID 201000145).

Dr Natascha Mehler acted as overall project director. The magnetometer survey was directed by Joris Coolen MA, with the assistance of Dr Mathias Hensch, Dr Frode Iversen, Dr Natascha Mehler, Marie Ødegaard MA and Dr Alexandra Sanmark.

The present report summarizes the geophysical survey at Tingwall, which is home of the most important assembly site of Shetland and thus a key site for TAP. The investigations on the supposed assembly sites of Papa Stour and Dale are dealt with in separate reports.

Site location, topography and geology

Tingwall is located to the north of the Loch of Tingwall, ca. 4.5 km NNE of Scalloway and 6 km NW of Lerwick, on Shetland's Mainland. The lake and the adjacent settlement, consisting today of just Tingwall Kirk and Tingwall Manse, are situated in the centre of a long valley extending from the East Voe near Scalloway in the south to Lax Firth in the north (Fig. 2). The valley provides a natural route across the mainland from its eastern North Sea coast to the western Atlantic coast. Its northern and gentler side is intensively used for agriculture, and also



Figure 1 Map of Shetland with location of the surveyed sites. Data: ESRI.

hosts Tingwall airport, while the southern part has steeper slopes.

The water level of Loch of Tingwall lies at around 8m O.D. Hills on the west side of the lake rise up to 112m, while those of the east side reach 146m. Geologically, Tingwall valley consists of a number of formations running parallel along the valley. On the lower part of the western shore, the bedrock is made of micaceous psammite and semipelite (metamorphosed sand- and siltstone) of the Wadbister-Ness-Formation. The Lax Firth limestone formation runs through the centre of the lake and is flanked by a narrow stripe of metalava and metatuff of the Astarte bed on the east. The eastern shore of the lake mainly consists of semipelite of the Clift Hills Phyllitic Formation. Overall the survey area, the bedrock is covered by till, left by the glaciers at the end of the last ice age. The lake is surrounded by a strip of marshland, which reaches a maximum width of 120m to the southwest of Tingwall Manse.

The main area of the assembly site is located on a small promontory on the north side of the lake, known as Law Ting Holm. It is connected to the shore by a marshy area, which is only submerged during periods of heavy rainfall



Figure 2 View of Tingwall valley and Loch of Tingwall from the North. Scalloway and East Voe at the upper part, Tingwall Manse at the bottom (photograph: D. Cowley, RCAHMS).

(Fig. 3); but as the name (Old Norse “*holmr*” = a small island) indicates, it may originally have been an islet in the lake.

At the time of the survey, the biggest part of the survey area was in use as grazing or hay land. The marshland surrounding the lake was not actively used for agricultural purposes.

Historical and archaeological background

Tingwall is the location of an assembly site, home of the lawting and principal court of Shetland during the Middle Ages. The name derives from Old Norse “*þing völlr*”, meaning field(s) of the parliament. Similar names can be found elsewhere in Scandinavia and the British Islands, and they usually refer to the main assembly site in a legislative area (e. g. Fellows-Jensen 1996: 16 ff.). In a recent paper, Brian Smith (2009) has summarized the written evidence for the activities that took place at Tingwall during the assemblies.

It is not clear when Tingwall first came into use as an assembly site. However, it seems to have been the site of the lawting at least since the late 13th century (Fellows-Jensen 1996: 22; Smith 2009: 38). According to written sources (see below), the assemblies took place at three areas. The most important area was Law Ting Holm, protruding into the Loch of Tingwall at its northern end. Here, the officials met, vividly separated from the other participants of the assembly which sat at north of Law Ting Holm at the shore of the lake, the second area of action.

The third area is that of St Magnus kirk, the former church at Tingwall. It was probably built in the late 12th century and the most important church and parish in Shetland as well as the base of the archdeacon until the establishment of Presbyterianism in 1690 (Cant 1975: 21). During bad weather the church served as a substitute meeting-place for the assembly site at Law Ting Holm. This is noted in a decree of the lawting, issued on 19th of May 1307, which came together on that date in the church at “*Þingavollr*” (SD I, no. 3; Smith 2009: 41). The present church was built between 1788 and 1790 presumably near or at the site of the old St Magnus, after the old church had been torn down. Near the middle of the churchyard stands



Figure 3 The Law Ting Holm and causeway after a period of heavy rainfall (picture taken on January 11th, 2007). http://shetlopedia.com/Image:Law_Ting_Holm_Shetlopedia.com_Shetland.JPG (access 4-8-2010).

a small oblong burial-vault of the Mitchells of Westshore, which, according to tradition, once was part of the former kirk of St Magnus (Fig. 4). A tombstone has been built into the eastern gable of the present church (RCAHMS 1946: No. 1496). The former St Magnus kirk is recorded in the Shetland Amenity Trust Monuments List as SMR 901: St Magnus’ Church, Tingwall.

Tingwall was used as assembly site for at least 300 years. The site fell out of use when Lord Robert Stewart moved the assembly from Tingwall to Scalloway in the 1570s (Smith 2009: 39).

Figure 4 The church of Tingwall and Tingwall Manse at the right (Photo ref. no. DP081216, copyright RCAHMS).



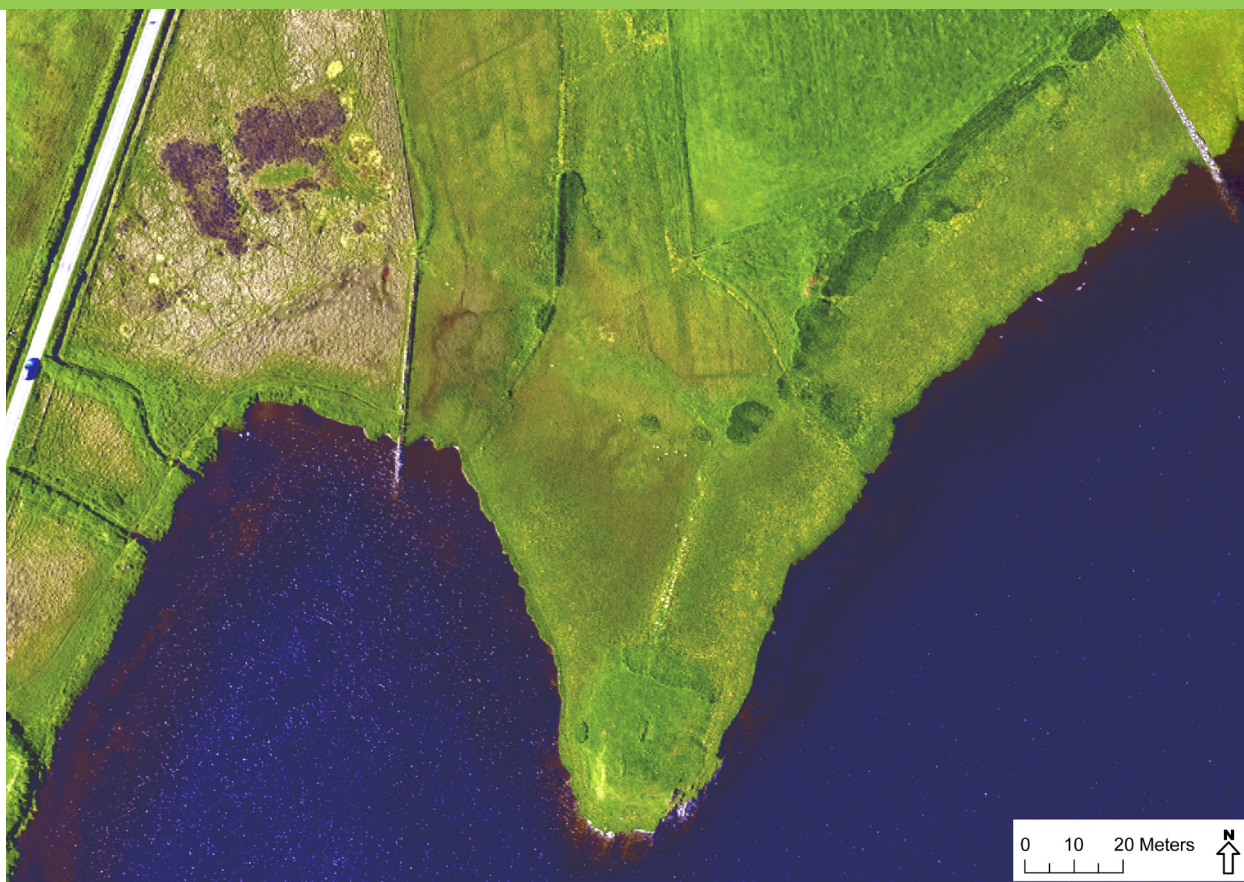


Figure 5 Georeferenced and color enhanced aerial photograph of the Law Ting Holm, taken by Dave Cowley for the RCAHMS on June 15th 2010. Photo ref. no. DP082229 and DP082232, courtesy RCAHMS.

Law Ting Holm

NGR HU 4180 4340

RCAHMS site no. HU44SW 11

During the assemblies the officials came together at Tingaholm (Smith 2009: 39-41). The other participants of the assembly sat in the open field below the kirk, as is documented from the late 17th century (Bruce 1908: 18; Smith 2009: 41). During its use as a central place for the officials in the later Middle Ages the Holm was surrounded by water, only accessible by a causeway defined by a stone curb. The stone curb of the causeway is still visible today (Fig. 5). It is most likely that the causeway once led up the hill to the church, connecting the Holm with the shore when the former was still an islet. In the 1850s, the water was drained from the lake (Smith 2009: 41) and the Holm turned into a peninsula, as it is today. However, in bad weather conditions and with floodwaters Law Ting Holm reverts to its former appearance even today (see Fig. 3).

Law Ting Holm consists of an outcrop of local bedrock and shows no clear archaeological features on its surface. However, in recent centuries the place and its remains were described several times. In 1701, John Brand reports that “*three or four great Stones are to be seen, upon which the Judge, Clerk and other Officers of the Court did sit*” (Brand 1701: 121; Fellows-Jensen 1996: 22; Smith 2009: 41). Some years later, in 1774, George Low tells of the stones having been torn up to clear the area for grazing (Low 1879: 77; Tudor 1883: 467; Smith 2009: 41). But according to Arthur Edmonston “*the site of the bench and surrounding seats can still be traced*” in 1809 (Edmonston 1809: 130; Smith 2009: 44 footnote 33).

John Brand also gives an account of how the meetings were carried out at Tingwall: “*All the Country concerned to be there, stood at some distance from the Holm on the side of the Loch, and when any of their Causes was to be Judged or Determined, or the judge found it necessary*

that any Person should compear before him, he was called upon by the Officer, and went in by these steping stones, who when heard, returned the same way he came.” (Brand 1701: 121 f.; Fellows-Jensen 1996: 22 f.; Smith 2009: 41). Brand also tells of the damage being done to the grass land by the many horses of the people attending the assembly: “[A]t every end of the Loch there is a House, upon whose Grass the Country Men coming to the Court did leave their Horses, and by reason the Masters of the Houses did suffer a loss this way, they were declared to be Scat free ...” (Brand 1701: 122; Fellows-Jensen 1996: 22 f.; Smith 2009: 41).

Written evidence suggests that documents were issued at Law Ting Holm. A letter of 1532, dated at the “ting holm”, announces the election of Nicol of Aith as “lawman generale of all Yet-land” (SD I: p. 196; Smith 2009: 39).

The causeway today is about 1.7 m wide and consists of a double row of boulders, which can still be traced for about 40m in length. The

boulders are more complete on the E side and rather intermittent on the W side (Figs. 6 and 7). A second, less obvious alignment of loose stones leads from the north end of the causeway towards the field boundary in the West, more or less following the old shoreline, which is still marked by a clear division in the vegetation. Where the stone alignment meets the field boundary, the latter bends at an angle of about 10°. The stone dyke that forms the boundary has at least two different phases, the southern part leading towards the lake obviously being the earliest. Just before the curve the older dyke shows a remarkable semicircular course. Archaeological fieldwork on or near Law Ting Holm has been restricted to a quick topographical survey, carried out by Val Turner (pers. comm.) about 20 years ago. Up to now, Law Ting Holm has not been subject to a detailed archaeological study. In 1946 the site was visited by the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHM).

Figure 6 Outline of features visible on the aerial photo (Fig. 5) and mentioned in the text, overlain on the OS cadastral map (© Crown Copyright/database right 2010. An Ordnance Survey/EDINA supplied service). a – Stone alignment; b – old shoreline; c – old dyke; d – causeway; e – Law Ting Holm; f – stone feature. Map created by J. Coolen and A. Sanmark.

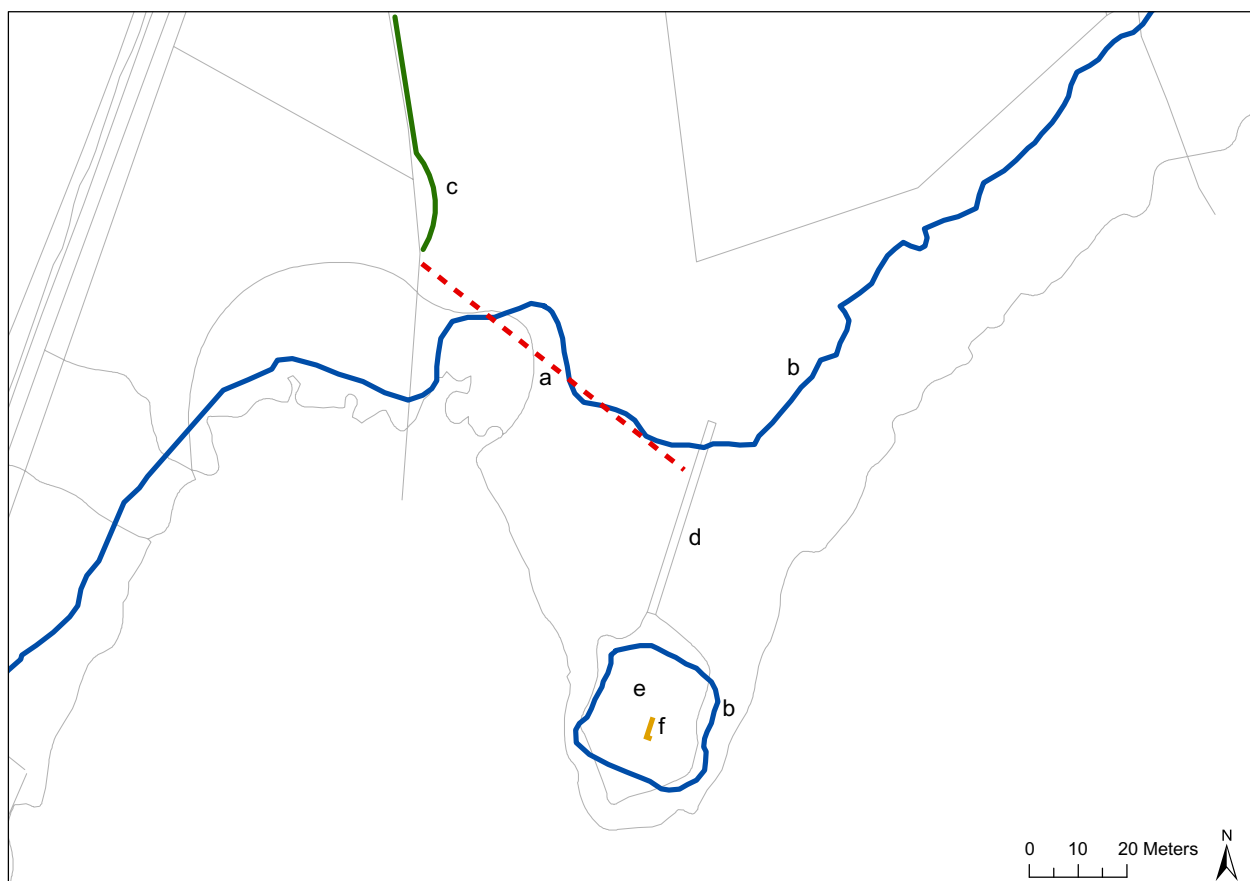




Figure 7 The causeway leading towards the church of Tingwall; photograph N. Mehler.

The subsequent report mentions traces of a wall, running at right angles to the causeway at the base of the Holm “to enclose the whole island” (RCAHM report A.1.1.INV/12: 124). This is obviously the patchy line of stones running roughly in WE direction from the causeway (see Figs. 5 and 6). In 1968 this statement was revised after another site inspection. The possible remains of the wall were now interpreted as an old field wall (<http://canmore.rcahms.gov.uk/en/site/1104/details/law+ting+holm/>) (accessed 22-7-2010).

During a site visit in 2009 James Moncrieff, Shetland Amenity Trust, found an Iron Age pottery fragment at the Ting Holm, just after the causeway (pers. comm.).

In 1996 Law Ting Holm was scheduled as protected monument by Historic Scotland (Index Nr. 2074). The Shetland Amenity Trust Monument List reports the causeway, the dyke and the assembly site to be of Norse period (c. 1000-1450 AD) (SMR No. 900).

The archaeology at Tingwall valley

Besides the assembly site at Law Ting Holm the valley of Tingwall hosts other archaeological features. Since Viking age or medieval assembly sites often incorporate older monuments such as grave mounds or stone settings a closer look at the surroundings of the Law Ting Holm is necessary to assess whether any other ar-

chaeological remains in the vicinity could have been part of the assembly site. The following sums up the known archaeology in the vicinity of the Loch of Tingwall (Figs. 8-9). All evidence is gathered in the Monument List of the Shetland Amenity Trust. The numbers of the various sites refer to the Sites & Monuments Record (SMR).

SMR 895: Loch of Tingwall, Standing Stone (NGR HU 41246 4202)

The “Standing Stone” is popularly known as the “Murder Stone” and located right beside the E side of the road at the S end of Loch of Tingwall. The stone is of uncertain date.

The Monuments Warden’s Report of Historic Scotland for 1995 reports the stone to be a roughly oblong block of ca. 2m height. The east face is flat and a vein of quartz crosses it diagonally. The west side facing the road is angled, i. e. has two faces. The stone stands on a slight mound and a few stones protrude around the base. Its major axis is approximately NNE – SSW. According to an oral tradition, probably of recent origin, the stone is related to a Norse tradition of pardon. If murderers could run from the Law Ting Holm to the Murder Stone unscathed and against the efforts of the victim’s family and friends, the culprit was reprieved (Fojut 1994: 116). Another oral tradition relating to the standing stone is at least 130 years old. In



Figure 8 View of the northern end of Loch of Tingwall and its surroundings with known archaeological monuments (Photo ref. no. DP082240, copyright RCAHMS).

1833, John R. Tudor (1883: 58) reported: “Malise Sperra [Lord of Skaldale] seems to have endeavoured to establish himself in Shetland, and in a quarrel which arose between the cousins at a Thing meeting in the year 1389, was slain; when the standing stone of grey granite close to the roadside between the Lochs of Tingwall and Asta was probably erected to mark the spot where he fell”.

SMR 899: Kirkasetter (NGR HU 4156 4272)

SMR 899 is officially recorded as “Kirkasetter chapel” but this is a wrong identification. On a promontory at the west side of the Loch of Tingwall lies an old building believed to have been a catholic chapel, as recorded in the OS map of 1878. A later survey could not find any trace of a building and the promontory has been much mutilated by quarrying. Historic Scotland’s Monument Warden records in 1995 note that: “Occupier Jim Leask (at house opposite the [standing] stone [SMR 895]) was involved in

excavation of the chapel site on the west side of Loch of Tingwall and he was a good source of information on local history and archaeology.”

The site has recently been investigated by other scholars which led to a revision of the old interpretation. In 1996, Ian Tait records a circular house with a rampart at the south face and two parallel walls at N, which converge. The latter two walls have been truncated by cultivation (Figs. 10-11). Prehistoric pottery was found at the site. The present place name of the nearby farm Kirkasetter is probably a corrupted version of Kurkasetter, which often means a steep slope, exactly as it is behind the farm (Watt & Tait 1996: 92; pers. comm. Ian Tait).

During a site visit by V. Turner, C. Dyer, E. Brooke-Freemant and L. Doughton (all Shetland Amenity Trust) in March 2010 it was observed that the previously interpreted chapel site appears to consist of a broadly sub-rectangular or figure-of-eight shaped structure, similar in form to a prehistoric house. Its alignment was noted as approximately north-south, and



Figure 9 Loch of Tingwall facing south and known archaeological monuments (photograph: D. Cowley, RCAHMS).

therefore at odds with any chapel building and an expected east-west alignment.

SMR 900: Law Ting Holm (see above)

SMR 901: St Magnus' Church, Tingwall (see above)

SMR 906: Tingwall Glebe (NGR HU 4100 4300)

"Tingwall Glebe" is recorded to be the find spot of three axes of porphyritic stone of uncertain date. (The find spot is not illustrated in Figs. 8-9).

SMR 907: Burra Burn (NGR HU 4240 4330)

Neil Anderson of Gott reports two possible house sites at the west bank of Burra Burn. In a survey in 2000, Simon Clarke and Nigel Melton tried to find the two possible house sites but identified a symmetrical burnt mound, measuring 13.8m × 14.3m and ca. 1.7m high. The mound is covered by grass, but some burnt stones are visible. The second possible site could not be seen.

SMR 908: Griesta (NGR HU 4150 4420)

Peter Garrick from Cunningsburgh reports in 1971 that while digging a silage pit, the edge of a midden was touched and a Viking age weav-



Figures 10 and 11 The promontory at the west side of the Loch with the ruins of a prehistoric building (photographs: I. Tait).

ing comb and a pear-shaped rotary quern were uncovered. The finds are stored at the Shetland Museum. In 2002 a house development was planned at HU 4142 4421 with an access road apparently cutting across a midden. The area under the road had been levelled and upcast lay adjacent. The upcast contained no obvious signs of midden material or artefacts.

SMR 4746: Kirkasetter (NGR HU 4118 4267)

A circular stone structure is built into the hillside. Its external diameter measures 4m, its maximum height is 1.75m. Some stones have tumbled off the walls and now lie on the ground. The structure is marked in the OS map of 1971 as lime kiln and resembles very much that of SMR 4748 at North Setter (see below).

SMR 4747: Kirkasetter (NGR HU 4121 4276)

A roughly circular stone lies on sloping ground. It comprises a circular bank with some stones protruding the NE and SW. The external diameter is approximately 5m, the internal diameter about 2m. Immediately to the west lies a quarry. The structure is marked in the OS map of 1971 as lime kiln.

SMR 4748: North Setter (NGR HU 4134 4361)

A well-built circular stone structure of 3.5m in diameter and a maximum height of 1.5m was recorded at North Setter. Many stones are lying on the ground around the structure. In the east and west sides there are two gaps at the

bottom of the walls that lie opposite each other. The site is identified as lime kiln and the structure similar to that of SMR 4746 at Kirkasetter. (North Setter lies to the North of South Setter and to the West of Law Ting Holm and is not shown on Figs. 8-9.)

Gallow Hill

The valley of Tingwall is confined by a ridge of hills at the west side and the east side. The highest peak of the western ridge goes by the place name "Gallow Hill". The Gallow Hill lies in the middle of a district called the Herra, which again refers to the old land division of the *her-að* (Smith 2009: 43 f.). There is no written evidence to this but this place of execution must surely be connected to the assembly site at Law Ting Holm, where justice was dispensed. Standing at Law Ting Holm or the northern shore of the Loch the Gallow Hill is clearly visible, as would be any executed person. From the top of the Gallow Hill the view in all directions is spectacular (Fig. 12). No clear structures are visible at the crown of the Gallow Hill but there is a cairn as well as scattered rocks (Fig. 13).

There is no entry of the Gallow Hill in the Shetland Amenity Trust Monuments List.



Figure 12 View from Gallow Hill towards Law Ting Holm (photograph: N. Mehler).

Aims and objectives

Tingwall is one of the key sites for The Assembly Project (TAP). Up to now, only a limited number of assembly sites have been subject to archaeological research in Northern Europe (e. g., Ólafsson 1987; Sanmark and Semple 2008). 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 outlined above, several different actions took place at Tingwall that could have included the preparation of food and the setting up of temporary shelters, all of which could have left traces in the ground. In addition, assembly sites sometimes included older monuments such as (prehistoric?) burial mounds and stone settings etc. (e. g. Sanmark and Semple 2008).

The most important part of the survey area was Law Ting Holm and the causeway leading towards it. This area is specifically promising since written evidence, though post-dating the events that took place here, refers to a bench and seats of stone (see above). Hence, it would be especially interesting to see if a geomagnetic survey shows any traces of these or of any other features, such as walls, demarcations or

pits, connected to the assembly; and, in the case of the causeway, to see if it extends beyond the stretch still visible today.

The northern shore area of the Loch was also surveyed in order to see whether the area contains any archaeological features related to the assembly or older monuments such as burial mounds, stone settings or roads that could have been part of the assembly site.

Figure 13 Cairn and loose stones on top of the Gallow Hill (photograph: N. Mehler).



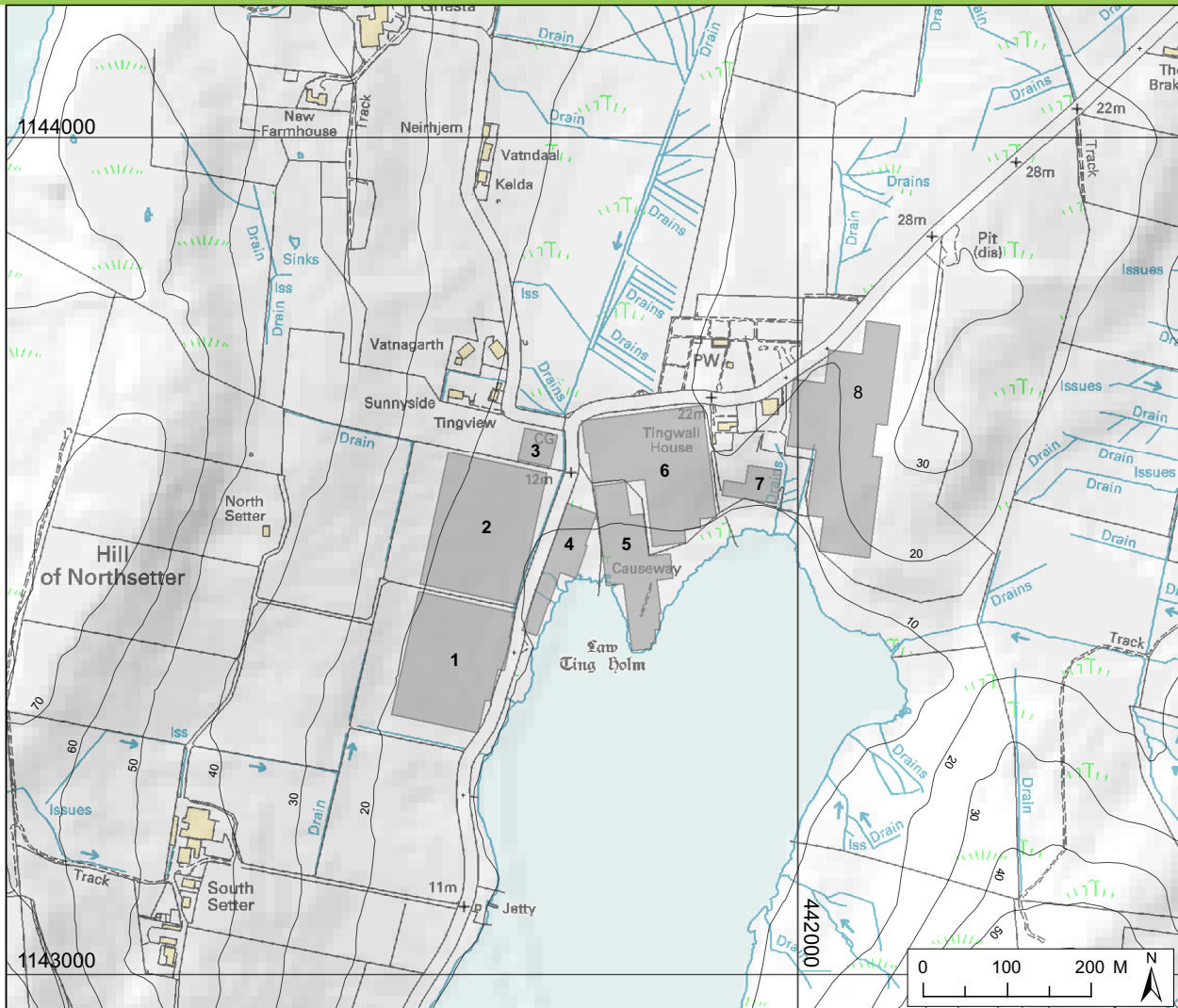


Figure 14 Overview of the surveyed areas in Tingwall, overlain on the OS Map, hill shade and 10m-contour lines (© Crown Copyright/database right 2010. An Ordnance Survey/EDINA supplied service). Map created by J. Coolen and A. Sanmark.

With these problems in mind, a geophysical survey seemed the best way to initiate archaeological fieldwork at Tingwall, as it has the advantages of being both extensive and non-destructive. Thus, the main aim of the geophysical survey was to see if Law Ting Holm and its surroundings show any archaeological features and if so, what those could tell of the function of the particular area within the assembly site. Although admittedly positivist, we feel that such an approach can be justified for this rather unexplored type of site. A large-scale geophysical survey thus forms the basis for any further archaeological research at Tingwall.

Methodology

Method of choice

Given the wide range of features, which could possibly be expected at Tingwall, 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 causes anomalies in the magnetic 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 9.3 hectares was surveyed in eight days between June 1st and 21st, making it the largest geophysical survey carried out so far in Shetland. Because of the many obstacles (fences, ditches, roads, lake) the survey area had to be divided into several areas, each of which was laid out separately to make the best use of the available space. For reference, the separate survey areas were eventually numbered one to eight (Fig. 14). Areas 1, 2 and 3 comprise the whole surveyed area west of the road, which had to be divided into three parts due to metal fences. Area 4 is the narrow strip at the western lake side, enclosed between the road and the lake. The Law Ting Holm and the marshland north of it constitute area 5. Area 6 is located to the north of area 5, separated from it by a fence. Area 7 comprises two grid squares in the field south of Tingwall Manse. Area 8, the largest contiguous area surveyed in Tingwall, comprises the slopes to the east and southeast of Tingwall Manse.

Survey grid

The survey was carried out over a grid of 40m squares and analysed using ESRI ArcMap with the Hawth's Analysis Tools extension (<http://www.spatial ecology.com/htools/tool desc.php> (accessed 22-7-2010)). The survey grid was staked out by a commercial surveyor using a Leica total station. In some cases, grid squares or single traverses had to be shortened to avoid obstacles.

Instrumentation

The survey utilised a multisensor fluxgate gradiometer system produced by Sensys (Fig. 15). Where ground conditions allowed the use of a cart, we used five FGM-650B gradiometers. The marshy parts of the survey area at the lake side were surveyed with a handheld system, using three FGM-650 sensors. In each case, the sensors were set at 0.5 m intervals. Samples were taken at 0.1 m intervals and stored on a DLM-98 datalogger produced by Sensys. The Sensys gradiometer system uses a logarithmic measuring mode: measurements are taken continuously, and re-sampled 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



Figure 15 The Sensys multichannel fluxgate gradiometer system in use at Tingwall (photograph: N. Mehler).

range of the Sensys gradiometers is reduced to ± 3000 nT. The two single-axis fluxgate sensors are 650 mm apart, the resolution is 0.1 nT.

Data processing

At the end of each day, 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 de-striping, de-staggering and interpolating. Striping in the data was reduced by subtracting the median from each traverse, except for traverses with very large and strong anomalies, where this would have led to a strong mismatch between adjacent grids or traverses. In these areas, a low pass filter was used instead, using a small window of 3×3 data-points and Gaussian weighting. 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 0.125×0.1 m, and subsequently exported to in ESRI ArcMap where it was georeferenced.

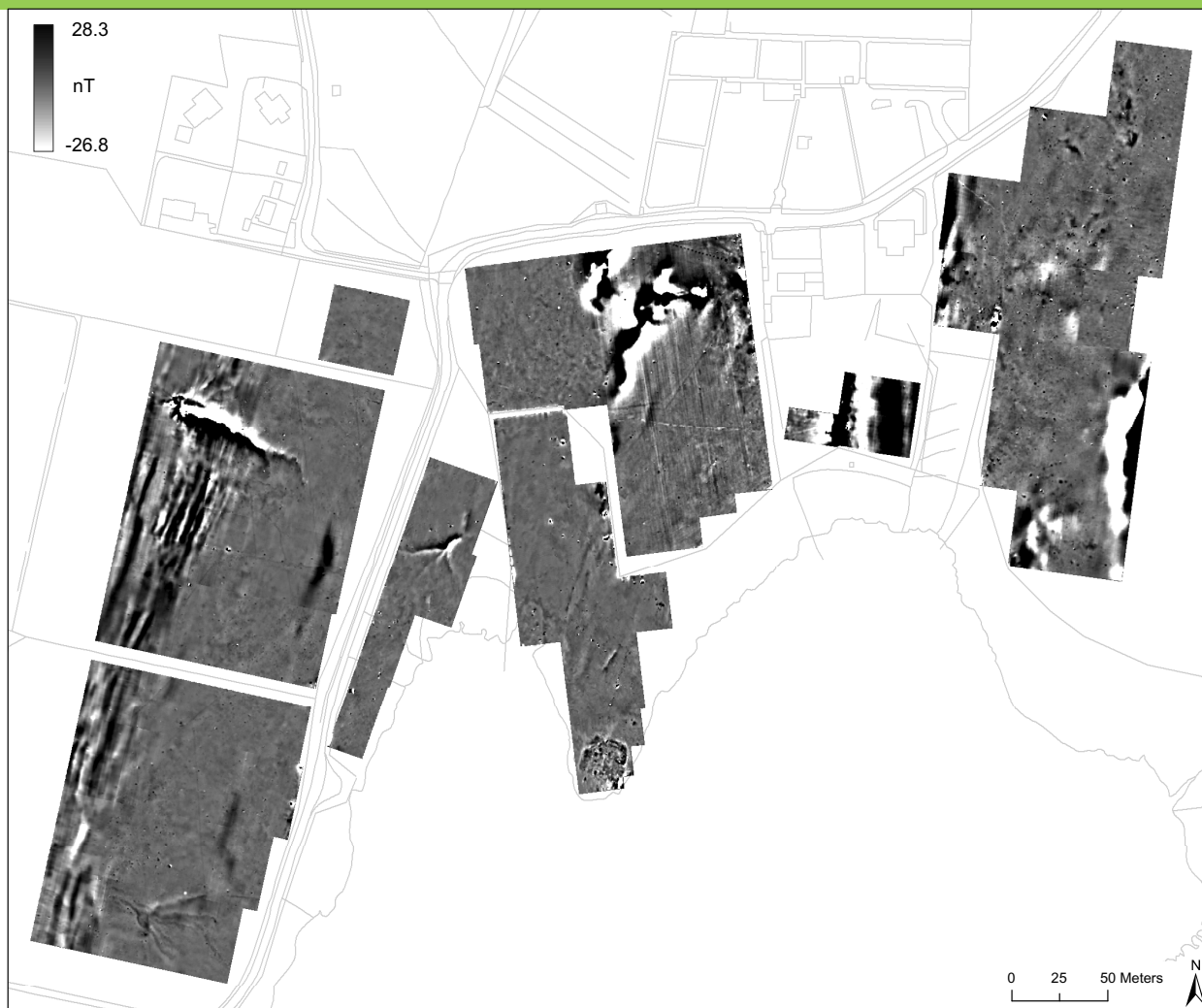


Figure 16 Shade plot of the enhanced magnetic survey data, clipped at 0.5 standard deviation (55.0 nT), overlain on the OS cadastral map (© Crown Copyright/database right 2010. An Ordnance Survey/EDINA supplied service). Map created by J. Coolen and A. Sanmark.

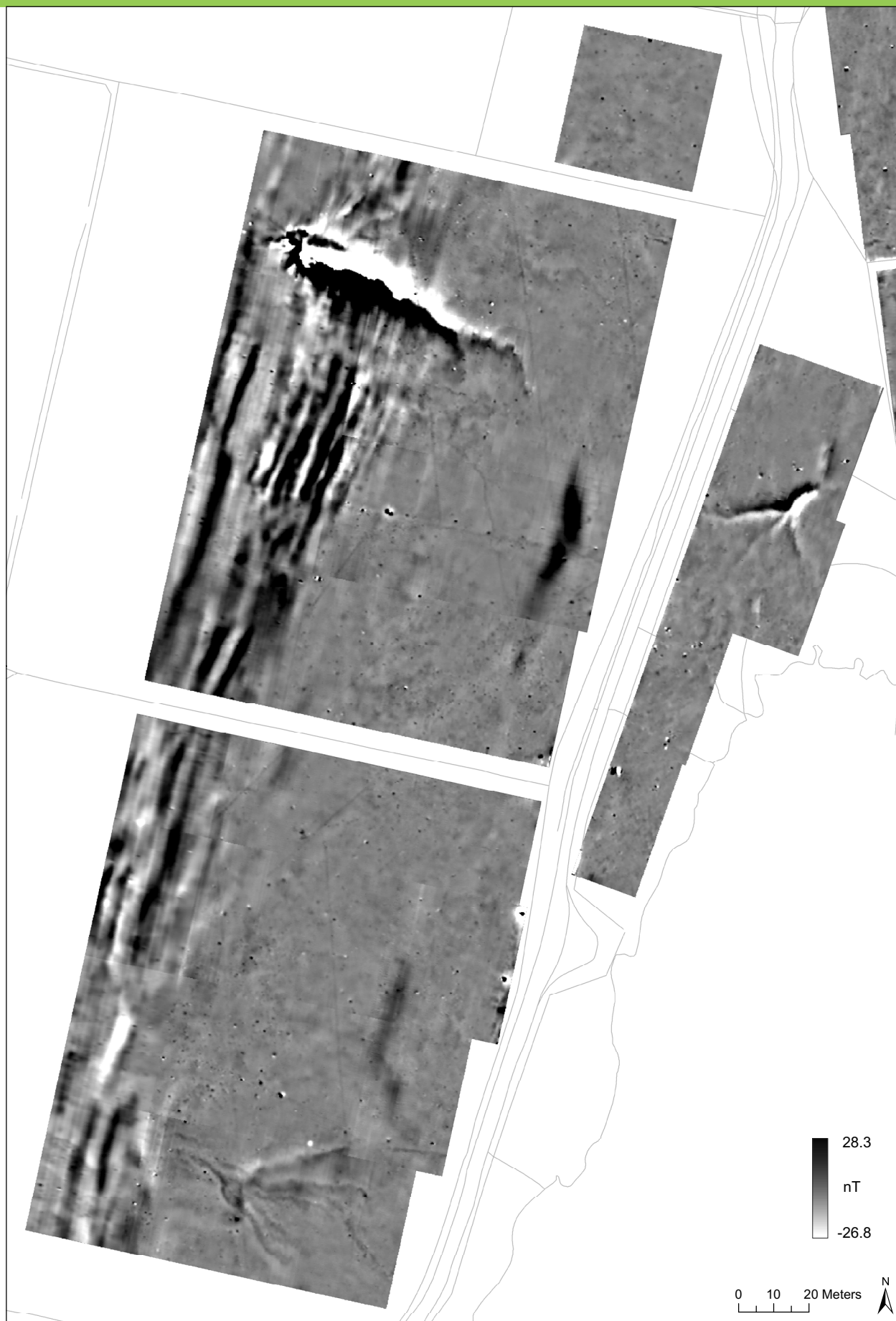
Results

General characteristics

With a standard deviation of 55.0 nT and extrema of 2391.8 and -2496.0, the magnetic response encountered at the site is extremely strong (Fig. 16). This is mainly caused by the magnetic properties of the local bedrock, producing very large and very strong, both positively and negatively magnetised, elongated anomalies. They mainly appear on the slopes towards the edges of the surveyed area, where the rock crops out. Corresponding to the general orientation of the valley and its constituting geological formations, most of these anomalies show a clear NNE-SSW to N-S orientation. They can be classified in two different types, namely the narrow stripes visible in the western part of the survey area, and the much stronger, ir-

Figure 17 (right) Shade plot of the enhanced magnetic survey data of areas 1 to 4, overlain on the OS cadastral map (© Crown Copyright/database right 2010. An Ordnance Survey/EDINA supplied service). Grey scale plot clipped at 0.5 standard deviation of the entire dataset (55.0 nT). Map created by J. Coolen and A. Sanmark.

regularly shaped, bipolar anomalies in areas 6, 7 and 8. The two types probably correspond to different geological formations. These anomalies are restricted to certain limited areas only and therefore do not impede the overall usefulness of the geomagnetic survey. The extremely high magnetic response of the local bedrock does, though, imply that single stones of the same material can also cause strong anomalies. This is exemplified by the stones of the causeway and the stone alignment leading away



from it. Both can be clearly identified as a series of small anomalies with maximum values ranging from 6.2 to 126.1 nT (the large, bipolar anomaly near the centre of the causeway, which has a maximum value of 1120.1 nT, is probably caused by some ferrous object) (see discussion for area 5). Indeed, large numbers of small, mainly positive anomalies appear throughout the survey area, most of which are doubtlessly caused by buried stones. However, the value range overlaps with the values caused by ferromagnetic or thermoremanently magnetised objects, making it hard to interpret most anomalies. Moreover, the strong magnetisation of the bedrock and soil formations in Tingwall does hamper the identification of archaeological features, which usually cause much weaker signals.

Areas 1, 2 and 3 (Figs. 17-18)

A number of parallel, 2 to 5m wide, mainly positively magnetised stripes dominate the western edge of areas 1 and 2 (Fig. 18a). They have maximum values between 7.5 and 328.9 nT but generally less than 70 nT. They are probably caused by iron oxides in the sandstone.

The parallel, stripe-like anomalies are cut through at a right angle by another, much stronger (max. 1319.7 nT) and wider, bipolar anomaly in the north of area 2 (Fig. 18b). The latter corresponds to a shallow depression in the field and is most likely a product of gully erosion, the anomaly itself probably being produced by the iron-rich soil. This also applies to two large, positive anomalies near the lake in the east of areas 1 and 2 (Fig. 18c). Another example of gully erosion appears in the south of area 1 (Fig. 18d).

Several weak, positive, linear anomalies in areas 1 and 2 constitute a large herringbone pattern, which is typical for modern drainage systems (Fig. 18e). In the southern half of area 1, two shorter lines run across the drainage system (Fig. 18f). Considering the similarity of these two anomalies to the drainage trenches, the former may equally be interpreted as backfilled ditches or trenches, but they are probably not part of the drainage system. In area 2, the central trench of the drainage system is crossed by an irregular line, which also appears as a

weak, positive anomaly (Fig. 18g). The irregular course does not imply any intentional design; the anomaly possibly represents a (refilled) cattle track.

A long trench, which had been dug and refilled recently before the survey (see Fig. 8), crossing area 1 and 2 from north to south, is not visible in the geomagnetic data.

Given the problems mentioned above regarding the interpretation of the many small, non-linear anomalies, there are no features in areas 1, 2 or 3 that are obviously of archaeological interest. Two notably stronger positive anomalies in area 1 with diameters of 1–1.5m could possibly be caused by pits with positively magnetised fillings.

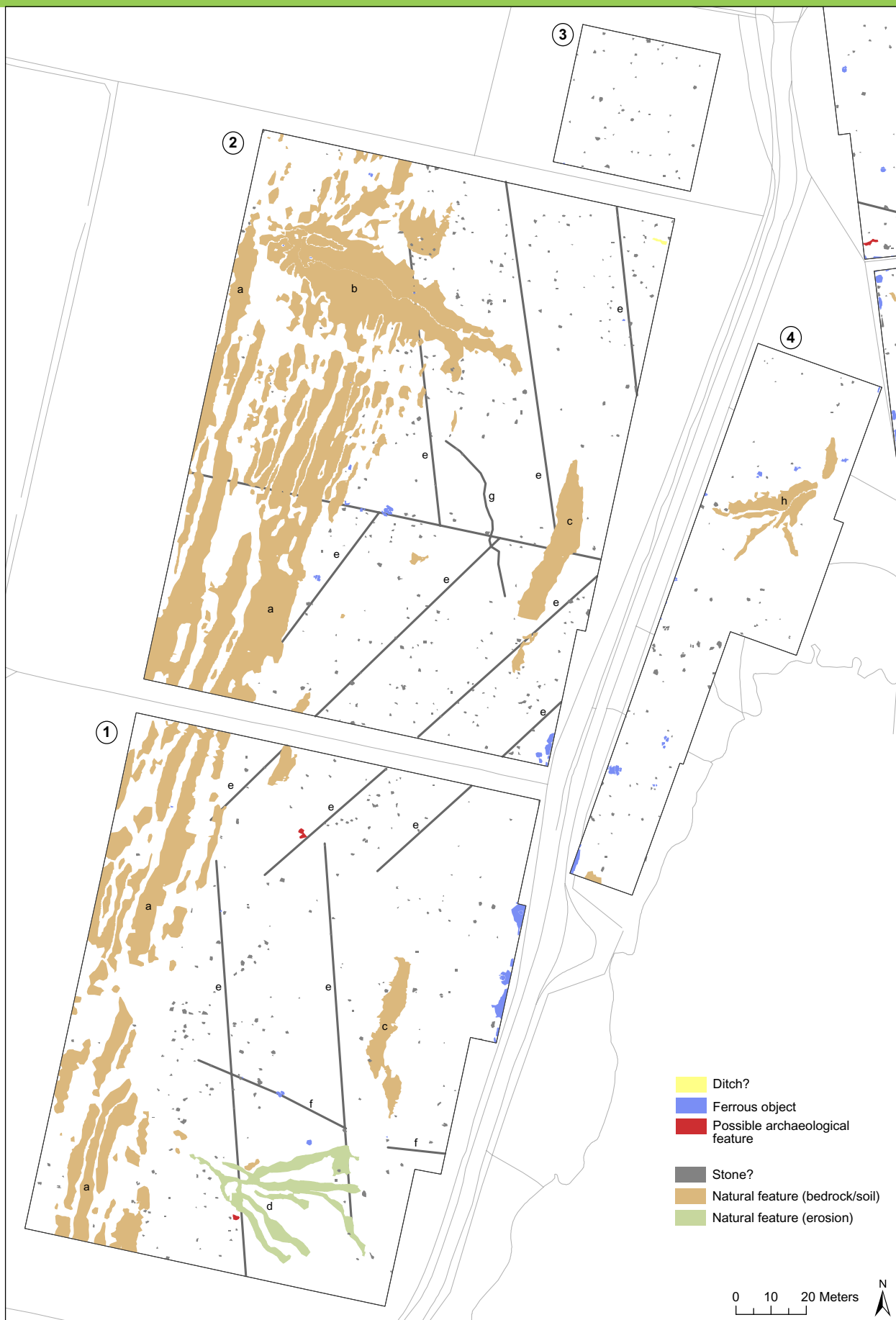
Area 4 (Figs. 17-18)

In the northern half of area 4, some large anomalies were encountered, which probably have a hydrogenetic origin (Fig. 18h). Similar to the large gully in area 1, they may be caused by an accumulation of iron oxides in the marshy soil. All other anomalies in this area are much smaller and most likely produced by single stones and ferrous debris.

Area 5 (Figs. 19-20)

The Law Ting Holm, at the south end of area 5, produces a series of strong anomalies and clearly stands out from the “quiet” surrounding marshland (Fig. 20A). Considering the strong response of the bedrock in areas 6, 7 and 8 – the same material that constitutes the Holm – this may not be surprising, and most anomalies at the Ting Holm are probably caused by natural features. However, the regular shape of the Holm is quite remarkable and may well be humanly modified. It appears as a rectangle of 25 × 21m with rounded corners. The outline is marked by a linear, negative anomaly (Fig. 20a), framed from the inside by a series of strong, positive anomalies (Fig. 20b). The latter are

Figure 18 (right) Interpretation of the magnetic survey in areas 1 to 4, overlain on the OS cadastral map (© Crown Copyright/database right 2010. An Ordnance Survey/EDINA supplied service). Map created by J. Coolen and A. Sanmark.



probably caused by rocks near, or protruding from, the surface. Nevertheless, the sharp outline of the Holm's northern side and the rather vague boundary in the south, as they appear in the geomagnetic data, are almost reverse to the present topography. In the contemporary landscape the Holm has a sharp edge at its southern end, while it gradually slopes down towards the north.

The rectangular shape of the Law Ting Holm is also revealed by a series of aerial photographs, taken by Dave Cowley for the Royal Commission on the Ancient and Historical Monuments of Scotland during the course of our survey (see Fig. 5). The sharp outline is also visible through vegetation marks: the marsh marigolds (*caltha palustris*), which abound in the marshland at the lake side, don't grow at the rocky islet, while patches of daffodils (*Narcissus*) mark the border between the marshland and the higher land (i.e. the old shoreline) at both ends of the causeway.

The edge of the depression at the centre of the Ting Holm appears in the geomagnetic data as a negative anomaly (Fig. 20c). This is mainly caused by the different height of the sensors above ground level on both sides of the edge. The geomagnetic data does not seem to support the hypothesis, that the stone is fire-cracked (see above). However, heating of the stone would only have resulted in thermoremanent magnetisation if the stone contains ferromagnetic or ferrimagnetic minerals and was exposed to temperatures higher than the Curie point.

Both the geomagnetic data and the aerial photographs also show that the causeway is not aligned with the centre of the Holm, but rather points to the west of it. The causeway appears in the geomagnetic data as an alignment of positive anomalies, caused by the igneous (?) stones (Fig. 20B). However, not all stones cause a magnetic anomaly. At the south end, where the double row of stones can be best recognized in the field, there are no significant anomalies. By contrast, the geomagnetic data reveals several stones at the north end, which seem to be overgrown by vegetation. The most northerly stones that can still be associated with the causeway are not in line anymore, indicating that the upper end of the causeway has been disturbed. In any case, the stone causeway does not continue beyond the old shoreline.

More or less halfway down the causeway a strong, bipolar anomaly can be seen, caused by a ferrous object (Fig. 20d). While the nature of this object can of course not be deduced from its magnetic anomaly, its central position on the causeway seems at least remarkable.

Several linear, yet rather fuzzy, anomalies were encountered to the north and west of the causeway, running parallel to it (Fig. 20e). Nevertheless, they may be caused by natural rather than archaeological features. Apart from the vague outline of the anomalies, it needs to be stressed that the direction of the causeway parallels the general orientation of the geological structures in the valley.

As mentioned before, the geomagnetic data also show the loose stone alignment leading from the upper part of the causeway to the northwest (Fig. 20f). This was interpreted as an old wall in the 1946 report of the RCAHM (see above). The stones are not as well aligned as those of the causeway, and very loosely spaced. The stones near the field boundary to the northwest, which seem to belong to the same alignment, do not appear in the magnetic data, nor does the semicircular field wall to their north. Both features are clearly visible on the aerial photographs (Figs. 5 and 6a and c).

Some 50m to the north of the stone alignment mentioned above, a series of strong, bipolar anomalies, caused by ferrous or thermoremanently magnetised objects, seems to constitute a parallel alignment (Fig. 20g). While certainly manmade, a further interpretation of these features is not possible at the moment.

Area 6 (Figs. 19-20)

Area 6 is dominated by a number of very strong, irregularly shaped, bipolar anomalies, probably caused by igneous bedrocks (Fig. 20h). They run diagonally through the northeast corner of the area, with values ranging from 2347.0 to -1437.4 nT. Similar anomalies were encountered in areas 7 and 8. According to the

Figure 19 (right) Shade plot of the enhanced magnetic survey data of areas 5 to 7, overlain on the OS cadastral map (© Crown Copyright/database right 2010. An Ordnance Survey/EDINA supplied service). Grey scale plot clipped at 0.5 standard deviation of the entire dataset (55.0 nT). Map created by J. Coolen and A. Sanmark.



geological survey, the local bedrock in these areas comprises metamorphosed igneous and sedimentary rocks (metallava, metatuff, metalimestone and semipelite).

The striping in the eastern half of area 6 is caused by recent ploughing marks, some of which constitute large anomalies (Fig. 20i). The sharp contrast between the western and eastern part of the survey area can be mainly attributed to the varying effect of the de-striping function.

A negative, linear anomaly runs in a slight curve in a WNW-E direction through area 6 and continues in area 7 (Fig. 20j). Here, it runs towards a large drain/cistern (Fig. 20k), and it can therefore be interpreted as a sewage drain or water supply.

A double linear feature in the central and north-eastern part of area 6 is harder to interpret (Fig. 20m). It consists of two parallel, weak positive anomalies, which converge with or cross the drain mentioned before. The two lines run more or less in W-E direction, about 3.5m apart, before taking a sharp turn towards the NE. After this turn, the two lines converge; only the southern anomaly continues in a straight line for at least 60m, following the same direction as the strong anomalies caused by the rocks. This line possibly extends further south as well, where a short and less clear, linear anomaly aligns with it (Fig. 20n). These anomalies are probably caused by the weakly magnetised filling of ditches or trenches, but the function of these alleged ditches cannot be concluded from the magnetic data. However, they might be of recent date, since the two parallel anomalies run in the same direction as the fence ahead of them and at a right angle to the ploughing marks in area 6.

A rather vague, linear anomaly can be seen in the eastern half of the area, which aligns with the causeway (Fig. 20o). It could be caused by a (gravel) track leading up to the church and might thus represent the continuation of the causeway, but this interpretation is highly speculative.

Most of the smaller anomalies in this area may be caused by buried stones and ferrous objects. However, on the basis of their shape, size and anomaly strength, some of them may possibly represent archaeological features such as pits.

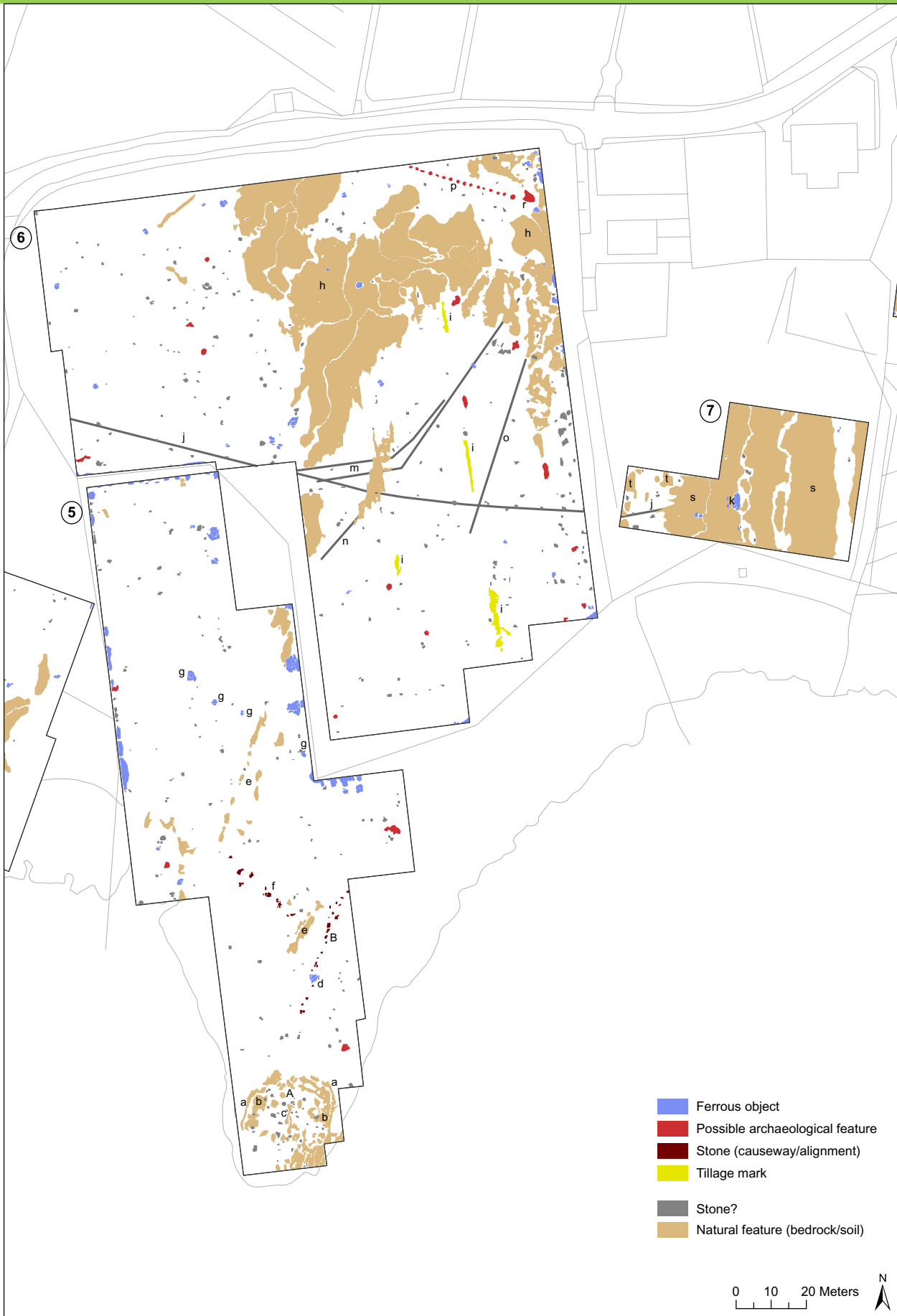
Except for the clear alignment of pit-like anomalies in the north-eastern corner, there are no obvious clusters of possible archaeological features, and it is hard to put them into context. The alignment mentioned before consists of sixteen positive anomalies of 0.5 to 1m diameter, spaced 2m apart (Fig. 20p). A larger anomaly at the eastern end may also be part of it, but is not exactly aligned with it, and could therefore also be natural (Fig. 20r). The anomaly strength of these features ranges from 12.2 to 199.3 nT, but mostly lies between 30 and 80 nT. These values seem rather high for regular pit fillings and correspond to thermoremanently magnetised or ferromagnetic objects. However, the anomalies lack the negative troughs typical for the latter. Considering the location and orientation of the alignment, it may connect to Tingwall Manse, but it could also predate the present infrastructure.

Area 7 (Figs. 19-20)

The small area 7 is almost entirely covered by some large anomalies of geological nature, which make it barely possible to detect any other, more subtle anomalies (Fig. 20s). These are probably caused by igneous bedrock; in fact, rocky outcrops prevented surveying in the north-western part of the area. The anomalies have a more regular outline than their counterparts in area 6 and consist of alternating, positively and negatively magnetised, N-S oriented stripes.

A concrete drain or well with a metal lid, located near the centre of the area, produced some anomalies which even outweigh the strongly magnetised background (Fig. 20k). The negative, linear anomaly, which crosses area 6 and continues in area 7, leads towards it, allowing for the interpretation as water supply or sewage drain (Fig. 20j). The smaller (but still fairly large) anomalies at the western edge of the area may also be produced by rocky outcrops just below the surface, but could also present archaeological features (Fig. 20t).

Figure 20 (right) Interpretation of the magnetic survey in areas 5 to 7, overlain on the OS cadastral map (© Crown Copyright/database right 2010. An Ordnance Survey/EDINA supplied service). Map created by J. Coolen and A. Sanmark.



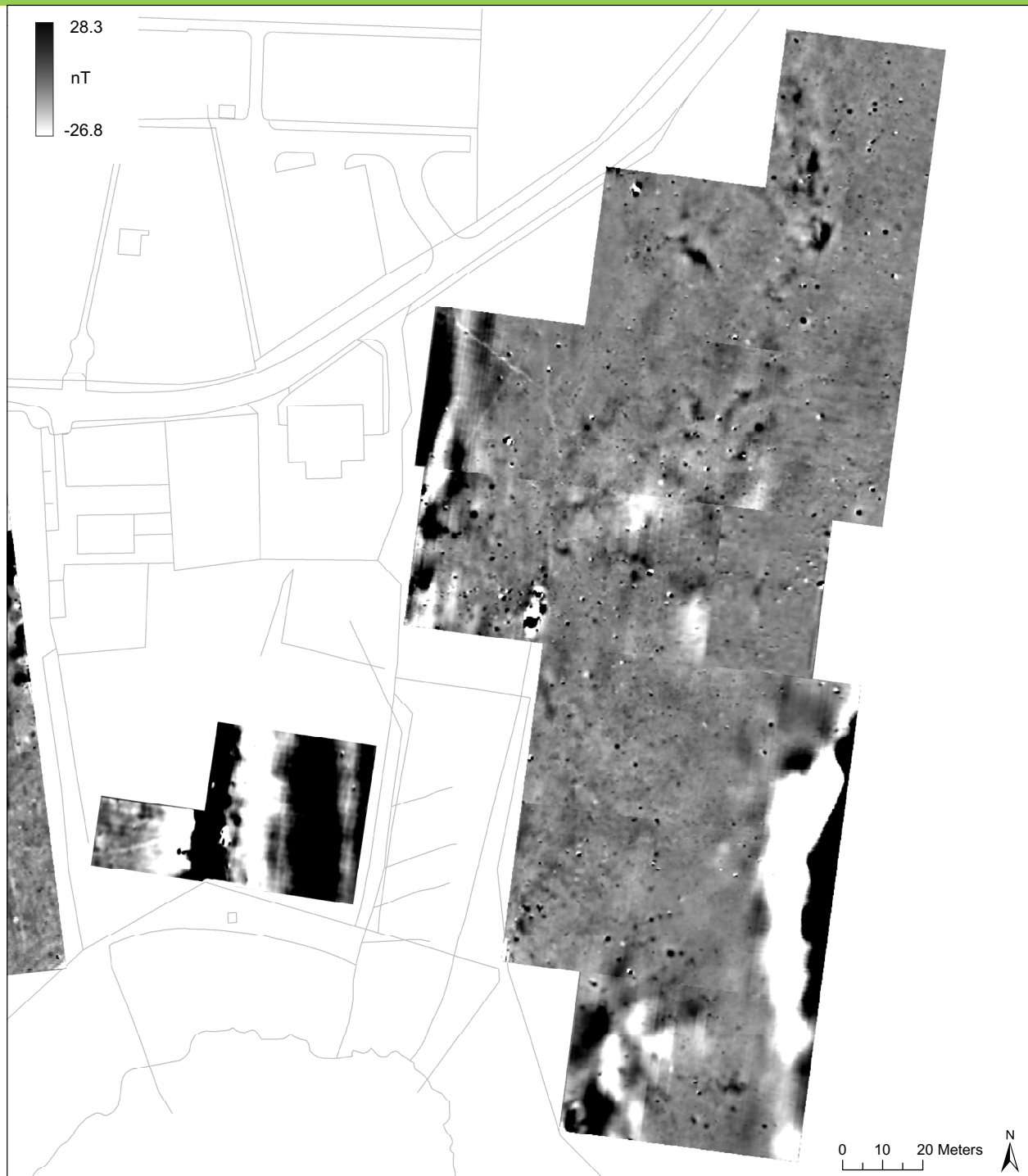


Figure 21 Shade plot of the enhanced magnetic survey data of areas 7 and 8, overlain on the OS cadastral map (© Crown Copyright/database right 2010. An Ordnance Survey/EDINA supplied service). Grey scale plot clipped at 0.5 standard deviation of the entire dataset (55.0 nT). Map created by J. Coolen and A. Sanmark.

Area 8 (Figs. 21-22)

Large and strong anomalies caused by the bedrock, similar to those encountered in areas 6 and 7, are restricted to the western and eastern edges of the area (Fig. 22a). A number of larger, irregularly shaped anomalies, both positive and negative, clustering in the northern half

of the area, may also be caused by geological or soil features (Fig. 22b). This whole area is characterised by being strewn with small, positive anomalies with varying strengths. Similar anomalies appear in all areas, but they appear in a much higher density in area 8. Again, most

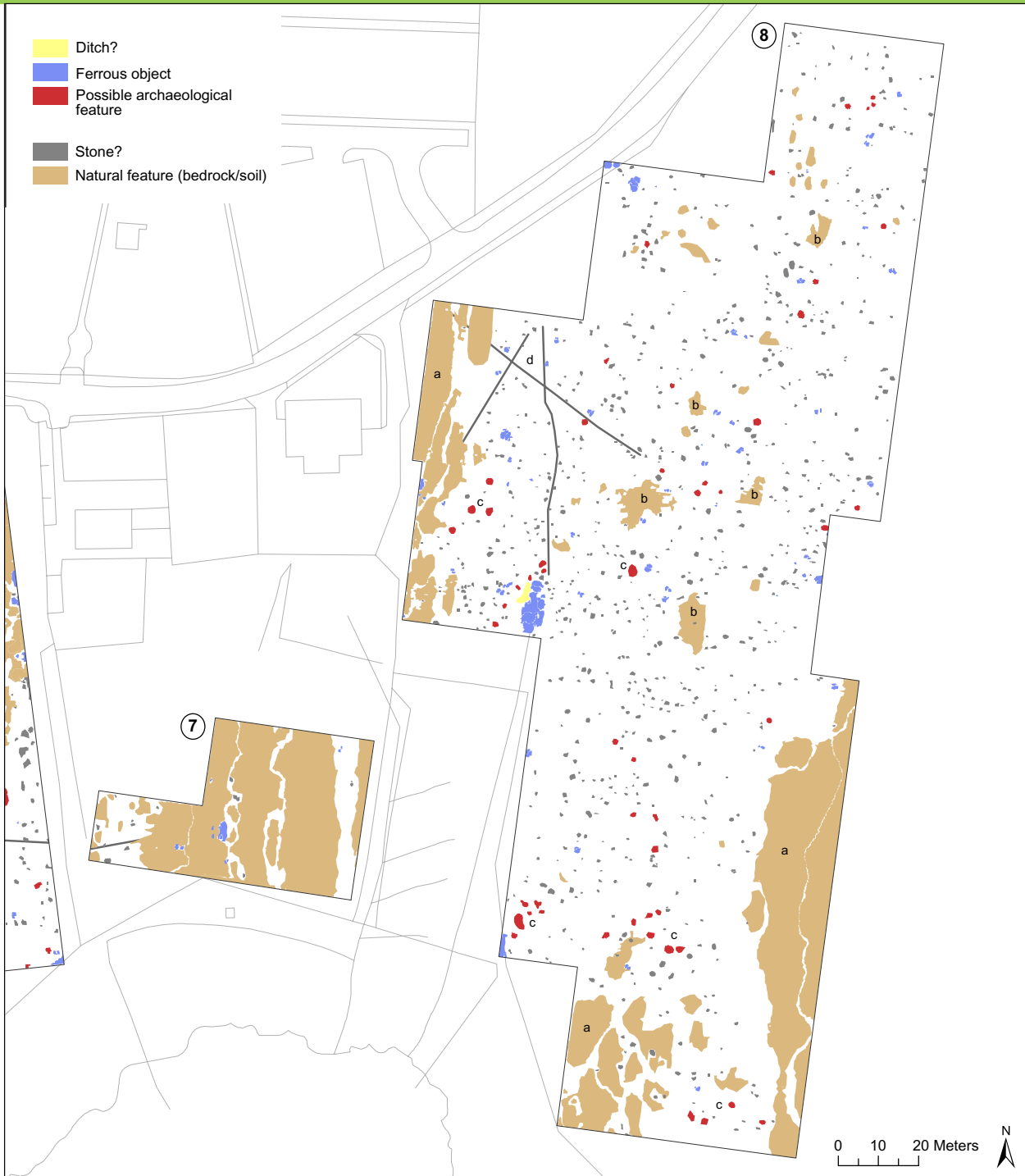


Figure 22 Interpretation of the magnetic survey in areas 7 and 8, overlain on the OS cadastral map (© Crown Copyright/database right 2010. An Ordnance Survey/EDINA supplied service). Map created by J. Coolen and A. Sanmark.

of them may be caused by single stones, while some show the high values and bipolarity typical for ferrous objects. However, some of these anomalies seem rather large for a single stone, and have a regular, near-round shape. They may be tentatively interpreted as possible archaeological features (Fig. 22c). Some of these

features constitute small clusters of up to eight pit-like anomalies. In the southwest of area 8 six roughly aligned pit-like structures are visible. Three negative, linear anomalies appear at the western edge of area 8, crossing each other (Fig. 22d). Two of them are straight, while the third and longest one, running N-S, shows

a curve in its centre. The latter runs towards a number of large, ferromagnetic anomalies, which in turn lie at the start of a drain also marked on the digital OS map (1:10.000). The linear anomaly running NE-SW aligns with the drain in area 7. Thus, the negatively magnetised lines are probably part of a drainage and/or sewage system.

Discussion

Despite the magnetic response encountered at the site being predominantly good, the interpretation of the data is severely hampered by the strong magnetisation of the local geology. While large outcrops of bedrock and concentrations of iron oxides in the marshland can be easily identified, the vast majority of small anomalies cannot be readily interpreted. Considering the anomaly strength encountered over the bedrock outcrops, single stones belonging to the same rock unit, can be expected to produce clear anomalies as well. These may have values similar to those produced by ferrous or thermoremanently magnetised features, but obviously, dependent on the size, depth and orientation of the object, much lower values are possible too. Hence, the anomaly strength hardly presents a clue for the interpretation. Moreover, the large number of relatively strong anomalies reduces the chance for weaker anomalies, such as can be expected from most archaeological features, to be recognised. Based on their shape, distribution and (less so) magnetisation, some promising anomalies were tentatively interpreted as archaeological features, but we deliberately refrain from a further classification.

Archaeologically speaking, the most interesting results were obtained at the Law Ting Holm. The shape of the Holm appears far more regular in the geomagnetic data than on aerial photographs or in the field. While a natural feature in itself, the outline of the Holm may well have been artificially modified to highlight its significance and comply with a standardised mental template of a legal site being round. The shape of the Holm is rectangular, rather than being completely round. This conflicts with the description in the Gulathing Law that a Ting site should have a round shape (e.g., Brink 2002: 90). However, the rounded edges of the rectan-

gle might be the results of an attempt to give the Holm a round shape.

The detected stones at Law Ting Holm could be natural or part of archaeological features. In any case, the results do not contradict the descriptions handed down by Brand and Edmonston referring to a bench and seats made of stone for the officials gathering at Law Ting Holm (see above). An archaeological excavation of the site would surely help to clarify such features. It would also increase the knowledge about the causeway which according to the survey data was once more extensive than it now is, with several stones overgrown at the northern end and continuing about 20m further than visible today. An excavation would also shed light on the possible track discovered in area 6 and tentatively interpreted as track connecting Law Ting Holm with the old kirk.

If it is true that a crowd gathered at the slopes surrounding the Law Ting Holm every year for several centuries, presumably for several days each time, it is most likely that this has left traces behind. It is feasible that some of the possible archaeological features in areas 5, 6 and 8 are traces of rubbish pits, substructures for shelters, fireplaces (indeed, some anomalies may be thermoremanently magnetised) or (metallic) objects lost by the attendants of the Ting. Most of the anomalies, which were interpreted as possible archaeological features, are located in areas 6 and 8. Some clustering can be seen, but clear structures are not deducible.

The alignment of loose stones in area 5, leading from the north end of the causeway towards the field boundary in the West, more or less following the old shoreline, was previously interpreted as an old field wall or as a wall confining the northern shore of the lake (see above) (see Figs. 5 and 20). However, a field wall situated immediately by the former shore of the loch does not seem very likely. A water colour drawing of Sir Henry Dryden, made ca. 1855, shows the Law Ting Holm and the northern shore of the lake (Fig. 23). The image was produced before the lake was artificially lowered. Both Holm and the causeway are clearly visible, as is a wall or dike-like structure confining the northern shore of the lake. The stones in question could be part of this structure, but the structure does not necessarily relate to the assemblies but could have been part of a dike protecting the land from flooding.



Figure 23 Law Ting Holm on a water colour painting by Sir Henry Dryden, ca. 1855. Cover illustration of *Old-Lore Miscellany* 1910.

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