Clachan an Diridh 'Four Poster'

Topographic and Geophysical Survey Report

AOC 22190

3rd October 2012

AOC Archaeology Group

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Clachan an Diridh 'Four Poster' Stone Circle
Topographic and Geophysical Survey Report

On Behalf of:	**Forestry Commission Scotland** **Inverness Business and Retail Park** **1 Highlander Way** **Inverness**
National Grid Reference (NGR):	**NN 838 620**
AOC Project No:	**22190**
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Illustration by:	**Gemma Hudson** **Tony Liddell** **Graeme Cavers**
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Date of Report:	**23rd October 2012**

This document has been prepared in accordance with AOC standard operating procedures.

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Abstract

A laser scan survey and geophysical prospection, involving resistivity and magnetometry was undertaken at Clachan an Diridh 'four poster' stone circle on behalf of Forestry Commission Scotland. The geophysical results are inconclusive but may suggest the presence of sub-surface archaeology near the standing stones. The results of the 3D survey above ground were integrated with the geophysical results to produce a 3D visualisation of all elements of the site.

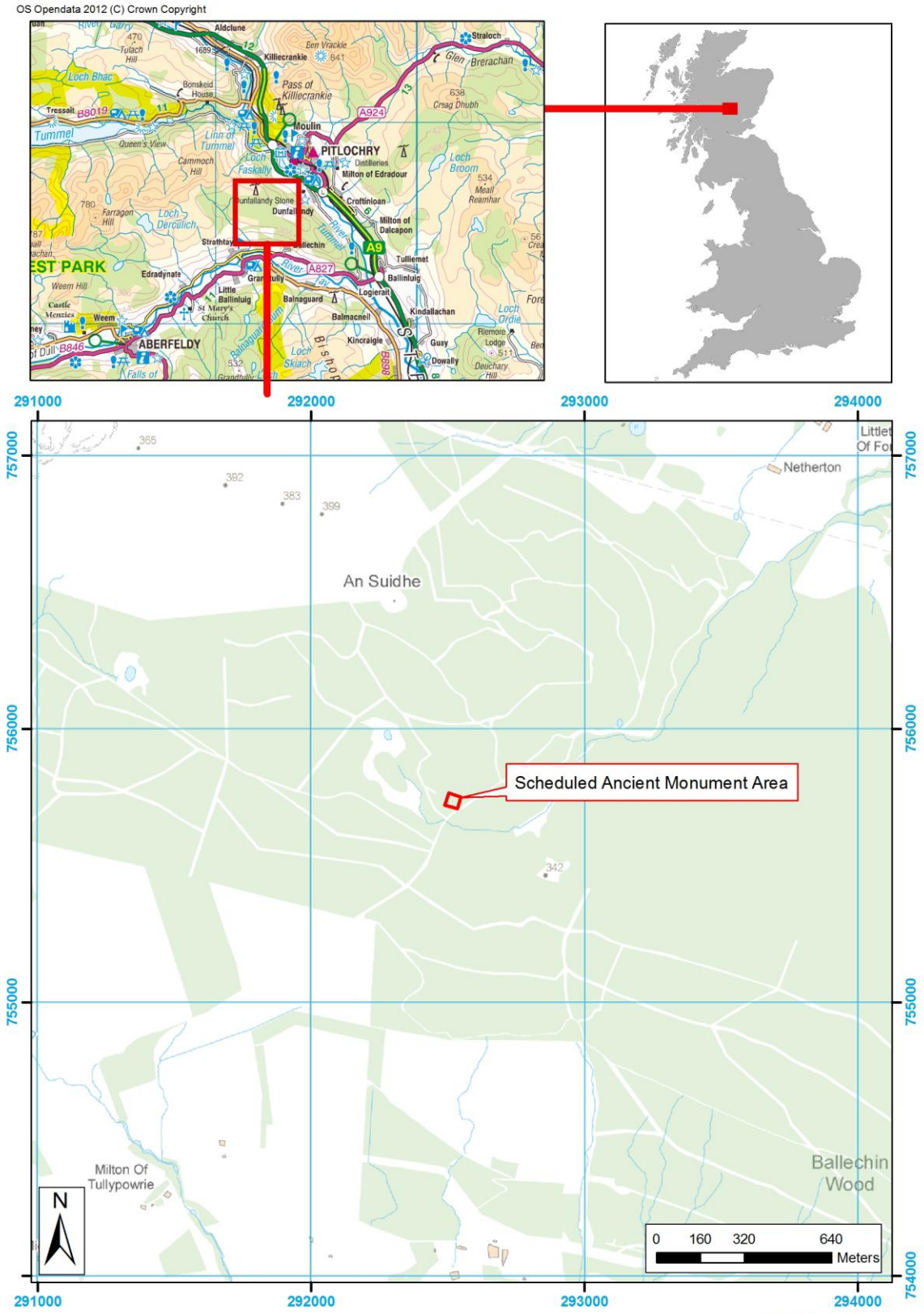

Figure 1: Location of Clachan an Diridh

Clachan an Diridh Stone Circle

Topographic Survey

1.0 Clachan an Diridh

1.1 'Clachan an Diridh' is the name given to the small probable 'four poster' stone circle located half a kilometre south-west of Pitlochry (Figure 1; NGR: NN 92518 55743; NMRS No.:NN95NW 5). The name means 'stones of the ascent or brae' which reflects the slope steepness leading up to the site (Burl, 1976). The site has been known locally as "Clachan-direach" (Coles, 1908), "The Druids Stones" (OS, 1971) and "Fonab Moor" (Burl, 1976), and has been suggested as dating to c.1600BC (Burl, 1971). Coles (1908) also mentions the name "Four Stones" for the site and mentions how this name must have been handed down for generations seeing as the site has only ever been recorded as having three stones, with the first instance being by Wilson in his 1983 *'Prehistoric Annuls of Scotland.'*

1.2 The site is considered to be a 'four poster' stone circle although only three stones remain; that is a quadrilateral arrangement formed by four large orthostats, generally dating to the later Neolithic and early Bronze Age period. There is a particularly dense concentration of such sites in northern Perthshire, with examples scattered through the Tay, Earn and Tummel valleys.

1.0 Earlier Surveys

1.2 The site was surveyed by Coles (see figures 2 to 4) in 1908 and visited and recorded by the Ordnance Survey in 1971, although the current survey constitutes the first modern detailed archaeological survey.

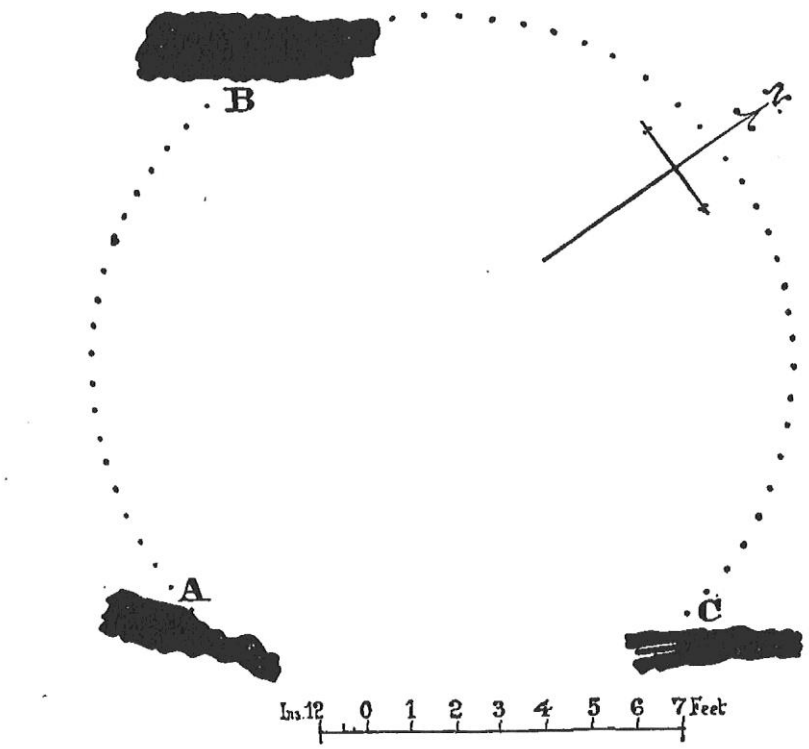

Figure 2: Plan of the site made by Coles (1908:110).

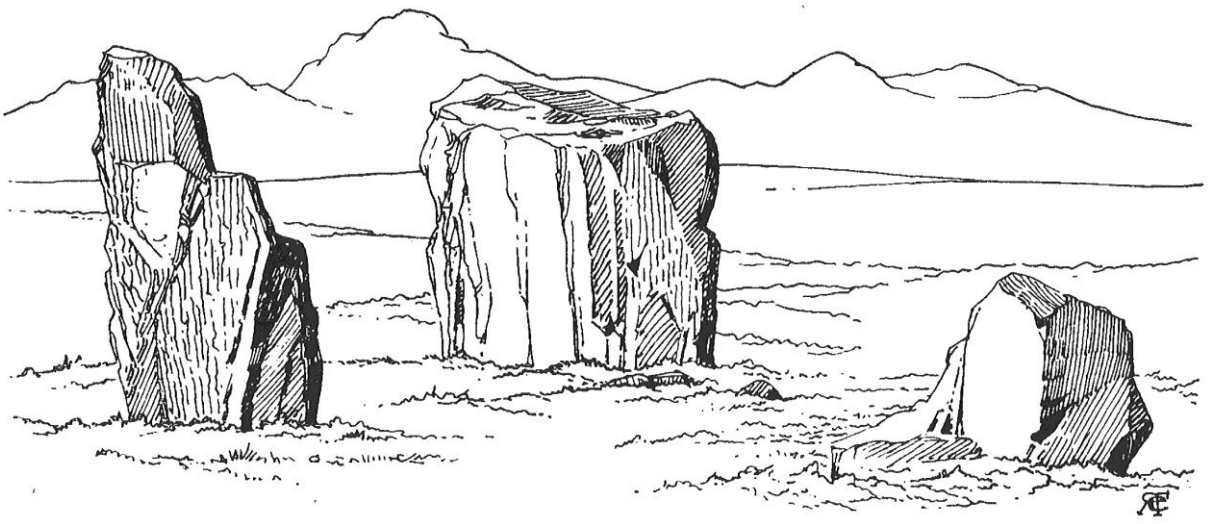

Figure 3: View of the site from the East published by Coles (1908:111).

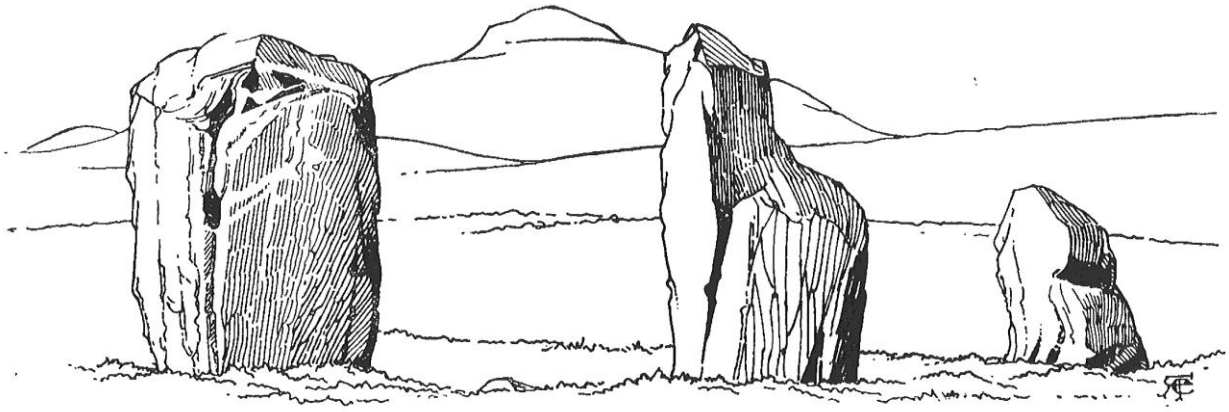

Figure 4: View of the site from the South, published by Coles (1908:111).

3.0 Laser scan survey

Objective

3.1 The topographic survey aimed to produce a detailed 3-dimensional record of the stone circle and its immediate environment. The products of the 3D survey were designed in a format designed to allow the integration of the gephysical results and visualisation in 3D.

Methods Statement

3.2 The survey was carried out using a Faro Focus 3D laser scanner, controlled using a Trimble S6 total station. Given the dense coverage of heather on the site, the total station was used to produce a ground surface elevation model, reaching areas that could not be seen by the scanner. A point cloud of the site and surrounding topography was produced containing 280 million measurements- the data was registered in Faro Scene and edited in Trimble Realworks. The raw pointcloud was processed to detailed geometric meshes using Trimble Realworks. 3D visualisations of the site were produced using Blender 2.6 to integrate the geophysical and topographic data. 3D views and animated flythroughs were produced to assist in the interpretation of the combined datasets (see section 2).

Dates

3.3 The topographic survey was carried out on 27th September 2012.

Personnel

3.4 The topographic survey was carried out by Gemma Hudson and Jake Streatfeild-James with test-pitting by Jake Streatfeild-James.

OASIS

3.5 An OASIS entry has been created for the topographic survey, linked to that created for the geophysical survey. AOC Archaeology Group's OASIS ID is for this project is **aocarcha1-136133.**

4.0 Description of the site

4.1 The site is generally as described by previous surveyors. The most visible element of the site are the three large orthostats of the quartzieous gritty sandstone. A number of stone fragments are strewn between the stones which may be remnants of the original fourth orthostat. The three orthostats vary greatly in dimension and shape although they all follow the same NNE-SSW alignment. The largest of the group is the most westerly stone which stands upright at an opposing height of 1.5m, width of 1.65m and maximum thickness of 0.5m. The WNW and ESE faces are relatively smooth, even and flat but the shorter SSW and NNE faces are jagged and cracked along the stone grain. At the time of survey the stone was almost an even cuboid shape apart from the top which

was flat and even apart from its general sloping down to the north end of the stone. The south stone has a maximum height of 1.65m which is higher than the west stone although it is almost L-shaped as much off the top of its northern end has eroded away. The NNW and SSE faces are 1.55m wide and relatively smooth on their lower half although the tops of them are very uneven and eroded. The stone is 0.30m thick at its southern end and decreases in width to a 0.05m on its northern end. The stone is visibly frost-cracked all over in the same vein as the west stone. The stone is still upright but is visibly falling out in a SSE direction. The northern stone is the smallest of the group with a maximum height of 0.80m, although it is now falling into the site in a north-west direction. It is almost triangular, with a maximum width of 0.85m and is also trangular in plan with a thickness that varies from 0.17m in the southern end to just 0.10m at the northern end.

4.2 The four stones form a triangle although with a fourth they would have set a square approximately 4.65m NNE-SSW and 4.5m WNW-SSE. The stones sit atop a natural ridge approximately 28m in diameter from east to west which sits 1.5m higher than its surroundings, although the general topography of the area is undulating. The stones are situated within an area of forestry which has been recently cleared, leaving many tree stumps on and around the site. A track created for timber haul vehicles crosses the site from east to west at the north of the Scheduled Ancient Monument Area.

4.3 To the south-east of the site an area of quarrying is visible next to the forest track. This is most likely where material to build the track was sourced from.

4.4 The site does not seem to be set on top of a cairn in the way that similar sites have been found to, although the area was greatly overgrown with heather at the time of survey which may obscure any kerb stones or other features that may indicate the existance of a cairn. No further features of the site are visible above ground.

5.0 Condition

5.1 The site is generally in good condition, with few obvious imminent threats to its integrity given the modern management of the surrounding forestry. Tree growth has been managed around the site although there are several stumps on and close to the site. The track that crosses the site does not appear to have caused any damage and is at least 7m from any of the stones. No evidence for animal burrowing was seen although the site was extensively overgrown with heather, burrows may have been obscured from sight.

6.0 Test Pits

6.1 The platform occupied by Clachan an Diridh stone circle has been adversely affected, after having been tracked over by forestry machinery. In order to investigate the scope of the damage, and the make-up of the platform, three metre square test pits were excavated through the rutted area. Excavations were undertaken on an overcast day with showers, good archaeological visibility was maintained throughout.

Results:

Test pit 1:

0.00 to 0.10m mid red brown peaty topsoil, friable
0.10 to 0.14m 'b' horizon mid brown orange peaty topsoil, friable
0.14 to 0.25m mid brown orange clayey sand, compacted

Test pit 2:

0.00 to 0.12m mid red brown peaty topsoil, friable
0.12 to 0.16m 'b' horizon mid brown orange peaty topsoil, friable
0.16 to 0.20m mid brown orange clayey sand, compacted

Test pit 3:

0.00 to 0.11m mid red brown peaty topsoil, friable
0.11 to 0.14m 'b' horizon mid brown orange peaty topsoil, friable
0.14 to 0.50m mid brown orange clayey sand, compacted

No archaeologically significant material was encountered during the excavation of the three test pits. Test pits 1 and 2 were excavated to the upper interface of the natural, while test pit three was excavated to a depth of 0.50m, to investigate the make-up of the mound. Natural subsoil was found to be a highly compacted mid brown orange clayey sand. At 0.40m inclusions of weathered bedrock were discovered, increasing in frequency through the subsequent 0.10m. It is therefore suggested that the platform is a bedrock outcrop and not an anthropogenic feature.

Geophysical Survey

7.0 Objective

7.1 The principal aim of the surveys was to detect and map any sub-surface features associated with the stone circle, in order to broaden the understanding of the Clachan an Diridh monument and to inform any further heritage management and conservation issues at the site.

Methods statement

7.2 The surveys have been undertaken in accordance with instructions from the client and to current national standards and guidance (see para. 8.1 below).

7.3 Since the survey was within a Scheduled Monument the surveys were undertaken in accordance with a licence granted by Scottish Ministers under Section 42 of the Ancient Monuments and Archaeological Areas Act 1979.

Dates

7.4 Fieldwork was undertaken on the 20th and 21st August 2012. This report was prepared for 7th September 2012.

Personnel

7.5 Fieldwork was conducted by Duncan Hale (the Project Manager) and Rebekah Watson. The geophysical data were processed by Duncan Hale. This geophysical part of the report was prepared by Duncan Hale, the Project Manager, with illustrations by Janine Watson.

Archive/OASIS

7.6 The site code is **CAD12**, for **Clachan an D**iridh 20**12**. The survey archive will be supplied on CD to the client for deposition with the project archive in due course. Archaeological Services Durham University is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (**OASIS**). The OASIS ID number for this project is **archaeol3-133547**.

8.0 Landuse, topography and geology

8.1 At the time of survey the stone circle was within a large forestry plantation. Trees had been felled on all sides except to the north-east of the monument, and consequently much of the ground outside the actual stones was covered with brushwood, with tree stumps and larger debris also still remaining. It was therefore not possible to collect data in the southern and western corners of the 40m square survey.

8.2 The monument itself was in grass, with heather and sphagnum, on peaty soil. Narrow drainage channels cut across the survey area. Wheel ruts from forestry vehicles formed a rough track along the north-eastern side of the survey area, immediately beyond which were mature plantation trees.

8.3 The survey area varied in elevation between approximately 351m OD and 354m OD. The stone circle occupied a relatively level raised area at approximately 354m OD. There was a small low mound approximately 6m north-west of the stones. Beyond this higher ground the land fell away gently in each direction.

8.4 The underlying solid geology of the area comprises Neoproterozoic-Paleozoic metalava and metatuff of the Southern Highland Group, overlain by till in this area.

9.0 Geophysical survey

Standards

9.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Institute for Archaeologists (IfA) *Standard and Guidance for archaeological geophysical survey* (2011); the IfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Guide to Good Practice: Geophysical Data in Archaeology* (Schmidt & Ernenwein 2011).

Technique selection

9.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a suite of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar, electromagnetic survey and topsoil magnetic susceptibility survey. Some techniques are more suitable than others in particular situations, depending on site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.

9.3 In this instance, it was considered likely that cut features such as stone-holes, post-holes, ditches and pits might be present on the site, and that other types of feature such as cairns, stone or timber burial chambers and fired structures (for example cremations, kilns and hearths) might also be present.

9.4 Given the anticipated depth and nature of targets and the geological environment of the study area, two complimentary techniques were considered appropriate in this instance: fluxgate gradiometry and earth electrical resistance survey.

9.5 Electrical resistance survey is not affected by the local rock type and is suitable for detecting stone features such as cairns, walls, paths and culverts; it can also detect soil-filled features, depending on ground conditions at the time of survey. When a small electrical current is injected through the earth it encounters resistance which can be measured. Since resistance is linked to moisture content and porosity, stone and brick features will give relatively high resistance values while soil-filled features, which typically retain more moisture, will provide relatively low resistance values. Fluxgate gradiometry involves the use of hand-held magnetometers to detect and record anomalies in the vertical component of the Earth's magnetic field, which are caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect, for example, ferrous, stone, brick and soil-filled features.

Field methods

9.6 A 20m grid was established across the survey area and related to the Ordnance Survey National Grid using a Leica GS15 global navigation satellite system (GNSS) with real time kinematic (RTK) correction typically providing accuracy of 10-15mm.

9.7 Measurements of earth electrical resistance were determined using a Geoscan RM15D Advanced resistance meter with MPX15 multiplexer and a mobile twin probe separation of 0.5m. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was set to 0.1ohm, the sample interval was 0.5m and the traverse interval was 0.5m, thus providing 1,600 sample measurements per 20m grid unit.

9.8 Measurements of vertical geomagnetic field gradient were determined using a Bartington Grad601-2 dual fluxgate gradiometer. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was nominally 0.03nT, the sample interval was 0.25m and the traverse interval was 0.5m, thus providing 3,200 sample measurements per 20m grid unit.

9.9 Data were downloaded on site into a laptop computer for initial processing and storage, and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

9.10 Geoplot v.3 software was used to process the geophysical data and to produce both continuous tone greyscale images and trace plots of the raw (minimally processed) data. The greyscale images and interpretations are presented in Figures 2-4; the trace plots are provided in Figure 5. In the greyscale images, positive magnetic and high resistance anomalies are displayed as dark grey while negative magnetic and low resistance anomalies are shown as light grey. Palette bars relate the greyscale intensities to anomaly values in ohm for the electrical resistance data and nanoTesla for the geomagnetic data .

9.11 The following basic processing functions have been applied to the resistance data:

despike locates and suppresses spikes in data due to poor contact resistance

add adds or subtracts a positive or negative constant value to defined blocks of data; used to reduce discontinuity at grid edges

interpolate increases the number of data points in a survey to match sample and traverse intervals; in this instance the data have been interpolated to 0.125m x 0.125m intervals

9.12 The following basic processing functions have been applied to the geomagnetic data:

clip clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic

zero mean traverse sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities

destagger corrects for displacement of geomagnetic anomalies caused by alternate zig-zag traverses

interpolate increases the number of data points in a survey to match sample and traverse intervals; in this instance the data have been interpolated to 0.125m x 0.125m intervals

Interpretation: anomaly types

9.13 Colour-coded geophysical interpretations are provided. Two types of resistance anomaly have been distinguished in the data:

high resistance regions of anomalously high resistance, which may reflect concentrations of stone or rockhead, foundations, tracks, paths and rubble

low resistance regions of anomalously low resistance, which may be associated with soil-filled features such as pits and ditches

9.14 Three types of geomagnetic anomaly have been distinguished in the data:

positive magnetic regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic susceptibility soil-filled structures such as pits and ditches

negative magnetic regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings and other concentrations of sedimentary rock or voids

dipolar magnetic paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths

Interpretation: features

9.15 A colour-coded archaeological interpretation plan is provided.

9.16 A large oval of high resistance has been detected encompassing the standing stones. This could either reflect stone that was deliberately placed to form a platform or cairn, or could reflect near-surface bedrock.

9.17 Relatively low resistance values were recorded in the central part of this area. Additionally, four small pockets of low resistance were detected within the generally high resistance area. Given the presence of these it is perhaps more likely that the high resistance values reflect a man-made structure as opposed to bedrock with apparent voids. The four pockets of low resistance indicate an absence of stone, and each corresponds to a strong magnetic anomaly. The magnetic anomalies do not appear to be intense enough to reflect ferrous materials, but are of considerably higher magnetic susceptibility than typical soils and sediments; these anomalies could reflect burnt earth or other burnt/fired materials. It is probable then that these could reflect voids containing magnetically enhanced earth or burnt materials, which by extension could be interpreted as possibly cists, pots and cremated materials. Two of these features are within and adjacent to the standing stones. The most westerly feature could be within or beneath a small low mound noted on the ground about 6m west of the stones.

9.18 Small high resistance anomalies have been detected immediately adjacent to the three standing stones. These anomalies could reflect packing stones and backfill associated with the erection of the three stones.

9.19 Some discrete positive magnetic anomalies could possibly reflect the remains of narrow soil-filled features such as gullies, though these do not appear to be related to the monument.

9.20 Narrow parallel anomalies have been detected by both techniques across much of the survey area. These reflect existing drainage channels at the site.

9.21 Although some geomagnetic anomalies can be identified and interpreted, the data are relatively 'noisy'. This is almost certainly due to the local rock.

10.0 Conclusions

10.1 High resolution geomagnetic and earth electrical resistance surveys were undertaken at Clachan an Diridh four-poster stone circle near Pitlochry in Perth & Kinross.

10.2 The resistance survey has been the more useful technique in this instance, due to the magnetic component of the local rock, however, the techniques have been complementary in some regards.

10.3 An oval of high resistance anomalies around the standing stones appears to reflect a platform or cairn of deliberately placed stones rather than the rockhead. Four geomagnetic and resistance anomalies within this material could possibly reflect voids or cists within which burnt or fired materials have been placed. These anomalies could also reflect more recent materials or disturbance, however, they do not appear intense enough to reflect typical ferrous litter.

10.4 The surveys have not provided clear evidence for a kerb or ditch around the monument.

10.5 Several small magnetic anomalies could possibly reflect remains of small gullies, which do not appear to be associated with the monument.

10.6 Modern drainage channels across the site were detected by both techniques.

11.0 References

Burl, H. A. W. (1971) 'Two "Scottish" stone circles in Northumberland', *Archaeol Aeliana, 4th, vol.49* Pages): 45, 50

Burl, A. (1976) *The stone circles of the British Isles,* London and New Haven, p.363

Coles, F.R. 1908 'Report on Stone Circles Surveyed in Perthsire: North Eastern Section; with measured plans and drawings', *Proceedings of the Society of Antiquaries of Scotland*, vol.42, pp.95-165

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation*. English Heritage

Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*. Technical Paper **6**, Institute of Field Archaeologists

IfA 2011 *Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

Schmidt, A, & Ernenwein, E, 2011 *Guide to Good Practice: Geophysical Data in Archaeology*. Archaeology Data Service

Acknowledgements

AOC and Archaeological Services Durham University are grateful for the assistance of personnel of the Tay Forest District branch of the Forestry Commission Scotland for facilitating this scheme of works.

Clachan an Diridh 'Four Poster' Stone Circle

Survey Report

Section 2: Site Surveys and Plates

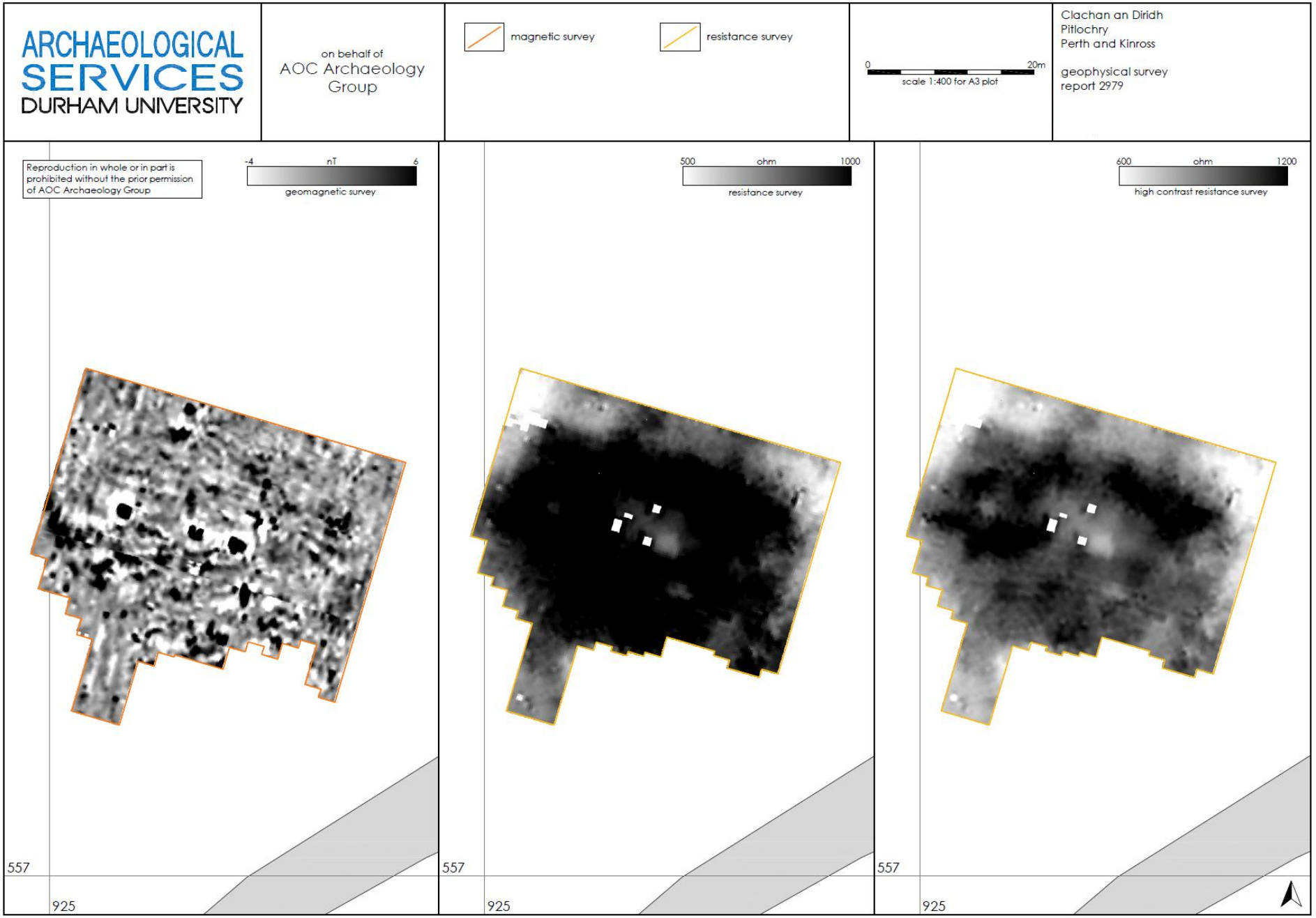

Figure 5: Geomagnetic and resistance surveys.

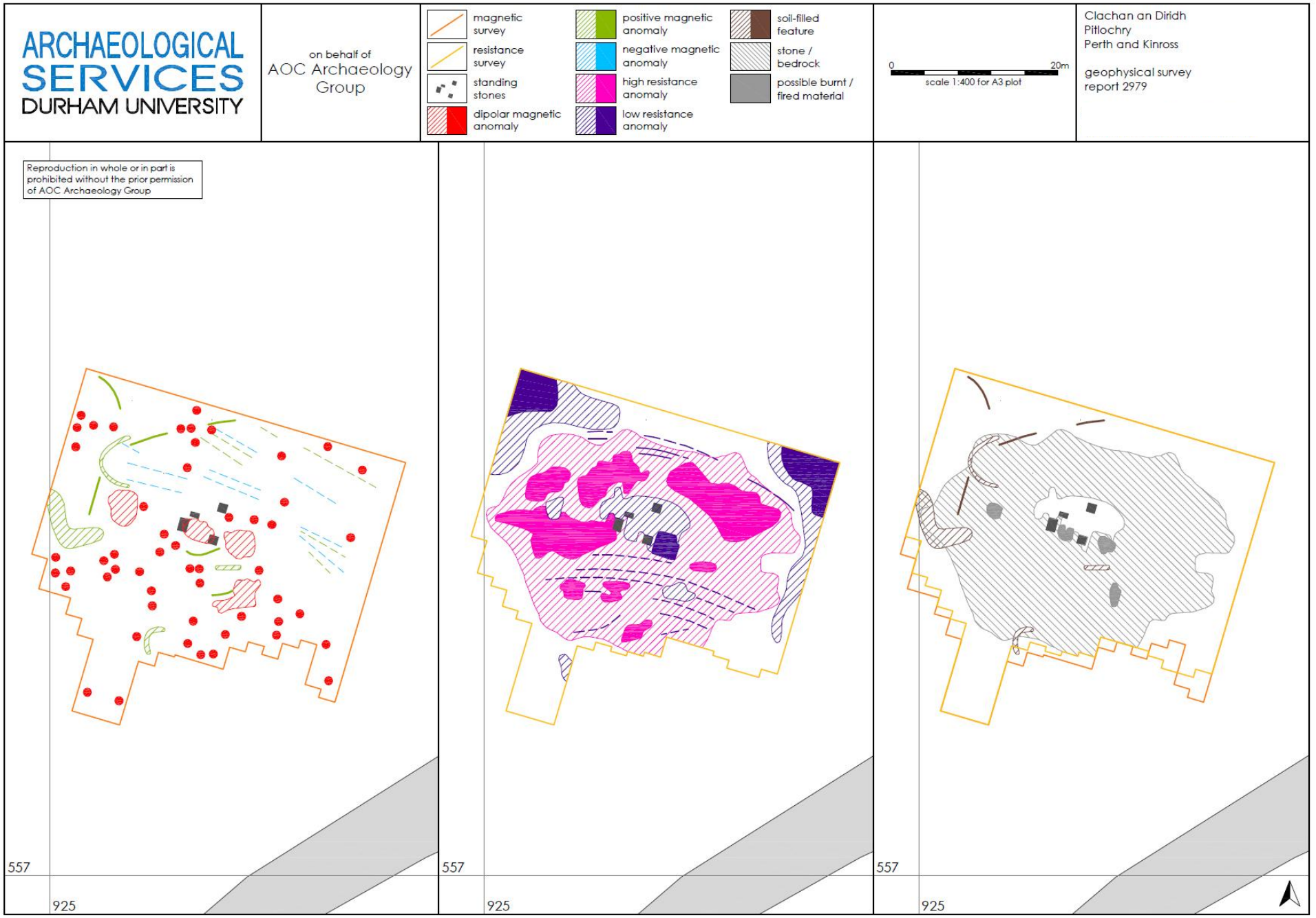

Figure 6: Geophysical and archaeological interpretations.

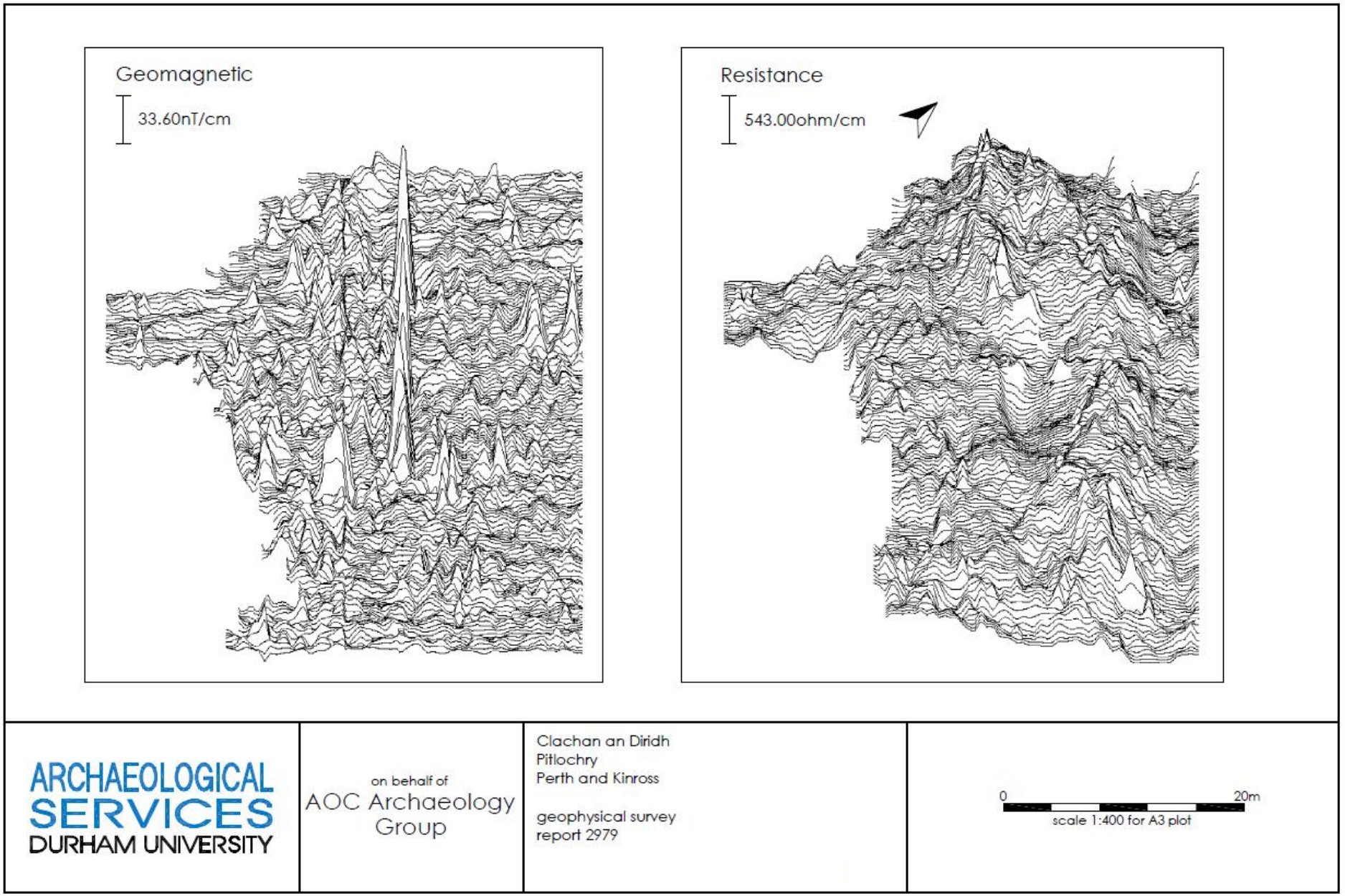

Figure 7: Trace plots of geophysical data

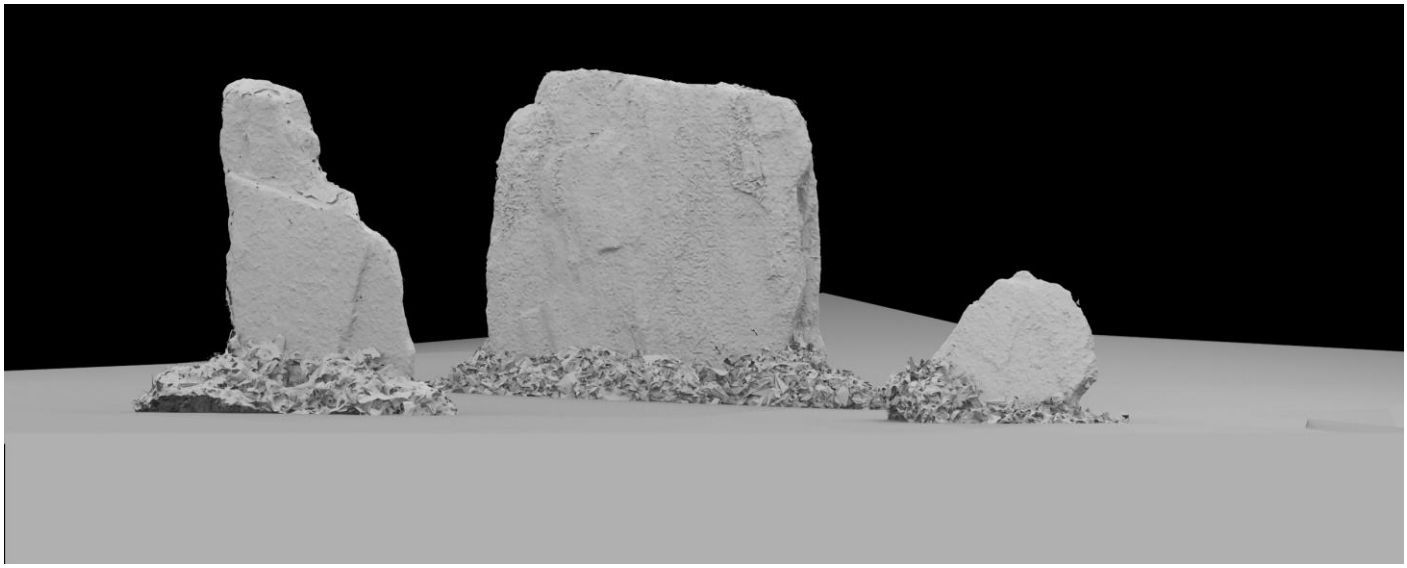

Figure 8: Laser scan view of the stones, from the E.

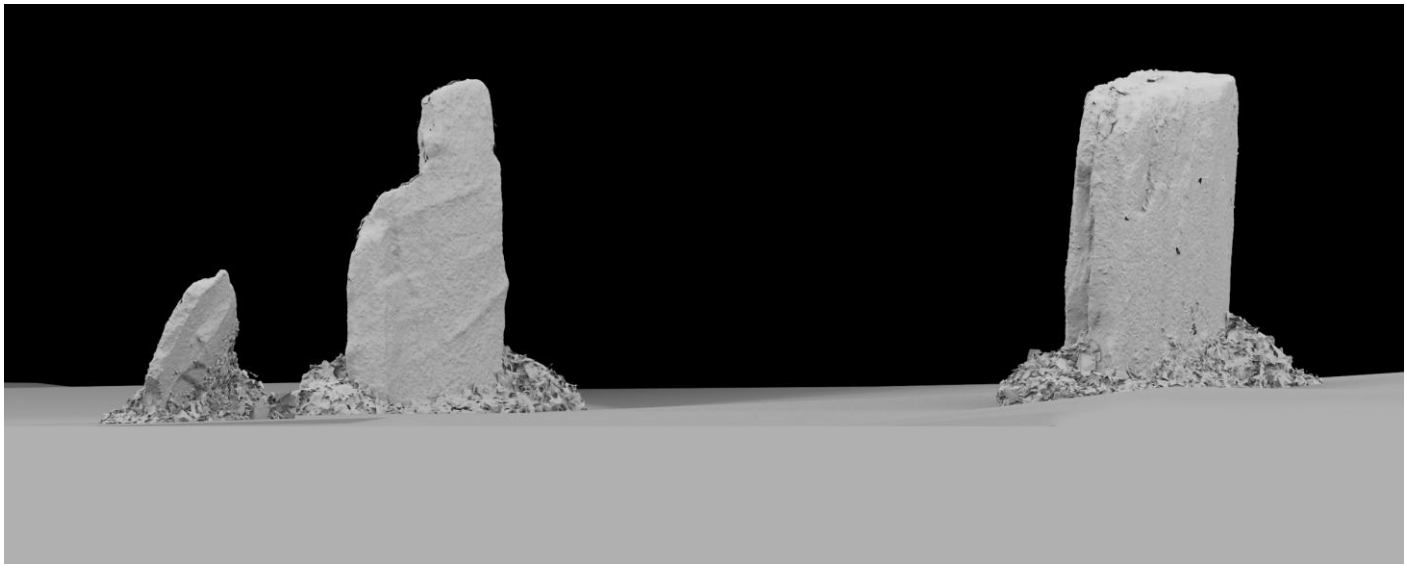

Figure 9: Laser scan view of the stones, from the N.

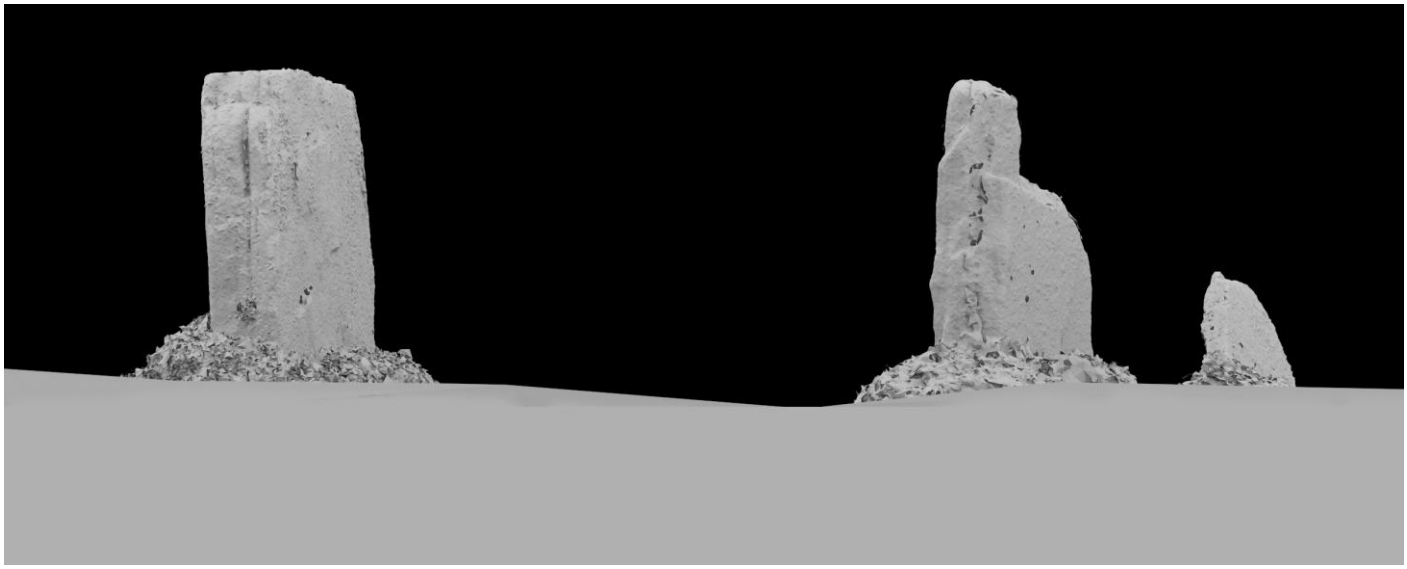

Figure 10: Laser scan view of the stones, from the S.

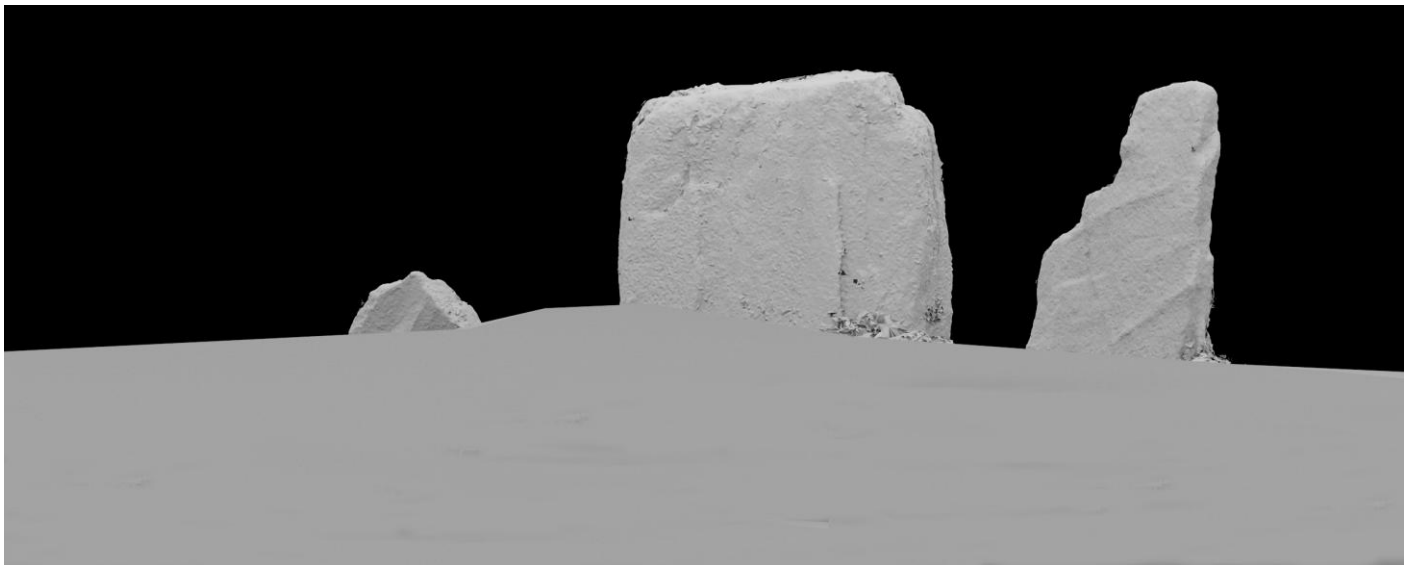

Figure 11: Laser scan view of the stones, from the W.

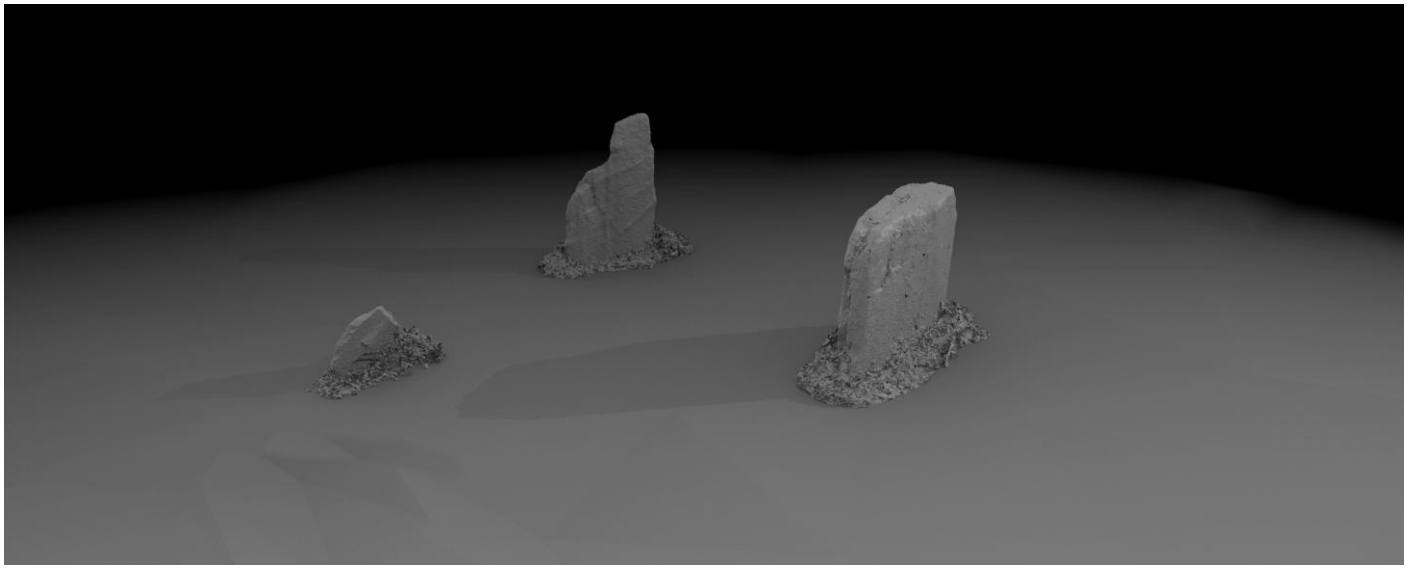

Figure 12: Laser scan view of the stones, from NW, lit from W.

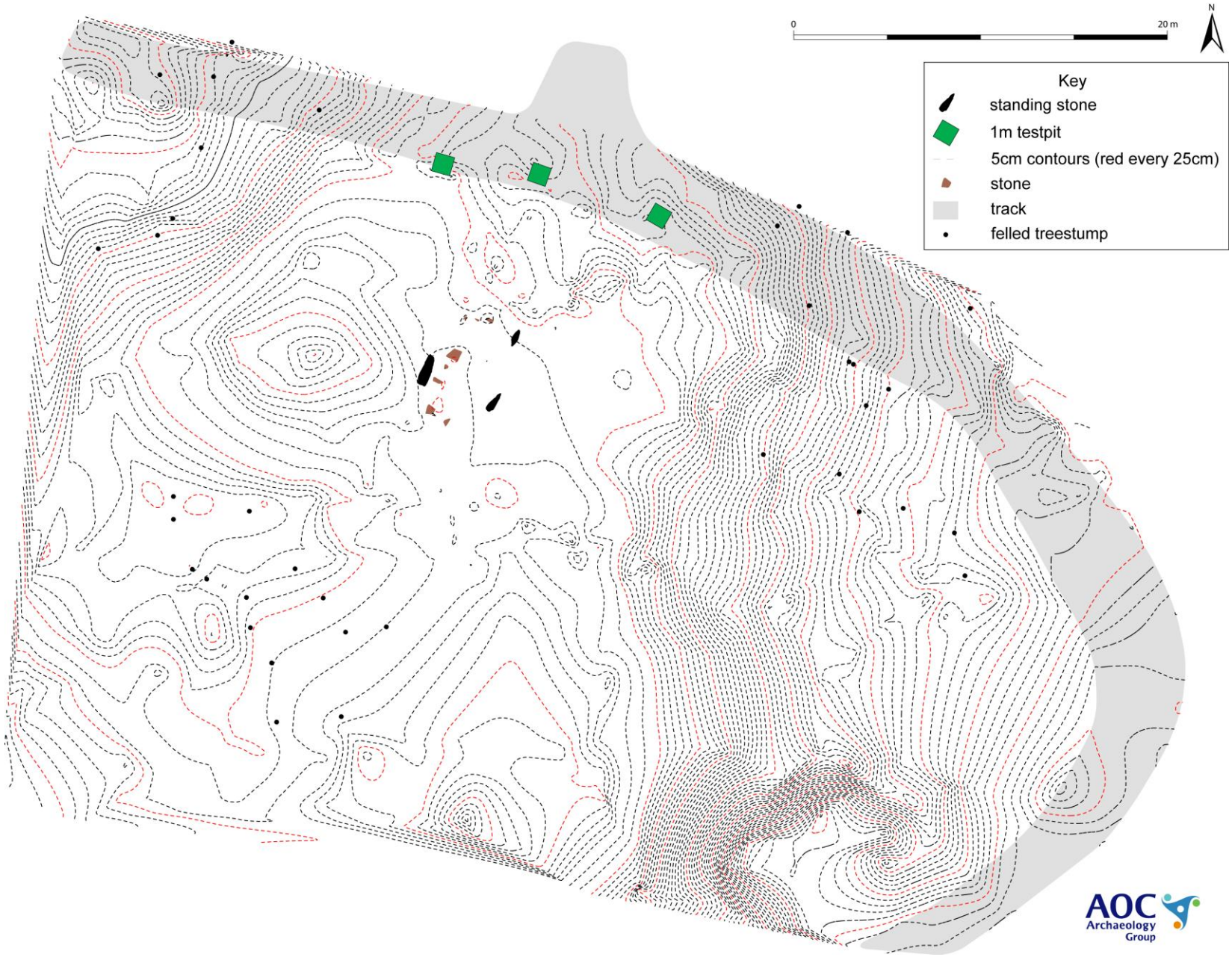

Figure 13: Topographic survey of the site

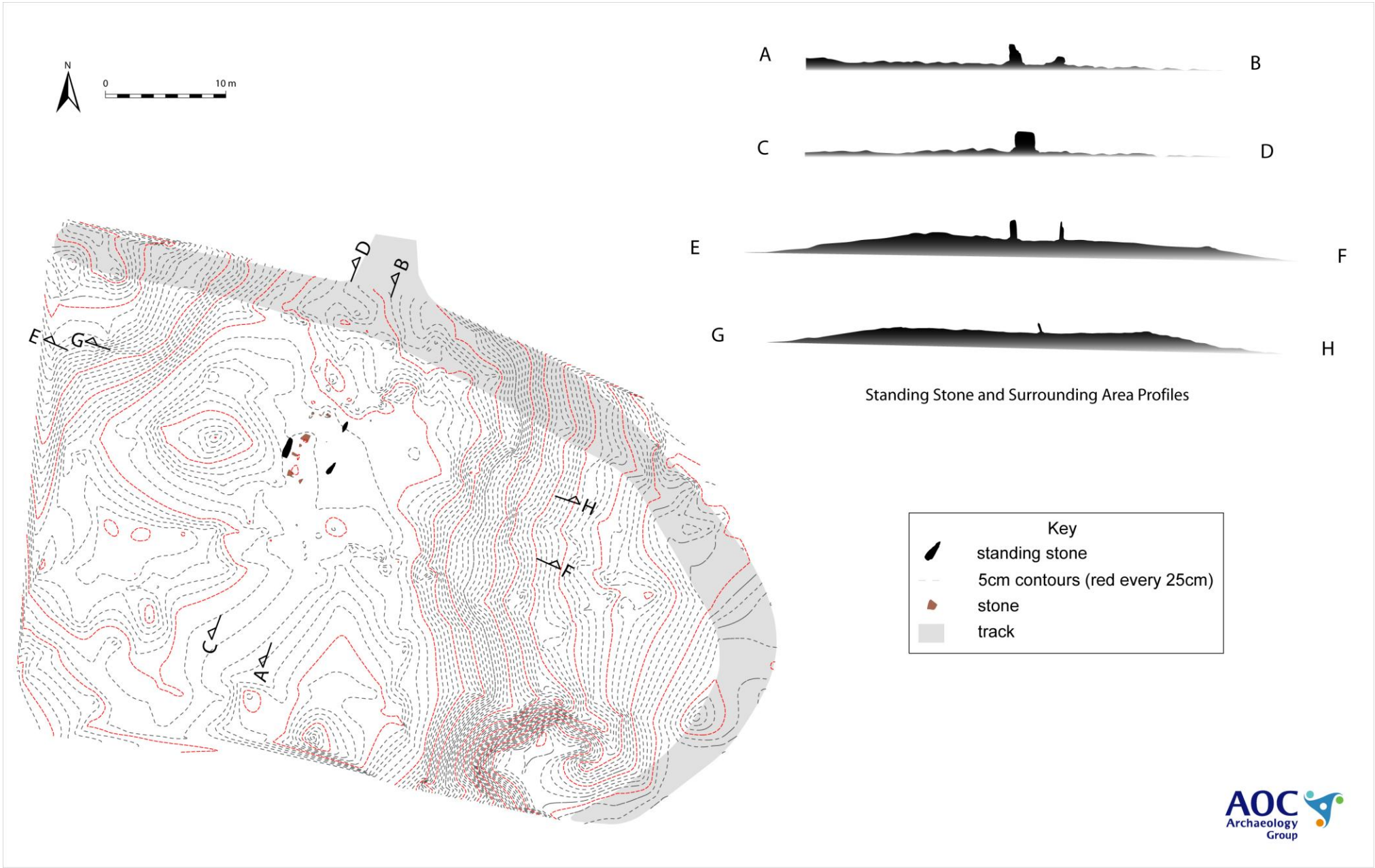

Figure 14: Topographic survey of the site with profiles

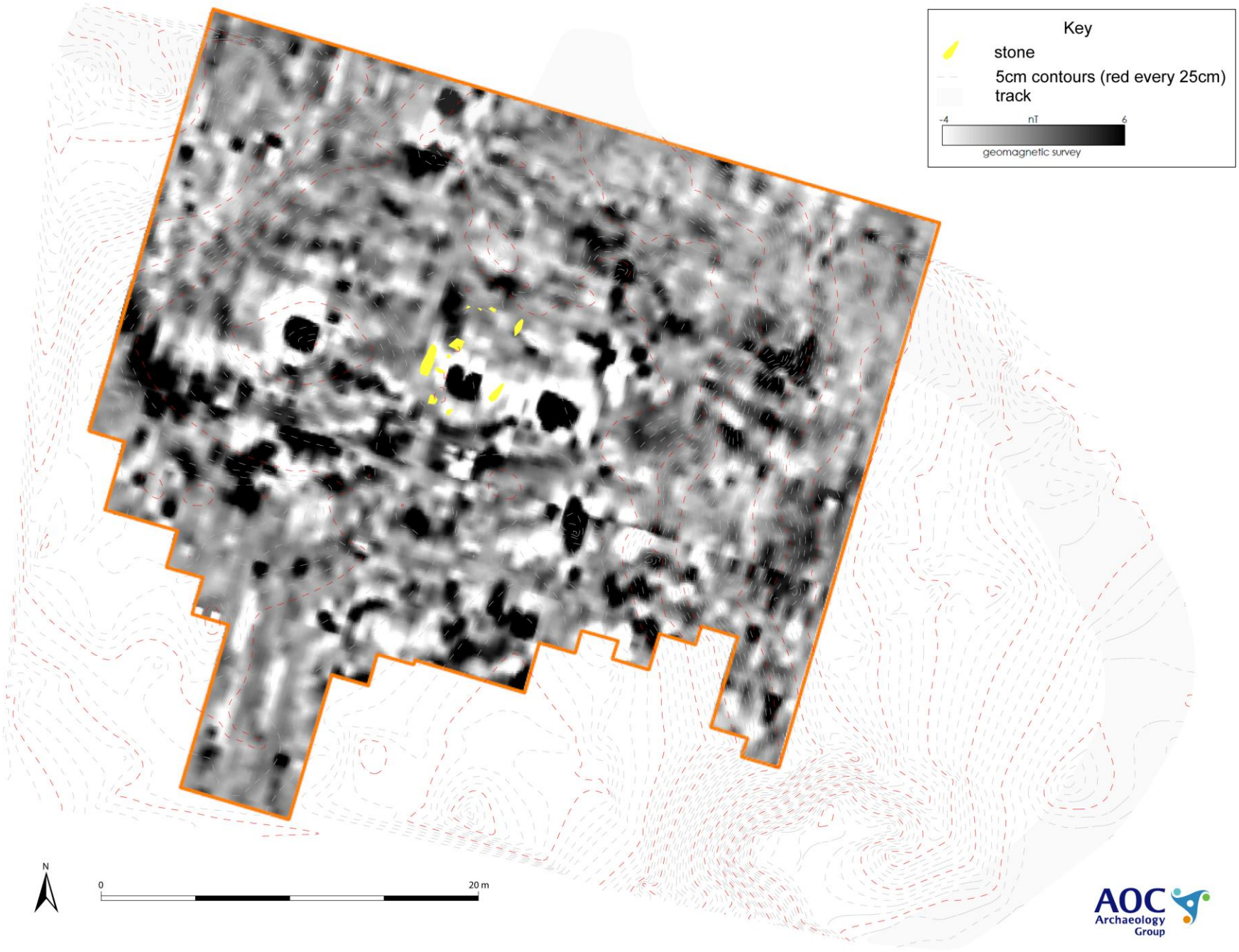

Figure 15: Topographic survey with geomagnetic survey

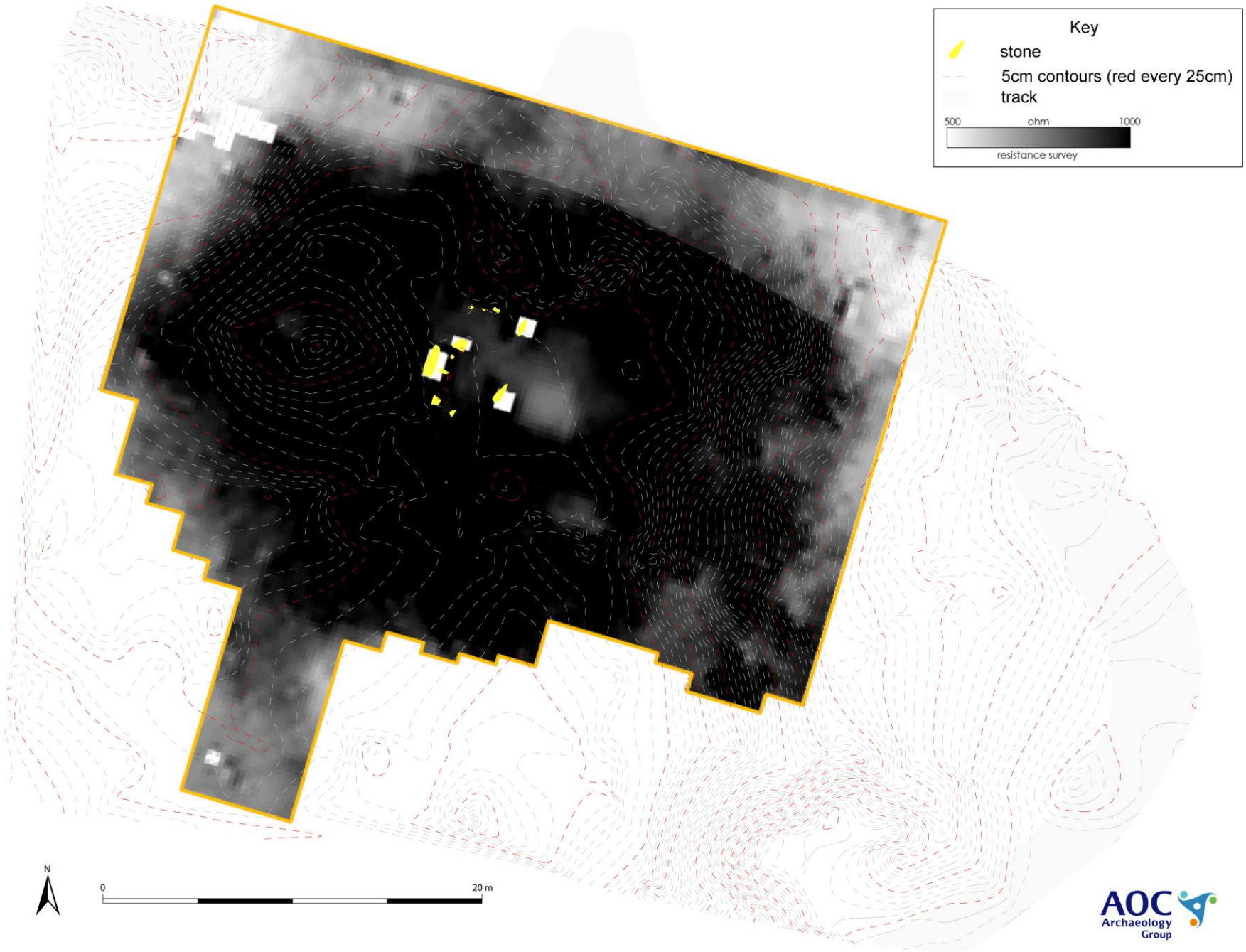

Figure 16: Topographic survey with resistance survey

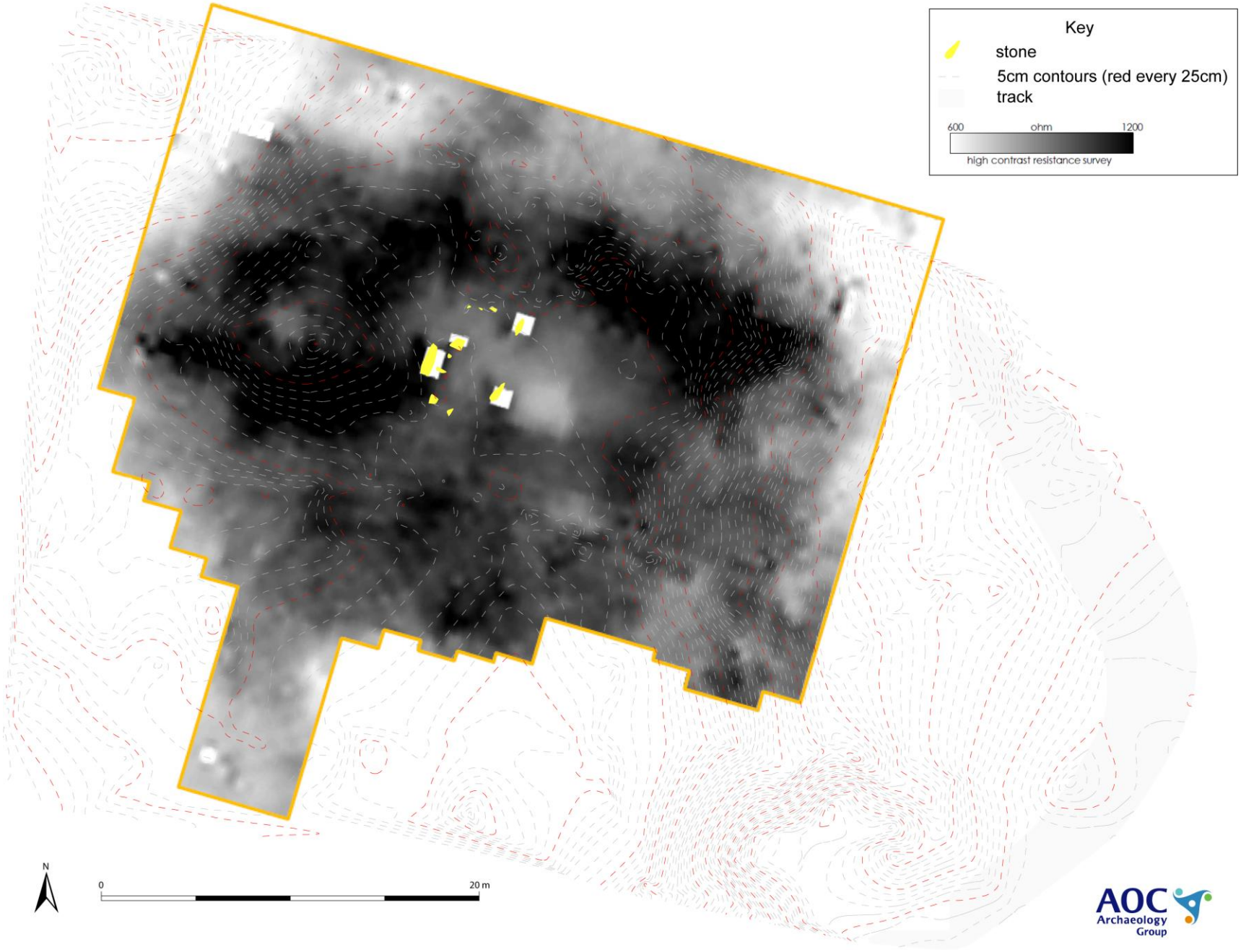

Figure 17: Topographic survey with high contrast resistance survey

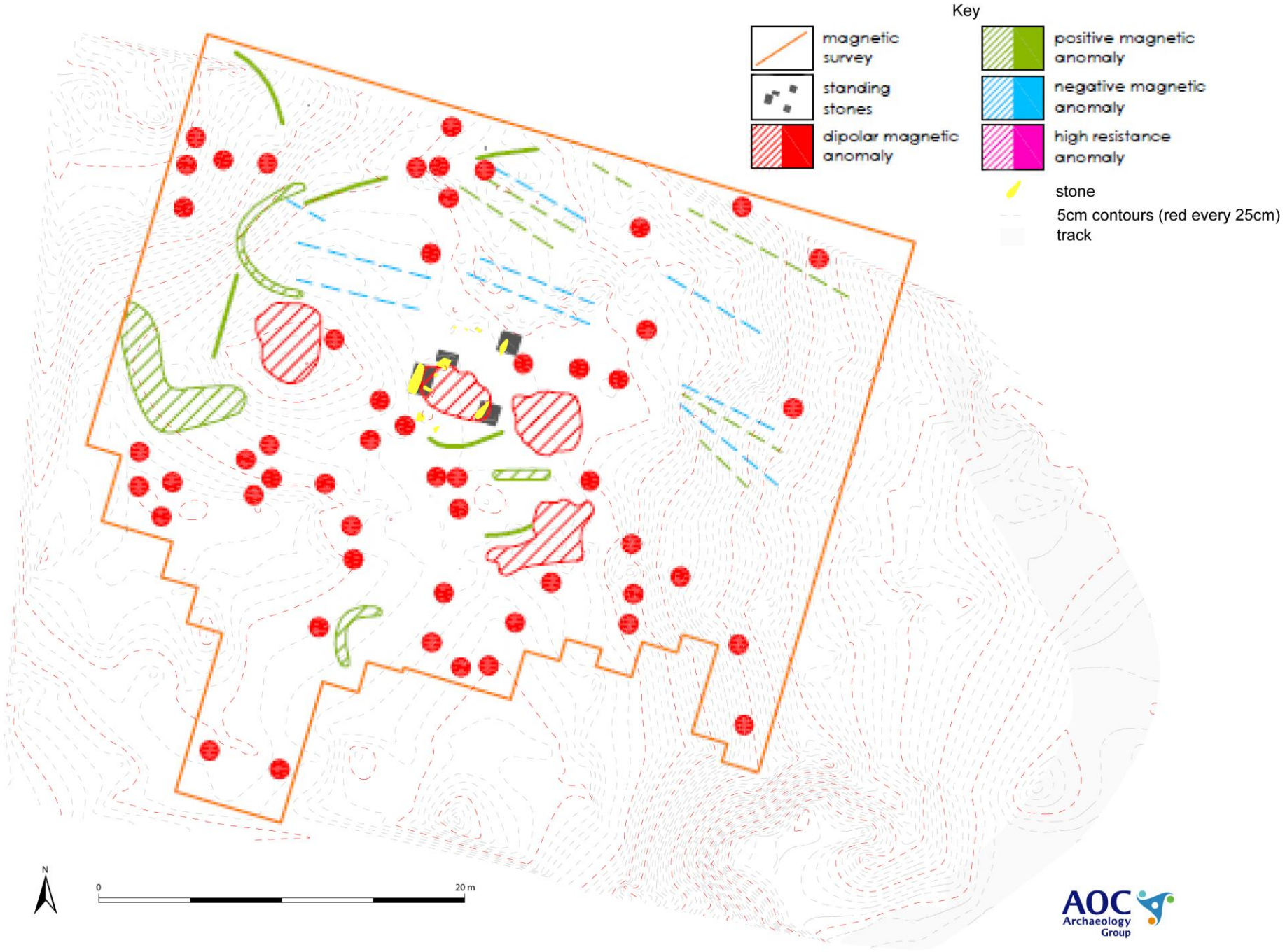

Figure 18: Topographic survey with interpreted geomagnetic data

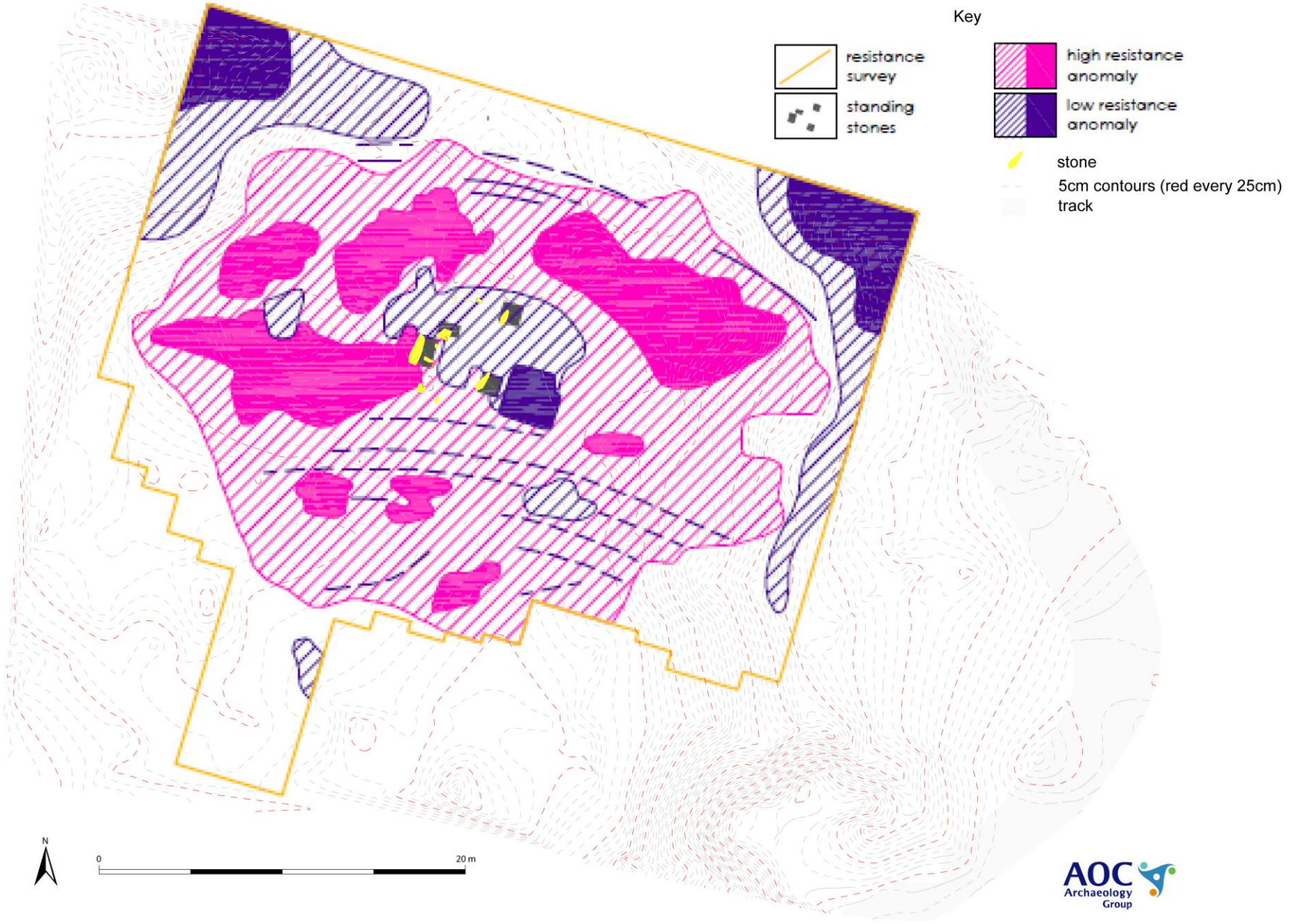

Figure 19: Topographic survey with interpreted resistance data

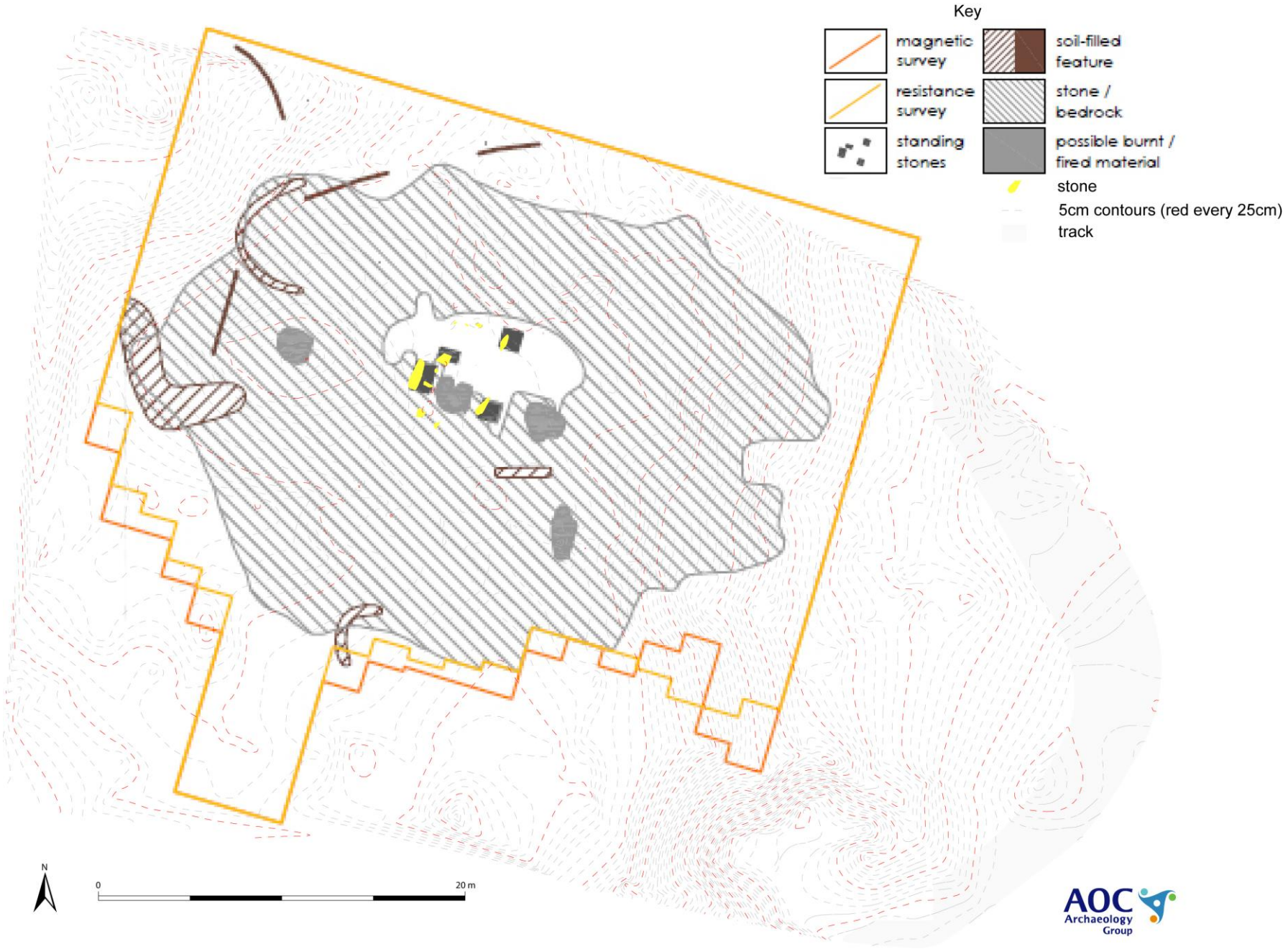

Figure 20: Topographic survey with interpreted archaeological features

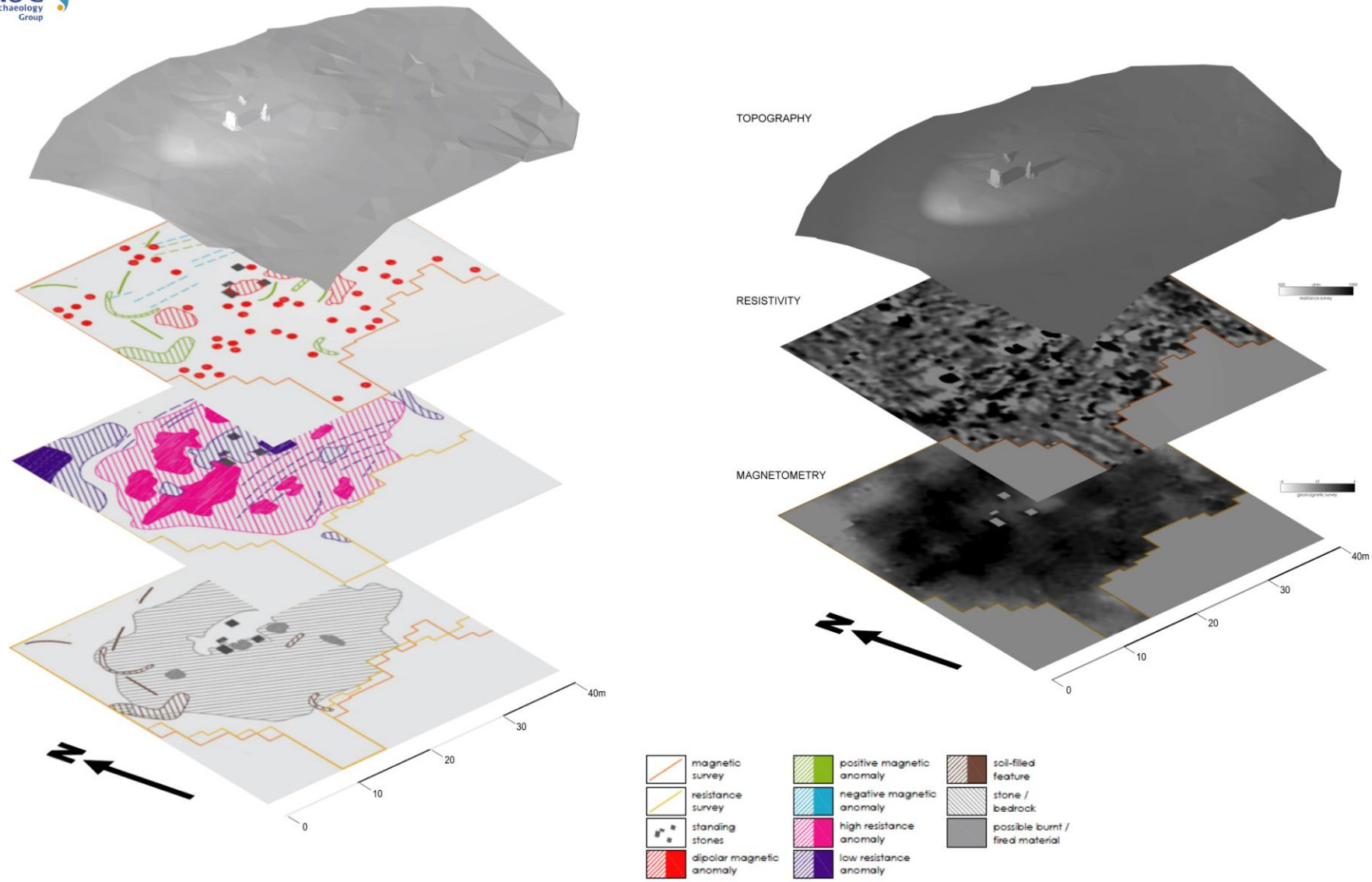

Figure 21: Integrated topographic and geophysical survey results, with interpretation, isometric view.

Plate 1: Standing stones from the east

Plate 2: Western most stone, from E

Plate 3: Western most stone, from W

Plate 4: Western most stone, from S.

Plate 5: SE Stone, from E.

Plate 6: SE Stone, from S.

Plate 7: NE stone, from E.

Plate 8: NE stone, from S.

Plate 9: Forestry track, to the N of the site.

Plate 10: Test pit 1, post-excavation.

Plate 11: Test pit 2, post-excavation.

Plate 12: Test pit 3, post-excavation.

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