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PRELIMINARY REPORT ON THE GEOPHYSICAL SURVEY AND EXCAVATION OF A FALLEN STANDING STONE AT LLANFECHELL, ANGLESEY, JANUARY 2010

Project No. G2109
Report No. 860

Prepared for Cadw
March 2010

By George Smith and David Hopewell

Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust
01248 352535 01248 370925 email : gat@heneb.co.uk

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Cover picture:
Llanfechell fallen standing stone during lifting, January 2010

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SH 36999164 PRN 3048 SAM An80

1. INTRODUCTION

A large and well-known standing stone at the edge of the village of Llanfechell was reported to have fallen down on Monday 16th November 2009. The Cadw inspector Dr Mike Yates then arranged for a visit from GAT to provide an assessment and project design with a view to excavating the disturbed stone-hole and re-erecting the standing stone.

The standing stone at Llanfechell, SAM An 80 was visited in 2002 as part of the Cadw Funerary and Ritual Monument survey and was then leaning slightly to the east. The stone is a large flat slab, about 2.5m high and 2.1m wide, approximately even in thickness, at about 30cm and rectangular in shape, tapering slightly to the top. It stood on a slight ridge overlooking the valley around which Llanfechell is focussed and with a view to the west to another monument, an unusual setting of three standing stones on top of a slight hill (Fig 1).

The stone had fallen to the east and was lying flat on the ground without damage. Its base could then be seen to consist of an asymmetric triangular point of which only 70cm of the stone had been in the ground and supporting it. The basal point had kicked up a part of the pit fill with a packing stone left *in situ* adhering to the stone and lifting some of the natural subsoil from the side of the pit at the same time (Fig. 2).

A rapid measured drawing was made of the fallen stone and this was used to estimate the size of the pit and this was later used to produce a design for a new pit for re-erecting the stone (Fig. 3). A section was also drawn across the portion of the base of the stone that retained part of the pit fill and a packing stone.

The site was then visited with Stuart Brown from *Cadwraeth Cymru* in order to make further arrangements for re-erection of the stone. It was decided that the fallen stone would first have to be moved in order to allow the pit to be excavated. An engineering design was produced for re-erection of the stone, involving excavation of a pit 1.6m x 3m and 1m deep (Fig. 4). The stone would then be lifted into place and the pit filled with hardcore and compacted. This would be mounded up around the base of the stone to stop erosion by trampling cattle.

On 5th January 2010 a small rubber-tracked crane was used to lift the stone to one side and place it on timber blocks supervised by a team from *Cadwraeth Cymru*. The crane recorded the weight lifted, which was 4.6 tons (Figs 5 and 6).

A high resolution geophysical survey was then carried out of an area of 40m square centred on the site of the standing stone pit, as described below.

The area of the stone pit was then excavated by hand on 6th and 7th January 2010.

Thanks are due to the landowner Prof. Robin Groves-White for reporting the fallen stone and for allowing access for the work.

2. GEOPHYSICAL SURVEY (Figs 7 and 8)

By David Hopewell

Methodology

Fluxgate gradiometer survey provides a relatively swift and non-invasive method of surveying large areas. The current surveys were designed to assess the effectiveness of gradiometer survey on prehistoric field systems.

Instrumentation

The survey was carried out using a Bartington Grad601-2 dual Fluxgate Gradiometer. This uses a pair of Grad-01-100 sensors. These are high stability fluxgate gradient sensors with a 1.0m separation between the sensing elements, giving a strong response to deeper anomalies.

The instrument detects variations in the earth's magnetic field caused by the presence of iron in the soil. This is usually in the form of weakly magnetised iron oxides which tend to be concentrated in the topsoil. Features cut into the subsoil and backfilled or silted with topsoil therefore contain greater amounts of iron and can therefore be detected with the gradiometer. This is a simplified description as there are other processes and materials which can produce detectable anomalies. The most obvious is the presence of pieces of iron in the soil or immediate environs which usually produce very high readings and can mask the relatively weak readings produced by variations in the soil. Strong readings are also produced by archaeological features such as hearths or kilns because fired clay acquires a permanent thermo-remnant magnetic field upon cooling. This material can also get spread into the soil leading to a more generalised magnetic enhancement around settlement sites.

Not all surveys can produce good results as anomalies can be masked by large magnetic variations in the bedrock or soil or high levels of natural background "noise" (interference consisting of random signals produced by material within the soil). In some cases, there may be little variation between the topsoil and subsoil resulting in undetectable features. It must therefore be stressed that a lack of detectable anomalies cannot be taken to mean that that there is no extant archaeology.

The Bartington Grad601 is a hand held instrument and readings can be taken automatically as the operator walks at a constant speed along a series of fixed length traverses. The sensor consists of two vertically aligned fluxgates set 1.0m apart. Their Mumetal cores are driven in and out of magnetic saturation by an alternating current passing through two opposing driver coils. As the cores come out of saturation, the external magnetic field can enter them producing an electrical pulse proportional to the field strength in a sensor coil. The high frequency of the detection cycle produces what is in effect a continuous output.

The gradiometer can detect anomalies down to a depth of approximately one metre. The magnetic variations are measured in nanoTeslas (nT). The earth's magnetic field strength is about 48,000 nT, typical archaeological features produce readings of below 15nT although burnt features and iron objects can result in changes of several hundred nT. The instrument is capable of detecting changes as low as 0.1nT.

Data Collection

The gradiometer includes an on-board data-logger. Readings in the surveys were taken along parallel traverses of one axis of a 20m x 20m grid. The survey was carried out at high resolution, with a traverse interval of 0.5m and a sample interval of 0.25m. This method is used where the priority is producing very accurate high resolution surveys. Guide lines are used in order to ensure very precise data collection. This survey method is more time consuming that standard resolution and is generally used in research surveys where specific smaller archaeological features are being surveyed. It is also useful for surveying very uneven sites or areas containing a lot of obstacles where the guide lines allow accurate survey and allow variable survey rates to be used.

Data presentation

The data was transferred from the data-logger to a computer where it was compiled and processed using ArchaeoSurveyor 2 software. The data is presented as a grey-scale plot (Fig. 7) where data values are represented by modulation of the intensity of a grey scale within a rectangular area corresponding to the data collection point within the grid. This produces a plan view of the survey and allows subtle changes in the data to be displayed. This is supplemented by an interpretation diagram (Fig. 8) showing the main features of the survey with reference numbers linking the anomalies to descriptions in the written report. It should be noted that the interpretation is based on the examination of the shape, scale and intensity of the anomalies and comparison to features found in previous surveys and excavations etc. In some cases the shape of an anomaly is sufficient to allow a definite interpretation e.g. a Roman fort. In other cases all that can be provided is the most likely interpretation. Weak and poorly defined anomalies are susceptible to misinterpretation due to the propensity for the human brain to define shapes and patterns in random background noise. An assessment of the confidence of the interpretation is given in the text. The survey will often detect several overlying phases of archaeological remains and it is not usually possible to distinguish between them.

Data Processing

The data is presented with a minimum of processing although corrections were made to compensate for instrument drift and other data collection inconsistencies. High readings caused by stray pieces of iron, fences, etc are usually modified on the grey scale plot as they have a tendency to compress the rest of the data. The data is however carefully examined before this procedure is carried out as kilns and other burnt features can produce similar readings. Grey-scale plots are always somewhat pixellated due to the resolution of the survey. This at times makes it difficult to see less obvious anomalies. The readings in the plots are usually smoothed thus producing more but smaller pixels. This reduces the perceived effects of background noise thus making anomalies easier to see. Any further processing is noted in relation to the individual plot.

RESULTS

A square area with dimensions of 40m x 40m was surveyed at high resolution (0.5m x 0.25m). Survey conditions were good with a flat field and short grass. Background noise levels were very low and geophysical anomalies were generally weak. The data was clipped to +-4nT in order to make archaeological anomalies more visible.

Both the stone-hole (1) and the fallen stone (2) produced clear anomalies. This probably indicates that the stone and the packing stones in the hole are weakly magnetic. Two parallel roughly linear anomalies (3) crossing the survey area may be related to the footpath marked on Ordnance Survey maps. The two anomalies are about 3m apart so are too far apart for wheel ruts. The best interpretation would therefore seem to be a double ditched former field boundary. A regular but faint circular anomaly (4) could be a small barrow but is most likely to be a natural subsoil feature. A series of similar but obviously natural sub-circular anomalies can be seen in the southern part of the survey.
The survey is crossed by several poorly defined but roughly parallel anomalies that are probably the result of ploughing. Also visible are a scatter of stronger dipoles that are the result of stray pieces of ferrous material in the topsoil, usually deposited during manuring.

Discussion

The responses in this survey were generally weak but detected several features. Only the stone hole with its packing stones and the and fallen stone itself appear to be prehistoric

3. EXCAVATION RESULTS

The fallen stone was first re-drawn in plan and profile. This showed that the slab had probably been trimmed slightly to shape around its top by smashing the edges (Fig. 9).

The area of the pit needed for the new re-erection pit was excavated by hand revealing the stone pit to be teardrop-shaped in plan (Fig. 10), designed to fit the stone, which had an asymmetric pointed foot, so that the pit needed to be deeper on the north side (Fig. 11). There were no other features cut into the subsoil in the area around the pit but at the east side of the former stone was a thin layer of dark charcoal-rich material (10), compacted into the top of the subsoil (Fig. 10). This was sampled for laboratory study (Sample 105) and included hazel and oak charcoal (Table 1).

The excavation of the stone pit was hampered by incoming ground water. The stone pit had medium sloping sides in cross-profile and was cut into a subsoil of orange-brown glacial till. The pit was filled with a darker soil than would be expected if it was just re-deposited subsoil. However, most of it was taken up with twenty large packing stones, varying from 20-50cm in length, all of which had been disturbed to some extent by the collapse of the stone (Fig. 12). A small amount of fill was still *in situ* against the east side of the pit where it had not been kicked out by the foot of the stone. Two pieces of charcoal (Samples 103 and 104), one of which was of hazel (Table 1) were collected from this area and 10L of soil was collected for flotation for possible other carbonised macrobotanical remains.

The pit had a base that slope down from south to north and had been designed to fit the shape of the base of the standing stone. At the lowest part of the pit, where the pointed toe of the stone had been a small horizontal slab was found still *in situ* that was clearly a pad stone under the toe of the standing stone (Fig. 11). Removal of this slab revealed a small steep-side pit [6] 0.30m dia. and 0.12m deep. Its fill was dark and stone-free, with no visible inclusions. Because of rising ground water all the fill of the pit was taken out and retained for study in the laboratory (Sample 102).

After backfilling the pit with soil and replacing the turfs, the packing stones were placed on top of the pit ready to be moved before excavation of the new pit. It was almost dark by the time backfilling was completed.

Difficulties in organising the re-excavation and re-erection meant that the site would have to be left for 3 months so the site of the excavation was re-visited to check on its condition. It was then seen that one of the three largest packing stones had a cup and ring-mark carving and another single cup mark on one of its faces (Fig. 13). The cup-marks were fairly deep and steep-sided compared to most known examples. The ring mark in contrast was shallow and rather inaccurately executed with individual peck marks visible. The carvings were on a flat face of a sub-rectangular slab *c.* 0.5m square and 0.15m thick and were not set centrally on the slab. The reverse side of the slab was green with algae, showing that this face had been exposed on the surface, perhaps standing in a pool of water after collapse of the stone. All the packing stones were then cleaned and inspected carefully, then photographed and drawn but no other marks were found. Most of the stones were thick flat slabs of a similar rock and thickness to that of the standing stone. It seemed a possibility that these were the remains of a larger slab that had been broken up. However, this was not so because careful study showed that their edges, although angular, were weathered and so not recently broken prior to burial. A few of the rocks were glacial erratics of other rock types.

4. SAMPLING

The individual charcoal samples and the fill of Pit 6 were sent to Lampeter Univ. Part of the fill of the pit was processed and produced a small amount of charcoal. The charcoal was identified by Kate Griffiths (Table 1).

Table 1 Charcoal from Llanfechell

Sample	Number	Species	No. rings	Weight/ grammes	Comments
102	1	Ericaceae	5	0.030	Round wood stem frag. *AMS
102	2	Ericaceae	-	0.022	Round wood stem frag. *AMS
102	3	Ericaceae	-	0.010	Round wood stem frag. *AMS
103	1	Corylus	1+	0.281	Frag of round wood. *AMS
103	2	Corylus	-	-	-
104					Very small fragments of charcoal - too small to identify.
105	1	Corylus	2+	1.187	Not round wood, quite knotty fragment.
105	2	Quercus	8+	-	
105	3	Corylus	5+	0.415	Not round wood. *AMS

*AMS samples enclosed

Samples 102 and 103 were selected for AMS dating and sent to SUERC laboratories at Glasgow in early February. The results are expected about mid April.

The bulk soil sample from the fill of the main stone pit has also been delivered to Lampeter and will be floated to look for any other carbonised macrobotanical remains.

Two micro-samples from the cup-marked stone were taken. One from inside the cup mark and one from a blank area of the stone. These will be studied by Ben Stern at the University of Glasgow, Dept of Archaeology as part of research into the presence of organic materials in stone objects. It is possible that the cup-marks had libations of organic substances or pigment or of oils for use as simple wick lamps.

5. INTERPRETATION

The small pit under the toe of the standing stone was a deliberate foundation deposit. The dark fill did not contain any obvious artefacts or inclusions such as charcoal or cremated bone but certainly was organic-rich. The laboratory analysis may be able to reveal more about its purpose. Part of the fill was processed by flotation and produced some charcoal of heather, which is a little unusual, see Table 1. The remainder of the fill was retained for dry processing and possible chemical analysis.

The presence of the pit provided good confirmation that the standing stone was indeed a prehistoric feature and not a post-medieval folly or cattle rubbing stone.

The foundation pit must signify the actual moment of erecting the stone and so a radiocarbon date from it would be significant for knowledge about standing stone generally. Standing stones on Anglesey and Llŷn are quite numerous. They occupy generally slightly elevated locations but not dramatic view points and are scattered relatively evenly and widely within Anglesey, compared to the more grouped occurrence of Neolithic chambered tombs, for instance. They sometimes have associated features of Early Bronze Age date but which could have been added much later. Primary dating material is rare so the actual date and function of standing stones is uncertain. One standing stone, small and squat so not typical, was found beneath an Early Bronze Age burial mound at Bedd Branwen, Anglesey and a date for this stone was surprisingly within the Early Neolithic period (Lynch 1991, 348). Another fallen standing stone at Cremlyn, Anglesey, has also been excavated (*ibid*) but this did not produce any artefactual or other dating evidence. It did show a small pit at its base which was interpreted as a hole for a post that must have been the precursor to the standing stone. There must also be a possibility that the pit was for a foundation deposit like that at Llanfechell.

A fuller report will be prepared for publication when the dating and analysis are completed.

The landowner, Prof. Robin Grove-White has agreed to donate the cup and ring-marked stone to the Oriel Ynys Mon and it is hoped that the standing stone will be re-erected later in April 2010.

6. REFERENCES

Lynch, F.M. 1991. *Prehistoric Anglesey*, Anglesey Antiquarian Society

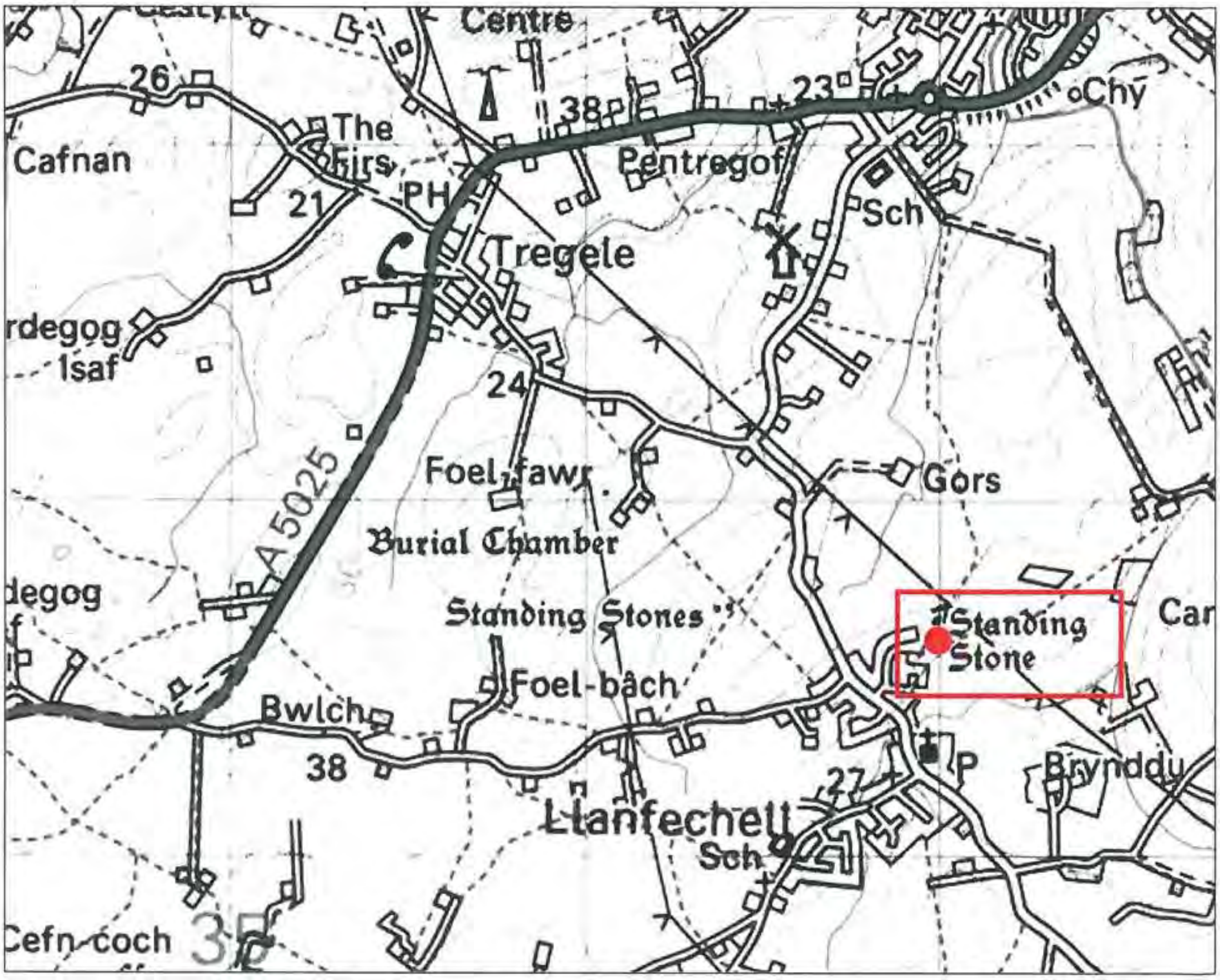

Fig. 1 Llanfechell Standing Stone Location map

Fig. 2a L.lanfechell fallen standing stone SAM An 80, from the south

Fig. 2b Llanfechell fallen standing stone. Detail of toe of stone
and uplifted pit fill, from the north

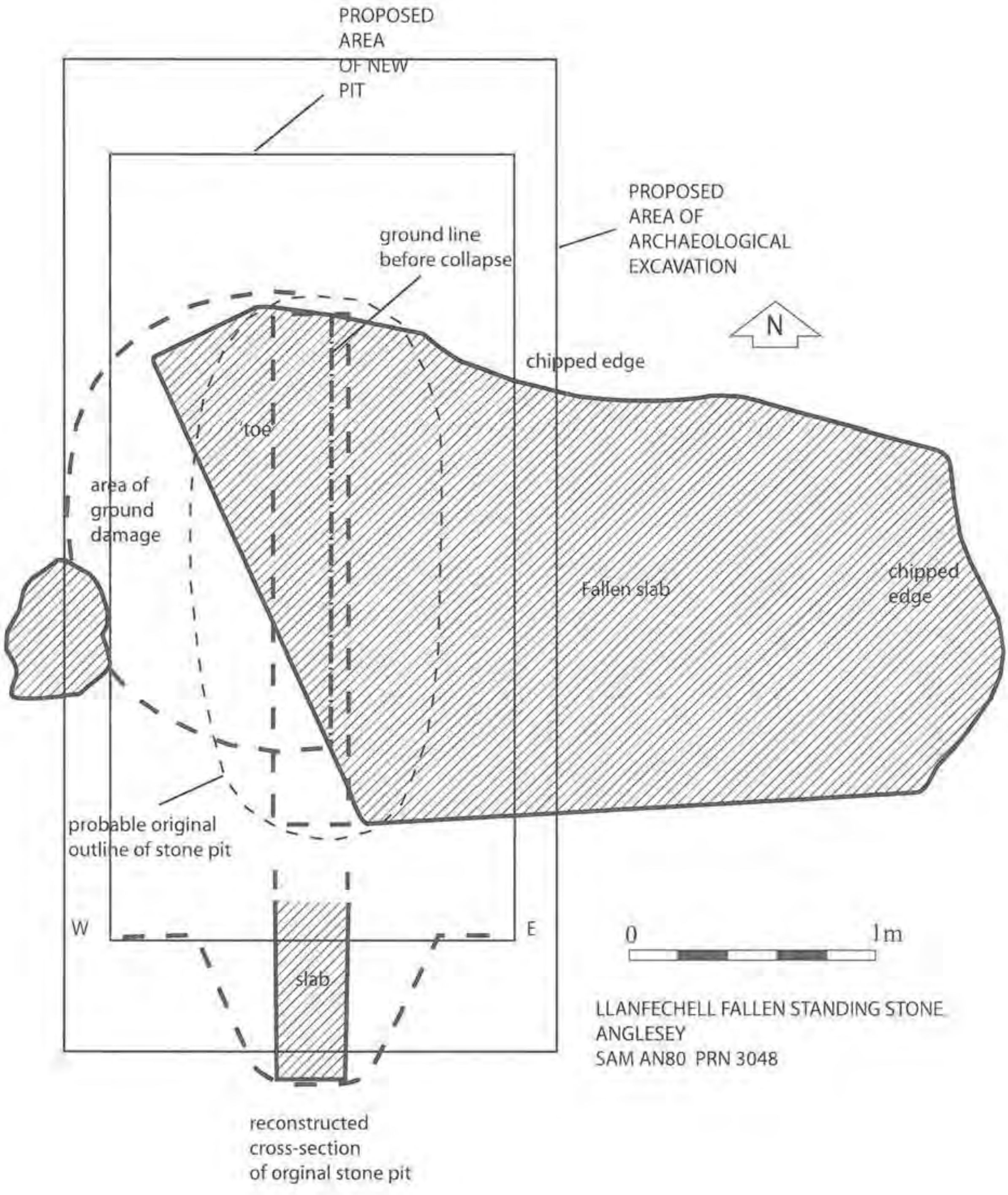

Fig. 3 Llanfechell fallen standing stone SAM An 80, rapid measured drawing and estimate of stone pit depth

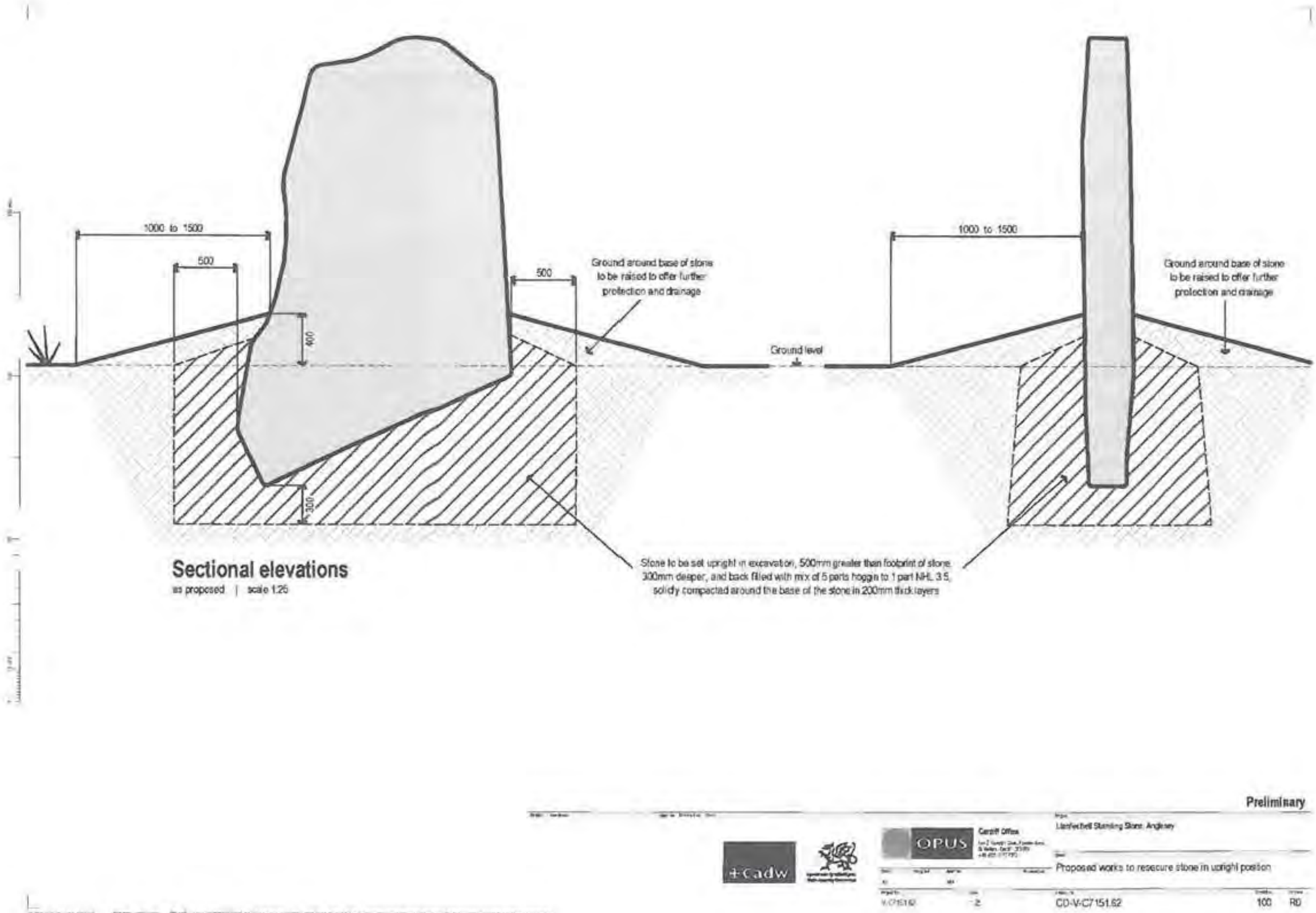

Fig. 4 Cadwraeth Cymru design for re-instatement of fallen standing stone

Fig. 5 Llanfechell fallen standing stone. Lifting the fallen stone

Fig. 6 Llanfechell fallen standing stone. Placing the stone on blocks

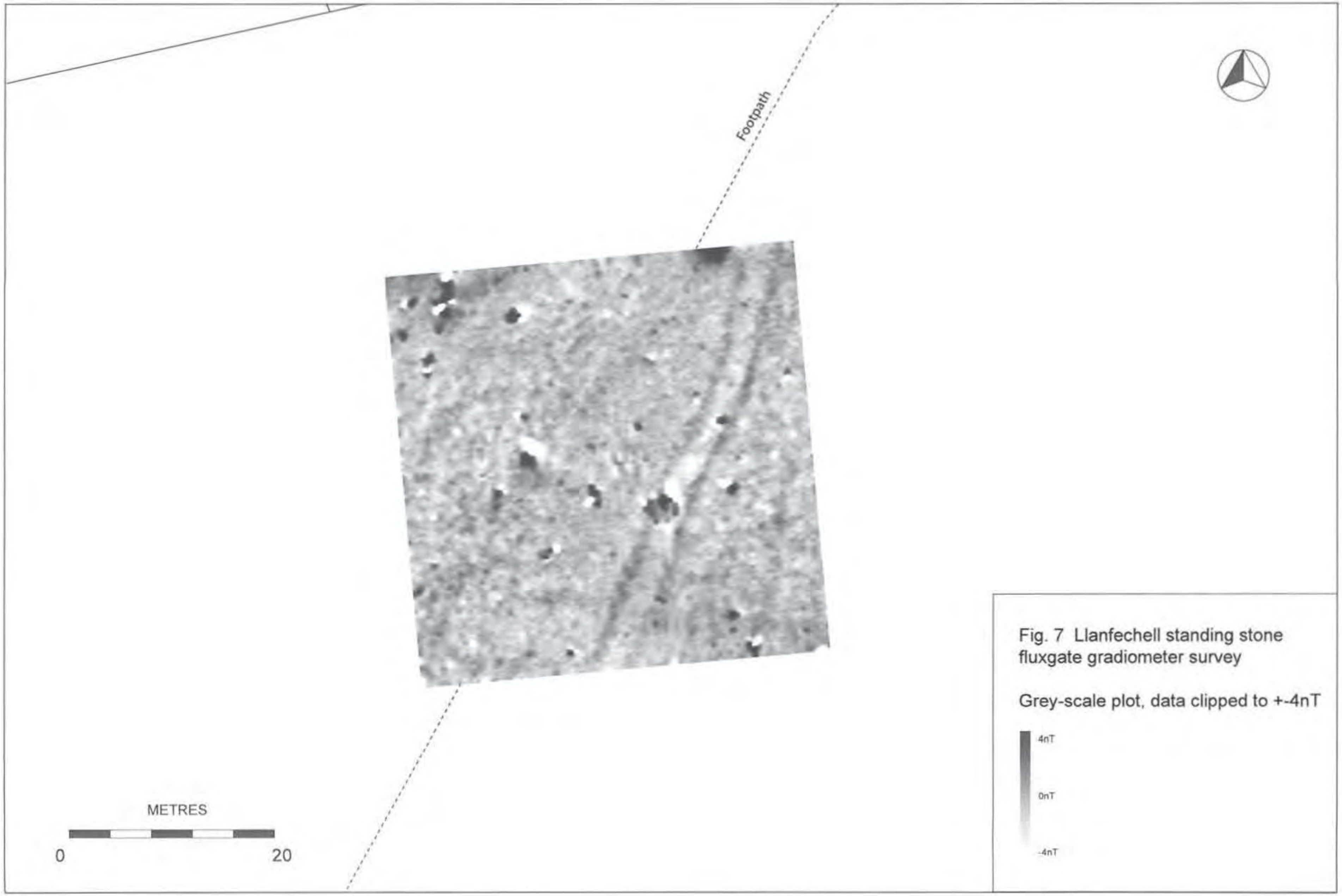

Fig. 7 Llanfechell standing stone
fluxgate gradiometer survey

Grey-scale plot, data clipped to +-4nT

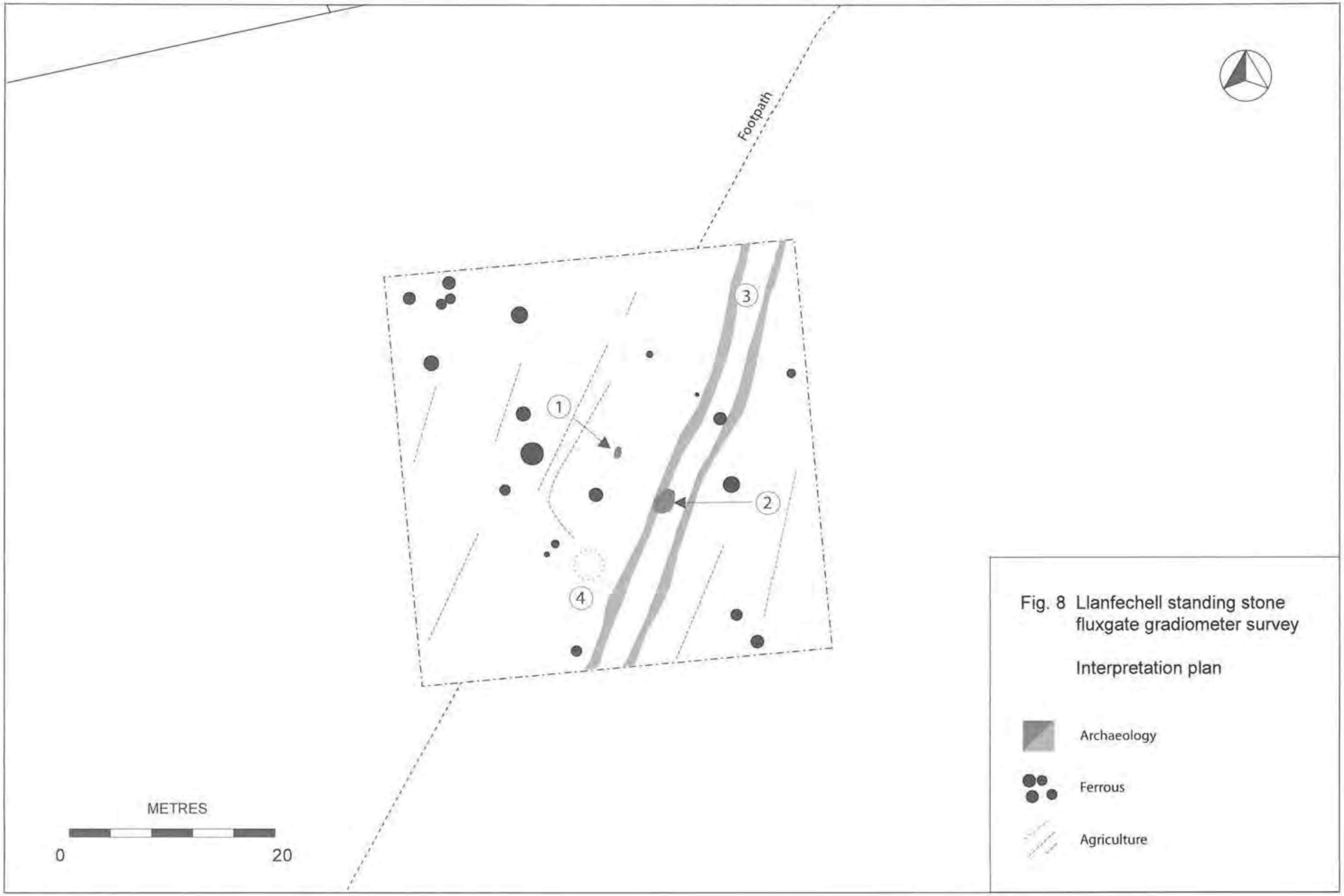

Fig. 8 Llanfechell standing stone fluxgate gradiometer survey

Interpretation plan

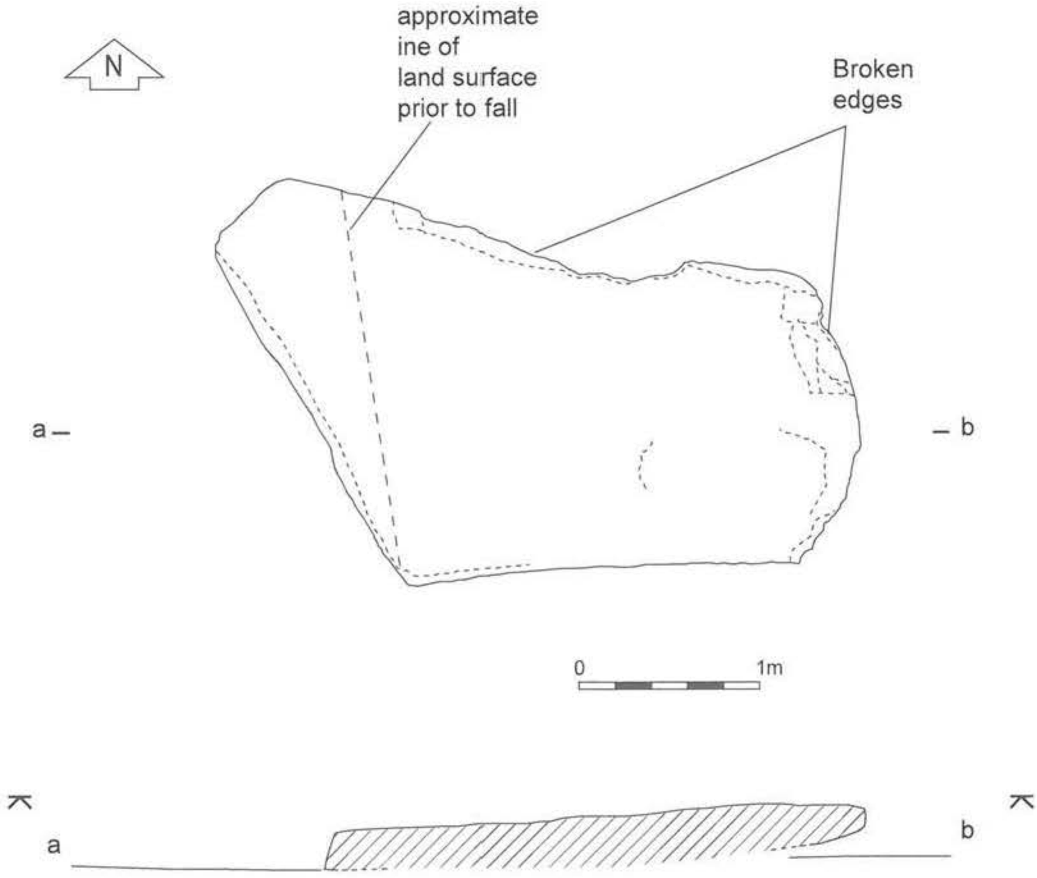

Fig. 9 Llanfechell fallen standing stone. Plan and profilee

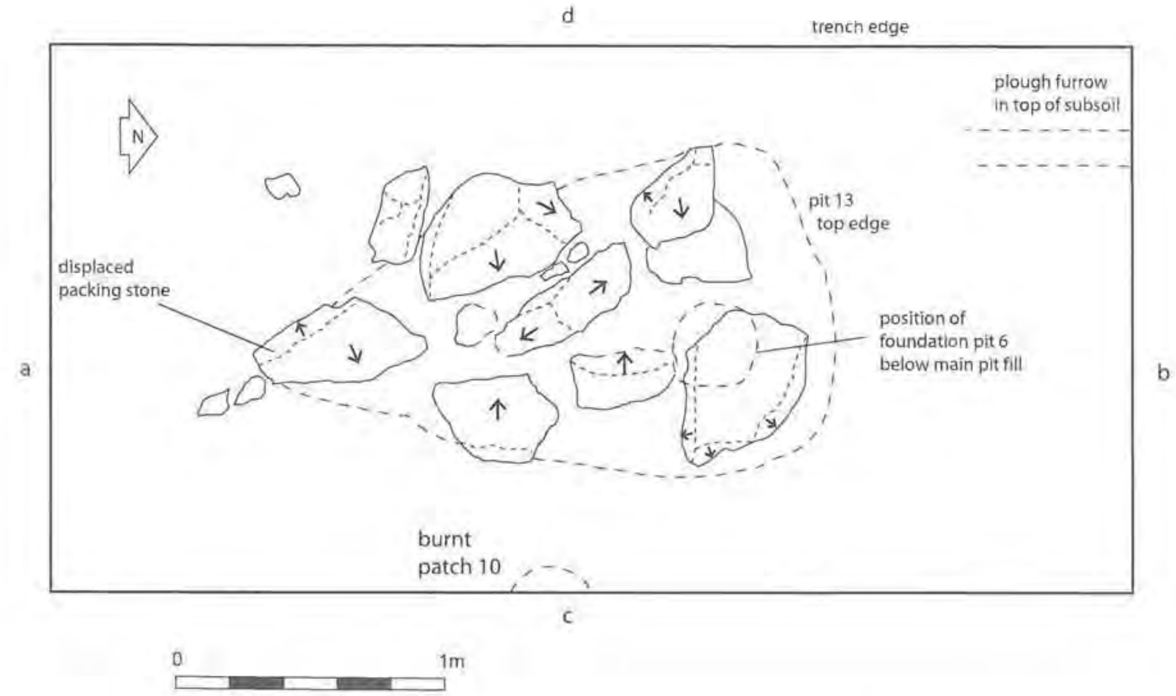

Fig. 10 Llanfechell fallen standing stone. Plan of stone pit

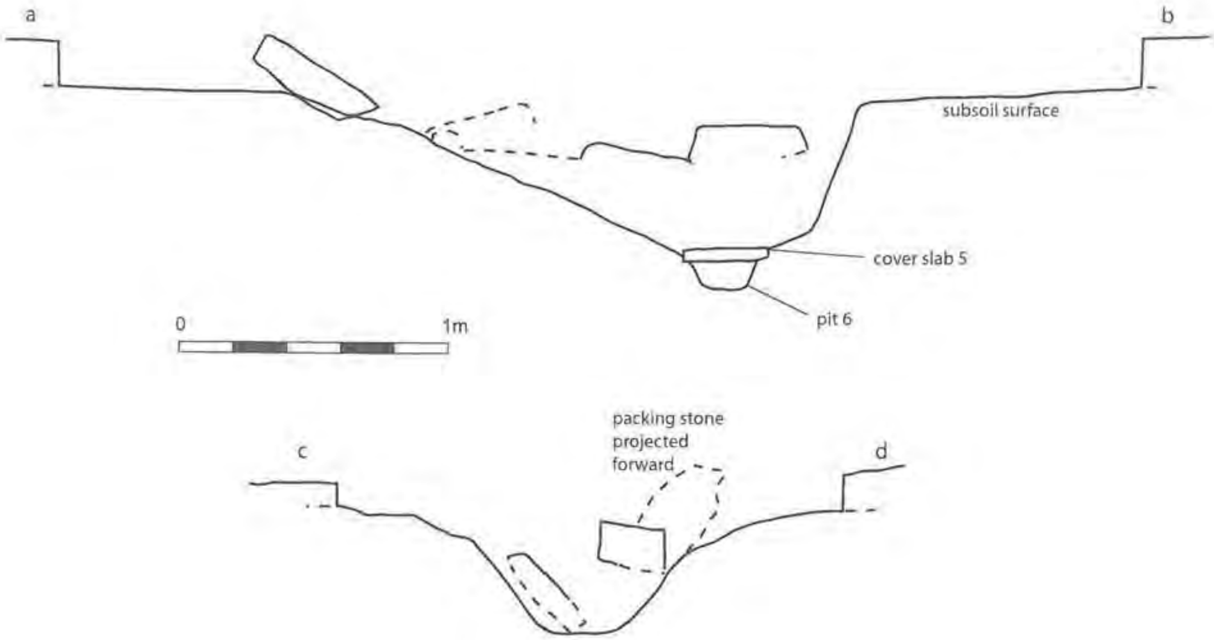

Fig. 11 Llanfechell fallen standing stone. Profiles of stone pit

Fig. 12 Llanfechell fallen standing stone. Stone pit with disturbed packing stones still *in situ*, from the east

Fig. 13 Llanfechell fallen standing stone. Cup and ring-marked stone

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GWYNEDD ARCHAEOLOGICAL TRUST

Craig Beuno, Ffordd y Garth, Bangor, Gwynedd LL57 2RT Ffon/Tel 01248 352535 Ffacs/Fax 01248 370925
e-mail: gat@heneb.co.uk web site: www.heneb.co.uk