CRUGIAU CEMMAES
NEVERN
PEMBROKESHIRE
2009

GEOPHYSICAL SURVEY

REPORT No 2009/36

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Crugiau Cemmaes, Nevern, Pembrokeshire 2009 Geophysical Survey

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Cover: Geophysical surveying at Crugiau Cemmaes. View East

SUMMARY

A geophysical survey was undertaken around a part of a Bronze Age barrow cemetery known as Cregiau Cemmaes. To the west of the barrows large ditches were recorded, probably parts of large enclosures, adding to information visible on aerial photographs, along with one or two circular features that maybe roundhouses, rather than barrows. To the east a less substantial ditch formed complete, oval enclosure, with an entrance on the southeast side. Within this were one or two roundhouses and possibly two rectangular structures. It is likely that the oval enclosure is Iron Age, but the date of the other remains must remain speculative.

INTRODUCTION

Project commission

Cadw grant-aided, with assistance from Pembrokeshire Coast National Park Authority, and commissioned Dyfed Archaeological Trust to undertake a geophysical survey on the fields to east and west of part of the barrow cemetery known as Crugiau Cemmaes (SAM PE197), near Nevern, Pembrokeshire (centred on SN 1250041600)(Fig 1).

Scope of the project

The project was designed to establish whether a geophysical survey, using a gradiometer, could detect archaeological features on this site, in addition to those seen on aerial photographs.

Report outline

Because of the limited nature of this project, together with the considerable archaeological evidence in the area, this report is restricted solely to the results of the geophysical survey.

Abbreviations

Sites recorded on the Regional Historic Environment Record (HER) are identified by their Primary Record Number (PRN) and located by their National Grid Reference (NGR). Some sites have also been registered as a Scheduled Ancient Monument (SAM).

THE SITE

Location and Archaeological Potential

Crugiau Cemmaes barrow cemetery (SN 12534263) lies 4.5km northeast of Nevern just to the north of the B4582 and 7.0km southwest of Cardigan (Fig 1). The southern two barrows, between the two fields surveyed, are on a prominent ridge, nearly 200m above sea level, with open views in all directions. The barrows are within a fenced-off corridor allowing public access. Between the two barrows there is a rectangular water reservoir.

The tithe map (Bayvil, probably in 1845) only shows a boundary dividing the present fields, but no barrows. The Ordnance Survey illustrates the same boundary but in more detail, plus the barrows, but also an east-west division across the large field to the west (Fig 2). An aerial photograph taken in 1981 (Photos 1 and 2) indicates a major ditch just to the west of the barrows, with a further ditch with an apparent in-turned entrance further westward, while around the steep slope in the north-west corner of the field there appears to be part of a smaller double ditch enclosure.

The western field, now under pasture, has been cultivated for some time and has slightly encroached into the bases of the barrows where some stone from the edges of these have been disturbed.

The All Wales Ploughing Championship was held in 2007 in the western field (pers. comm. P Groom): this may explain the prominent plough marks recorded in this geophysical survey.

METHODOLOGY

A fluxgate gradiometer was used for the survey. This detects variations in the earth's magnetic field was used for this survey (full specifications are in appendix 1). Readings were taken on traverses 0.5m wide and every 0.25m along for the all of the east field and the southern part of the west field. The northern part of the west field was undertaken at a lower resolution with traverses 0.1m wide due to little detail showing in this field and budget constraints

RESULTS

Limitations

The survey was undertaken between 11th and 20th March 2009. The weather was generally fine, except for a few misty and cold early mornings. The fields were low pasture recently vacated by cattle. The lower western edge of the west field was quite poached, especially around the gateway into the next field and therefore little attempt was made to survey that part of this field. The unevenness due to poaching and some slopes in the field will have caused some small variations in data collection. However, pacing lines were used throughout the survey and any variations in the data collections are likely to have been small.

Potentially more of a problem was the adjacent roads that carry significant numbers of lorries, mostly from the nearby quarry, but survey work was paused when working near the roads whilst the majority of this traffic passed, although a

few artificial anomalies may have occurred. There are pipelines connected with the reservoir, wire fences and some ferrous detritus that have cause significant anomalies. There was evidence of some mole burrows in the western field; it has been suggested in the past that this activity can produce minor anomalies on magnetometer surveys, but in this instance any such features here are probably masked by the plough marks.

The underlying geology is Ordovician sedimentary shale (British Geological Survey 1994) with dark brown humic topsoil. This did not appear to cause any problems with the survey.

Geophysical interpretation

(Results Fig 4 and interpretation Fig 5)
Only the major features are discussed.

Western Field

The ditch just to the west of the barrows and reservoir, seen on the 1981 aerial photographs, is clearly visible on the survey (Fig 5, 1). This ditch produces a strong response in a number of places especially near the southern barrow and it is therefore likely that the fill of this ditch contains heat-affected material. Adjacent to the east side there is a negative response (2), possibly the remains of a bank. Between this ditch (1) and bank (2) and the southern barrow there is a very strong response, possibly a hearth (3).

About 80m further west there is a curvilinear ditch (4) and bank (5) with an apparent in-turned entrance (6). These features appear to be at the top of the break of slope. This would need to be confirmed by combining this geophysical survey with a topographic survey. Given the location of these features they would appear to be part of an Iron Age enclosure. There are vague suggestions of features (7) within this enclosure, but they are obscured to a great extent by the plough marks.

At the north end of the curvilinear ditch (4), there is possibly a broader ditch (8) cutting north-south across a small blind valley and up either slope. However, this feature is not that distinct and could possibly be natural. Just to the east of this there is possibly a small ditch (9), running up the southern edge of this blind valley, but this alignment is the same as the plough-marks and therefore could be misleading.

To the north there is a continuous outer ditch (10) around the slope, with a bank (11) along its straighter edge. There also appears to be an inner ditch (12) on the west side of the slope. Both of these ditches are visible on the aerial photographs, but this survey shows the outer ditch (10) continuing to the east. Within these ditches on the top of the slope there does appear to be one definite curved gully (13), possibly part of a ring ditch for a roundhouse or barrow.

Modern features consist of distinct parallel lines (14), a removed field boundary, and a clearer grey area (15) to the west, possibly spread soil dug from ponds lying to the west. There is also a lot of ferrous debris.

Eastern Field

The eastern field has similar ditch and bank (16 and 17) to those in the west field; these could be a continuation of 10 and 11, although if so there must be a dog leg between the two lengths of bank and ditch around the location of the current hedge-bank. It would appear that the eastern terminal of the ditch (16)

and bank (17) respects that of the inner ditch (18), and is therefore likely to be a later development. There is another linear ditch (19) adjoining the north site of the inner ditch (18), this may just be associated with an earlier roadside hedge bank, but is more likely to be contemporaneous with some of the other geophysical anomalies. A ditch (20) is almost certainly part of the roadside hedge-bank- it can still be seen as a slight surface feature.

Within this eastern field there is a ditch (21), possibly with an internal bank (22), forming an oval, with a ditched entranceway (23). It is likely that this is an Iron Age defended enclosure, many of which have been indentified in southwest Wales. It is particularly interesting to note how this site is positioned within the landscape, adjacent to the barrows, on fairly level ground except for the northwestern part, which is much higher with a steep slope.

Running east-west and joining the west side of the enclosure ditch there is a linear feature (24); unfortunately this is on the same alignment as some plough marks but appears to consist of a ditch with at least part of a bank on its northern side. Adjacent to where this linear feature meets a modern pipeline (37) there is a negative, (bank?), rectangular or square anomaly (25). However, the shape of this may be influenced by the plough marks and the pipe trench and given the slope here (this would need confirmation by a topographic survey) it may represent a natural outcrop. It is possibly significant that nothing shows west of the pipe trench in this field. Close by this “square” anomaly (25), there is a small arc (26), but it is uncertain as to whether this is an archaeological feature.

Inside the enclosure ditch (21) there is a linear feature (27), possibly three sides of a square feature. In the centre of this there appears to be a pit (28). This is an usual feature and could represent an Iron Age shrine (no shrines or temples have, however, been identified in Wales), an early medieval special grave, of which some are known, of a building or ditch of earlier of later periods.

There may be a similar square feature (29) some 40m further east, although this is less well defined and may be on the edge of a steep slope, making it less likely to be a structure.

The features listed below are tentative at best due to the striping caused by ploughing: There are at least two likely ring ditches (30 and 31) and a possible third (32). These are more likely to be ring ditches for roundhouses rather than for round barrows. Also within the enclosure (21) there are three apparent large arcs (33, 34, 35). The last of these (35) is definitely too large to be a part of a roundhouse.

As in the west field there is a scatter of ferrous debris, characterized by small adjacent positive and negative responses. Most, if not all, of these are from modern detritus, but obviously there is a chance that they could be finds of archaeological significance. There are two pipelines (36 and 37) from the reservoir.

DISCUSSION AND SUGGESTIONS FOR FURTHER WORK

This survey has confirmed and enhanced the features seen in the western field on the 1981 aerial photographs. Significantly, it has also discovered an enclosure in the eastern field that appears to show evidence of internal settlement or other usage. Crugiau Cemmaes shows a sequence of activity. Remains in the eastern field indicate at least two phases of enclosure. It is uncertain how, if at all, the eastern field enclosures relates to the one in the western field. Crugiau Cemmais

barrows are clearly Bronze Age, but the date of the other remains is speculative. An Iron Age date for the enclosure in the eastern field is favoured, as is a similar date of those in the western field.

There were no obvious further major barrow-type features. It is likely that, if they existed, they would have had substantial ring ditches and would have been easily recognisable in the survey results.

When commissioning geophysical surveys where there are known archaeological features, significant earthworks or complex topography it is strongly advised that an archaeological topographical survey is undertaken at the same time. It is therefore recommended that a topographical survey be carried out on this site in the near future and combined with these geophysical results, which should provide enhanced interpretation of the archaeological features.

The dating and therefore the phasing of both the previously recognised and the newly discovered features are unknown. Targeted evaluation by small test trenches is considered likely to be cost effective on these sites. This would also give an opportunity to look at any plough damage and the implications of further deep plough damage especially in the eastern field.

CONCLUSION

This survey confirms the aerial photographic evidence that there are elements to this site which would appear to be a substantial, probably Iron Age enclosure, or enclosures. Significantly this survey has discovered a new enclosure, with evidence of interior settlement or other use. This is could be of Iron Age date, but may extend into later periods.

ACKNOWLEDGEMENTS

I would like to thank Phil Poucher from Dyfed Archaeological Trust for his assistance with this survey. Also Hubert Wilson from Dyfed Archaeological Trust for production of the base map.

ARCHIVE DEPOSITION

The archive will initially be held by DAT, before being passed to the National Monument Record, Aberystwyth.

SOURCES

Bayvil Tithe map 1845?

British Geological Survey 1994 The Rocks of Wales 1:250,000

Ordnance Survey 1891 First Edition 25 inch PEMB VI.6

APPENDIX 1: METHODOLOGY AND INSTRUMENTATION

Geophysical Survey Instrumentation

A fluxgate gradiometer survey provides a relatively swift and completely non-invasive method of surveying large areas.

The survey was carried out using a Bartington Grad601-2 dual Fluxgate Gradiometer, which 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. There are, however, other processes and materials that 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. Archaeological features such as hearths or kilns also produce strong readings because fired clay acquires a permanent thermo-remnant magnetic field upon cooling. This material can also get spread into the surrounding soil leading to a more generalised magnetic enhancement around settlement sites.

Not all surveys produce good results as anomalies can also 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 features being un-detectable. It must therefore be stressed that a lack of detectable anomalies cannot be taken to mean that that there are no below ground archaeological features.

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 (Clark 1996).

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.

Geophysical Survey Data Collection

The gradiometer includes an on-board data-logger. Readings in the surveys were taken along parallel traverses of one axis of a grid made up of 20m x 20m squares. The traverse intervals were either 0.5m or 1.0m apart. Readings were logged at intervals of 0.25m along each traverse giving 3200 readings per grid

square (medium resolution on 0.5m traverses), or 1600 readings per grid square (low resolution on 1.0m traverses).

Geophysical Survey 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 grey-scale plot 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. A separate grey-scale plot with interpretation of the main features is also included as necessary.

Geophysical Survey Data Processing

The data is presented with a minimum of processing although corrections are 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. The data on some noisy or very complex sites can benefit from 'smoothing'. 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 can therefore be interpolated thus producing more but smaller pixels and a small amount of low pass filtering can be applied. 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.

Reliability

Geophysical survey is an immensely useful tool but it should be realised that while a survey will detect a wide range of features, it may not detect *all* buried features. A gradiometer survey detects changes in magnetic flux density and relies on there being a detectable difference between the archaeology and the substrate. This may not occur for many reasons (e.g. a cut feature being backfilled with subsoil). It must therefore be stressed that a lack of archaeological responses from a geophysical survey does not prove that there is no archaeology present.

Grid locations

The survey grids were located by measurements to fixed points such as cliff edges and metal survey markers located during the survey (Fig 4: A2, B and B2).

Bibliography

Clark A J 1996 *Seeing Beneath the Soil* (2nd edition). Batsford, London

Photo 1: Aerial view 1981, north toward top left.

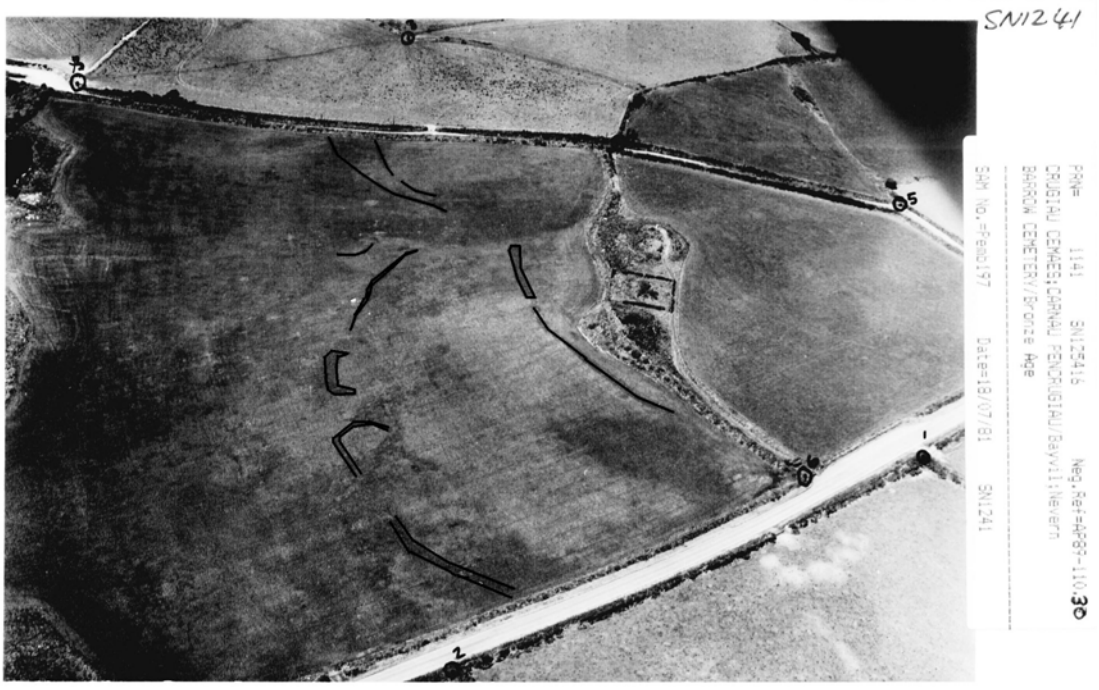

Photo 2: Aerial view 1981 with interpretation (T Driver), north toward top left.

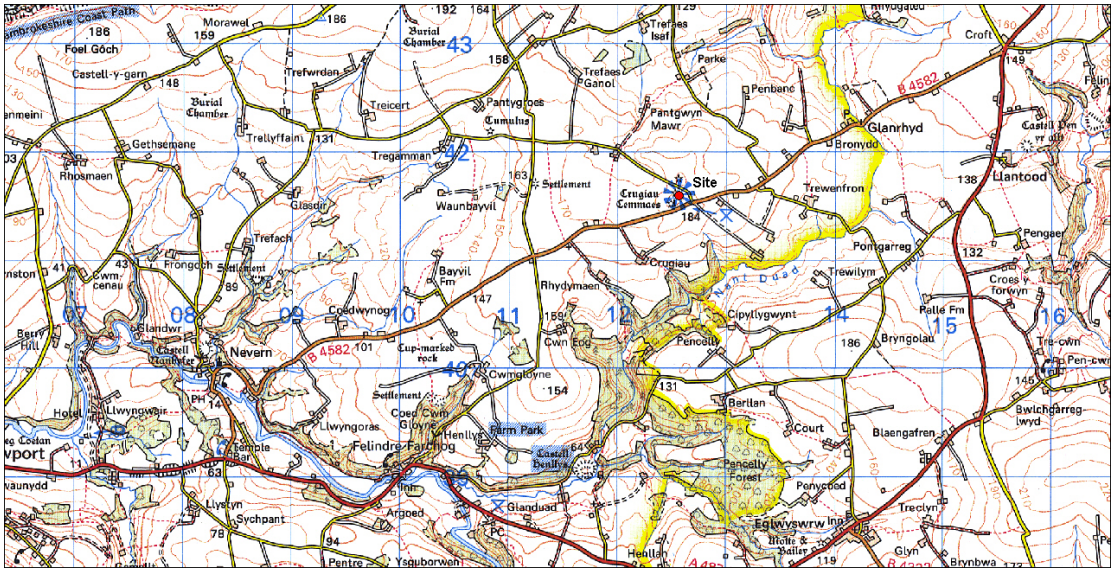

Figure 1: Location of Crugiau Cemmaes (SN 12534263)
Reproduced from the 1997 Ordnance Survey 1:50,000 scale Landranger Map with the permission of The Controller of Her Majesty's Stationery Office, © Crown Copyright Cambria Archaeology, The Shire Hall, Carmarthen Street, Llandeilo, Carmarthenshire SA19 6AF. Licence No AL51842A.

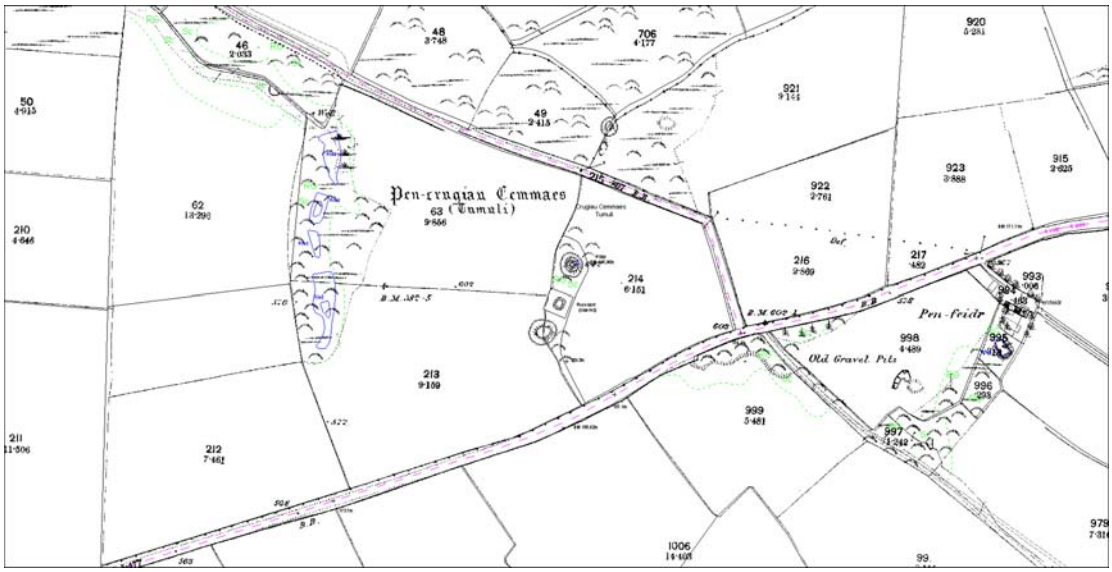

Figure 2: Ordnance Survey First Edition 1891 plus, modern features.
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Figure 3: Gradiometer survey, greyscale

Figure 4: Gradiometer survey, greyscale, interpretation

Crugiau Cemmaes, Nevern, Pembrokeshire 2009
Geophysical Survey

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March 2009

Paratowyd yr adroddiad hwn gan / This report has been prepared by Pete Crane

Swydd / Position: Senior Archaeologist

Llofnod / Signature ..... Dyddiad / Date

Mae'r adroddiad hwn wedi ei gael yn gywir a derbyn sêl bendith
This report has been checked and approved by Ken Murphy

ar ran Ymddiriedolaeth Archaeolegol Dyfed Cyf.
on behalf of Dyfed Archaeological Trust Ltd.

Swydd / Position: Trust Director

Llofnod / Signature ..... Dyddiad / Date

Yn unol â'n nôd i roddi gwasanaeth o ansawdd uchel, croesawn unrhyw sylwadau sydd gennych ar gynnwys neu strwythur yr adroddiad hwn

As part of our desire to provide a quality service we would welcome any comments you may have on the content or presentation of this report

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