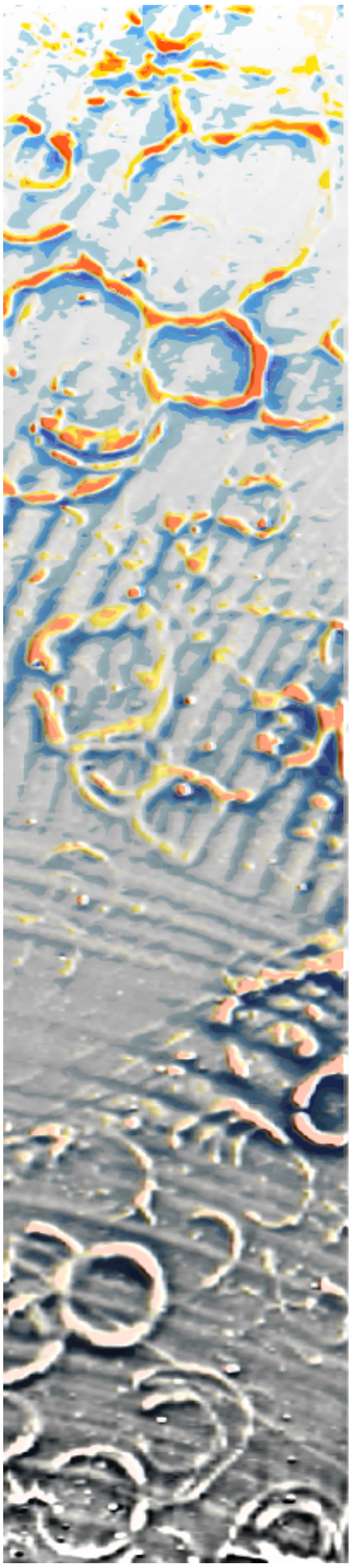

# Veryan Castle, Cornwall

## Geophysical Survey Report

## Produced for the National Trust

## Unlocking Our Coastal Heritage Project

**Project code NTC129**

**July 2013**

**MJ Roseveare, ACK Roseveare**

**ArchaeoPhysica Ltd**

Kitchener's, Home Farm, Harewood End, Hereford HR2 8JS
Tel. +44 (0) 1989 730 564 www.archaeophysica.com

## Non-Technical Summary

A magnetic survey was commissioned by the National Trust to prospect land at Veryan Castle for buried structures of archaeological interest, under the aegis of the Unlocking Our Coastal Heritage project.

The survey has confirmed the earthwork and aerial photographic evidence for an outer defensive circuit some 90m from the centre of the monument. In addition and despite the small size of the survey a number of other ditch fills both inside and outside the monument have been found.

## Digital Data

| Item | Sent to | Sent date |
|---|---|---|
| CAD – Vector Elements | Jim Parry email | 01/08/13 |
| | | |

## Audit

| Version | Author | Checked | Date |
|---|---|---|---|
| Interim | MJR | | |
| Draft Final | MJR, ACKR | ACKR | 01/08/13 |
| Final | | | |
| Revision | | | |
| OASIS | | | |

# Table of Contents

# 1 Introduction

Land east of Veryan castle was surveyed using ArchaeoPhysica's sledge mounted caesium vapour magnetometer array as part of the National Trust's Unlocking our Coastal Heritage project, to prospect for buried structures of archaeological interest.

## 1.1 Location

| | |
|---|---|
| **Country** | England |
| **County** | Cornwall |
| **Nearest Settlement** | Veryan |
| **Central Co-ordinates** | 190908, 38815 |

Approximately 0.4 hectares were surveyed within the corner of a field adjacent to the core of the monument.

## 1.2 Constraints & variations

Access problems were encountered (later resolved), necessitating two visits to the site. Steeply sloping areas were not surveyed.

# 2 Context

## 2.1 Archaeology

The following information is quoted verbatim from the brief (Parry, 2012):

*"Veryan Castle has been interpreted as an Iron Age 'round'. This is well preserved, perched on a steep sided valley overlooking Gerrans Bay. The enclosed area is 0.3ha though there is evidence of earthworks outside this area."*

## 2.2 Environment

| | |
|---|---|
| **Superficial 1: 50000 BGS** | None recorded |
| **Bedrock 1:50000 BGS** | Pendower Formation - Mudstone (PWER) |
| **Topography** | Fairly level |
| **Hydrology** | Unknown but presumed to be free-draining |
| **Current Land Use** | Pasture |
| **Historic Land Use** | Mixed agricultural |
| **Vegetation Cover** | Grass |
| **Sources of Interference** | Wire fences, gates etc. |

The Devonian mudstone is likely to support sufficient natural susceptibility enhancement to allow the detection of features cut into the bedrock or with fills containing former topsoil. In this area sometimes strong natural enhancement is evident which greatly facilitates the detection of buried archaeological features by the magnetic technique.

# 3 Methodology

## 3.1 Survey

### 3.1.1 Technical equipment

| | |
|---|---|
| **Measured variable** | Magnetic flux density / nT |
| **Instrument** | Array of Geometrics G858 Magmapper caesium magnetometers |
| **Configuration** | Non-gradiometric transverse array (4 sensors, ATV towed) |
| **Sensitivity** | 0.03 nT @ 10 Hz (manufacturer's specification) |
| **QA Procedure** | Continuous observation |
| **Spatial resolution** | 1.0m between lines, 0.3m mean along line interval |

### 3.1.2 Monitoring & quality assessment

The system continuously displays all incoming data as well as line speed and spatial data resolution per acquisition channel during survey. Rest mode system noise is therefore easy to inspect simply by pausing during survey, and the continuous display makes monitoring for quality intrinsic to the process of undertaking a survey. Rest mode test results (static test) are available from the system.

## 3.2 Data processing

### 3.2.1 Procedure

All data processing is minimised and limited to what is essential for the class of data being collected, e.g. reduction of orientation effects, suppression of single point defects (drop-outs or spikes) etc. The processing stream for this data is as follows:

| **Process** | **Software** | **Parameters** |
|---|---|---|
| Measurement & GNSS receiver data alignment | Proprietary | |
| Gridding | Surfer | Kriging, 0.25m x 0.25m |
| Smoothing | Surfer | Gaussian lowpass 3x3 data |
| Imaging and presentation | Manifold GIS | |

The initial processing uses proprietary software developed in conjunction with the multisensor acquisition system. Gridded data is ported as data surfaces (not images) into Manifold GIS for final imaging and detailed analysis. Specialist analysis is undertaken using proprietary software.

General information on processes commonly applied to data can be found in standard text books and also in the 2008 English Heritage Guidelines "Geophysical Survey in Archaeological Field Evaluation" at http://www.helm.org.uk/upload/pdf/Geophysical_LoRes.pdf.

ArchaeoPhysica uses more advanced processing for magnetic data using potential field techniques standard to near-surface geophysics. Details of these can be found in Blakely, 1996, "Potential Theory in Gravity and Magnetic Applications", Cambridge University Press.

All archived data includes process metadata.

## 3.3 Interpretation framework

### 3.3.1 Resources

Numerous sources are used in the interpretive process which takes into account shallow geological conditions, past and present land use, drainage, weather before and during survey, topography and any

previous knowledge about the site and the surrounding area. Old Ordnance Survey mapping is consulted and also older sources if available.

### 3.3.2 Magnetic

Interpretative logic is based on structural class and examples are given below. For example a linear field or gradient enhancement defining an enclosed or semi-enclosed shape is likely to be a ditch fill, if there is no evidence for accumulation of susceptible material against a non-magnetic structure. Weakly dipolar discrete anomalies of small size are likely to have shallow non-ferrous sources and are therefore likely to be pits. Larger ones of the same class could also be pits or locally-deeper topsoil but if strongly magnetic could also be hearths. Strongly dipolar discrete anomalies are in all cases likely to be ferrous or similarly magnetic debris, although small repeatedly heated and in-situ hearths can produce similar anomalies. Reduced field strength (or gradient) linear anomalies without pronounced dipolar form are likely to be caused by relatively low susceptibility materials, e.g. masonry walls, stony banks or stony or sandy ditch fills.

## 3.4 Standards & guidance

All work was conducted in accordance with the following standards and guidance:

- David et al, "Geophysical Survey in Archaeological Field Evaluation", English Heritage, 2008.
- "Standard and Guidance for Archaeological Field Evaluation", Institute for Archaeologists, 2008.

In addition, all work is undertaken in accordance with the high professional standards and technical competence expected by the Geological Society of London and the European Association of Geoscientists and Engineers.

All personnel are experienced surveyors trained to use the equipment in accordance with the manufacturer's expectations. All aspects of the work are monitored and directed by fully qualified professional geophysicists.

# 4 Catalogue

| Label | Anomaly Type | Feature Type | Description | Easting | Northing |
|---|---|---|---|---|---|
| 1 | Linear dipolar enhanced | Fill - Ditch | A wide (c2.5m) ditch fill extends southeast the line of the western field margin but is much wider than a field boundary ditch and it also turns south as if to remain broadly concentric with the earthworks of Veryan Castle. It seems likely that this is part of a further defensive circuit that has not survived within the field system | 190973.7 | 38839.2 |
| 2 | Linear dipolar enhanced | Fill - Ditch | A fill, approximately 1m wide, might mark a former field boundary. It appears to cross the line of [1] and is therefore likely to be of later date | 191038.0 | 38816.4 |
| 3 | Linear dipolar enhanced | Fill - Ditch? | One of two (see also [4]) possible short ditches that appear to partition the area between [2] and [5], forming small enclosures. This suggests that [2] and [5] should probably be thought of as contemporary | 191032.2 | 38807.7 |
| 4 | Linear dipolar enhanced | Fill - Ditch? | See [3] | 191012.9 | 38803.7 |
| 5 | Linear dipolar enhanced | Fill - Ditch | Former field boundary? | 191023.2 | 38797.4 |
| 6 | Linear dipolar enhanced? | Fill? - Ditch? | Projecting perpendicular to [7] appears to be a short stub of ditch fill, as if there was further structure alongside [7] and pre-dating the present field boundaries | 190970.3 | 38809.0 |
| 7 | Linear dipolar enhanced | Fill - Ditch | The alignment of this, parallel to [1], suggests that they may relate in some way but there is little else visible to explain its function | 190970.6 | 38818.0 |
| 8 | Area enhanced | Fill? - Ditch? | Uncertain interpretation | 190979.8 | 38796.3 |

# 5 Discussion

## 5.1 Introduction

The sections below first discuss the geophysical context within which the results need to be considered and then specific features or anomalies of particular interest. Not all will be discussed here and the reader is advised to consult the catalogue (ibid) in conjunction with the graphical elements of this report.

## 5.2 Principles

In general, topsoil is more magnetic than subsoil which can be slightly more magnetic than parent geology, whether sands, gravels or clays, however, there are exceptions to this. The reasons for this are natural and are due to biological processes in the topsoil that change iron between various oxidation states, each differently magnetic. Where there is an accumulation of topsoil or where topsoil has been incorporated into other features, a greater magnetic susceptibility will result.

Within landscapes soil tends to accumulate in negative features like pits and ditches and will include soil particles with thermo-remanent magnetization (TRM) through exposure to heat if there is settlement or industry nearby. In addition, particles slowly settling out of stationary water will attempt to align with the ambient magnetic field at the time, creating a deposit with depositional remanent magnetization (DRM).

As a consequence, magnetic survey is nearly always more a case of mapping accumulated magnetic soils than structures which would not be detected unless magnetic in their own right, e.g. built of brick or tile. As a prospecting tool it is thus indirect. Fortunately, the mechanisms outlined above are commonplace and favoured by human activity and it is nearly always the case that cut features will alter in some way the local magnetic field.

### 5.2.1 Instrumentation

The use of the magnetic sensors in non-gradiometric (vertical) configuration avoids measurement sensitisation to the shallowest region of the soil, allowing deeper structures, whether natural or otherwise to be imaged within the sensitivity of the instrumentation. However, this does remove suppression of ambient noise and temporal trends which have to be suppressed later during processing. When compared to vertical gradiometers in archaeological use, there is no significant reduction in lateral resolution when using non-gradiometric sensor arrays and the inability of gradiometers to detect laminar structures is completely avoided.

Caesium instrumentation has a greater sensitivity than fluxgate instruments, however, at the 10 Hz sampling rate used here this increase in sensitivity is limited to about one order of magnitude.

The array system is designed to be non-magnetic and to contribute virtually nothing to the magnetic measurement, whether through direct interference or through motion noise. There is, however, some limited contribution from the towing ATV.

## 5.3 Character & principal results

### 5.3.1 Geology

There is little visible variation contributed by the Devonian mudstone although a larger survey would likely reveal more, e.g. changes in soil depth or chemistry associated with erosion structures etc. The soil magnetic susceptibility is fairly high and buried earth-cut structures are associated with strong magnetic anomalies.

### 5.3.2 Land use

Probable ditch fills [2] and [5] suggest that there has been some re-organisation of the landscape, probably after disuse of the outer defensive circuit of the monument. However, it remains possible that these fills pre-date construction of ditch fill [1].

### 5.3.3 Archaeology

The wide (2 - 3m) ditch fill [1] confirms the existence of a further defensive circuit about 50m outside the core defensive structures. The amount of land therefore enclosed might suggest that the site functioned as a defensible farmstead, with sufficient land protected to support its inhabitants.

There are various linear fills, some of which, e.g. [2] and [5] might relate to previous land divisions but could also be parts of early field systems or settlement.

More enigmatic are [6], [7] and [8] which appear to be ditch fills but have insufficient length visible to be able to gauge their layout and hence possible function.

## 5.4 Conclusions

The primary conclusion is that the survey has confirmed the earthwork and aerial photographic evidence for an outer defensive circuit some 90m from the centre of the monument. This, like the extant banks in the field to the west, is polygonal rather than oval or circular.

A range of other anomalies mark structures of archaeological interest and between them suggest that further survey would be successful in mapping the prehistoric and later landscapes.

## 5.5 Caveats

Geophysical survey is a systematic measurement of some physical property related to the earth. There are numerous sources of disturbance of this property, some due to archaeological features, some due to the measuring method, and others that relate to the environment in which the measurement is made. No disturbance, or 'anomaly', is capable of providing an unambiguous and comprehensive description of a feature, in particular in archaeological contexts where there are a myriad of factors involved.

The measured anomaly is generated by the presence or absence of certain materials within a feature, not by the feature itself. Not all archaeological features produce disturbances that can be detected by a particular instrument or methodology. For this reason, the absence of an anomaly must never be taken to mean the absence of an archaeological feature. The best surveys are those which use a variety of techniques over the same ground at resolutions adequate for the detection of a range of different features.

Where the specification is by a third party ArchaeoPhysica will always endeavour to produce the best possible result within any imposed constraints and any perceived failure of the specification remains the responsibility of that third party.

Where third party sources are used in interpretation or analysis ArchaeoPhysica will endeavour to verify their accuracy within reasonable limits but responsibility for any errors or omissions remains with the originator.

Any recommendations are made based upon the skills and experience of staff at ArchaeoPhysica and the information available to them at the time. ArchaeoPhysica is not responsible for the manner in which these may or may not be carried out, nor for any matters arising from the same.

## 5.6 Bibliography

Parry, 2012, "Unlocking Our Coastal Heritage Project: Carne Beacon and Veryan Castle, Nr Veryan, The Roseland, Cornwall – Brief for Geophysical Survey", the National Trust, unpublished

## 5.7 Acknowledgements

Jim Parry, National Trust archaeologist, and the National Trust wardens are thanked for their help and support throughout the survey and the farmer for access arrangements. The site-specific advice given by staff of Cornwall Council HES is gratefully acknowledged.

# 6 Appendices

## 6.1 Project metadata

| | |
|---|---|
| **Project Name** | Veryan Castle |
| **Project Code** | NTC129 |
| **Client** | The National Trust |
| **Fieldwork Dates** | 18th July 2013 |
| **Field Personnel** | D Rouse, R Vine |
| **Data Processing Personnel** | ACK Roseveare, MJ Roseveare |
| **Reporting Personnel** | MJ Roseveare |
| **Draft Report Date** | 31st July 2013 |
| **Final Report Date** | |

## 6.2 Qualifications & experience

All work is undertaken by qualified and experienced geophysicists who have specialised in the detection and mapping of near surface structures in archaeology and other disciplines using a wide variety of techniques. There is always a geophysicist qualified to post-graduate level on site during fieldwork and all processing and interpretation is undertaken under the direct influence of either the same individual or someone of similar qualifications and experience.

ArchaeoPhysica meets with ease the requirements of English Heritage in their 2008 Guidance "Geophysical Survey in Archaeological Field Evaluation" section 2.8 entitled "Competence of survey personnel". The company is one of the most experienced in European archaeological prospection and is a key professional player. It only employs people with recognised geoscience qualifications and capable of becoming Fellows of the Geological Society of London, the Chartered UK body for geophysicists and geologists.

## 6.3 Safety

Safety procedures follow the recommendations of the International Association of Geophysical Contractors (IAGC).

Principal personnel have passed the Rescue Emergency Care – Emergency First Aid course and CSCS cards are being sought for those members of staff currently without them.

All personnel are issued with appropriate PPE and receive training in its use. On all sites health and safety management is performed by the Project Geophysicist under supervision by the Operations Manager.

Health and safety policy documentation is reviewed every 12 months, or sooner if there is a change in UK legislation, a reported breach of such legislation, a reported Incident or Near Miss, or changes to ArchaeoPhysica's activities. Anne Roseveare, Operations Manager, has overall responsibility for conducting this review and ensuring documentation is maintained.

We are happy to confirm that ArchaeoPhysica has suffered no reportable accidents since its inception in 1998.

## 6.4 Archiving

ArchaeoPhysica maintains an archive for all its projects, access to which is permitted for research purposes. Copyright and intellectual property rights are retained by ArchaeoPhysica on all material it has produced, the client having full licence to use such material as benefits their project.

Archive formation is in the spirit of Schmidt, A., 2001, "Geophysical Data in Archaeology: A Guide to Good Practice", ADS.

Access is by appointment only. Some content is restricted and not available to third parties. There is no automatic right of access to this archive by members of the public. Some material retains commercial value and a charge may be made for its use. An administrative charge may be made for some enquiries, depending upon the exact nature of the request.

The archive contains all survey and project data, communications, field notes, reports and other related material including copies of third party data (e.g. CAD mapping, etc.) in digital form. Many are in proprietary formats while report components are available in PDF format.

In addition, there are paper elements to some project archives, usually provided by the client. Nearly all elements of the archive that are generated by ArchaeoPhysica are digital.

It is the client's responsibility to ensure that reports are distributed to all parties with a necessary interest in the project, e.g. local government offices, including the HER where present. ArchaeoPhysica reserves the right to display data from projects on its website and in other marketing or research publications, usually with the consent of the client. Information that might locate the project is normally removed unless otherwise authorised by the client.