TENBY JUNIOR COMMUNITY SCHOOL, HEYWOOD LANE, TENBY, PEMBROKESHIRE: GEOPHYSICAL SURVEY & ARCHAEOLOGICAL EVALUATION 2014





Prepared by DAT Archaeological Services For Pembrokeshire County Council





DYFED ARCHAEOLOGICAL TRUST



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SUMMARY

DAT Archaeological Services (the contractual arm of Dyfed Archaeological Trust) were commissioned by Pembrokeshire County Council to provide a scheme of archaeological works prior to the construction of a proposed new school build adjacent to Tenby Junior School, Heywood Lane, Tenby, Pembrokeshire (NGR SN1231 0093). The site covers an area of c.1.1 ha on land currently used as a sports playing field The archaeological works are required as a condition placed on planning permission for the development (Planning Application No.14/0185).

A Written Scheme of Investigation (WSI) defining the archaeological works was produced by DAT Archaeological Services and was approved by the local planning authority.

The archaeological advisors to the planning authority, Dyfed Archaeological Trust Heritage Management, recommended that in the first instance a geophysical survey of the entire site area would provide an indication of the archaeological potential of the site and this was included within the WSI. The geophysical survey was undertaken on 8th October 2014.

The geophysical survey results appeared to show the presence of archaeologically significant remains within the development area. Interpretation of the results indicated the possible remains of an Iron Age enclosure; typified by an enclosing ditch surrounding internal settlement features and characteristic of those built between 800 BC and the coming of the Romans in the 1st century AD.

Following discussions with Dyfed Archaeological Trust Heritage Management an archaeological evaluation was undertaken to characterise the nature and survival of the archaeological deposits. Three trial trenches were excavated targeting the possible enclosure ditch and internal features.

No significant archaeological deposits or remains were recorded within any of the three trenches. The survey results and interpretation diagrams are not always a definitive model of what lies beneath the ground surface and in this case it would appear features recorded during the geophysical survey are the result of the underlying geology and the east – west strike fault known to run through the middle of the area, which marks the boundary between the Bishopston Mudstone Formation and the Pembroke Limestone Group.

Although no significant archaeological remains or deposits were recorded within the development area, the potential for the survival of archaeological deposits elsewhere in the vicinity of the development still remains.

INTRODUCTION

1.1. Project commission

1.1.1. DAT Archaeological Services (the contracting arm of Dyfed Archaeological Trust) were commissioned by Pembrokeshire County Council to provide a scheme of archaeological works prior to the construction of a proposed new school build adjacent to Tenby Junior School, Heywood Lane, Tenby, Pembrokeshire (NGR SN1231 0093; Figure 1). The site covers an area of c.1.1 ha on land currently used as a sports playing field (Figure 2). The archaeological works are required as a condition placed on planning permission for the development (Planning Application No.14/0185). The condition states:

No development shall take place until the applicant, or their agents or successors in title, has secured the implementation of a programme of archaeological work in accordance with a written scheme of investigation which has been submitted to and approved in writing by the Local Planning Authority.

- 1.1.2. A Written Scheme of Investigation (WSI) defining the archaeological works was produced by DAT Archaeological Services and was approved by the local planning authority. The scheme was implemented in order to fulfil the archaeological condition that has been recommended to be placed on any forthcoming planning permission for the site.
- 1.1.3. The archaeological advisors to the planning authority, Dyfed Archaeological Trust Heritage Management, recommended that in the first instance a geophysical survey of the entire site area would provide an indication of the archaeological potential of the site and this was included within the WSI. The geophysical survey was undertaken on 8th October 2014.
- 1.1.4. The results of the geophysical survey indicated the strong possibility that significant archaeological features survived within the development area.
- 1.1.5. Following discussions with the archaeological advisor to the planning authority (Dyfed Archaeological Trust Heritage Management) it was determined that an archaeological evaluation should be undertaken. This evaluation would comprise excavating by mechanical excavator a number or trial trenches targeted across archaeological features identified from the geophysical survey, to characterise the nature and depth of said features and deposits.
- 1.1.6. The aim of the evaluation was to provide information on the character and significance of any below ground archaeological remains that may be present within the development area. Thereby providing information on further mitigation that should be implemented at the school site prior to and possibly during development.

1.2. Scope of the project

- 1.2.1. The aims of the project were twofold:
 - to characterise by geophysical survey, using a gradiometer, possible buried archaeological features in the area of the proposed new school development,

• and to evaluate by trial trenching the nature of any significant archaeological features identified by the geophysical survey.

1.3. Report outline

This report outlines the results of both stages of work as described above and outlines recommendations for further work.

1.4. Abbreviations

1.4.1. 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). Gradiometer readings are measured in nanoTesla (nT).

1.5. Timeline

1.5.1. The following table illustrates the approximate dates for the archaeological periods discussed in this report:

PERIOD	APPROXIMATE DATE	
PALAEOLITHIC	<i>c</i> .120,000 BC – <i>c</i> .10,000 BC	
MESOLITHIC	<i>c</i> .10,000 BC – <i>c</i> .4400 BC	
NEOLITHIC	<i>c</i> .4400 BC – <i>c</i> .2300 BC	
BRONZE AGE	<i>c</i> .2300 BC – <i>c</i> .700 BC	
IRON AGE	<i>c.</i> 700 BC – <i>c.</i> 43 AD	
ROMAN	<i>c</i> .43 AD – <i>c</i> .410 AD	
EARLY MEDIEVAL	<i>c.</i> 410 AD - <i>c.</i> 1086	
MEDIEVAL	<i>c.</i> 1086 - <i>c.</i> 1536	
POST MEDIEVAL	<i>c</i> .1536 – <i>c</i> .1900	
MODERN	c.1900 onwards	

Table 1: Archaeological and historical timeline

2. THE SITE

2.1. Location and Archaeological Potential

- 2.1.1. The development area covers an area of c.1.1ha on which a new school will be constructed. The development area is currently a level sports playing field belonging to Greenhill Secondary School (Figure 2).
- 2.1.2. The planning application was fully approved by the planning committee of Pembrokeshire Coast National Park Authority on 5th August 2014.
- 2.1.3. The northern half of the development area is underlain by Bishopston Mudstone Formation, that is described on the BGS website as a mid to dark grey mudstone containing beds of siltstone, mudstone and minor pale quartzic sandstones containing rare thin coals. The southern half is shown to be underlain by Pembroke Limestone Group, which is described on the BGS website as a skeletal and ooidal limestone. An east – west strike fault is shown to run through the middle of the area, which marks the boundary between the Bishopston Mudstone Formation and the Pembroke Limestone Group.
- 2.1.4. Within the development area no superficial deposits are indicated on the geological maps.

2.2. Archaeological and Historical Background

- 2.2.1. The information described below is taken from the regional Historic Environment Record (HER) held by Dyfed Archaeological Trust, within a search area of 600m from the boundary of the proposed school site. Table 2 summarises the results of the HER search and the distribution of these sites is recorded in Figure 3, none of these sites are located within the area of the proposed school development.
- 2.2.2. The development area lies within a short distance of several sites of historical and archaeological interest including the remains of a scheduled medieval mansion house (PRN 3699; SAM PE547), several undated crop mark features (PRN's 3422, 3670, 3705 & 14980) and two Bronze Age find spots (PRN's 4313 & 3707) (Figure 3 & Table 2). Therefore there was considered to be a strong possibility that archaeological material could extend into the application area and be adversely affected by the proposed development.
- 2.2.3. Cartographic evidence provides little information on earlier uses or the history of the area within which the development is located. The 1st edition Ordnance Survey 1:2500 map (Figure 4) shows the area as enclosed fields



Figure 1: Location map, based on the Ordnance Survey. Development area circled in red. Reproduced from the Ordnance Survey 1:25,000 scale Explorer Map with the permission of The Controller of Her Majesty's Stationery Office, © Crown Copyright Dyfed Archaeological Trust Ltd., The Shire Hall, Carmarthen Street, Llandeilo, Carmarthenshire SA19 6AF. Licence No 100020930



Figure 2: Detailed location map, based on the Ordnance Survey. Development area outlined in red. Reproduced from the Ordnance Survey 1:25,000 scale Explorer Map with the permission of The Controller of Her Majesty's Stationery Office, © Crown Copyright Dyfed Archaeological Trust Ltd., The Shire Hall, Carmarthen Street, Llandeilo, Carmarthenshire SA19 6AF. Licence No 100020930



Figure 3: Plan showing the archaeological and historical sites listed in Table 2. Development area outlined in red. Reproduced from the Ordnance Survey 1:25,000 scale Explorer Map with the permission of The Controller of Her Majesty's Stationery Office, © Crown Copyright Dyfed Archaeological Trust Ltd., The Shire Hall, Carmarthen Street, Llandeilo, Carmarthenshire SA19 6AF. Licence No 100020930

PRN	NPRN	Name	Description	National Grid	Site Type	Period
No.	No.			Ref		
3422		Castle Hill 'B'	Crop mark – possible enclosure visible on aerial photographs. Possibly related field name 'Castle Hill'	SN11940132	Crop mark	Unknown
3670		Castle Hill `C'	Crop mark - possible enclosure visible on aerial photographs. Possibly related field name 'Castle Hill'	SN12010129	Crop mark	Unknown
3690		St Marys Chapel	Documentary evidence of a medieval chapel	SN12830082	Hospital	Medieval
3699		Scotsborough House	A now ruined mansion house whose origins may date from the C13th. In early C20 th there are records of visible defensive earthworks. Architectural details suggest beginning of C14 th . The ruined mansion was partially converted into cottages during the early C19th but occupation ceased c.1824. Scheduled Ancient Monument Ref: PE547	SN11730108	Dwelling	Medieval; Post- medieval
3701		Brython Place	Roman 3 rd century coin of Claudius Gothicus (269-70) found at Brython Place, Tenby.	SN128010	Finds	Roman
3705		Castle Hill'A'	Crop mark – small ringwork visible on aerial photographs. Possibly related field name 'Castle Hill'.	SN11910133	Crop mark	Unknown
3707		The Paddock	Bronze palstave axe – a loopless palstave was found in 1961 3ft deep in the garden of 'The Paddock', The Maudlins, Tenby, whilst digging foundations. Now in Tenby museum.	SN12730103	Finds	Bronze Age
4313		The Paddock	Bronze palstave axe – a palstave found whilst digging foundations in the garden of 'The Paddock', Tenby. Found 2-3 weeks before (PRN 3707) but not retained and thrown away.	SN12720104	Finds	Bronze Age
12581		The Green	A medieval mill in this location is suggested by Rees' map, which purports to show wales in the 14 th century.	SN128008	Water mill	Medieval
14980		Big Castle Hill	A large rectilinear enclosure in the form of a crop mark is visible on a recent AP. The nature of this site is uncertain and it was not detected during field walking.	SN117013	Crop mark	Unknown
20621	30207	St Marys's Hill	Grade II Listed post-medieval building - Early to mid C19th. 2-storey; stuccoed; 3 bays; slate roof. Listed Building Ref: 6160	SN12760081	Dwelling	Post- medieval

20622	21950	The Gables	Grade II Listed post-medieval building - Formerly listed as the Gables only. Early C19 cottage with an earlier core. Now divided into two parts with a tenant in gable end. Cottage built around a small existing cottage known as Magdalene cottage, traces of which still remain towards the rear of the present structure Listed Building Refs: 6161, 26363	SN12750086	Dwelling	Post- medieval
20623	21675	Broadmead	Grade II Listed post-medieval building - Early C19th, 2 storeys, stuccoed walls; Gothic detail. Said to have been designed by the same architect as the Gables (PRN 20622) slate roof with plain stacks. Listed Building Ref: 6162	SN12140084	Dwelling	Post- medieval
20624	22055	Heywood Mount	Grade II Listed post-medieval building - Mid C19 circa. 2- storey house with stuccoed walls and Gothic details. Listed Building Ref: 6163	SN12090093	Dwelling	Post- medieval
59880		Coach House to Gable End	Coach House - Mid C19 small coach-house and stable to a picturesque villa formerly known as The Gables (PRN 20622), now divided into two houses, The Gables and Gable End, the coach-house now belonging to the latter. The Gables was probably built in 1847 as the lease dates from then and this building is contemporary, marked on a map of 1849 and mentioned in a sale advertisement 1876. Listed Building Ref: 26364	SN12780084	Coach house	Post- medieval
59898		No 1 Marsh Road Cottages	Grade II Listed post-medieval cottage - One of a row of four matching earlier to mid C19 single-storey Gothic cottages, said to have been built for workers in the limestone quarries. Apparently built before the 1851 census Listed Building Ref: 26382	SN12530051	Cottage	Post- medieval
59899		No 2 Marsh Road Cottages	Grade II Listed post-medieval cottage - One of a row of four matching earlier to mid C19 single-storey Gothic cottages, said to have been built for workers in the limestone quarries. Apparently built before the 1851 census Listed Building Ref: 26383	SN12540051	Cottage	Post- medieval
59900		No 3 Marsh Road Cottages	Grade II Listed post-medieval cottage - One of a row of four matching earlier to mid C19 single-storey Gothic cottages, said to have been built for workers in the limestone quarries. Apparently built before the 1851 census	SN12530051	Cottage	Post- medieval

		Listed Building Ref: 26384			
59901	No 4 Marsh Road Cottages	Grade II Listed post-medieval cottage - One of a row of four matching earlier to mid C19 single-storey Gothic cottages, said to have been built for workers in the limestone quarries. Apparently built before the 1851 census Listed Building Ref: 26385	SN12560051	Cottage	Post- medieval
59902	Milestone	Grade II Listed milestone - cast-iron early C19 mile marker on the Tenby to Pembroke turnpike road Listed Building Ref: 26386	SN1210054	Milestone	Post- medieval
103401	The Clicketts	'Old Limekiln' shown on the 1890 1 st edition and 1907 2 nd edition OS maps.	SN11870083	Limekiln	Post- medieval

Table 2: Archaeological and historical sites recorded on the Dyfed HER within *c*.600m of the proposed development and shown in Figure 3.



Figure 4: Extract of the Ordnance Survey 1st edition 1890 1:2500 map. Development area outlined in red.

DAT Archaeological Services

3. GEOPHYSICAL SURVEY

3.1. Methodology

- 3.1.1. A fluxgate gradiometer was used for the survey, which detects variations in the earth's magnetic field. Readings were taken at a low resolution on traverses 1m wide and every 0.25m within a 20m x 20m or 30m x 30m grid across the site. The full area of the proposed development site was surveyed, some 1.1ha in total. A Trimble TST was used to tie the survey grid into the local Ordnance Survey grid.
- 3.1.2. The underlying geology and soils were considered suitable for geophysical survey.
- 3.1.3. Processing was performed using TerraSurveyor 3.0. The data was presented with a minimum of processing. The presence of high values caused by ferrous objects, which tend to hide fine details and obscure archaeological features, was 'clipped' to remove the extreme values allowing the finer details to show through.
- 3.1.4. The processed data was presented as grey-scale plots overlaid on local topographical features. The main magnetic anomalies were identified and plotted onto the local topographical features as a level of interpretation.

3.2. Results

- 3.2.1. The geophysical survey was carried out on 8th October 2014.
- 3.2.2. The weather was changeable with occasional lighting storms nearby. This does not appear to have affected the results.
- 3.2.3. The results are presented in Figure 5 as a greyscale plot on a graded scale of ± 8 nT (nanoTesla).
- 3.2.4. The main magnetic anomalies have been identified and an interpretation of those results is shown in Figure 6. Only the major features are discussed and any interpretation of these geophysical results is by its nature speculative.
- 3.2.5. The location of likely or possible buried modern services is indicated by the lines coloured magenta. The magenta boxes indicate the location of observed or suspected modern service access covers, or buried service features like couplings or joints.
- 3.2.6. The two features labelled A in Figure 6 indicate the location of the football/rugby posts observed during the survey. The large magnetic 'shadow' caused by these features may obscure the location of further archaeological remains.
- 3.2.7. The positive features across the site, coloured brown on Figure 6, may reflect the presence of soil filled features, such as ditches (B, C and D) or pits (E-M).

- 3.2.8. The shape and size of features B and D is strongly suggestive of a prehistoric Iron Age defended enclosure. The subtle nature of the readings may indicate that the feature is shallow or horizontally truncated.
- 3.2.9. Feature C could be a distinct phase of feature B/D or an entirely separate feature, and may even be related to the services.
- 3.2.10. Within the centre of the possible enclosure defined by ditch B is a concentration of features that could indicate former occupation within the enclosure. The presence of pit H at a possible 'entrance' to the enclosure may also indicate related archaeological activity in this area.
- 3.2.11. This type of settlement defended by a deep ditch and associated bank is typical of that built between 800 BC and the coming of the Romans in the 1st century AD. People, however, continued to live in these settlements during the Roman period, and some carried on in use into the 5th and 6th centuries AD and perhaps beyond.
- 3.2.12. The survey results and interpretation diagrams should not be seen as a definitive model of what lies beneath the ground surface, not all buried features will provide a magnetic response that can be identified by the gradiometer. In interpreting those features that are recorded the shape is the principal diagnostic tool, along with comparison with known features from other surveys. The intensity of the magnetic response could provide further information, a strong response for example indicates burning, high ferric content or thermoremnancy in geology. The context may provide further clues but the interpretation of many of these features is still largely subjective.
- 3.2.13. All measurements given were approximate as accurate measurements are difficult to determine from fluxgate gradiometer surveys. The width and length of identified features can be affected by its relative depth and magnetic strength.
- 3.2.14. The interpretation diagrams were used to identify the presence/absence of any potential archaeological deposits. The archaeological advisors to the planning authority, Dyfed Archaeological Trust-Heritage Management were informed of these results.



Figure 5: Geophysical survey results presented as a greyscale plot, graded scale of ± 8 nT (nanoTesla) and set within local topographical detail.



Figure 6: Main anomalies identified from the geophysical survey set within local topographical detail. Brown represents magnetically positive readings; grey magnetically negative readings and magenta are readings indicating probable modern services.

4. ARCHAEOLOGICAL EVALUATION

4.1. Methodology

- 4.1.1. The interpretation diagrams were used to identify the potential presence/absence of any archaeological deposits. After consulting the archaeological advisors to the planning authority, Dyfed Archaeological Trust-Heritage Management, it was proposed that further archaeological mitigation was required in the form of a phase of trial trench evaluation, to better ascertain the significance and state of preservation of the features identified during the geophysical survey. This would involve the machine excavation of trenches under archaeological supervision in targeted areas across the site. The trenches would then be cleaned and the identified archaeology recorded and sample excavated.
- 4.1.2. The information from this scheme of works would clarify the results of the geophysical survey, identify the presence or absence of archaeology, and determine the state of preservation of any identified remains, their date, significance and extent.

4.1.3. *Proposed trenches (Figure 7)*

- **Trench 1** One trench of 40m x 2m targeted to cross the linear anomaly that may define an enclosure of possible archaeological origin and the smaller anomalies within the centre of the possible enclosure.
- **Trench 2** One 30m x 2m trench targeted to cross 2 linear anomalies of possible archaeological origin.
- **Trench 3** A right angled trench measuring N-S 15m and E-W 17m to target 2 linear anomalies.
- 4.1.4. The proposed trench arrangement was designed to target those features identified by the geophysical survey. The targeted trenches were located to target the enclosure ditches and other features of likely archaeological origin.
- 4.1.5. In total it was proposed to open around 110m length of *c*.2m wide trenches in the locations shown on Figure 7.
- 4.1.6. The trenches were excavated using a mechanical excavator, fitted with a flat bladed bucket. Arisings were stored adjacent to the trench (at a safe distance). Trenches were excavated to remove all non-archaeologically significant overburden, down onto either archaeological levels or the underlying natural undisturbed ground surface.
- 4.1.7. Following machine excavation, the trenches were appropriately cleaned to prove the presence, or absence, of archaeological features and to determine their significance. The excavation of the minimum number of archaeological features needed to elucidate the character, distribution, extent, date and importance of the archaeological remains were undertaken.
- 4.1.8. All deposits were recorded by archaeological context record sheet, scale drawing, photography and site notebooks. All individual deposits were numbered using the open-ended numbering system in accordance with

DAT Archaeological Services' Recording Manual¹. Significant deposits were recorded by scale drawing (no less than 1:20); drawn plans will be related to Ordnance Datum and, where possible, known boundaries. A photographic record was maintained using digital and monochrome print formats.

4.1.9. All archaeologically significant artefacts, ecofacts and samples were retained and, where possible, related to the contexts from which they derived.



Figure 7: Plan showing the proposed location of the evaluation trenches overlying the archaeological interpretation of the geophysical survey results.

¹ DAT Archaeological Services use the Recording Manual developed by English Heritage Centre for Archaeology. A copy will be available for inspection if required.

4.2. Results

- 4.2.1. The evaluation was undertaken over 17th and 18th November 2014 in fine weather.
- 4.2.2. The trial trenches, as shown in Figure 7, were excavated using an 8 tonne mechanical excavator with a grading bucket (Photos 1-3). All non-archaeologically significant overburden was removed down onto either archaeological levels or the underlying natural undisturbed ground surface.
- 4.2.3. The trial trenches revealed the shallow depth of topsoil above the natural bedrock. The topsoil comprised brown silty clay with rootlets, 20th century pottery sherds, glass fragments and coal pieces. In places across the site a shallow layer of slightly gravelly clay was present between the topsoil and the natural bedrock.
- 4.2.4. Bedrock was visible as a weathered horizon of sub-angular to angular boulders and cobbles of limestone, interspersed with areas of light brown/orange clay that possibly indicate the presence of infilled solution features.

Trench 1 (Photos 1-3)

- 4.2.5. Trench 1, measuring approximately 45m in length, was positioned to target the possible enclosure ditch and smaller outer ditch. features as shown in Figure 7.
- 4.2.6. The topsoil was of a consistent depth of 0.20m across the whole length of the trench. At the northern end of the trench the topsoil lay directly above natural limestone cobbles and clay.
- 4.2.7. Approximately 5.0m south of the north end of the trench the natural bedrock began to slope gently downwards, indicating the edge of a natural depression or solution feature within the limestone bedrock. A narrow trench (Photo 2) was excavated along the eastern edge of the trench in this area to characterise the feature.
- 4.2.8. The depression was recorded as having a maximum depth of 0.85m and was filled with dense silty clay containing very few inclusions. Towards the southern end of the trench was a deposit of stone in the top of the fill of the depression (Photo 3). Within this deposit was a number of pottery sherds of 20th century date. This stone lay directly below the topsoil.
- 4.2.9. The southern limit of the depression lay beyond the southern end of Trench 1.
- 4.2.10. Apart from a number of modern land drains no other archaeologically significant features were located with Trench 1.

Trench 2 (Photo 4)

- 4.2.11. Trench 2, measuring approximately 30m in length, was positioned to target the possible enclosure ditch and internal features as shown in Figure 7.
- 4.2.12. The excavated trench revealed that the topsoil varied from 0.33m deep at the eastern end of the trench, to 0.60m deep at the western end.

- 4.2.13. Three modern land drains were recorded at c. 8 metre intervals, running roughly north-south across the trench.
- 4.2.14. No archaeologically significant features or deposits were recorded within Trench 2.

Trench 3 (Photos 5 & 6)

- 4.2.15. Trench 3, measuring N-S 15m and E-W 17m was positioned to target 2 linear anomalies.
- 4.2.16. Within the trench the topsoil varied between 0.12m to 0.30m and lay directly above natural clay and limestone bedrock.
- 4.2.17. No archaeologically significant features or deposits were recorded with Trench 3.

5. CONCLUSIONS

- 5.1.1. No significant archaeological deposits or remains were recorded within any of the three trenches. The survey results and interpretation diagrams are not always a definitive model of what lies beneath the ground surface. In this case it would appear that the underlying geology and the east west strike fault known to run through the middle of the area, which marks the boundary between the Bishopston Mudstone Formation and the Pembroke Limestone Group, has led to natural changes in the underlying geology appearing similar to archaeological features when recorded by geophysical survey.
- 5.1.2. Survey results and interpretation diagrams cannot be regarded as a definitive model of what lies beneath the ground surface; not all buried features will provide a magnetic response that can be identified by the gradiometer. During the interpretation of the recorded features the shape was the principal diagnostic tool, along with comparison with known features from other surveys and professional judgement. This has proved to be extremely successful in previous projects in predicting what archaeological features might lie underground. However, in this case the underlying geology has obstructed the correct interpretation of the survey results.
- 5.1.3. Although no significant archaeological remains or deposits were recorded within the development area, the potential for the survival of archaeological deposits elsewhere in the vicinity of the development still remains.

6. ACKNOWLEDGEMENTS

6.1. This report was prepared by Fran Murphy of DAT Archaeological Services. The survey was undertaken by Charlie Enright and Ed Davies of DAT Archaeological Services. We are indebted to Greenhill School for allowing access onto their land.

7. SOURCES

Published

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

Database

Dyfed Archaeological Trust Historic Environment Record, housed with Dyfed Archaeological Trust in The Shire Hall, Llandeilo, Carmarthenshire, SA19 6AF

RCAHMW Coflein Database http://www.coflein.gov.uk/

Cartographic

Ordnance Survey 1890 1:2500 1st edition Pembrokeshire

Aerial Photographs

Next Perspectives – digital aerial photographs held by the Dyfed Historic Environment Record.

PHOTOGRAPHS



Photo 1: The northern end of Trench 1 showing the shallow nature of the topsoil above the underlying natural subsoil. No archaeological features were visible in this end of the trench. Photograph taken facing NNE.



Photo 2: The southern end of Trench 1 showing the trench excavated through the wide concave depression, which may be a naturally formed feature. It would appear that in the recent past the depression was still evident and has been possibly levelled with stone, shown within the red box. Photograph taken facing NNE.



Photo 3: Detailed photograph of the stone layer within the upper fill of the large natural depression at the southern end of Trench 1. Photograph taken facing N.



Photo 4: Photograph taken facing west of Trench 2 showing the natural clay below the topsoil. The dark bands running across the trench are modern land drains.



Photo 5: The eastern arm of Trench 3. Note the shallow depth of topsoil above the underlying natural clay and limestone. Photograph taken facing south.



Photo 6: The southern arm of Trench 3. Note the band of limestone running in a rough east-west direction along the trench Photograph taken facing west.

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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 thermoremnant 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 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 2.5 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'. Greyscale 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 field boundaries located during the survey.

Bibliography

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

TENBY JUNIOR COMMUNITY SCHOOL, HEYWOOD LANE, TENBY, PEMBROKESHIRE: GEOPHYSICAL SURVEY & ARCAHEOLOGICAL EVALUATION 2014

RHIF YR ADRODDIAD / REPORT NUMBER 2014/51

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JAMES MEEK

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

Swydd / Position: HEAD OF DAT ARCHAEOLOGICAL SERVICES

Llofnod / Signature Dyddiad / Date 08/12/2014

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

