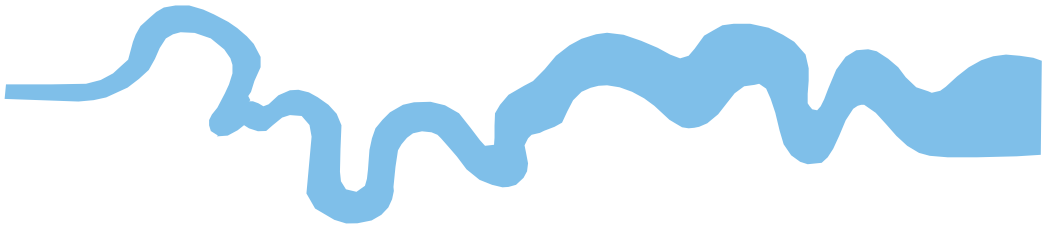
T V A S



SOUTH WEST

Land at Uplyme Quarry, Shapwick Grange, Uplyme, Devon

Geophysical Survey (Magnetic)

by Kyle Beaverstock and Tim Dawson

Site Code: UQD20/70

(SY 3106 9184)

Land at Uplyme Quarry, Shapwick Grange, Uplyme, Devon

Geophysical Survey (Magnetic) Report

For David Lush and Son

by Kyle Beaverstock and Tim Dawson

Thames Valley Archaeological Services Ltd

Site Code UQD 20/70

June 2020

Summary

Site name: Land at Uplyme Quarry, Shapwick Grange, Uplyme, Devon

Grid reference: SY 3106 9184

Site activity: Magnetometer survey

Date and duration of project: 18th June 2020

Project coordinator: Tim Dawson

Site supervisor: Kyle Beaverstock

Site code: UQD 20/70

Area of site: 2.68ha (2.97ha surveyed)

Summary of results: The geophysical survey mapped magnetic anomalies across the area of the proposed quarry extension. The majority of these anomalies are likely to be geological in origin but there is a cluster towards the southern end of the area which may indicate the presence of buried archaeological features.

Location of archive: The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

Report edited/checked by: Steve Ford✓ 30.06.20

TVAS South West, 21 Apple Business Centre, Frobisher Way, Taunton, Somerset, TA2 6BB
Tel: 01823 288 284; Email: southwest@tvas.co.uk; Website: www.tvas.co.uk/southwest

Land at Uplyme Quarry, Shapwick Grange, Uplyme, Devon
A Geophysical Survey (Magnetic)

by Kyle Beaverstock and Tim Dawson

Report 20/70b

Introduction

This report documents the results of a geophysical survey (magnetic) carried out on a plot of land to the north-west of Uplyme Quarry, Shapwick Grange, Uplyme, Devon (SY 3106 9184) (Fig. 1). The work was commissioned by Mr Nick Dunn of Land & Mineral Management Ltd, on behalf of David Lush & Son of Shapwick Quarry, Uplyme, Lyme Regis, Dorset, DT7 3SP.

Conditional planning permission has been granted to extend the end date of the original permission (14/3018/CM) for the extraction of chalk at the existing quarry. In advance of a proposal to extend the quarry into land immediately to the west and included within the Mineral Safeguarding Area, a geophysical survey has been requested. This is in accordance with County's policies on archaeology. The field investigation was carried out to a specification approved by Mr Steve Reed, Senior Historic Environment Officer for Devon. The fieldwork was undertaken by Kyle Beaverstock on 18th June 2020 and the site code is UQD 20/70.

The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies and will be deposited with the ADS in due course.

Location, topography and geology

The site is located approximately 800m north-west of the hamlet of Pinhay and *c*.3km west of the town of Lyme Regis (Fig. 1). Situated within a larger field and lying immediately adjacent to the western boundary of the existing quarry area, the site comprises a rectangular parcel of land on a NE-SW alignment. The larger field originally formed part of Shapwick Grange Farm and is within the civil parish of Uplyme, although the core settlement of that name is *c*.2.2km to the north-east. At the north-east corner, the site is at a height of approximately 139m above Ordnance Datum (aOD), but the land rises gradually towards the south-west, increasing to around 150m aOD at the opposite corner. At the time of the survey the field was recently planted and the crops were beginning to grow. The underlying geology is recorded as Cretaceous sedimentary deposits of Chalk with superficial Quaternary deposits of Clay-with-flints Formation (BGS 2020).

Site history and archaeological background

A desk-based assessment undertaken for the development (Daniel 2020) highlights the site's position within a Roman landscape with Holcombe villa to the north-east and a likely Roman road to the south. The report included a study of historic maps which showed that the site has been undeveloped agricultural land since at least the early 19th century. The Historic Environment Record listed a range of sites within the immediate vicinity of site but these are primarily vestiges of medieval and post-medieval farming field systems and sites of chalk extraction.

Methodology

Sample interval

Data collection involved the traversing of the survey area along straight and parallel lines using two cart-mounted Bartington Grad601-2 fluxgate gradiometers. Even coverage was achieved with the use of regularly spaced markers at the ends of traverses and the real-time positional trace plot. Readings were taken at 0.25m intervals along traverses 1m apart, providing an appropriate methodology balancing cost and time with resolution. Traverses were walked at an alternating north-east to south-west zig-zag pattern. The survey area was free from obstacles and ground conditions were dry, although the weather was overcast.

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. Under normal operating conditions it can be expected to identify buried features >0.5m in diameter. Features which can be detected include disturbed soil, such as the fill of a ditch, structures that have been heated to high temperatures (magnetic thermoremnance) and objects made from ferro-magnetic materials. The strength of the magnetic field is measured in nano Tesla (nT), equivalent to 10^{-9} Tesla, the SI unit of magnetic flux density.

Equipment

The purpose of the survey was to identify geophysical anomalies that may be archaeological in origin in order to inform a targeted archaeological investigation of the site prior to development. The survey and report generally follow the recommendations and standards set out by both European Archaeological Council (EAC 2015) and the Chartered Institute *for* Archaeologists (2002, 2014).

Magnetometry was chosen as a survey method as it offers the most rapid ground coverage and responds to a wide range of anomalies caused by past human activity. These properties make it ideal for the fast yet detailed surveying of an area.

The detailed magnetometry survey was carried out using two dual sensor Bartington Instruments Grad 601-2 fluxgate gradiometers mounted upon a Bartington non-magnetic cart. A two-wheeled lightweight structure pushed by hand, the cart consisted a bank of four vertically-mounted Bartington Grad601-2 magnetic sensor tubes at 1m apart and a Trimble Geo 7x centimetre edition GPS. Readings were collected by two Bartington Grad601-2 loggers and collated using MLgrad601 software on a Linx 12x64 tablet running Windows 10 mounted at the rear of the cart. This enables readings to be taken of both the general background magnetic field and any localised anomalies with the difference being plotted as either positive or negative buried features. All sensors are calibrated to cancel out the local magnetic field and react only to anomalies above or below this base line. On this basis, strong magnetic anomalies such as burnt features (kilns and hearths) will give a high response as will buried ferrous objects. More subtle anomalies such as pits and ditches can be seen from their infilling soils containing higher proportions of humic material, rich in ferrous oxides, compared to the undisturbed subsoil. This will stand out in relation to the background magnetic readings and appear in plan following the course of a linear feature or within a discrete area.

The Trimble Geo7x centimetre edition GPS system with centimetre real-time accuracy was used to tie the cart traverses into the Ordnance Survey national grid. This unit offers both real-time correction and post-survey processing; enabling a high level of accuracy to be obtained both in the field and in the final post-processed data.

Data gathered in the field was processed using the TerraSurveyor software package. This allows the survey data to be collated and manipulated to enhance the visibility of anomalies, particularly those likely to be of archaeological origin. The table below lists the processes applied to this survey, full survey and data information is recorded in Appendix 1.

Process	**Effect**
Clip from -1.80 to 2.20 nT	Enhance the contrast of the image to improve the appearance of possible archaeological anomalies.
De-stripe: median, all sensors	Removes the striping effect caused by differences in sensor calibration, enhancing the visibility of potential archaeological anomalies.
De-spike: threshold 1, window size 3×3	Compresses outlying magnetic points caused by interference of metal objects within the survey area.
De-stagger: all grids, both by -1 intervals	Cancels out effects of site's topography on irregularities in the traverse speed.

The raw data plot is presented as a greyscale plot shown in relation to the site (Fig. 2) with the processed data then presented as a second figure (Fig. 3), followed by a third plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 4). Anomalies are shown as colour-coded lines, points and polygons.

The greyscale plot of the processed data is exported from TerraSurveyor in a georeferenced portable network graphics (.PNG) format, a raster image format chosen for its lossless data compression and support for transparent pixels, enabling it to easily be overlaid onto an existing site plan. The data plot is combined with grid and site plans in QGIS 2.18.15 and exported again in .PNG format in order to present them in figure templates in Adobe InDesign CS5.5, creating .INDD file formats. Once the figures are finalised they are exported in .PDF format for inclusion within the finished report.

Results

A range of magnetic anomalies were recorded across the survey area (Figs. 2 and 3), both positive and dipolar. A series of weaker positive linear anomalies cross the site central and northern parts of the site on an east - west and north-east – south-west orientation (Fig. 4). They do not align with the orientation of the field so are unlikely to be of agricultural origin but do follow the slope of the ground and therefore probably represent changes in the underlying geology, e.g. cracks in the chalk. A series of larger, stronger positive anomalies were recorded at the south-western end of the site, with a few discrete examples in the centre and north-eastern end. These, and the weaker linear positive anomalies that appear to be associated with them, may indicate the presence of buried features of archaeological interest. Together, these anomalies form a rough rectangular enclosure with a group of scattered discrete features. However, their somewhat irregular and fragmentary appearance raises the possibility that these may be indicative of geological rather than archaeological features. Both these and the previously noted possible geological features appear to be similar in alignment to the features noted in the LiDAR component of the desk-based assessment (Daniel 2020) but none can be matched to specific anomalies.

Patches of stronger magnetic readings were recorded at the northern end of the eastern boundary and approximately half way along the western boundary. The nature of these indicates magnetic disturbance caused by in the case of the former a near-by ferrous object such as a fence, and for the latter scattered ferrous debris within the soil. Further magnetic spikes were detected dotted across the site, most likely indicating the presence of individual ferromagnetic objects, such as fragments of broken farm machinery, within the topsoil. These areas of stronger magnetic readings may obscure weaker anomalies of archaeological origin.

Conclusion

The geophysical survey of the proposed quarry extension was successfully undertaken and mapped a range of magnetic anomalies across the area. The majority of these anomalies can be interpreted as being caused by changes in the underlying geology or ferrous objects within or close-by to the site. However, there are a small number of linear and discrete positive magnetic anomalies which may indicate the presence of buried archaeological features. These are mainly clustered at the southern end of the survey area and potentially represent ditches and pits of unknown date, although there is a possibility that these too are geological in origin.

References

BGS, 2020, *Geology of Britain Viewer*, http://mapapps.bgs.ac.uk/geologyofbritain/home.html (accessed 18/6/20)

CI*f*A, 2014, 'Standard and Guidance for archaeological geophysical survey', Reading

Daniel, H, 2020, 'Uplyme Quarry, Shapwick Grange, Uplyme, Devon: An archaeological desk-based assessment', TVAS South West unpublished report 20/70, Taunton

EAC, 2015, *EAC Guidelines for the use of Geophysics in Archaeology: Questions to Ask and Points to Consider*, EAC Guidelines 2, Namur

IFA, 2002, 'The Use of Geophysical Techniques in Archaeological Evaluation', IFA Paper No. 6, Reading

Appendix 1. Survey and data information

Programme:
Name: TerraSurveyor
Version: 3.0.36.0

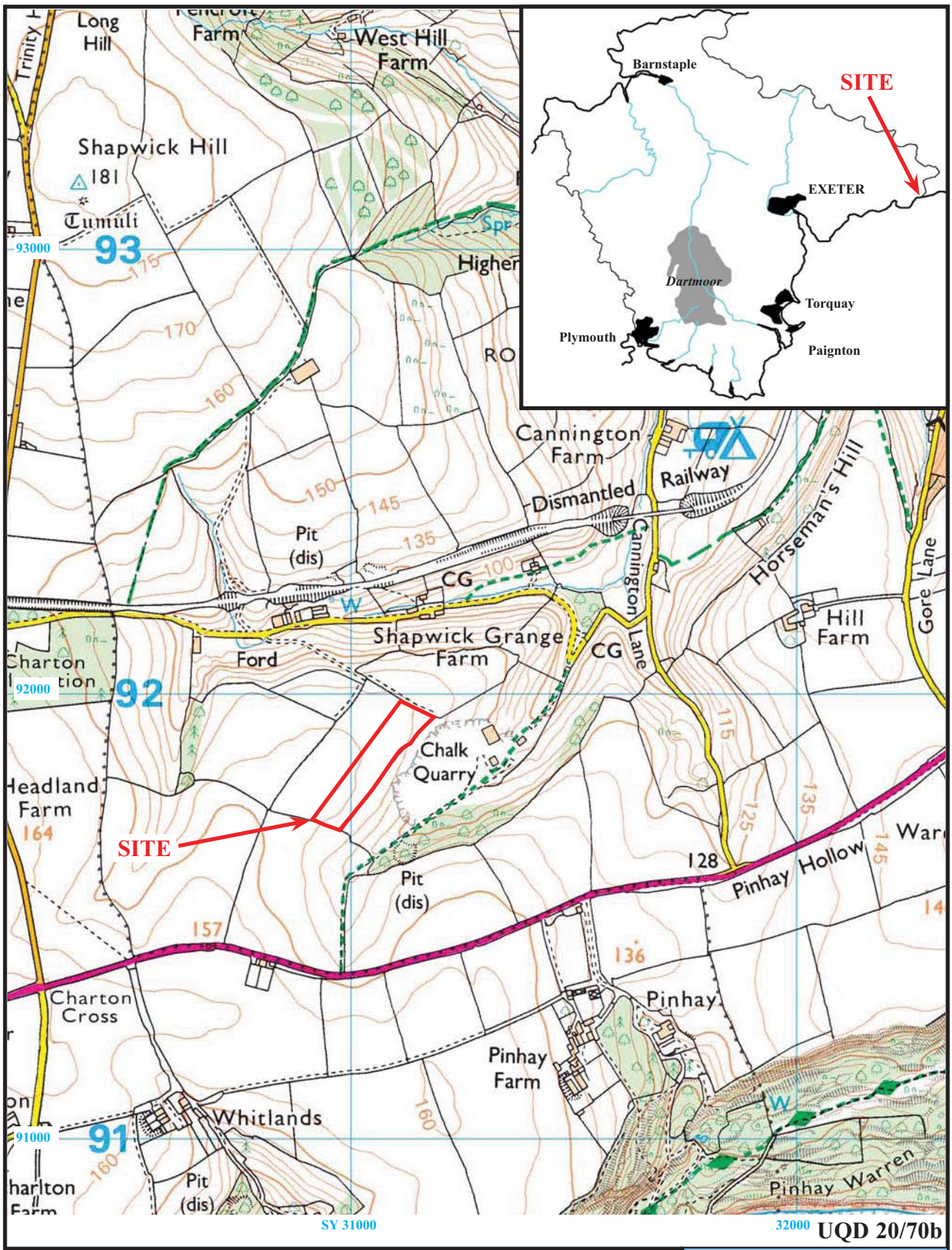
Raw data
UTM Zone: 30
Survey corner coordinates (X/Y):
Northwest corner: 330884.046819146, 91995.8317817508 m
Southeast corner: 331175.506819146, 91695.0117817508 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions
Survey Size (meters): 291 m x 301 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 92991, Recorded: 92991

Stats
Max: 89.28
Min: -105.22
Std Dev: 1.92
Mean: 0.40
Median: 0.35
Composite Area: 8.7677 ha
Surveyed Area: 2.976 ha

Processed data
Stats
Max: 2.41
Min: -2.00
Std Dev: 0.50
Mean: 0.03
Median: 0.01

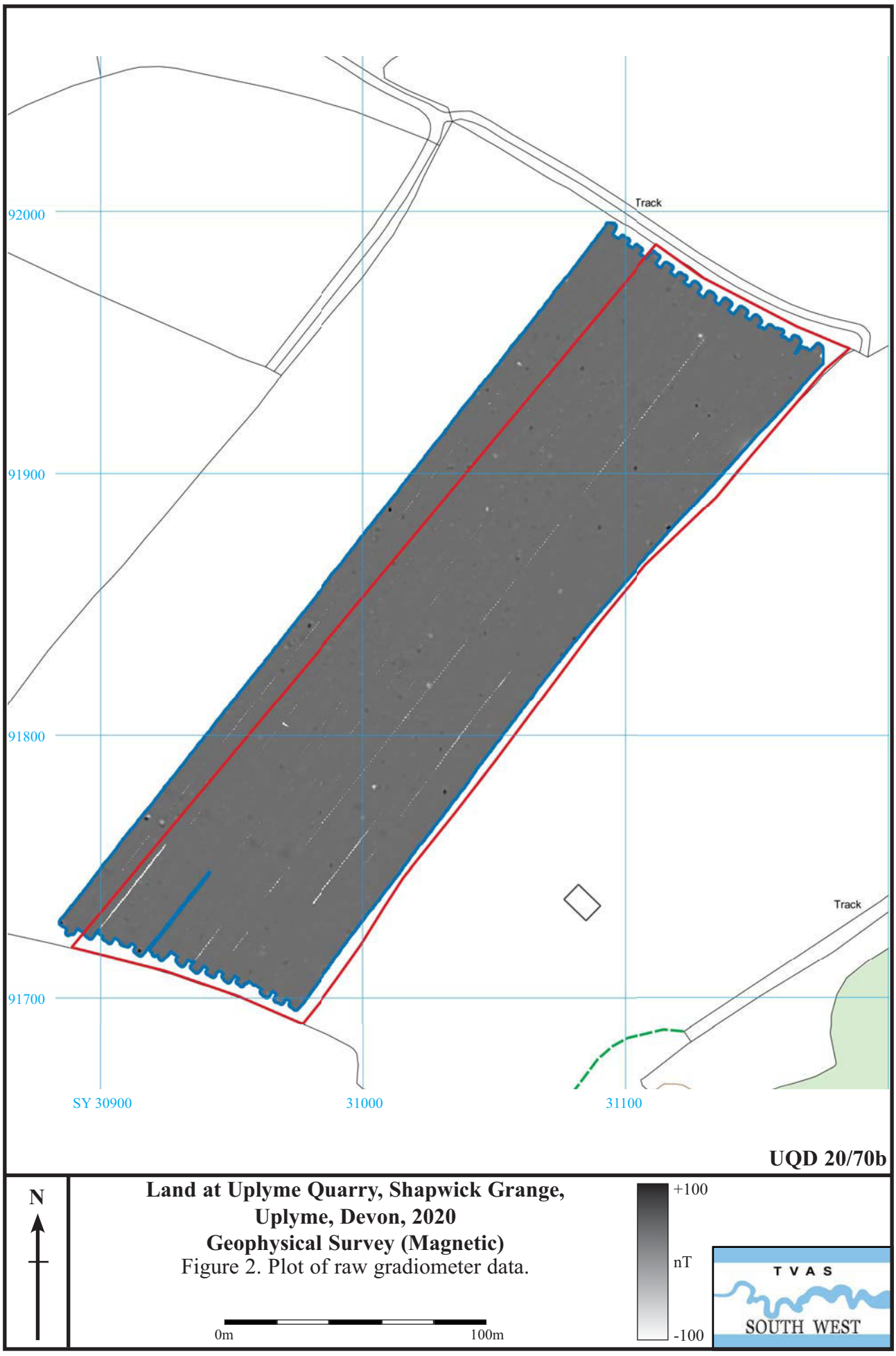
GPS based Processes: 6
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Despike Threshold: 1 Window dia: 3
5 Clip at 2.00 SD
6 Clip from -1.80 to 2.20

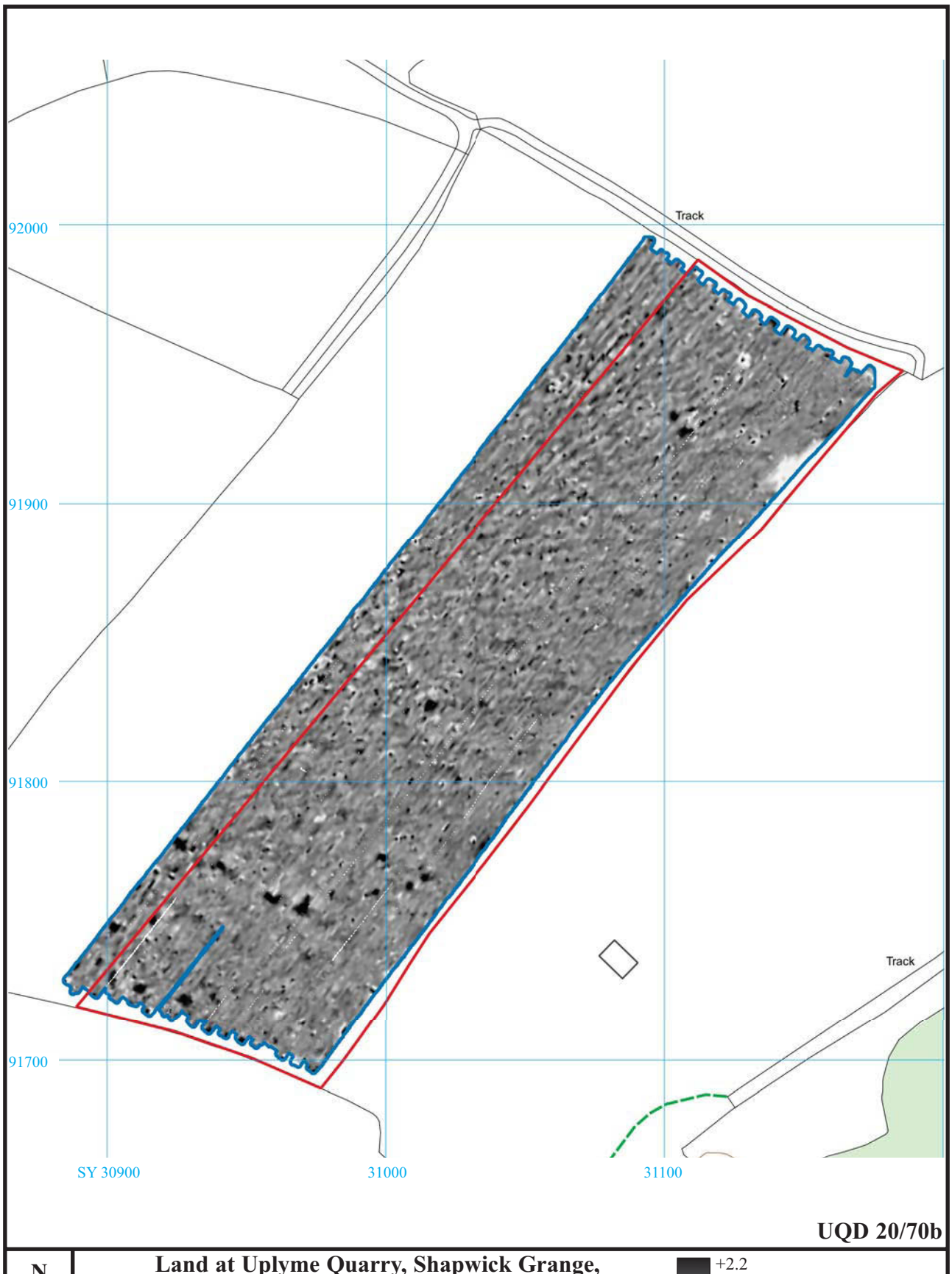


UQD 20/70b

Land at Uplyme Quarry, Shapwick Grange, Uplyme, Devon, 2020
Geophysical Survey (Magnetic)
Figure 1. Location of site within Uplyme and Devon.

TVAS SOUTH WEST


Track
92000
91900
91800
91700
Track
SY 30900
31000
31100
UQD 20/70b
N
Land at Uplyme Quarry, Shapwick Grange,
Uplyme, Devon, 2020
Geophysical Survey (Magnetic)
Figure 2. Plot of raw gradiometer data.
0m
100m
+100
nT
-100
TVAS
SOUTH WEST


Track
92000
91900
91800
91700
Track
SY 30900
31000
31100
UQD 20/70b
N
Land at Uplyme Quarry, Shapwick Grange,
Uplyme, Devon, 2020
Geophysical Survey (Magnetic)
Figure 3. Plot of processed gradiometer data.
0m
100m
+2.2
nT
-1.8
TVAS
SOUTH WEST

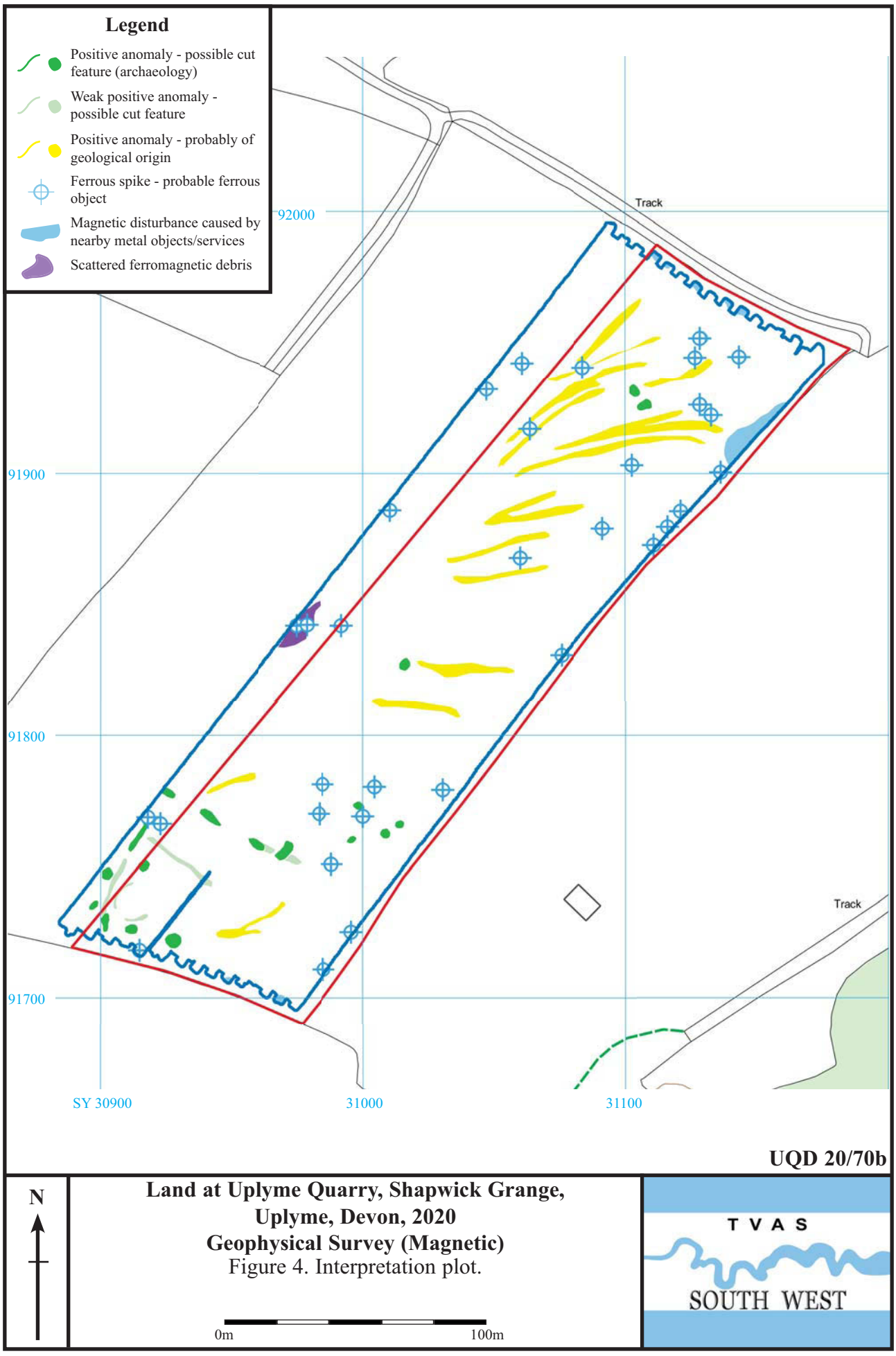

Legend
Positive anomaly - possible cut feature (archaeology)
Weak positive anomaly - possible cut feature
Positive anomaly - probably of geological origin
Ferrous spike - probable ferrous object
Magnetic disturbance caused by nearby metal objects/services
Scattered ferromagnetic debris
Track
92000
91900
91800
91700
Track
SY 30900
31000
31100
UQD 20/70b
N
Land at Uplyme Quarry, Shapwick Grange,
Uplyme, Devon, 2020
Geophysical Survey (Magnetic)
Figure 4. Interpretation plot.
0m
100m
TVAS
SOUTH WEST

Plate 1. The survey area, looking north-east.

Plate 2. The survey area, looking south.

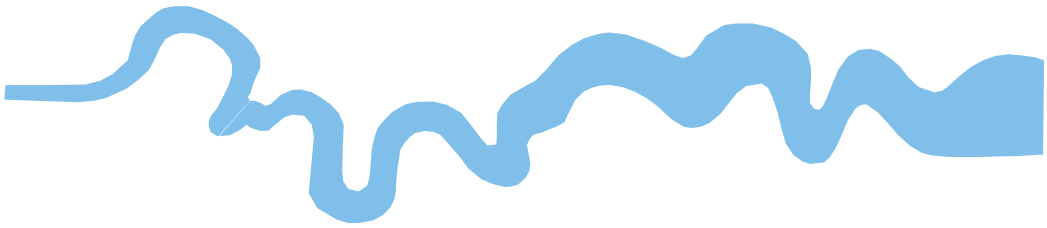
UQD 20/70b

Land at Uplyme Quarry, Shapwick Grange, Uplyme, Devon, 2020
Geophysical Survey (Magnetic)
Plates 1 and 2.

TVAS SOUTH WEST

TIME CHART

	Calendar Years
Modern	AD 1901
Victorian	AD 1837
Post Medieval	AD 1500
Medieval	AD 1066
Saxon	AD 410
Roman	AD 43
	AD 0 BC
Iron Age	750 BC
Bronze Age: Late	1300 BC
Bronze Age: Middle	1700 BC
Bronze Age: Early	2100 BC
Neolithic: Late	3300 BC
Neolithic: Early	4300 BC
Mesolithic: Late	6000 BC
Mesolithic: Early	10000 BC
Palaeolithic: Upper	30000 BC
Palaeolithic: Middle	70000 BC
Palaeolithic: Lower	2,000,000 BC



TVAS (South West),
Unit 21 Apple Business Centre,
Frobisher Way,
Taunton TA2 6BB
Tel: 01823 288284
Email: southwest@tvas.co.uk
Web: www.tvas.co.uk/southwest

Offices in:
Reading, Brighton, Stoke-on-Trent, Wellingborough and Ennis (Ireland)