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ST. PETER'S CHURCH ROPLEY, HAMPSHIRE: GROUND PENETRATING RADAR SURVEY

Prepared for the Ropley Parochial Church Council

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SUMMARY

A ground penetrating radar survey was commissioned by Mr Andrew Bonner of Ropley Parochial Church Council to obtain evidence for the sub surface morphology of St. Peter's church Ropely, Hampshire. The church is a grade II listed building.
The survey identified various graves in the interior and exterior of the church.

1. INTRODUCTION

1.1 In June 2015, at the request of Mr. Andrew Bonner of Ropley Parochial Church Council (RPCC), ARCA carried out a Ground Penetrating Radar (GPR) survey at the site. The works presented in this report were carried out in accordance with a verbal agreement- and subsequent written quotation- between ARCA and Mr. Bonner at a meeting on 1st June.

1.2 This document presents the results of the survey of the interior of the church and a four metre wide survey of the perimeter. It is arranged as follows: first a brief account is provided of the architectural, geological and methodological background to the geophysical project; the results of GPR surveys are then described in detail, followed by conclusions. A bibliography and an appendix (CD-ROM) containing time slice data. complete the document.

1.3 The parish church of St Peter (SU 64593198) is situated in Church Street, Ropley. It is Listed grade II (NHLE 1339053). It consists of chancel, with south chapel; and nave with north aisle, south-east tower and south porch. The walls are of flint and dressed in stone and brick. The oldest parts of the building belong to the *c.*1300 (arcade to the south chapel) the south wall and tower. The porch is *c.*1700. Restoration work of 1847 and 1896/7 has obliterated earlier fabric (NHLE 1339053; Page 1908, 55-8; Pevsner and Lloyd 1967, 488-9). William Page in the Victoria County History volume for Hampshire gives a detailed description of the church and should be consulted rather than the confusing précis in the National Heritage Listing for England; Pevsner is blunt.

1.4 The British Geological Survey (BGS) map the church as lying on bedrock of the Seaford Chalk Formation, a Cretaceous deposit dating to approximately 89 - 84my BP (BGS 2014).

1.5 On 19th June 2014 a devastating fire destroyed the church leaving only the walls standing. The RPCC are raising funds for the rebuilding and the aim of the project, therefore, was to investigate the sub surface morphology of the church and its immediate environs in advance of reconstruction. To this end two objectives are defined:

1.5.1 First to identify any sub surface features that could assist the subsequent planning of any architectural intervention. For example, the presence of offset wall foundations or graves below where new roof support be needed, and

1.5.2 Secondly, to assist in the mitigation of any archaeological work that may be required through the planning process.

2. METHODOLOGY

2.1 Ground Penetrating Radar survey

2.1.1 Ground Penetrating Radar transmits electromagnetic waves from a leading antenna which reflect from layers and objects in the ground. These reflections are received by a second, trailing antenna. As the transmitting and receiving antennae are moved along the ground surface, the recordings are processed in real time to create a radar profile of the sub surface on a graphic recorder. The technique is dependent on the difference in dielectric constant of buried materials: moist clayey material has high electrical conductivity and penetration is poor, on the other hand, air voids in graves and tombs and dry, massive material such as concrete, are both good conductors. The short wavelengths used (250MHz) results in good resolution of interfaces and discrete objects (metal in tombs for example), however, the attenuation of the signals is high which limits the depth of penetration to 5m. In our case, this was more than sufficient to map the chalk bedrock (Conyers 2004).

2.1.2 On the interior of the church the survey was carried out with reference to a base line laid out the length of the north aisle wall. A plan of the church commissioned by RPCC from Andrew Waring Associates, consulting structural and civil engineers, was taken as a master plan. The interior of the tower was not surveyed being deemed too dangerous. Outside the church a rectangle measuring four metres distant from the walls was set up around the perimeter of the building. The National Grid Reference for the four corners of the area was recorded using a Lieca Smart Net GPS. Both areas were surveyed using the GPR equipment as fully as possible, with dummy readings being inserted where it was not possible to survey a full line due to obstructions.

2.1.3 The GPR survey was carried out using a pulse EKKO PRO 250 MHz transducer connected to a Digital Video Logger (DVL) used to control and record the data from the unit (Sensors & Software Inc., 2010). The two areas were surveyed using a series of linear zigzag traverses spaced at one metre intervals with readings being taken to a depth of 4.3m (Sensors & Software Inc., 2005, p. 41). The readings were automatically logged at 25mm

intervals, giving a resolution of 800 readings per 20m linear traverse.

2.1.4 Upon completion of the survey, the geophysical data was transferred from the DVL to a desktop PC for processing and plotting using EKKO _ Mapping software (Sensors & Software Inc., 2005, p. 51). The results are displayed as a block shaded images using a colour ramp scale. Images were produced both in multiple depth slices, in increments of 100mm in depth, and also in cross-section form, produced through interesting areas of data (Sensors & Software Inc., 2010). This data is stored on a CD-ROM.

2.2 Archive

2.2.1 The geophysical archive from the site comprises digital records: GPR data, ESRI shape files, and digital photographs held on the University of Winchester server. A copy this report will also be deposited with the Archaeological Data Service.

3. SURVEY RESULTS

3.1 The results from both GPR surveys carried out on the interior and exterior of the church are tabulated in turn below. The interpretations of the features identified on the time slice plots are described in Section 4.

3.2 GPR Survey - Interior

3.2.1 The results from the GPR survey from the interior of the church are shown in Appendix 1 as a series of time slices. From these data eight anomalies have been identified and are listed in Table 1 and marked on Figure 1 in red.

Anomaly No.	Location	Time Slice (m)	Thickness/depth of feature (m)	Depth of feature from ground surface (m)	Dimensions (m)
1 Standing water	Entire Vestry	0.00-0.50	0.50	0.00	4.19x6.26
2	Centre west of chancel	0.30-0.90	0.60	0.30	1.40x0.58
3	North east corner of aisle (west side of the safe)	0.10-0.90	0.80	0.10	0.44x0.77
4	North east corner of chancel	0.50-0.90	0.40	0.50	1.35x0.44
5	Centre of chancel arcade	0.60-0.90	0.30	0.60	0.90x0.70
6	Centre of first bay of nave arcade.	0.60-1.10	0.50	0.60	1.40x1.16
7	West of centre of	0.50-1.20	0.70	0.50	1.28x0.76

	chancel arch				
8	Adjacent to East window	1.00-1.40	0.40	1.00	2.24x2.29
9	Entire church interior	1.20-4.30	3.10	1.20	20.00x14.00

Table 1. .Anomalies identified on the GPR time slices underlying the floor of St Peter's Church.

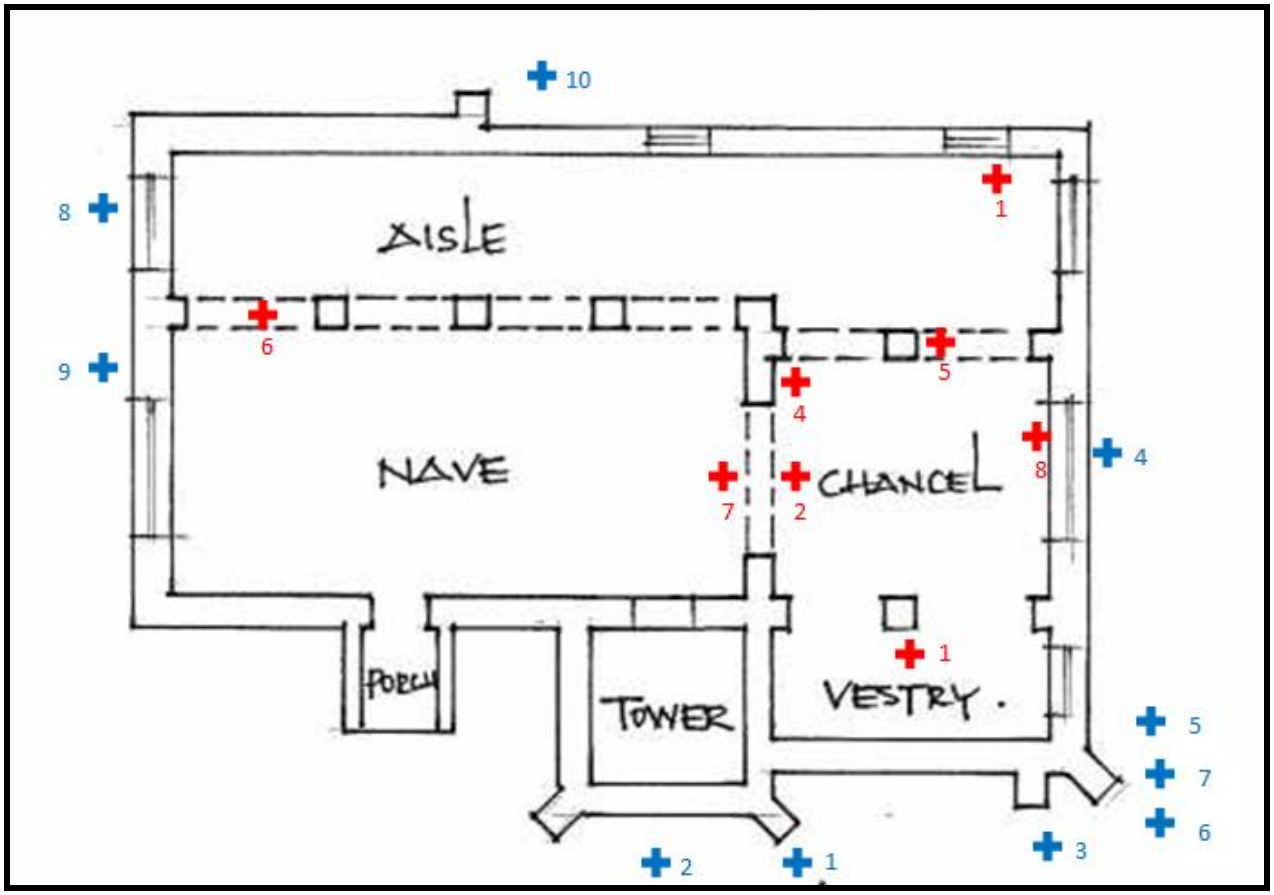

Figure 1 Interior and exterior anomalies. North at top. Anomaly 9 is not marked see Table 1 (Figure courtesy of Andrew Waring Associates).(Not to scale)

3.3 GPR Survey - Exterior

3.3.1 The results from the GPR survey from the exterior of the church are shown in Appendix 2 as a series of time slices. From these data 10 anomalies have been identified and are listed in Table 2 and marked on Figure 1 in blue.

Anomaly No.	Location	Time Slice (m)	Thickness/depth of feature (m)	Depth of feature from ground surface (m)	Dimensions (m)
1	South of tower east buttress	0.30-1.20	0.90	0.30	1.50x0.94
2	South of tower	0.20-0.60	0.40	0.20	1.94x0.85
3	South of east end buttress	0.90-1.20	0.30	0.90	2.36x0.94
4 Modern soak away	Length of east end	0.00-0.50	0.50	0.00	13.91x1.53
5	South corner of east end	0.10-0.70	0.60	0.10	1.53x1.17
6	South corner of east end	0.50-1.20	0.70	0.50	1.60x0.82
7	South corner of east end	0.80-1.20	0.40	0.80	1.86x0.82
8	West end north	0.50-0.90	0.40	0.50	1.91x1.88
9	West end centre	0.40-0.90	0.50	0.40	1.06x0.70
10	North of centre of north wall	0.70-1.70	1.00	0.70	2.77x1.06

Table 2 Anomalies identified on the GPR time slices in the 4m perimeter of St Peter's Church.

4. INTERPRETATION

4.1 The 19 features that have been identified on the time slice plot are discussed below under four headings: Modern; Graves; Structures; and Geology.

4.2 Modern

4.2.1 The first type of feature identified is modern and comprises of exterior anomaly 4 and interior anomaly 1. Four is probably a modern soak away. One is caused by the accumulation of several tens of mm of water in the vestry that impeded the radar velocity and has created a false anomaly.

4.3 Graves

4.3.1 The second type of feature identified is that of graves comprising interior anomalies 2-7 and exterior anomalies 1-3 and 5-10. The interior anomalies show parabolic reflections perhaps indicative of metal fittings or lead lined coffins in graves. There is no evidence of air voids however and this suggests they are filled with surrounding sediments and are not sealed tombs. On the exterior a similar pattern is recorded and also interpreted as graves. Some are related to grave memorials (2, 3, 5, 8, and 9).

4.4 Structures

4.4.1 The third type of feature identified is that of a possible structure, interior anomaly 8. This feature is sub rectangular in shape and projects west from the east end wall. It may relate to an earlier phase of the church building removed in Victorian times or a geological high point. The other possibility is that it is the filled remains of a tomb on an east west alignment: it is a significant feature.

4.5 Geology

4.5.1 The last type of feature identified on the GPR time slices is the underlying geology, interior anomaly 9. It is a solid anomaly and represents the Seaford Chalk Formation underlying the church. The exterior survey has not recorded the geology because of the presence of deep cemetery soils.

5. CONCLUSIONS

5.1 There are 19 anomalies of which 15 are believed to be graves. Of the remaining four one is either a structural feature or a tomb; two are modern: one is a soak away, the other is water covering the vestry floor; and the fourth is the geology estimated at 1.2m below the interior floor surface. No stepped footings have been recorded, however, this does not imply that the foundations are insubstantial. There appears to be no stone floor beneath the timber parquet. No metal services have been identified either on the interior or exterior.

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APPENDIX 1

GPR time slices of the interior of the church (see CD ROM). **Please note:** the data is orientated such that the top of the page is south, the right hand side is east, the bottom of the page is north, and the left hand side is west. (A mirror image rotated on an east west axis)

APPENDIX 2

GPR time slices of the exterior of the church (see CD ROM). **Please note:** the data is orientated such that the top of the page is south, the right hand side is east, the bottom of the page is north, and the left hand side is west. (A mirror image rotated on an east west axis)