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ARCA

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3 WELL STREET, EXETER: GEOARCHAEOLOGICAL BOREHOLES

Prepared for Border Archaeology

Phil Stastney

ARCA
Department of Archaeology
University of Winchester
Winchester
SO22 4NR
http://www.arcauk.com

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SUMMARY

On 1st July 2014, ARCA carried out a geoarchaeological borehole survey of a possible Medieval masonry-lined octagonal well located at 3 Well Street, Exeter.

A borehole drilled in the centre of the Medieval structure encountered bedrock of the Whipton Formation at a depth of 3.26m. Layers of peat and organic mud overlying the bedrock between 3.26m and 2.08m depth appear to have formed in a vegetated wet environment, and may potentially predate the construction of the Medieval masonry structure. Coarser, more mineral rich strata containing traces of charcoal and CBM were encountered over the organic strata, filling in the Medieval well.

Given the relatively shallow depth of the well, and the presence of peats which appear unlikely to have formed at the base of a covered well structure, it is hypothesised that the Medieval well may have been constructed at the site of a naturally occurring spring. The basal peat strata at the site may therefore have formed prior to the Medieval period in a wet hollow around this spring. ^{14}C dating of the peat strata may be utilised to test this hypothesis.

If the hypothesis that the well was constructed over a spring is correct, it is possible that water levels may, at times, have been near to the top of the masonry structure.

1. INTRODUCTION

1.1 On 1 July 2014 ARCA, at the request of Border Archaeology, carried out a borehole survey of a Medieval well at 3 Well Street, Exeter (henceforth 'the site').

1.2 This document assesses the stratigraphic sequence within, and in the vicinity of, the Medieval well at the site. It is arranged as follows: first a brief account is provided of the geographic, geological and methodological background to the project; secondly the borehole stratigraphy is described in detail; and finally the potential of the sample resource in the boreholes to address the questions outlined in Section 1.6 is assessed. A bibliography completes the document.

1.3 The site lies north east of Exeter city centre and is centred on NGR SX 92555 93204. Well Street is currently a predominantly residential street; 3 Well Street is presently occupied by a late 19th/early 20th century garage, situated opposite a primary school. The site lies at an elevation of approximately +44m OD midway down a slope with higher ground lying to the east and lower ground to the west.

1.4 The British Geological Survey map the site as lying on bedrock of the Whipton Formation, a Permian deposit dating to c.299-251 Mya; the Knowle Sandstone Formation (c.299-251 Mya) and the underlying Crackington Formation (322-312 Mya) outcrop c.150m to west and north west of the site, respectively (BGS 2014).

1.5 No previous geoarchaeological investigations of the site and its vicinity are known to the author. Archaeological investigations of the site carried out by Border Archaeology in 2014 revealed a Medieval octagonal masonry well structure, a late 19th century brick-lined well structure immediately to east, and other associated brick and masonry structures and the remnants of a cobbled surface and possible drain. The Medieval structure has an internal diameter of 1.05m and, at the time of the author's visit, had been excavated to a depth of c.0.5m below the top of the masonry structure.

1.6 The objectives of the geoarchaeological project at the site were to:

1.6.1 Determine the depth and lithostratigraphy of the fills of the Medieval masonry structure.

1.6.2 Determine the geological and sedimentary sequence at the site generally.

A particular focus of the investigation of the Medieval well was to determine the likely depth of the water within the well, and to test the hypothesis that the well was flowing (i.e. that the well was an active spring).

2. METHODOLOGY

2.1 To investigate the fills of the Medieval masonry well structure a borehole was drilled from the top of the extant fills of the structure to the top of the bedrock. This borehole was drilled using Eijkelkamp gouge augers driven by a Makita electric heavy breaker. Sediments recovered in the gouge were photographed and described on site using standard geological criteria (Troels-Smith 1955, Tucker 1982, Jones *et al.* 1999, Munsell Color 2000).

2.2 Further boreholes at the site were drilled using hand equipment (gouge augers and Edelman corer) from the surface to the top of the bedrock within the 19th century brick-lined structure, the masonry structure immediately west of the Medieval masonry well, and in the base of a small trial pit the north eastern corner of the site. Sediments recovered in the gouges were also photographed and described on site using standard geological criteria (Tucker 1982, Jones *et al.* 1999, Munsell Color 2000).

3. BOREHOLE STRATIGRAPHY

3.1 Medieval Masonry Well

Depth (m below top of structure)	**Description**	**Interpretation**
0.00 – 0.66	Void	---
0.66 – 1.01	7.5 YR 4/4 Brown matrix-supported clayey gravel of frequent granular to fine pebble-sized angular clasts of various igneous lithologies. Sharp to:	Fill of well
1.01 – 1.16	7.5 YR 3/2 Dark brown slightly humic silt/clay with occasional fine to coarse sand-sized mineral grains, rare fibrous organic remains and rare rounded basalt pebbles. Sharp	Fill of well

	boundary to:	
1.16 – 1.43	7.5 YR 4/4 Brown matrix-supported clayey gravel of frequent granular to fine pebble-sized angular clasts of various lithologies. Sharp to:	Fill of well
1.43 – 1.46	7.5 YR 3/2 Dark brown slightly humic silt/clay with occasional fine to coarse sand-sized mineral grains. Water table.	Fill of well
1.46 – 1.51	Void	---
1.51 – 2.08	7.5 YR 4/3 Brown soft clayey gravel with rare CBM and charcoal granules. Sharp boundary to:	Fill of well
2.08 – 2.25	7.5 YR 3/2 Dark brown soft slightly fine sandy silty clayey very fibrous peat with rare herbaceous aerial plant remains and frequent fine rootlets. Distinct horizontal laminar structure. Rare mollusc shell (*Candidula* sp.). (Troels-Smith: $Th^{2}3$ Ag1 Ga+ Sh+, Humo 2). Bulk sample collected 2.12m-2.17m depth. Sharp boundary to:	Peat – marshy hollow?
2.25 – 2.32	7.5 YR 4/3 Brown soft sandy clay with some fine gravel, and occasional pebble-sized greenish mottles.	Slightly organic clay -marshy hollow?
2.32 – 3.26	7.5 YR 3/2 Dark brown soft slightly fine sandy silty clayey very fibrous peat with frequent fine rootlets. Horizontal laminar structure. Occasional thin lenses of soft brown (7.5 YR 4/3) silt/clay. Sharp boundary to:	Peat and organic clay - marshy hollow?
3.26 – 3.36	2.5 YR 4/6 Red firm very sandy silt/clay. Auger refused at 3.36m.End of Borehole.	Bedrock [Whipton Formation]

Table 1: Lithostratigraphy of borehole in the Medieval Masonry Well.

3.1.1 Table 1 shows the lithostratigraphy of the borehole drilled within the Medieval masonry structure.

3.1.2 The upper 0.66m of the structure was void since these had been excavated by hand by Border Archaeology.

3.1.3 From 0.66m and 2.08m depth a series of soft mineral rich clayey gravelly strata were encountered. These are interpreted as being almost certainly fills of the well and include rare anthropogenic inclusions such as CBM (i.e. brick/tile) and charcoal granules. These deposits also include occasional layers of slightly darker more organic-rich material.

3.1.4 A sharp boundary occurs at 2.08m depth between the mineral-rich deposits described above and a stratum of slightly clayey peat. The peaty layers between 2.08m and 2.25m and between 2.32m and 3.26m depth show a distinct horizontal laminar structure with frequent fibrous rootlets and rare moderately humified fragments of the aerial parts of herbaceous plants. These features suggest that the peaty strata formed *in-situ* in a damp vegetated environment such as a marshy peat-forming hollow. A single terrestrial mollusc was noted in the peat, identified as *Candidula* sp.; this taxon usually associated with dry open habitats and is therefore likely to have been washed in from the surrounding area. Given that it appears to be unlikely that plants (e.g. grasses, sedges etc.) would be actively growing (and forming peat) at the bottom of a 2-3m deep masonry structure (especially so if the well was previously covered in any way), these strata may instead have formed in a wet hollow surrounding a natural spring predating the Medieval masonry structure. Further excavation of the structure (to ascertain the stratigraphic relationship between the peat and the masonry structure) or ^{14}C dating of the peat may allow this hypothesis to be tested.

3.1.5 A sharp boundary was encountered at a depth of 3.26m between the peaty strata and bedrock of the Whipton Formation. The Whipton Formation was represented by red firm to very stiff very sandy silt/clay.

3.2 Other boreholes

3.2.1 Three other boreholes were drilled at the site using hand equipment.

3.3.2 A borehole drilled in the centre of the 19th century brick-lined well, immediately east of the Medieval structure, encountered bedrock of the Whipton Formation (firm red very sandy clay) was encountered at a depth of 1.10m which was overlain by brown clayey gravel fill.

3.2.3 A borehole drilled immediately to the west of an arch inserted into the western side of the Medieval masonry structure encountered 1.55m of soft very wet clay with sand, gravel and brick fragments overlying an impenetrable obstruction (possibly the bedrock, or structural remains).

3.2.4 A final borehole was drilled in the base of a shallow trial pit (approximately 0.4m x 0.4m wide). Firm sands and red sandy clays of the Whipton Formation were encountered directly underlying the present concrete surface.

4. ASSESSMENT

4.1 Sedimentary sequence

4.1.1 The earliest strata at the site are sands and sandy clays of the Whipton Formation which were deposited in a desert environment c.299–251 Mya during the Permian period.

4.1.2 During the Holocene it appears that a spring may have formed at the site, as water carried within the permeable sand strata of the Whipton Formation emerged at the surface at the contact with an impermeable underlying stratum (either clayey strata of the Whipton Formation, or clays/mudstone of the underlying Crackington Formation) (e.g. see Rapp and Hill 1998, 132).

4.1.3 The borehole drilled through the octagonal masonry structure encountered peats overlying the Whipton Formation bedrock. Whilst it is possible that the peat found overlying the bedrock at this location formed within the masonry structure, it is perhaps more likely that the peat formed within a small wet hollow around the possible natural spring during an earlier period in the Holocene. This feature appears to have been of very restricted extent since no such peaty strata were encountered elsewhere at the site. A bulk sample of peat was collected from the borehole at 2.12m – 2.17m depth; ^{14}C dating of this sample may be used to test the hypothesis that peat formation at the site predates the Medieval period. A natural spring at the site might potentially have given rise to a small stream flowing downhill towards the west.

4.1.4 During the Medieval period, possibly post-dating the formation of the spring and the onset of peat formation, an octagonal masonry structure was built at the site. The relatively shallow depth of strata overlying the bedrock appears to support the

hypothesis that the well was in fact located over a naturally occurring spring where the water table was either at, or very near to, the ground surface. It is therefore feasible that water might at times have been close to the top of, or even might have flowed from, the structure. After the construction of the octagonal masonry structure, a series of other masonry, cobble and brick structures were constructed at the site during the Medieval to Modern periods, culminating in the construction of the present garage and concrete floor surface. Away from the spring/well, these later structures were constructed directly on top of the Whipton Formation bedrock.

4.2 Archaeological and palaeoenvironmental significance

4.2.1 Given the Permian age of these deposits, the Whipton Formation has NO archaeological or palaeoenvironmental potential.

4.2.2 The peat strata encountered at the site of the Medieval well between 2.08m and 3.26m depth are assessed as being of HIGH palaeoenvironmental significance. Well-preserved plant and mollusc macrofossils were noted in the sediments, and microbiological remains such as pollen are also likely to be well preserved in such waterlogged *in-situ* organic strata. Analysis of these macro- and microbiological remains has the potential to provide evidence for the environmental history of the immediate vicinity of the site (the catchment of the well and any possible earlier natural spring is likely to have been small since the feature has been shown to be very restricted in extent).

4.2.3 Similarly the peat strata are assessed as being of MODERATE to HIGH archaeological potential. These organic strata are readily datable using ^{14}C which may be used to test the hypothesis that the Medieval masonry structure was built at the site of an earlier peat-forming spring. Were this hypothesis to be correct, these waterlogged deposits may contain evidence for earlier human activity at the site of the spring (although no artefacts were observed within the peat strata in the gouge augers).

4.2.4 The fills of the Medieval masonry well between 2.08m and 0.66m depth (the base of the Border Archaeology excavations) are assessed as being of HIGH archaeological potential since these demonstrably contain archaeological material (e.g. CBM and charcoal fragments) and are almost certainly the fills of the Medieval structure. Archaeological assessment of the uppermost fills of the well has already been carried out by Border Archaeology.

5. ACKNOWLEDGEMENTS

5.1 ARCA would like to thank Amy Bunce (Border Archaeology) and Rebecca and Grahame Dudley for their help during the course of the geoarchaeological project.

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