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RYALL NORTH QUARRY: GEOARCHAEOLOGICAL REPORT

Prepared for Cotswold Archaeology Ltd

by
Nick Watson

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

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SUMMARY

In July 2019 ARCA visited archaeological excavations on land at Ryall North Quarry at the request of Cotswold Archaeology Ltd. The site is located on the midpoint of a point bar of the River Severn near the village of Ryall, Worcestershire, and is being quarried for gravel by Cemex UK Operations Ltd.

The excavations have revealed that a Roman occupation surface has developed in the top of a bed of fine sand and lies west of a low gravel terrace assigned to the Worcester Terrace. The sand is sterile, >0.3m thick and preserves current ripple cross-lamination. It has been laid down on the east margin of a palaeochannel and on laps against Devensian solifluction deposits and the terrace gravels.

1. INTRODUCTION

1.1 This report discusses the results of a geoarchaeological investigation of the deposits uncovered during the excavation of archaeological trenches on land (henceforth the site) being quarried for gravel by Cemex UK Operations Ltd as part of their Ryall North Quarry works. The fieldwork was undertaken by ARCA, on behalf of Cotswold Archaeology Ltd on 11th July 2019.

1.2 The site is centred on National Grid Reference (NGR) SO84992 42122 on the eastern floodplain of the River Severn, *c.* 2.3km northwest of the Ryall, Worcestershire, and the A38 trunk road. It lies at an elevation of *c.* 11m OD on open farmland on a point bar of the River Severn, midway (*c.* 350m) between the river and the steeply rising ground of the bedrock mudstone. The river flows north to south and the point bar is *c.* 1.4km^2.

1.3 The British Geological Survey (BGS 1993, 1:50,000, sheet 199) map the bedrock geology of the site as the Branscombe Mudstone Formation dating from the Norian to the Rhaetian Age (227–201Ma) of the Late Triassic Epoch. It forms the low hills (*c.* 40m in altitude) of the east side of the river valley. Unconformably overlying the bedrock is the Holt Heath Sand and Gravel Member (the Main Terrace or third terrace of the River Severn). It lies to the southeast of the site at an elevation of *c.* 15–20m OD and dates to the Wolstonian Stage. Lying within the valley and at an elevation of *c.* 12m OD is the Worcester Member (the Worcester Terrace or second terrace) dating to the Devensian Stage. It is mapped as an outcrop *c.* 600mm south of the site, however, further outcrops appear to lie on the east of the site and are part of the quarry operation. The lithology of the Worcester Member is cross-bedded sands and gravels in which well-rounded Triassic quartzite pebbles predominate. The youngest deposit mapped is Alluvium and consist of clay, silt and sand, possibly with intercalated peats and a basal gravel (the Power House Member of the first terrace overlain by Holocene alluvium). It dates to the Holocene Epoch (11.7ka to the present) (BGS 2019a; 2019b).

1.4 Of particular interest at the site was evidence for a Late Devensian or early to mid-Holocene landscape that comprises fine sand apparently deposited within a palaeochannel on a north/south axis. At the time of the visit to the site the east bank was visible in section. The palaeochannel appears to respect the location of the Worcester Member terrace: the sand

on laps against a thin, red, matrix-supported solifluction deposit lying over the terrace gravels that forms the east bank of the channel.[1] Occupation layers, from at least the Early Iron Age to the Roman period, are preferentially located on the sand and cut into it (pers. comm. Peter Busby 2019). The slightly higher gravel terrace immediately east is devoid of occupation, however, it is host to trackways that lead eastwards, up and over the solifluction deposits and gravel towards the valley side. Medieval alluvium buries the earlier archaeology and the modern topsoil has developed within the top fraction.

1.5 The aims of the work at the site were threefold:

1.5.1 Characterise the Quaternary lithostratigraphy; and

1.5.2 Determine the mode of formation of the Quaternary strata.

1.5.3 Make recommendations for further work.

2. METHODOLOGY

2.1 Two sections (Section 1 and 2) were logged following standard geological criteria (Munsell 2018; Tucker 2011). The first section had suffered considerable drying out and was degraded by deep mud crack fissures. The second section was of more recent excavation and the deposits retained some moisture. No artefacts were recovered during the recording.

3. RESULTS

3.1 The following stratigraphic units were encountered on the site and are listed from youngest to oldest (Figure 1, Figure 2, Table 1 and Table 2):

1. Topsoil and oxidized B horizon (Modern plough soil).
2. Fine grained alluvium (late Holocene (medieval) floodplain deposits).
3. Fine sand with Iron Age and Roman occupation debris (Late Holocene palaeosol or land surface).

[1] The solifluction deposit has erroneously been referred to as till by the excavators. Till is not mapped in the area because the maximum extent of the Devensian ice lies *c.* 40km west at Hereford. Nor would till be expected to overlie the Worcester terrace.

4. Sterile, fine to very fine sand with current ripple cross-lamination (uppermost fill of palaeochannel of possible late Devensian to mid-Holocene date).
5. Red solifluction deposits (Devensian Stage).
6. Worcester Member sand and gravels (The Worcester or second terrace of Devensian Stage).

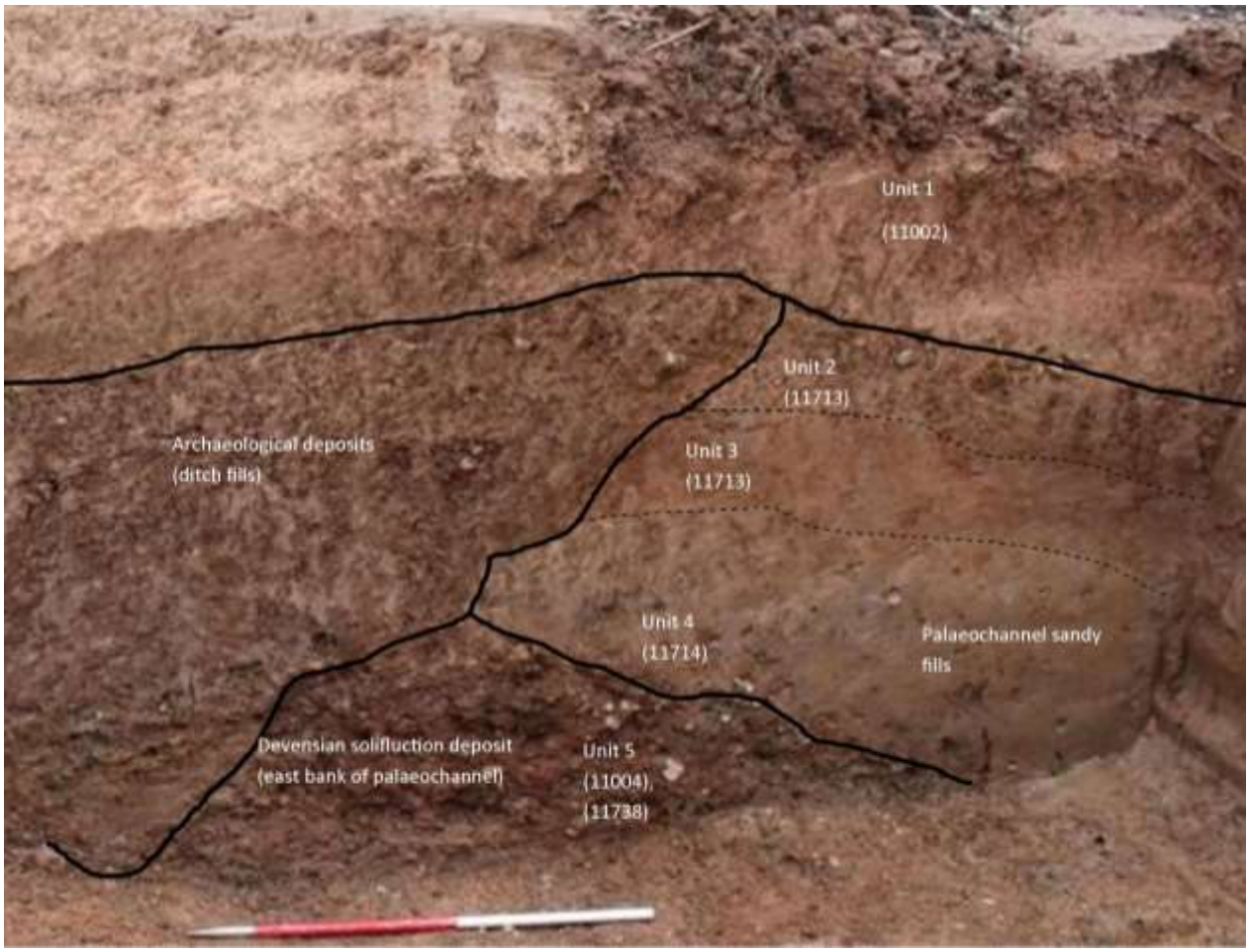

Figure 1. Section 1 showing the major stratigraphic units of the palaeochannel. (Based on Drawing number 11.217; photograph curtesy of Peter Busby).

Unit	**Description**
1 (0-0.6m)	5YR 5/3 (moist) Reddish brown, hard, dry and cracked but friable silt/clay with poorly developed granular peds. Heavily bioturbated with fine pebble-sized roots and frequent micropores. Homogenous and massive oxidized bed. (Medieval alluvium). Sharp boundary to:

2 (0.6-0.9m)	5YR 5/3 (moist) Reddish brown, hard, dry and cracked but friable silt/clay with frequent very fine sand. Occasional to frequent granular to medium pebble-sized clasts of sub- to very well-rounded quartzite pebbles. Iron oxide staining is more frequent than in Unit 1. Bioturbated by roots. (Palaeosol; clasts derived from Devensian solifluction deposits/gravels). Sharp boundary to:
3 (0.9-1.2m)	5YR 5/3 (moist) Reddish brown very fine to fine sand. Hard, dry with only rare cracks as a result of low clay content. Friable, beaks into individual grains. 5-10% iron oxide staining. Massive and homogeneous. Occasional bioturbation by roots. (Channel deposit of sand). Gradual boundary to:
4 (1.2-1.8m)	5YR 5/3 (moist) Reddish brown and 5YR5/1 (moist) Grey, hard, dry and cracked silt/clay. Occasional fine to medium-sized, well-rounded quartzite pebble throughout the unit. Occasional to frequent fine sand. Bioturbated by deep roots. (Channel deposit of sandy silt/clay).
5	5YR 4/3 (moist) Reddish brown, firm to hard matrix-supported diamict. Silt/clay matrix. Frequent granular to coarse pebble-sized, sub- to well-rounded quartzite clasts. Occasional fine sand lenses. (Devensian solifluction deposits derived from valley side bedrock and earlier terrace deposits).

Table 1. Lithology of the units of the palaeochannel in Section 1, overlying alluvium and the Devensian solifluction deposits.

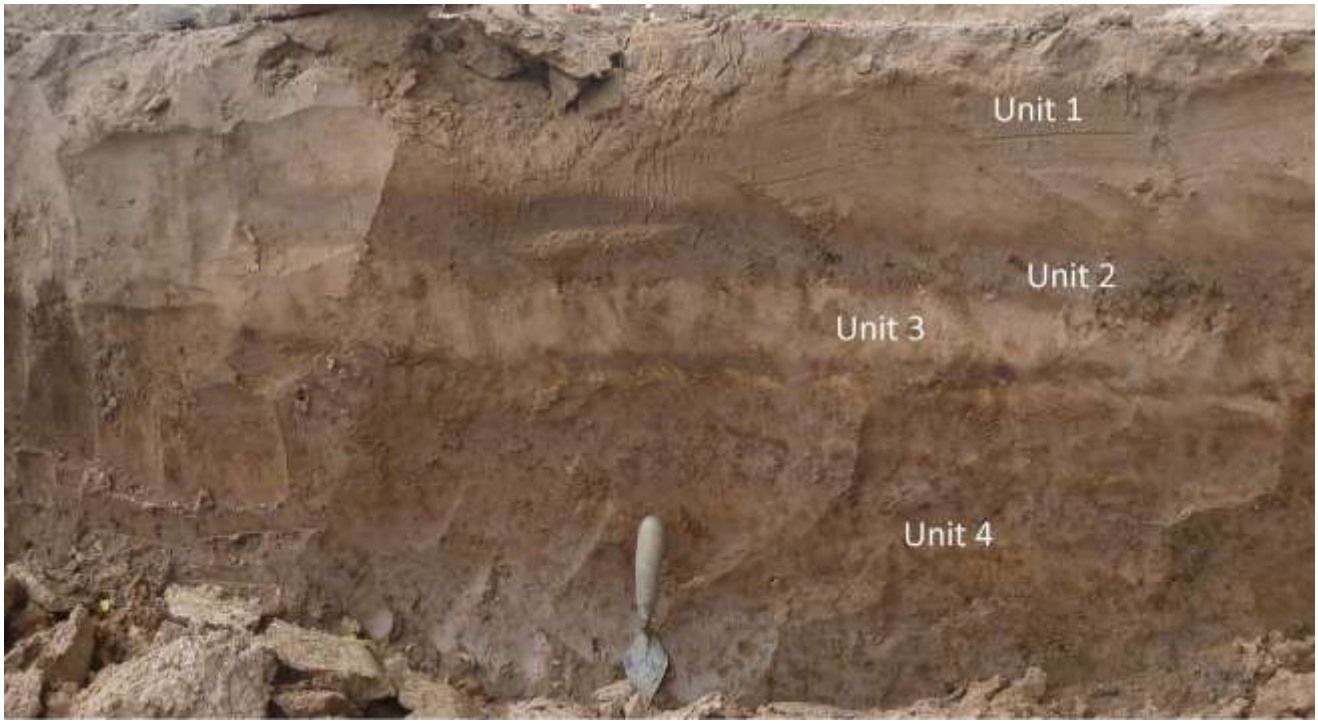

Figure 2. Section 2 showing the major interbedded sand and sandy clay units in the top of the palaeochannel. (see Cotswold Archaeology Ltd Section drawing 11.264 for the overlying archaeology)

Unit	**Description**
1 (0-0.3m)	10YR 6/4 Light yellowish brown to 10YR 7/6 Yellow very fine to fine sand. Firm and dryish (loose when dry). Very faint current ripple cross-laminations. No bioturbation. Top of section is the boundary with a sandy palaeosol containing archaeological material. Oxidized: iron oxide. (Channel sand). Sharp boundary to:
2 (0.3-0.39m)	7.5YR 4/3 Brown firm and moist silt/clay with occasional to frequent fine sand. Oxidized. (Overbank/levee deposit) Sharp boundary to:
3 (0.39- 0.44)	10YR 6/4 Light yellowish brown to 10YR 7/6 Yellow very fine to fine sand. Firm and dryish (loose when dry). No current ripple cross-laminations visible. No bioturbation. Oxidized: manganese and iron oxide. (Channel sand).

	Sharp boundary to:
4 (0.44-0.77m)	10YR 5/3 Brown and 7.5 4/3 Brown firm and moist interbedded silt/clay and sand. Sand is very fine to fine grade. Bedding is fine, (100mm and less thick) horizontal and interdigitating over *c* 1m. Oxidized: manganese and iron oxide staining. (Overbank/levee deposit).

Table 2. Lithology of the sand and sandy clay beds in Section 2.

4. ASSESSMENT

4.0.1 Sections 4.1–4.6 review the lithostratigraphic and evidence against the relevant aims of Section 1.5.

4.1 Lithostratigraphic sequence

4.1. The Branscombe Mudstone Formation forms an incised and terraced basement to later Quaternary deposits of the ancient River Severn. The site lies on the point bar of the present day floodplain northwest of and below the earlier Holt Heath Sand and Gravel Member of the Main Terrace that dates to the Wolstonian Stage, MIS6-10, 352ka – 130ka. Underlying the site are two separate lithological units. The earliest is the Worcester terrace composed of sand and gravels with a discontinuous cap of solifluction deposits that outcrops on the west of the site at a fractionally higher altitude; these deposits date to the Late Devensian Stage (MIS2) *c.* 18ka – 13ka (Maddy and Lewis 2005, 80). The later deposits (at a lower altitude) are sand and sandy clays that form the final fill of the eastern most side of a north/south trending palaeochannel. These deposits also form a degraded levee (on the channel bank) and on lap against the gravel terrace.

4.2 The Worcester terrace was aggraded by the action of very high energy braided channels in a periglacial environment during a pause in the deglaciation of the Devensian ice sheet (Maddy and Lewis 2005). The lithology is primarily clast supported quartzite gravels with subordinate sand. The overlying solifluction deposits are derived from the valley side bedrock and the earlier and higher terrace material. Following the climatic amelioration at the beginning of the Holocene, the Severn is confined to relict channels as an anastomosing and later meandering planform evolves. One of these relict channels would appear to be the palaeochannel identified on site. Fine grained minerogenic

deposition takes place on the east bank against the earlier gravel and solifluction deposits, first as a longitudinal bar and later evolving into a point bar typical of a meandering river. The sand units recorded on site are low energy fluvial deposits that build the bar and faint current ripple cross-laminations are preserved (Figure 3) (Nicols 2009, 51). The sand is overlain by thin flood plain clays as the channel migrates west; however, this migration process is not consistently westwards and movement of the channel back eastwards will occur, for example, during periods of wetter years. As a result, interbedded sand and clay strata are formed: clay once deposited requires considerable force to re-entrain and tends to be overlain rather than eroded away in a low energy environment. The formation of point bars is a very complex process and channels that cross the bar with their own deposits can also form (Bridge 2003).

Figure 3. Current ripple cross laminations (drawn for emphasis) in Unit 1 of Section 2.

4.3 The uppermost fraction of the sand unit has a palaeosol developed within it (excavated away in Figure 2) that contains Early Iron Age to Roman artefacts clearly indicative of a shift of the river further west. The palaeosol is a grey (7.5YR 6/1) fine to very fine sand with a minor clay component. Its colour possibly reflects comminuted charcoal and ash, and eluviation (the leaching of soil components by rainwater). It has been reworked

as a result of general traffic and activity as the presence of artefacts distributed throughout the soft and friable stratum demonstrates. Occupation is limited to the lower sandy area rather than the slightly higher terrace. This may be the result of better drainage on the sand, or at least the ease with which drainage diches may be dug. The terrace, which is overlain in part by very clayey and intractable solifluction deposits, may have tended to pool water. The interbedded sand and clays showed no evidence of bioturbation (the preservation of current ripples is evidence of this) which suggests that the flora was low and restricted, and no ploughing took place. One might also expect a sandy beach to be found on the cusp of the developing meander bend providing easy access to the river.

4.4 The point bar would flood but unless the waters are charged with sediment the surface will not accrete. Such nuisance flooding was presumably dealt with by ditching, as recutting suggests. Floodplain accretion began in earnest in the medieval period probably as a result of surface stripping by more intensive ploughing (Macklin *et al* 2014). On site *c.* 0.7m of fine grained alluvium was deposited.

4.5 A possible date for the sand and clay units is the early to mid-Holocene. River morphology can experience remarkable changes over very short time as Brown (2018) has shown for the Danube, although this is often the result of human management in the historical period. A linear growth of the point bar to its present location implies just *c.* 60mm/annum for mid-Holocene starting date.

4.6 It is recommended that OSL dates are taken of the current ripple sand units.

5. ACKNOWLEDGEMENTS

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