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November 2015 (Published January 2024)

First published in 2024 by

Archaeology South-East, UCL Institute of Archaeology

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Available to download free: https://discovery.ucl.ac.uk/

https://doi.org/10.14324/000.rp.10187407

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ABSTRACT

Excavations undertaken by Archaeology South-East (ASE; UCL Institute of Archaeology) revealed a medieval saltern located on the Ouse Estuary between Newhaven and Bishopstone. It survived as a low oval mound some 75m by 50m in size, with evidence of salt-making activity surviving as numerous pits (some of which were clay-lined), up to four re-used hearth sites, two enigmatic bone alignments and a number of large pits or depressions that may have served as water reservoirs. The saltern was in use in the late 11th to 12th centuries. Fieldwalking revealed the sites of two further possible salterns, whilst a watching brief produced a small quantity of unstratified prehistoric worked flints.

INTRODUCTION

The site (Fig. 1) is situated approximately 1km east of Newhaven, East Sussex (NGR TQ 45402 01026). Topographically the site lies at a height of approximately 2.6mAOD on the eastern alluvial floodplain of the River Ouse, approximately 500m from the existing watercourse. The site lies within a substantial area of water meadows bounded to the north and east by the A259, to the west by an industrial estate and to the south by Mill Creek and the Lewes to Eastbourne railway line. The underlying geology according to the British Geological Survey is recorded as alluvium.

The archaeological fieldwork was undertaken in advance of a major conservation initiative to manage flood water and provide wildlife compensation to offset development of the adjacent Eastside Business Park.

Archaeological assessment of the immediate area, undertaken in 1998, had identified the potential for the presence of archaeological remains sealed beneath alluvial deposits (Dunkin 1998). In particular, aerial photographs, cartographic sources and a walkover survey had located a number of features, including several low mounds, some of which were associated with surface finds of medieval pottery. Subsequent fieldwalking and targeted evaluation across the site established that two of these mounds were likely to be medieval salterns (Greatorex 2000; Griffin 2000). In consultation with Dr Andrew Woodcock, then County Archaeologist (East Sussex County Council), one saltern was selected for detailed excavation in advance of proposed groundworks, with a watching brief carried out during the creation of reed beds and landscaping elsewhere on the site.

RESULTS

Watching Brief

The watching brief maintained during the creation of reed beds and general landscaping across the site revealed evidence of prehistoric activity in the form of worked flints. All were collected from the machined surfaces and no associated features were observed. Various alluvial clays, silts and sands were exposed, with flint shingle noted at depths generally in excess of 1m below existing ground level. A few deliberately infilled ditches were also identified, all of which correlated with those depicted on early Ordnance Survey maps.

Excavation (Figs 2–4)

Introduction

The mound was sub-divided into quadrants centred on its summit (Fig. 2). Under archaeological supervision, the topsoil was initially machine-stripped from two opposing quadrants (A and B), with subsequent strata being removed in *c*. 50mm spits (generally following the topography of the mound), and recording features where encountered. The remaining quadrants (C and D) were treated in the same way (leaving 1.5m wide upstanding baulks between the quadrants). Quadrant D was not excavated to the very edge of the visible mound as it became clear as excavation progressed that features within it were centrally located.

Due to the complex formation processes associated with the creation of the mound from many interdigitating laminations of sand and silt, its continual weathering both during and after its use, and subsequent later agricultural practices, it was impossible to assign context numbers to each discrete deposit. Instead, broadly similar ‘horizontal’ deposits were recorded as one, with more detailed recording taking place, where warranted, against the exposed running sections. Broad stratigraphic relationships could be inferred from the relative vertical position of features within the saltern mound, although very few physical relationships between features were actually present.

Simplified Stratigraphy

Ground level at the highest point on the saltern measured *c.* 3.20m AOD resulting in a low mound only some 1m above the average ground level of the alluvial flood plain.

The earliest deposit recorded comprised alluvial/marsh clay [23]. This was directly sealed by the surviving saltern mound itself [13], in turn sealed by a relict ploughsoil [2], heavily derived from alluvial clays and silts (with some fine sand), from which a range of artefacts were recovered. The sequence was capped with modern topsoil [1]. In addition, a differentiated former ploughsoil was noted between [1] and [2] at the northern edge of the saltern.

Throughout [13] were numerous spreads of charcoal and similar burnt material, probably representing the discarding of waste ash from the frequent fires that were clearly a key element in the salt extraction process. It was also quite clear from an early stage in the excavation that many hundreds of discrete laminations of sand and silt constituted the mound's make-up. With the resources available, recording all of these in detail was not a viable option, particularly as they were likely to have been reworked by a number of other processes such as wind and rain. An attempt was made to record the complexity of the mound in the upstanding long sections (Fig. 3), but even this required considerable simplification as the laminations were as little as 1mm thick in many places.

During excavation of the saltern mound [13] approximately 40 discrete ephemeral spreads of charcoal and/or burnt clay-rich silts and sands were recorded (e.g. [93] and [103]; mostly not illustrated on the plans for clarity). The majority of these tended to be concentrated around the central area of the saltern, and were most common within Quadrant A. A number were spatially associated with hearths and probably represent discrete episodes of raking out in between firings. A number of deposits showed evidence that they had been reworked, presumably by wind and rain, or perhaps even disturbed by the salt workers as they went about their tasks.

A number of these deposits were also found to contain small quantities of pottery (deposits [98], [117], [131], [219] and pit [222]). Larger assemblages were found within deposits [34] (containing fragments of a necked cooking pot) and [77], which contained the largest assemblage from the site (see below).

Hearths

Four hearth sites were located during the excavations (Hearths H1, H2, H3 and H4) (Fig. 2). These were all of the same general form, consisting of shallow, steep sided and flat bottomed rectangular flues that were open at both ends and with no obvious upper covering structure.

Hearth 1 can be divided into three distinct phases of use, based principally on definable firing-events. The largest and earliest of these is defined by [169] and had a thin charcoal-rich deposit [172] at its base (Fig. 2, section 1). This hearth subsequently became infilled with waste material derived from salt extraction [170], but it is unclear if this was a deliberate act or by natural erosional processes. The next hearth episode is defined by [171] and is slightly offset to the south-west. This was the most clearly defined of three phases of use, and also contained a concentration of dark, charcoal-rich material at its base and subsequently infilled in a similar way as the earlier hearth by [173]. The final firing episode was defined by [174]. On this occasion, the feature was largely infilled with sand [176], which again may be either a natural or deliberate process. Burning within this hearth was represented by a thin charcoal-rich upper fill [177] and the reddening of the immediately underlying deposit, a similar effect that was also noted in the earlier hearth episodes.

An unknown, but probably relatively short period elapsed during which time the site of Hearth 1 became inundated by and buried beneath sand and silts. When these deposits had reached a depth of around 150mm a second hearth site was created, Hearth 2, almost exactly over the earlier structures (Fig. 2). On this occasion only a single-phase flue of similar dimensions was created [35] (not illustrated), although a distinct hard baked ‘lining’ of the vertical faces and the base of the flue were noted. There was also a darkening of the deposits immediately surrounding the flue. The fill of the flue was not only rich with charcoal, but also fragments of burnt clay which are likely to be derived from the collapse of the structure.

Some 5m to the east and only partially exposed in the north facing section of Quadrant A, a succession of at least four fire pits were identified (earliest to latest): [132], [151], [152] and [154], grouped as Hearth 3 (Fig. 2, section 2). The last of these was the only one to contain a distinct layer of charcoal-rich material [142] at its base, indicating that earlier hearths had been carefully cleaned out. This final hearth was sealed beneath spreads of sand and silt [146], [147] and [148] in addition to two distinct charcoal rich deposits [149] and [150] which may be derived from the cleaning of other nearby hearths.

Hearth 4 was found to exist in a more isolated position within Quadrant C. The earliest phase of use [83] (not illustrated), although truncated by later fire pits, appeared to be more oval in shape and gently sloped in profile implying that an ‘informal’ fire site was adapted into a formal hearth. The underlying deposit was distinctively fire-affected, being a dark reddish brown, but becoming greyer as

proximity to the site of fire increased. This original fire pit contained no charcoal-rich primary deposit, indicating that it had been cleaned out, but subsequently infilled by redeposited sandy clay including some burnt fragments. A flue, [63], was cut into this context and was of a similar form, retaining distinctive baked sides and entirely infilled with charcoal-rich fill, which also contained burnt clay. This feature was largely destroyed by the excavation of a shallow pit [78] (not illustrated), which was filled by soft sandy-clay; its base and sides subsequently becoming baked hard through use. This was overlain by a shallow flue [59]/[61] with almost identical characteristics and slightly offset to the northwest. Fill [60] contained the charred remains of the final firing, including fragments of burnt clay.

Lined pits

A number of lined pits were also revealed, including pits [99] and [121] within Quadrant A (Fig. 2), intercutting pits [8] and [14], and [10] and [22] within Quadrant B (Fig. 2 and Fig. 4, sections 3 and 4), and possibly pit [135] within Quadrant C (Fig. 2). These were all roughly circular in plan, with near vertical sides (with the exception of [121] which had shallow concave sides) and flat bases. There was some variation in size, ranging from 0.85m to 1.5m in diameter and with surviving depths of between 0.1m to 0.6m. The lining was usually represented by a distinct clay deposit around the sides of the feature, but not on the base. In the case of pits [10], [22] and [135] this was seen as a stain forming a 'halo' around the feature. This 'halo' was also partially visible behind the clay lining of pit [99] and it is possible that such attributes may represent the decayed remains of organic linings.

Intercutting pits [10] and [22] were both originally constructed by cutting down to the underlying alluvial clay and therefore, in conjunction with the surviving traces of clay lining, indicate that these features could have been designed to hold liquid. The absence of clay bases within the other pits (with the exception of a few patches at the base of pit [8]) would presumably have meant that these were not impervious to liquid stored within.

All the pits became progressively infilled with silty sand very similar to that which constitutes the saltern mound, presumably an unavoidable process as the mound expanded, rather than deliberate backfilling.

Probable drains and other linear features

Two enigmatic bone alignments set in shallow gullies were excavated within the upper levels of the mound (context [26]/[45] and context [76]/[82] (Fig. 2). Context

[45] consisted of a *c*.4m straight length of tightly packed cattle bones generally laid perpendicular to the long axis of the feature. This alignment sloped gently from 2.75mAOD at the east to 2.55mAOD at the west, presumably following the topography of the mound at that time. A discrete deposit of animal bone was found *c*. 1.5m beyond the eastern end of this alignment at 2.8mAOD (context [26]) and possibly indicates the true extent of this feature. No associated gully into which the bones might have been laid could be discerned.

The bones comprising the second alignment, [76]/[82], were more spaced out, with irregular gaps in between. Furthermore this alignment curved distinctly to the east at its northern end (into the baulk, but not beyond it). It also displayed a gentle slope, falling from north to south. Linear gully [110] was faintly visible at the southern end of the bone alignment, with one fragmentary long bone lying between the edges within the feature. The ephemeral nature of this gully, however, meant that it was not possible to be certain whether it continued in either direction beyond where it was identified.

Two further ephemeral linear features were identified towards the southern edge of the saltern: gully [17] (Fig. 2, Quadrant B) and deposit [227], Quadrant C. The former comprised a shallow round bottomed gully that appeared to curve slightly southwards at its eastern extent, but became indistinct. The latter was less clearly defined, but similarly appeared to curve to the south, at its western end, where it also became indistinct. Both fills comprised of sandy-silt containing occasional charcoal flecks.

Possible sumps/tanks

Four large features were identified. Depression [235] (Fig. 2, Quadrant A) comprised an amorphous, shallow, flat bottomed feature some 6.6m by 7.3m and up to a maximum 0.4m deep, cutting the alluvial/marsh clay [23]. Its basal fill comprised homogenous clay-silt with sparse charcoal flecks throughout and was overlain by soft, lighter coloured silty-sand that contained similar charcoal inclusions. It is possible that this feature represents a natural depression in the marsh clay, possibly caused by erosional processes towards the western edge of the saltern mound. A shallow feature of similar dimensions, [50] (not illustrated), located in roughly the same position, but higher up in the mound sequence possibly indicates a specific function for a depression of this size in this location.

A 0.2m deep steep sided, flat bottomed feature *c.* 4.5m long was partially exposed against the western baulk, context [37] (Fig. 2 Quadrant B), but not detected beyond into Quadrant C. This was filled by soft brown silty-sand containing charcoal flecks (occasional concentrated patches present) and occasional pieces of burnt clay.

The largest feature within the saltern comprised linear anomaly [127] measuring *c*. 18m long, between 3m to 5.5m wide, with rounded terminals at each end and crossed the baulk between Quadrants B and D. Excavation at the southern terminal found it to be *c.* 0.8m deep with a stepped profile (cut from *c*. 2.03mAOD), flat bottomed and its lower extent cut into the alluvial clay (Fig. 4, section 5). A second intervention close to the northern terminal found it to be shallower (maximum *c*. 0.5m, but cut from approximately the same level. This also revealed that the base gently sloped in a south-westerly direction. Fills consisted of silty-sand, the earliest of which [129] contained significantly more charcoal fragments.

Other Features

A number of other features, predominantly pits, were located within the saltern. These tended to be concentrated within the central area of the mound, but some dispersed features were located towards the periphery of the mound. Whilst some pits appeared to have simply become engulfed by the growing mound, others were apparently used for the disposal of hearth debris e.g. [42] Quadrant B and [259] Quadrant D (Fig. 2), and were also found to contain fragments of two distinct cooking pots. Elongated pit [66] in Quadrant B was stained brown around its entire edge and may indicate a decayed organic lining (Fig. 2).

Pit [184] (Fig. 2 Quadrant C; Fig. 4, section 6) contained numerous charcoal-rich fills separated by layers of sand and silt that may have been the result of either deliberate dumping (cooking pot fragments were found) or natural infilling. Pit [133] (Fig. 2, Quadrant A) was rectangular in plan with steep sides and a flat base. It was filled by [134], which contained many lenses of silty sand and is likely to represent natural silting. A more distinct dark layer of lenses towards the base of the feature (139], was found to contain pottery including fragments of a spouted pitcher.

A group of three shallow pits was located north of the main focus of activity (pits [111], [113] and [119], but their function was not ascertained.

Very little evidence of structures was found, although this may be due to the techniques employed to excavate the mound and perhaps their ephemeral nature. A small number of postholes were encountered (e.g. [53] and [209], Quadrant A; [24]

and [47], Quadrant B; [73] Quadrant C; and [195], Quadrant D). Those in Quadrant A may be associated with Hearth 1 ([53] was also overlain by a quern stone), whilst [73] and [47] may be associated with the pits which they are situated next to. The remaining postholes are isolated and are therefore more enigmatic.

Some 600 years passed from the cessation of salt-making activity before the saltern mound was utilised once more; this time as a convenient anchorage point for what is thought to represent a steel barrage balloon cable found attached to a large block of concrete towards the edge of Quadrant B (not illustrated).

THE FINDS

The Pottery by Luke Barber

Introduction

The excavations recovered a total of 169 sherds of pottery, weighing 2,029g, from 29 individually numbered contexts. With the exception of two 19th- century sherds from topsoil context [1] the assemblage is entirely of mid 11th- to 12th- century date. Although the average sherd size of the medieval pottery is 12g there are many larger pieces, and virtually all sherds, large or small, have fresh breaks demonstrating they have not been subjected to redeposition. Unfortunately no large groups are present: the largest consisting of a mere 24 sherds from charcoal deposit [77]. Despite this, there is little chronological distinction between the ceramics from the upper and lower deposits suggesting the saltern mound was formed over a relatively short period, though admittedly, the close dating of many of these wares is notoriously difficult. As such the assemblage has been generally treated as a whole. The main aim of this report is to establish the range of fabrics/forms present at the site and thus the lower Ouse Valley as a whole for a period which has until now produced very few useful sealed groups from the vicinity.

Fabrics

Seven different fabric groups were noted. Their quantities (number of sherds/weight) in the overall site assemblage are given in brackets. Although some are very distinct, other groups tend to merge, probably indicating variability at the same production centre. All are of a similar chronological range, though some fabrics may continue into the early 13th century. Although some groups tend to favour a reduced or

oxidised finish it is clear many vessels are patchily fired. Only cooking vessels are present in the assemblage.

M1 Moderate/abundant multicoloured (white, grey, red, brown, black) flint grits to 1mm. Usually oxidized, but some reduced. (72/585g)

M2 Sparse/moderate grey/black flint grits to 1mm and rare chalk to 0.5mm. Usually reduced. (32/314g). Cat No. 4.

M3 Abundant grey flint to 1mm and sparse/moderate chalk to 0.5mm. Usually reduced. (21/327g). Cat. Nos 3 and 6.

M4 Sparse/moderate fine/medium sand with sparse multicoloured flint grits and chalk to 0.25mm. Usually oxidized. (7/40g)

M5 Abundant multicoloured (white, grey, black) flint grits to 0.25mm. Usually oxidized. (33/702g). Cat. Nos 1, 2 and 5.

M6 Sparse to moderate chalk and sparse black/grey flint to 0.25mm. Some sand. Usually reduced. (1/9g)

M7 Moderate medium sand with very rare flint inclusions to 0.5mm. Low-fired. Usually reduced. (1/21g)

Very few feature sherds are present in the assemblage. This increases the problems of dating the ceramics, particularly when no large groups are present to allow the study of fabric ratios. All feature sherds have been catalogued and illustrated (Fig. 6) in order to give an impression of the forms present.

Pit [133] (Fills [134] and [139])

1. Spouted pitcher in Fabric M5. The body of the pitcher is decorated with oblique scratched/incised lines. Mid-dark grey core with grey interior and dull brown orange/light grey patchy exterior surfaces. Sherds from the same vessel were recovered from two different fills within this pit. This vessel, judging by its form, may be one of the earliest recovered from the site and could even be of 10th- century date. However, the decoration is reminiscent of scratch-marked ware from Southampton (Brown 2002, 9 figs 5–6) where it is considered to be an indicator of a post-Conquest date and is notably common in the 12th century. Similarly decoration vessels from the Star Inn, Lewes have been dated to the second half of the 12th century (Barton 1979, 142). Taking

the form and decoration combined a date in the later 11th to early/mid 12th century seems probable.

Pit [259] (Fill [264])

2. Cooking pot with slight thumbing on rim. Fabric M5. Brick red with dull orange – light brown surfaces. Similar forms have been recovered from Lewes Priory where they have been dated to the 12th century (Lyne 1997, fig. 19, No. 6).

3. Cooking pot with inset rim. Fabric M3. Black core with dark brown/grey interior and dull orange brown to dark grey patchy exterior surfaces.

Pit [184] (Fill [185])

4. Cooking pot with upright everted rim. Fabric M2. Light grey core with dull brown/mid grey surfaces.

Layer [34]

5. Necked cooking pot. Fabric M5. Dark grey core with light/mid grey brown interior and dull orange-grey patchy exterior surfaces. Very slight traces of thumbing on rim.

Layer [2]

6. Cooking pot with sagging base and everted rim. Well formed and certainly finished on a slow wheel. Fabric M3. Dark grey-black core with dark grey/black to dull orange brown patchy surfaces. Second half of 12th century, possibly into early 13th century.

Conclusions

The nearby Bishopstone village ceramic sequence appears earlier than the current assemblage and is likely to be pre-Conquest, though at the time of writing analysis was yet to be undertaken (Gabor Thomas *pers. comm*.). Most of the assemblages from the nearby towns, most notably Seaford, appear to be predominantly of the later 12th century onward (Machling 1995; Barber 2004). It is unfortunate that although excavations in Lewes have produced pottery of similar character and date most has either come from early excavations or/and slightly mixed deposits (Lyne 1997; Freke 1976). The overall evidence of the current group would suggest a post-Conquest start date for the onset of activities at the saltern, perhaps toward the late 11th

century. Most activity/pottery can be placed within the 12th century though the exact date of abandonment is uncertain. A date toward the end of the century is possible. Further work on the other salterns in the valley would be highly desirable in order to compare their ceramic groups with the current one. If all are of similar date, which the initial field-walking did suggest, then their establishment may mark a deliberate economic undertaking by the new Norman Lord.

The Metalwork by Luke Barber

The excavations recovered a mere 16 pieces of metalwork from nine different contexts, virtually all of which were dated to the mid 11th- to 12th- century. All has been listed on pro forma. The assemblage consists of eight iron and eight lead items. The majority of the lead was located by metal detector towards the end of the excavation.

The ironwork is in a very poor state of preservation with heavy corrosion products adhering in most instances and several pieces being nearly completely mineralised. With the exception of a clench bolt (measuring 28mm between head and rove internally; context [5]), all the ironwork consists of large nail fragments.

The lead items consist mainly of waste in the form of off-cut sheeting (one piece partly shaped into a 28mm long trough and one plain; subsoil [2]) or amorphous lumps which have obviously been in a molten state (one piece in subsoil [2]; two pieces in saltern mound [13]; one each in charcoal deposits [77] and [219]). These waste pieces are likely to be the result of the repair of the lead salt-pans used in the final evaporation process. However, the presence of a rectangular net weight (subsoil [2]; Fig. 7) indicates that fishing may have also partly employed the salt-worker's time. The presence of large nails and a clench bolt would suggest the presence of a boat/boat repairs and indeed, some of the lead waste may also relate to the manufacture of lead fishing weights. A saltern mound in the estuary would provide a convenient base for small-scale localized fishing.

The Animal Bone by Lucy Sibun

A total of 97 bone fragments were recovered from three contexts: [45], [76], and [82]. Whilst dating evidence was only recovered from [82] it is thought that all three contexts date to the 11th to 12th centuries. Contexts [45] and [76] are linear deposits of complete or almost complete skeletal elements, neatly arranged apparently on the

ground surface. Context [82] bone is arranged in a similar manner but appears to be within gully [110]. Preservation of the material is varied. Most elements are almost complete with some post-deposition damage but in all three contexts the bone surfaces show signs of weathering. The only two species identified in the assemblage were cattle and horse. Due to the small size of the assemblage and as there was no significant difference between the elements in each context, all three will be studied together.

A total of 88 elements were identified as cattle, the majority of which (59 elements) were long bones. Mandibles, scapulae, innominate bones and metapodials were also present in smaller quantities. Together these elements represent a minimum number of thirteen cattle. Whilst the vast majority of elements appear to be from skeletally mature animals, at least one individual is less than approximately 3½ years of age (1 of 3 distal femur unfused, 1 of 3 distal radius unfused). The dental evidence supports the mature age of the cattle. Of a total of eighteen mandibles, eleven contained teeth and in every case this included a well-worn third molar suggesting an age of at least three. A single radius could be measured and provided a withers height calculation of 1.29m.

Nine elements were identified as horse. These comprised four longbones, four metapodials and an innominate bone and represented a minimum number of three animals. All were skeletally mature. Six provided measurements for withers height calculations and these range from 1.29m to 1.71m.

There was no evidence for butchery on any of the elements, and it is thought likely that the majority were complete when deposited. In a single case, a horse metacarpal, the adjacent 3rd carpal was also present suggesting that the bones had still been attached when deposited.

The Charcoal by Rowena Gale

Introduction

This report presents the analysis of six samples of charcoal collected from a medieval saltern, dated to the 11th and 12th centuries, to establish the type of fuel used for brine evaporation.

Methodology

Bulk samples were processed using bucket flotation with flots caught on a 500 micron mesh. The resulting flots were examined under low magnification and charcoal fragments measuring >4mm were separated out. The charcoal was firm and well preserved although mostly rather fragmented. The samples were prepared using standard methods (Gale and Cutler 2000). Anatomical structures were examined using incident light on a Nikon Labophot-2 compound microscope at magnifications up to x400 and matched to prepared reference slides of modern wood. When possible, the maturity of the wood was assessed (i.e., heartwood/sapwood).

Results

Context details and the taxa identified are presented in Table 1.

Table 1. Charcoal from the medieval saltern

Key: h = heartwood

The number of fragments identified is indicated

Context	**Feature**	***Fagus***	***Prunus***	***Quercus***
[4]	Fill of pit [3]	3	3	-
[36]	Fill of hearth flue [35]	21	-	-
[93]	Charcoal deposit	68	-	-
[103]	Charcoal deposit	47	-	-
[129]	Fill of pit [127]	17	1	-
[185]	Fill of pit [184]	79	-	1h

Discussion

Charcoal debris from salt-making processes was recorded in several features. Samples were collected from the fill of pit [127] and hearth flue [35], charcoal deposits [93] and [103] and the fill of pit [184], and the fill of pit [3]. The charcoal was sufficiently well-preserved to enable species identification and suggested the consistent use of beech (*Fagus* sp.) firewood. Owing to the fragmentation of the charcoal it was difficult to assess the maturity of the beech, although it did not appear to be narrow roundwood (i.e., <20mm in diameter). In addition, narrow blackthorn (*Prunus spinosa*) stems were recorded from context [129], hearth context [127], and from context [4], the fill of pit [3]; and a minimal amount of oak (*Quercus* sp.) heartwood was present in context [185], the fill of pit [184] (Table 1).

Beech wood provides high quality firewood which, when well-seasoned, burns easily and evenly. Although the charcoal was too comminuted to assess the origins of the firewood from coppiced sources, the evidence suggests that fuel was obtained from beech woods growing within easy access of the saltern site. Beech is an important component of the Sussex Weald, located north of the site, where it grows mainly in association with oak and birch (*Betula* sp.) (Tittensor 1978). The dominance of beech suggests that a) it was the preferred fuel and b) that supplies were plentiful enough to more or less negate the use of other species. There was no evidence to indicate the use of wetland species such as alder (*Alnus glutinosa*) or willow (*Salix* sp.), which probably grew on the damp estuarine soils close to the site. The type of fuel used (i.e., fast- or slow-burning) would have influenced the rate of evaporation, which in turn would have affected the quality and size of the salt granules (Hagen 1994).

DISCUSSION

Much has been written on the process of extracting salt from sea water and the reader is therefore directed to the following texts, which are by no means exhaustive, for more detailed descriptions (Brownrigg 1748; Holden and Hudson 1981; Ridgeway 2000). In summary, the saltern is likely to have been located on the estuary above, but close to the spring high tide line, so as to utilise an area between ordinary and spring high tides where inundation would have been a predictable and common occurrence. Each flood episode would deposit a layer of silt and sand, which when dried by wind and sunshine, would have contained a concentration of salt. These salt-enriched deposits would be harvested and stockpiled before being placed within troughs or partially lined pits which, by the application of either fresh or salt water would enable the raw material to be separated into a concentrated brine and residual sand and silt sediment. Further reduction of this brine would be achieved by the controlled heating over a fire (usually in lead pans), allowing the formation of salt crystals which could then be easily collected and dried (perhaps elsewhere) before being packaged and distributed. The sand and silt by-product would simply be dumped and over time create a noticeable mound, which as it grew would no doubt have offered a secure dry ‘island’ on which to carry out the salt processing activities.

The excavated saltern lies on the alluvial floodplain of the River Ouse, although the modern course of the river is likely to follow a somewhat different route to that present during the late 11th to 12th centuries during which time the saltern was

in use (Brandon 1971; Farrant 1972; Morris 1931). Unfortunately the watching brief maintained across the whole site during landscaping failed to identify sufficient evidence to suggest an alternative course.

Whilst the Adur Valley between Beeding and Lancing has long been recognised as being an important centre for salt production from late Saxon times to the mid 14th century and has been the subject of research and fieldwork (Gardiner 1995; Holden and Hudson 1981; Holden 1962; Holden 1975), little consideration has been given to the Ouse Valley. The occurrence of post-Conquest salterns across Sussex, as inferred from the Domesday Book, number in excess of 300, although only eleven can be assigned to the Ouse Estuary, compared to perhaps as many as 78 for the Adur (Salzman 1973, 232; Holden and Hudson 1981, 126). Those which are recorded are to be found further up stream at Rodmell, Iford and on Glynde Reach (Pam Coombes *pers. comm.*). This evidence implies that such an industry was not as established on the River Ouse at the time of Domesday and based on current knowledge perhaps it never was as prevalent, although fieldwalking did identify at least two potential salterns close by forming a roughly linear arrangement. As stated above, the pottery evidence suggests that a new Norman lord may have seen an opportunity to profit from a largely untapped resource within his manor. Just which manor this was is open to question as the course of the Ouse at this time is not known. Should the saltern lie to the east of the Ouse then it would lie within Bishopstone Manor, where excavations adjacent to St Andrew's church have revealed a late Saxon settlement which predates the saltern (Thomas 2010). Should the saltern lie to the west of the Ouse it would fall within the manor of Meeching. Further evidence of salt working may of course now be lost to agriculture or buried below layers of alluvium. The current site therefore represents the only medieval saltern confirmed by excavation on the River Ouse.

Excavations of saltern mounds both within Sussex and further afield have generally revealed similar characteristics in terms of types of features present (i.e. circular and square pits (some apparently clay lined), hearths, deposits of charcoal and burnt clay and larger sumps/tanks) although there is often a variation in shape and size of the mound itself.

The visible extent of the Ouse Estuary saltern was defined by a roughly oval mound measuring some 75m by 50m in plan and rising to *c*. 1m (*c*. 3.2mAOD) above the general level of the floodplain, although some 800 years of erosion has no doubt diminished its former stature. The excavations also showed that the lower fringes of the saltern had to an unknown extent been overlain by later alluvium, further reducing

its apparent size. Even so, its area still considerably dwarfs the salterns of the Adur group, although some of these had visible heights in the order of 2m (Holden & Hudson 1981, 129) whilst examples in Kent (Thompson 1956, 47) and Lincolnshire (Rudkin *et al.* 1959–60, 76) are known to exceed 4.5m and 6m high respectively

Whilst the majority of features were grouped around the central area of the saltern there is a clear grouping within the northwest quadrant which appears to respect the large depressions defined by [50] and [235]. It is possibly that [235] represents one of the earliest features on the site, cutting marsh clay [23] a *c*. 2.00mAOD and may have been used as a sump or tank for holding water that may have flowed in naturally at the highest tides. Either through natural processes, or due to progressive expansion of the mound, this feature went out of use and [50] may represent a later recreation. Possible tank [127] is of comparable size to examples found at medieval salterns at in Essex where a network of banks are thought to have regulated the flow of water (Brown 1999, 118). No obvious trace of a similar arrangement having existed adjacent to the Ouse Estuary saltern was identified within the limitations of the excavation, but their presence cannot be conclusively ruled out.

The two distinct bone alignments are somewhat enigmatic and with the exception of the neatly spaced arrangement at Fishbourne, interpreted as a post-medieval drainage feature (Manley and Rudkin 2003, 78–80), no parallels could readily be found. It is clear that these had a specific function associated with salt making and it is not unlikely that they were used as a means of filtration whereby the silt and sand would be trapped behind successive bone barriers whilst the salty liquor ran on to be collected in some form of receptacle. Although no gully was seen associated with alignment [26]/[45], alignment [76]/[82] appeared to have been deliberately placed within gully [110] for at least part of its length.

Hearths formed an integral part of the process and the identified hearth sites were no doubt situated at the most efficient locations both in term of proximity to pits, but also on the windward side of the mound aligned with the prevailing wind. The small number of lead fragments recovered suggests that the brine was heated in lead pans in accordance with other excavated salterns and documentary accounts. The consistent use of beech as firewood does imply a deliberate selection process and could easily be transported southwards from the Weald by water direct to the site.

The lined pits would almost certainly have been used as settling, filtration or perhaps even storage tanks, but the primary function of the unlined pits is somewhat more difficult to explain. It is unlikely that they were dug for the disposal of waste

when the mound itself would function as a midden (although rubbish was dumped within when pits were engulfed by the growing mound). The numerous deposits and spreads of charcoal and burnt clay, some of which contained broken pottery, attests to the fact that keeping the mound tidy was of little concern.

The lack of any substantial evidence for structures does not necessarily mean that they were not present. The likelihood is that if present on the mound itself they would by necessity be temporary in nature so that they could easily be taken down and rebuilt as the saltern rose from the floodplain. Posthole evidence would be very elusive as the fills would be indistinct from the general mound makeup unless the timbers rotted or were burnt *in situ*. It is possible that structures of a more permanent stature could have been situated beyond the working area, but still above the spring high tide line.

The precise duration of activity at this saltern is difficult to establish, but does not match the longevity of activity, albeit intermittent, recorded at the Bramber saltern which spanned in excess of three centuries (Ridgeway 2000, 151). In the absence of any conclusive dating evidence from other potential salterns along the Ouse estuary it is also impossible to suggest over what period the industry was taking place as a whole, although the same climatic factors from *c.* 1300 that virtually ceased activity on the Adur within around 50 years, in addition to cheaper continental importation (Holden and Hudson 1981, 141) would no doubt have affected many other salt working sites along the south coast.

To better understand the salt working industry of the Ouse Estuary it will be necessary to undertake further fieldwork, not only to identify other possible salterns, but to establish a chronology for the industry. A complementary study to establish the contemporary course of the Ouse would be immensely useful, not least so that the manor/s which were potentially involved in this activity can be explored.

ACKNOWLEDGEMENTS

Archaeology South-East would like to thank East Sussex County Council for funding the fieldwork and post-excavation work. The author would like to thank Ian Greig and Luke Barber for overall site management and post-excavation management respectively. Thanks also go to Luke Barber, Chris Butler, David Dunkin, Rowena Gale, Pat Hinton and Dr. Sophie Seel for finds analysis and Dr Ed Jarzembowski for sharing his research into the geology and past ecology of the area. The excavation

team were Fiona Griffin, Alex Langlands, Paul Riccoboni and Ed Wilkinson. This report was edited for publication by Louise Rayner and Andy Margetts. Figures were produced by Justin Russell and Fiona Griffin.

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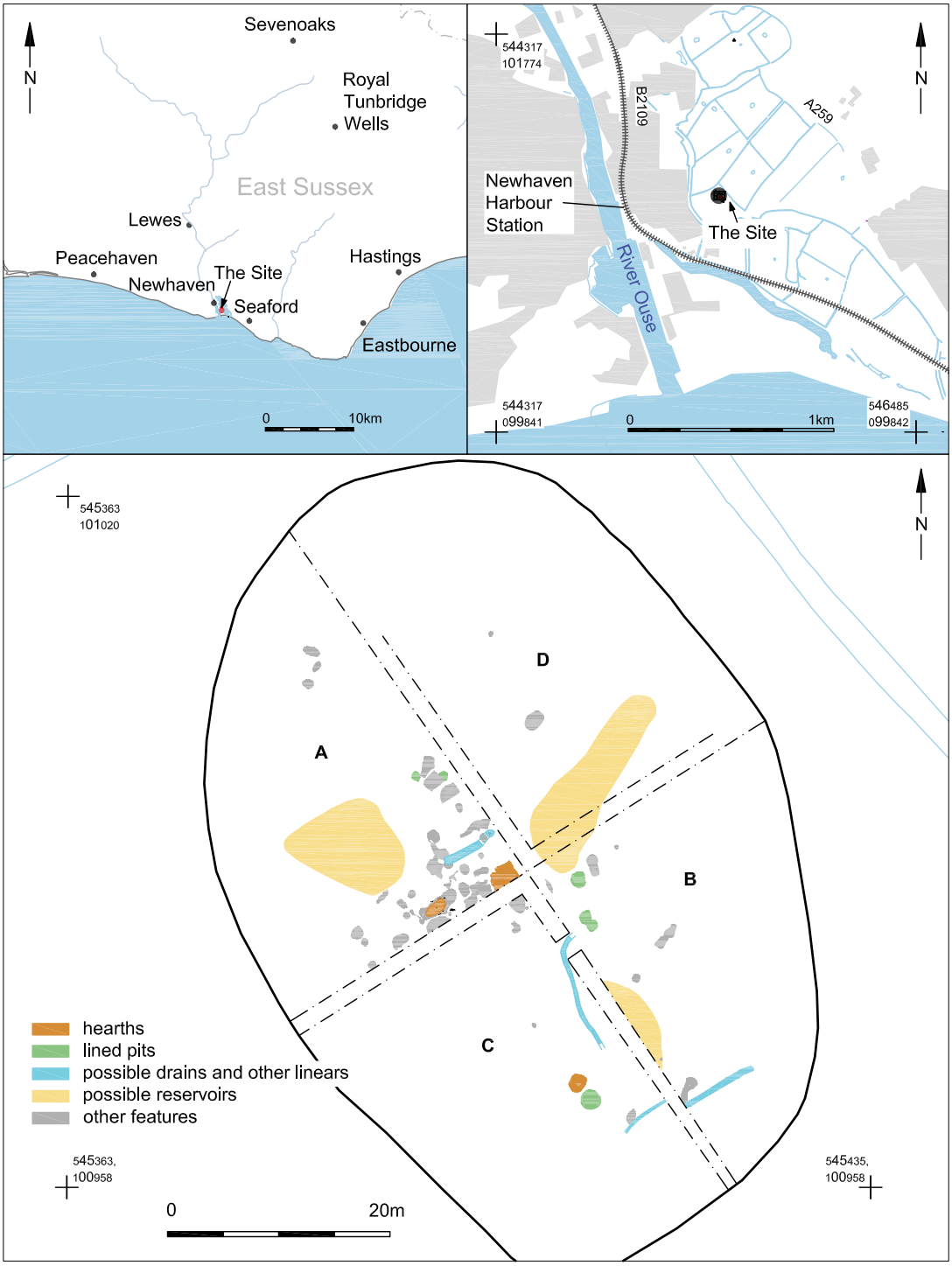
Fig. 1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Peacehaven
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The Site
Seaford
Hastings
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B2109
A259
Newhaven Harbour Station
The Site
River Ouse
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1km
546485
099842
545363
101020
D
A
B
C
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lined pits
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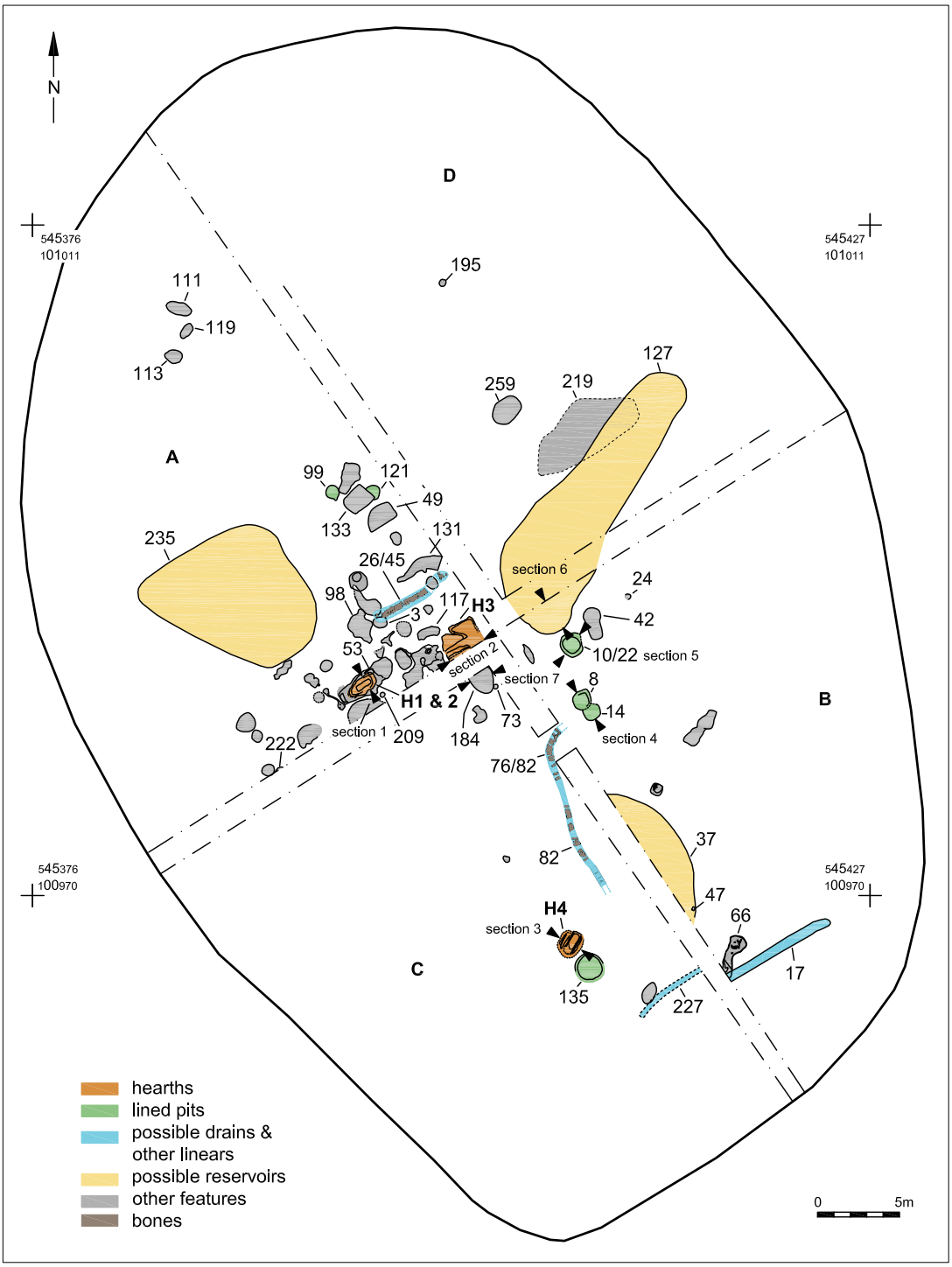
Fig. 2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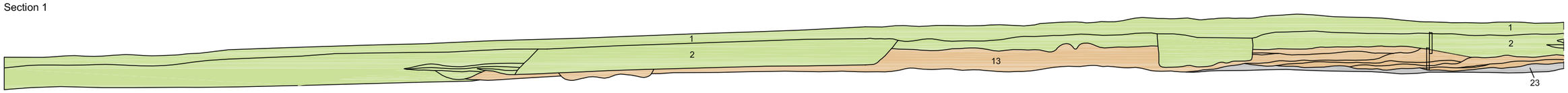
545427
100970
195
111
119
113
259
219
127
99
121
49
133
131
235
26/45
section 6
24
98
117
H3
3
42
53
section 2
10/22
section 5
section 7
8
H1 & 2
14
73
section 1
209
184
section 4
222
76/82
37
82
47
66
H4
section 3
17
135
227
hearths
lined pits
possible drains &
other linears
possible reservoirs
other features
bones
0
5m

Fig. 3

QUAD A W Facing

Section 1



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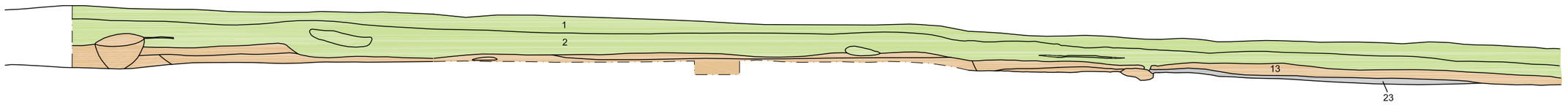

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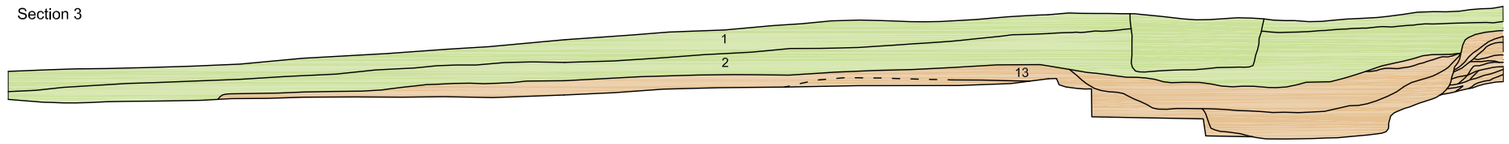
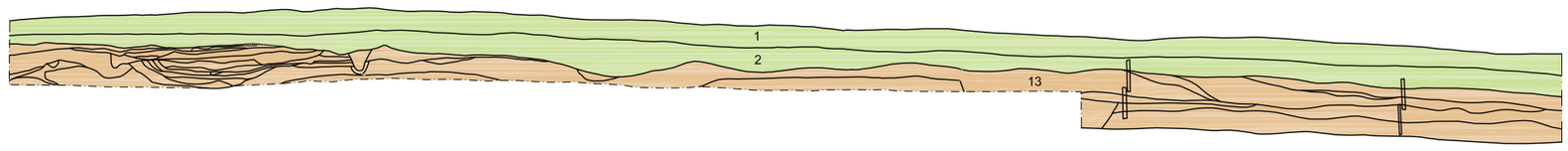


Section 4

Quad A N facing



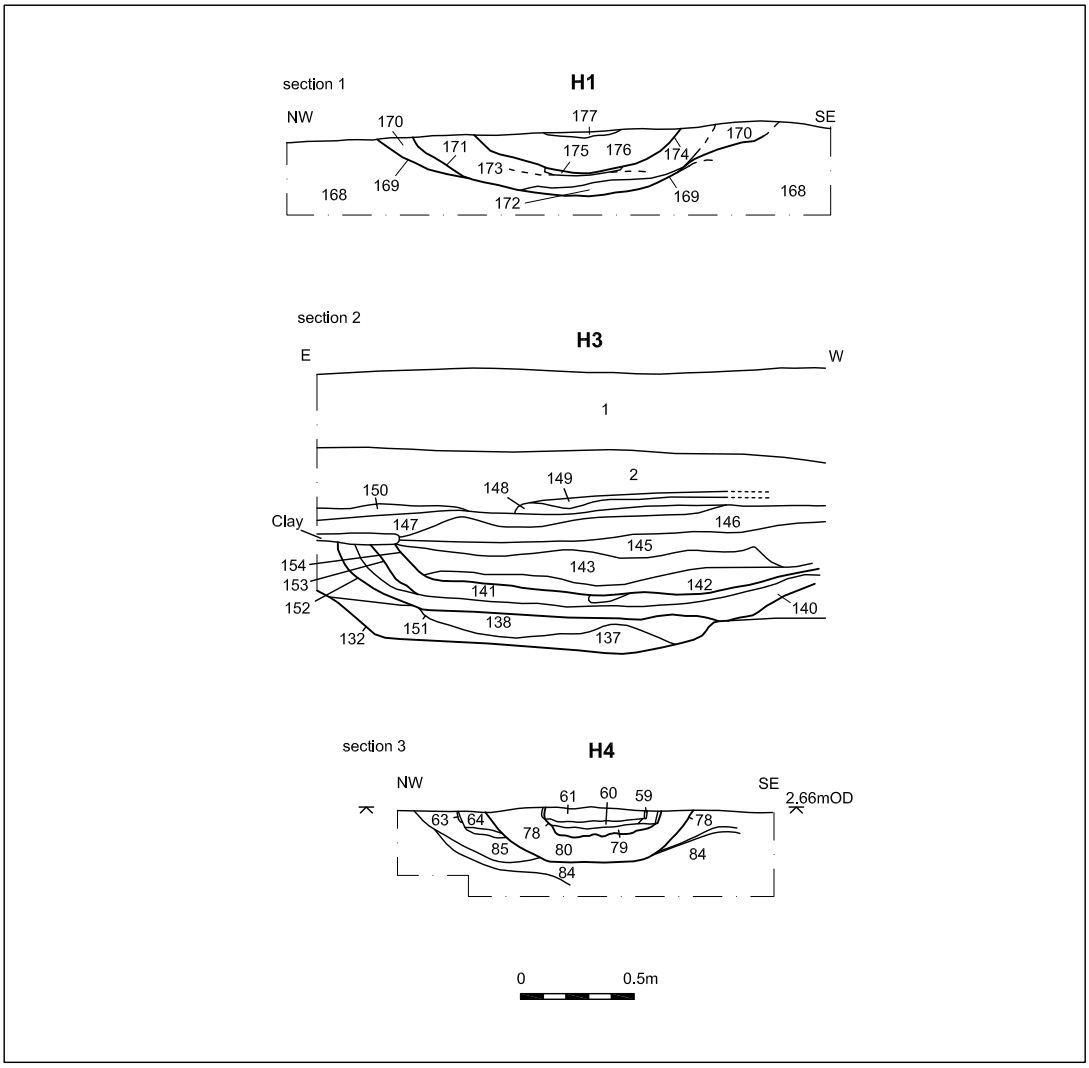
0 2m

modern/topsoil/ subsoil

saltern mound

alluvial/ marsh clay

Fig. 4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H1
NW
SE
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177
170
171
175
176
174
173
169
168
172
169
168
section 2
H3
E
W
1
2
150
148
149
Clay
147
146
145
154
143
153
141
142
152
140
151
138
132
137
section 3
H4
NW
SE
61
60
59
2.66mOD
63
64
78
78
85
80
79
84
84
0
0.5m

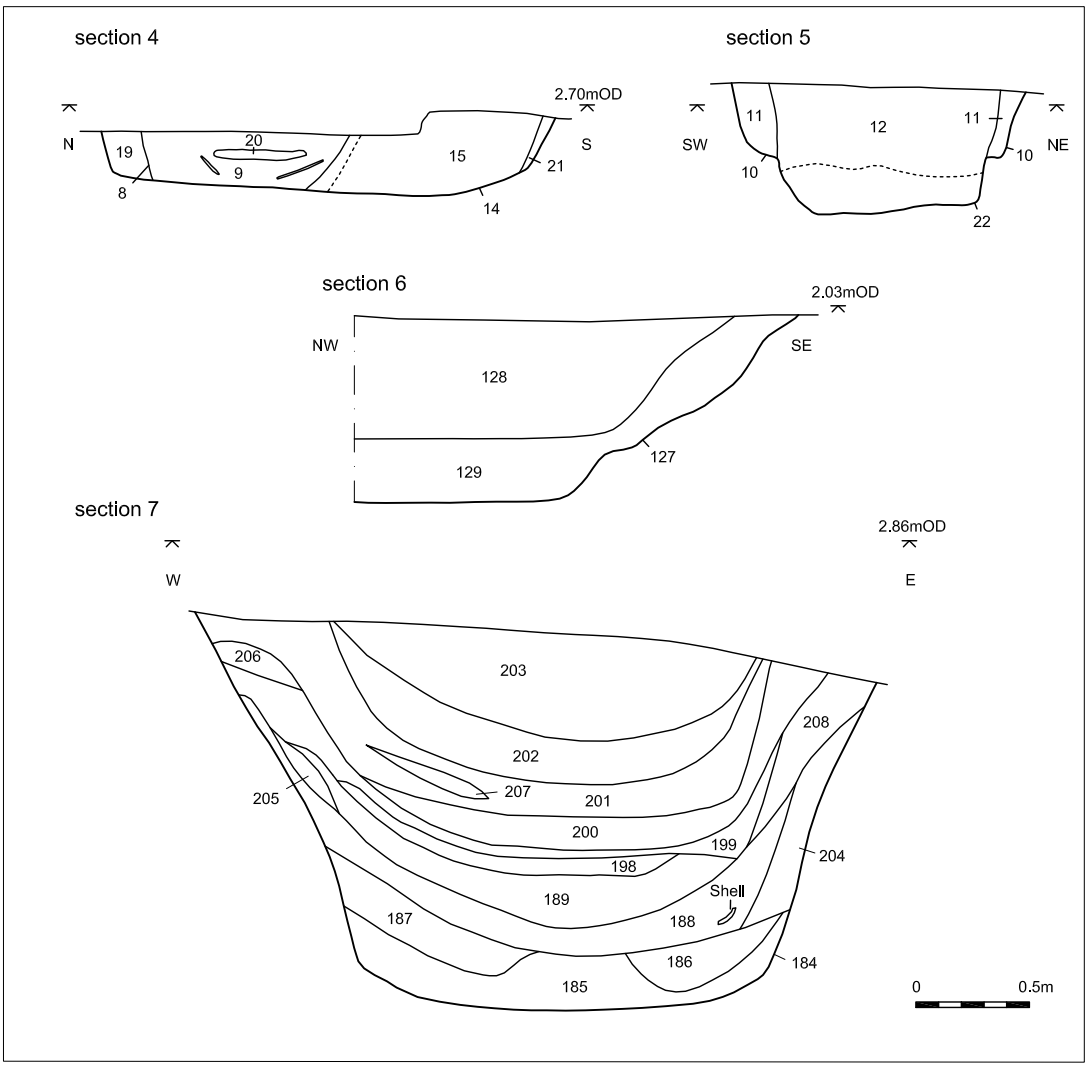
section 4
2.70mOD
N
S
19
20
9
15
21
8
14
section 5
SW
NE
11
12
11
10
10
22
section 6
2.03mOD
NW
SE
128
129
127
section 7
2.86mOD
W
E
206
203
208
202
205
207
201
200
199
204
198
189
Shell
187
188
186
184
185
0
0.5m

Fig. 6

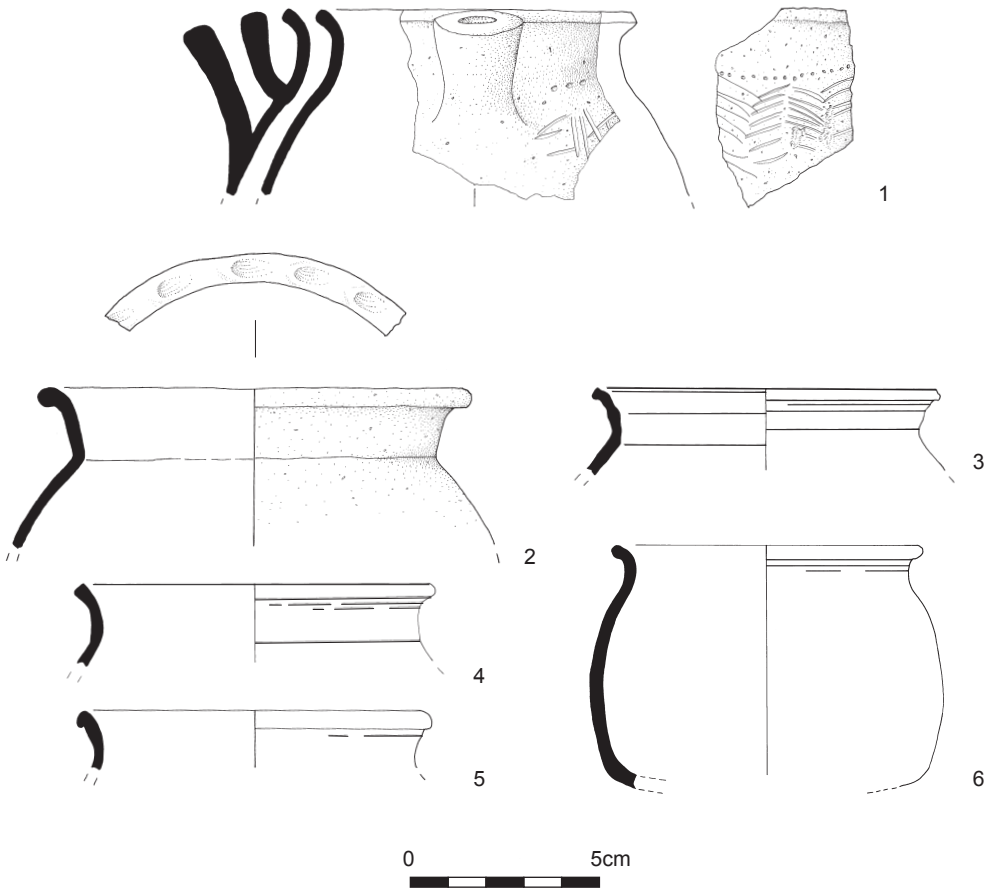

Fig.7