Assessment of the Fired Clay from the Skegness to Ingoldmells Water Pipeline (SIP 04)

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The Skegness to Ingoldmells water pipeline excavations produced a large and well-preserved collection of fired clay, much of it related to salt production of Iron Age to early Roman date. A small quantity of fired clay came from a site where salt production of medieval date was carried out, a period where the methods of production used are poorly documented and where it would be extremely useful for future management of the archaeological resource to be able to use fired clay as a means of identifying salt production. A small proportion of the material came from domestic sites of medieval or later date and this material seems to be a mixture of residual Iron Age or early Roman salt production waste and perhaps fragments of late and post-medieval brick.

Description

It was not possible to count the fragments of fired clay, since the material included bags of clay retrieved from sieved residues and is also in some cases very friable. Table 1 lists the finds by the number of records made (i.e. groups of clay objects with the same characteristics and from the same context) and by weight.

Table 1

Trench	Records	Sum of Weight
1;PL3B	27	1151
10; PL7	2	810
10;PL7	1	107
2;PL3B	60	5730
3;PL3B	2	378
4;PL4B	4	175
5;PL4B	186	21938
5;PL9	51	2113
6;PL13	533	42627
9;PL7	4	453
PL01	2	13
PL03B	38	7979
PL04A	1	40
PL04B	1	2
PL07	6	6174
PL09	13	1450
PL10	8	325
PL11	5	131
PL12	6	301
PL13	98	20881
PL13B	1	46
PL17	1	8

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PL3B	1	63
PL4	3	206
PL7	6	93
PL9	1	5
WB;PL11	38	2745
WB;PL12	350	48851
WB;PL13	64	8529
WB;PL16+17	54	5787
WB;PL6	31	2145
Grand Total	1598	181256

Fired Clay

Fabrics

The fired clay was examined visually and divided into fabrics.

Fabric 1 is organic tempered with few other inclusions visible by eye. The organic inclusions were charred and, usually, turned to a white ash as a result of use. A few examples of low fired, black-coloured fabric were present and these, it is assumed, are representative of the fabric after its initial manufacture.

Fabric 2 is slightly sandy and contains sparse large angular inclusions of flint. It is likely that it was used first in an unfired state which would explain why only the inner face of the hearth walls is represented.

Fabric 3 is similar to Fabric 2 but contains more quartz sand and large angular ironstone.

Fabric 4 contains round-sectioned organic voids (reed stems?) is a groundmass of silt-sized quartz, muscovite and calcareous inclusions.

Fabric 5 contains moderate rounded chalk inclusions, moderate angular and rounded flint, sparse rounded, polished quartz grains in a groundmass of silt-sized quartz, muscovite and calcareous inclusions.

Fabric 6 contains abundant organic voids (a mixture of round-sectioned stems and narrow ribbed leaf fragments) in a groundmass of silt-sized quartz, muscovite and calcareous inclusions.

Fabric 7 contains moderate rounded chalk inclusions and abundant rounded quartz in a fine-grained, probably calcareous groundmass.

Fabric 8 contains abundant organic voids (straw?), sparse rounded chalk and moderate rounded quartz grains in a fine-grained probably calcareous groundmass.

Fabric 9 contains ill-sorted moderate rounded chalk fragments, and abundant rounded quartzose grains. The groundmass is fine-textured but probably calcareous.

Fabric 10 contains well-sorted subangular quartz sand, c0.2mm across, in a groundmass of silt-sized quartz, muscovite and calcareous inclusions.

Fabric 11 contains sparse rounded fragments of ironstone, sandstone and quartz up to 4.0mm across, abundant illsorted subangular and rounded quartz and moderate organic voids. It is probably a boulder clay tempered with straw or dung.

Fabric 12 is a loosely-compacted sandy clay containing sparse subangular chalk fragments and moderate dark grey to white ash fragments up to 10mm across. Some of these have a rounded, vesicular form. Other inclusions may include fragments of briquettage containers. The material appears to be refired salt production waste.

Fabric 13 is fine-textured, containing sparse rootlet or insect burrows in a groundmass of silty, micaceous, probably calcareous clay.

Fabric 14 contains sparse rounded quartz and angular flint up to 3.0mm across and sparse rootlets and/or insect burrows in a fine-textured groundmass. It is possibly burnt but unworked boulder clay.

Interpretation

There are probably two main groups of clays used on the SIP sites. The first are boulder clays and the second are estuarine silts. This reflects the natural stratigraphy of the Skegness to Ingoldmells pipeline. The only fabric which might originate outside this area is Fabric 5, which contains polished quartz grains. These, however, outcrop in the Red Chalk and lower Cretaceous deposits and might have been present in boulder clay as erratics. Within the two basic fabric groups there are variations which may be due to the use of different sources of raw materials (for example, Fabrics 2, 3, 11 and 14 are non-calcareous boulder clays whilst Fabrics 7, 8 and 9 are calcareous). It is likely that Fabrics 2 and 3 were de-calcified post-burial rather than originating in a different area and this may be due to elevation and drainage. Fabric 5 appears to be a mixture, containing the inclusions which typify the chalky boulder clays with a groundmass which is more typical of estuarine silts.

In addition to these natural variations in the raw materials used, it is clear that the use of organic tempering is a deliberate feature of some fabrics, although organic inclusions are also present in the salt marsh silts. These can occur as detrital bands or as *in situ* roots and stems. No definite root material was noted visually, nor were there any burrows, often lined with a finer, darker clay. These features are typical of the use of silt blocks used without further working. Nevertheless, it is possible that such material is present since only a small proportion of the fired clay could be examined in detail during the assessment.

Finally, Fabric 12 appears to be composed of the saltern matrix which has been burnt.

Forms

The material was classified in a similar manner to that employed for other briquettage collections. Objects were assigned to the following categories:

- Hearth walling. These have a single, flat, remaining face and often show evidence of being over 100mm thick. In many cases, a fragment interpreted as wall might be a small piece of a brick or pedestal. However, there are several pieces which have a thick salt glaze on one fact and these are clearly hearth walling.
- Slabs. Examples with two flat faces at right angles were classed as slabs, especially if they showed evidence of prolonged heating in close contact with brine. However, they might have come from the inner top corner of a hearth wall. A small number of thin slabs were present. These were initially classified as thick base sherds of containers, until a corner fragment was found.
- Pedestals. Several different types of pedestal were noted, most of them roughly cylindrical and crudely made. Some show signs of being well made, for example one has a truncated pyramidal form, and they vary in the character of the upper surface, some being flat and horizontal and others, the majority, having a sloping and sometimes definitely concave upper surface. In one case, it is clear that the pedestal supported a trough-shaped container, with a vertical face at one end and curved walls. Where the lower surface survives it is invariably flat and horizontal. However, two examples of tall spindle-like pedestals were found (in Fabric 1) and similar objects from Cowbit were interpreted by Morris as being used to support a second tier of containers. The Cowbit examples have a forked lower surface, suggesting that they were made to hook over the rims of the lower tier of containers. In the SIP examples, the lower surface does not survive, whilst the upper surface (if such it is) is horizontal. Pedestal fragments were classified according to their overall shape (circular, truncated codes, truncated pyramids) and the nature of the upper surface (horizontal, angled or sloping. The maximum height was measured where it survived. Individual pedestal types were coded PD1 onwards.
- Spacers and clips. These consist of irregularly-shaped lumps of clay which have two flat faces, sometimes roughly parallel and sometimes at an angle to each other. These are interpreted as being supports between the containers and the hearth walls, and between pairs of containers. The larger fragments were classified according to the number of surfaces they contain (where the clip was pressed against the container or hearth/oven wall). Codes are prefixed CL…
- Containers. A surprisingly small proportion of the fired clay comes from containers. Two basic shapes are represented: trough-shaped vessels with a semi-circular cross section and flat vertical ends and rectangular or subrectangular trays. Where parts of the vessel could be classified they have been assigned alphanumerical codes (R1 onwards for rims; BS1 onwards for wall fragments and B1 onwards for base fragments).

- Unidentified. The majority of the unidentified fragments are small with no surviving surfaces since any pieces with cylindrical surfaces were classed as pedestals and any with one flat face and at least some traces of a rough second surface were classified as clips and spaces.

Use

Most of the fragments show signs of exposure to intense heat. In many cases, a thick yellow/cream/green salt-surface has developed. This is a result of the reaction of clay minerals, calcium carbonate and salt. The degree of salt surfacing has been noted and there are clear differences between object types and within object types. This is consistent with both present-day ethnographic evidence and experimental archaeology, where it is suggested that containers were not equally exposed to heat but instead the brine was moved from container to container, concentrating its salt content.

Assessment

Plot 3b Area 1

Excavation at Area 1 revealed natural alluvium (Phase 0) cut by a ditch (Phase 1) containing 12th to 13th-century pottery followed by partial inundation of the site and occupation (Phase 2), the establishment of a road, boundary ditch and pit (Phase 3) and various pits, postholes, a ditch and a structure, Phase 4, all dating to the late 18th century or later.

Only a small quantity of fired clay was recovered (889gm). That from Phase 1 includes a large pedestal (PD11, Drawing No 31) and unidentifiable fragments in a different fabric.

Fired clay from subsequent layers includes no definite fragments associated with containers/pedestals and it is possible that some of this later material, recorded as hearth/oven wall, and pedestal fragments is actually degraded and fragmented brick.

It is recommended that the fired clay from Phase 1 is examined in more detail and the results published. The remaining material is unlikely to repay further investigation.

Plot 3a Area 2

Excavation at Area 2 produced a sequence of medieval industrial activity, probably salt-production. The excavated sequence starts with natural deposits (Phase 0) followed by pits and ditches dated by pottery to the 12th century (Phase 1). Subsequent activity consists of the reuse of some of the Phase 1 ditches and is dated by pottery to the later 13th to 15th centuries (Phase 2) and a series of pits and ditches datable by pottery to the 15th to 16th centuries (Phase 3).

A total of 5.730 Kg of fired clay was recovered, mostly from Phase 1 deposits but including moderate quantities from Phase 2 and 3 deposits.

There is a single small (2gm) fragment of a container and two fragments which could be pieces of clip or spacer (17gm in total). These probably represent a prehistoric/early Roman background scatter. However, the majority of the fired clay consists of moderate to large fragments and is probably associated with contemporary medieval activity.

Phase 1 produced 14 identifiable fragments and 2.327 Kg of small fragments. These fragments mostly have a single flat face and two have surfaces with straw/reed impressions. Four different fabrics were identified by eye.

Phase 2 produced 139 fragments, weighing 646 gm, and 406gm of small fragments. The same four fabrics were represented in this collection, although only three were present as large fragments. Their relative proportions differ from Phase 1.

Phase 3 produced 13 identifiable fragments, mostly with just one flat surface, and 1.393 Kg of small fragments.

The fired clay from Area 2 is consistent with the excavator's interpretation of the site as being a salt production site. However, the exact role which the fired clay played in the process is unclear and it would be worthwhile examining these fragments in more detail to see if they can be associated with specific processes.

McAvoy's description of the production process found at Wainfleet ({McAvoy 1994 #46003}) states that there were three processes carried out on these sites:

Firstly, salt-rich mud from mud flats which were normally above the high tide mark was scraped into piles and gathered up. This mud (probably a calcareous, slightly organic silt) was then taken to the saltern where brine was washed through the mud to extract the salt. The Wainfleet filtration tanks were rectangular wooden structures sitting on of a layer of peat/turf. From other sites along the Lincolnshire coast, it seems that the "turf" used to support the filtration tanks might have consisted of spade-cut blocks of silt which were then fired to form bricks (otherwise, the flow of brine would quickly erode their structure). At a certain point in the late medieval/early post-medieval period true bricks probably replaced these turf blocks.

The resulting brine was collected in clay-lined pits and then heated in lead pans to evaporate the water leaving salt. The lead pans would have had to be suspended above the fire and the hearth itself (whether immediately underneath the pan or in a separate stoke hole) might have had a clay lining or wall.

It is not clear from our initial recording whether the identifiable fragments from Area 2 are capable of being related to one or other of these processes. The fragments with reed/straw impressions, for example, might be related to the filtration process whilst those with flat faces might be discarded fragments of subsoil "brick", parts of the hearth lining or walling or even fragments of the clay-lined pits which have accidentally been burnt.

We therefore recommend that these identifiable fragments are re-examined, looking in detail for evidence for subsoil structure (in-situ rootlets and insect burrows, and the absence of evidence for kneading) and looking for wood impressions, evidence for hand moulding and so on. We also recommend the thin section and chemical analysis of a sample of the various fabrics recognised on the site to determine their source.

Plot 4b Trench 4A

Ten fragments of fired clay were recovered from the fill of Ditch 412, Period 1, on Trench 4B. The fragments are mostly featureless but two have flat faces. None have wattle impression and the collection might therefore be from the wall of a hearth or oven or from one or more bricks. The ditch fill produced a single Iron Age or early Roman potsherd and is therefore not closely datable.

Plot 4b Trench 5

Trench 5 produced a sequence of alluvium (Phase 0) overlain by salt-working debris (Phase 1) which was itself sealed by an occupation layer, ditches and a pit (Phase 2) datable by pottery to the mid 3rd or 4th centuries.

Over 21 kg of fired clay was recovered from Trench 5. The majority of this material came from Phase 1 deposits, whose terminal deposition date is given by mid/late Roman activity in the overlying Phase 2. Phase 3 (alluvium, representing an inundation of the site) and Phase 4 (ditches associated with late 11th or 12th-century pottery) both produced small quantities of fired clay, but the character of all of the fired clay from the site is similar, suggesting that all the material in Phases 2 to 4 is residual from Phase 1.

The fired clay from Trench 5 is probably all related to salt extraction using ceramic trays in which the brine was boiled, leaving a salt residue. Thus it is probably of prehistoric or early Roman date but in the absence of associated datable finds it can only be dated by typological comparison.

In her description of the salt making debris from Cowbit and Morton Saltern, Elaine Morris describes similar types to those found in Trench 5 (Lane & Morris 2001). At those sites, it seems that brine was boiled in hearths (i.e. open topped) or ovens (i.e. closed topped) having in their base two flues linked to a fire pit. Slabs of clay were laid across the flues and the trough-shaped containers were suspended over the flues by pedestals of different heights, indicating that the troughs were deeper at one end than the other. The containers were then secured in position by spacers and clips which were used between the containers and the hearth walls and between pairs of containers.

At Cowbit, there was evidence for a second tier of containers, set at right angles to the first tier and held in position by taller, thinner pedestals which hooked over the rims of the first tier of containers.

Whilst it is clear that the containers used at Trench 5 were almost identical to those at Cowbit, the evidence for the use of slabs of clay to cover the flues was dubious, and most of the examples could equally have come from the walls of the hearth, especially if those walls were quite short and with a flat top. In addition, all of these possible slab pieces have only one side remaining, and show a gradient in firing temperature from the surviving face to the core. Furthermore, none of these pieces is fired to the sort of temperatures that some of the pedestals were subjected to.

This leads us to question whether the hearths/ovens used by the SIP Trench 5 salt makers had flues and to suggest that perhaps the pedestals sat on the floor and were subjected to the full intensity of the flames.

Because of this possible difference in the extraction process at Trench 5 we think that the evidence from this site should be published, including drawings of examples of tray fragments, pedestals, spacer/clips and hearth wall fragments. In addition, a concordance of the material from Phase 1 should be published, to show which types actually occurred in association.

Visual examination of the fabric of these fragments leads us to suggest that perhaps the trays were produced off-site, using a silty marine clay tempered with straw, whilst boulder clay was used to make the kiln walls, pedestals, clips and spacers. Clearly, the latter would have to have been present in an unfired state. This therefore suggests that outcrops of boulder clay were exposed on or close to the site. To test this suggestion we recommend that samples of the containers, heath walls, pedestals and clips are analysed using thin section and chemical analysis and that the results of this analysis are incorporated into a single report for publication.

Plot 6 Watching Brief

A group of salt-production waste was recovered from context 3012. The collection includes several fragments of container all of which appear to be of the trough shape, including curved wall and base fragments and one piece from the corner with a vertical wall on the narrow end and a curved wall. There are 12 clips or spacers, 8 fragments of thin slab and no pedestals. Ten pieces deserve illustration to illustrate the range of material present. The range and quantities of different types may imply that the containers rest directly on thin slabs, over a flue, with clips supporting the trays against the hearth wall.

Plot 7 Watching Brief

A collection of fired clay came from 4 contexts (3014, 12245-7). This includes container fragments, and possible pedestals or clips. It is likely that this collection comes from Iron Age or early Roman salt production, but not necessarily on the site.

Plot 7 Trench 9

A collection of fired clay from Plot 7 Trench 9 (904 and 908) includes no definite Iron Age or early Roman salt production waste and might therefore either be medieval salt production waste or late or post-medieval brick.

Plot 7 Trench 10

A single pyramidal pedestal was recovered (PD11). This pedestal was probably used in salt production but could easily have been transported some distance from the production site.

Plot 9 / Area 5

Area 5 revealed a series of boundary ditches and rubbish pits indicating that settlement was present close to the site in the medieval period. Pottery wastes of later 14th to 16th century date were present on the site.

Phase 1

Late 11th to 12th-century activity consisted of alluvium, other deposits, a ditch and a gully. Fired clay was recovered from the fill of ditch 9051=9035. A single wall sherd from a container used in salt extraction was present whilst the remainder of the fragments had a different fabric but were too small to identify. This material is likely to have been residual salt-extraction waste, and the present of a ceramic contain suggests a date in the prehistoric or early Roman period.

Phase 2a

Nine unidentifiable fragments of fired clay were present in two layers (9010 and 9022).

Phase 2b

A number of features in Phase 2b produced small fragments of fired clay. Apart from a single container fragment none of the fragments were identifiable. The container is in a different fabric from that found in Phase 1. The material is extremely comminuted, and weighed 572gm in total.

Phase 3

A number of features in Phase 3 produced fragments of fired clay. As in previous phases, the material is mainly too small and undiagnostic for identification. However, eight fragments

from the fill of Ditch 9060 were from pedestals or clips, associated with prehistoric or early Roman salt extraction.

Phase 4

The fills of ditch 9053, dated to the post-medieval period, contained fragments of fired clay, most of which consisted of small unidentifiable pieces. However, five fragments were of recognisable forms, mostly simply fragments with flat faces. Given their date, these might be fragments of brick although they have been interpreted in the record as possible salt-production waste since they show the same degree of extreme fragmentation noted on the earlier finds.

Unphased

Two fragments of pedestal, one possible fragment of pedestal or slab and a collection of small unidentifiable fragments were recovered from Pit 9027.

Discussion

Despite the presence of misfired potsherds from Phase 2a, 2b and 3 deposits, none of the fired clay appears to be associated with pottery production (such as firebars, kiln walling or other kiln furniture) and some of the material is clearly associated with salt extraction. Since this material includes container fragments and ceramic containers are thought to have gone out of use within the Roman period, it is likely that the entire collection is residual, either through the natural erosion of saltern mounds or the use of these mounds to backfill features or raise the ground level.

Given the probable residual nature of the material it is recommended that no further work takes place on the Area 5 fired clay.

Plot 11 Watching Brief

A small to moderate sized collection of fired clay came from Plot 11 watching brief (contexts 3018-9). It includes fragments of container, a thin slab, clips and pedestals, and walling and is certainly evidence for Iron Age or Early Roman salt production. The pedestals only include the long thin variety (PD3) interpreted by Morris as supports for a second tier of containers. This may be due to sample size or may imply that the containers rested directly on slabs.

Plot 12 Watching Brief

A large collection of fired clay was recovered from context 3023. It is the largest collection from the SIP project. The container fragments include some from round walled, trough-shaped vessels. Fragments from straight sides might come from rectangular pans or the ends of a trough. A large number of fragments of thin slab are present. Some of the clips (CL6 and PD3) have little salt-surfacing and appear to have been either shielded from the hot gases or from brine. It is suggested that these might have been used to support containers

during their first use (assuming that they come onto site in a leather-hard condition or were made on site). A number of pedestals of PD2 were found. These have a curved or angled upper surface and were used to support trough-shaped containers. This site also produced a unique pedestal type, PD15, whose precise function is uncertain. The containers also seem to have been supported by clips added at the rim and hooking over the hearth wall (CL11, CL12, CL13, CL14, CL16 and CL19). A number of clips appear to have been fastened to the container at the rim but have so sign of being attached to anything else, typically having a large thumb impression opposite the container, often with no conceivable way in which any other object could be secured. The hearth or oven is represented by possible mud brick fragments and other wall fragments, some of which have possible wood impressions, implying that the walls were constructed in a wooden frame, presumably removed before use. Some pieces have what might be upper surfaces, implying that the walls were flat-topped and vertical sided.

This collection definitely comes from an Iron Age or early Roman salt production site.

Plot 13 Area 6

The Area 6 excavation produced a large collection of fired clay, amounting to 41.869 Kg.

Phase 1

Phase 1 consisted of spreads of ash and fired clay, debris from salt production. These layers produced 28.479 Kg of fired clay. Four fabrics were recognised visually, although only two of these were common (Fabrics 2 and 6. These indicate that both silt and till deposits were used.

Container fragments were present and were mostly in Fabric 2 (i.e. without organic inclusions and produced using a sandy till). These included base angles indicating that at least some of the containers were flat-bottomed and vertical-sided. However, some of the pedestal fragments have sloping top surfaces, suggesting that trough-shaped containers were also used.

Various clips and spacers were present, some in Fabric 2 but the majority in Fabric 6, a silty organic fabric.

A large number of pedestal fragments were present. These include truncated cones and large pyramids indicating that at least two different systems of container support were represented.

Slab and/or wall fragments were present. Most of these were in fabric 2 with a small number in Fabric 6. Fragments from corners occur in both fabrics and these suggest that slabs were definitely present. However, some of the pieces with a single surface were up to 80mm thick and these probably come from the heath/oven wall.

Plot 13 Watching Brief

A collection of fired clay from the watching brief at Plot 13 is similar in character to that from the excavated material from Area 6.

Plot 16 Watching Brief

A moderate collection came from Plot 16 during the watching brief, contexts 3036 and 3037. The collection includes several container fragments, with three rim forms and two base forms (B1 and B3). These could all come from trough-shaped containers.

Chronology of fired clay use

Iron Age or Early Roman

None of the sites produced the horned pedestals found at Tetney which were dated to the Late Bronze Age by association with pottery. It is likely that none of the material from the SIP sites is of that early date. However, the fired clay on the various SIP sites is poorly dated, owing to the lack of other artefacts in the earliest levels. Four excavated sites produced stratified Iron Age or Early Roman fired clay, all of which might be associated with salt production in ceramic containers. These sites are Trench 4a, Trench 5, Area 6 and Trench 9. Of these, only two produced a range of identifiable fragments, Trench 5 and Area 6 (Table 1). There are several differences between these two groups of briquettage, of which the most obvious is that the containers from Trench 5 were organic-tempered and quite distinct from the hearth/oven wall, clip/spacer and pedestal fragments, whereas those from Area 6 were made from the same fabrics. There is also a large difference in the frequency of container fragments. By weight, these represent 27% of the fired clay from Trench 5 but only 2.8% of that from Area 6. This difference is shown quite clearly by comparing the ratio of pedestal to container fragments (by weight). At Trench 5 there are approximately equal quantities of both whereas as Area 6 the ratio is 11 times as high. This might be due to the removal of containers from the site at Area 6 (fragments of briquettage container have been found well away from the coast, for example at Danebury in northern Hampshire, and this has led to the suggestion that salt was distributed in the containers). However, another possibility is that at Area 6 some pedestals were being used with non-ceramic containers. If so, then these non-ceramic containers were being held in place using ceramic clips and spacers, which are relatively common in the Area 6 assemblage.

Table 2

form group	GROUP	PL04B;TR 4A	PL04B;TR5	PL07;TR 9	PL13;AREA 6	Grand Total
clips and spacers	SILT				3607	3607
	SILT/TILL				5	5
	TILL		1465		2033	3498
clips and spacers Total			1465		5645	7110

Container	SILT				13	13
	TILL		2710		786	3496
	UNKNOWN		1461			1461
container Total			4171		799	4970
Pedestals	SILT				3727	3727
	TILL		4630		5344	9974
	UNKNOWN		218			218
pedestals Total			4848		9071	13919
Unknown	SILT			453	189	642
	TILL		2333		252	2585
	UNKNOWN		197			197
unknown Total			2530	453	441	3424
wall and slab	SILT	145			1541	1686
	TILL		1519		10982	12501
	UNKNOWN		735			735
wall and slab Total		145	2254		12523	14922
Grand Total		145	15268	453	28479	44345

The fabrics used at these sites varies (Table 2). These variations may be due to the use of intensely local raw materials and to variations in the natural geology. Silt, for example, is used at Trenches 4A and 9 and Area 6 but not at Trench 5. However, it is also possible that there is a chronological component as well.

Table 3

GROUP	SUBFABRIC	PL04B;TR 4A	PL04B;TR5	PL07;TR 9	PL13;AREA 6	Grand Total
SILT	BR04				67	67
	BR06	145		453	9010	9608
SILT/TILL	BR05				5	5
TILL	BR01/BR02		2710			2710
	BR02		9522		19397	28919
	BR02;WHITE		320			320
	BR03		105			105
UNKNOWN	BR01		2611			2611
Grand Total		145	15268	453	28479	44345

In addition, four collections of fired clay recovered from the watching brief provide sufficient material to demonstrate that salt production was taking place in the vicinity and a representative sample of the fabrics and forms used. These collections come from Plot 11, Plot 12, Plot 13 and Plot 14. Of these, the Plot 13 material may be from the same site as that investigated in Area 6 but the others are clearly different. They cannot provide even the slight chronological control of the excavated material but do serve to show the variability in production techniques used in the Lindsey Marshes.

Three sites produced fired clay in 12th to 14th century contexts, Areas 1, 2 and 5. The quantities of material recovered are much lower than in the Iron Age to early Roman period. Small scraps of container were found, in Trench 5 and Area 5, and some/all of the material from Trench 5 is likely to be residual. Only the material from Area 2 is clearly contemporary and associated with salt production. It consists of pedestal fragments and wall or slab fragments and requires further examination to investigate whether it might reveal details of the processes of salt production carried out on those sites (Table 3).

Table 4

form group	PL03A;AREA 2	PL03B;AREA 1	PL04B;TR5	PL09;AREA 5	Grand Total
clips and spacers			134		134
Container			2	2	4
Pedestals	17	167	46		230
Unknown	1319	69	143	211	1742
wall and slab	1945				1945
Grand Total	3281	236	325	213	4055

As in the earlier period, there are differences in the fabrics used from site to site (Table 4) and these might be either related to the character of the underlying geology. In this case, however, they are not explicable in terms of chronology, since the sites appear to cover the similar date ranges. It is likely that at least some of the variation in fabric is due to the presence of residual material.

Table 5

GROUP	PL03A;AREA 2	PL03B;AREA 1	PL04B;TR5	PL09;AREA 5	Grand Total
SILT	3133	69		184	3386
SILT/TILL	115				115
TILL	33	167	323	28	551
UNKNOWN			2	1	3
Grand Total	3281	236	325	213	4055

A larger quantity of fired clay was recovered from late 15th to 17th-century deposits. In Area 2 a small quantity of this material is clearly residual whilst in Area 6 a much larger residual element is present. Furthermore, there is a strong possibility that material identified as pedestals, wall and slab fragments includes fragments of late/post-medieval brick. No clear evidence that any of this material was associated with contemporary salt production was found. It is therefore unlikely that this material would repay further study.

Table 6

form group	PL03A;AREA 2	PL03B;AREA 1	PL07;TR10	PL09;AREA 5	PL13;AREA 6	Grand Total
clips and spacers					1187	1187
container	2				292	294
pedestals			107	66	2766	2939
unknown	1799	150		1556	5376	8881
wall and slab	644	233		50	3630	4557
Grand Total	2445	383	107	1672	13251	17858

Table 7

GROUP	PL03A;AREA 2	PL03B;AREA 1	PL07;TR10	PL09;AREA 5	PL13;AREA 6	Grand Total
SILT	2030	138	107	1611	8046	11932
SILT/TILL		212		25	2091	2328
TILL	415	33		36	3114	3598
Grand Total	2445	383	107	1672	13251	17858

Further Work

The Iron Age to Early Roman salt production waste is well-preserved and has the potential to reveal details of the methods used. There are clear differences in the forms of container, clips, pedestals, slabs and hearth walls from the various sites and these should be documented by illustrating an example of each type in each major collection (Task 1).

A catalogue should then be prepared describing the fired clay assemblages from these sites (Task 2).

The fabric series should be thin-sectioned and described to document the visual fabric classification (Task 3).

It is clear that the differences in the character of the clays available in the different parts of the pipeline provide an opportunity to possibly distinguish three groups of objects:

i) those made off-site and brought to the site already fired. This may include the containers and possibly some of the better-made pedestals.

ii) Those produced on site but fired before use. This may include trays and some pedestals.

iii) Those produced on site and fired as part of the salt production process. This certainly includes all clips and spacers and certainly includes some pedestals, which can be seen to have compressed under the weight of the tray, but may also include containers and other pedestals.

It is therefore recommended that for the major assemblages of Iron Age to early Roman salt-production debris a sample of the various forms is analysed using Inductively-Coupled Plasma Spectroscopy looking for differences in the composition of containers, clips/spacers, pedestals, slabs and hearth walling (Task 4, Table 7).

Table 8

form group	PL04B;TR5	PL12 WB	PL13;AREA 6	Grand Total
clips and spacers	3	3	3	9
Container	6	6	6	18
Pedestals	6	6	6	18
wall and slab	3	3	3	9
Grand Total	18	18	18	54

Finally, for the Iron Age to Early Roman material, a discussion should be prepared setting out the various options for how the production system may have worked, illustrated with diagrams (Tasks 5 and 6).

The medieval salt-production debris from Area 2 should be examined in detail, alongside the site stratigraphy, to see if it is possible to identify the function of the various fired clay artefacts from the site (Task 7). This may include illustration of selected pieces (Task 8) and chemical analysis of a sample of fragments, mainly for comparison with the earlier material (Task 9). A report on the results of this study should then be prepared (Task 10).

Table 9

Task	Description	Amount	Cost (2006/7 rates)
1	Illustration of selected fragments of Iron Age to early Roman briquettage.	132 items	To be illustrated in house by Network Archaeology. Cost of extraction/liaison: £192 plus VAT
2	Preparation of catalogue of Iron Age to early Roman briquettage.	3 days	£576 plus VAT
3	Thin section analysis of Fabric Series	14 samples	£336 plus VAT
4	Chemical analysis of selected fragments	54 samples	£1296 plus VAT
5	Preparation of discussion	2 days	£384 plus VAT
6	Production of diagrams illustrating salt production methods	1 day	To be prepared in house by Network Archaeology. Cost of production of draft sketches and liaison: £192 plus VAT
7	Detailed examination of fired clay from Area 2	1 day	£192 plus VAT
8	Illustration of selected fired clay from Area 2	Between 1 and 5 items	To be illustrated in house by Network Archaeology. To be extracted during Task 7
9	ICPS analysis of a sample of fired clay from Area 2	6 samples	£144 plus VAT
10	Report on Area 2 fired clay.	1 day	£192 plus VAT
Total			£3504 plus VAT
VAT			£613.20
Grand Total			£4117.20