

INVESTIGATIONS ON THE SOUTH SHORE OF
BROWNSEA ISLAND BY THE DORSET
ALUM AND COPPERAS INDUSTRIES PROJECT

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Summary

Archaeological investigations carried out on behalf of the Poole Harbour Heritage Project initially identified a possible seventeenth-century copperas works on the south shore of Brownsea Island as part of a project researching the Dorset Alum and Copperas industries. The remains of a rectangular brick-lined 'tank' and brick surface exposed by coastal erosion were excavated and fifteen test pits were dug in the surrounding area to discover other associated features. Both structures were constructed of late-eighteenth- or early-nineteenth-century bricks. The bricks in the tank appear to be reused and include specialised gutter bricks. A series of earthworks, a large clay pit and a sand pit were recorded. Historic maps suggest that all these features formed part of a brickworks of late-eighteenth- and early-nineteenth-century date, rather than part of the seventeenth-century copperas works.

Introduction

Dr William Sheldrick has argued that the birth of the chemical industry in England can be traced to a copperas plant at Parkstone, Poole, started by Lord Mountjoy in the mid sixteenth century (Sheldrick, 2006). The history of this industry in Dorset is little known and poorly understood. The Dorset Alum and Copperas Project was set up by Poole Harbour Heritage Project to investigate the social, economic and historical factors relating to these industries by documentary research and limited archaeological investigation into three sites, at Kimmeridge, Studland and Brownsea Island, all of which had been suggested as having links with alum and copperas production. The archaeological project was supported by English Heritage with the aim of providing data to help characterise the remains of this industry. In the event, the link between the three excavated sites and the alum and copperas industry was not established to a certain degree.

Alum is a double sulphate of aluminium in conjunction with an alkali, either potassium or ammonium. Copperas is a hydrated ferrous sulphate and was also known as green vitriol. Historically the

primary use of both alum and copperas was in the textile industry, where they were used as dye fixatives. Alum was also used in tanning and papermaking and copperas used in making black dye and ink.

The technical aspects of alum and copperas production have been described in the literature (Rout 1997; Miller 2002; Allen *et al.* 2004). Briefly, the process of alum manufacture consisted of the burning of alum shales followed by steeping in water to extract the soluble salts, which were then boiled to concentrate the liquor. Alkali, normally in the form of urine, was then added and the mixture allowed to cool in order to crystallise out the alum. Copperas was produced either from alum shales or clays or from iron pyrites nodules. The earliest copperas production was probably the result of failed attempts to make alum (which was the more valuable product). The more common copperas manufacturing process in England used iron pyrites. Nodules of pyrites, found in cliffs or on beaches, were weathered with air and water to produce dilute ferrous sulphate, which was then concentrated and crystallized to form copperas in a process cycle that could take several years (Allen *et al.* 2004).

Historical background

In the later medieval and early post-medieval period alum and copperas were widely used in the textile, tanning and papermaking industries. The primary use of alum was in the textile industry where it was used as a mordant, or dye fixative. In the sixteenth century the main source of alum was from the Papal states in Italy. Increasing Papal control over both the price and importation of alum into England led to moves to produce domestic supplies. By the reign of Elizabeth I these endeavours were being actively encouraged and supported by the Crown.

Some of the earliest recorded attempts to manufacture alum and copperas in England stem from a 1564 patent granted by Queen Elizabeth to Cornelius de Vos, a London merchant originally from Liège, (Betley 1982, 91; Allen *et al.* 2004, 31). This patent granted him the rights to open and work mines in connection with the production of copperas and alum over the whole of England. Before long Cornelius

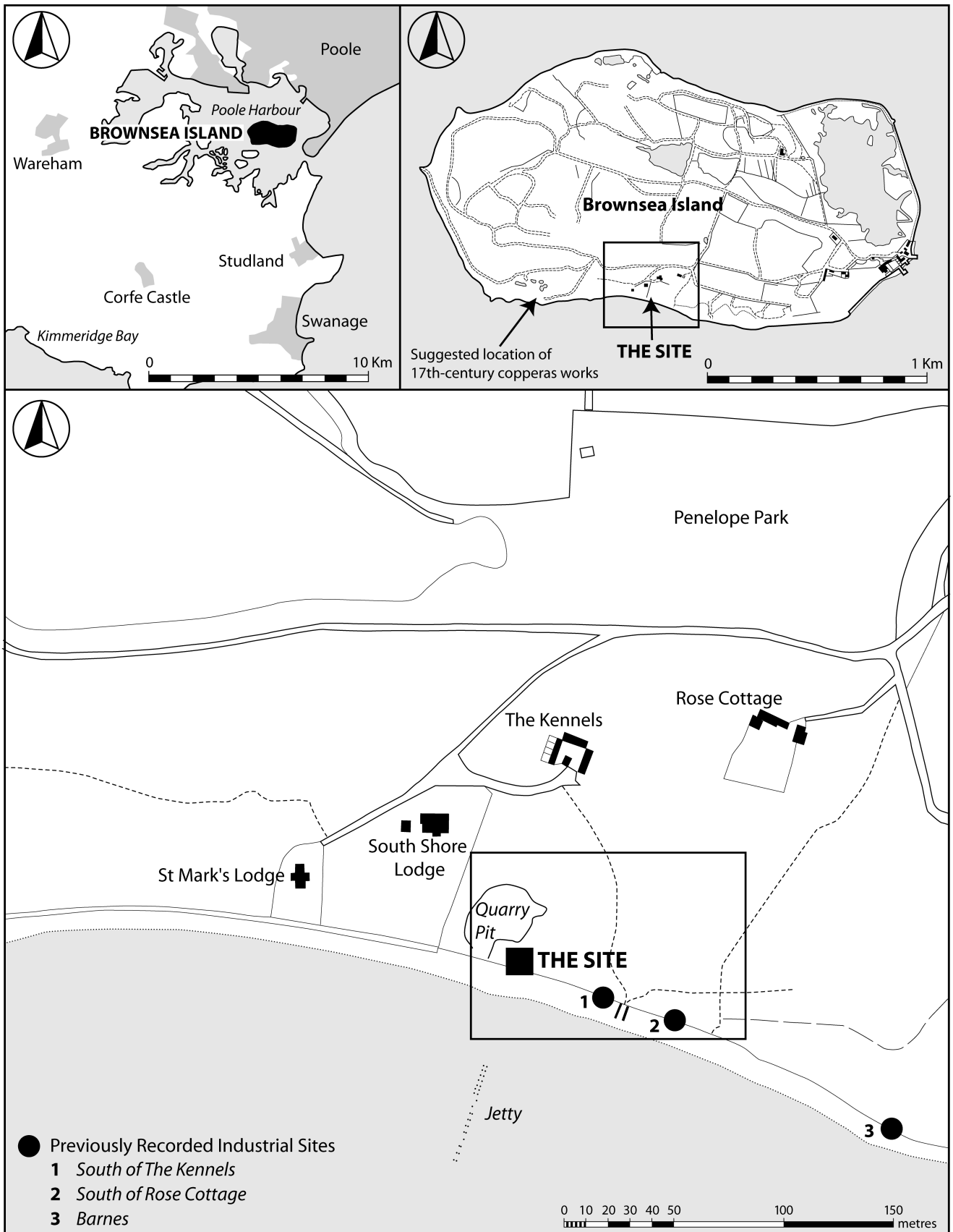


Figure 1. Location plan of the excavated site on the south shore of Brownsea Island.

de Vos assigned his patent to James Blount, the 6th Lord Mountjoy, the owner and Lord of the manor of Canford (Allen *et al.* 2004, 31). The Canford estate was already enjoying benefits from copperas recovered from Durley Cliffs and around 1564 Mountjoy started to mine and boil alum shale at Parkstone (Crick 1908, 330; Cochrane, 1970, 73-9). A monopoly for the manufacture of alum and copperas was conferred on Mountjoy for twenty-five years from April 1567 (Betley 2001, 2). By 1580 two factories producing copperas were operating in Parkstone based on alum shale mined nearby. Soon there were also works at Brownsea Island, Alum Chine and Boscombe (Allen *et al.* 2004, 33-4).

Copperas production on Brownsea Island is thought to have been established about 1569, possibly by Lord Mountjoy (Betley 1982, 92; Bugler & Drew 1995, 8). It had been hoped to produce alum, but only copperas was produced. The works appear to have been situated at the west end of the island. The 1586 Ralph Treswell 'Survey of the Isle of Purbeck' (DHC B/KL) shows a building in this area and an early seventeenth-century map of the island in the Cecil Papers (DHC ph404) labels this same area as 'the mynes'. By the later sixteenth century the copperas works had passed into the hands of the earl of Huntingdon. The works are said to have ceased production by the end of the sixteenth century but were recommenced by Sir Robert Clayton following his purchase of the Island in 1665 (Betley 2001, 7). However, the works proved so unprofitable that they were finally closed down in 1704 (Van Raalte, 1905, 191).

The best description of the Brownsea Island copperas works (in 1686 during Sir Robert Clayton's period of ownership) is by Celia Fiennes, following her visit to the island during her travels through Britain (Fiennes 1888, 5-6). In her diary she gives a detailed account of the process of retrieving copperas stones from the shore which were then placed in a series of raised copperas beds, where the copperas stones were allowed to weather and the resulting 'liquor' was then piped down into the house containing the boiling pans.

In the nineteenth century Colonel Waugh made a final attempt to establish a viable alum and copperas industry on the island, but he was made bankrupt before completion of the works could be achieved and the island was put up for sale. The location of these works was adjacent to the Large Pottery in the south-

west of the island. An 1853 map of Brownsea (DHC D263/T1) produced as part of the conveyance of the island to Colonel Waugh from its previous owner, Sir Frederick Foster, has a copperas works marked schematically in the south-west corner of the island.

There are few other documentary references to the exact location of the copperas and alum works and it is likely that more than one plant was built on the island between the sixteenth and nineteenth centuries. Brannon, writing in 1857, records the discovery of 'some of the old cisterns formed of solid oak staves, which had been used in the former alum and copperas works'. Unfortunately his record of the location of these features is imprecise, as it is described as being near some kilns which were 'on a piece of level land between the bank and the water', below a Scotch fir 'nearly at the end of the first plantation' (Brannon, 1857, 22), but this is most likely to be somewhere along the central or west southern shore of the island. In the eighteenth and nineteenth century, there was a brickworks in the area of the site, as shown on Isaac Taylor's 1770 map (DHC Ph1/1) and on another map of the island dated 1853 (DHC D263/T1).

In 2005, the National Trust recorded a series of industrial remains along the south shore of Brownsea Island, which were being eroded by the sea (Papworth 2005). The majority of the sites investigated were related to brick making. However, one feature was identified by Dr William Sheldrick as possibly a pre-heater belonging to the processing works of a copperas house (Papworth 2005, 147).

Site location

The site lies to the south-east of South Lodge on the south shore of Brownsea Island (NGR SZ 0200 8748) (Fig. 1). The survey area extended along the shoreline for a distance of 120 m and inland for up to 80 m. The southern limit was marked by an actively eroding cliff face 2-3 metres high. To the east and west, dense rhododendron effectively restricted access and formed the limit in these directions. The northern edge of the survey area was marked by a footpath leading to the beach. The ground rises gently to the north from 4 m OD to 7 m OD.

Methods

The investigations comprised an earthwork survey, sample excavation and geoarchaeological recording

and sampling of the soils and sediments.

The earthwork survey was undertaken in February 2009 and June 2010 by Mark Corney and Nik Morris. An approximate area of one hectare was surveyed, stretching about 130 m along the shore and up to 40 m inland. The earthwork survey and associated profiles used a total station and tied into the Ordnance Survey grid and height datum. Ground conditions for the first stage of survey were generally poor, the survey area being for the most part heavily overgrown with unmanaged rhododendrons. In these areas detailed measurements could only be made by taped offsets through narrow, cleared transects. However, by the time of the second phase of survey, the rhododendrons had been removed from the area west and south of the footpath down to the shore.

The archaeological excavations were undertaken in May 2008. The brick-lined 'tank' and adjacent brick surface were partially exposed by coastal erosion and by previous investigation by the National Trust (Papworth 2005). These features were more fully excavated by a trench (Trench 4) about 11 m long and 4 m wide, which was opened to expose the full extent of

the brick surface and the remains of the 'tank' (Figs 2 and 3). The interior of the 'tank' was half-sectioned. All deposits of possible industrial residues were sampled and where necessary parts of the structure were dismantled to determine the constructional details. In addition, approximately 19 m of the eroding sea cliff were cut back and cleaned by hand, from about 5 m west of the brick structure to 4 m east of the eastern edge of the brick surface.

Fifteen one metre square test pits (Trenches 1-3; 5-16) were excavated on a grid to the north and east of the 'tank' (Fig. 2), in order to investigate the immediate context of the exposed structures, specifically to search for any further structural remains and deposits which may be associated with copperas working. Where deposits or features of archaeological interest were encountered (in Trenches 1, 5, 9, 10 and 11), the trenches were extended to enable further investigation.

The geoarchaeological recording was undertaken by Dr Clare Wilson, University of Stirling. The local soils and sediments were examined, described and sampled. The eroding sea section was studied in detail as it revealed a full soil and sedimentary sequence.

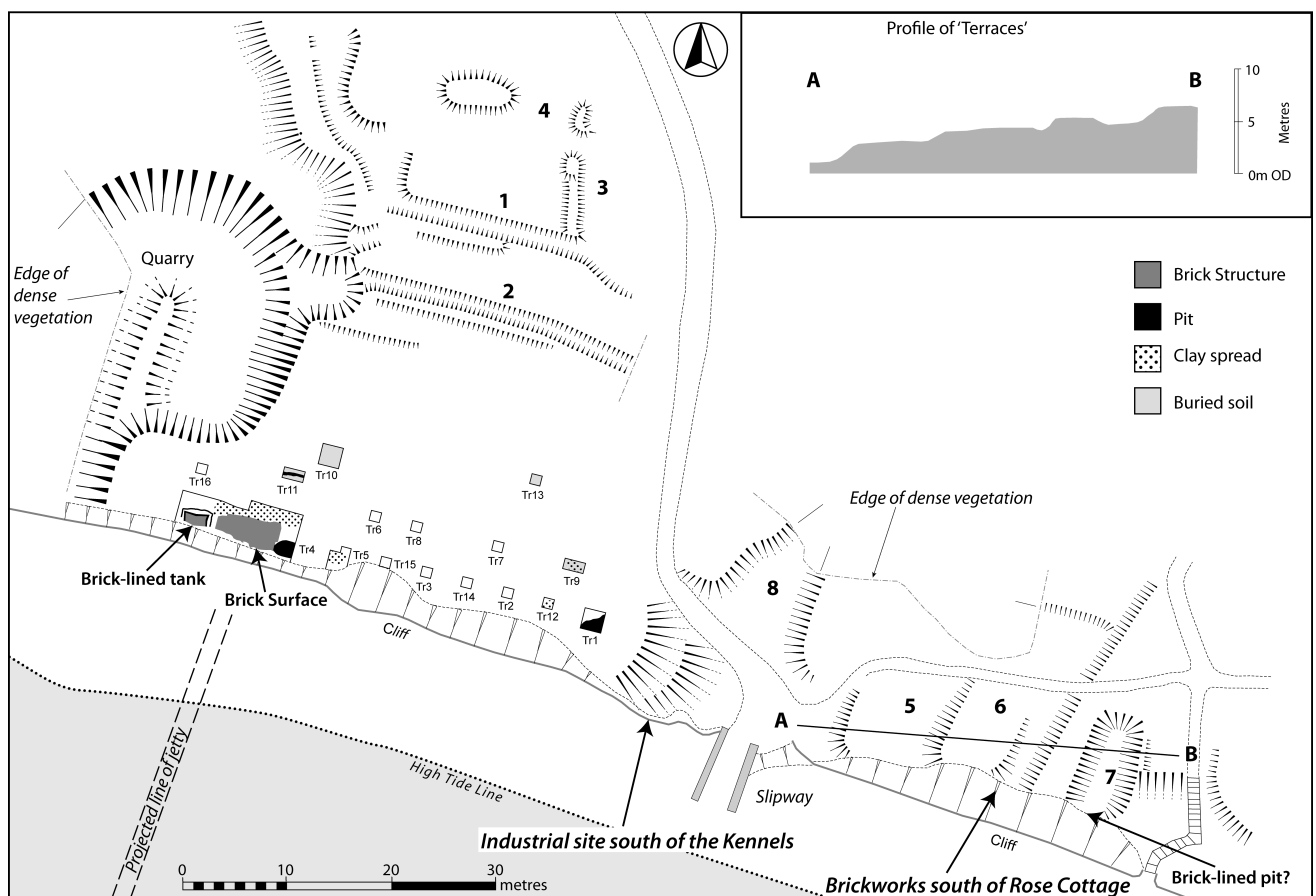


Figure 2: Plan of excavation area on the south shore of Brownsea Island, showing the surviving earthworks.

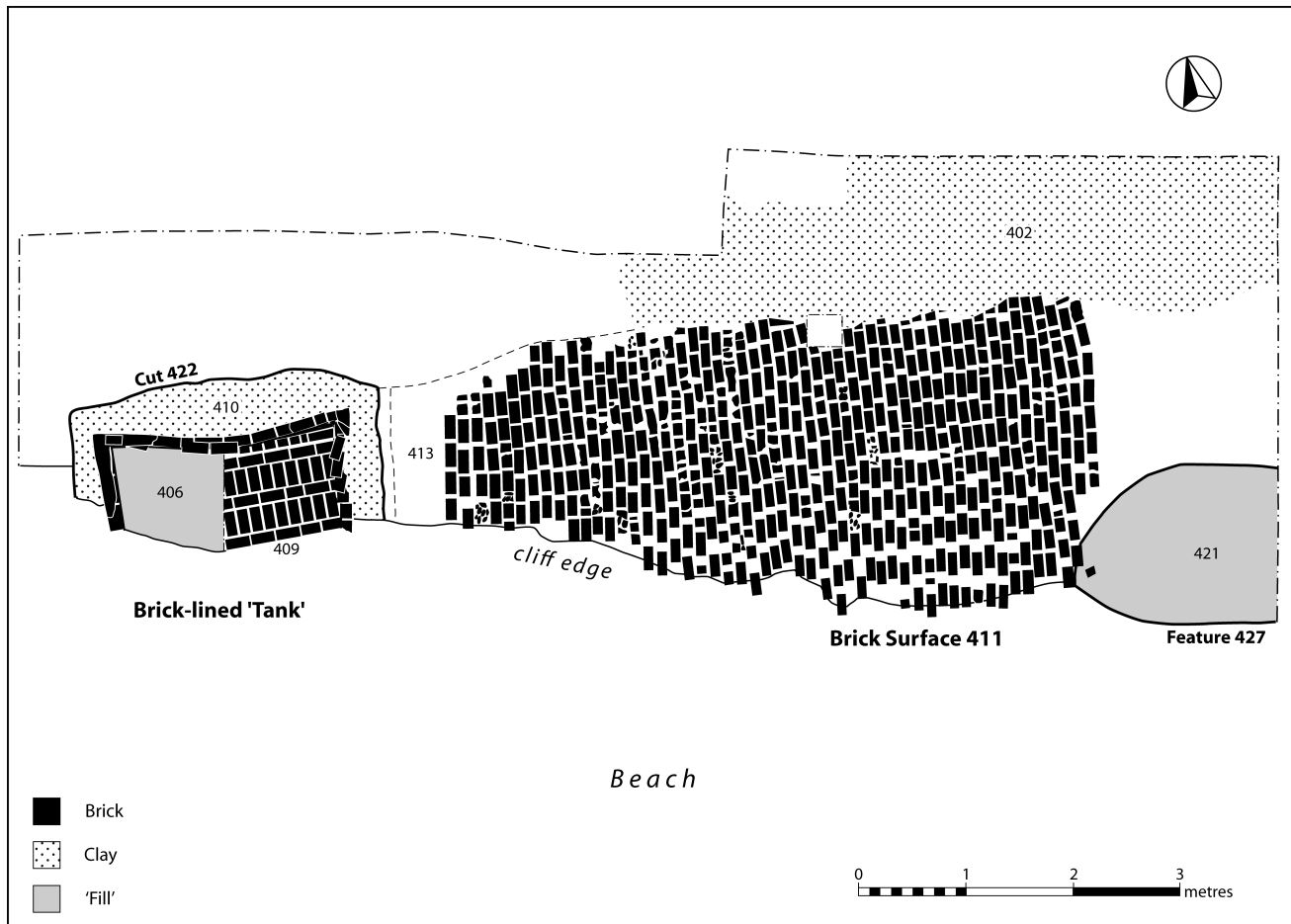


Figure 3: Plan of the brick-lined 'tank' and brick surface.

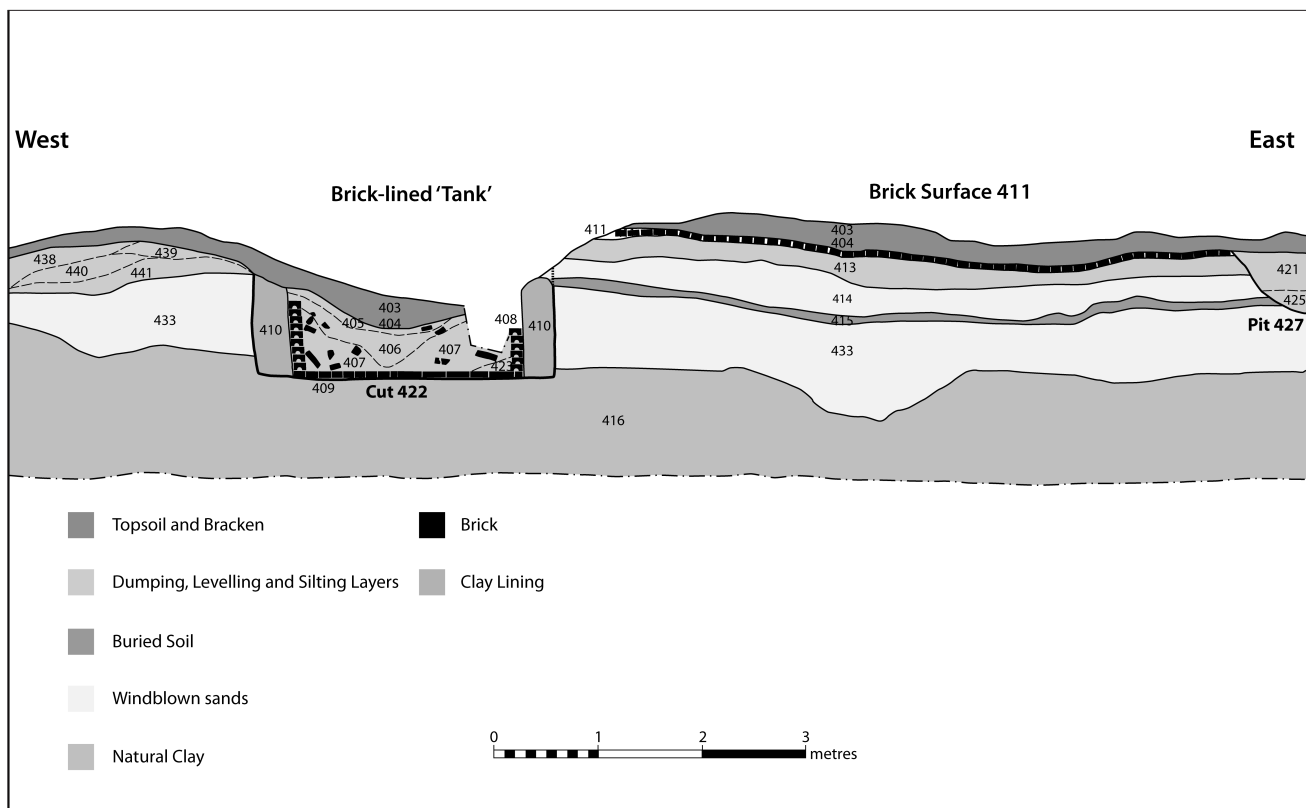


Figure 4: Section of the stratigraphy exposed in the eroding sea cliff.

Soils and sediments were described according to Hodgson (1976). Undisturbed samples (80 x 60 x 50 mm) were cut from the section covering contexts 413, 414, and 415. Bulk samples were taken from the same locations and also from the clay at the base of the section (context 416). The fill of the 'tank' was examined and undisturbed samples were taken of the clay lining material from the base of the 'tank'. A brick from the 'tank' structure was analysed using optical and scanning electron microscopy (SEM) to determine the nature of the black residue present on the hollowed surface of the bricks. The surface of the brick facing the 'tank' was also analysed using SEM-EDS to identify the presence of chemical residues from any liner that may have been present.

Soils and natural deposits

The soils are strongly podzolised, having developed in wind-blown sands overlying the Parkstone clays and appear to correspond well with the mapped hummo-ferric podzols belonging to the Shirrell-Heath I soil association (Findlay *et al.* 1984). These acid soils are characterised by the down profile movement of iron and aluminium, organic matter and clay. They consist of a dark, structureless, stone free humic layer (50-150 mm thick) with frequent fine roots and few medium roots, overlying a structureless grey sandy layer with few fine and medium roots. This horizon also contains occasional dark blackish-brown organic laminae, 2-5 mm thick and at greater depth some profiles also contain evidence of iron accumulation at depth in the form of reddish 'spodic' horizons and cemented iron pans.

The grey coloured sand layer (Ae horizon) is typical of such soils and is created when iron, together with organic matter, clay, aluminium and other metal cations are washed out of the acid surface horizons, to be deposited lower down within the profile. The grey colouration is the result of the loss of iron (reddish-brown pigment) and the presence of small pellets of dark organic matter, which remain between the sand grains. Neither field nor microscopic examination indicated the presence of charcoal in this grey soil horizon, or indeed elsewhere in the surrounding soils. The mobility of metals (not just aluminium and iron) in these soils also means that it is unlikely that geochemical soil signatures of former anthropogenic activity will have been preserved. In these acid soils preservation of bone, lime mortars and other calcareous materials will

also be poor.

The soil and sedimentary sequence of the eroding sea section was recorded in detail (Fig. 4). At the base of the section was natural Parkstone Clay, overlain by natural laminated mineral units of clay and coarse and medium sands. This was overlain by the humic Ah horizon of a buried soil. This buried soil was also noted in Trenches 9, 10, 11 and 13 around the northern margins of the area.

This former land surface pre-dates the 'tank' structure and brick surface. A well-developed podzolic soil had clearly developed in the sands between their deposition and the construction of the brick surface. In free-draining materials such as sands and under acid vegetation such as coniferous trees or heath, podzols can develop relatively quickly. Examples of well-developed podzols can be found in the Netherlands that have developed in less than 100 years (Breemen and Buurman, 2002). The time span between the buried surface and the brick structures would need to be at least this long and in all likelihood considerably longer.

The buried surface appears to represent an earlier phase of stability in sand deposition, as it was sealed by another sand deposit consisting of primarily windblown quartz sands. A basic inspection of the mineralogy suggests they have the same origin as the beach sand, though the iron coatings have been bleached as a result of podzolisation, hence their paler colour. These sands correspond to the ashy grey sub-surface horizon of the modern topsoil, i.e. soils developed in the wind blown sands from which iron and organic matter have been washed and out and deposited lower down in the profile.

The lack of the organic topsoil in the beach section beneath the brick surface suggests truncation of this profile, perhaps as a result of levelling activities. Context 413, immediately beneath the brick surface, appears to be a deliberate dump, possibly a levelling or bedding deposit.

Earthworks

A series of man-made earthworks along a 130 m stretch of the southern coast of Brownsea Island was identified and surveyed. These can be divided into two groups: a western level area, bounded by a pair of shallow ditches on the north and an eastern area, east of the modern slipway and track, comprising a

series of terraces rising to the east with a rectangular depression at the highest point (Fig. 2).

The western area has all the appearance of being artificially levelled to form a terrace, measuring approximately 50 m east-west and 35 m north-south. It is bounded to the north by a pair of parallel ditches 10 m apart (Fig. 2, 1-2). Both ditches are about 30 m in length, up to 1.2 m wide, and with a maximum depth of 0.7 m. There are traces of a very slight bank, no higher than 0.2 m, on the south side of each ditch. To the west, the southernmost ditch is truncated by a large quarry of irregular ovoid plan. The relationship between the northern ditch and further earthworks associated with the quarry has been disturbed and remains uncertain. At the eastern end of the northern ditch, another bank, aligned approximately north-south, was traced for a distance of 15 m (Fig. 2, 3). This is up to 1.5 m wide with a maximum height of 0.7 m. Between the parallel ditches and the modern footpath are irregular hollows and a low mound; all probably associated with minor extractive activities (Fig. 2, 4). The quarry pit is over 2.8 m deep on the northern side decreasing to 1.4 m deep on the south. This quarry clearly post-dates the southern ditch but its purpose could not be ascertained from the surface remains, but it is possible that it is a clay pit associated with brick kilns noted 60 m to the east. To the north of the quarry an irregular west-facing scarp, up to 1 m high was traced for a distance of 20 m before being lost in dense scrub.

The date of these features remains unresolved, although the ditches are very similar to those associated with the nineteenth-century brick works located 400 m to the west. Comparison of the dimensions and profiles of the two ditches with dated examples on similar Tertiary geology elsewhere in southern England (for example at Crowthorne Wood, Berkshire (Smith, 1995)) would suggest an age of approximately 150 years.

The eastern area produced clear evidence for landscaping, comprising the creation of a tier of three terraces rising to the east (Fig. 2, 5-7). The uppermost terrace (7) has a rectangular depression that resembles some form of tank for storage. The terraces are defined by scarps running north-east and are set at 90° to the sea-cliff. The lowest terrace measures 20 m east-west, the second 9 m east-west, with the eastern end being defined by a shallow ditch approximately 1.8 m wide and up to 0.5 m deep. The easternmost terrace is at least

15 m east-west and contains a rectangular depression measuring 7 m east-west, 11 m north-south and a maximum depth of 1.1 m. The terraces appear to run inland for a maximum distance of 20 m and may be defined by an east-west scarp up to 0.2 m high. Dense vegetation in this area made detailed measurement difficult and the survey results in this area must be regarded as provisional, because the survey data for this area is only reliable for larger scarps in excess of 0.2–0.3 m high, as the area is covered in dense bracken and the depth of dead bracken may mask further features. Given the nature of the vegetation over this area it is possible that the lower two terraces may also contain filled or partially silted depressions, not currently visible. Examination of the exposed sea cliff below the earthworks, shows that the terraces correlate strongly with archaeological features visible in section and recorded by the National Trust. The rectangular depression in the upper terrace directly relates to a brick-lined pit or 'tank' of probable eighteenth- or nineteenth-century date (Papworth 2005, 146, feature 155). Other surface earthwork features can be associated with two brick kilns possibly dating to the seventeenth century (Papworth, 2005, 146, kilns 114 and 128).

To the north of the modern slipway, a further shallow feature was located and partly surveyed. This is up to 10 m wide on the south, tapering northwards to 5 m with a maximum depth of 0.7 m (Fig. 2, 8). The northern limit is masked by dense vegetation and the character of the feature remains uncertain, but may be the remains of a disused track also recorded by the National Trust eroding out of the sea cliff (Papworth, 2005, 146-7).

Brick structures

Two brick structures eroding out of the sea cliff were visible prior to excavation. They comprised a probably originally rectangular clay and brick-lined 'tank' with a brick surface immediately to the east. No direct stratigraphic relationship between these two features survived as a result of erosion, but enough survives to indicate they are likely to have been contemporary.

Brick-lined 'tank'

The 'tank' comprised a rectangular cut with vertical sides and a flat bottom, which measured 2.9 m wide east-west and survived 1.5 m long north-south, the

southern end having been eroded away. The cut survived just over 1 m deep, but the upper part was eroded and the original depth is estimated at about 1.35 m. It was dug through the natural sand into the top of the underlying natural clay. The sides of the cut were lined with grey clay (410), 0.3 m thick. The base of the cut was lined with a layer of bricks (409), laid in alternate directions (Fig. 3). A small number of these bricks had traces of mortar surviving on the bottom face, suggesting that they may be reused. On top of this base, was a brick lining (408) constructed around the sides and which had bowed considerably inwards on the northern side. The bricks were laid end to end and up to ten courses survived. The lowest nine courses were constructed of gutter bricks with a semi-circular hollow along their length. These bricks were laid consistently with the hollow at the bottom of the brick (Fig. 4). In the corners, the bricks were interlocking, meaning that the hollow in the bricks did not form a continuous channel around the structure. The upper course was of plain bricks.

Given that the 'tank' was first lined with clay and then with brick, it is probable that it was intended to hold liquid: the clay would form a watertight lining and the bricks would protect the clay from erosion. One of the bricks from the side of the 'tank' was analysed by SEM-EDS to test for traces of lead, which could indicate the presence of a lead liner, but none was found. The black staining on the surface of the gutter was also examined and found to consist of humic material and rootlets.

The fill of the 'tank' appeared to be the result of natural silting and deliberate backfill after the structure had gone out of use (Fig. 4). In the northern half of the structure, lying on the brick surface and partly up the walls was a thin layer of dark reddish-brown mineralised sand (424) containing frequent small pieces of brick and a banded layer of grey clay and yellow mineral panning (423), which probably derive from initial silting and weathering of the structure after abandonment. Overlying these deposits were layers of greyish-brown and reddish-brown clay (405, 406, 407) containing frequent flecks of yellow clay, brick pieces, and flint gravel. This is probably the result of deliberate backfilling of the feature with dumped material containing demolished elements of the structure. The only dating material was two sherds of sixteenth-/seventeenth-century pottery found in the uppermost layer of the fill (405).

To the west of the brick-lined 'tank' was a sequence of dumped redeposited natural sands (438-41), probably derived from the initial excavation of the feature.

Brick surface

Immediately to the east of the 'tank' were the remains of a brick surface (411) that survived over an area of about 6.2 m by 2.8 m (Fig. 3). The bricks were laid end to end in rows running roughly north-south. The northern edge was ragged and did not appear to be 'finished' and the southern and western edges had been eroded away. There had been quite a lot of movement of the bricks along the southern edge, where the coastal erosion has undermined the cliff. It is not clear whether the surviving eastern end is the original edge of the structure, as there has been significant erosion in this area. Some of the bricks, especially in the western part, were very heavily weathered and broken. The floor was constructed on a 0.2 m thick layer of loose pale yellowish-brown sand (413) containing occasional small brick pieces and flint gravel, which overlay the windblown sand deposit 414. This appeared to be a deliberate levelling or bedding deposit for the floor.

Lapping the northern edge of the floor was a dump of yellowish-brown clay (402), 0.2 m thick and over 1.5 m wide. A similar thin irregular deposit of yellowish-brown sandy clay, up to 0.1 m thick, was found in Trench 5 and may be part of the same deposit.

Other features

Pit 427

Immediately to the east of the brick surface the remains of a large irregular pit (427) was partially exposed: the southern side had eroded away and the eastern part lay beyond the edge of the excavation (Figs 3-4). This pit was probably originally oval or sub-circular and measured over 4.1 m across and 1 m deep with sloping sides and an undulating base. It was filled with layers of loose sand, containing brick fragments and flint gravel. The precise relationship between the pit and the brick surface is unclear due to erosion and post-depositional movement, but it is most likely that it was cut against the eastern edge of the floor. The brick fragments in the fill of the pit suggest that it was a later feature. The function of this

pit is unclear, but its rather uneven form may suggest it was dug to extract sand. No dating evidence was recovered.

Pit 107

Another probable sand pit (107) was found in Trench 1 about 28 m east of the brick surface. The full plan of this pit was not exposed, but the excavated portion comprised a slightly undulating vertical cut into the natural windblown sands down on to the top of the natural Parkstone clay beneath. A number of spade marks were preserved in the clay at the base of the pit. It was filled with a series of layers of sand, with some clay and a few fragments of brick. The pit was sealed by deposits of broken brick and clay debris, which appeared to fill and level up the depression made by the settling of the contents of the pit. Further deposits of clay were found in adjacent Trenches 9 and 12.

The size of pit 107 suggests it may be a sand quarry. It lies close to the eighteenth-century brick-making features 'South of the Kennels' investigated by the National Trust in 2005 (Papworth 2005) and is probably associated with them.

Gully 1105

A shallow gully was found in Trench 11 to the north of the brick surface (Fig. 2). It was cut into the buried soil layer and sealed by a thin layer of sand and topsoil. This gully is a very ephemeral feature and its significance is difficult to determine, but may be related to the linear ditches further north discovered during the earthwork survey and on a similar alignment.

Jetty

A series of eroded timber posts was plotted in the intertidal zone in August 2006. These posts formed two rows, about 1 m apart and ran in a roughly south-south-west direction for nearly 45 m, about 43 m from the present sea cliff (Fig. 2). The posts were mainly roundwood, about 0.1 m diameter, with two rectangular posts 0.09 m by 0.14 m across. The posts are most likely to be the remains of a wooden jetty. The landward part of this structure was wider (about 1.5 m) and more regular than the seaward part, which was on a slightly different alignment, perhaps suggesting two phases. What appears to be a jetty is marked on an 1853 map of Brownsea in roughly this position (DHC

D263 T1) and a few of the posts were still visible on a photograph included in the 1927 sale particulars for the island. The jetty is not shown on any other map of Brownsea Island.

Finds

Only a very small quantity of finds was recovered and almost all were from the topsoil and will not be considered further here.

Brick

by Lorraine Mephram

Bricks from the 'tank' are of two types: unfrogged rectangular bricks forming the tank floor (409), and brick 'specials', of gullied profile (gutter blocks), forming the walls (408). Both types appear to be the products of similar manufacturing techniques: all are handmade from a fairly well wedged, sandy clay, firing to a pale colour, buff-pink to salmon pink.

The standard bricks from the floor are good quality, sand-faced facing bricks, unfrogged, with sharp arrises and would have been suitable for above-ground use. There are slight irregularities, as would result from manufacture by hand, but size is consistent (220-25 mm x 100-110 mm x 60 mm). One brick retains mortar on one face; this is a sandy mortar.

The gutter blocks from the tank walls (three samples taken from each of the north, east and west walls) are similar, and are consistent in size (240-55 mm x 110-25 mm x 70-75 mm, with gullies 60-70 mm across by 30-35 mm deep); there is slightly more irregularity in the shape, probably resulting from the process of forming the gully (achieved, perhaps, by pressing a pole of suitable diameter into the upper surface).

The three brick samples taken from the brick surface 411 are of similar appearance and dimensions to those from the tank floor (220 mm x 110 mm x 60-65 mm).

A few of the bricks, including examples from all contexts, exhibit a brown surface staining, which is most likely to have a humic origin. There is nothing on any of the bricks to suggest subjection to the high temperatures that would be associated with certain industrial processes.

The brick forms and dimensions are consistent with a later eighteenth or, more likely, first half of the nineteenth century date. Gutter blocks, such as the examples found here, have a lengthy period of use:

they are recorded, for example, in the late sixteenth-century manor house at Hill Hall, Essex, and the type lasted into the nineteenth century (Drury 2009, 158, fig. 122, 78). In this instance, the similarity in manufacturing technique suggests a comparable date range.

The five brick fragments recovered from pit 107 (fill 111) are superficially similar to those from the tank and floor surface; the dimensions correspond (widths 105-110 mm, depths 60-65 mm; no surviving lengths), but the manufacture appears cruder. Two fragments in particular exhibit a poorly wedged fabric and more irregular, creased surfaces. These bricks may not have been suitable for above-ground use.

Pottery

by Lorraine Mephram

Pottery was recovered from two contexts. The two sherds from upper tank fill 405 are the earliest in date: these are both in Verwood-type earthenware from east Dorset, and include the rim from a small, thin-walled convex jar, possibly a pipkin. This has a probable date range of sixteenth-/seventeenth-century.

The 36 sherds from topsoil layer 404 includes twenty-seven sherds of unglazed redware, from at least three separate vessels (based on rim sherds), all horticultural vessels. Seven sherds belong to a late nineteenth- or early twentieth-century cylindrical preserve jar in felspathic-glazed stoneware, while two sherds are in nineteenth- or twentieth-century refined whiteware, one transfer-printed.

Discussion

The investigation of this site tested the hypothesis that it represented the remains of a copperas works, perhaps the late seventeenth-century works of Sir Robert Clayton. These works were described by Celia Fiennes when she visited Brownsea

where there is much Copperice made, the stones being found about y^e Isle in y^e shore in great quanteties [...] they gather y^e Stones and place them on ground raised like y^e beds in gardens, rows one above the other and are all Shelving, so y^t y^e raine dissolves y^e Stones and it drains down into trenches and pipes made to receive and Convey it to y^e house, y^{ch} is fitted with Iron pannes four square and of a pretty depth at least

12 yards over. They place Iron spikes in y^e pannes full of branches and so as y^e Liquor boyles to a candy it hangs on those branches; I saw some taken up — it look'd like a vast bunch of grapes. Y^e Coullour of y^e Copperace not being much differing it lookes cleare like Suger-Candy — so when y^e water is boyled to a Candy they take it out and replenish the pannes with more liquor. I do not remember they added anything to it only y^e Stones of Copperice dissolved by y^e raine into liquor as I mention'd at first — there are great furnaces under, y^t Keepes all the pannes boyling — it was a large room or building with Severall of these large pannes: they do add old Iron and nailes to y^e Copperas Stones (Fiennes 1888, 5-6).

This paints a vivid picture, but what evidence is there for this?

The initial identification of this site hinges on the suggestion put forward by William Sheldrick that the brick-lined 'tank' was the remains of a copperas liquor pre-heater. The first use of a pre-heater in a copperas works was at Deptford in the 1670s, where it was a lead tank set above the copperas furnace into which cold copperas liquor was poured and pre-heated using the waste heat from the fire (Colwell 1677). Sheldrick has suggested that the Brownsea feature was a cheaper development. His proposal appears to be based on the idea that the channels in the bricks around the sides of the tank were used to conduct heat around it to heat its contents, particularly since there appeared to be dark deposits (soot?) adhering to the channels. The difficulties with this interpretation are that the tank is set into the ground and there seems to have been no way to introduce the heat into the base. A photograph held by the National Trust, taken in 1996, shows the tank with its south side almost intact and constructed in an identical fashion to the other sides. There is no evidence for a flue or chimney to draw the hot air around the tank and the 'channels' themselves are not connected to enable hot air to be conducted around all sides of the feature. The black deposits were examined by optical and SEM microscopy, which confirmed that these were formed of humic organic material and rootlets rather than soot. As there is no other indication that the tank was heated, it seems highly unlikely that the 'tank' was used as a pre-heater in a copperas works. Another fact, which argues against the 'tank' being part of the copperas works is that the bricks used in the base of the feature are late eighteenth or

more probably early nineteenth century in date.

The brick surface appears to be contemporaneous with the 'tank', with a similar type of brick. The brick surface does not appear to have been associated with a substantial structure, as no trace of walls were identified. It is possible that a light wooden roof structure was provided, but no evidence was found. There were no surviving deposits on the floor that could indicate the function of this structure.

The series of terraces to the east of the path were initially suggested as being the remains of copperas weathering beds. However, examination of these terraces and their relationship to the subsurface features exposed in the eroding cliff face suggests they are mainly surface features rather than deliberately constructed terraces.

No trace of any furnace or evidence of significant burning was found. It is possible that features such as a boiling house have been completely destroyed by coastal erosion. However, it is notable that there was virtually no trace of charcoal flecks, nor any coal and clinker fragments found on the site. Also, there was remarkably little iron found considering Fiennes' description of large quantities of old iron and nails used in the manufacturing process. Taken together, there is no compelling evidence that the excavated remains were part of a copperas works.

On the other hand, given the likely eighteenth- or early-nineteenth-century date of the features, it is more likely they belong to the brickworks shown on late eighteenth- and nineteenth-century maps. Isaac Taylor's 1770 map (DHC Ph1/1) shows three square and rectangular structures in the area of the site, which are labelled as a brick works and the 1853 map of the island (DHC D263/T1) shows the same three structures. It is not clear from the later map whether the brickworks were still in operation in the mid-nineteenth century, as it is not labelled, except for the westernmost building which is marked 'Lime Kiln'. A wooden jetty is marked in the approximate position of the jetty remains discovered in the intertidal zone. The 1854 map also has a 'copperas works' and an 'old pottery' marked schematically in the south-west corner of the island. (The old pottery is also shown on Taylor's 1770 map.) The copperas works are marked roughly in the position of Waugh's later 'Large Pottery' and unfinished alum works (at about SZ 0123 8747). The map pre-dates Waugh's development of

the island, so does this map mark the position of Sir Robert Clayton's copperas works?

The south-west part of the island is probably a more suitable location for a copperas works, having a plentiful water supply, unlike the central part of the south shore of the island, and a greater expanse of level or gently sloping open land in which to site the works. It is interesting to note that this also appears to be the area in which the first alum and copperas works were established by Lord Mountjoy in about 1569 (DHC ph404).

Thus, the documentary evidence suggests that the excavated features could be part of a brickworks, perhaps of late-eighteenth- or early-nineteenth-century date. The brick surface could have been part of an open brick shed. The 'tank' may have been for the storage of water, as there does not appear to have been a convenient water supply. The large quarry pit may have been a clay pit exploited for the clay raw material for brick making. The spreads of clay adjacent to the brick surface and close to Pit 107 may have been the remains of weathered clay dumps. Pit 107 is probably a sand quarry, perhaps associated with the brickworks. Close to Pit 107, were the remains of a pit filled with industrial debris including bricks of the same type as found in Pit 107 and in the brick surface 411, recorded by the National Trust and thought to belong to the brickworks marked on Taylor's map (Papworth, 2005, 146-7, South of the Kennels). Also of interest is another possible brick-lined pit or tank found further to the east of the seventeenth-century brickworks 'South of Rose Cottage' (Papworth, 2005, 146, Feature 155). This was constructed with bricks similar to those in the brick surface (411). The fuller understanding of the relationship between these different features will need to await full publication of the National Trust's investigations.

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REFERENCES

- Allen, T. Cotterill, M. and Pike, G. 2004. *Copperas: An account of the Whitstable Works and the first industrial-scale chemical production in England*, Canterbury Archaeological Trust Occasional Paper No. 2.
- Betty, J.H. 1982. 'The Production of Alum and Copperas in Southern England', *Textile History* **13** (1), 91-98.
- Betty, J.H. 2001. 'A Fruitless Quest for Wealth: The Mining of Alum and Copperas in Dorset c 1568-1617', *Southern History* **23**, 1-9.
- Brannon, P. 1857. *An Illustrated Historical and Picturesque Description of the Island and Castle of Branksea, Dorsetshire* (extracted from the *Guide to the Town and Harbour of Poole*), Sydenham, Poole.
- Bugler, J. and Drew, G. 1995. *A History of Brownsea Island*, Dorset County Council, Dorchester.
- Cochrane, C. 1970. *Poole Bay and Purbeck 300BC-AD1660*, The Gavin Press.
- Colwell, D. 1677. 'An account of the way of making English Green Copperas' *Philosophical Transactions of the Royal Society* **12**, 1056-59.
- Crick, M.M. 1908 'Introduction' to 'Industries' *Victoria History of the Counties of England. Dorset II*, Archibald Constable & Company Ltd, London, 325-31.
- Drury, P. 2009. *Hill Hall: a singular house devised by a Tudor intellectual*, Society of Antiquaries, London.
- Fiennes, C. 1888. *Through England on a Side Saddle in the Time of William and Mary. Being the Diary of Celia Fiennes. With an introduction by the Hon. Mrs Griffiths*, The Leadenhall Press, London.
- Findlay, D. Colborne, G. Cope, D. Harrod, T. Hogan, D. Staines S. and Mackney, D. 1984. 'Soils and their use in south west England'. 1:250,000, Bulletin Series 14. Soil Survey of England and Wales, Harpenden.
- Hodgson, J.M. 1976. *Soil survey field handbook*, Soil Survey of England and Wales, Harpenden.
- Miller, I. (ed) 2002. *Steeped in History: the Alum Industry of North-East Yorkshire*, North York Moors National Park Authority, Helmsley.
- Papworth, M. 2005. 'Brownsea Island, South Shore: Industrial Archaeology. Interim Report', *Proceedings of the Dorset Natural History and Archaeological Society* **127**, 145-47.
- Rout, A.E. 1997. 'The North-Yorkshire alum industry: a technical analysis of the processes used', *Cleveland Industrial Archaeology* **24**, 13-55.
- Sheldrick, W. 2006 'Poole and the birth of the chemical industry', *Dorset Life* **329**, 39-43.
- Smith, N. 1995. 'Military Training Earthworks in Crowthorne Wood, Berkshire', *Archaeological Journal* **152**, 422-40.
- Van Raalte, C., 1905. 'Brownsea Island' *Proceedings of the Dorset Natural History and Antiquarian Field Club* **26**, 187-94.