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Abbreviations
The abbreviations used in this volume follow the system laid down in British Standard 4148 part 2; many of the most relevant abbreviations are listed in *Signposts for archaeological publication* ed 3. London: Council for British Archaeology, 1991.

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II: Geophysical Survey of the Holt Roman Tile and Pottery Works, 2018

by Chris Matthews, John Cubitt and Paul Hinchliffe*

This paper summarises the results of a geophysical survey of the Roman tile and pottery works at Holt carried out in January 2018. The site was excavated by T Arthur Acton of Wrexham between 1907 and 1915 and published by W F Grimes in 1930 after Acton's death. The results of the survey have allowed some of the structures excavated by Acton to be repositioned, including the workshops and double-flue kiln, which now appear to form parts of a single complex. There are also likely to be additional structures associated with the Roman tile works that were not identified by Acton, including two new kilns and smaller ancillary structures as well as possible settlement activity to the south of the barracks.

Introduction

In 2018 the Holt Local History Society organised a geophysical survey of the Roman tile and pottery works that lie to the north-west of the village (Illus II.1). Part of the site is a scheduled monument under the Ancient Monuments and Archaeological Areas Act 1979 (reference DE013), and the society was granted Section 42 consent to conduct the investigation based on a methodology approved by Cadw (Matthews 2017).

The work was carried out as part of a long-term research project into the history and archaeology of Holt organised and funded by the society. Archaeological Survey West was commissioned to carry out the fieldwork with the assistance of volunteers from the society. The purpose was to determine the presence and extent of archaeological features both within the scheduled area and in adjacent fields.

The survey area covered twenty-one hectares across seven fields adjacent to a linear stretch of the River Dee. At the time of the survey, Fields 1, 2, 3 and 4 were in use as pasture. Fields 5 and 6 consist of pasture that opens out onto a flood plain and meadow adjacent to the river. Field 7 consists of an arable field that had been cropped at the time of the survey.

The geology of the site consists primarily of recent superficial alluvial and river terrace deposits overlying Triassic age sandstones. In areas of high ground underlying the alluvium

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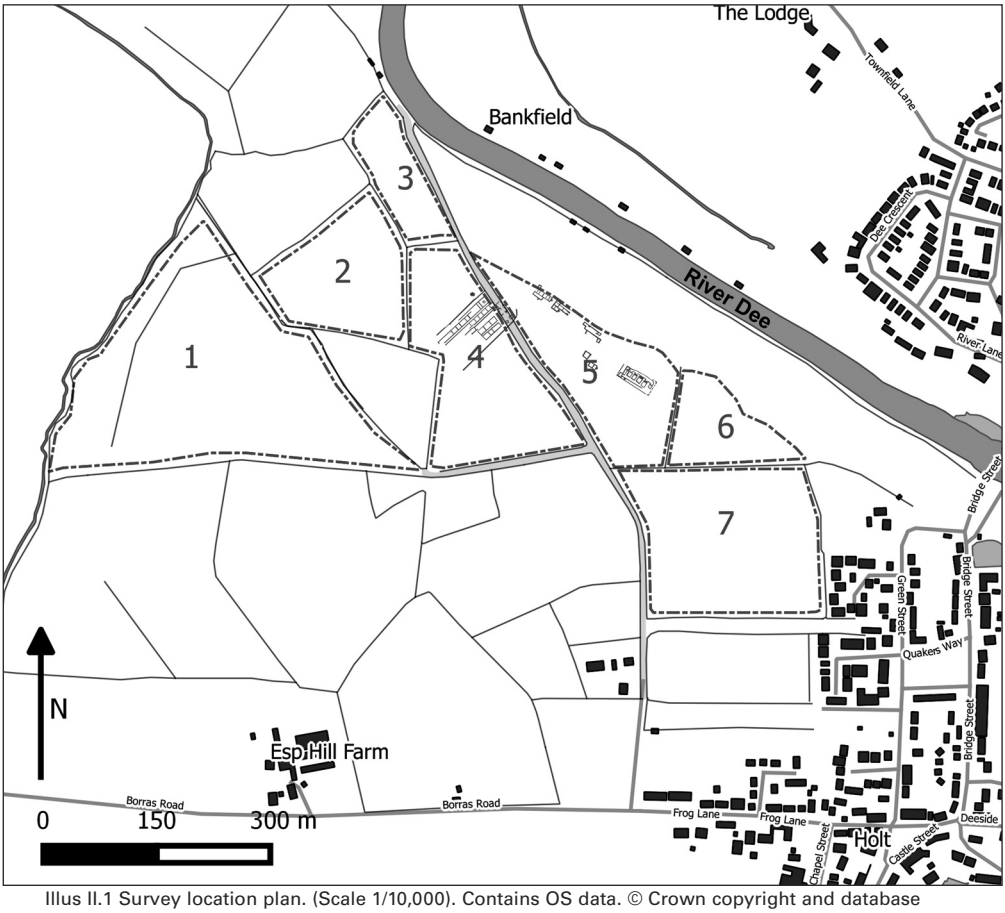
there is till of Devensian age that consists of a variety of materials deposited by meltwater (British Geological Survey). The deposition of alluvial deposits can often result in a noisy background in magnetic data and therefore has the potential to limit the detection of more subtle features, a factor considered during the analysis of the survey results.

Historical and archaeological background

Roman remains in the form of a hypocaust containing stamped tiles of Legion XX VV were first recorded at Holt in the early seventeenth century. The location of this discovery was re-established by A N Palmer (1906), who also correctly conjectured the function of the site. Subsequently, excavations carried out between 1907 and 1915 by T Arthur Acton of Wrexham uncovered several industrial buildings including a large kiln complex, a double-flue kiln and a pottery workshop, as well as military and domestic buildings including a bath-house, high-status building, and an enclosed barracks with ancillary buildings (Haverfield 1915; Grimes 1930; Burnham & Davies eds 2010, 181–2) (Illus II.2).



Illus II.1 Survey location plan. (Scale 1/10,000). Contains OS data. © Crown copyright and database right 2017

Acton began his excavations as an amateur archaeologist but gained the interest and support of Professor Francis Haverfield, who published Acton's and his own initial observations in 1915. These observations form the only contemporary publication of the excavation, as Acton himself did not produce any form of report. Some photographs and plans of the work (but no notes) were deposited with the National Museum of Wales and were used as the basis of a report by W F Grimes (1930), for which he gained the degree of MA. Consequently the main spatial data for the site now consists of the map and plans published by Grimes, which are based on a variety of sources. This leaves the potential for significant error in the location and interpretation of the structures. Despite its inevitable shortcomings, Grimes's report was a landmark, and his list and classification of Romano-British kilns was the first of its kind (Swan 1984, 2).

The early excavations amassed a substantial finds assemblage: tile along with pottery including samian ware (Ward 1998a; 1998b), 'legionary ware' (Greene 1977), mortaria, amphorae and various domestic red and buff wares. The assemblage also includes coins, metal artefacts such as buckles, brooches and pins, as well as melon beads, window glass, querns and inscribed stones.

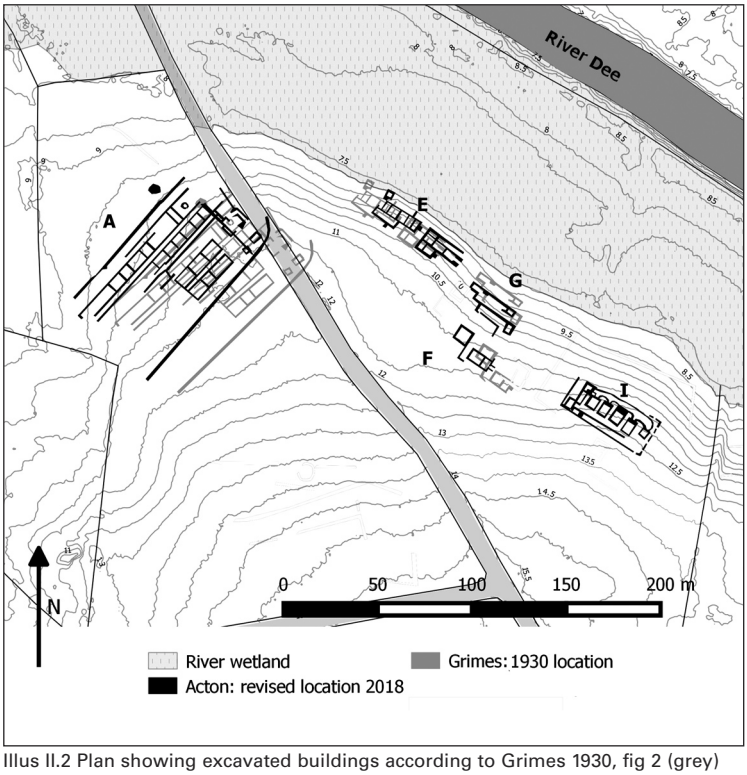
Known archaeological features

One of the main objectives of the survey was to re-establish the locations of the structures excavated by Acton. This required a detailed assessment of the existing information in order to gauge the accuracy with which the structures had been recorded and their likely state of preservation.

Compound and barracks (Illus II.2, A)

The compound was defined by a 2.13m-wide stone wall and contained three ranges of long buildings identified as barracks, and two ranges of ancillary buildings identified as stores or cookhouses (Grimes 1930, 14–16; Burnham & Davies eds 2010, 181). The compound and its buildings were noted by Grimes to have been in poor condition because of intensive agricultural activity and probably stone-robbing. It was not possible to assess their condition in greater detail as no photographs or other records survive.

Grimes stated that the 'domestic character' of the finds assemblage associated with the compound 'clearly indicates that the barracks are to be grouped with the domestic buildings as the quarters of the potters and workmen who must have formed the greater part of the settlement', despite the apparent similarity of the compound to a fort (1930, 15–16). Later references to the barracks by Mason (2012, 162) have reaffirmed this interpretation, downplaying any direct military occupation and referring to the internal structures as 'barrack-like'. This interpretation may underestimate the military presence, given the existence of the compound and the plans of the buildings, as well as the discovery of legionary antefixes, a centurial stone found within the compound and two others elsewhere on the site (Grimes 1930, 132, no 1; nos 2–3; *RIB* **1**, 441; 440, 439 respectively) and a graffito on a stamped tile of Legion XX VV attesting Iulius Aventinus, a soldier of the *Cohors I Sunicorum* (Grimes 1930, 133, no 13 and fig 60, 3; *RIB* **2** (4), 2463.15/*RIB* **2** (5), 2491.96). Even so, the antefixes and centurial stones need only attest building activity rather than ongoing military occupation. Again, the graffito may only reflect a brief visit but it could suggest the longer-term



Illus II.2 Plan showing excavated buildings according to Grimes 1930, fig 2 (grey) and as repositioned in the light of the 2018 geophysical survey (black). (Scale 1/4000). Contains OS data. © Crown copyright and database right 2017

presence of a detachment of this auxiliary unit, which was based at Caernarfon about the end of the second century (*RIB* **1**, 430). In addition, the domestic character of the finds as indicative of civilian workers' residence could now be seen as flawed, as similar assemblages have been found on military sites across Britain, such as the fortress at Caerleon and Usk (Guest *et al* 2011; Bédoyère 2001, 129; Manning 1989), contradicting earlier ideas about military and civilian segregation. G R Stephens (1984, 83–6) identified Range 1 in the compound as military barracks but suggested that Ranges 2–3, if not stores, could have accommodated a slave workforce, as mooted by Greene (1977), and that the compound wall was designed to prevent the flight of this workforce as well as for defence.

Bathhouse (Illus II.2, E)

This structure was of simple *reihentyp* military design, containing an *apodyterium* (changing room), *frigidarium* (cold room) and two hypocaust rooms, probably a *tepidarium* (warm room) and *caldarium* (hot room) (Grimes 1930, 16–19).The plan was noted as 'practically complete' except for the north-west end. The building was one of the more photographed features by Acton and it was possible to re-orientate these images using the background features.

'High-status' building (Illus II.2, E)

Grimes (1930, 19–21) recorded that this structure, to the south-east of the bathhouse, consisted of three hypocaust rooms, three apparently unheated rooms and a corridor (or veranda). He identified this as a typical corridor house, like others excavated at the time such as in Silchester (Haverfield 1906). This interpretation was challenged by a local amateur archaeologist, Geoffrey Bevan of Wrexham, by Burnham and Davies (eds 2010, 181) and Mason (2012, 162), who suggested that it may have been a second or later bathhouse. It is however unclear how these conclusions were reached. The layout is comparable to domestic residences excavated across Britain such as Ditchley and Bignor (Applebaum 1958, 77) as well as the high-status residence identified at the lead-working site at Flint (O'Leary, 1989).

Few internal features of the building survived and crumbling of the river bank had caused part of the outer wall of the corridor or veranda to collapse.

Other examples of military industrial sites established by Legion XX VV include the lead works at Flint, which have produced a high-status building identified as a residence for the overseer of the works (Mason 2012, 162). It is possible that the building at Holt had a similar function.

Pottery workshops (Illus II.2, G)

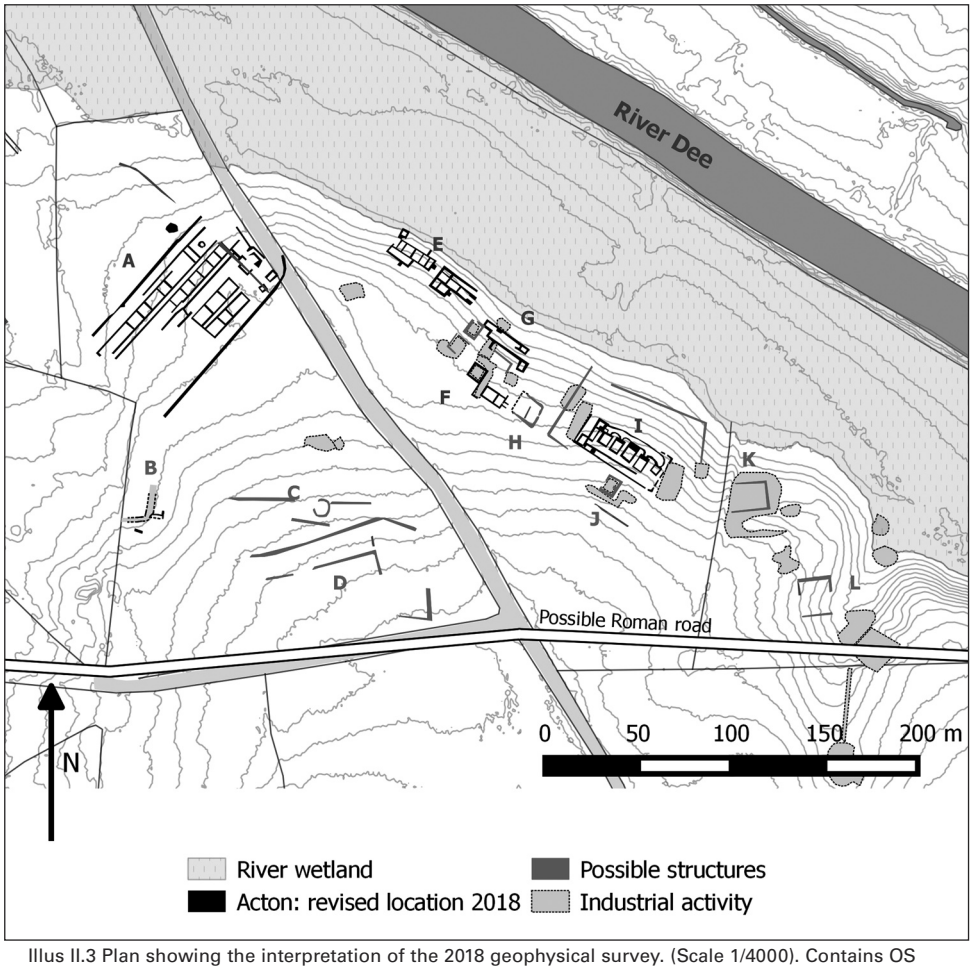
The main workshops were described by Grimes (1930, 21–4) as a long structure adjacent to the river bank, to the north-east of the double-flue kiln. However, no detailed plans or photographs of the structure survive, and Grimes noted that a large part of the building was ruined by a landslip on the river side. His description also noted that a complex series of walled pits, floors, and other structures which covered the ground surrounding the kilns was omitted from the original plans'.

Double-flue kiln and workshops (Illus II.2, F)

The double-flue pottery kiln was set within a square sandstone structure and was comparatively well preserved (Grimes 1930, 24–8). The adjacent structure consisted of a single hypocaust chamber and a larger room that have been interpreted as a drying shed, possibly for tiles, with a workshop, located within reach of the double-flue kiln (Grimes 1930, 21–8; Swan 1984, 47).

Main kiln plant (Illus II.2, I)

The main kiln plant consisted of seven rectangular kilns, a possible covered woodstore, and a later round kiln (Grimes 1930, 29–40). The outer wall of the woodstore was shown on Grimes's plan (facing page 29) as only partly excavated but was extrapolated to form a boundary wall around the kilns. The kilns themselves were below ground level and built onto the natural bedrock with a sandstone masonry casing. Rectangular kilns were generally used in the Greco-Roman world for tiles and heavy vessels requiring slow firing, circular kilns for pottery. By contrast, at Holt rectangular kilns 1, 6 and 7 were thought to be used for firing pottery. However, the pottery found in these kilns may have been waste from the circular kiln, no 2, dumped after they had gone out of use; alternatively, the rectangular kilns may have been used for both tiles and pottery (Swan 1984, 87–9).



Illus II.3 Plan showing the interpretation of the 2018 geophysical survey. (Scale 1/4000). Contains OS data. © Crown copyright and database right 2017

Bronze Age burial

During the excavation by Acton, a Bronze Age burial was uncovered in 1909 near the north-east corner of the barracks compound (Grimes 1930, 187–8 and fig 80). It consisted of two cinerary urns, an incense cup and a food vessel. One of the cinerary urns contained calcined bone identified as belonging to a 'stoutly built man and a child of about 8–10 years old' (Keith in Grimes 1930). The recording of this feature was again very poor. Very little is known about the details of the burial itself or any associated structure such as a mound, which could have been destroyed in Roman times or by more recent ploughing.

Geophysical methodology

Given the known industrial activity, as well as the scale of the survey, it was clear that magnetometry would provide the most effective survey method to meet the objectives of the project. Industrial features such as kilns, as well as ceramic building materials, produce clear thermal anomalies that can usually be differentiated from surface spikes and topsoil

Illus II.4 Greyscale plot of the 2018 geophysical survey showing Fields 4, 5 and 6. (Scale 1/4000). Contains OS data. © Crown copyright and database right 2017. Survey data produced by Archaeological Survey West LLP ©

debris. The kilns known to have been present on the site would be detectable because of their size, even though Acton's photographs show that they lay at some depth. Concentrations of ceramic and burnt material can also aid in identifying areas of increased activity. The main limitation to the survey was the potential for low magnetic susceptibility and noisy background readings from the local soils, given the combination of sandy gravel geology and alluvial deposition from the River Dee. These factors could limit the visibility of more subtle features such as ditches or gullies.

Magnetic gradiometry was therefore chosen as the primary survey method, with smaller electrical resistance surveys and the analysis of the 1m resolution environment LiDAR data used as supporting comparisons. The equipment used for the magnetic survey consisted of a Barttington 601-2 twin sensor gradiometer, operating at a standard resolution of 0.25m sample and a 1m traverse. This is capable of detection at between 0.5m to 1m depth. The resistance survey used a Geoscan RM15 multiplexer resistance meter with samples taken every 0.5m with a 1m traverse. This is capable of detection at 0.5m depth based on standard a 0.5m probe separation. All surveys were located using a Trimble GPS with a correction system capable of producing 14mm accuracy. The survey was carried out in accordance

with national standards, as laid out by Cadw and the Chartered Institute for Archaeology (CIFA 2014) and the results are described in detail in Matthews 2018.

Survey results

The following section summarises the interpretation of the combined geophysical results and historical excavation data. There were three main objectives to this analysis: to identify the features excavated by Acton and compare them with the interpretations published by Grimes in 1930; to establish the extent of industrial activity within and around the currently scheduled area; and to identify any other features of potential archaeological significance.

An attempt has been made to compare the published floor plans with the geophysical data and relocate them where necessary. Whilst the floor plans were not clearly visible in the data, prior knowledge of them has allowed for a more in-depth and interpretative evaluation of features detected in the survey, as well as helping to determine the accuracy of earlier site plans.

Compound and barracks (Illus II.2–.4, A)

The interpretation of anomalies in the data for Field 4 potentially relating to the compound and its buildings has proved to be problematical. The footprint of the compound was not clear, with plough scars running in the same direction further hampering interpretation (Illus II.4). However, there were some sharply defined strong positive linear features, with the most prominent forming a rectangle measuring 12m x 7.5m with a north-east to south-west orientation. This appeared to take the same form as one of buildings recorded by Acton to the east of the barracks. Once this was identified as possibly structural, Acton's plans were overlaid onto this feature and other strong north-east to south-west linears appeared, corresponding with the known recorded structural features. This would suggest that the compound was in fact situated 21m to the north-west of its published position (Grimes 1930, fig 2), placing the latrines (in the north-east corner of the enclosure) within Wall Lock Field (Field 4), as opposed to under Chester Lane as depicted by Grimes (Illus II.2).

A strong positive linear feature visible to the north-west of the compound, which also crossed the northern part of the compound and barracks, could suggest a ceramic drain or culvert. This does not relate to any features noted on the original excavation plans. However, if the repositioning of the compound and its buildings is correct, then it would have headed for the latrines and may have been associated with them. Alternatively, it could be a modern feature postdating Acton's excavation and perhaps be associated with the rebuilding of Chester Lane.

Bathhouse and 'high-status building (Illus II.2–.4, E)

Initial interpretation of the data suggested that an L-shaped structural anomaly overlying part of the published positions of the baths and high-status building could represent the latter. However, the lack of features visible to the north-west of this anomaly suggests that it is more likely to represent the remains of the bathhouse, with the area of structural disturbance to the south-east representing the high-status building. The anomalies identified as those of the bathhouse appear as sharply defined strong positive linears, suggesting surviving structural remains (walls) with some evidence of heating in the form of thermal magnetic

spikes. In the excavation photographs of the bathhouse published by Grimes (1930, fig 7), upstanding walls can be seen to survive at a relatively shallow depth, whereas those of the high-status building indicate poorer survival of upstanding walls, with structural features surviving at a greater depth (Grimes 1930, figs 12 and 13).

Given that the different levels of structural preservation visible in the excavation photographs are consistent with the magnetic anomalies in the data, and that there is an absence of structural anomalies in the positions shown on Grimes' 1930's plan, these anomalies appear most likely to represent the positions of the bathhouse and high-status building.

Pottery workshops and the double-flue kiln (Illus II.2–.4, G and F)

To the north-west of the main kiln plant a group of structural and industrial anomalies probably represent the pottery workshops, albeit *c* 10m south-west of the published position. The most prominent feature in the area was a large industrial anomaly that, by process of elimination, is most likely to represent the double-flue kiln, shown by Grimes 16m further south-east. Other anomalies to the north of the putative double-flue kiln include several additional industrial and possible structural features, of similar form to those identified as kilns. A further area of possible structural anomaly was identified to the south-east, which could relate to the drying sheds noted by Haverfield but not recorded by Acton (Illus II.3, H).

The positioning of these features suggests a concentration of activity rather than the dispersed structures depicted by Grimes and Haverfield. This had already been suggested by Grimes (1930, 12 and 21), who highlighted the fact that Acton had failed to record a complex of structural features associated with the pottery workshops and double-flue kiln.

Main kiln plant (Illus II.2–.4, I and J)

The most positive feature in Hilly Field (Illus II.1, Field 5) was a strong industrial anomaly that appears to correlate accurately with the position of the main kiln plant as shown by Grimes (1930, fig 2). In addition to the known eight kilns within the complex, there appears to have been another possible kiln, indicated by similar areas of industrial activity with strong magnetic epicentres, of which the most prominent included a structural anomaly immediately to the south-west of the main complex (Illus II.3, J). The strength of magnetic readings in this area limited the visibility of structural details, such as the possible wood store identified during the excavations. However, the data does suggest a probable continuation of the enclosure wall towards the north, giving a larger footprint to the kiln complex than that excavated by Acton.

Additional features (Illus II.3–.4)

There were several features within both Hilly Field and Wall Lock Field (Illus II.1, Fields 5 and 4 respectively) that have been identified as archaeologically significant. In Hilly Field these include at least two new industrial spots discussed above as probably associated with kilns. Other features include areas of activity connecting the kiln complex with the workshops to the north (Illus II.3, H), as well as large scatters of metallic and/or industrial deposits adjacent to Chester Lane. The pottery observed on the surface during the survey, as well as concentrations of ceramics noted by the Grosvenor Museum (Ward 1998a), could indicate pits or smaller production. However, no clear structural features were visible.

In Wall Lock Field there was a concentration of linear features in the south-eastern area adjacent to the possible Roman road. These seem to more substantial than common field drains and could have been associated with structures or a road (Illus II.3–.4, D). This area also displayed greater magnetic noise or disturbance than the remainder of the field, suggesting archaeological remains with possible structural elements. Grimes (1930, 12 and fig 2) highlighted this area as having potentially undiscovered buildings, citing the drain recorded by Acton entering the field near its south-eastern corner. Excavations in 2000 by Cambrian Archaeology (2009) identified a smaller possible Roman road, together with a ditch believed to be of a 'structural' nature (Illus II.3, B). No clear building remains associated with these linear features were visible in the 2018 data, but this field has undergone heavy and deep ploughing that has resulted in the near destruction of the barracks to the north and is likely to have had a similar impact on other possible features. The exception was a single structural feature situated to the north of these linear features that was defined by a circular positive anomaly with an internal ferrous spike. This could indicate a domestic structure such as a prehistoric or Roman-period roundhouse or a collection of burnt material implying industrial activity (Illus II.3–.4, C). Although poorly defined, this feature indicates activity that is certainly of archaeological interest and requires further investigation. An isolated large ferrous spike near this feature suggesting an industrial anomaly could indicate a small furnace or kiln. This is, however, detached from the main industrial complex and therefore does not necessarily indicate a pottery kiln or a feature of Roman origin but it remains as a feature of potential archaeological interest.

Surrounding fields (Illus II.3–.4)

The most prominent features located outside the scheduled area were found within Brick Kiln Field (Illus II.1, Field 6; Illus II.3–.4, K and L). These consisted of several industrial and possible structural anomalies identified through both magnetic and resistance survey. It is possible that some of these features may relate to the Roman industrial settlement, but they may also represent post-medieval industrial activity as indicated by the field name.

Other features from the surrounding fields primarily represent agricultural activity, including ridge and furrow ploughing and field boundaries. There was also an indication of possible industrial and structural activity in Field 1 that could resemble prehistoric settlement, but the feature was very weak and poorly defined.

Conclusions

The results of this survey have, to a reasonable extent, identified all the features excavated by Acton, as well as having more accurately located them. This relocation has clearly demonstrated the relatively poor level of archaeological recording that has until now been relied upon for all interpretations of the site. However, the most significant discovery was that the pottery workshops were part of an area of intensive activity, including additional kilns not excavated by Acton, rather than one of a small number of isolated structures. The main kiln plant also appears to have been part of a wider area of industrial activity, and whilst some of the apparent evidence for this is likely to be material from the plant spread by ploughing, there were several more structural features including walls and a possible smaller kiln that were not excavated by Acton.

The results from Wall Lock Field (Illus II.1, Field 4) were more difficult to interpret. The extensive ploughing that has taken place has had a significant impact on the preservation of the barracks, which were barely visible in the data. Nevertheless, the interpretation that these were workers' accommodation can now be questioned. The features to the south of the compound (Illus II.3–.4, B, C and D) suggest further buildings in that area, potentially a civilian settlement. It is therefore possible that the compound was in fact a military depot, with the garrison supervising a civilian workforce (*cf* Webster 2011, 62 for a discussion of possible organisation and workforce). A fort adjacent to the industrial site at Wilderspool has been posited but not yet proved, and a compound like that at Holt, with manufacturing outside it, may have existed at Holditch, Staffordshire (Rogers & Garner 2007, 20, 24–5; 135–6 respectively).

The survey has shown that several anomalies may indicate potential structural elements of the site that were missed or incompletely investigated by Acton, and their investigation could significantly improve our understanding of the site. The Holt Local History Society will therefore be seeking, in collaboration with the landowners and the scheduling authorities, to further investigate the archaeology of the area over the next few years.

For more information regarding this project, please contact the Holt Local History Society via https://holtlhs.weebly.com /contacts.html.

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