

# Two 12th-century Wich Houses in Nantwich, Cheshire

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*EXCAVATIONS in Wood Street, Nantwich uncovered two salt or wich houses, the first medieval wich houses belonging to an inland production centre to be thoroughly investigated. From the excavation a picture emerges of a highly structured and ordered organization, with each stage in the production of salt clearly defined and demarcated. The two wich houses were approximately the same size and both included amongst their equipment a trough, either clay-puddled or, in the later periods, a hollowed-out tree trunk, technically called a 'ship'. These were used for storing the brine, once it had been carried across the river in wooden pipes. There was no trace of this aqueduct network. The brine was then boiled in lead pans over an open fire. There were six hearths to each wich house. The houses are dated to the late 12th century. One was pulled down shortly after it was built; for the other the last recorded date is in the 16th century.*

## INTRODUCTION

Nantwich, Middlewich and Northwich were the three salt towns of Cheshire, and their position is directly related to where the brine rises to the surface as springs, or where the rock salt could be easily extracted. In Britain three methods of producing salt were possible: solar evaporation; artificial evaporation from sea water and artificial evaporation from natural brine springs. In cold temperate Britain, however, there was little opportunity for solar evaporation, so the open pan method was developed for both brine and salt water. Here, the brine was heated in some form of container, either pottery or metal, and the salt crystallized out as the brine evaporated. Brine is stronger and purer than sea water, containing less of the bitter salts Calcium and Magnesium, and more salt per volume is produced from the natural brine springs of Cheshire than from sea water.<sup>1</sup> There were obvious advantages in exploiting the brine in these inland centres, providing there was a plentiful supply of fuel<sup>2</sup> and a good transport network.

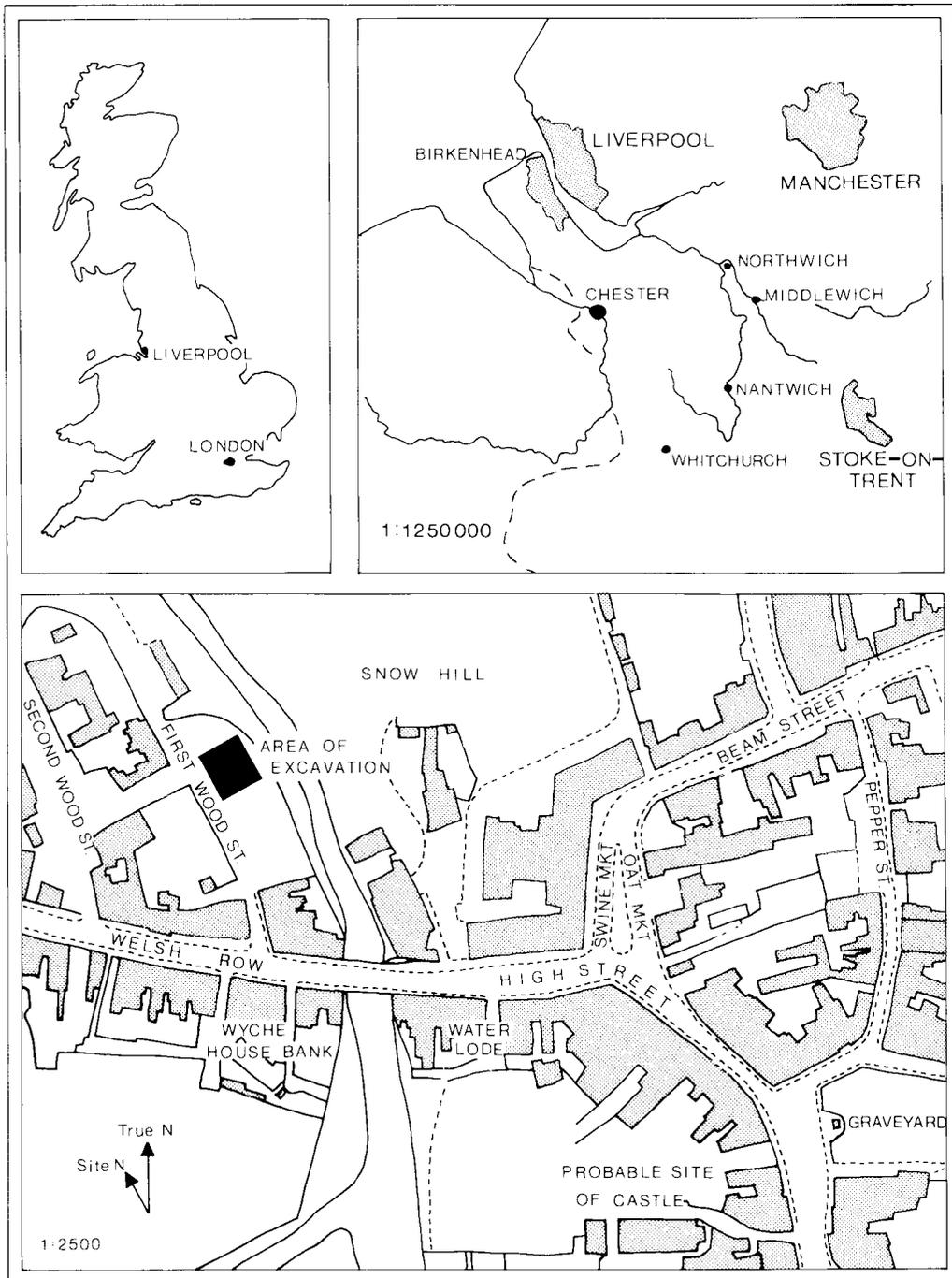


FIG. 1

Location map of Nantwich and plan showing the position of 1979-80 excavations

## GEOLOGY

The Cheshire plain is a lowland between two hill masses. To the E. lie the Pennines and to the W. the Clwyd uplands. The geological structure which accounts for the general form of the county is comparatively simple. The plain is everywhere underlain by Triassic rocks, formed about 225–190 million years ago and the map of solid geology shows their great extent in Cheshire and the order in which they occur from top to bottom.

The three uppermost beds in the plain are collectively termed Keuper. The lowest two beds of the Keuper and all three of the underlying Bunter beds are sandstones of varying types, which form the C Cheshire ridge and the Tarvin ridge. The topmost of the Keuper beds is the Keuper Marl (now known as the Mercia Mudstone Group), the underlying rock of the E. Cheshire basin. These marls are greenish-red, sticky clays, which include the richest rock salt deposits in Britain.

The Cheshire Pennines are geologically distinct from the Cheshire plain, being formed from Carboniferous rocks, and consist from upper to lower series of Coal Measures, Millstone Grit and Carboniferous Limestone.

The Keuper Marls, or more correctly mudstones, contain beds of rock salt at two main levels, the Upper and Lower Saliferous Beds. These are approximately horizontal, each being about 30 m thick and separated from each other by several hundred metres of middle marl. The total thickness of the mudstone deposits is calculated at more than 1400 m after a borehole at Wilkesley. The salt deposits extend southwards, from Lymm through C Cheshire into Shropshire, but their continuity has been disrupted by faulting. The Weaver Valley, in the centre of the rock salt deposits, is and was the major production area.

Mining of the rock salt first occurred in the 17th century. Prior to this the natural brine springs were the only source of salt. Brine springs form locally above the highest remaining rock salt beds. The deposits of rock salt are dissolved from the topmost layers of the salt bed by the action of groundwater and emerge at the surface as brine springs.

Such is the basic geological structure, but the greater part of Cheshire is covered by a blanket of drift, deposited in the Pleistocene and recent periods of the Quaternary Era. The deposits consist of clays, including boulder clays, sands and gravels.

## HISTORICAL BACKGROUND

There is at present no evidence of prehistoric interest in the Nantwich brine. Roman pottery has been found in scattered locations throughout the town,<sup>3</sup> and recent finds including briquetage indicate that the focus of the Roman presence may be found on Snow Hill. The earliest account of salt working can be found in the Domesday Survey<sup>4</sup> where a minimum of eight salt or wich houses is mentioned; these and an unspecified further number were surrounded on one side by the river and on the other by a moat. The brine spring emerges on Snow Hill and this is the obvious location for the original and later salt works. By the 13th century<sup>5</sup> Great and

Little Wood Streets on the W. side of the R. Weaver were frequently mentioned as localities of wich houses. Salt is known to have been produced on Wyche House Bank and in Waterlode,<sup>6</sup> but in the main these must be considered as later developments. The history of the town is fortunately well documented and transcriptions of several 16th- and 17th-century documents can be found in a 19th-century history<sup>7</sup> and in a recent collection.<sup>8</sup> There are several dated accounts pertaining to the area and to Wood St, formerly Great Wood St, in particular, where mention is made of individual salt houses<sup>9</sup> in one and a detailed catalogue of the equipment used is described in another.<sup>10</sup>

### THE EXCAVATION

The excavation was carried out in the inevitable extremes of weather and digging conditions encountered during the winter of 1979 and the spring of 1980, in advance of a Crewe and Nantwich Borough drainage contract. A 15 m sq. area was laid out in Wood St, Nantwich (SJ 6492 5255), but the N. and E. sides were stepped in as the excavation deepened. A mechanical excavator removed the top metre of overburden (tarmac overlying brick rubble derived from the demolished 19th-century terrace), but all other deposits were excavated manually. After the demolition of the terrace the site was in use as a car park until 1979.

Undisturbed fluvial sands were reached in the S. half of the site at *c.* 2¾ m below present ground level, i.e. at a depth of between 32.00 m and 32.50 m above O.D. Not all of the N. part was totally excavated but undisturbed sands were recorded at 32.50 m and 32.75 m above O.D.

From the first the site divided into two halves, which were subsequently realized as marking the two wich house plots. As there was no indication of this division before the excavation started, the extent of the trench as defined by the rescue threat was extremely fortunate. If the excavation had been sited one metre N. or S., the available evidence would have biased the understanding and interpretation to such an extent that no estimates about the nature and size of the wich houses would have been possible. The N.-S. division was further emphasized by the character of the deposits, which in general were more anaerobic in the S., and therefore conducive to the preservation of organic remains, especially structural members of the wich houses. This marked a progression, although not mirroring the two wich houses, from posts and stakes *in situ*, to post-sockets and stake-holes.

The excavation was conducted as an open area excavation, and all layers and features were dug without sections. The overall understanding of the site would have been frustrated by sections, but this meant that frequent horizontal planning was a prerequisite. Wood, leather and special finds, the latter termed Collection Numbers, were recorded three-dimensionally and prefixed with the letters W, L and CN respectively with the numbers in each class potentially running from nought to infinity, regardless of the layer number. Over 3,700 sherds of medieval pottery were recovered during the excavation, but as it was not practical to record each piece three-dimensionally, the pottery was collected generally by layer, or by grid co-ordinates within each layer or by Collection Number. This type of recording meant

that a flexible attitude was adopted with regard to the importance of each deposit, so for instance if finds needed to be plotted at any stage, this was easily accommodated by the system and their exact distribution or general density in an area was recorded by the most apposite method. With the exception of Period III deposits (18th–20th centuries) feature numbers have been given and the following abbreviations are used in the text:

W	= Wood	P	= Pit
T	= Trough	S	= Brine-boiling hearths
C	= Channel	H	= Hearth
BP	= Barrel-Pit	WH	= Wich House
F	= Fence		
PH	= Post-hole (the same number is used for the post)		

Layers and general spreads are indicated by the context number used during the excavation. The history of the salt works is ordered into three main periods, each subdivided into phases. The excavation records, including a table correlating all layers and feature numbers,<sup>11</sup> are held in archive at Liverpool University.

#### PERIOD III: PHASE I

The recent history of the site from the 18th to 20th centuries is summarized below and only the features influencing and impinging upon the earlier horizons are discussed.

In the centre of the site a 20th-century brick and concrete housing (41) formed the intersection of several domestic drains, two holding wooden pipes (9, 35, 19, 82, 21, 7, 31). The brick housing, although placed directly over the ship (W<sub>5</sub>), fortuitously did little damage to the wood. The 19th-century terrace buildings had no cellars, but deep foundations were present in three instances (11, 85) and may be interpreted as riverside walls built because of the threat of flooding. Some of the walls robbed out in the 19th century (25, 27, 85) had similar alignments to walls robbed out in the 18th century (82, 39) and were obviously replacements of them. Feature 85 is here interpreted as a wall base because it was parallel to and equi-distant from other known walls (173, 11) and because its shape and clay fill can be equated with the foundation for 11 (seen in section only).

The three irregular-shaped pits (P<sub>3</sub>, 4, 5), filled with brick wasters, clay and rubble, were dug solely to bury the waste material from the destruction of the walls. These pits were dug into wich house 1 deposits and did some damage to these earlier horizons. Two parallel fence lines (PH<sub>7-11</sub> and 1-6) cut through the northern edge of 85 and the middle of P<sub>5</sub>, late in the 18th century, and these stakes were probably more numerous and more regularly spaced than the plan shows. Early in the same century four rectangular post-pits (PH<sub>12-14</sub> and 185), housing in three instances circular post-pipes, were dug. The 18th-century garden soil in the SW. quadrant (2, 49, 69, 83) was bounded on two sides by walls, indicating the extent of the terrace backyards.

This is a period concerned with a change in land use and its conversion from an industrial site to a purely domestic one. The one major interest in this is that it supplies a *terminus ante quem* for the decline of the salt works at around 1700.

The description of the two salt houses follows, starting with the earliest, wich house 1.

## PERIOD I: PHASES 1 AND 2 (Figs. 2, 3 and 8; Pl. v)

*The Building*

As can be seen from the plan only half of wich house 1 was available for excavation. This house was deliberately dismantled, so details of its construction were only clarified by a close examination of the destruction layers, and where appropriate the two events have been considered together.

The house (WH 1) was constructed of two stake and wattle walls (F1, F2), but it was only along the outer wall (F1) that posts of any size were detected. These were rough and unwhittled, sometimes with the bark remaining (W39, W133–37) and were irregularly spaced. Interspaced between the posts and beyond them, were several post-pits, some of which had been robbed twice for both the inner and outer walls. With this consideration, it is apparent that each upright was set approximately 0.6 m apart. The pits themselves alternated between deep and shallow, starting and finishing with deep robbings, denoting the assumed approximate depth of the driven posts. Two points are interesting: firstly post-hole 50 was exceptionally deep (0.54 m), and, with two chocks still *in situ* in its base, it patently served as a corner post for the building; secondly, the deep-founded posts terminated with pit 54, the post of which (W137) was inverted when the wall was dismantled. These larger posts were used to tie in a light outer screen (F1) held on small circular stakes, spaced at 0.3–0.4 m intervals. This screen, traced by stakes and wattling in the W. and stake-holes in the E., extended to include a larger terminal post (W132) giving an overall length of 10 m for the wich house.

The inner wall (F2) consisted of flat hazel sails (100 × 60 mm), driven into the ground for about 0.30 m and positioned at regular 0.30 m intervals, which were interwoven with pleachers. This wattling was preserved to a height of up to 1 m and was a continuous weave from W96 to W110, that is the stakes were inserted first and woven with withies from one end to the other. Thereafter, traces of hurdling and shallow robbed-out pits (PH57 and ?58) extended the line for another 4½ metres.

These two walls form a single unit of cavity construction (Pl. v, c) which may have run the whole length of the building, or may have only been present at the W. end<sup>12</sup> where certain details of planning were observed: firstly, the flat inner sails and the outer earthfast posts terminated at a point where the first brine-boiling hearth was located; secondly, the meander in both walls noticeable from post-hole 54 and W110, along with the occasional double stakes, is consistent with the pattern produced by individual hurdles erected side to side. The total absence of any hurdles in the E. prompts the suggestion that the individual panels were redeployed, whereas the western end survived intact because it could not be easily dismantled. The removal of the panels and the pulling out of key posts ensured the total destruction of the wich house as a working unit. A semi-circular setting of stakes, surrounding a vertical-sided pit (P8), was incorporated into the framework of wich house 1. Although part of this pit had been dug away during the construction of wich house 2, the presence of a circular grey stain at the bottom suggests that it may have held a wooden container for brine or water storage.

The door frame was hung on two deep-founded posts (PH60, PH61). These had been robbed out but large wedge-shaped chocks were found lying diagonally at the base of the pits. In the later blocking of the entrance, two stakes (W86–87) were inserted on the same line as posts 60 and 61, and both of these had a smaller stake driven diagonally against the front face, so that a V-shaped gap existed, in which a gate or stop wedge could be positioned. A flat piece of wood discovered W. of the stakes may be viewed as the collapsed blocking.

The entrance led into a porch or lobby, which was recessed into the W. end of the wich house. It consisted of a boat-shaped area of stakes (F3–4), refurbished at least once with additional stakes on the N. face (F3) and planking on the S. (F4). The lobby had a maximum width of 1.20 m at the door posts, but narrowed inwards to 0.60 m. The stakes used were round in section, often double-spaced and more numerous than those of the internal wall.

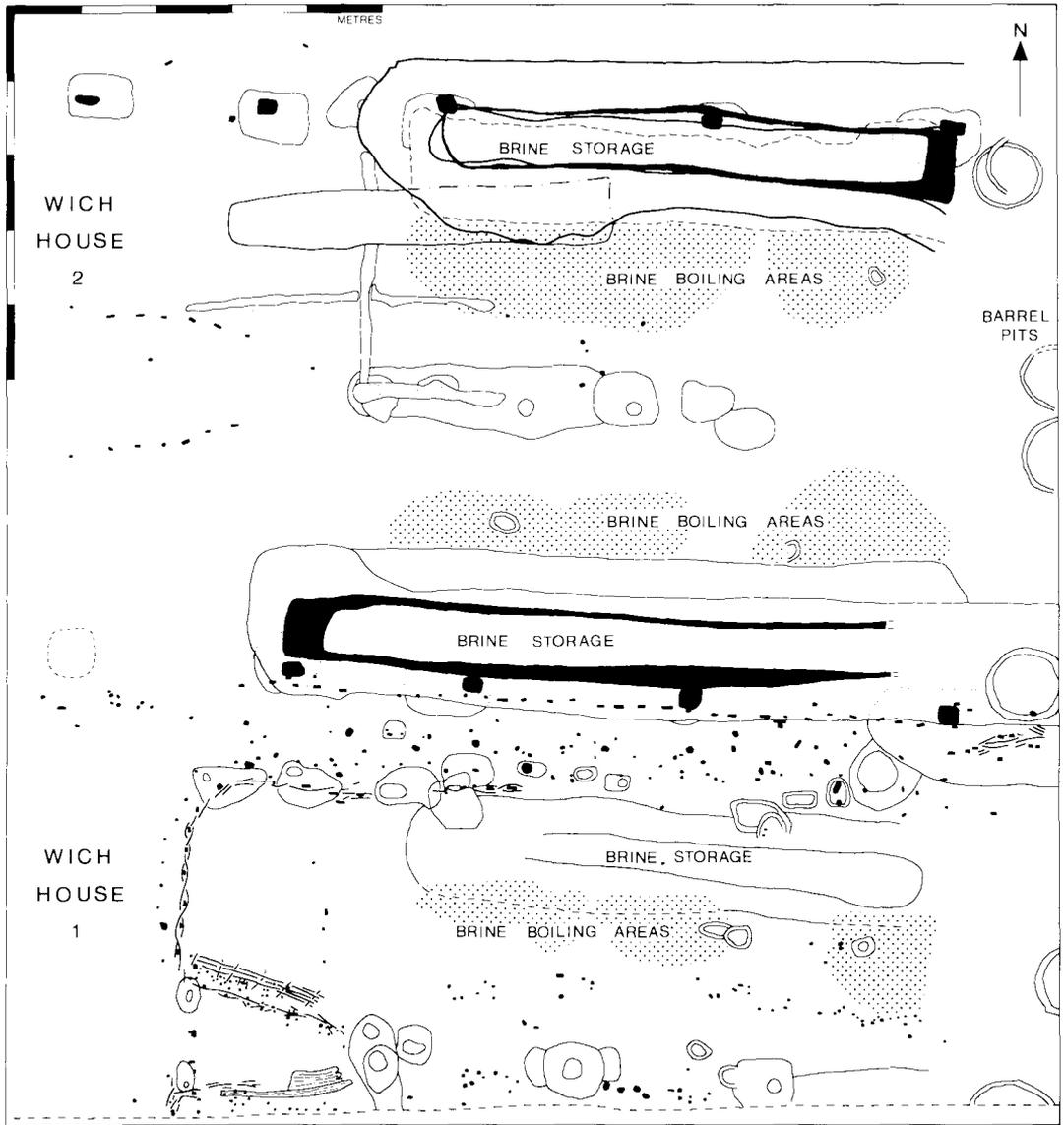


FIG. 2  
Composite plan of site showing major features



Cutting channels 5 and 6 and post-hole 62 were two later post-holes (PH64–65) from which circular posts 0.20 m plus had been robbed out. The pits were both 0.65 m deep and were filled with a rich charcoally silt loam.

These features are all on the same axis and, with the exception of post-holes 64 and 65, are taken to be associated. Together they may have constituted an internal partition which consisted of wall panels of various materials hung on structural uprights. The distance from the N. wall to the partition was 4 m. If the wick house was symmetrical, and the evidence would indicate that this was so, its overall size would be at least 10 m long and 8 m wide.

The boundary of the wick house 1 plot was marked by an E.–W. fence (F8), lying due N. of the house, and was detected as a line of circular stake-holes. The stakes, associated with some fragmentary hurdling, had diameters of 80–120 mm and were driven into the ground for upward of 200 mm.

### *Inventory*

Three brine-boiling hearths were identified (S7–9). These were sited N. of the central partition in an E.–W. alignment (Pl. v, A). As six better preserved hearths were discovered in the later wick house, the details of all the hearths will be discussed below. Suffice to mention that these three hearths displayed, although in somewhat disseminated form, the same pattern of a central ashy deposit, an encircling ring of burnt loam and an outer spread of industrial waste or 'scratch'.<sup>13</sup> In wick house 1 the fires stood directly on the ground: this was evidenced by the reddening of the natural sand to a depth of 0.20 m. One hearth was encircled by a number of stakes (F9) and although 18th-century pits had cut through some of the other burning areas, surviving arcs of stake-holes are thought to mark their limits. Three small posts (PH66–68), one of which (PH66) was replaced, sunk into pits rather than driven into the ground, were positioned eccentrically to two of the hearths (S8–9). Both these, and the stakes, are interpreted as a screen or stand from which the 'barrows' could be hung. Barrows were the open-ended, conical-shaped wicker baskets used for storing the salt.<sup>14</sup> The interpretation of these as supporting structures is based on a 16th-century illustration of a salt works in Saxony where empty and full barrows are seen suspended from a woven panel<sup>15</sup> and from a description of the 13th-century sunworks at Lymington, Hants.<sup>16</sup> Two incomplete barrows were discovered. One (CN214) was associated with the wick house 2 deposits (201), but the other (CN300: Pl. v, B) was found lying on top of the collapsed hurdle F5 and had demonstrably been stacked upside down against the entrance wall. Because of its shape, the barrow provided the most convenient means of storing and transporting bulky materials, as contemporary illustrations of creel carriers show.<sup>17</sup>

Associated with the three brine-boiling hearths was a clay-puddled cistern (T1), 7 m long and 1.5 m wide. It was stepped internally to produce a deeper trough, 5.5 m long, 0.60 m wide and 0.35 m deep and had been recut several times. The trough was filled with a greasy clayey loam, which was heavily contaminated with daub, ash and charcoal, and several sizeable tree-trunks had been thrown into the uppermost fills. One vertical stake (W138) had been driven into the base of the trough. The cistern was positioned alongside the N. wall, but on its southern edge no clear distinction was possible between it and the edge of the hearths, with both their deposits merging together, or even underlying and overlying each other in apparently random fashion. The only explanation for this must lie in their contemporaneous use: sometimes the hearths covered part of the cistern, but when the cistern was renovated its clay then sealed and incorporated the earlier boiling deposits. This inter-action between storage and production of salt has blurred the original relationship.

There was a distinct break between the deposits in the W. of the house and those in the E. In the western bay the natural sand was scarped so that the ground sloped unnaturally away from the river. Above this was a deposit of hard compacted sand (266, 338, 362), giving the appearance of a beaten earth floor. Concentrations of hard and gritty charcoal (230) were found to the N. and E. of the sand. Within the entrance an organic woody deposit (229)

overlay a deposit (265) formed from charcoal and burnt wood. This in turn overlay a grey silty sand (323, 343, 363), which likewise sloped downhill from E. to W. This contouring of the ground may have facilitated drainage and provided a run-off for the 'leach brine' into the yard. The salts within this liquid may have caused some cementation of surface deposits, resulting in the impression of a beaten earth floor. Leach brine is the liquid which drains out from the newly stoved (or heated) salt, i.e. open pan salt which was dried in the lump form.<sup>18</sup> In this context the cavity wall may have been specifically designed to assist ventilation, which was fundamental to the drying out process.

The presence of one salt barrow and six salt rakes in this quarter<sup>19</sup> was surely not fortuitous, and it is believed that in addition to being a drying room for the stoved salt this end of the house also served as a storeroom for equipment. This speculation is impossible to verify, being dependant on negative evidence, but an empty room uncluttered by heavy equipment is a suitable candidate for use as a depository.

The ground level outside the house was continuously built up by the alternate deposition of organic layers, charcoal layers and some rake-out (180–82). This accumulation describes intense but specific industrial activity. The organic deposits contained some fragments of wood and some wooden artefacts, but the bulk of each layer was formed from wood chippings and shavings, which are interpreted as the offcuts from wood working, amounting to no more than what would be produced by the shaping and whittling of stakes and the chopping up of wood for firewood on a seasonal basis.<sup>20</sup> The charcoal layers were hard and gritty and are related to those found inside the house and are probably the remains of fuel stacks. Because of its clinker-like quality the charcoal may have been spread over the area to provide an improved floor surface as at Roman Middlewich<sup>21</sup> and to prevent it from puddling.

These deposits were initially identified in a zone encircling the N. and W. walls of the house, but were subsequently located under the western part of wich house 2, and are interpreted as being yard areas, with ill-defined boundaries. Although fence 8 acted as a physical barrier in the E., in the W. its line did not continue beyond the confines of the wich house and it is here that a communal yard is envisaged. In this respect fence 8 was laid out solely to demarcate the northern limits of the wich house plot. The yard was situated not at the back but at the front of the building, providing access on to Wood St and a convenient depot for the fuel used in the boiling. To the N. of the house, between the property boundary and the building itself, the sands (289, 292) had become compacted, presumably from repeated trampling.

#### *Stratigraphic Relationship of Wich House 1 with Wich House 2*

Wich house 1 was superseded by wich house 2 and the stratigraphic relationship between the two buildings was proven in several instances: wich house 1 deposits (180, 181, P8) were cut into by some of the wich house 2 posts (PH42 and 45); in the case of the latter no attempt was made to remove W132 and it was left upstanding in the post-pit fill. The eastern hearth (S9) and the slot (C8) were sealed by scratch (278) emanating from the replacement wich house. The deliberate defacing of wich house 1 was probably directly related to the construction of wich house 2 and it is evident that no great time elapsed between the building of the two houses.<sup>22</sup> Furthermore, wich house 1 can be seen as a temporary measure prior to the construction of the main wich house.

#### *Later History*

After the demolition of wich house 1, the southern half of the site was blanketed with a black organic deposit (76) which was an accumulation formed during a period of abandonment and apparent disuse of the wich house 1 plot. Artefacts found in this horizon were few in number and mixed in their date range, indicating a long period of inactivity.

There is an intimation of another wick house or structure (WH3) built over this earlier plot. The scantling of the two recut central posts (PH64 and 65) was disproportionate to the framework of wick house 1 and the presence of these posts is not convincingly explained as belonging to the original building. Two barrel-pits (BP6 and 7) at the eastern end of the site were truncated so that only a few centimetres of their original height remained. This levelling may be associated with the deposit 52, which overlay 76, but was unfortunately contaminated with modern material. If the modern finds are ignored, since they were washed into the excavation during a flood, this horizon is dated to the 15th century. If this levelling removed evidence for any associated structures, only the deeper posts and the sunken barrel bases would survive, in which case wick houses 2 and 3 may have existed alongside each other for a short period. Pottery from the robbed post-pits 64 and 65 is comparable with the wick house 2 pottery. Finally, it may be appropriate here to postulate the likely use of sill-beams for wick house 3, which would leave little trace in the archaeological record, and to reconsider feature 85 as an unfinished base for a brine tank.

#### PERIOD II: PHASE I (Figs. 2, 4 and 9; Pls VI and VII)

##### *The Building* (pl. VI, A)

The overall dimensions of wick house 2 were 11.70 m long by 7.90 m wide and the framework of the building was supported on ten load-bearing posts, five along each side. The resultant ground plan was trapezoidal. The first S. upright to the W. was not recovered owing to deep 19th-century activity (30, 178), but a shallow depression (PH46) measuring approximately 0.76 × 0.60 × 0.13 m found in the right location and at the predicted depth purports to be the base of the post-pit, and any measurements given for the house are calculated on the assumed position of the extracted upright. Beginning from the W. end of the house, the first three posts of both walls were equally spaced (2.40 m), but thereafter the distance from centre to centre was more erratic: posts 39 and 40 were separated by 3.54 m whilst their southern counterparts 43 and 44 were only 2.95 m apart. The distance between posts 40 and 41 was 3.20 m and 3.40 m separated posts 44 and 45. There was a gradual progression from smaller and shallow-based pits in the W. to larger and deeper ones in the E. and the earthfast posts are a confirmation of the need to anchor that part of the building closest to the river. No attempt had been made to terrace the land prior to development and there was a rise of 0.30 between the E. and W. end of the house.

The posts were sunk into individual pits and in the main these were rectangular or sub-rectangular; the two shallow 'ears' to pits 40 and 41 being explained as initial incorrect cuts. Pit 45 was intended to be of rectangular form c. 1.20 m × 1.00 m, but was enlarged to incorporate a breakwater (F14) consisting of long flat stakes interwoven with hurdling and rammed deep into the soft soil, a marshy alluvium cut away repeatedly by the erosion of the river bank. The pits were usually dug with vertical sides to a flat bottom and sometimes had a slight socket for the timber (e.g. PH42). One, however (PH39) had tapering sides, two (PH40 and 44) had a ledge part way down and one (PH44) was bell-shaped because of undercutting and subsidence of the sides by ground water at the time of excavation.

Most of the pits were dug into and backfilled with an organic woody deposit which had accrued during the tenancy of wick house 1 or was the result of activity immediately preceding the occupation of wick house 2 and was similar in character to the yard deposits belonging to the earlier house. Much ash, charcoal and wood was noted in the upper levels of post-pits 39, 40 and 41, which were contaminations from later brine boilings. No distinction could be made between the fill of post-pit 45 and that of the breakwater (F14) but industrial rakeout emanating from the eponymous house (228) sealed the upper layers of both.

Because of the absence of available packing stones, chocks and stakes were employed to wedge posts. Four chocks, wedged at an angle to the posts, were detected in position; one each in post-pits 40 and 41, and two in post-pit 45, set edge to edge against the base of the

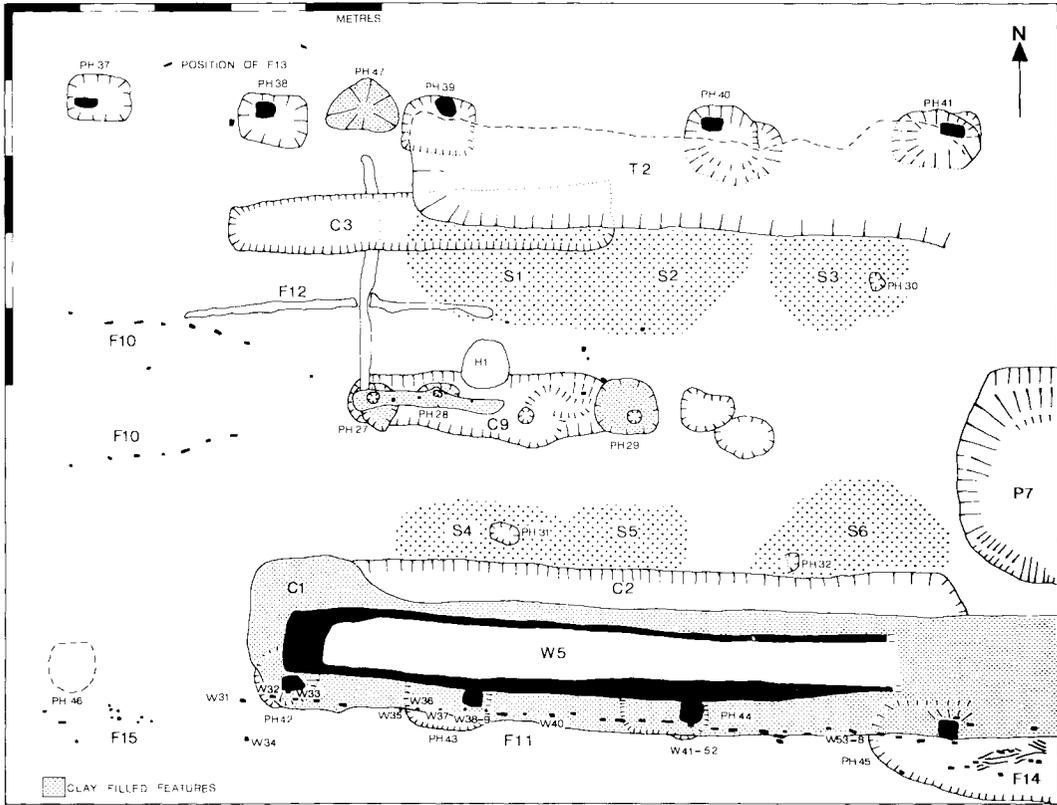


FIG. 4

Plan of wick house 2 at period II/1-2

upright. Tamping stakes which were driven vertically against the post face were found in post-pits 39 and 42. Two notched blocks, 60 mm long, were discovered in post-pits 43 and 44. They had a circular groove cut into the upper face and although displaced, were intended to ensure a snug fit between the uprights and the ship (W5) and epitomize the care taken in constructing a wick house.

The timber-framed construction owed its rigidity to the depth of the earthfast posts (*c.* 0.75 m) and to the size of the timbers used which were in excess of 0.25 × 0.20 m. The oak timbers were squared off and three of the southern posts had a rebate cut down an outside corner. One timber (PH43) was stepped inward on one side, 0.35 m up from its base.

Both the magnitude of the posts and the size of the building (*c.* 12 × 8 m) are commensurate with a building of some stature: certainly, there was no legacy from wick house 1 to encourage aggrandisement on such a scale. The answer may lie with the ship (see below), which superseded the earlier brine troughs; perhaps this 'grandiose' wick house was custom-built, to a master plan, in a manner befitting the new invention. To judge by the long tenancy of wick house 2, it was a successful improvement on its predecessor.

A short irregular bedding trench (C9), midway between the lines, and beneath two later posts (PH27 and 29), housed two and possibly three circular posts. The slight scantling of the posts precluded their use as roof supports.

A line (F11, W31-58) of thin upright laths 60 mm wide and 40 mm thick, regularly positioned at 0.30-0.40 m intervals, was sited astride the southern uprights. The extant stakes survived above ground for heights of 0.10-0.20 m and were securely rammed into the earth for upwards of 0.15 m. Between W33 and W35 the wood had decayed leaving two grey stake-holes, and in the ensuing gap the position of another missing stake can be deduced. The more rounded outlines of the stakes, especially within PH43, exhibit the tapering characteristic of slats and are not anomalies in an otherwise well planned arrangement. Some of the unallocated stakes beyond post 42 may belong to this line, but they are either unaligned with it or circular in shape and should be disregarded in this connection. The main concentration of flat stakes is bounded by posts 42 and 45, which are the terminal posts for the later ship (W5) and were obviously so placed to have some relationship with the ship. Since the laths were covered up by the clay C1 in which the ship was embedded their period of use was short. One might argue that the original plan to protect the ship from the weather by building a closely spaced wall of laths along its length, was modified to leave the spaces between the posts completely open, or one can explain the stakes as markers for laying down the clay bed, which were dispensed with once the ship was in position. This may seem to involve a lot of effort, but it must be remembered that the insertion of the ship was no casual matter, but followed a precise plan. However, neither solution is totally satisfactory and the original intention of the designers must remain unresolved.

Traces of collapsed hurdling (F13) with no surviving verticals were exposed between posts 37 and 38. This hurdling taken with an irregular arrangement of small rounded stakes (F15) S. of post-holes 46 and 42 may constitute the surviving evidence for wall panels at this end of the building.

### *Inventory*

The six brine-boiling hearths (S1-6) were arranged in two E.-W. belts with three in each (Pl. vi, B). These were adjacent to and contiguous with either a ship (W5, W6) or a trough (T2, T4), and were separated from each other by a corridor of black greasy, charcoal-enriched loamy silt (162). Each hearth was characterized by three discrete elements, each the result of a different process. Firstly, in the centre of the oval formation, was the 'scratch', formed by materials which had coalesced during the firing: this ashy conglomeration ranged in texture from soapy and loose to hard and compacted and was generally pink in colour but varied through white to yellow. Secondly, there was an encircling ring of loamy material ranging in colour from black through brown-grey depending upon the quantity of charcoal present. The ring was sometimes lipped, delineating the extent of the fire, and was produced by the burning of the underlying deposits (263) which influenced its colour and composition. An outer clay surround in part flanked the burnt oval. This is interpreted as a denuded wall or lip to the hearth, never more than 0.20 m high, and was traced through successive plans in formats varying from unburnt clay at one end to fired clay 'daub' at the other.

This configuration was repeated continuously and the maximum dimensions of the fire area can be calculated as 2.30 m × 1.18 m without the clay wall, and 2.50 m × 1.18 m with it. Little attempt was made to clean out the hearths and each subsequent fire was in approximately the same position; this explains the slight oscillations in the outline and the variegated deposits forming the perimeter. During the initial occupation of the house shallow pits were dug to contain the fire: these ranged in size from 2.00 m to 2.40 m in length and 1.20 m in width, measurements which are congruent with the above figures. In all respects, save the digging of the pits, the hearths of wick houses 1 and 2 were virtually identical. This difference was only noted with the initial wick house 2 hearths, for as the brine-boiling areas built up the fire-pit was discarded and the clay wall was employed.

The congeries of burnt waste constituted the final component. This consisted of laminations of partially fired clays, charcoal and ash, always soapy in texture, and spread in an arc beyond the hearths.

Most of the residue from the fires was dumped to the E. and S. of the wich house. Some (228) spilled through masking the slats (F11) and sealed the post-pit (45) and the breakwater (F14). This tipping pre-dated the insertion of the ship and is a further pointer to the open style of building. The rest of the waste (278) was used to level up the eroded river channel and in so doing covered up one of the wich house 1 hearths (S9) thus linking the disuse of the early house with the use of the later one.

Lead pans were used to evaporate the brine.<sup>23</sup> Not surprisingly no complete or near-complete lead pans were found, since the scrap metal would have been remelted, but there were enough lead fragments (44 pieces) to postulate the exclusive use of lead pans at this time.

Three stakes skirting two of the hearths (S1, S2) are tentatively interpreted as part of a screen. Although there is insufficient evidence, the concept of partitioning off different activities is reinforced by an examination of the central mainly black zone and the surrounding multi-coloured hearths, whereby no appreciable mixing of the deposits were discerned, and to account for this difference some structure, however lightweight and temporary must be envisaged. Three small posts (PH30-32) were sunk with pits into the earliest brine-boiling accretions. Their interpretation as a stand is based on their eccentric positions and implied relationship with the hearths. Both the screen and the stand have good antecedents in the earlier wich house.

The clay-puddled trough (T2), contiguous to and partly coeval with three of the hearths (S1-3), completed the original furniture of wich house 2. The clay was well trodden and intermixed with much charcoal, daub and loam, and the similarity between T1 and T2 requires no comment. The overlying ship (W6) had obscured much of the detail of the trough and its exact shape was difficult to define, but as excavated it was roughly rectangular, 7.30 m × 1.20 m × 0.15 m minimum. The southern side was more or less straight, but the meander of the northern side was intended to align the trough with posts 39, 40 and 41: a deduction which is examined in greater detail when the arguments for the intrinsic relationship between the ship (W5) and the southern uprights are considered. Finally, the trough should be viewed as a makeshift brine container, thus enabling salt production to proceed before the installation of the ship (W5).

## PERIOD II: PHASE 2 (Figs. 2, 4, and 9)

### *The Building*

During this phase few structural alterations were made, except for the recutting of the central post-holes. The use of clay as a building medium can be seen in the packing for these posts and was first introduced at this time. These sub-circular pits (PH27-29) with battered sides and flat bottom were disproportionately large for the size of the posts (*c.* 0.20 m), all of which had been robbed out. These supports formed the framework for a light partition, the N. limits of which were defined by post-hole 47, likewise employing clay as a packing material. The partition (F12), recorded through several plans, was reconstructed at least twice. Its basic shape was a cross with an additional southerly extension towards the E. This arm comprised a thin clay base, which sealed post-pits 27 and 28, into which several stakes had been set. From the regular distribution of the stakes it was evident that the screen was hung from the larger uprights. The clay, along with one possible stake, was traced for 0.60 m beyond post 28 and may have continued to meet post 29. The section running from N. to S. comprised a burnt wattle and daub loop, a length of decayed wood, possibly planking, unfired and fired daub and was cut by channel 3. The cross, the two halves of which did not actually meet, survived to the E. in mainly unburnt form with only occasional burnt inclusions and to the W. as a disjointed line of red brash-like material demarcating two different deposits. This partitioning bounded a brine-boiling hearth (S1) on one side and

abutted the entrance to the wick house (F10) on the other. Two nearby concentrations of iron nails were discovered to lie parallel to two of the arms. If these belonged to the screen their distribution prompts the suggestion that the collapsed partition once stood to a minimum height of one metre.

The doorway (F10) was similar in shape to that of wick house 1 and consisted of a boat-shaped area of stakes, refurbished with planking. Some of the discarded pieces of wood found in this area might be the collapsed or dismantled door frame. Unfortunately, owing to the presence of sand (148) in this quarter, the stakes had disintegrated to such a degree as to leave just perceptible stains in the ground. Enough remained to deduce that the stakes were of rectangular form (c. 0.10 × 0.04 m) and that the entrance was located midway between the long walls, but marginally eccentric to the central uprights.

### *Inventory*

This phase is largely characterized by the insertion of a hollowed-out tree trunk called a 'ship' (W5: Pl. VI, B). These ships were a repeated feature of the medieval salt works in Wood St and there are unmistakable resemblances in size and position between the two found on site. They were obviously designed for a specific use, that is, as a storage vessel, the word 'ship' for a brine container first occurring in a 17th-century document:<sup>24</sup>

The ship is a long and deep trough that runs along ye side of ye wick house within: to hold brine brought thither by ye troughs without; and they are made so large as to hold brine for four days walling or one kindling.

Transcribing from an earlier 16th-century itinerary, dated pre-1583, James Hall, a reliable 19th-century historian, inserts in parenthesis the word ship for trough.<sup>25</sup> Clay-puddled and clay-lined troughs are also present on site both early and late but unfortunately there are no early documents concerned with the technology and method of manufacture, and it remains ambiguous as to whether the words ship and trough are interchangeable. Despite this, the term 'ship' is used in the text when referring to the hollowed-out tree trunks while clay-lined and clay-puddled troughs are called 'kinches'<sup>26</sup> and 'troughs' respectively.

Ship W5 was made from oak.<sup>27</sup> During the excavation some of the overhanging wood became detached from the main trunk and the brick housing (41) had artificially stepped the sides down in one area. The E. section was extremely desiccated when compared with the rest of the wood, and a short length of up to 0.1 m may have been removed by a modern trench. In the main the ship was in an excellent state of preservation and has been successfully lifted and removed for conservation.<sup>28</sup>

The ship was no small timber and had an external length of 8.30 m and an internal one of 7.80 m. The internal diameters varied from 0.60 m to 0.75 m whilst the external diameters ranged from 0.80 m to 0.95 m. Maximum and minimum depths of 0.40 m and 0.20 m were recorded from the overhang and from the top of the flat squared-off W. end. The ship was on average 0.1 m thick, but ranged from 0.15 m to a few centimetres at the E. end, which was for the first 0.70 m heavily charred. There was probably a gate or blocking at this end, although no trace of this was found.

The ship was encased in a solid bed of clay (C1) so that the whole structure was sunk with its top level with the floor. The lower levels of the clay were fresh and clean, but in the highest levels, although no break could be detected, there was some grey silt lensing and mulching over of the wick house 2 uprights. The ship and the main posts owe their preservation to the impermeable clay. Above this surface the posts had rotted away and some of this discoloration may be attributable to this decay. An alternative suggestion is that there was some later patching up of the clay. Certainly the ship was still in use several centuries after it was installed and it is likely that the clay would need some reparation during this period. The discovery of a medieval floor tile and a leather shoe sealed in the upper levels of the clay add weight to this argument and it is suggested that any modifications took place

some time in the 15th/16th centuries. The clay filled a butt-ended trench some 11 m long which extended westwards beyond wich house 2. It was dug with a near vertical southern side, but accommodated a purpose-built channel (C2) on the N., the outer edge of which was a continuum to the interpreted line of the clay.

The ship was sited E.-W. athwart the southern uprights of wich house 2 and a detailed examination of the plan shows how skilful this engineering was. Three out of four posts were tangential with the ship, which was so positioned that it terminated flush with post 42. The ship stopped just short of post 45, possibly to gain access around the end of the container. The importance of the notched pieces found in the pit fills of posts 43 and 44 is now fully realized and increasing credence can be placed on the second interpretation of the slats F11. The accumulated evidence leaves no doubt that the ship and the wich house were conjoint and that the ship was deliberately and accurately positioned inside and against the long wall of the house.<sup>29</sup> The sequence of events was the construction of the wich house first, with the transplant of the ship occurring very soon after. This statement is further illustrated by the parity in the dates obtained for the ship and the uprights by dendrochronological assay.

Channel 2 was coeval with and adjacent to the ship. It was a rectangular trench (7 m × 0.49 m × 0.80 m max.) filled with what is best described as kiln debris. The deposition of the kiln debris was in a series of tips: in the general *mélange* there was no discernible sequence of tipping, but in one section ten individual tips were identified. The debris consisted of amorphous and extremely rough lumps of crudely fired clay or daub, retaining in some instances the impressions of organic detritus; grass, straw, hair, twigs and possibly wattles. Sometimes the pieces had one flat surface and were up to 0.20 m long, but they were generally smaller and often over 60 mm thick. A large percentage of the debris was extremely decayed with no discernible structure, sometimes fragmenting into a coarse brash. Overlying each tip was a grey silty loam intermixed with quantities of charcoal, much of which was in the form of burnt twigs and branches. Also present in the fill was grass cud and matted cow hair. Some of the impressions in the daub were clearly those of twigs and although some of these were forked, many were straight and of the correct size for wattling. It is impossible to reconstruct a structure of any magnitude from the debris recovered from each tip and one possible explanation for the daub is that it is the dismantled supporting wall or lip around each brine-boiling area: the difference between the kiln debris and the clay was that where the base of the wall was left *in situ*, it was prone to weathering, whereas the kiln debris or upper part of the wall was buried immediately and underwent no further alteration in its structure.

One other similar channel (C3) was uncovered. This was later in the series and was slightly smaller than C2 (5 m × 0.60 m × 0.45 m). It too was parallel to the long axis of the house in close proximity to a hearth and contained appreciable amounts of kiln debris and lesser amounts of charcoal and ash.

Channels 2 and 3 may describe rubbish-pits dug to a specific blueprint and used exclusively for the disposal of the hearth wall. There are other plausible interpretations: it is possible that the ship was originally totally encased in clay. If this clay was dug away and the trench filled, it would explain the unexpected break in the clay outline and in the archaeological record the two events would appear contemporary. One can imagine that the clay would become slippery and dangerous as the brine was transferred from the ship to the lead pans, so the fill of C2 may now be considered as periodic attempts to provide a well-drained surface utilising suitable materials already at hand. Another explanation for these channels is suggested by Jackson<sup>30</sup> who describes how the newly filled salt barrows stood in leach troughs to drain off the excess leach brine. The straight nature of these channels and the fact that the sides and bottom are not heavily burnt favours this argument, although the fill could cancel out this usage. Brackner describes a trough kept close to the ship to contain the scum, which was later sold mixed with all sorts of sweepings as manure.<sup>31</sup> In the final analysis it remains unclear whether the interpretations of these channels are dependant on their shape and position, their fill, or a combination of both and other unexplored factors. As there is no easily determined function, the channels have not been assigned to a particular category.

Brine boiling undoubtedly took place during phase 2, but out of this metre of deposit only 0.20 m can be ascribed with any certainty to this phase: the rest represents a rapid and extensive accretion belonging to phase 1. Interpretation was further hindered by the fact that the diagnostic qualities of each hearth were only well defined in the basal horizons. When the phase 2 deposits were exposed the hearths had merged one with another to produce two distinct swaths of loamy clay recognisable as isolated patches of burning only. Retrospectively it was realized that these formations were in fact the disseminated hearths, but only when a composite plan was drawn up showing the extent of burning in each spit, which illustrated the close spatial relationship of one burning with its predecessor.

The discovery of three oval or D-shaped brashy formations overlying the latest salt-pan deposits reinforces the concept of there being a clay wall to each hearth. The brash is interpreted as the collapsed structure resulting from the final boiling, which under normal circumstances would have been dismantled and the fragments jettisoned into the rubbish-pits. One bowl hearth (H1) filled with ash, remains unallocated, but its position and its size (0.62 × 0.58 × 0.10 m) argue for a function different from brine boiling.

One large pit (P7) (2.90 m × 1.40 m — to the E. section) was dug outside the wick house and was filled with a grey charcoally and ashy loam. It may not be associated with the wick house since it does not seem to be integrated into the well-organized salt works, and may have been dug to provide material for elsewhere. Its only interest lies in that it was sealed by two barrel-pits, BP3 and 4.<sup>32</sup>

## PERIOD II: PHASE 3 (Fig. 5)

### *Inventory*

At some point another ship (W6) was inserted against the realigned N. wall of wick house 2 (Pl. VII, A). This replaced the earlier trough (T2) and was itself replaced by a kinch (T4). The ship was in an extremely decayed state when excavated and only the vestigial imprint of the wood remained. The disintegration of the wood must be related to the fact that this ship, unlike W5, was not encased in a clay bed. The N. edge was charred, especially at its E. end, and a round hole was recorded in the bottom of the W. end. In contrast to W5 the E. end was squared off. There is some support for piecemeal refurbishment in the form of planking, particularly along the discontinuous southern side.

### *The Building*

Wick house 2 was possibly partially rebuilt at this time, although the evidence is tenuous. W6 lay over some of the original posts of the wick house. One post-stub (PH40) was buried by W6 and the posts either side (PH39 and 41) were sawn off below the level of the surviving post-pits. Posts 37 and 38 stood to a greater height because they were positioned beyond the confines of W6.

Several clay-filled features, continuing an established practice, along with some timber fragments may be considered as the evidence for the rebuilt wall. Post-hole 47, which was first dug in phase 2, was directly in line with a sub-rectangular clay plug, possibly a post-pit base (PH48) and a shallow channel (C4). These are tentatively seen as the slight remains of post-pits and bedding trenches. The distance between the two posts was just over 6 m, but quite substantial timber fragments either side of the two posts and close to the bedding trench might be interpreted as dug-up posts lying near to their original positions. If this hypothesis is correct one might envisage at least four uprights at 3 m intervals. There was no sign of any such activity along the S. wall, but the clay bed (C1) would have provided a suitable base for the posts. The straddle of stakes embedded in and around the clay bed may represent a wall screen (F16).

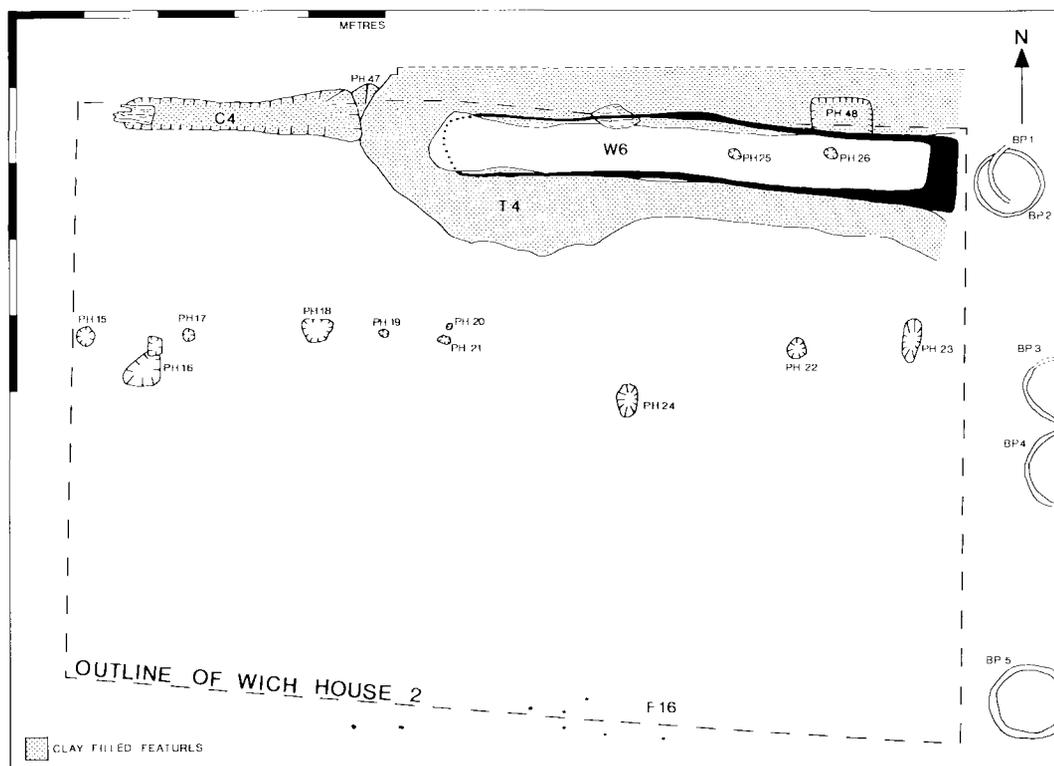


FIG. 5

Plan of wick house 2 at period II/3-4

## PERIOD II: PHASE 2/3

*Inventory*

Seven barrels were placed in a row orthogonally to the two ships. They were deliberately set below ground level<sup>33</sup> and from the documentary evidence<sup>34</sup> there are parallels for the use of barrels for brine storage. They may or may not be contemporaneous with the ships and there is some doubt as to whether they were even in use at the same time, because the limited dating evidence fixes the period of the abandonment of the salt works rather than its occupation. All were filled with a blue-grey silt into which some rake-out had washed in.

Owing to deep 19th-century activity along the E. edge of the excavation, the barrels were found in various incomplete states. Two of the barrels (BP1 and 4) were represented only as segments of the original, whereas BP3 was only traced as a circular shadow. In the case of barrel 6, at least two thirds of the total height was removed by levelling so that only the bottom 0.25 m remained. Barrel 5 stood to virtually its full height. Here, and to a lesser degree in barrels 1, 3 and 4 the cooper's bands around the sides and the planked bottom were evident. Barrel pit 5 was 0.79 m deep with a maximum diameter of 0.90 m and an estimated cubic capacity of 0.55 m<sup>3</sup> (the imperial measurement being 97.98 gallons). Although the others survived in vestigial form only, they appeared to be of similar size and capacity.

Three potential types can be identified: those with a definite clay lining (BP4, 6, 7); those utilizing a pre-existing clay bed (BP1, 5) and those with no associated clay surround and only defined by a thin brown wood stain (BP2, 3). How much credence can be placed in the later

examples is questionable, since they were almost completely obliterated. Whether there is any evolution of types or whether the different types served different functions is also open to speculation,<sup>35</sup> but BP1 was demonstrably the latest as it replaced BP2 and was cut into the clay bed (T4). On this inference barrel 5 could be coeval with barrel 1, since their positioning central to the line of the containers was surely deliberate. More important than the chronology of the barrels is their location outside the wick house. Whilst barrels 1–5 clearly belong to wick house 2, barrels 6 and 7 are not so easy to allocate. They might represent encroachments by the wick house 2 tenants, or alternatively be the only remains of another salt-working site, built over the still demarcated wick house 1 plot.

#### PERIOD II: PHASE 4 (Fig. 5)

##### *The Building*

Belonging to this phase are several post- and stake-holes (PH15–24) some with surviving post-pipes, forming an erratic E.–W. line across the excavation. They were not necessarily all related, or all proven to be stake-holes, but have been grouped together because of their alignment and because of similarities in the post-pit fills. The flimsy uprights represented by the stakes and posts would only have supported a light-weight structure, possibly a replacement for an earlier partition. Only three finds were recovered *in toto* from these pits. Two further posts (PH25–26), also with a gravelly pit fill, were cut into the earlier abandoned trough (T4).

This trough was a clay-lined kinch some 8 m long and was positioned E.–W., replacing W6 as a brine container. The clay bed was 2.00 m deep and 1.00 m thick and the similarity in the size of this and the clay around W5 is self evident. The internal trough was smaller, being some 7 m long, 0.70 m wide and 0.30 m deep, with a vertical S. edge, but stepped N. edge. On excavation, T4 contained a mixture of coke, ash, clinker, charcoal and sand, with the sand concentrated in the N. This fill was different in character from that of earlier brine containers or pits where ash and daub were preponderant. If it is industrial residue from salt working, it represents a change in firing techniques and fuels. Since freshly dug clay was used for the bed, finds were minimal, but a date in the 15th/16th century is acceptable for the laying down of the clay and initial use. The clay was stained yellow-green at infrequent intervals along the ledge and on site this chemical reaction occurred when the clay came into contact with organic deposits, especially wood. Traces of extremely decayed wood remained against the N. side, the line and angle of which suggested that T4 originally had planked or wooden sides. It is evident that the clay mass was disproportionate for the size of the trough and prompts the notion that it was initially designed for a ship, which for some reason was never inserted.

##### *Wick House 2: The Conclusion*

The fill of the ship W5 reflected both its infilling and its disuse. It included rake-out from the hearths, a multi-coloured conglomerate of burnt clay, charcoal and ash, and natural silting consisting of a grey peaty organic deposit with many twigs, some with diameters of 30–40 mm, but generally smaller, with some large pieces of wood. At the time of its abandonment wooden cross spars, of unknown function, divided the trunk into unequally-sized compartments. Pottery and leather recovered from the uppermost silts date the abandonment to the end of the 15th/beginning of the 16th centuries, but two shoes L1A and L1B seem to have been thrown in as an afterthought possibly as late as the 17th century. The pottery formed a unified group belonging to the 'Midland Purple' tradition.

Two tygs were found in W6 and T4, whilst the disuse of barrel 5 is dated by a Cistercian type cup. There were no other finds from sealed contexts. Whilst it is understood that neither the use nor the disuse of the barrels is necessarily contemporaneous, the final decline of the wick house is dated by implication to broadly the same period, that is in the late 16th century

and certainly before the general usage of the clay tobacco pipe, which is generally reckoned to be from *c.* 1610.

These few finds complete the assemblage and post-date the original occupation of the salt house by several hundred years and present a lacuna in the archaeological record. Either the salt works continued through to the 16th century, an idea for which there is little corroborative evidence in the form of artefacts or additional equipment, or there was a hiatus between the active salt industry in the 12th/14th centuries and its final dispersal.

There is evidence that the ultimate wick house 2 was partially burnt down. This is seen in a rough quadrilateral of burnt clays and loams (43, 45, 46 in part, 108, 111) spread generally to the W. of the N. arm of the partition F12. Two points are interesting: firstly no brine-boiling hearths were sited W. of this partition and therefore any burnt deposits represent one collapse and burning rather than successive brine-boiling accretions; secondly the outline of this rectangular area, taken with the entrance F10, can be juxtaposed with the butt end of wick house 1 and so by analogy may also have been used for drying the newly stoved salt.

One should consider whether the burning down of the W. end acted as a catalyst for the abandonment of the salt house or whether the overall desuetude, as evidenced by the rotting of the southern uprights, the silting-up of the brine tanks and the collapse of the partition, were symptomatic of an already moribund industry. The general absence of finds, coupled with the 19th-century disturbances, has left these questions unresolved.

To summarize, phases 1-4 saw the zenith and demise of wick house 2. The building was modified with later use, but each successive activity was carried out in prescribed quarters, and ships or troughs, barrels and brine-boiling hearths continued as essential equipment from the 12th to 16th century.

## DISCUSSION

Evaporation tanks or brine troughs are a standard piece of equipment on both inland and seawater sites of all periods and are usually clay-lined or clay-puddled. Of the few examples known oval<sup>36</sup> and rectangular troughs<sup>37</sup> are the norm in the medieval period, replacing square or circular ones.<sup>38</sup> The shape of the seawater troughs may have been dictated by natural rather than artificial restrictions and the three clay troughs in Wood St would fit into any of the above descriptions. Where Nantwich differs is in the adoption of a specially manufactured wooden container, 'the ship', in place of the trough and it is not apparent where this innovation came from or why.<sup>39</sup> At present the ship is a unique discovery in Cheshire, if not in Britain. Wood is used in tanks for various purposes; for instance at Roman Droitwich stakes set against the face of the tank prevented the erosion of the clay<sup>40</sup> and brine pits were frequently wood-lined for the same reason. A large timber board in pit 2 at Middlewich is interpreted as a removable cover.<sup>41</sup> Devices to aid the filtering of the brine, consisting of hazel twigs<sup>42</sup> or a raft of timbers and branches,<sup>43</sup> have been recorded at both brine and seawater sites. In Lancashire in recent times wooden troughs with holes bored in the bottom were lined with peat, straw and rushes to facilitate filtering.<sup>44</sup> The arrival of the ship may have been a direct response to any of these factors, and the certain advantage of the ship over the trough was that it was an efficient sedimentation tank, where loss of brine was minimal, a container easily cleaned out, requiring little or no maintenance and one which was virtually indestructible.

From an economic aspect, it is not inconceivable that the ship provided a very practical means of controlling the amount of salt produced at any one boiling by the simple expedient of regulating the brine distributed to a wich house. This could be effected without difficulty if the brine container was made to a standard size. This rationalization is clearly illustrated when the two ships are compared with each other and with the brine troughs (Fig. 6). It is noticeable that there was only one brine container in use at any one time, and generally the siting of the troughs alternated from one side of the building to the other. It is difficult to see why the ship W6 was installed, as W5 was still functioning and in good condition. The explanation may lie in the practice of subletting half a wich house, whereby both tenants shared the same building.<sup>45</sup>

The brine-boiling areas were essentially very simple hearths. Potentially analogous hearths were uncovered at Roman Middlewich and the Romano-British saltern at Cliffe, Kent.<sup>46</sup> Both have the surrounding clay wall and in the later example the fire shifted with each boiling. Details of the encircling wall construction bear strong resemblances to that in the prehistoric salt mound at Red Hills, Peldon,

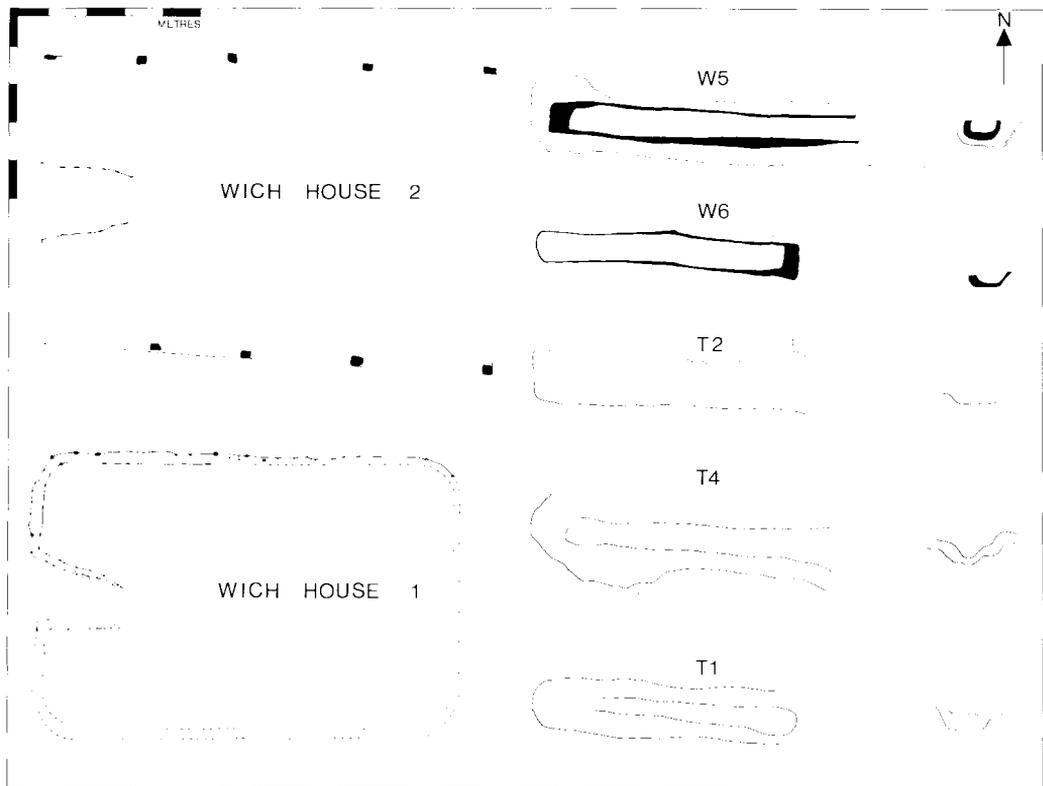


FIG. 6

Outline plans of wich houses 1 and 2 and their associated brine containers

Essex<sup>47</sup> and to those found in the prehistoric sites on the Lincolnshire coast.<sup>48</sup> The recurrence of this type of primitive hearth illustrates that there was no need for an elaborate superstructure or kiln in salt boiling.

The magnitude of the mound from the waste is greater in the salterns because of the need to leach out the sand and the bitter salts, but the pattern formed is essentially the same with both inland and seawater sites, with the hearth at one side and the tips to the other. At the medieval saltern at Bicker Haven the tipping from the salt panning, consisting of ash, clay and peat<sup>49</sup> is comparable to Nantwich, reinforcing the view that the open pan process was equally well developed in both localities. One interesting issue has been resolved. In 1978 excavations were conducted behind the Crown Hotel, Nantwich, and a tip consisting of alternate bands of charcoal and partially fired clays was recognized as being of industrial origin,<sup>50</sup> but it was unclear which type of industry produced such waste. It now seems fairly certain that it is salt waste and as such is a verification of salt working in the Waterlode area in the 11th or 12th centuries.

The compartmentalization of the building for different activities was inherent in wich house 1 and presaged the development of the later wich house. Both production and storage of salt were polarized in separate parts of the building, with the W. end reserved for the final commodity and the E. end concerned with its manufacture. Each activity was prescribed not only as to its location, but also with regard to its relation with other industrial processes, resulting in a close interdependence between the building and its equipment, whereby the salt industry was streamlined and highly structured for maximum efficiency.

The paradigm of the salt house was surely founded in a long tradition, perhaps originating with the earliest brine exploitation, but almost certainly present by the time of Domesday, and as such can be surmised from the regulations contained within the survey.<sup>51</sup> Inevitably documentation is largely lacking for the interim period, but in later accounts about the salt of Nantwich the emphasis is on the standardization and regimentation of the industry.<sup>52</sup> The division of a wich house is alluded to by Georgius Agricola who wrote a survey on contemporary industrial techniques early in the 16th century<sup>53</sup> and describes how the boiling sheds were partitioned into three sections, a store, a drying room and a boiling room, a building not dissimilar to that in Wood St.

If wich house 1 represents half of a complete wich house, the dimensions of the two houses excavated are in close agreement. This means that a medieval wich house in Nantwich was between 10–12 m long and 8 m wide and implicit in this is a uniformity and consistency in design if not in execution (Fig. 6). These wich houses are the only two known to the author in Britain, and although not a valid sample, nevertheless justify a generalization. With this proviso it is envisaged that the wich house was built to a master plan as a standardized unit in the ratio of 3:2 with a regulated space allotted to each discrete industrial process. It may be anticipated that results from future inland medieval salt works will be commensurate with Wood St.

From the constructional details in wich house 1, it is only possible to suggest that the W. end or drying room was roofed over, probably with thatch or a network of

overlapping hurdles. This roofing was secured with grass or straw ropes, of which one fragment (CN210) is an example.<sup>54</sup> The additional wall panels<sup>55</sup> beyond delineated the production quarter and acted at minimum as a windbreak. Although there is little corroboration, a lean-to or light roof has been included in the reconstruction. This reconstruction is suggested by the position of the ship in the later wick house, and, by implication, the trough is thought to have been under cover. At best the roof was probably a makeshift affair, providing some, but not necessarily a complete, cover. If the only purpose of the roofing was to exclude the worst of the weather, to ensure that the fires were not doused or the brine diluted, then a fully waterproof surface was not critical.

Although rectangular structures have a long ancestry<sup>56</sup> there are certain unequivocal traits in wick house 1 which require closer examination. The use of flat sails is noticeably rare,<sup>57</sup> but the addition of larger reinforcing stakes, employed as corner posts or set in or behind the fence line, are more common.<sup>58</sup> However, the

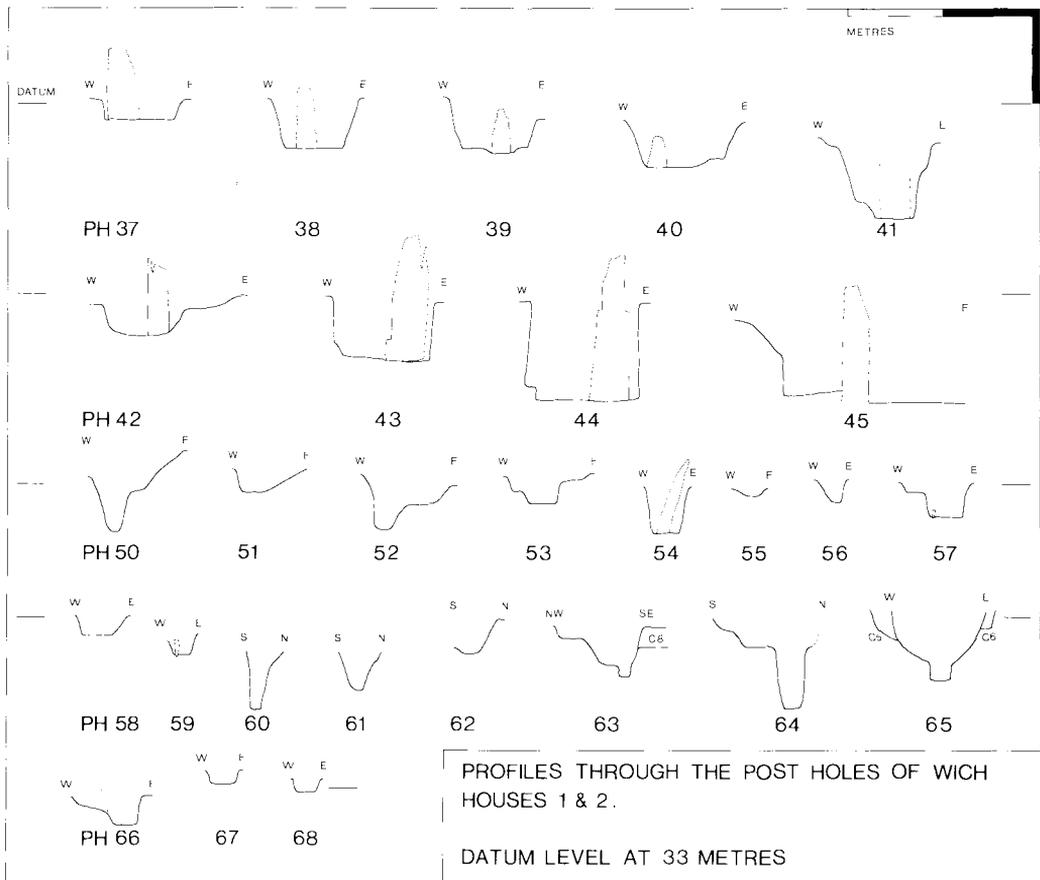


FIG. 7

Profiles through major post-holes of wick houses 1 and 2

most salient feature is the cavity wall construction. Several houses *c.* 4.6 × 5.1 m using the cavity wall have been recorded at Dublin,<sup>59</sup> although there the inner stakes are round and there are more elaborate arrangements for the doorway. This type of wall, referred to in the Irish literature,<sup>60</sup> might tentatively be postulated for some of the structures at King's Lynn and Durham,<sup>61</sup> and in the latter case there may also be a door of similar format to that of wick houses 1 and 2. Carver has pointed out that the standard width for buildings in Durham and Dublin is 4.6 m giving a tenement width of 5.02 m;<sup>62</sup> a tenement width for the industrial building in Nantwich is nearly twice this size (estimated at 9.2 m). Despite the insubstantial appearance of wick house 1, it nevertheless embodies a combination of structural elements, all of which are individually present in 9th- and 10th-century horizons, and which when used together increase the stability and rigidity of the building (Fig. 8). Finally when all these traits are encountered, the buildings themselves are of low socio-economic standing. Thus wick house 1 is viewed as a late survival derived from an earlier peasant building tradition.

Wick house 2 is by its nature easier to reconstruct (Fig. 9). The uprights would have been capable of withstanding the load of an upper storey, but considering the general absence of domestic refuse, the fire hazard, the smoke-filled atmosphere and the insalubrious conditions, this appears unlikely. Owing to the absence of excavated examples, one is compelled to compare the ground plan and extant timbers with the few known illustrations and descriptions,<sup>63</sup> taken by necessity from widely disparate sources. Agricola<sup>64</sup> depicts the sheds with back and side walls, but remaining entirely open at the front and describes the walls as being made from baked earth or from wickerwork covered with mud. The over-riding impression from all these sources is of a one-storey barn-like building.

The reconstruction allows for an entrance and a closed gable end on to the street, with the wall panels, by analogy with the inner wall of wick house 1, continuing as far as the ship and the brine boiling hearths.<sup>65</sup>

Wick house 2, with its post-in-hole method of construction, represents by 1200 an archaic form of building, ostensibly deriving from a different tradition to that employed in wick house 1 and, as Rahtz has emphasized, this technique is only found in major buildings.<sup>66</sup> The late re-emergence of the post-hole building is not unknown. At North Elmham, building A is of particular interest with the funnel doorway and irregularly spaced posts.<sup>67</sup> However, the span of the building, the digging of large and deep post-pits and the irregular pairing of the posts, together with the position of the doorway, are traits more closely paralleled in the 10th- and 11th-century halls at Cheddar<sup>68</sup> and it is the incidence of these elements in the wick house which suggest that the design for its construction originated with such large spacious buildings, rather than from the typical long-house or buildings with closely set irregularly spaced post-holes.<sup>69</sup>

The disposition of the two wick houses fronting Wood St and following the line of the R. Weaver and their identical internal arrangements argues for a planned industrial quarter separated from the urban centre. The idea of occupational zoning within towns is now well attested<sup>70</sup> and it is no surprise that trades comparable with salt production because of their water requirements, such as tanning and dyeing, are

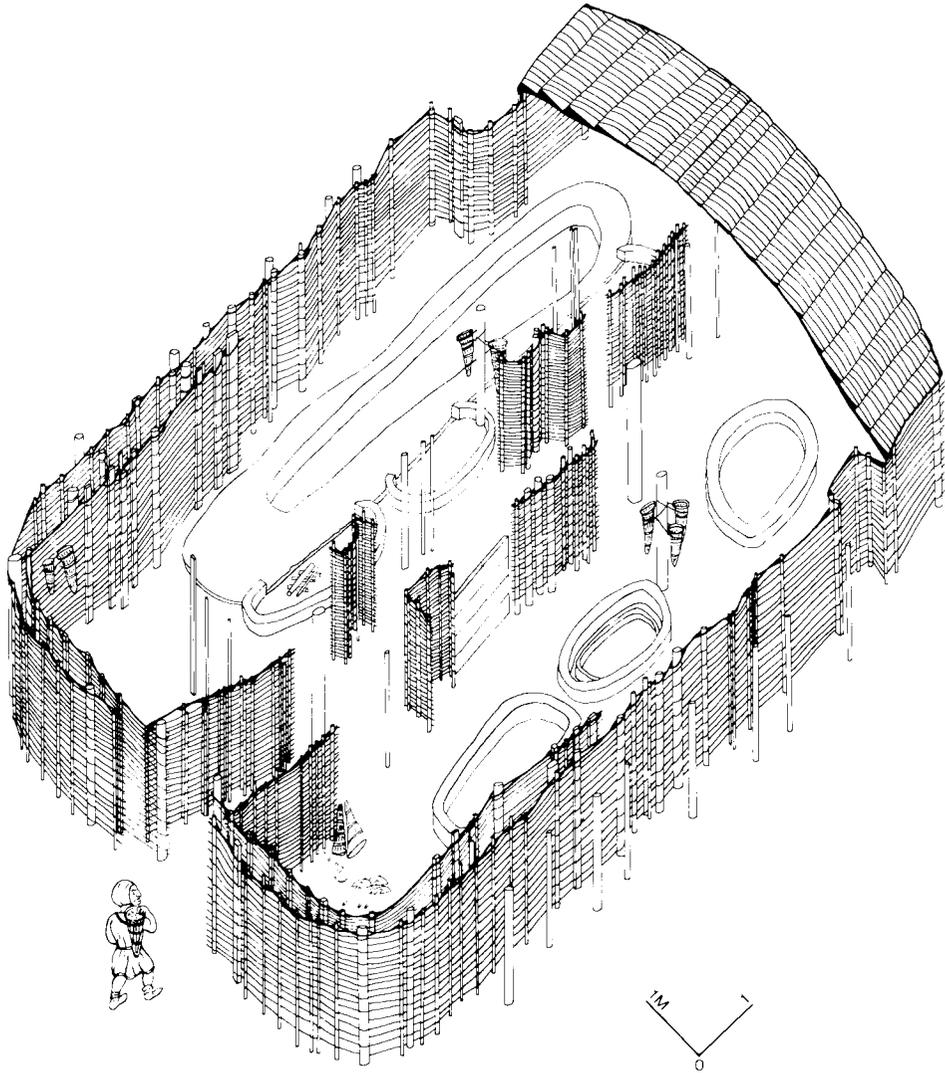


FIG. 8  
Reconstruction of wick house 1

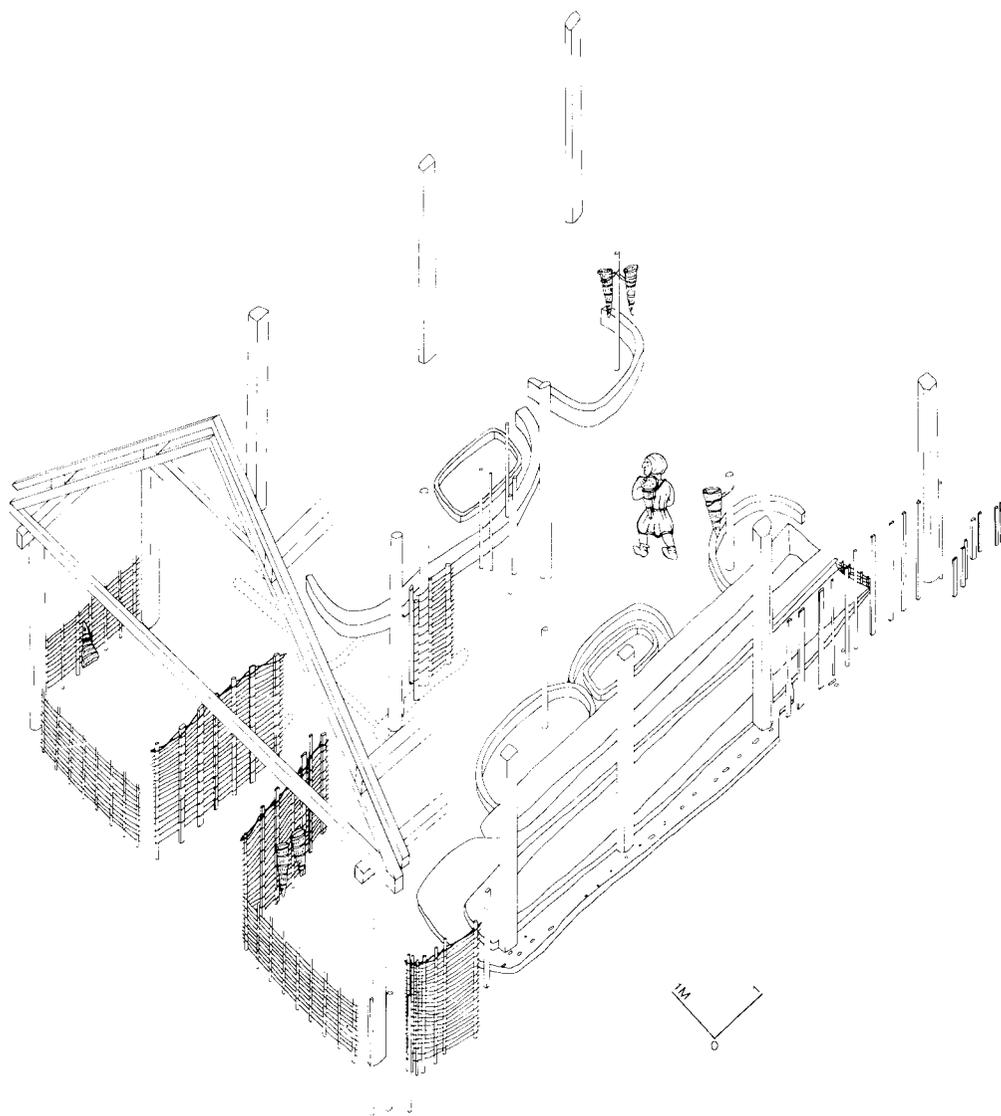


FIG. 9  
Reconstruction of wick house 2

found in riverside locations. What is interesting about Wood St is that the buildings were totally industrial, with seemingly no residential use. The 11th-century and later dye workshops in Winchester, Bristol and Norwich<sup>71</sup> and the 10th-/12th-century tannery at Ousegate, York<sup>72</sup> are examples of industrial premises, but in these centres the industrial use of the building was not always divorced from its domestic use. In Nantwich, once land was recognized as 'walling land', that is an area where salt boiling occurred,<sup>73</sup> there was no change in its use until the decline of the industry. In Wood St this change is seen with the appearance of domestic rubbish-pits and gardens, dug or laid out with total disregard for the wick house plot, whose main characteristic was the insulation of all activities, and in Snow Hill the complete loss of the early street pattern is evidence of the same.<sup>74</sup> If the two wick houses and probably wick house 3 (see p. 50) typify industrial planning, one suspects that where land was at such a premium, there would have been a dense pattern of workshops in the key riverside localities, a proposition extremely difficult to substantiate. When the known and putative salt houses are plotted for the 12th century, the hypothetical estate covers 6% of the town.<sup>75</sup> This calculation is based on the minimum figure of nineteen houses and uses the 12 × 8 m unit as a constant factor. It can be broken down in the following fashion: five houses in Snowhill and two in Wood St owned by Combermere, Wenlock Abbey and the hospital of St Nicholas, and possibly another in Pepper St,<sup>76</sup> giving a total of eight recorded wick houses. To this number can be added the two excavated examples in Wood St and the waste tips of another in Waterlode,<sup>77</sup> plus the eight mentioned in Domesday,<sup>78</sup> which are assumed to have continued production into the 12th century. Tentative figures for the 11th and 13th centuries are equally meagre, 24 and 12 respectively, but give a similar ratio when plotted out.

Such examples are unrealistically low. At the other extreme are numbers seemingly too high. In late medieval manuscripts the customary number of salt properties is given as 216 with six leads in each.<sup>79</sup> Mention is made of 200 houses in 1583, with all but one destroyed by fire, although this figure is discounted by Hall.<sup>80</sup> In a lease of 1624<sup>81</sup> a total of 116 houses can be plotted, 34 of these being in Wood St. In 1636, Henry, the fifth earl of Huntingdon, on a visit wrote that there were about 55 salt houses in the town.<sup>82</sup> Since these counts are secure only after 1500 any assessment about the industrial enclave must be readjusted to account for the post-medieval expansion<sup>83</sup> and interestingly the growth in the size of the town is complimented by a corresponding drop in the area covered by salt working, denoting not a decline in the industry but increasing limitations of its area. Projecting the Earl of Huntingdon's 55 wick houses on to the 12th-century map gives a 15% coverage. However, the 1624 lease may provide a pointer as to how a reasonable analysis can be obtained, as it presents a breakdown of the number of houses in each quarter. The only way to order the 34 houses enumerated in the census for Wood St is to arrange them lying E. to W. either side of the street. If the grid pattern is repeated in Snow Hill<sup>84</sup> then the salt industry in the 17th century assumes a central position, occupying 5% of Nantwich. When the same computations are made for the 12th century, the result is even more impressive, giving a 30% coverage, and although this interpretation is circumspect, it gives a more balanced

picture, one approaching the presumed layout, concentration and pattern of wich houses typical of the zenith of the salt industry. In 1306, 65 salt houses in Northwich were destroyed by fire.<sup>85</sup> As Nantwich was reputedly the most important of the three wiches in the 14th century, it is realistic to postulate an even higher number of salt houses for the town and an equivalent number at least for the preceding two centuries. Inaccuracies in these assessments could derive in the first instance from the underestimation of the possible number of salt houses and in the second from the assumption that the wich house was a constant size. However, what is under consideration is the relative density rather than individual numbers of wich houses and the percentage can be used in the context of measuring the importance attached to salt production in Nantwich.

Mr J. Oxley has convincingly argued that Nantwich met five of the criteria necessary for urban status,<sup>86</sup> a view which is contrary to the earlier opinion that it was a 'manufacturing enclave'.<sup>87</sup> Archaeologically the evidence is equivocal: one can show that the salt houses occupied demarcated and well defined zones and that the markets and domiciles developed around and alongside these insulae, i.e. there was a strong industrial nucleus. Oxley and others<sup>88</sup> have pointed out that whereas there are no residents mentioned in 1086, by the 1130s people are described as burgesses, suggesting that Nantwich was urbanized. The true description of Nantwich must lie somewhere between these two viewpoints, as neither could exist without the other. There is, in the author's opinion, some weight in believing that the urban status was almost entirely fostered by the salt extraction and that the town developed in response to its efficient organization.

Unfortunately, wich house 1 is dated solely by its finds, most of which come from robbed features or general spreads. The position as regards wich house 2 is immeasurably better: three of the post-pits contained sealed artefact groups, and samples from four of the posts were submitted for tree-ring dating, so an opportunity has arisen to evaluate two independent dating media. The value of the dendrochronological assay lies in the concomitance of the results, both for the last recorded tree-ring and for the estimated felling dates. As Dr Leggett and Dr Hughes have pointed out, all the trees are likely to have been cut down within a short period of time. Whilst the felling dates are not in dispute, the date for the construction of the wich house is debatable, being dependent on the dating of the artefacts recovered from the post-pits. The underlying assumption is the belief that the dates for the felling of the trees, the construction of the house and the insertion of the ship are related, if not interchangeable, and that there is no appreciable interval between the three events and consequently the finds and the building are closely dated to the last quarter of the 12th century. Some reservations about accepting a 12th-century date do remain, since the pottery alone without the tree-ring dates would previously have dated the construction of the building to the 13th century. There are no indications that the pits were re-dug or cleaned out, enabling 13th-century finds to fall into the open holes, so other possibilities must be aired. There is little likelihood that the wood was seasoned, or left lying around once felled for a considerable period of time.<sup>89</sup> Once the ship W<sub>5</sub> was installed it would rapidly become impregnated or pickled with brine, rendering any seasoning obsolete. Re-use of timbers remains the

only alternative. Some of the uprights were stepped and are questionably examples of reshaping the wood in the 13th/14th centuries, but the same cannot be said for the ship as it was patently tailor-made to fit the wick house. The chances of selecting such a uniform group of timbers at random are extremely slight, unless they came from an earlier wick house, but again it is unacceptable that a bulky and delicate item such as a ship would be transferred from one salt house to another. In the final analysis one must accept with some caution that the building, the ship and the finds are effectively contemporary. If this statement is valid it has implications for pottery studies and the subsequent somewhat earlier dating of sites in NW. Britain.

Artefacts associated with the early occupation of wick houses 1 and 2 belong to the period 1150–1300, but those few finds dating the stagnation and eventual decline belong to a different and later tradition, so there is a period of at least 100 years not significantly represented. The conclusion about the disparity in dates remains open-ended, for either there is a hiatus in the industrial occupation with later and unrelated activity, or the works continued to manufacture salt without a break for several hundred years. In support of the former view is the absence of any salt-boiling accumulations post-dating the main tenancy (Per. II: Ph. 2). On the other hand there is enough circumstantial evidence for some late reparation, from which some continuity in use might be inferred.

On balance, it is argued that there was a shift in the production of salt from wick house 2 to another unrecorded wick house, but the building continued in intermittent use for the next few centuries and was finally closed down in the 16th century. Certainly after Period II, Phase 2 there was no massive rebuilding and any additions and subsequent modifications such as W6, T4 and F16 were far inferior to their predecessors. Such piecemeal activity supports the theory of refurbishment as and when the exigency arose and explains the rarity of later finds.

From the documentation the decline of the salt industry in Nantwich is apparent from the 18th century onwards, initiated by the discovery in 1670 of rock salt at Marbury, Northwich and concluding with the last surviving salt works closing down in 1856.<sup>90</sup> When the excavation results are considered two quiescent periods are noticed. The first, dated by the silting up of the ship W5 in the late 15th/early 16th century, agrees with a recession noted by Oxley in his research,<sup>91</sup> the causation of which is not yet fully understood but is perhaps attributable to a weakening of the brine, which made it harder to extract, and a shrinkage of the woodlands necessary for the fuel. There is a slight revival after this, not lasting for more than 50 years and the Wood St salt houses were finally abandoned by the end of the 16th century.

The occupation of Wood St shows a secondary expansion of the industry across the river from its primary site on Snow Hill. As there was no sign of any earlier activity on the site, the wick houses mentioned in Domesday and the Saxon settlement will be found on the E. side of the R. Weaver. As discussed above, the two wick houses are dated to the late 12th century with tenancy continuing until the 16th. Finally it is worth remembering that such items as salt rakes, barrows and six lead pans are mentioned by Camden in 1590, and the ship is first described in 1669, yet this furniture is recorded on site in 12th- and 13th-century contexts. This

emphasis on traditional methods and lack of technological innovations is one of the hallmarks of the salt industry in Nantwich and elsewhere and this fossilization was, at least in part, symptomatic of the final decline. More salt works of all periods need to be excavated, if only to confirm some of the ideas presented in this paper and to enable Nantwich to be studied in relation to other production centres.

## ENVIRONMENTAL AND ARTEFACTUAL EVIDENCE

### TREE-RING DATING OF THE TIMBERS. By M. K. HUGHES and P. A. LEGGETT

Eight oak timbers from the excavation were sampled as transverse slices. These were prepared, measured and cross-dated.<sup>92</sup> The series of ring-widths for each timber was compared with the absolutely dated 401-year Nantwich master chronology. It was possible to date five of the timbers, from wich house 2 and ship W<sub>5</sub>, with confidence (Table 1) but no date could be given for the other three. We believe this to result from bands of very narrow, scarcely measurable rings in these three samples. The last measured ring in each of the five dated timbers fell within the period A.D. 1140–1170 whilst the *estimated* felling dates were in the period A.D. 1177–1191. These are based on the actual heartwood/sapwood boundary being present in three timbers (Table 1). Since the felling dates are statistical estimates it is quite possible that all five dated timbers came from trees felled within a very short period.

These five samples will strengthen the early part of the Nantwich chronology and extend it back from A.D. 930 to 901 (Fig. 10). The samples for identification (A<sub>13</sub>.W<sub>92</sub> and A<sub>9</sub>.W<sub>128</sub>) contained eight pieces of young hazel stem.

TABLE 1  
TIMBERS DATED

Sample	Nantwich number	Number of rings <sup>a</sup>	't' value with Master <sup>b</sup>	Actual last year <sup>c</sup>	Estimated felling date <sup>d</sup>
LP676	W27 (PH 42)	253	4.65	1153	1183*
LP678	W28 (PH 43)	237	5.72	1142	1172
LP679	W79 (PH 39)	184	7.69	1159	1189*
LP682	W78 (PH 38)	202	7.59	1153	1177
LP683	W5	95	7.68	1166	1191
Nan <sub>5</sub> (Mean of these five)		266	9.25		

- (a) The numbers of rings actually measured.  
 (b) The 't' statistic gives an indication of the quality of match between the ring-width series and the Nantwich Master. All the values here are highly significant statistically.  
 (c) This is not an estimate. It is the absolute date of the last measurable ring on this sample.  
 (d) This is an estimate. In the case of those timbers asterisked\* no sapwood was present and it has been assumed that the last ring measured was the last heartwood ring formed. In the case of the other three samples the heartwood/sapwood boundary was present. A sapwood allowance of 30 rings is made with 95% confidence limits of 19 and 50.<sup>93</sup> For example, in LP682 the last heartwood year was A.D. 1147, the mean estimated felling date was 1177. There is only a one in twenty chance of the true felling date being before 1166 or after 1197.

## NANTWICH TIMBERS

Nantwich master chronology (only 930-1170 shown)

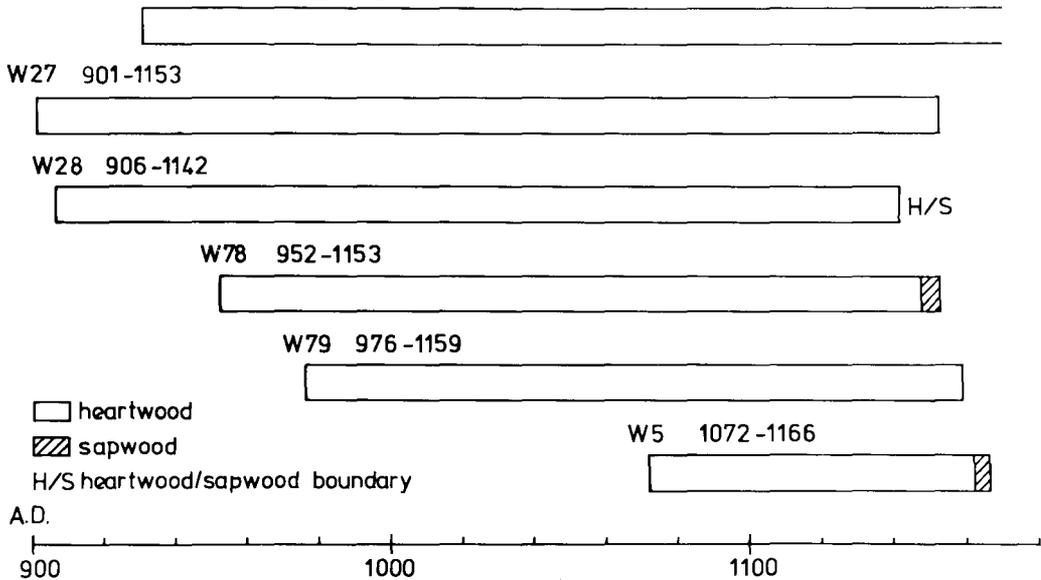


FIG. 10  
Nantwich Master Chronology

THE MEDIEVAL POTTERY. By VICTORIA NAILOR

A total of 3,703 sherds, weighing 65 kilograms, with an estimated minimum number of 264 vessels and maximum of 503, was recovered. Although from an industrial site, the pottery was similar to that from a domestic assemblage. The pottery probably represents material in use during intermittent salt production, rather than permanent occupation of the wick houses themselves. No firm evidence was provided by the vessel shape or internal residue to suggest the use of pottery containers during part or all of the salt-making process.<sup>94</sup>

The range of forms and fabrics from the excavation is similar to material from other excavated sites in Nantwich.<sup>95</sup> Most of the cooking-pots or storage vessels are reduced sandy wares. From the material which can be paralleled to known production centres, it is noticeable that there are several sources for the pottery coming into Nantwich in the medieval period.<sup>96</sup> The majority of the more exotic material seems to have a southern or eastern England origin. However, the variations in fabric and form also indicate a number of different local sources of production. Salt production may have increased the importance of Nantwich as a local marketing centre, while the trade in salt could have led to the incidental introduction of pottery from outside the area. Few of the pottery types found in Nantwich can, as yet, be paralleled with those from the known local kiln sites at Audlem, Ashton, and the recently discovered site near Tarporley. Some material can be paralleled with that from the Sneyd Green kiln, Stoke-on-Trent.

The reduced sandy wares are the dominant type of pottery. From the late 12th century there are small but increasing amounts of light-bodied wares present in the pottery groups. These light-bodied wares have a number of sources.<sup>97</sup> By the late medieval period, there is an increasing dominance of heavily quartz-tempered light-bodied wares. This dominance declines with the introduction of 'Midland Purple' types in the 15th century.

In terms of dating, the pottery from Wood St falls within two distinct categories: a short period associated with the construction and early use of wick houses 1 and 2, and a more general accumulation of pottery covering a longer time period in the area outside wick house 2. The early period of activity is associated with a good series of dendrochronological dates, but the longer period has no associated dating evidence. Only the well dated period of activity on the site is recorded in detail.

*The Period of Construction and Use of Wick House 1: Period I: Phase 1 and 2*

Although a relatively small quantity of pottery was recovered from wick house 1, a reasonably large number of vessels was represented (minimum vessels 11, maximum vessels 41). Some of this material is intrusive as it was discovered in some of the robbed-out post-holes.

The pottery found in wick house 1 is typical of the material found elsewhere in Nantwich. The only exception is the occurrence of a calcite-(shell-) gritted sagging jar base, a tradition previously unknown in the town. A possible eastern England origin is suggested for this vessel. The majority of the pottery is similar to the pottery associated with the early period of activity of wick house 2.

The lack of pottery within wick house 1 may indicate that the structure was not occupied on a permanent basis, and certainly the construction of the building suggests a temporary structure. Owing to the nature of the salt-making industry it was unlikely to provide an attractive prospect for permanent habitation.<sup>98</sup> Evidence suggests a short time span between the destruction of wick house 1 and the construction of wick house 2. As the construction of the second wick house is dated by dendrochronological assay to 1180–90, wick house 1 probably dates to the third quarter of the 12th century.<sup>99</sup>

*The Construction and Early Phase of Activity of Wick House 2: Period II: Phases 1 and 2*

Pottery associated with this phase of activity in wick house 2 was found from three different groups: in deposits immediately preceding the building of wick house 2, in the post-holes of the wick house, and from a series of tips outside the wick house.<sup>100</sup>

A quantity of pottery was found from the post-holes of wick house 2 and this pottery must be considered in conjunction with the series of dendrochronological dates obtained from the remains of the massive post supports. These dates fell within the last quarter of the 12th century. A number of jugs was discovered in the sealed post-holes. These reflect a variety in the actual size of the jugs, but an overall similarity in shape, being squat, ovoid forms with short necks (Fig. 13, nos. 30, 40). A number of decorative techniques occurs including incised horizontal lines (Figs. 12, 13, nos. 21, 30) and more individual designs (Fig. 13, no. 28).

The date of the pottery from the deposit immediately preceding the construction of the wick house is suggested as the third quarter of the 12th century, the construction date of the house as c. 1180–90, and the early phase of use of the building as c. 1190–1220.

Pottery from the deposits immediately preceding the building of wick house 2 (201) had similar material to the other two groups. Three vessels, however, are of particular interest: there is an unusual form with a flanged rim, in a coarse white fabric with spots of yellow glaze, probably an import (Fig. 12, no. 17).<sup>101</sup> Also represented in this deposit is a large percentage of hand-made, short-necked, wide-bodied vessels. In shape this form would seem to have more affinity to the spouted pitcher or multi-handled vessel type, rather than the jug form. It is in a reduced sandy ware, with crude incised and applied decoration and a thin yellowy-green glaze (Fig. 12, no. 18). Finally of interest is the occurrence of a decorated jug fragment which appears to have an applied face decoration (Fig. 12, no. 20).

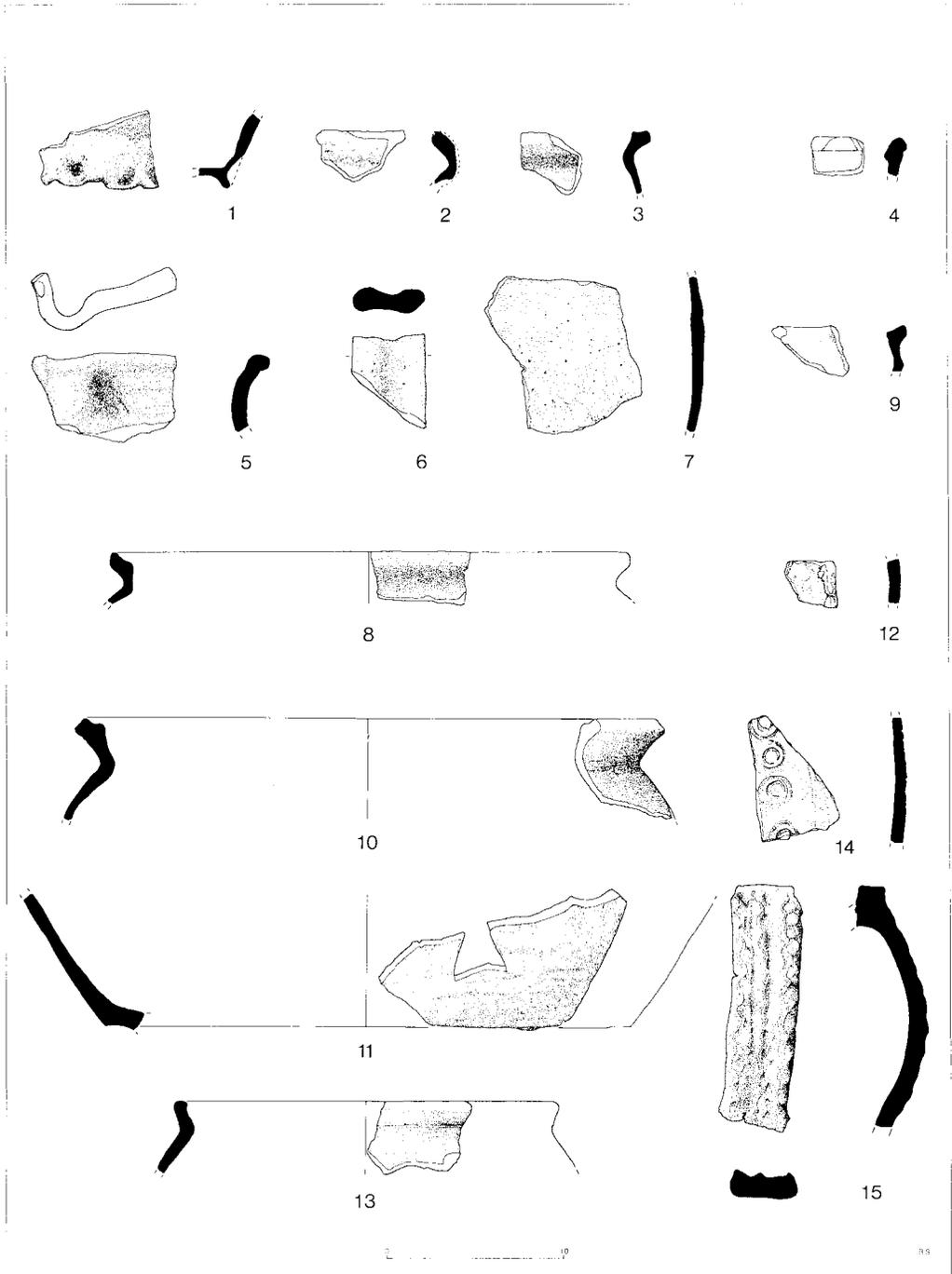


FIG. 11  
Wich house 1 pottery (Period I/1). See text for descriptions. Scale 1 : 4

The material from the series of tips is similar to that found elsewhere in Nantwich, with jugs, cooking-pots and storage vessels represented.<sup>102</sup> In this phase of activity the most common jug type is in a reduced fine sandy ware, in a relatively squat form, with a simple out-turned rim, a short neck, and a handle which is a flat oval in section, often with a neat stab design (Fig. 13, no. 34). Decoration on these vessels is often in the form of wavy applied strips, with either a lustrous dark green glaze or a pale yellowy-green glaze, which sometimes appears to have been brushed on. Examples of this ware also occur in the deposits immediately preceding the construction of wick house 2 (Fig. 12, no. 19). In particular in this group there is an example of a tripod leg in a slightly sandier fabric (Fig. 12, no. 22). This vessel form is known from the Oxford, Shrewsbury and other regions.<sup>103</sup> A number of jugs with thumbled bases was found in wick house 1 and 2 contexts. As a type they are often associated with bands of decorative square rouletting (Fig. 14, no. 36).

*Wick house 1: Illustrations* (Fig. 11)

- 1: Thumbled jug base, sandy fabric (F21),<sup>104</sup> with pale brown surface, grey core, and a thin reduced green glaze. Context PH53.
- 2: Cooking-pot/jar, reduced sandy fabric (F1), with brown surfaces and a dark grey core. The internal surface is eroded. PH63.
- 3: Cooking-pot/jar, reduced sandy fabric (F4), with light grey surface and core. PH63.
- 4: Cooking-pot/jar, reduced sandy fabric (F1), with pale brown surface and dark grey core. PH64, possibly intrusive.
- 5: Jug, reduced fine sandy fabric (F7), with a grey core and a thick glossy greeny-brown glaze. PH66.
- 6: Jug strap handle, off-white sandy fabric (F3), with a thick yellowy-green glaze, may be 13th century in date. T1, possibly intrusive.
- 7: Jug, reduced sandy fabric (F4), with a pale grey internal surface and a grey core. Three bands of pronged combed wavy line decoration. Thick glossy greeny-brown glaze. Residual sherds of this vessel also occur in later deposits. T1.
- 8: Cooking-pot/jar, reduced sandy fabric (F41), with dark grey surfaces and core. T1,(?) intrusive.
- 9: Jug, reduced sandy fabric (F43), with red surfaces and core, and thin orange glaze. C5.
- 10: Jar/Storage vessel, reduced sandy fabric (F28), with brown surfaces and a dark grey core. Bands of incised horizontal line decoration. This sherd may be later in date, as this fabric most commonly occurs in the 13th rather than the 12th century. C8.
- 11: Possible tripod pitcher base, sandy fabric (F21), with a pale orange internal surface and a grey core. Diagonally combed decoration. Patchy, greeny-brown glaze. This vessel is in a different fabric to the other example of a possible tripod pitcher (see Fig. 12, no. 22). 266.
- 12: Jug, sandy fabric (F44), with a pale brown internal surface and a grey core. Combed wavy line and applied strip decoration. Greeny-brown glaze. 266.
- 13: Cooking-pot/jar, sandy fabric (F21), with pink surfaces and a grey core. 230.
- 14: Jug, reduced sandy fabric (F21), with a brownish-grey internal surface and a grey core. Applied strip and stamped concentric circle decoration. Thick greeny-brown glaze. 265.
- 15: Jug strap handle, reduced fine sandy fabric (F7), with pale brown surfaces and a dark grey core. Raised wavy line decoration. Thin patchy, greeny-brown glaze. 343.

*Wick House 2: Illustrations. Period II: Phases 1 and 2* (Figs. 12–14)

- 16: Cooking-pot/jar, with calcite gritted fabric (F8), with orange surfaces, and a grey core. Thumbing on the rim edge. Context 201.
- 17: (?)Jar, off-white gritty fabric (F60), pale yellow surfaces, off-white core, with spots of yellow glaze. This vessel may be an import. 201.
- 18: Wide-necked, large bodied vessel, reduced sandy fabric (F21), pale grey internal surface and grey core. Around the rim are diagonally incised lines, and on the body thin, thumbled, applied strips. Thin eroded green glaze. 201.
- 19: Jug, reduced fine sandy fabric (F7), pale grey core, with applied wavy line decoration and a stabbed handle. The (?)brushed-on glaze ranges from a thick dark green to a thin pale yellowy-green. The vessel is partly glazed on the interior. 201.

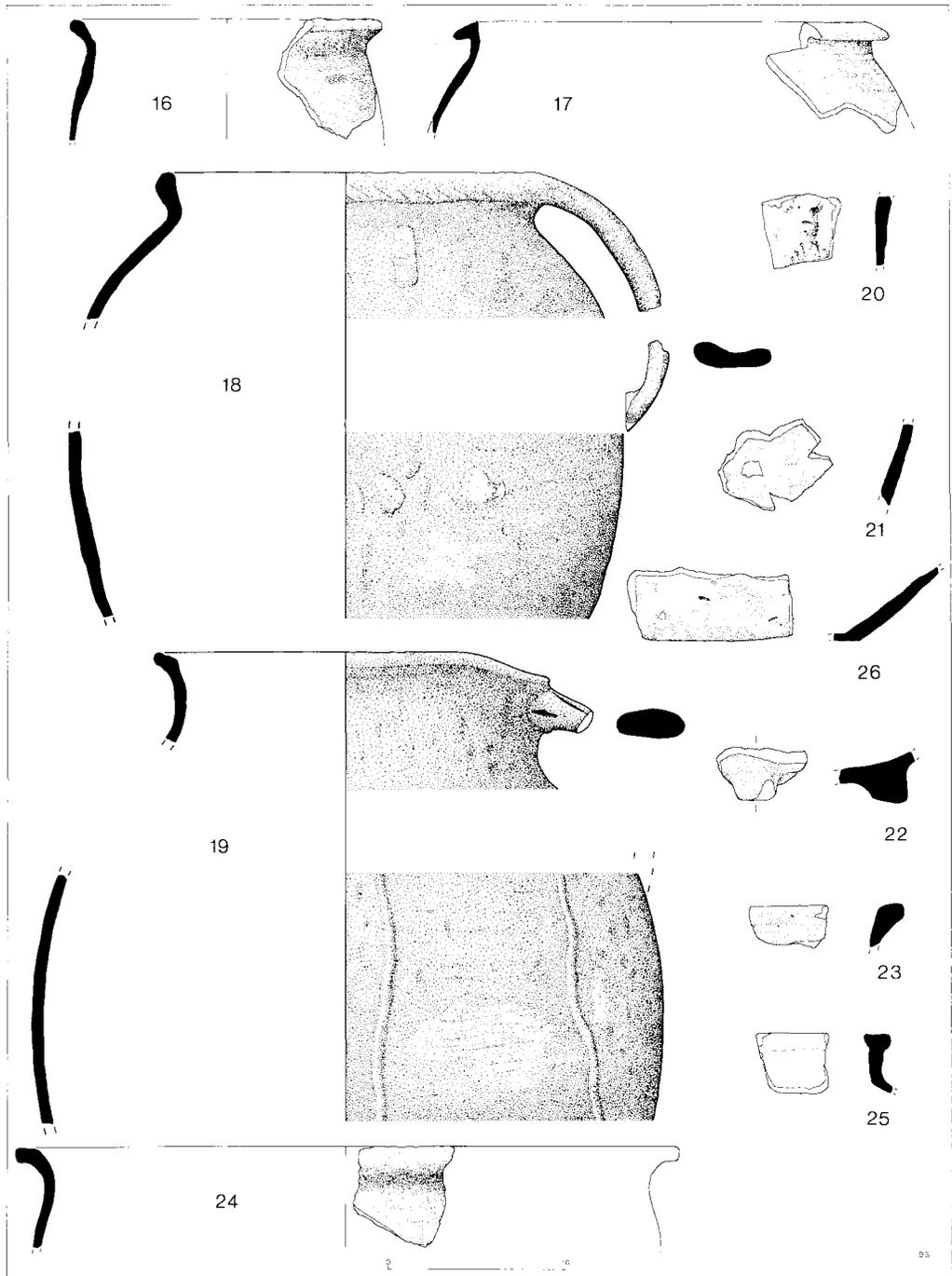


FIG. 12  
 Wich house 2 pottery (Period II/1-2). Scale 1 : 4

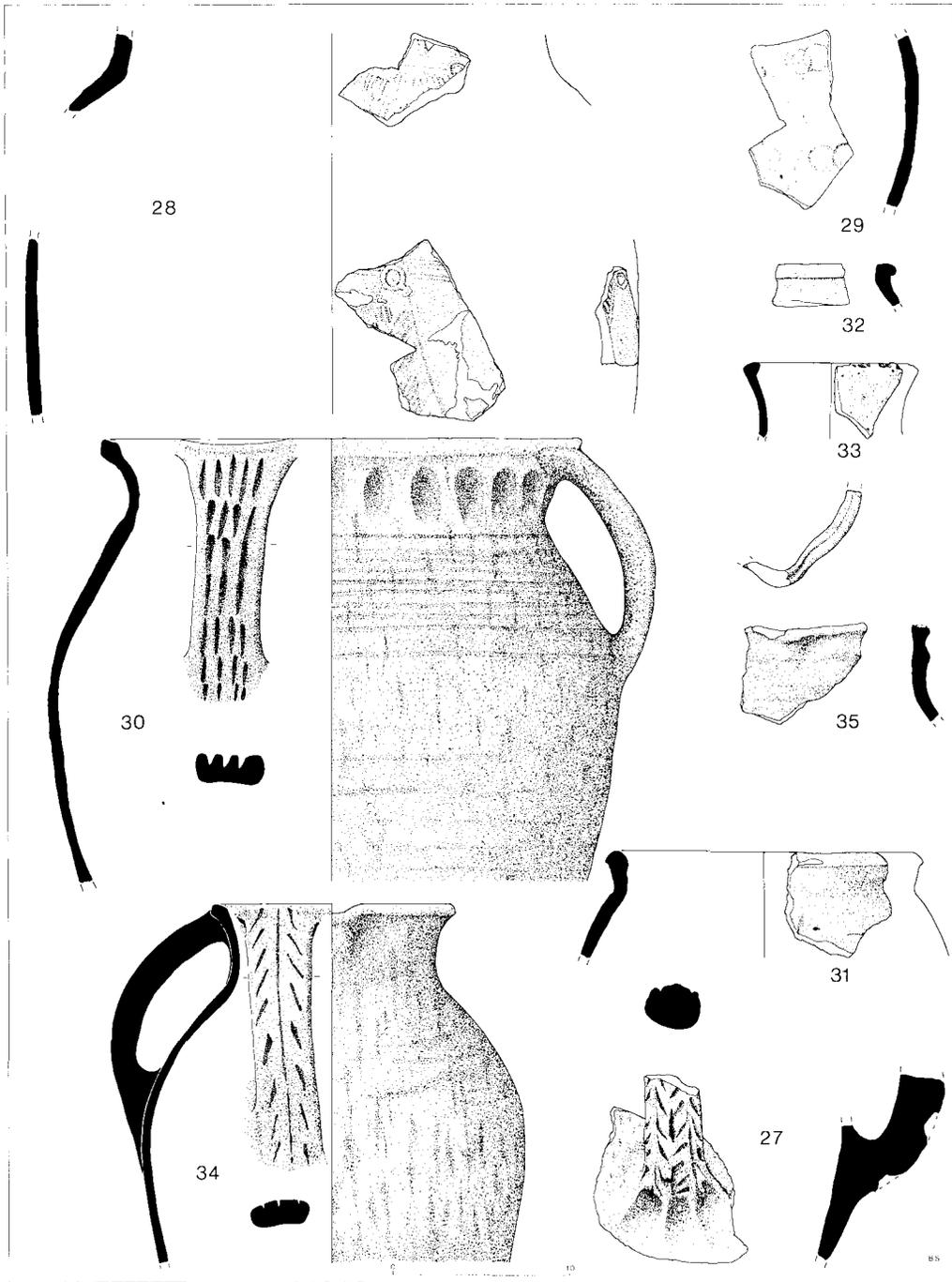


FIG. 13

Wich house 2 pottery (Period II/1-2). Scale 1:4

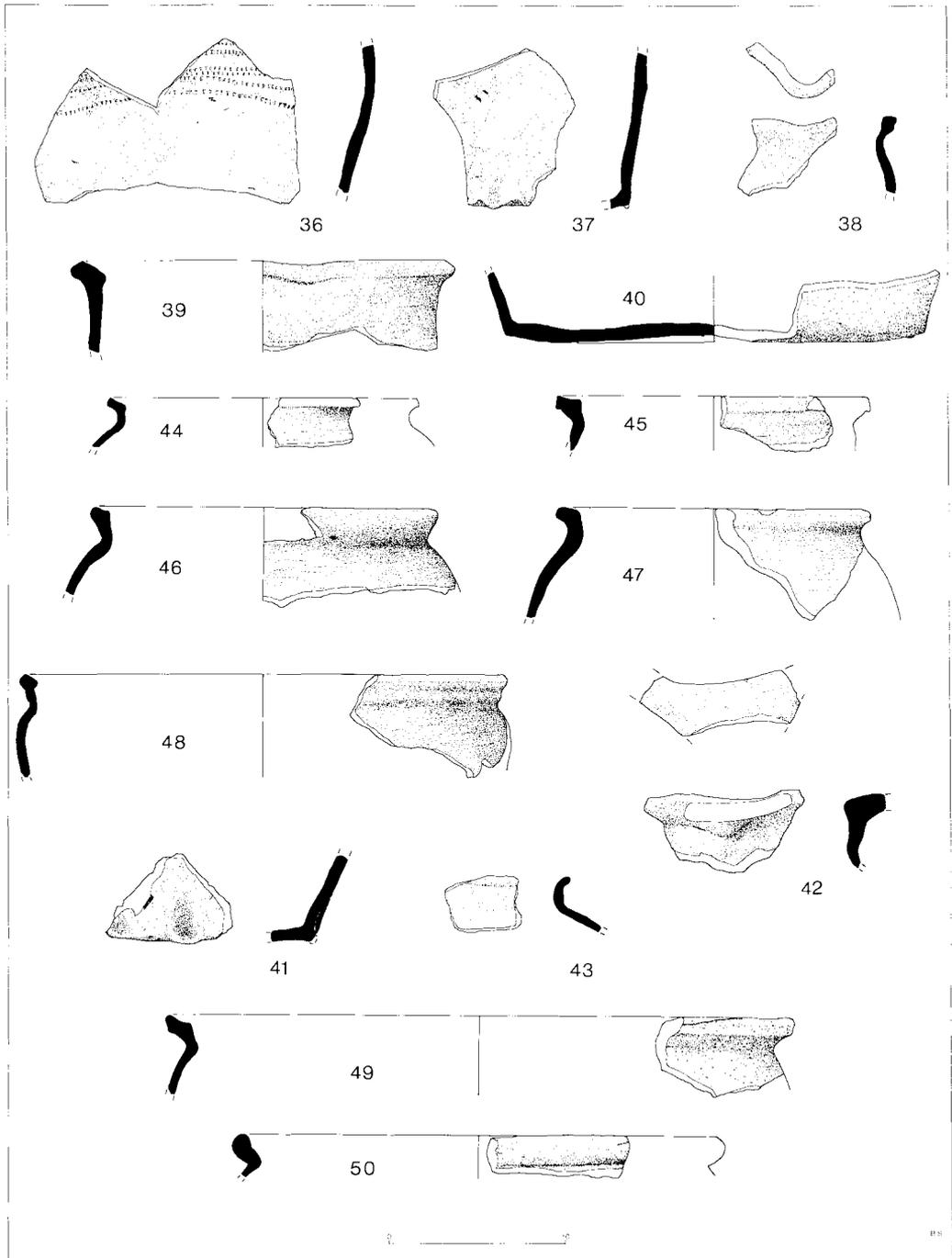


FIG. 14  
Wich house 2 pottery (Period II/1-2). Scale 1:4

- 20: Jug, reduced fine sandy fabric (F7), pale brown internal surface and grey core with an applied moulded face, and possible leg and body decoration. Thick reduced green glaze. 201.
- 21: Jug, reduced fine sandy ware (F7), grey core and incised horizontal line decoration, with thick, glossy brownish-green glaze. The interior is thinly glazed. 201.
- 22: (?) Tripod pitcher, reduced sandy ware (F1), with a pale grey internal surface, dark grey core, and a thin greenish-brown glaze. The fragment is badly eroded. Tripod pitchers are known from Shrewsbury, etc. 201.
- 23: Cooking-pot/jar, reduced sandy fabric (F1), brownish-grey surfaces and dark grey core. 201.
- 24: Cooking-pot/jar, reduced sandy fabric (F1), pale grey external surface and dark grey internal surface and core. This rim type is unusual in this fabric. 201.
- 25: Cooking-pot/jar, reduced sandy fabric (F21), brownish-grey surfaces and grey core. 201.
- 26: (?) Storage vessel, oxidized sandy fabric (F21), pinkish-brown surfaces and grey core. 201.
- 27: Jug handle, reduced sandy fabric (F7), grey core, with neatly stabbed handle. Thick brownish-green glaze, with poorly mixed flecks of copper. Thinly glazed on interior. 292.
- 28: Jug, reduced fine sandy fabric (F7), grey core, with combed and stamped decoration. Thick greenish-brown glaze, which has been partly burnt. Thin glaze on interior. These sherds may be from the same vessel as no. 27, and may therefore relate to the period preceding the construction of wich house 2. PH42.
- 29: Jug, reduced fine sandy fabric (F7), orange internal surface and grey core with incised wavy line decoration and impressed circle decoration. Thin greenish-brown glaze. PH42.
- 30: Jug, reduced fine sandy fabric (F7), orange internal surface and grey core. Incised horizontal line decoration on shoulder of vessel, thumbing on neck and neatly stabbed design on the strap handle. Thick glossy, reduced green glaze. PH43.
- 31: Cooking-pot/jar, reduced sandy fabric (F1), with pale brown surfaces and dark grey core. This is the most common rim type of this fabric. S1.
- 32: Cooking-pot/jar, oxidized sandy fabric (F1), with pink surfaces and grey core. S1.
- 33: Jug, reduced sandy fabric (F4), with a pale brown internal surface and a grey core. Incised diagonal line decoration on top of the rim and glossy, patchy greenish-brown glaze. S1.
- 34: Jug, reduced sandy fabric (F7), with a pale brown surface and a grey core. The glaze is (?) brushed on, glossy brownish-green in colour. The strap handle has a neat incised design. S3/278.
- 35: Jug, reduced sandy fabric (F7), with an orange internal surface and a grey core. The glaze is thick, glossy and green in colour. 278.
- 36: Jug, reduced fine sandy fabric (F7), with a grey internal surface and core and square rouletted decoration. The glaze is thin and greenish-brown in colour. The base may be thumbled. 278.
- 37: Thumbled jug base, sandy fabric (F7), with a pale orange internal surface and a grey core. Glossy, orange-green glaze. 278.
- 38: (?) Small jug, reduced sandy fabric (F38), with a grey core and a thick glossy brownish-green glaze. 278.
- 39: (?) Jug, reduced fine sandy fabric (F7), with a grey core and a thin greenish-brown glaze on internal and external surfaces. 278.
- 40: Large jug base, reduced sandy fabric (F7), with an orange external surface and a grey internal surface and core. The glaze is brownish-green. 278.
- 41: Thumbled jug base, reduced sandy fabric (F1), with pale brown surfaces and a grey core. The glaze is thin and eroded and brown in colour. 278.
- 42: Storage vessel/jug, sandy fabric (F21), with orange surfaces and grey core. Rim with strap handle. 278.
- 43: Cooking-pot/jar, reduced sandy fabric (F1), with brown surfaces and a dark grey core. 278.
- 43: Eroded internal surface. 278.
- 44: Cooking-pot/jar, reduced fine sandy fabric (F7), with grey surfaces and core. 278.
- 45: Cooking-pot/jar, reduced sandy fabric (F28), with brownish-grey surfaces and dark grey core. 278.
- 46: Cooking-pot/jar, reduced sandy fabric (F28), with brownish-grey surfaces and dark grey core. 278.
- 47: Cooking-pot/jar, reduced sandy fabric (F1), with pale brown surfaces and dark grey core. 223.
- 48: Cooking-pot, reduced sandy fabric (F1), with pale brown surfaces and grey core. The rim form is unusual in this fabric and may be of a later date. 223.
- 49: Cooking-pot/jar, reduced sandy fabric (F41), with dark grey surfaces and core. 223.
- 50: Jar, sandy fabric (F61), with pale orange surfaces and mid grey core. 223.

*The Latest Period of Activity of Wich House 2: Period III: Phases 2, 3 and 4*

The main feature of the second phase of activity of wich house 2 was the addition of the ship for the storage of brine. Although the date for the ship obtained by dendrochronological assay was 1191, all the pottery dates to its abandonment, an event some three hundred years after its manufacture.

With the exception of a 13th-century decorated jug body sherd (?Nuneaton), the rest of the material was 'Midland Purple' storage vessels and cisterns.<sup>105</sup> This material dates the disuse of the ship to the late 15th or first half of the 16th century. A shoe fragment associated with these vessels is of welt construction, a technique which was first introduced around 1500.

Some 'Midland purple' wares, a Cistercian type tyg and some residual medieval pottery were discovered in the disused barrel-pits and other brine troughs.

Relatively little pottery was recovered from the other features relating to the second phase of activity of wich house 2. Most of this material dates to the 13th century. This is reflected by the date range of the accumulations of material in the yard area around the wich house. This includes splayed jug bases and well thrown cooking-pots and jar forms.

The majority of the pottery from the site dates to the later 12th and 13th centuries. However, a small quantity of pottery is attributable to the 14th century and a few sherds may be 15th century in date. The occurrence of 'Midland Purple' wares in the fill of the ship and the barrel-pits reflects the decline of salt working towards the middle of the 16th century.

*Wich House 2: The Later Pottery: Illustrations (Fig. 15)*

51: Storage vessel, 'Midland Purple' (F50). Context W5.

52: Storage vessel, 'Midland Purple' (F50). W5.

53: (?) Cistern, 'Midland Purple' (F50), with horizontal thumbled applied strip decoration. W5.

54: Storage vessel/cistern, 'Midland Purple' (F50), with knife-trimmed base. W5.

55: Cistern, 'Midland Purple' (F50), with bung-hole. W5.

## THE MEDIEVAL TILE FRAGMENT. By BERYL NOAKE

The tile is square with a pale slip and yellowish glaze on a red body. It is likely to be 15th century, one of a range of similar designs found at many localities in Staffordshire, and N. Shropshire and less frequently in Cheshire, Lancashire and one or two in mid or N. Wales.<sup>106</sup>

## THE LEATHER ARTEFACTS. By PAULA HUTCHINGS

The leather collection is both poor in quantity and quality; the small quantity may reflect a low level of domestic rubbish disposal on the site, whereas the evident lack of quality may be a result of poor preservation coupled with a local necessity to make footwear last for as long as possible.

Of the 20 individually recorded leather items recovered, thirteen are shoe pieces, three are offcuts with no stitch-holes, three are unidentifiable fragments, and one is possibly part of a sheath. The shoe fragments may be further subdivided into ten separate sole and insoles, and three separate uppers. No decoration or signs of colouration were observed. Only one nearly complete shoe (L1A) was recovered, while the scarcity of offcuts suggests that there was no shoemaking in the immediate vicinity.

The collection may be divided into two groups according to context: firstly, those objects from the ship (W5) and its surrounding clay packing (C1), and secondly, those objects from earlier medieval deposits across the rest of the site.

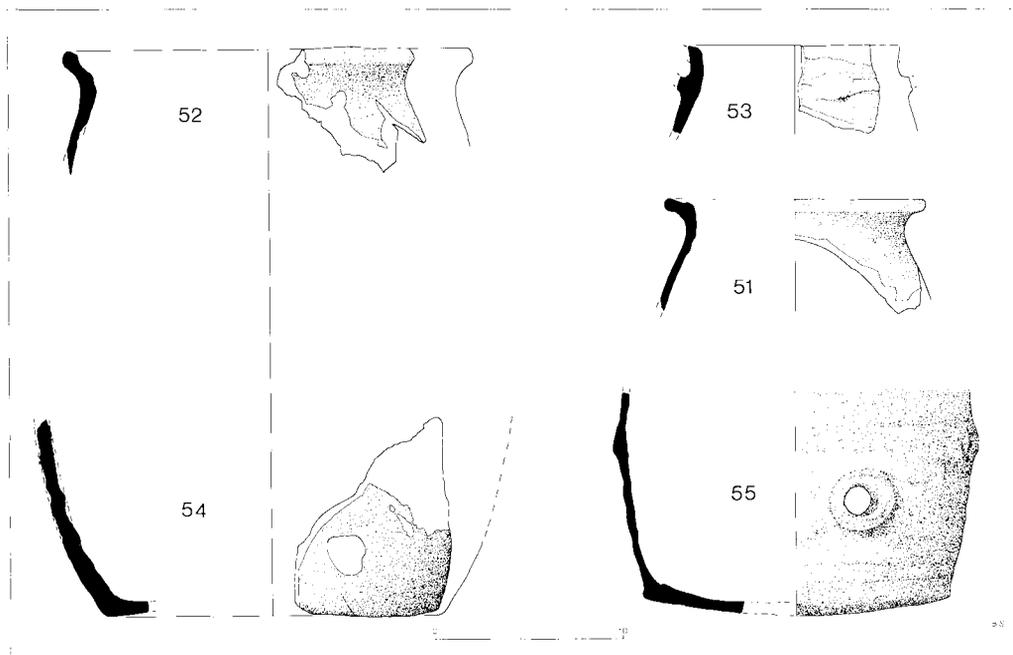


FIG. 15

Pottery from the ship W<sub>5</sub>, wich house 2 (Period II). Scale 1:4

The more interesting group is that from W<sub>5</sub> and C<sub>1</sub>. The upper levels of the ship (at about 33.70 m) produced two items (L<sub>1</sub>A and L<sub>1</sub>B) both dated to post 1600. Below these, at a depth of about 33.56–33.59 m was found a group of items (L<sub>2</sub>, L<sub>3</sub>, L<sub>4</sub>, L<sub>5</sub>) all in close proximity. L<sub>4</sub> and L<sub>5</sub> have been dated to the general period of 1520–80, while L<sub>2</sub> and L<sub>3</sub> are both post-1500 in date. Pottery from the lowest levels of W<sub>5</sub> helps to date its initial infilling while the leather finds suggest it might have taken around 100 years to fill up. The one leather find (L<sub>13</sub>) in the surrounding clay (C<sub>1</sub>) is dated to the 16th century and reflects a later period of disturbance to this deposit.

The group of medieval shoes was recovered from a number of deposits across the site. In general, it may be observed that no truly pointed toe-shapes are represented, since all are bluntly and roundly pointed. This may reflect the social class of people in the area who were more concerned with practicalities than with considerations of fashion.

The following catalogue includes all the leather objects illustrated in Fig. 16, with dating where possible.<sup>107</sup>

**L1A** Fragmentary, flesh-side out, welted shoe: vamp, two-piece quarters and welt.

Vamp: rounded point at toe, throat not complete but evidently quite high. Wings missing but low-cut sides apparent. Two holes for laces at centre throat.

L. (toe to throat) 117 mm. Welt seam holes 8–10 mm apart.

Quarters: in two pieces with butt seam down centre back. Cut high at back with dipping top edges. Butt seams on inside and outside quarters where vamp wings would have been attached. Small, open sides with latches to tie over and through the tongue. One latchet is torn, the other is cut and has four tiny holes on cut edge. On the inside of this latchet are three holes in a line with an impressed groove above, probably for the attachment of a fastening. On the inside of one of the quarters there are eight tunnel stitched holes set in two lines of four, positioned just below the curved cut-out section. The other piece has six holes in a similar position.

H. (at back) *c.* 65 mm. Welt seam holes *c.* 8 mm apart. Butt seam holes 3 mm apart.

Welt: L. 75 mm. W. 9 mm. Upper seam holes 8–10 mm apart. Sole seam holes 4 mm apart (enlarged and weakened with wear).

The open sides and vamp lace holes suggest a date of the early 17th century. (Period II/2, W5)

L1B Fragment of small insole, made straight. Worn thin and damaged down one side of forepart and at toe. Thin and broken at waist. Slender shape.

L. (toe to waist) 133 mm. W. (widest part of forepart) *c.* 55 mm. Waist 22 mm. Edge/flesh seam holes 9 mm apart.

This insole would be for a shoe similar to L1A and is probably early 17th century. (Period II/2, W5)

L2 Two roughly rectangular pieces of leather, each with a marked curve in section.

L. 90 mm. W. 55 mm. Th. 2 mm.

One long side of each has grain/flesh stitch-holes, all other sides have butted seams, invisible on the grain side.

Grain/flesh holes 6–10 mm apart. Butt seam holes 3–5 mm apart.

Identification has not been possible although they may be part of a sheath of some kind. The method of construction is consistent with a post-medieval date. (Period II/2, W5)

L3 Fragments of at least one welted shoe, cut up probably for reuse, leaving only strips of sole and welt with a larger piece of sole worn thin at centre tread.

Sole/welt seam holes 5–6 mm apart. With much evidence of re-stitching. Welt/upper seam holes 8–10 mm apart.

These fragments may be dated to post-1500. (Period II/2, W5)

L4 Insole of a (probably right) welted shoe with grain side to the foot. Square toed, tapering to a quite narrow seat. Damaged on forepart. No foot impression.

Edge/flesh seam holes 8–10 mm apart.

Dated 1520–50. (Period II/2, W5)

L5 Vamp of wide round-toed shoe. Wings missing. Cut across vamp throat may originally have been slashed decoration. Puckers at the toe.

L. (toe to throat) 112 mm. Grain/flesh seam holes 9–10 mm apart.

The shape of this vamp suggests a date in the second half of the 16th century, but probably pre-1580s when the majority became more pointed at the toe. (Period II/2, W5)

L6 Sole of a shoe made straight. Cut across the tread and with part of the forepart missing. Rounded point at the toe. Grain/flesh seam holes around the edge suggest this may be a sole from a turn-welt or welted shoe, although its context suggests an earlier date and it may actually be a repair sole for a medieval turnshoe.

L. (toe to tread) 117 mm. W. (widest part) 72 mm. Grain/flesh seam holes 7–8 mm apart. (Period I/1, 181)

L7 and L8 Two small fragments of leather with no stitch-holes. (Period II/1, 179 and Period I/1, 181)

L9 Large medieval turnshoe sole, possibly slightly shaped for the right. Round-toed with wide waist. Worn thin and damaged at waist with heel missing. Four larger grain/flesh holes (20–25 mm apart) run close to edge/flesh seam, with one additional hole at centre of tread.

L. 240 mm. W. 110 mm. Edge/flesh seam holes 4–5 mm apart. (Period I/1, 181)

L10 Thong-laced insert from a medieval ankle boot.<sup>108</sup> Butted seams where vamp extension and quarters would have been attached. The top edge is cut straight for part of its length, the rest is torn but may have extended partly over the instep with the threaded thongs being used for fastening. The instep opening has a scalloped binding seam which extends *c.* 20 mm along the vamp extension seam.

Vamp extension butt seam holes 4–5 mm apart. Quarters butt seam holes 3–4 mm apart. Binding seam holes 5 mm apart. (Period I/1, 181)

L11 Small triangular fragment. Edge/flesh stitch holes along one edge 5 mm apart. (Period I/1, 181)

L12 Right medieval turnshoe sole. In good condition. Bluntly pointed toe with narrow waist which has been cut through.

L. (toe to waist) 176 mm. W. (widest part) 95 mm. Waist 35 mm. Edge/flesh seam holes 5 mm apart.

Probably mid 14th century in date. (Period II/1 or 2, 201)

L13 Part of small insole from welted shoe. Heel and forepart missing.

L. 110 mm. Waist 35 mm. Welt seam holes 7–10 mm apart.

Not made straight, and presumably 16th century in date. (Period II/2, C1)

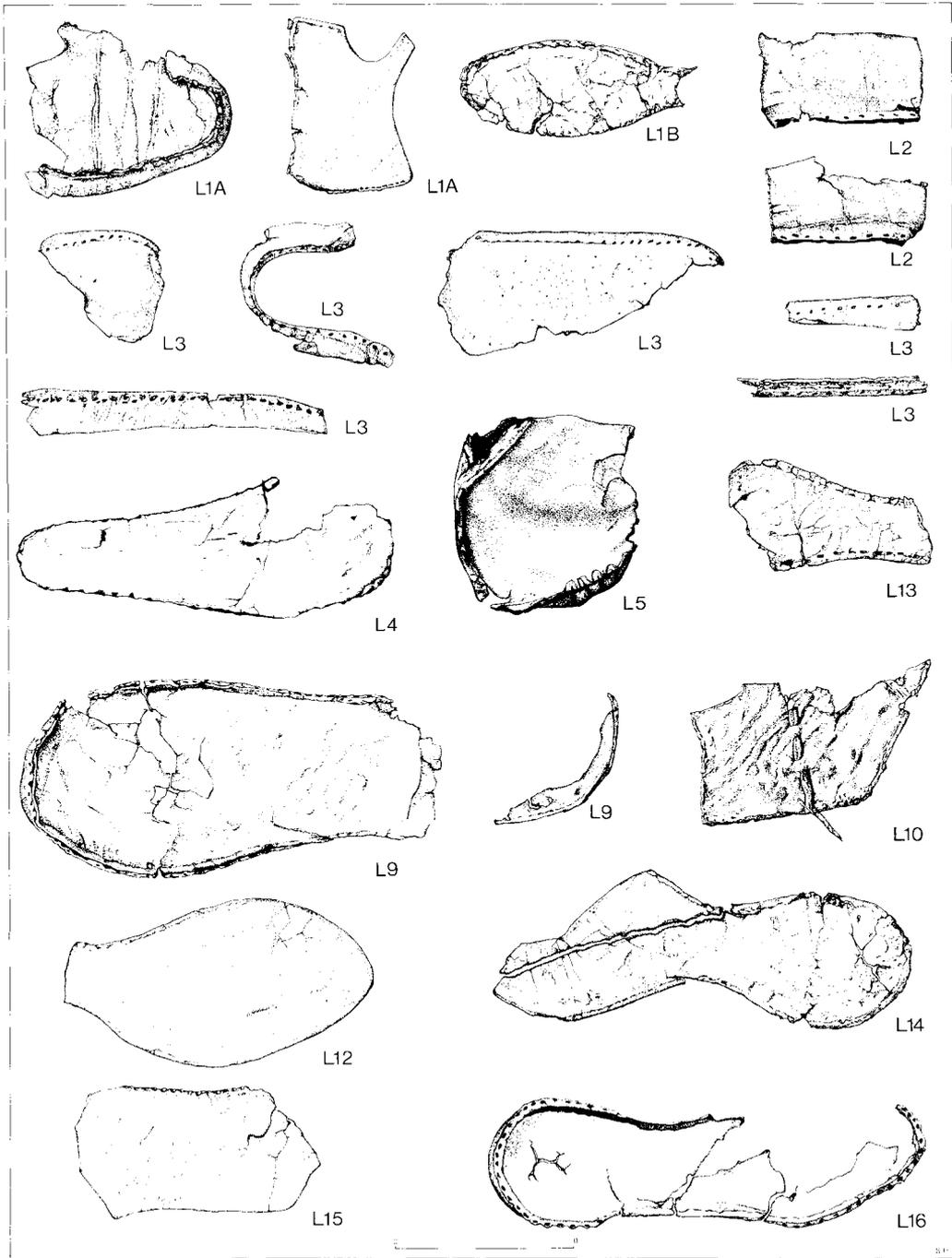


FIG. 16  
Leather. See text for descriptions. Scale 1:4

L14 Medieval turnshoe sole in two pieces. Some of the forepart has been cut away. Worn thin on the heel.

L. 235 mm. Waist 40 mm. Edge/flesh seam holes 5 mm apart.

Probably mid 14th century in date. (Period II/1 or 2, 201)

L15 Medieval turnshoe sole with heel and forepart missing. Cut down one side and at one end. The other end is worn thin. Probably cut for reuse of leather.

L. 138 mm. W. 67 mm. Edge/flesh seam holes 5 mm apart (on one side only).

(Period I/1, 181)

L16 Right medieval turnshoe sole. Worn thin on heel and much of forepart is missing. Bluntly pointed toe. The size of the holes and their spacing suggests that a rand was inserted.

L. 260 mm. Waist 53 mm. Edge/flesh seam holes 6–8 mm part.

(Period II/1, PH44)

*Not illus.:*

L17 Small roughly triangular offcut. (Period I/1, 181)

L18 Slightly tapering strip of leather with butt seam holes down one side. L. 126 mm. W. 22–38 mm. Butt seam holes 3 mm apart.

Possible piece of shoe upper with a butt seam on one edge and a grain/flesh seam on another.

Butt seam holes 3 mm apart. Grain/flesh seam holes 3 mm apart.

(Period I/1, 181)

#### THE WOODEN ARTEFACTS. By PAULA HUTCHINGS

The site produced a large quantity of wood, of which 131 pieces were individually recorded. Most of these were stakes, posts, planks and other constructional pieces and offcuts, and only two objects of this nature (W59, W60) are included in the catalogue because of their specialized function. The brine troughs or 'ships' are not included since they have already been discussed in the main structural report.

There are thirteen wooden artefacts, all recovered from the medieval deposits of Period I/1 with only one item from Period II/1 or 2. This apparent concentration of wood in the area of wick house 1 may be because these deposits were more conducive to the preservation of organic matter, since the southern half of the site in general produced far larger quantities of wood and leather than the northern half.

It is notable that there are only four objects that are, or could be, purely domestic in character whilst objects of a specialized industrial character total nine. These nine items are all heads from salt rakes which were used for raking the precipitating salt to the sides of the pan.

This large collection of salt rakes is unique and emphasizes the importance of industrial activity on the site during the medieval period. All except one of the rakes were found in the deposits relating to wick house 1.

A similar, although smaller salt rake, dated to the 17th century, is displayed in the Salt Museum, Northwich, Cheshire. Three objects interpreted as being salt-rake heads are also described by Mr M. W. Thompson,<sup>109</sup> although these are appreciably larger than the examples from Nantwich. They are dated to around the 13th century.

It has not been possible to identify the type of wood used in the manufacture of the following objects, although it is observed that the salt rakes appear to be made of oak.

#### *Salt-Rake Heads* (Fig. 17)

W13 L. 310 mm, W. 115 mm, Th. of curved edge 30 mm tapering to 4 mm, D. of hole 26–35 mm.

The hole is angled. Bottom edge of rake is fire-blackened. Front face (that facing the user) slightly convex, back face slightly concave. (Period I/1, 230)

W16 L. 246 mm, W. 137 mm, Th. of curved edge 10 mm tapering to 1 mm, Th. of straight edge 1 mm, D. of hole 23–25 mm.

The hole is angled. The rake is split across the hole. (Period I/1, 266)

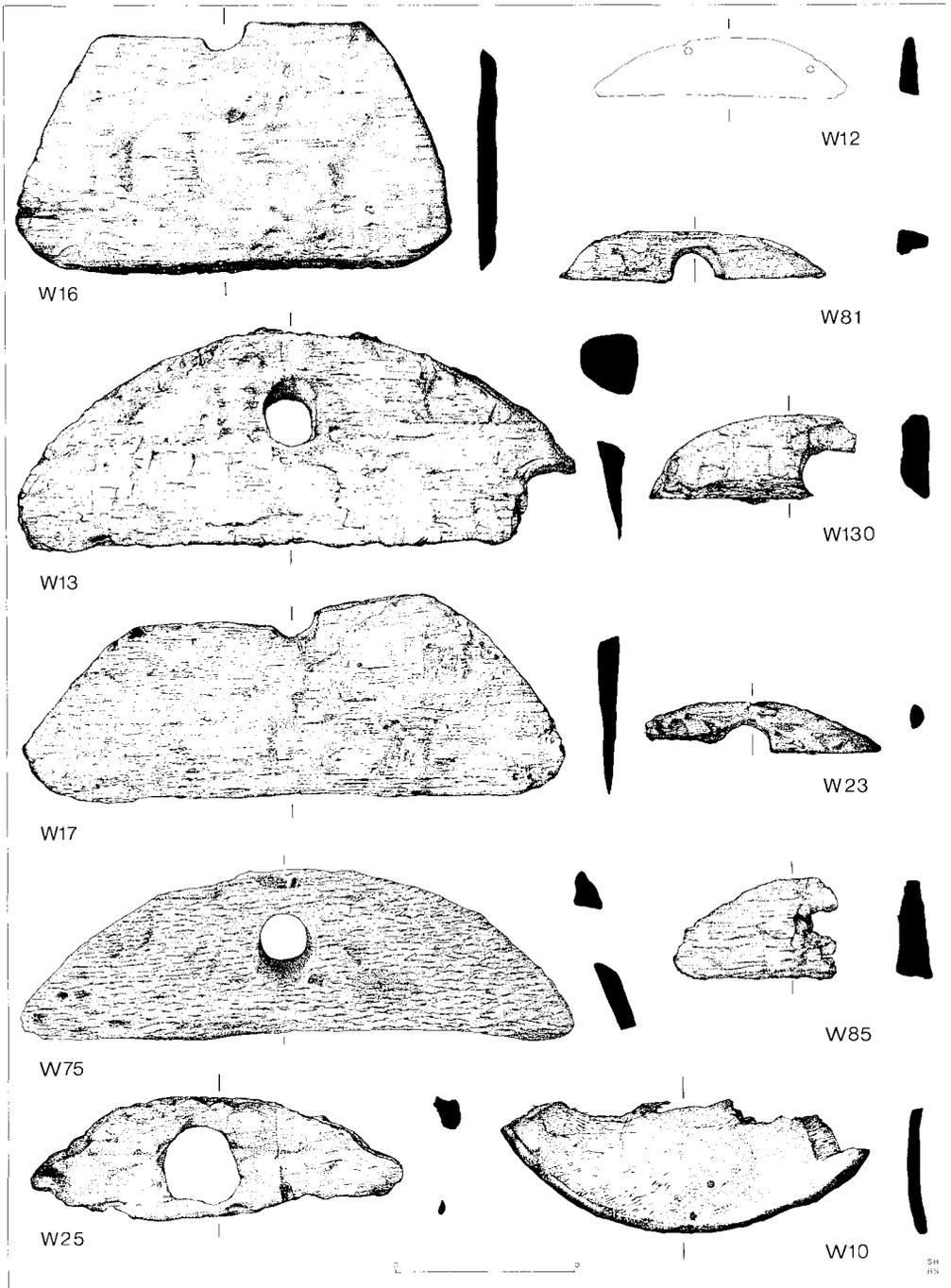


FIG. 17

Wooden artefacts: Salt rakes, platter and lid. See text for descriptions. Scale 1:4

W17 L. 300 mm, W. 112 mm, Th. of curved edge 10 mm tapering to 2 mm, Th. of straight edge 2 mm, D. of hole 26 mm.

The hole is angled. The rake is split across the hole. (Period I/1, 266)

W23 Very weathered fragment. L. 130 mm, W. 28 mm, Th. 8 mm, D. of hole 30 mm.

The hole is angled. (Period I/1, 223)

W25 Very weathered fragment and apparently split lengthwise. L. 210 mm, W. 70 mm, Th. 10 mm max., D. of hole 42–44 mm. (Period I/1, 292)

W75 L. 310 mm, W. 95 mm, Th. of curved edge 20 mm tapering to 9 mm, Th. of straight edge 2–9 mm, D. of hole 27–35 mm.

The hole is angled. Front face slightly convex, back face slightly concave. Split along the straight edge. The straight edge is thickest in the centre below the hole. (Period I/1, 337)

W81 Incomplete fragment. L. 150 mm, W. 27 mm, Th. 20 mm, D. of hole 28 mm.

The hole is angled. Split across the hole and across the circular edge. Slightly fire-blackened on part of one surface. (Period II/1 or 2, 201)

W85 Incomplete fragment. L. 92 mm, W. 57 mm, Th. of curved edge 1 mm, Th. of straight edge 20 mm. (Period I/1, 292)

W130 Incomplete fragment. L. 117 mm, W. 49 mm, Th. 15–19 mm, D. of hole, c. 26 mm.

Split across the hole and broken in half through hole from curved to straight edge. (Period I/1, 181)

*Miscellaneous Wooden Artefacts* (W10, W12: Fig. 17. Remainder unillustrated)

W10 Incomplete plate/platter. Underside is grooved 10–15 mm inside the rim. Inside is grooved around the base. A slightly raised lip is present.

D. c. 240 mm, Depth c. 20 mm, Th. 6–7 mm.

(Period I/1, 223)

W12 Semi-circular piece of wood, probably a fragment of a lid. One face is convex, the other is flat. Two holes with diameters of 4–5 mm are set 70 mm apart and very close to the curved edge. A groove above each hole suggests wear from a thong or twine attached through the holes.

D. 142 mm, Th. of straight edge 10 mm, Th. of curved edge 3 mm.

(Period I/1, 229)

W59 Roughly L-shaped piece of wood, broken at one end. Used to ensure a tight fit between a load-bearing post (PH43) and the ship (W5).

Max. L. 69 mm, Max. W. 44 mm, Th. 15–19 mm.

(Period II/1, PH43)

W60 Roughly L-shaped piece of wood, broken at one end like W59. Used to ensure a tight fit between a load-bearing post (PH44) and the ship (W5).

Max. L. 70 mm, Max. W. 37 mm, Th. 25 mm.

(Period II/1, PH44)

W76 Incomplete bowl with flat bottom. An incised groove on the inside is crudely decorative, and indicates where the bowl flattens out to form the base.

D. 160–170 mm, D. of base 80 mm, Depth 45 mm, Th. 4–5 mm.

(Period I/1, PH53)

W82 Unidentified ring of wood. Well smoothed on outside surface, rather rough on inside. One end is broken, the other cut. ?Possibly a handle of some kind.

Th. 15 mm.

(Period I/1, 181).

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sewerage and drainage contract. Mr I. Abram and Mr D. Yorke of the Borough Council provided invaluable assistance and engineering advice during the excavation and when the 'ship' was lifted. Accommodation and tools were provided by Crewe and Nantwich Borough Council and by Mr and Mrs Ashley, publicans of the Three Pigeons.

Thanks are due to Rhys Williams for visiting the site and discussing the structural remains; to Catherine Rew and Mary Rochester for help in the identification of salt artefacts; to Dennis Petch and Anthony David for their efforts to conserve the ship; to staff of Northampton Museum for their comments on the leather; to John Oxley for discussing his researches on Nantwich with me and to Beryl Noake for the tile identification.

Warmest thanks are due to all those who worked on or for the excavation, including Penny Noake, Margaret Gleave and Mrs M. Litherland, who gave so much of their time both during and after the excavation.

Particular thanks are due to the other contributors: to Victoria Nailor for the Medieval Pottery Report; to Paula Hutchings for the Leather and Wood Reports and reading of the first draft and for drawing up the structural plans; to Bevis Sale and Stewart Hargrave for drawing the pottery, leather and wood; to Clive Hughes, Jim Stallybrass and Roger Dickinson for the photography; to Dr P. A. Leggett and Dr M. K. Hughes for the Tree-Ring Dating Report.

Finally, I am most grateful to these colleagues and to David Freke, Peter Davey and Mary Jean Evers who kindly read the report in draft and made a number of valuable suggestions.

## NOTES

<sup>1</sup> W. H. Challoner, 'Salt in Cheshire 1600-1870', *Trans. Lancashire and Cheshire Antiq. Soc.*, 71 (1961), 58-74.

<sup>2</sup> For discussion of extent of woodland in 1086 see I. B. Terrett, 'Cheshire', 330-92 in H. C. Darby and L. S. Maxwell (eds.), *The Domesday Geography of Northern England* (Cambridge University Press, 1962). A good summary of the medieval woodlands can be found in D. Sylvester and G. Nulty (eds.), *The Historical Atlas of Cheshire* (Cheshire Community Council, 1958), 18-23.

<sup>3</sup> F. H. Thompson, *Roman Cheshire* (Cheshire Community Council, 1965), 102-06; W. Thompson Watkins, *Roman Cheshire* (C. Tingling and Co., 1886; Reprinted Scolar Press, 1974), 68-69, 291-92, 310; P. Hutchings, 'Roman Pottery', 18-19 in R. McNeil Sale, *Archaeology in Nantwich: Crown Car Park Excavations* (Bemrose Press, 1978). Discoveries of two lead pans in Welsh Row confirm the Roman interest, although these were on the other side of the river: pers. comm. D. F. Petch.

<sup>4</sup> J. Morris (ed.), *Domesday Book: Cheshire including Lancashire, Cumbria and North Wales. History from the Sources* (Chichester, 1978), 268b.

<sup>5</sup> Pers. comm. J. Oxley.

<sup>6</sup> Pers. comm. J. Oxley.

<sup>7</sup> J. Hall, *A History of the Town and Parish of Nantwich* (E. J. Morten, 1976; 1st Edition privately printed, 1883). Where earlier authors are quoted their names and date appear in brackets at the end of the note. This also applies for works cited in notes 1 and 8.

<sup>8</sup> M. Rochester, *Salt in Cheshire. Part 1. Salt Making* (Cheshire County Council, 1975).

<sup>9</sup> Hall, op. cit. in note 7, 101.

<sup>10</sup> The accounts by Thomas Brackner and Dr Jackson are particularly interesting as they deal with the technology of salt production in Cheshire in the late 17th century. Furthermore the equipment is catalogued in some detail. The double boiling of the brine is elaborated on, and both refer to the addition of various ingredients, such as blood, eggs and ale to clarify the brine. The process of 'doping' was practised until recently; see G. D. Twigg, 'Glossary of Open Pan Salt Terms' (1963; typescript in Salt Museum, Northwich, Cheshire); Hall, op. cit. in note 7, 259-62 (Brackner 1675); and Rochester op. cit. in note 8, 15-16 (Jackson 1669).

<sup>11</sup> Numbers in this report are not the same as those used in the interim report, R. McNeil Sale, *Wood Street Salt Works: Nantwich* (Bemrose Press, 1980).

<sup>12</sup> As it is more convenient to refer to all alignments as E.-W. rather than the correct one of EWE.-WSW., this convention has been adopted throughout.

<sup>13</sup> W. Brownrigg, *The Art of Making Salt, as now Practised in most parts of the World; with several improvements proposed in that art for the use of the British Dominions* (London, 1748), 103-04.

<sup>14</sup> Hall, op. cit. in note 7, 255 (Smith c. 1580), 262 (Brackner 1675); and Rochester, op. cit. in note 8, 15, fig. 16 (Jackson 1669).

<sup>15</sup> Brownrigg, op. cit. in note 13, pl. V.

<sup>16</sup> E. H. Rudkin, 'Medieval Salt Making in Lincolnshire', 37-40 in K. de Brisay (ed.), *Salt: The study of an Ancient Industry* (Colchester Archaeol. Group, 1975).

<sup>17</sup> P. Greene drew my attention to these illustrations in D. Hartley and M. M. Elliot, *Life and Work of the People of England, Vol. 1. The Middle Ages A.D. 1000-1499* (Batsford, London, 1931), pls. 9b, 21d.

- <sup>18</sup> Rochester, op. cit. in note 8, 15–16 (Jackson 1669). See also Twigg, op. cit. in note 10.
- <sup>19</sup> P. Hutchings, 'Wooden Artefacts', 20 in McNeil Sale, op. cit. in note 11.
- <sup>20</sup> D. Keene, 'Rubbish in medieval towns', 26–29 in A. R. Hall and H. K. Kenward, *Environmental Archaeology in the Urban Context* (London, Council for Brit. Archaeol. Res. Rep. 43, 1982).
- <sup>21</sup> At *Salinae*, briquetage was used. J. D. Bestwick, *Newsletter*, 24 (Sept. 1974).
- <sup>22</sup> The 'Rulers of Walling' or salt inspectors had the right forcibly to pull down the wich houses if there were any transgressions. Hall op. cit. in note 7, 255–58. In 15th-century leases mention is made of salt houses lying vacant: J. Oxley, pers. comm.
- <sup>23</sup> Hall, op. cit. in note 7, 254 (Leland c.1530), 255 (Smith c. 1580; Camden c. 1590). See also 203, 206, 259 where mention is made of the introduction of iron pans and coal as fuel in the 17th century. Rochester, op. cit. in note 8, 15 (Jackson 1669). Three lead pans 3 ft 4 in. × 2 ft 10 in. × 4 in. were uncovered 10–12 ft below the surface at Northwich. They were described in *Archaeol. J.*, xxii (1865), 78–79 as lying side by side, imbedded in charcoal or burnt wood. At the time there was some debate as to whether they were Roman or medieval pans. What is perhaps relevant to Nantwich is the number of pans and the absence of any kiln structure.
- <sup>24</sup> Hall, op. cit. in note 7, 259–62 (Brackner 1675). Compare this description with an almost identical one written six years earlier: see Rochester, op. cit. in note 8, 15 (Jackson 1669).
- <sup>25</sup> Hall, op. cit. in note 7, 254.
- <sup>26</sup> R. Taylor, 'The Coastal Salt Industry of Amounderness', *Trans. Lancashire Cheshire Antiq. Soc.*, 78 (1975), 14–21.
- <sup>27</sup> Identification was made by Dr Leggett and Dr Hughes of Liverpool Polytechnic, whose report on the wood follows.
- <sup>28</sup> The ship is being conserved and will eventually be housed in the Salt Museum, Northwich, Cheshire.
- <sup>29</sup> Hall, op. cit. in note 7, 262. Although written in 1675 Brackner's description of the position of the ship was valid for the 12th and 13th centuries.
- <sup>30</sup> Rochester, op. cit. in note 8, 15–16 (Jackson 1669).
- <sup>31</sup> Hall, op. cit. in note 7, 262 (Brackner 1675).
- <sup>32</sup> At the salt working site at Trebarveth, four pits dug into clay around the perimeter wall might reasonably be considered as brine vats, although this does not appear to be the explanation for pit 7: D. P. S. Peacock, 'A Romano-British Salt-working Site at Trebarveth, St Keverne', *Cornish Archaeol.*, 8 (1969), 47–65.
- <sup>33</sup> McNeil Sale, op. cit. in note 11, 8, and fig. 12.
- <sup>34</sup> Hall, op. cit. in note 7, 253 (Smith c. 1580; Camden c. 1590).
- <sup>35</sup> According to a pamphlet entitled *Salt Making in Staffordshire* (Staffs. County Museum) barrels filled with water were used until recently as tool tanks to minimize the harmful effects of the salt.
- <sup>36</sup> Owing to the rarity of excavated examples, some of the following references are used solely to demonstrate that the basic method of open panning hardly changed through time, e.g. M. W. Thompson, 'A Group of Mounds on Seasalter level near Whitstable and the Medieval Inbanking in this Area', *Archaeol. Cantiana*, Lxx (1956), 44–67, 52–54.
- <sup>37</sup> R. H. Healey, 'A Medieval Salt-Making Site in Bicker Haven, Lincolnshire', 36 in de Brisay (ed.), op. cit. in note 16. There is a rectangular trough at Roman Droitwich, Worcestershire, J. Sawle, 'Excavations of the Old Bowling Green, Ricketts Lane, Droitwich', *Worcestershire Archaeol. Local History Newsletter*, 22 (1979), 1–3.
- <sup>38</sup> A. Miles, 'Salt Panning in Romano-British Kent', 29, in de Brisay (ed.) op. cit. in note 16; J. D. Bestwick, 'Romano-British Inland Salting at Middlewich (*Salinae*), Cheshire', *ibid.*, 67. See also K. de Brisay, 'Excavation of a Red Hill at Peldon, Essex', *Antiq. J.*, 58 (1978), 31–61 where tanks are circular and sub-circular.
- <sup>39</sup> In his most comprehensive survey, Nenquin describes seven rectangular wooden basins (15 × 4 ft) of the la Tène period found at Schwäbisch Hall, used for storing the brine and the brine-impregnated turf. There is no other record of later wooden brine containers. J. Nenquin, 'Salt, a Study in Economic Prehistory', *Dissertationes Archaeologicae Gandensis*, vi (1961).
- <sup>40</sup> Sawle, op. cit. in note 37, 1–2.
- <sup>41</sup> Bestwick, op. cit. in note 38, 67.
- <sup>42</sup> *Ibid.*, 67.
- <sup>43</sup> Thompson, op. cit. in note 36, 53, where the network of timbers and twigs is described as resembling a shallow boat.
- <sup>44</sup> Taylor, op. cit. in note 26, 14–21.
- <sup>45</sup> H. J. Hewitt, *Cheshire under the three Edwards* (Cheshire Community Council, Chester, 1967), 66. For same idea in Middlewich, J. Varley, 'A Middlewich Chartulary. Compiled by William Vernon in the Seventeenth Century', *Chetham Soc.*, 105 (1941), 67–217, 137, 198.
- <sup>46</sup> Bestwick, op. cit. in note 38, 67 and fig. 44b; and Miles, *ibid.*, 28.
- <sup>47</sup> de Brisay, op. cit. in note 38, 35, fig. 34, pl. XXVb.
- <sup>48</sup> At Ingoldmells, the wall of the hearth is described as flat on the inner face and rounded off in such a way as to preclude the idea that it was originally higher or formed the base of an oven-like wall. H. H. Swinerton, 'The Prehistoric Pottery Sites of the Lincolnshire Coast', *Antiq. J.*, xii (1932), 239–53, fig. 2.
- <sup>49</sup> Healey, op. cit. in note 37, 36.
- <sup>50</sup> McNeil Sale, op. cit. in note 3, 8.
- <sup>51</sup> Morris, op. cit. in note 4, 268b.
- <sup>52</sup> Hall, op. cit. in note 7, 252–64.
- <sup>53</sup> G. Agricola, *De Re Metallica* (Basle, 1556; Translated from the first Latin Edition, H. C. and L. H. Hoover, London, 1912), Book XII, 545–55.
- <sup>54</sup> See G. Beresford, 'Three Deserted Medieval Settlements on Dartmoor: A Report on the late E. Marie Minter's Excavations', *Medieval Archaeol.*, xxiii (1979), 128 for further examples of these ties.

<sup>55</sup> The use of the word hurdle may have continued into present usage in a debased form. In the medieval salt works it describes the walls; today it is used to describe loosely fitting wooden platforms at the side of the open pan, which allowed drainage of the brine from the piles of unstoved salt. See Rochester, *op. cit.* in note 8, 22; and Twigg, *op. cit.* in note 18.

<sup>56</sup> P. Rahtz, 'Buildings and Rural Settlement', 49–99 in D. M. Wilson (ed.), *The Archaeology of Anglo-Saxon England* (London, 1976).

<sup>57</sup> A. van de Walle, 'Excavations in the Ancient Centre of Antwerp', *Medieval Archaeol.*, v (1961), fig. 39 shows a rare example of the use of flat laths.

<sup>58</sup> M. O. H. Carver, 'Three Saxo-Norman Tenements in Durham City', *Medieval Archaeol.*, xv (1979), figs. 6 and 7; H. Clarke and A. Carter, *Excavations in King's Lynn 1963–1970* (The Society for Medieval Archaeol. Monograph Ser. No. 7) (1977), figs. 28 and 29.

<sup>59</sup> B. Ó Riordáin, 'Excavations at High Street and Winetavern Street, Dublin', *Medieval Archaeol.*, xv (1971), 74, 76, fig. 28.

<sup>60</sup> H. Murray, 'Documentary evidence for domestic buildings in Ireland c. 400–1200 in the light of archaeology', *Medieval Archaeol.*, xxiii (1979), 91.

<sup>61</sup> Carver, *op. cit.* in note 58, fig. 5 (F75, F76), fig. 6 (F68, F63). See also Clarke and Carter, *op. cit.* in note 58, fig. 11 (fence 8 and 8a) and p. 17.

<sup>62</sup> Carver, *op. cit.* in note 58, 79n., 93–94.

<sup>63</sup> Bestwick describes large timber warehouses of the 2nd century at Middlewich, at least 25 × 5 m in size: J. D. Bestwick, *Newsletter*, 24 (September 1974). In the same newsletter he describes two timber buildings, but it is not clear whether these are wick houses. They were 3.05 m × 4.75 m, constructed from closely set circular section timbers with square horizontal beams forming the foundation and are dated to the 12th/14th centuries. Jackson in 1675 describes the houses as barns, open up to the thatch: Rochester, *op. cit.* in note 8, 15. Seven years later, the houses were one storey, made of brick or stone, but like barns: J. Collis, *Salt and Fisheries* (1682. Original transcript in Salt Museum, Northwich, Cheshire). In 19th-century Northwich the wick houses were low spacious buildings, covered with a wooden roof, through which the steam could escape. S. Bagshaw, 'History and Gazetteer of the county of Cheshire' (1850), 18 in Rochester, *op. cit.* in note 8. I am grateful to staff of the Salt Museum for showing me an engraving of a saltern somewhere in Northumberland, built with squared posts and open on all sides: original by Thomas Kitchen, 1750 in Dean and Chapter Library, Durham.

<sup>64</sup> Agricola, *op. cit.* in note 53, 546–48, 549, 553.

<sup>65</sup> The entrance was associated securely with the II/2 horizon, but must have existed with the initial build. The NW. area of the site was not totally excavated, owing to the need to close the site, and the problem of identification was further compounded by the nature of the deposits, which degraded or totally destroyed any hurdling or fencing. This denudation is seen with F10 and F13; in the former case the stakes were recognized only because of the contrast between the sand and the underlying and overlying deposits. With the later example the withies had completely disintegrated, so that the hurdling was only identified as linear and slightly paler discolorations in an otherwise homogeneous deposit.

<sup>66</sup> Rahtz, *op. cit.* in note 56, 81–85.

<sup>67</sup> The site of N. Elmham typifies the various building traditions in use from the 7th century onwards. Building A, although of a much narrower span than WH2, represents a divergent type of construction for the larger building. See also building AK for comparative building sizes: P. Wade-Martins, 'Excavations in North Elmham Park 1967–1972', *East Anglian Archaeology*, 9 (1980), 239–45 for discussion of building sequence; Building A, 201, fig. 163; Building AK, 210–12, figs. 175–77.

<sup>68</sup> The scantling of the posts in West Halls I, II and III is generally greater (0.30–0.60 m) and the spacing of the uprights is comparatively more regular. The irregular spacing indicates the use of reversed rather than normal assembly and in this respect the roof reconstruction in WH2 may be simpler than shown: P. Rahtz, *The Saxon and Medieval Palaces at Cheddar* (Oxford, Brit. Archaeol. Repts. Brit. Ser. 65, 1979), 133–56, figs. 47, 50, 51, 53, 54; p. 154 for discussion of roof.

<sup>69</sup> See for instance Chalton, Houndtor and Maxey for very distinctive examples of these different house types: P. V. Addyman and D. Leigh, 'The Anglo-Saxon Village at Chalton, Hampshire', *Medieval Archaeol.*, xvii (1973), 1–26 and table 1 for details of post spacing; Beresford, *op. cit.* in note 54, 98–159; P. V. Addyman, 'A Dark Age Settlement at Maxey, Northants.', *Medieval Archaeol.*, viii (1964), 20–73.

<sup>70</sup> C. Platt, *The English Medieval Town* (London, 1979), 33–93.

<sup>71</sup> M. Biddle, 'Excavations at Winchester, 1970. Ninth interim report', *Antiq. J.*, 52 (1972), 93–132; J. Clarke and S. M. Youngs, 'Medieval Britain in 1980: Bristol', *Medieval Archaeol.*, xxv (1981), 205–06; A. Carter and J. P. Roberts, 'Excavations in Norwich — 1972. The Norwich Survey — second interim report', *Norfolk Archaeol.*, 35 (1973), 457–62, 464–67.

<sup>72</sup> J. Radley, 'Economic Aspects of Anglo-Danish York', *Medieval Archaeol.*, xv (1971), 37–57, 43–46, fig. 10.

<sup>73</sup> There are no details of any population mentioned in connection with the three Cheshire wiches. Perhaps the area was an industrial zone from late Saxon times: Terrett, *op. cit.* in note 2, 362–64.

<sup>74</sup> I am grateful to J. Oxley for allowing me to consult his unpublished manuscript; see J. Oxley, 'Nantwich: An eleventh-century Salt Town and its Origins (1)', *Trans. Hist. Soc. Lancashire Cheshire*, 131 (1982), 1–19.

<sup>75</sup> J. Oxley has discussed the difficulties in defining the late Saxon settlement from documentary sources: see Oxley, *op. cit.* in note 74. Nantwich in the medieval period was about half of its present size, although most of the streets were in existence by the 13th century: R. McNeil Sale, 'Nantwich: Three Years of Excavations and Observations', *Cheshire Archaeol. Bull.*, 7 (1980/81), 30–33.

<sup>76</sup> Per. comm. J. Oxley. This is not the present day Pepper St on the E. bank of the R. Weaver, but one (now lost) in the Wyche House Bank area.

<sup>77</sup> McNeil Sale, op. cit. in note 3, 8, figs. 12, 28.

<sup>78</sup> Oxley, op. cit. in note 74, where he argues for and against the inclusion of fifteen other salt houses in Nantwich.

<sup>79</sup> Pers. comm. J. Oxley.

<sup>80</sup> Hall, op. cit. in note 7, 254.

<sup>81</sup> 'A survey of the Walling Land in Wich Mal Bank, Sept. 6th 1624', Cheshire Record Office, Chester Castle DCH/Y/10/1.

<sup>82</sup> Challoner, op. cit. in note 1, 62 (Huntingdon, 1636).

<sup>83</sup> *Ibid.*, 82. The Earl of Huntingdon describes the town as bigger than Loughborough and one mile long. The 1794 Poor Relief Map of Nantwich is the earliest known map of the town and shows its probable extent by 1700. It is noticeable that buildings in Hospital St occupy substantial plots, which reflect the post-medieval aggrandisement and consequent wealth of Nantwich.

<sup>84</sup> Oxley, op. cit. in note 74.

<sup>85</sup> H. J. Hewitt, 'Medieval Cheshire. An Economic and Social History of Cheshire in the Reigns of the Three Edwards', *Chetham Soc.*, 88 (1929), 110.

<sup>86</sup> Oxley, op. cit. in note 74.

<sup>87</sup> Terrett, op. cit. in note 2. Separation between workshops and messuages is hinted at in the Middlewich accounts: Varley, op. cit. in note 45, 33.

<sup>88</sup> Terrett, op. cit. in note 2, 362–64.

<sup>89</sup> L. F. Salzman, *Building in England down to 1540: A Documentary History* (Oxford, 1952), 237–52.

<sup>90</sup> Hall, op. cit. in note 7, 252–67.

<sup>91</sup> This is based on a paper presented by J. Oxley to Liverpool University.

<sup>92</sup> According to methods described by P. A. Leggett, M. K. Hughes and F. A. Hibbert, 'A modern oak chronology from North Wales and its interpretation' in J. Fletcher (ed.), *Dendrochronology in Europe* (Oxford, Brit. Archaeol. Repts. Int. Ser. 51, 1978), 187–94.

<sup>93</sup> M. K. Hughes, S. J. Milsom and P. A. Leggett, 'Sapwood Estimates in the Interpretation of Tree Ring Dates', *J. Archaeol. Sci.*, 8 (1981), 381–90.

<sup>94</sup> As Mr S. Moorhouse has observed it is probable that the standard forms were used in a variety of ways so the possibility of use during the salt-making process cannot be ignored: S. J. Moorhouse, 'Documentary Evidence for the Use of Medieval Pottery: An Interim Statement', *Medieval Ceramics*, 2 (1978), 3–22.

<sup>95</sup> For detailed descriptions of the range of forms and fabrics, see the 'Crown Car Park, Nantwich', forthcoming. There is very little published on the medieval pottery in Nantwich, but see V. Nailor, 'Medieval Pottery', 20–25 in McNeil Sale, op. cit. in note 3; and V. Nailor, 'Medieval Pottery', 22–26 in McNeil Sale, op. cit. in note 11.

<sup>96</sup> Known sources of pottery coming into Nantwich in the medieval period include Stamford and Developed Stamford Ware, French imports (Crown Car Park), Lyveden, Nuneaton, and probably the area around Shrewsbury. It is likely that there are as yet unidentified wares imported into Nantwich from beyond the local area. Personal communication with S. Moorhouse has also indicated the wide range of pottery types in Middlewich, another salt-producing town.

<sup>97</sup> Sources for these light-bodied wares include possible foreign sources, Nuneaton, Sneyd Green and possibly Ewloe in N. Wales: H. M. Harrison and P. J. Davey, 'Ewloe Kiln', 92–99 in P. J. Davey (ed.), *Medieval Pottery from Excavations in the North West* (University of Liverpool, 1977).

<sup>98</sup> The production of salt from brine was an extremely hot and steamy process and it is highly probable that the salt workers did not necessarily live in the salt-working area of the town in the medieval period. For a similar situation see Rochester, op. cit. in note 8, 17, 18, 21–23.

<sup>99</sup> The actual period of use of the building may have been as short as 10 or 15 years.

<sup>100</sup> These series of tips probably contain rake-out from the salt-boiling process. A sherd from a salt pan in wich house 2 joins with materials from these tips. It is likely that these tips were deposited rapidly in response to erosion of the wich house by the R. Weaver.

<sup>101</sup> Personal communications with Dr L. Adams suggested that this may be a possible French import.

<sup>102</sup> In particular the material compares with the lower fill of the outer defensive ditch (Crown Car Park): V. Nailor, 'Medieval Pottery', 20–25 in McNeil Sale, op. cit. in note 3.

<sup>103</sup> Material from Shrewsbury was examined, and bore some similarities to this material. Material from the Oxford region was not examined.

<sup>104</sup> The code in brackets refers to the fabric types occurring in Nantwich. For context abbreviations, see p. 44.

<sup>105</sup> The term 'Midland Purple' ware is a loose definition, covering a range of different fabrics. The techniques of firing and the forms are however reasonably consistent.

<sup>106</sup> F. H. Thompson, 'Excavations at the Cistercian Abbey of Vale Royal, Cheshire', *Antiq. J.*, XLII (1962), fig. 6, 9.

<sup>107</sup> The terminology used is taken from J. H. Thornton, 'A Glossary of Shoe Terms', *Trans. Museum Assistants Group*, 12 (1973), 44–48.

<sup>108</sup> S. Thomas, *Medieval Footwear from Coventry* (Coventry Museums, 1980), 51, fig. 5 for a similar piece.

<sup>109</sup> Thompson, op. cit. in note 36, 57–59.

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