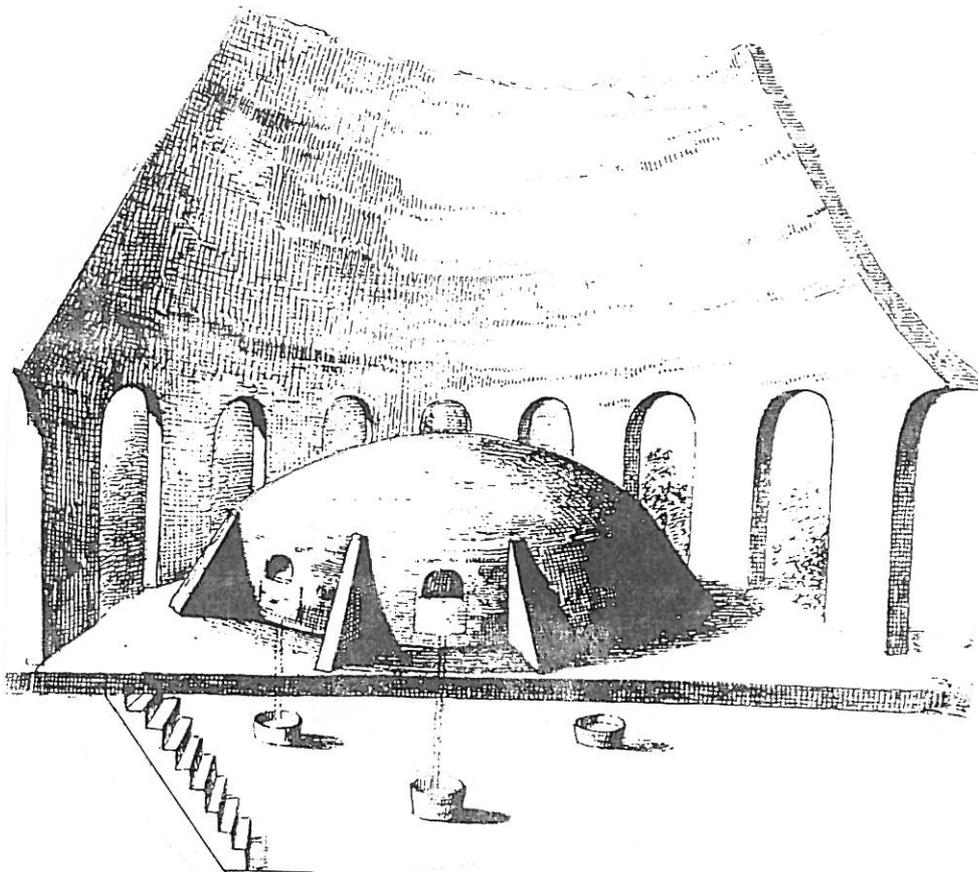


City of Hereford Archaeology Unit

# WARMLEY BRASSWORKS

WARMLEY,  
AVON



A SURVEY  
FOR MANAGEMENT

June 1995

Hereford Archaeology Series 247

EXCAVATION ■ EVALUATION ■ BUILDINGS SURVEY ■ HISTORICAL RESEARCH

This report is produced by the  
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for: **English Heritage**

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**Front cover:** Angerstein's 1754 sketch of the Warmley zinc smelting furnace  
(Liverpool University)

# WARMLEY BRASSWORKS

## A SURVEY FOR MANAGEMENT

Research and text: John van Laun FSA

Historical research: Joan Day FSA : Illustrations and design: Brian Byron

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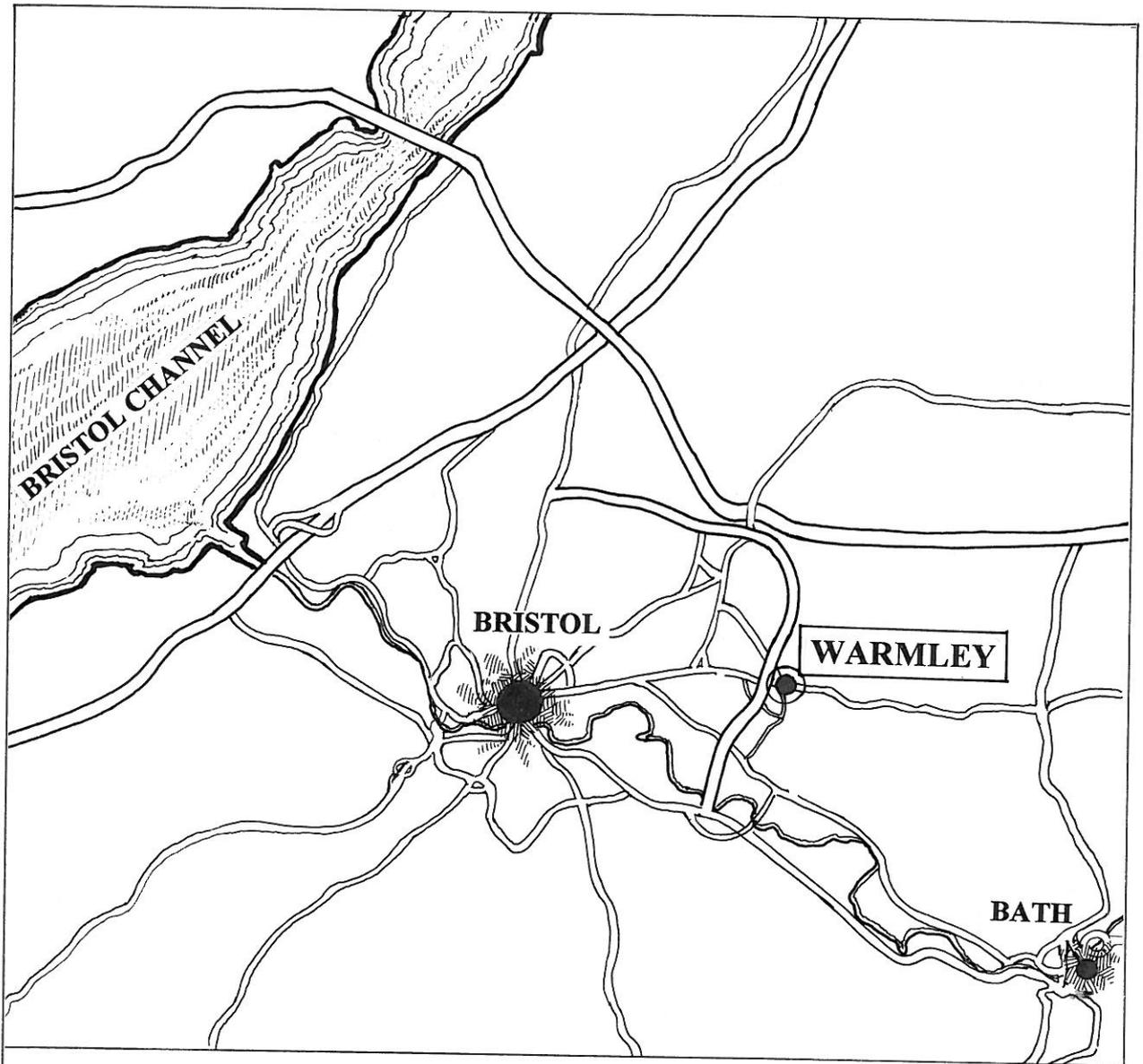
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**Fig. 1** The location of Warmley

**WARMLEY BRASSWORKS,  
WARMLEY, AVON  
(NGR. ST 668 728)**

**A SURVEY FOR MANAGEMENT**

*At its zenith the Warmley works was part of the itinerary of many famous tourists of the 18th century. In 1767 Sir Joseph Banks noted the 'immense number of wheels employed [and] two of the largest fire engines in England'. The following year Arthur Young fancied that 'The liquid pouring out of the furnaces...resemble[d] the eruption of Mount Vesuvius'. The ubiquitous John Wesley visited in 1761 and found a suitable text to describe the scene:*

*"I preached in the evening at North Common. There are sprung up, as if it were out of the earth, most of them employed in the neighbouring Brass Works. We took a view of these next day, and one thing I learned here, the prosperity of that expression 'His feet were as fine Brass, Burning in a furnace' [Revelations 1.15]. The brightness of this cannot be easily conceived. I have seen nothing like it, but clear white lightning"*

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## **1 Introduction**

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The Warmley Brassworks site (Fig 1) consists of a group of buildings and other associated environmental features of historical and architectural importance relating to the 18th century Bristol brass industry. Its particular importance derives from the fact that zinc smelting was successfully carried out here for the first time in Europe by William Champion (1709-98), a Quaker, during the middle of the 18th century.

Certain aspects of the site have previously been subject to specific archaeological investigation as will be later referred to in this work. This survey was commissioned by Andrew Davison (Inspector of Ancient Monuments for English Heritage) as a Survey of Management for the whole of the Warmley complex. The project included an investigation into the industrial history and technology of the complex by Joan Day.

The complex at Warmley includes of a number of different factors involving historical, archaeological, commercial and social interests. It is apparent that these various interests have led to various management problems in the past. Although the historical and archaeological importance of the complex should be considered paramount commercial and social interests need to be taken into consideration.

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## **2 Approach and methodology**

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### *The Approach*

In order to produce this Survey it has been necessary to establish:

1. A firm definition of the boundary of the whole complex.
2. The historical background, to determine the position of buildings, structures and features of the site during the key phase of its history, (the operation of the Champion Brassworks (1748-69)), with descriptions where possible.
3. The identification of surviving buildings, structures and features, with analysis where appropriate, and an assessment of their relative importance.
4. The location, extent and anticipated quality of the buried archaeological resource.

### *Methodology*

1. Joan Day, an acknowledged expert in the subject, was commissioned to collect primary historical data and details of the early brass industry.
2. Secondary source material was examined by the project officer.
3. Field visits were made to assess all upstanding buildings and an outline photographic survey (black and white) was made of the exteriors and, where possible, the interiors of buildings, structures and features of interest.
4. The documentary and archaeological evidence was evaluated to assess the potential of the complex as a whole.

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## **3 The technology of brassmaking and working**

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Brass is an alloy of copper and zinc. Zinc was produced from calamine, a carbonate of zinc found in the Mendip Hills and copper was brought from Cornwall. Plentiful supplies of water and coal made the area ideal for brassmaking and working.

The copper was smelted using coal-fired reverberatory furnaces, with a new technique developed in Bristol from the 1680s (Day 1974). Large rectangular reverberatory furnaces enclosed two sections which separated harmful gases given off by coal from the ores being smelted. As highly refined copper was needed for making a workable brass, Nehemiah Champion introduced alternative melting and roasting processes, up to twenty being recorded in his smelting methods. His son William adopted these methods.

Until the 16th century metallic zinc was unknown. Brass was made by the cementation process, in which calamine, copper and charcoal were heated together. Early in the 18th century brass was being made by heating crucibles with coal, the calamine and copper being added later (Day 1988).

The particular importance of the Warmley site is that metallic zinc was produced there for the first time in Europe. Champion's patent, about which he is known to have been extremely secretive, dates from 1738. Later descriptions (Tomlinson, 1851) show that the furnace in which the metallic zinc was produced was similar to a glass cone in which there was a domed inner furnace where the reduction took place. Six crucibles were placed round a central grate with a mixture of calcined ore and coal. The dome had openings above each crucible for the convenience of charging. An iron tube attached the base of the crucible to a vessel underneath. The upper end connecting into the crucible was first sealed with a wooden plug before the introduction of the charge. After the crucibles had been filled they were sealed at the top with a tile and fire-clay. The heating of the crucible caused the wooden plug to convert to charcoal which was porous enough to allow the passage of the zinc vapour but not solids. The distillation took place *per descensum* and was collected in the lower vessel in drops.

Although the manufacture of metallic zinc created a potential for increased production it was expensive to produce and the traditional method of brass production by the cementation process continued alongside (Day 1988).

To produce hollow-ware, brass was rolled into sheet metal which was then battered into the required shape by water-powered hammers. The battery that the metal received made it work-hard. Frequent annealing to soften the metal was therefore necessary and annealing furnaces were an integral part of a battery mill. From 1721, coal-fired furnaces were in use, but the sulphurous fumes contaminated the brass. This was eventually overcome by separating the metal from direct contact with the fire by 'muffling'.

For making wire the molten brass was run into casts made of granite stones, (Day 1973 says 4ft by 2ft [1.2m x 0.6m]) one above the other, with an iron spacer between. The resulting plates of about 4mm thick were slit lengthways into six or seven bars which were cut again to make 4mm square rods. These were then drawn into wire of the required diameter.

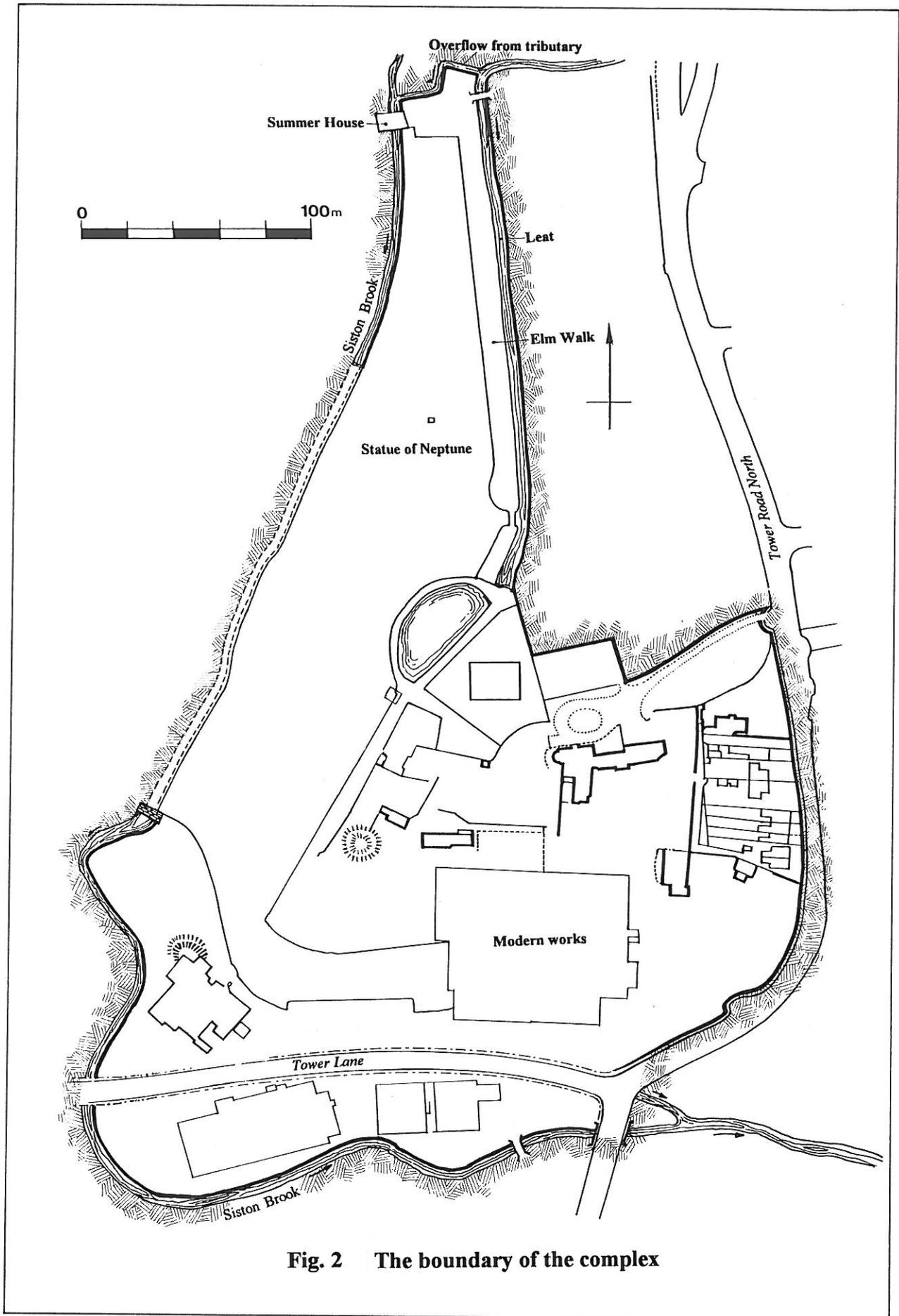
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#### **4. The extent of the complex (Fig 2)**

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The Warmley complex lies to the east of Siston Brook a tributary of the River Avon. At its broadest point it is about 500m x 250m and covers an area of approximately 12.5 hectares (21.5 acres). It was conveniently located to receive supplies of the basic raw materials (such as copper and calamine) via the navigable river Avon and the Bristol Channel.



**Fig. 2 The boundary of the complex**

The complex is bounded on the west and south by the Siston Brook starting at, and including the Summer House. On the eastern side the site is bounded by Tower Road North as far as the drive to Warmley House. The car park area to the north of the drive is included and from there the boundary follows the wall of the garden northwards and continues north again to include the east of Elm Walk thus rejoining the Siston Brook.

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## **5. The historical background**

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### **Outline history of the site**

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William Champion and his partners were at the Warmley site by 1748. Soon after, copper ore was noted as being smelted in nineteen separate furnaces. Calamine brass was made at this time from granulated copper, a technique patented in 1723 by Champion's father, Nehemiah (1678-1747), when he was manager of the the Bristol Brass Company (founded by Abraham Darby, a fellow Quaker, in 1702). The brass, produced was rolled into sheet, slit and drawn into wire.

Spelter (metallic zinc), is also likely to have been produced even in the early days at Warmley, by William Champion's patent process.

The works continued to expand and in 1749 a Newcomen engine was installed by Joseph Hornblower to recycle water after it had driven the 18 foot diameter water-wheels. This engine was a very early example of the combined use of steam and water power. The Swedish industrial spy, Reinhold Angerstein, sketched it on his visit to the works in 1754 when he also noted '15 copper furnaces; 12 brass furnaces; 4 spelter or zinc furnaces; a bater [battery] mill, or small mill for kettles; rolling mills for making plates, and a wire mill both of thick and fine drawn kinds'. In these early days the output of copper from Warmley was to about 25% of that refined by the Bristol Brass Company.

Following the death of William's father, relations with the Bristol company became increasingly strained. They were exacerbated by an unsuccessful campaign in 1750, strongly opposed by the older company, for an extension of the zinc-smelting patent. Although the technique was successful and was recognised as a significant innovation in Europe it was expensive to work because of high fuel costs. Significantly, the Warmley production of 'common' brass continued to rely on calamine rather than the more expensive metallic zinc.

By 1761, the works had expanded to include a windmill for stamping ore, and two horse mills. There were then twenty-two copper furnaces, fifteen brass furnaces, and twenty-five houses and tenements for workers. Champion now attempted to secure a monopoly on local coal and thus deprive the old brass company of supplies. This strained the relationship further between the two companies and accusation and counter-accusation passed between them over a number of matters not related to the coal cartel. Although

Champion may have been a difficult man, the local coalowners preferred to deal with him at this stage. However, problems began to arise with the small coal lessees who held land from the coal lords. The demand for coal had over-stimulated production and an outlet was needed for the surplus.

By 1765 Champion's company was under-capitalised and had to borrow large sums at high interest. An attempt was then made to make shares transferable and increase the partnership; an issue which, since the Bubble Act of 1720, required a Charter of Incorporation. This was proceeded with secretly. £400,000 of new capital was needed to fund further expansion, including copper furnaces at a new site at Kingswood and new brass manufacturing sites at Bitton and Kelston. The brass pin manufacture at Warmley dates from this time. Stressing the importance of his works to the nation in support of his Charter application, Champion claimed that the company provided employment for 600 local people and 1400 elsewhere.

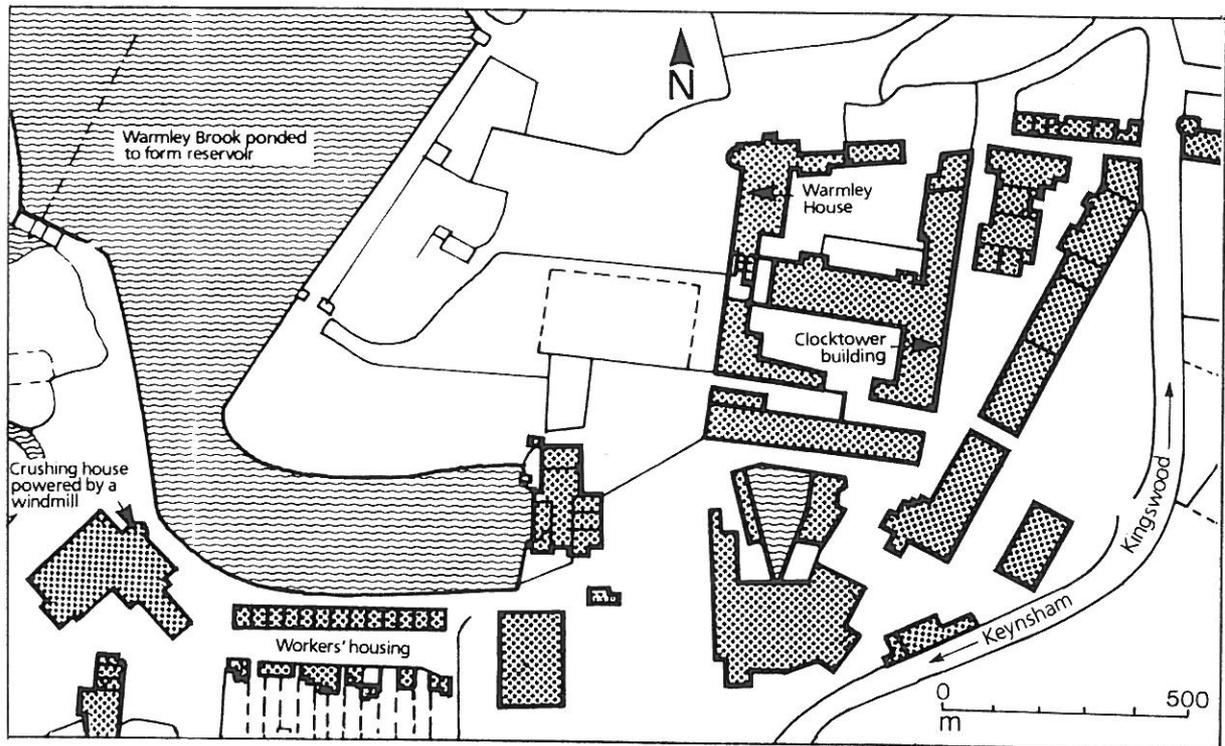
In 1767 Champion took out three further patents relating broadly to brass production. This year saw the issue of the warrant for the preparation of the Charter and parliamentary approval was sought. The secret was now out and the rival companies protested vigorously arguing that the brass industry had reached its full potential. However a second warrant was granted, but again the opposition mobilised saying that the Warmley Company would become a monopoly. The Charter of Incorporation was defeated and Champion attempted to withdraw capital and was dismissed by his partners.

In 1769, following William Champion's bankruptcy, the works was put up for auction and bought by the old rivals, the Bristol Brass Company. At the height of William's regnum the company was of major importance in the country and Europe, although its purchases of copper ore, never equalled that of the Bristol Company.

The Bristol company was reformed in 1786 but continued production at Warmley, although less intensively. The proposed sale of a Newcomen engine from Warmley suggests the termination of the use of water power but zinc smelting continued. All copper smelting had been transferred to Warmley in 1781, but by the end of the century it was moved to Swansea. By then, part of Warmley, was leased to John Barrety, under the name of Durnfords, the London pin manufacturer. There is no mention of later brass production or manufacture of brass wares, other than pins.

From around 1809 until about 1835 the Davidson family took over, still under the name of Durnfords. Harfords, successor to the old Bristol company, continued zinc smelting on the site. In 1830 the Davidsons purchased the fee simple of the property from Harfords and, from 1834 to about 1850, undertook the smelting of zinc to a much-reduced extent.

The high-temperature furnaces at Warmley would always have needed constant repair and an expertise in the production of ceramics must have developed. It is possible, but not recorded, that local sources of clay (part of the total Warmley estate of 79 acres) were exploited for brick-making in Champion's time. Initial experiments with pottery



**Fig. 3** The Tithe map of 1841  
(after Day, 1988)

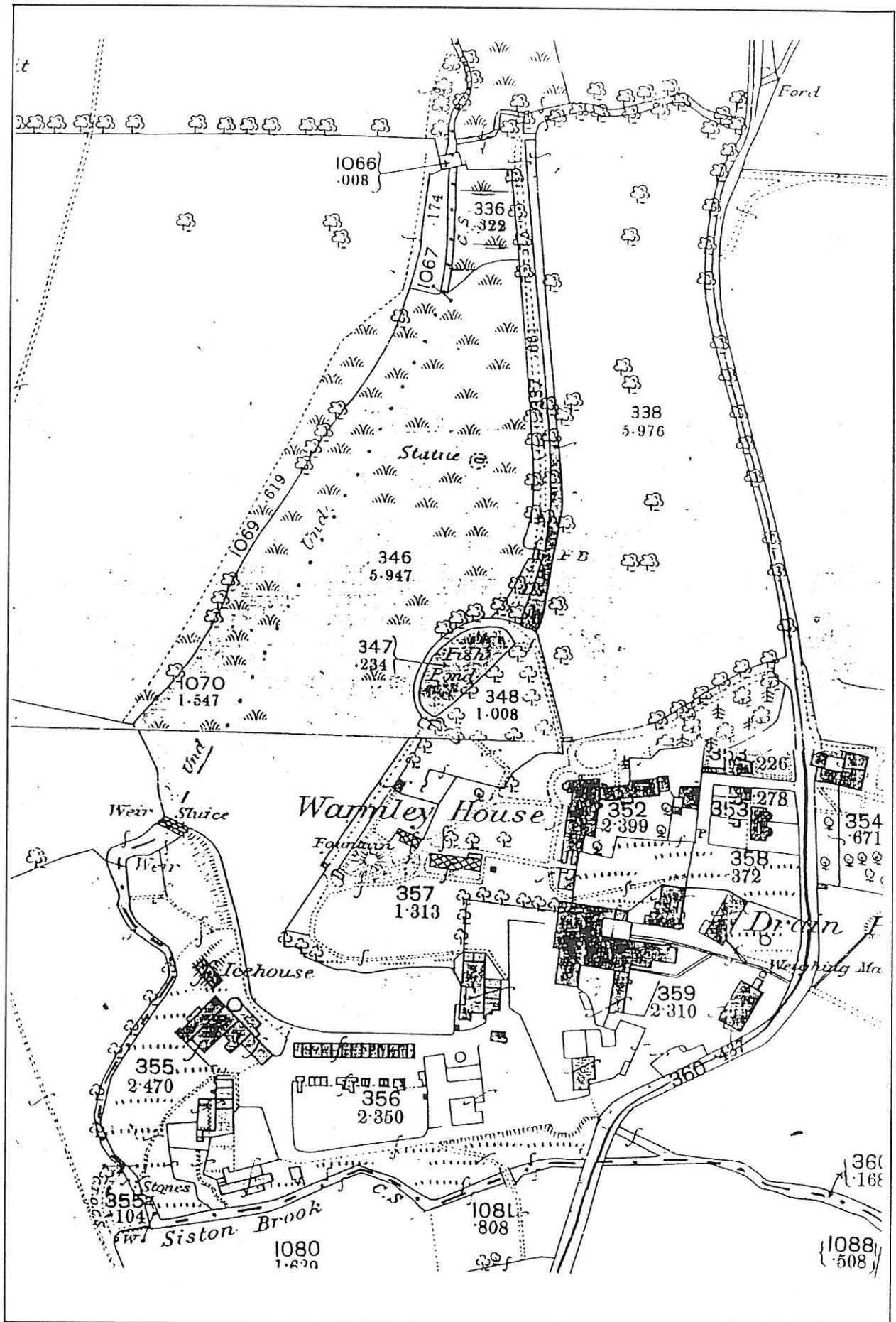


Fig. 4 1881 Ordnance Survey plan (25 inches to a mile)

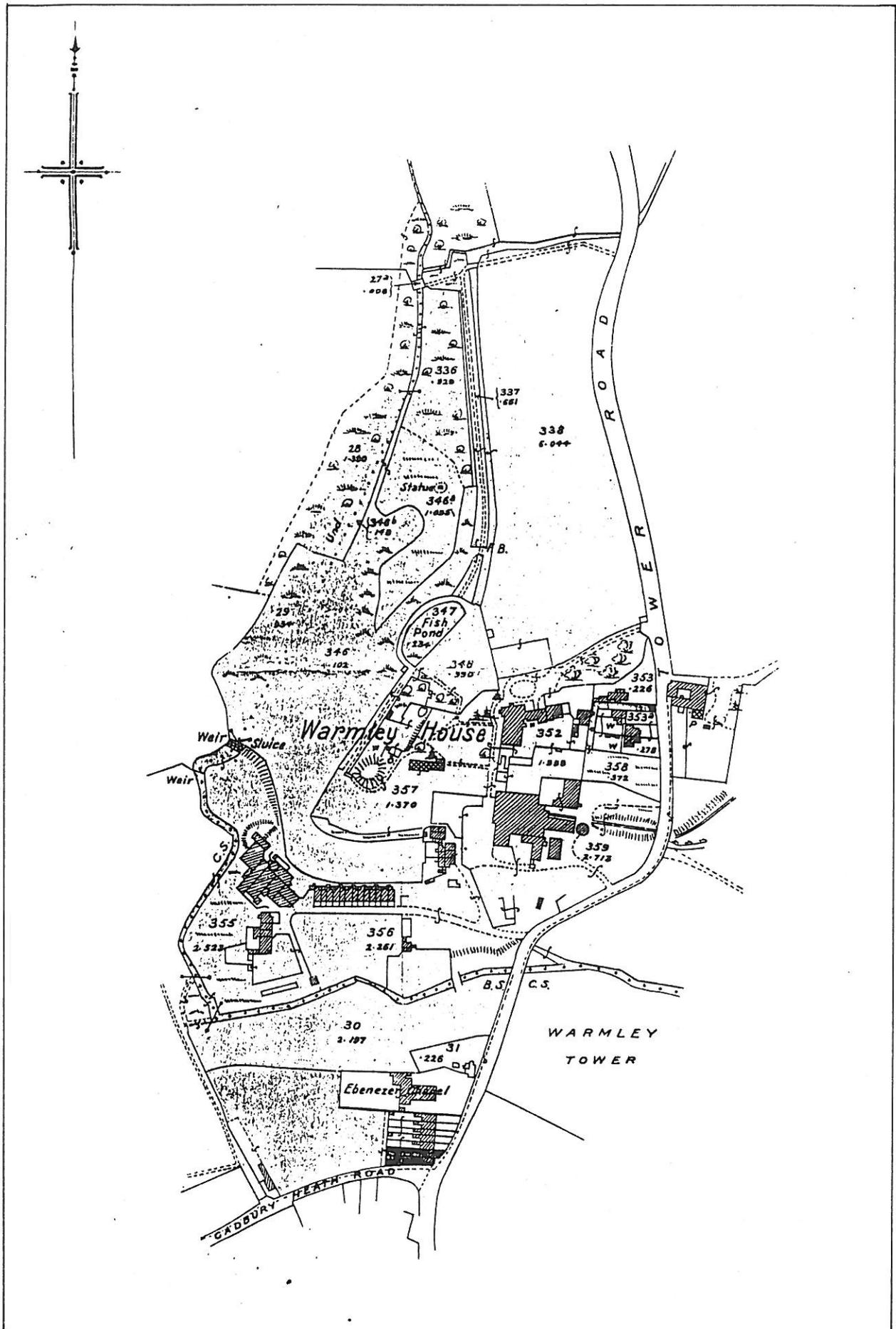


Fig. 5 A map accompanying a title of 1889

production by Albert Davidson's family were a failure, but the name of Davidson and West, trading in pottery in 1859, indicated its eventual success.

In 1880, Joseph Haskins leased the works, expanding production to stoneware pipes and other goods. Deposits of clay, east of Tower Road North, were exploited, to which railed access was gained through a tunnel under the road. This business continued until 1967. The Clocktower building had, meanwhile, been used for other purposes.

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### **The historical and documentary sources**

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There are a number of traveller's accounts of visits to the Warmley works. Although these give an impression of the importance of the works at that time they provide little technical detail. Reinhold Angerstein, sketched a copper smelting furnace and a zinc-smelting furnace in addition to the Newcomen engine in 1754. An inventory of 1761 (Gloucestershire County Record Office) provides details of the works at that time and this is supplemented by a Sale Notice of 1769 (Farley 1769)

The earliest cartographic evidence is the 1841 tithe map (Fig 3) which provides much of the information about the earliest buildings.

The 25 inches to a mile Ordnance Survey map of around 1880 (Fig 4) shows the development of some areas of the site and the contraction of others, as the ceramic production tended to be concentrated in one area.

A redrawn and updated plan accompanying a title of 1889 (Warmley Borough Council) (Fig 5) shows the growth of the ceramic works, the Dalton Young complex (Windmill area) and improvements to workers housing. The plan shows some of the watercourses and provides an indication of the likely location of the Newcomen engine(s).

The 25 inches to a mile O. S. map of 1902 shows little change since 1889.

The 25 inches to a mile O. S. map of 1953 illustrates the full extent of the ceramic works and shows all the external kilns.

The only graphical evidence from Champion's era that is known comprises the sketches made by Angerstein. However, a photograph taken in the early 1900s includes clear evidence of the location of an annealing furnace. An aerial photograph, taken some time before 1957, provides a clear outline of the site (Plate 13). In addition, a number of photographs taken in the 1960s (Kingswood Library) (including plates 11, 12, 14 & 15), before the wholesale clearance of the southern part of the site, has made it possible to locate a number of industrial buildings. Some of these appear on the 1841 Tithe map, but there are others apparently of 18th century date which do not.

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## 6 Archaeological interventions

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6.1 A considerable amount of archaeological work was carried out under an MSC scheme directed by Lesley Howes. Unfortunately, this has not been published and the total extent of this potentially important resource is uncertain. Where possible it has been incorporated in this report as a result of information kindly provided by A. Bryant who was closely associated with the project.

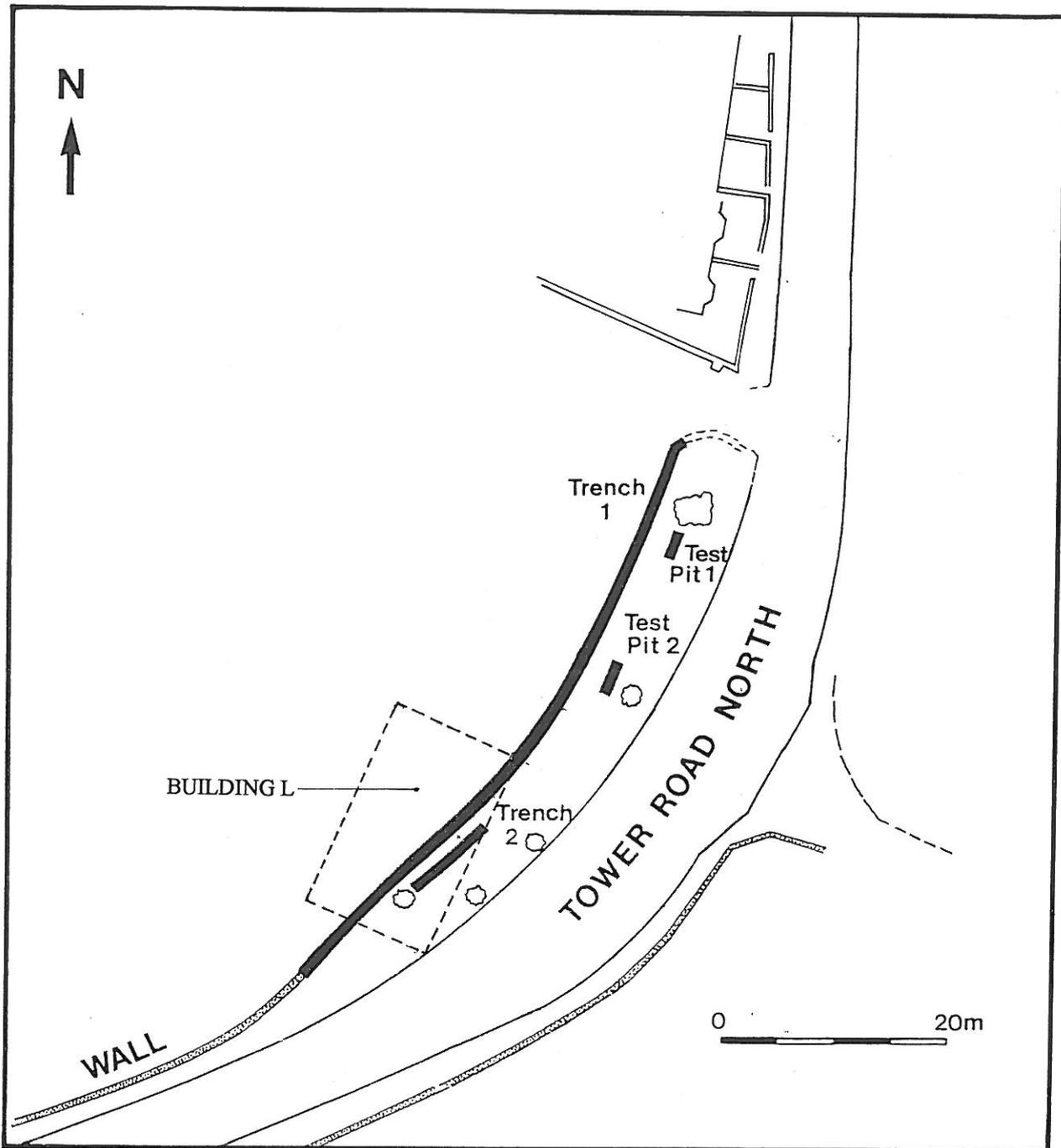
6.2 Day (1988) has shown that important remains lie under the nursing wing of Warmley House. In 1986 foundation trenches were driven through a set of three structures to the west of the back lane beyond 138 and 140 Tower Road North. These structures are thought to have been calamine brass furnaces, they were orientated east-west and contained within a ten metre area. The remaining cylindrical brick structures were confirmed as cementation furnaces. Unfortunately only outline recording was possible as the trenches were rapidly filled with concrete.

6.3 Remains of what are presumed to be part of Champion's works were discovered during the excavation of a trench in a narrow strip of land bordering Tower Road North (stated in the Report as NGR ST 6705 7281 but in fact 6702 7276). Further excavation in a parallel trench and in two test pits slightly to the east of the first trench, revealed parts of a structure and metallurgical waste that may be associated with zinc or brass making (Parry 1994).

Parry found a substantial external wall with a combined thickness of nearly 2m running north-west, south-east. The east side of the area revealed part of another substantial wall with a return. A similarly constructed structure lay 1m to the south with a similar alignment on the west aspect. To the south, three walls were uncovered within an area of approximately 3m. The southernmost of these contained a duct about 1m from surface level. The area between the north, east and south walls was interpreted as being composed of a number of free-standing pillars, originally surmounted with vaulting. The complex would therefore have formed a grid-like layout of passageways and ducts; much of which was probably subject to high temperatures as indicated by the presence of refractory bricks. It was concluded that the structure was either terraced or below ground at the time of its use. To the north a slightly irregular linear feature consisting of concrete fused with ceramic pipe fragments was revealed.

The remains were not related to previously known building, but by careful comparisons it has been possible to ascertain that the northern foundation represented an external wall of a substantial building possibly used for zinc smelting (Fig 6, Building L)

The eastern wall also appears to have been in part revealed with a possible doorway of about 1m width. The southern wall of this building lies approximately 20m south of the northern external wall. This would mean that the two other walls mentioned above are likely to contain a free-standing building. The existence of a duct and the localised



**Fig. 6** The relationship of the excavation to the pre-1841 building 'L' (after Parry, 1994)

metallurgical waste indicates that this may have been a furnace. This building does not appear on the Tithe map and because of its depth may have gone out of use soon after Champion's departure.

6.4. A small scale excavation (Erskine 1995), close to the modern Tower Road North bridge and on the site of the bridge shown on the 1841 Tithe map, consisted of an 8m. long trench parallel to the Siston Brook. The natural sand was overlain by topsoil, heavily contaminated by industrial ash and clinker, probably deliberately dumped in at least two episodes. After the construction of the present retaining wall (considered modern although containing slag blocks), the ground was made up with rubble to form footings for a temporary office. There were no significant finds associated with the Champion works.

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## 7. The buildings and upstanding features (Fig 7)

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### Warmley House (listed, grade II\*)(Plate 1)

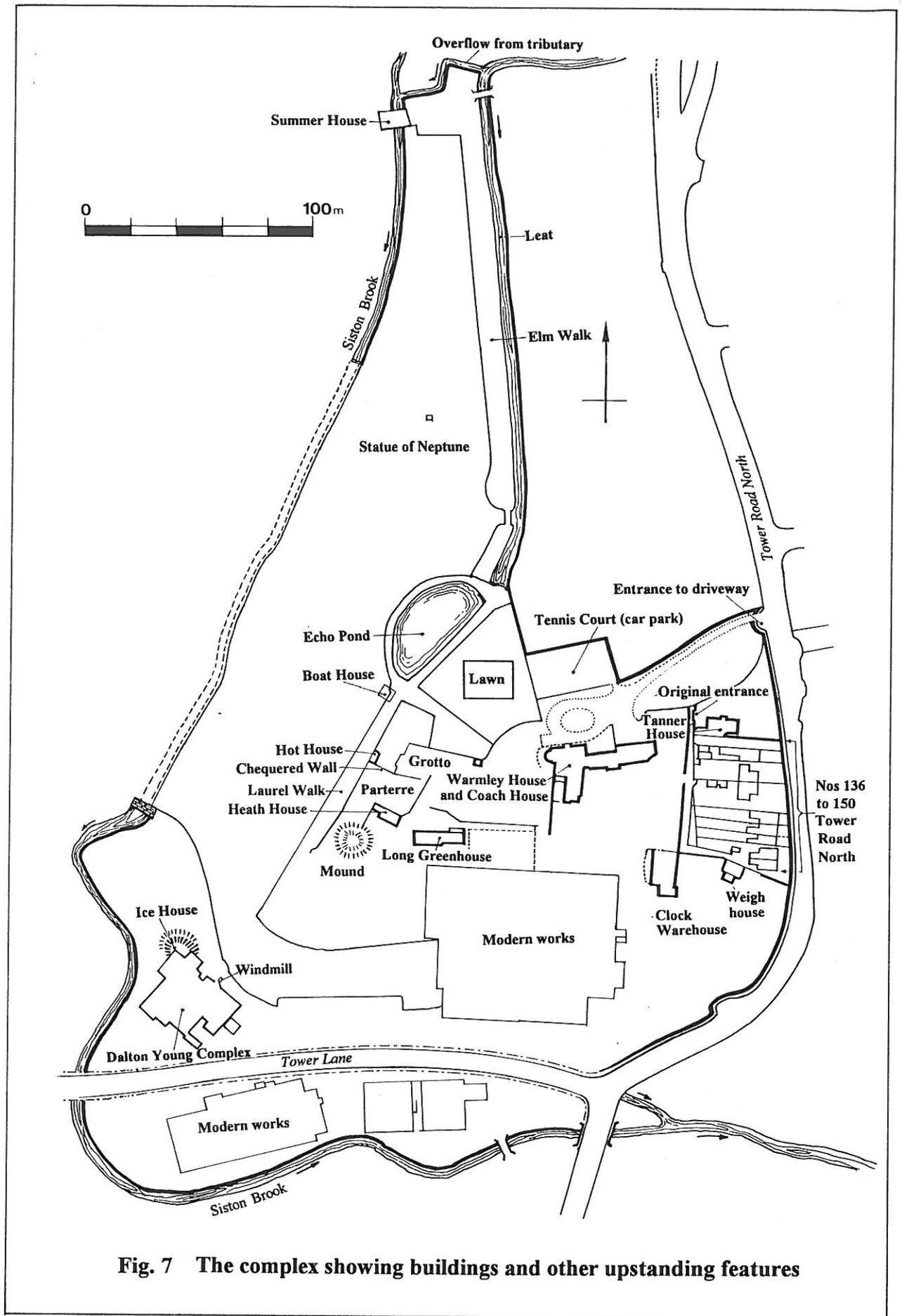
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This building, originally the home of William Champion, is now a private home for elderly people. It probably dates from the middle of the 18th century and was included in a sale advertisement of 1767 (Farley 1769) and George Tully a Bristol carpenter/surveyor is a possible architect especially as he had Quaker connections (he built the Friends Meeting House in the Friars, Bristol, 1747-9). Within recent years the house has been extended over some potentially rich archaeological areas including part of William Champion's works (Day 1988).

It is a Palladian building of Bath stone, with rusticated quoins. The facade is of five bays and three storeys, the central three bays slightly projecting under a pediment. The ground floor is rusticated up to the band course marking the pseudo piano nobile. A pedimented and rusticated porch, also of Bath stone, was added, sometime before 1841. On the south side of the house is an apsidal projection, with three lights on each of its two storeys, surmounted with a balustrade.

To the east of the main block is a five-bay balustraded wing of two storeys with a central rusticated architrave which echoes the porch. This wing links the house to the coach house (also included in the II\* listing) a pleasant two-storey brick building with four inappropriately infilled arches. Each arch has a projecting key stone and circular window over. A plain parapet partially hides the hipped pantiled roof.

Behind the main single-pile house, but adjoining it, is a further part of the building. This has a pantiled roof facing west, the other end is a plain gable. The ground floor of this section includes a bow window inserted late in the last century. The interior of the room behind was also remodelled at this time, the plaster ceiling being given Vitruvian scrolls and a picture rail added. The remainder of the house south of this appears to have been greatly altered since 1901.



**Fig. 7** The complex showing buildings and other upstanding features



Plate 1. Warmley House and stable block from the north



Plate 2. The chequered wall from the south-west



Plate 1. Warmley House and stable block from the north-west



Plate 2. The chequered wall from the south-west

Although the house has been adapted for its present use there are a number of original internal features. In the hall are two doorcases (north and south) of fluted Tuscan pilasters with a heavy dentilled entablature over. The south door gives access to the apsidal drawing room. The apse is separated from the main part by two Roman Ionic square fluted columns *in antis*. The sides of the drawing room are set with Roman Ionic pilasters supporting an entablature of heavy dentils. The hallway is divided into two by a three-centred arch with a keystone supported by Tuscan pilasters. There are dentil mouldings throughout the hall. The stairway, with a heavy moulded handrail with two balusters to each stair tread, is contemporary with the original building. At the top of the stairs is a further three-centred arch of similar design to that in the hall.

In 1940 the house was purchased by the then Warmley Rural District Council. In 1983 it became a home for the elderly.

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### **Entrance to the grounds**

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The entrance to Warmley House is by a driveway now shared between the residential home and Kingswood Borough Council, but maintained by the Council. The gateway, which gives access to the grounds, is flanked by two substantial stone piers from which two quadrants join slender piers at the driveway. These support iron gates with a top rail and centre rail with quatrefoils. The copings of the piers are in keeping with each other. A rubble wall of variable height, containing some copper slag blocks, joins the gateway to a point near the coach house (all these features are pre-1841 and listed grade II). The driveway continues to an island in front of the house itself, but includes a diversion to the right leading to a public car park.

Along the driveway are three cast-iron fluted lamp standards with attachments for ladders. There are acroteria<sup>1</sup> at the top corners, two have finials. Another lamppost near the house has a pseudo-Corinthian capital. All were cast in Bristol. Echoing the entrance to the drive is a single stone pillar close to the house which has an attachment for an oil lamp. This, and the entrance appear on the 1841 tithe map.

The car park is bounded on the south by a wall of random-coursed sandstone with copper slag blocks at irregular intervals. It is surmounted by copper slag copings of triangular form. On the east the car park is bounded by a low, random-coursed, stone and copper-slag-block wall. This wall has been broken through recently to provide access to the garden to the east. The north boundary is secured by split chestnut fencing. The car park was formerly a tennis court, possibly built by Fred Brian who bought the house in 1918, but certainly post-1901. Most of this area is now part of the Warmley Historic Garden.

An early entrance to the grounds may have been in the south side of the random-coursed wall leading towards the coach house. It now forms a continuous wall separating Warmley

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<sup>1</sup> An ancient Greek motif at the corner of a building.

House from Tanner House. It was disused by 1841, but the blocked opening is apparent. It was 3.5m wide and directly to the north was an attractive gothic arched gateway (1.1m wide). Copper slag blocks were incorporated into the jambs of both openings. This entrance way would have provided access to a flat open space in front of the coach house. Any entrance from the road on the east would have been completely lost when Tanner House was built about 1880.

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### **The historic garden**

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The garden (including the chequered wall, the mound and the Laurel Walk), grotto, Echo Pond, lawn, driveway, car park, Elm Walk and the northern end of the lake are collectively accorded grade II status in the Register of Parks and Gardens of special historic interest. A Management Plan for the garden, which is owned by Kingswood Borough Council, was produced in 1993 by Lesley Howes (Howes 1993). The original lay-out is attributed to Champion but the earliest description is not until 1881 (Ellacombe 1881).

#### ***The garden entrance and lawn***

The present entrance to the garden is from the car park through a plain opening in the north wall. On the right, a granite edge runner (1.06m. diameter), recovered from Echo Pond, lies abandoned<sup>2</sup>. A sloping lawn runs from the house to Echo Pond. An inappropriate border of shrubs stands in front of the pond. At the top (south-east edge) is a Ha Ha and in the corner six stone steps (listed grade II) that lead from Warmley House to the garden. Adjacent to the steps is the lawn entrance to the grotto consisting of two rusticated piers, approximately 0.5m square, supporting hinges and a latch for a gate since removed. It has been suggested (pers. comm. Alan Bryant) that the Ha Ha and gate would have secured the house from the intrusion of animals used to keep the lawn manageable. Two restored part-copper-slag piers lead from the north end of the lawn to Elm Walk.

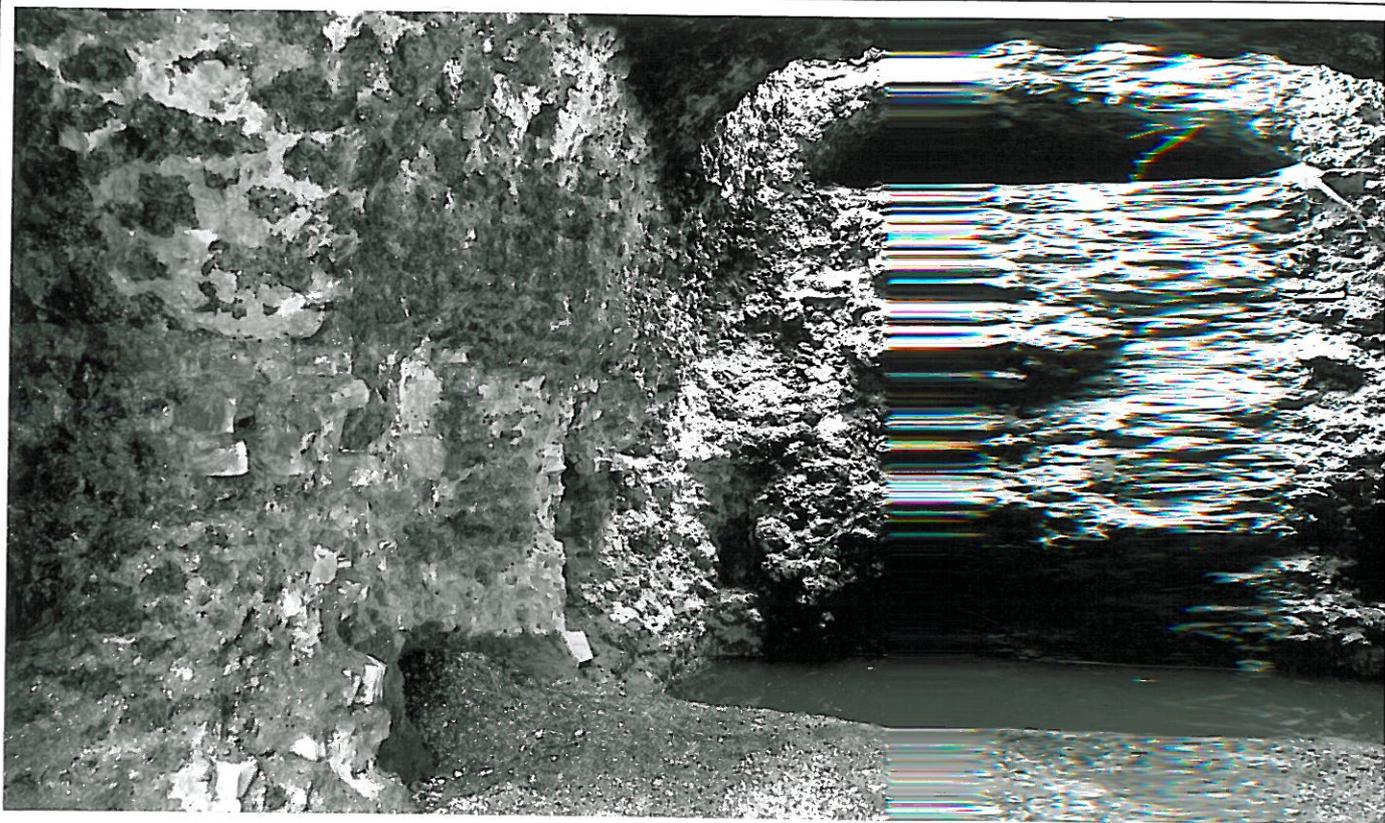
#### ***The Grotto*** (listed, grade II)(Plates 3 & 4)(Fig 8)

The Grotto is an extensive collection of underground passages and chambers associated with water features. It may have been partly constructed by cut-and-cover. If this was so, the slope would have been excavated first, and the stone retrieved from this would then have been used to construct the shells of the chambers.

The walls are in general of irregular clinker pieces set in a lime mortar. The entrance is now on the west side through a gate from the Laurel Walk, first noted as such in 1918 (Sales notice, 1918), but the main entrance would originally have been from the lawn. There was a second entrance from the lawn, but this is now blocked. It led to a chamber

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<sup>2</sup> Tomlinson, writing in 1851, mentioned that the calcined zinc ore was reduced to powder by heavy edge-runners. This one would certainly be suitable for that purpose.



**Plate 3. The Grotto - cascade pool**



**Plate 4. The Grotto - the blocked opening in the passage**

(slightly isolated from the main complex and now partly open to the sky) that contains some granite blocks and is associated with a high-level water channel. A channel from below the floor level in this chamber returned water to the lake. From this chamber, a passage leads south to the four chambers in the main part of the Grotto. The first one is open to the sky and contains a square *impluvium* giving the effect of a Roman atrium. The square chamber adjoining it to the south is also partly open at the roof and has a clear pool that was once supplied by a cascade of water from a high level chute (Plate 3). To the left (north-east) is another water channel at ground level. This is of good construction with three courses of copper slag blocks capped with another block and including a well-laid stone-slab floor. It appears to have been truncated at some time in the past. A floor of plain red tiles linked the *impluvium* to the cascade. The water collected beneath the cascade drained northwards into the *impluvium* and then through the northern chamber to Echo Pond and the Lake.

A Gothick vaulted passage leads eastwards up a gentle slope to a niche at its head. Under this runs a culvert of similar dimensions to that in the cascade room. It could curve through a right-angle to connect with the high level chute and the granite block chute in the northernmost chamber close to the lawn. A short passage (in earlier listing details described erroneously as an ice house) runs at right-angles to the main passage from near the niche to the garden entrance near the steps leading to the house.

The two western chambers are rectangular with barrel vaulting. The southernmost of these has a long and narrow bath in the floor that is quite deep and has a compacted earth floor. It is normally dry but if there was water in the lake it would presumably fill<sup>3</sup>. On the southern side of this chamber are three filled arches, originally a continuation of the chequered wall described below. A substantial wall, built partly into rock, separates this southern chamber from the main grotto. A short arched passage (2.2m high by 1.0m wide with alternate copper-slag block quoins giving the effect of headers and stretchers) leads through it into the cascade chamber. The arch (0.5m high) is of mixed brickwork, some tapered and some refactories.

The northernmost of the western chambers is now the entrance chamber and is joined by two irregular openings to the chamber with the deep bath. To the east one opening leads to the atrium and another to a tunnel with a blocked entrance.

The effect today is of a typical 18th century grotto. Contemporary appreciation would have been heightened by the sound of running water and even by the fumes from the works. The whole effect would then have been reminiscent to the cultured person of Aeneas's descent into the Underworld<sup>4 5</sup>.

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<sup>3</sup> The suggestion that this bath could have been associated with an industrial use such as the precipitation process whereby copper waste was recovered by the use of scrap iron has been discounted (pers. comm. D Bick).

<sup>4</sup> Virgil, *Aeneid*, Book 6

<sup>5</sup> David Whitehead points out that in the 1750s Thomas Wright laid out a classical landscape at Stoke Park, just north of Bristol, that was referred to as 'an epic space'. It was embellished with emblematic follies including a 9.1m. (30ft) long tunnel, clad like a grotto, which gave access to an undescribed water

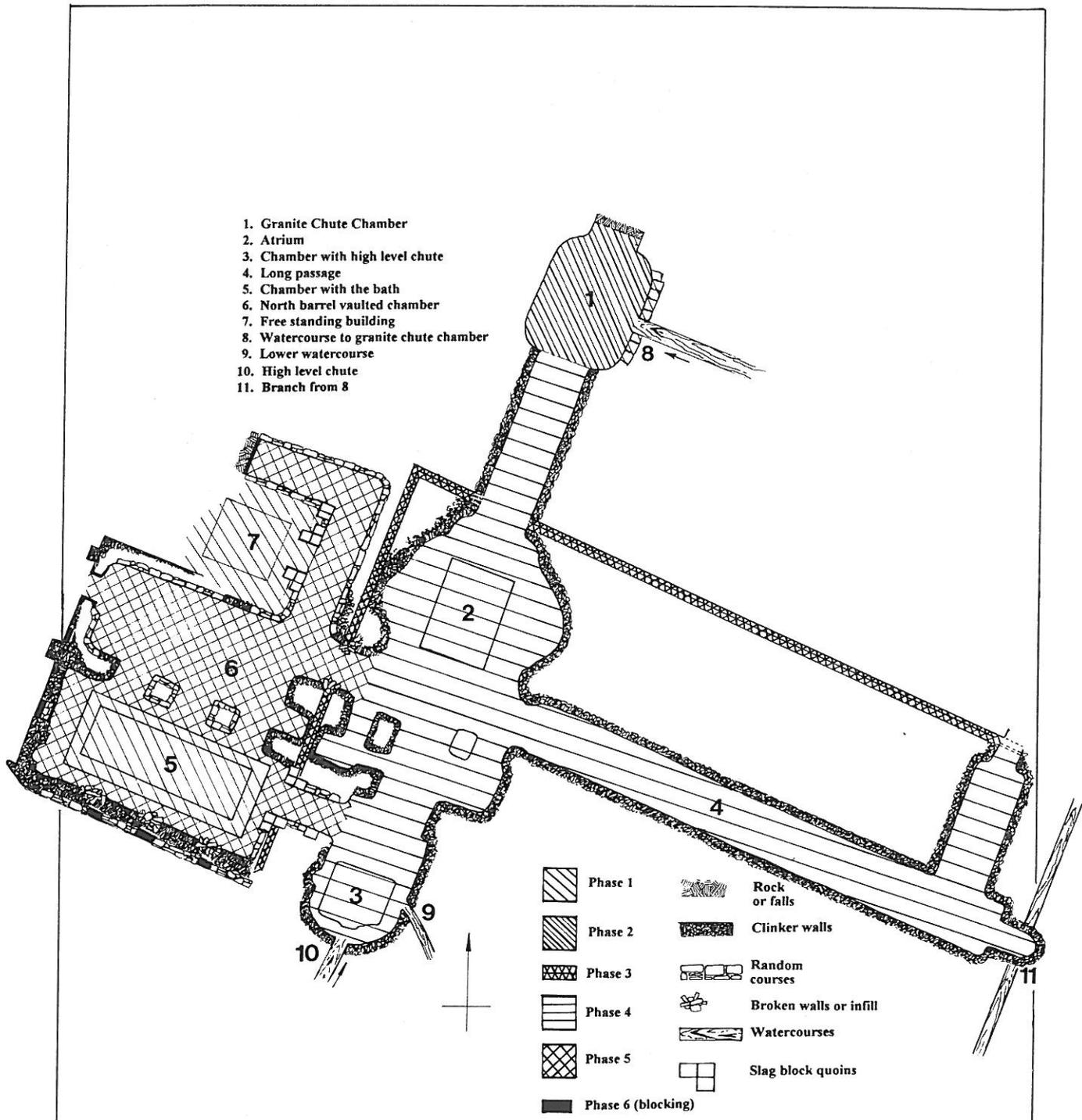


Fig. 8 The Grotto: preliminary suggestions of phasing

There are some anomalies within the grotto that require further consideration. After entering the Grotto from the Laurel Walk, there is a blocked entrance in the left wall (1.25m wide) disguised by added clinker. After a further 1.45m the wall turns at right-angles to the north, and 1.7m along there is a further blocked entrance (0.85m wide) with copper-slag jambs. This section is not covered in clinker and the wooden lintel above the opening can be seen although it has almost completely rotted away (Plate 4). After a further 1.3m the passage turns at right-angles again into a passage that is blocked at its western end. At the corner there are alternate header/stretcher copper-slag quoins. The outline indicates a free-standing structure, 6.2m. wide by 3.85m. long, with two means of access, one to the south and the other to the east. This structure, which would apparently have stood outside the grotto, is now inaccessible and probably without a roof. The visible stonework, the blocked doorways and the lintel are all suggestive of a pre-grotto free-standing building rather than part of the overall design of the folly. It is possible that this was originally part of the works.

It is apparent that the grotto was not constructed in one single operation, but is a complex structure that has been added to and altered from time to time. Fig. 8 shows a preliminary phasing but much more work is needed to establish the full sequence and provide a proper analysis.

### *The mound*

The mound rises some 9m. from the surrounding ground and is about 30m. across at the base. It is constructed of soil rather than industrial waste (Howes 1993). It would have provided a good vantage point, a feature often found in gardens with formal parterre, and its function in a garden without such a feature is difficult to explain. It is possible that the appeal to a character such as Champion was that he could stand there and overlook his works<sup>6</sup>. The area between the mound and the chequered wall to the north is flat, except for the later 'Heath House'. It could have contained formal areas, but these are rather far from the house. Although now surmounted by mature trees, the mound was once covered with coppiced holly, some stumps of which remain.

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feature. He suggests that this would be more like the Warmley grotto than Goldney, which was embellished with a profusion of shells, crystals and glistening corals. Goldney is much more polished, with Warmley being the antithesis, probably much more like Henry Hoares grotto at Stourhead constructed in the late 1740s. Hoare was a Bristol banker and may well have known Champion. At Warmley, Champion had the advantage of industrial waste to produce the effect of the underworld. The possible builders of the Warmley Grotto are Joseph and Josiah Lane who produced grottos of similar character at Painshill, Bowood and Wardour Castle which Burke appreciated as having '*delightful horror and sublime*'.

<sup>6</sup> . There are precedents for such a feature being built in the 1750s. Sanderson Miller introduced one at Wroxton in Warwickshire, whilst the Eagle House at Painswick serves the purpose of providing an overview of a formal garden.

### *The Heath House* (listed, grade II)

About 10m. north of the mound is a substantial stone rubble wall. This is 9.15m. long and approximately 4.25m. high. The mortar is flecked and there is a step-back topped by brick approximately 1m. above ground level, possibly for shelving or a bench. It consists of red brick headers with stretchers over. Higher up, the remains of rafter sockets are apparent. There are red-brick returns at each end. Remains of a refractory brick flue in the west end of the main wall were presumably for a free-standing stove. To the west, just above the chequered wall garden, is a clinker wall and corner running into brick and terminated by copper-slag block quoins. This adjoins the stone wall referred to above, but is free-standing, although some attempt had been made to tie the two together. The building that included this corner was approximately 2.9m. square. It obviously supported a monopitch roof running from the east to approximately 1m. above ground level in the west. The long wall would also have supported a monopitch roof, with the top to the north and falling to near ground level towards the mound.

The 1841 Tithe map shows buildings in these positions, and the 1881 O.S. plan indicates that both these buildings were glass-roofed. It is suggested that the larger building was a 'Heath House', Erica being a popular plant in Victorian times. It appears to have been out of use by 1901. The smaller building is shown under glass in 1881 but its size is more appropriate for a furnace room. However, it pre-dates the Heath House.

### *The long greenhouse wall*

A further greenhouse lay slightly to the east of the 'Heath House', outside the historic gardens but within the grounds of Warmley House. It was built between 1841 and 1881 and traces of a wall approximately 24m. long and 4m. high survive. It was built of brick with brick pilasters supporting it on the north side. It is not unusual to find a number of greenhouses in a Victorian garden. They were used to house the many different varieties that were then being imported from various parts of the Empire.

### *The Chequered Wall* (listed, grade II) (Plate 2).

The chequered wall is to the north of the mound and is 12m. long and approximately 4m. high. The 0.8m. thickness suggests a structural purpose. However, excavation has established that there were virtually no foundations to the south (pers. comm. A. Bryant). It is constructed mainly of clinker slag with four infilled openings of 18th century brick with slag-block diapering. At some stage the sills appear to have been raised suggesting partial infilling, but it is possible that they were built as blind panels. At the western end of the wall there is an opening leading to the grotto area, similar to one at the eastern end. Some time before 1841, when a hothouse was built against the wall on the grotto side, a lintel was inserted in this opening and the top part filled in. The hothouse measured approximately 5m by 3.5m. Excavation in 1987 revealed a stove at the east side (Howes 1993). This wall, together with the openings into the southern of the barrel-vaulted chambers of the Grotto, would have provided a splendid arcade.

### *Parterre.*<sup>7</sup>

As suggested above, the flat area between the mound and the chequered wall may have been parterre. The screen of the wall would then have provided a dynamic contrast, separating the grotto space from the formal garden<sup>8</sup>. During the excavations in this area a clay-puddled feature, presumed to be the lining of a pond, was exposed and is now marked out with heavy coping stones (Howes 1993). This might be the fountain marked on the 1881 plan. A well was also discovered lying beneath the clinker corner of the 'Heath House'. Although a well is shown on the 1901 plan, this appears to be further to the east. In the south-east corner of this area, there is a sloping (45 degree) random stone wall unsupported by mortar. It is approximately 4m. long and 3.5m. along the slope. It was probably built as a retaining wall to hold back the loose coal measures and shales that occur here.

### *The leat*

A leat (canal) originally led from the Siston brook to the north of the whole site and under a culvert to supply Echo Pond. From Echo Pond it continued to the south parallel to Elm Walk with the lake a little further to the west. Elm Walk supports a number of ancient Black Poplars but Dutch Elm disease killed the trees that Ellacombe noted (Ellacombe 1881). Underneath a modern footbridge, a silted-up return led from the leat to the lake, and abutments for the sluice were uncovered during recent excavations (Howes 1993). The leat was still in water in 1901 but is now dry and some of the adjacent gardens have been extended across it.

### *Echo Pond*

Echo Pond is semi-elliptical in shape. On the west it is bounded by a part copper-slag wall dating from the 18th century. At some stage, presumably well into the present century, a plinth of concrete was added. On the east side of the pond a low retaining wall, approximately 0.6m. high, separates the lawn from the pond. Accretions of soil and grass hide most of this. Separating Echo Pond from the lake would have been a narrow walkway approximately 2m. wide. The effect of this, when the lake was in water, must have been spectacular. In 1767 Sir Joseph Banks visited Warmley and noted the wall and the echo effect.

*'There is also in the garden at a small distance from Mr. Champion's house a very surprising echo. Standing about ten or twelve yards from the person who speaks, their voice seems to be repeated out of the clouds in the softest tone imaginable, they themselves not hearing the repetition; but what is still more remarkable is that tho' it is confined to a small gravel walk, not more than twenty*

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<sup>7</sup> Formal flower garden laid on a level area

<sup>8</sup> David Whitehead points out that Thomas Wright provided designs for a flower garden at Badmington with sinewy curves which would easily fit into the space available at Warmley.



**Plate 5. The statue of Neptune**

*yards length, it is not always in the same place, being sometimes at one part and sometimes at the other. The walk is close by the side of a semi-circular piece of water, walled in a small parapet, but I was told by the people there, that the Echo was there before that wall was built or water made'. (Bryant & Howes 1991)*

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### **The lake and the statue of Neptune**

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The 8 acre dried-up lake includes the Statue of Neptune (listed, grade II) (Plate 5). The lake ran southwards from the Summer House and then turned to the east to terminate in the area of the mills. The 1841 Tithe map clearly shows the lake, but by 1881 half of it is shown as a marsh, with the Siston brook discharging into it. The southern part of the lake still appears to have contained water in 1901, and continued to be flooded from time to time until around 1970 when the Siston Brook was culverted. Much of this former lake is now given over to mobile homes (Kingsway Mobile Home Park) but the eastern arm is a car park.

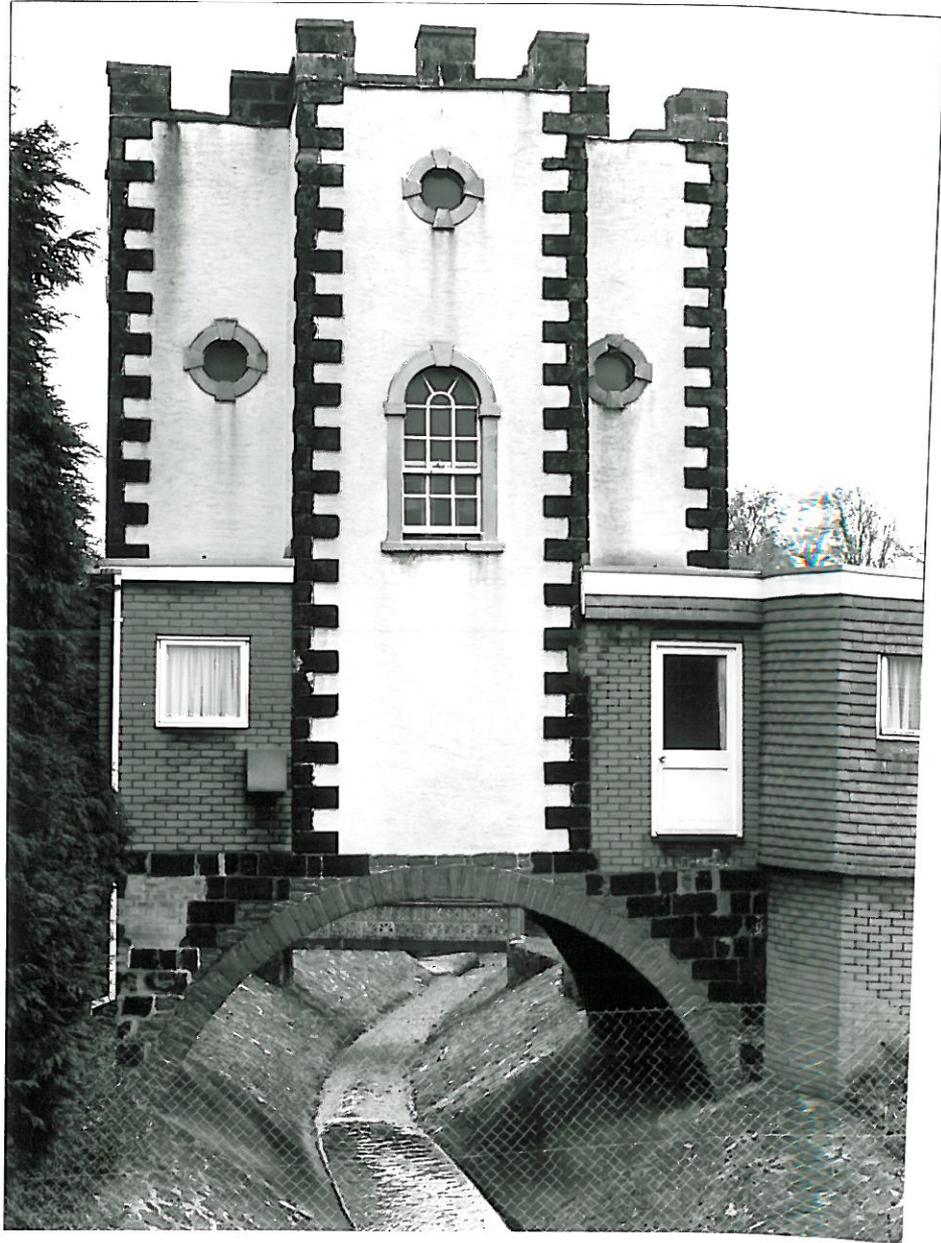
The statue of Neptune has been re-interpreted in concrete but still has his clinker clothing. This grotesque figure stands nearly 8m. high in the centre of what was the northern end of the lake. With his lion skin of clinker, he is much more reminiscent of Hercules than Neptune. His weight is supported on his left leg with the right one relaxed like the Farnese Hercules. His head is turned towards Warmley House. The bulk of the statue is supported by a curtain of clinker. The horseshoe-shaped wrought iron attachments for his trident are still *in situ*.

From the statue northwards, as far as the boundary by the Summer House, there is open land owned by Kingswood Borough Council. This area is also part of the historic garden. At the south end of the dried-up lake, where it borders A.B.A. Transport, the line of the dam wall can be clearly traced. The copper slag blocks resting on stone walling could well be part of the original dam. On the eastern side, the limits of the lake are clearly defined by sections of embankment and occasional copper slag blocks. Close to the mound the edge consists of a substantial slag block and rubble wall. In parts the depth of the lake must have been about 2m.

### **The Summer House** (listed, grade II) (Plate 6)

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The Summer House is built across the main flow of the Siston Brook and looks as though it should have acted as a feeder control to the lake. However, it is obvious that the main brook ran directly into the lake without any control whatsoever. The 1841 Tithe map shows the Summer House astride the entrance to the lake, with an eastern tributary running into the leat that supplied Echo Pond. An overflow from this tributary joined the main stream north of the Summer House. Presumably this tributary included a dam to divert the water into the leat. The tributary is now culverted underneath the lawn of the Summer House which is at the northern end of what had been the lake.



**Plate 6. The Summer House from the north**

The House stands astride a stone arch and is rectangular, apart from a projection in the middle of the north elevation. The south elevation is of slag blocks with two windows on each of its two storeys. The architraves of the sash windows are of Bath stone with original fenestration. Two flat-roofed wings were added to the Summer House a few years ago. One is built on the east end extending the House to the south. The other is an extension to the west. Both are unsightly. On the east side of the Summer House there is a single sash window at the second-storey level, the first storey being obscured by the wing addition. The quoins are constructed of slag blocks. The north elevation is projected in the middle with slag quoins. A single-arched sash window with a stone architrave is central to the whole facade. The imposts are of projecting stone and there is a projecting keystone. Over the window is a circular window with keystones at each quadrant. Either side of the projection are circular windows of the same form. To the west the wall is plain. The east, north and west walls are rendered except for the quoins. The whole structure is crenellated giving a Gothick effect which also supports the rococo character of the garden.

Its situation forms a convenient 'eye-catcher' and termination at the north end of the lake. The north elevation, which is, paradoxically, facing away from Warmley House is the most pleasing. However, the more open elevation to the south would have provided the best view of the lake. This tends to support the suggestion that the Summer House was a quiet refuge for the patron and his guests, rather than a simple dwelling house.

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#### **The Boat House (Plate 7)**

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The building known as the Boat House lies half within the historic garden and half in the area of the lake. It measures 4.6m. square and is approximately 4m. high on the east side. At some time, possibly at the beginning of this century, it was heightened by approximately a metre. Until 1967 it had a hipped roof, but it is now open. It is constructed of random-coursed sandstone with copper-slag quoins and the walls are 0.45m. thick on all sides. At some time it was rendered with a coal-based mortar. It is now of two storeys with a raised ground floor that was inserted in this century. In the south-west corner there is a small inserted fireplace at the second-floor level. On all sides there were arched openings 1.85m. high by 1.1m. wide. These have been partially blocked to make small windows. On the east and west sides there are secondary arches low down. The north elevation gives a clear indication of the inserted two floors; the original building being open to the roof. The second-storey window has a stone sill. The Boat House has been the subject of speculation as to its original purpose and an engine house has been suggested. Although its size and shape could well have housed a beam engine, with a bob wall supporting the beam, it does not appear ever to have been substantial enough for this purpose. Its situation half in the lake is also confusing. The later alterations must date from around 1900 when it was converted into a two-storey building to house the butterfly collection of Herbert Haskins (Howes 1993).

Approximately 2m east of the Boat House is a cast-iron circular grid, 0.5m. in diameter, inscribed 'BUSH & WILTON. IRON FOUNDERS. BITTON. GLOS.'



**Plate 7.**  
**The 'boat house'**  
**from the south**

**Plate 8.**  
**The Dalton Young**  
**complex from the**  
**south-west**



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## **The Kitchen Garden**

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A rectangular area between the mound and the eastern arm of the lake is occupied by Kingswood Borough Council as an open store for bins. Its shape suggests a kitchen garden. Until relatively recently it was a market garden - a natural successor to the kitchen garden for a large house.

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## **The Dalton Young Complex (part listed, grade II) (Plate 8)**

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The Dalton Young complex comprises a number of buildings, some of which are listed. The most notable is the windmill which gives its name to the area (Warmley Tower). The complex has been the subject of a survey and report (Architecton, 1993) including an assessment by the City of Hereford Archaeology Unit (Fig 9) from which the following description is taken.

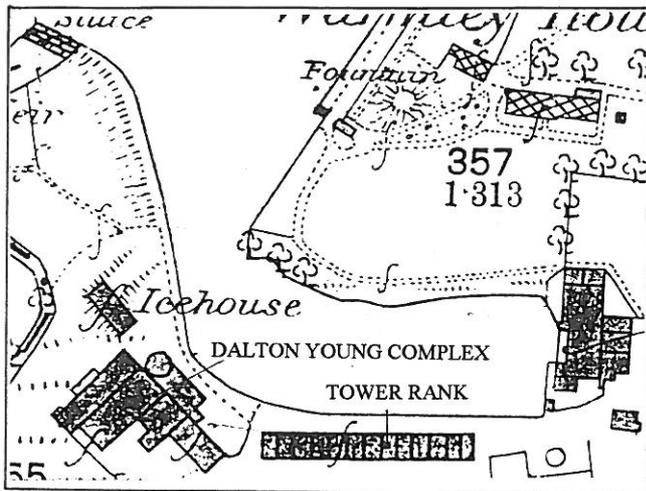
In 1918 it was referred to as 'factory premises known as the Old Flock Mill with three cottages and land; containing 10 large workrooms and a large smoke stack'

## ***The Windmill Tower (A) (Plates 8 & 9)***

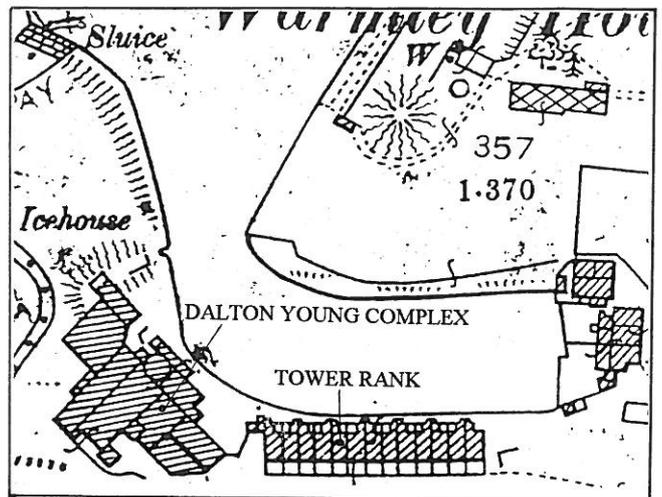
The tower was originally topped by a revolving cap to which sails were attached. Beam sockets indicate the position of a number of floors within the building. It was built of Pennant sandstone rubble set in a fine mortar with occasional slag lumps. From being approximately 7.4m. across at the base, it tapers to about 6.5m. at the top, which is approximately 18m. above ground level. There are four door openings at ground-floor level, each with a semi-circular head of thin red brick. Each doorway has a Bath stone key block. At the second floor level there are door openings in the east and west quadrants directly over the openings on the ground floor and with similar heads. It appears that a gallery originally encircled the building at this level. The third floor has windows in the north and south quadrants, also with similar heads to those below. The slight set back of the top section (0.3m.) would be associated with the curb on which the cap revolved and indicates that this was indeed a windmill. The opposite doors on the second floor, together with the gallery, would have been for setting the sails. A mid-18th century construction date is postulated; it is known to have been in existence by 1761. Its function has been variously described as powering stamping mills, a scoop wheel for lifting water back into the lake, or simply the obvious use as a grist mill<sup>9</sup>. The importation of Dutch workers, who would have been familiar with scoop wheels for drainage, around this time may be of significance.

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<sup>9</sup> Corn mill



Extract from 1881 OS map



Extract from 1902 OS map

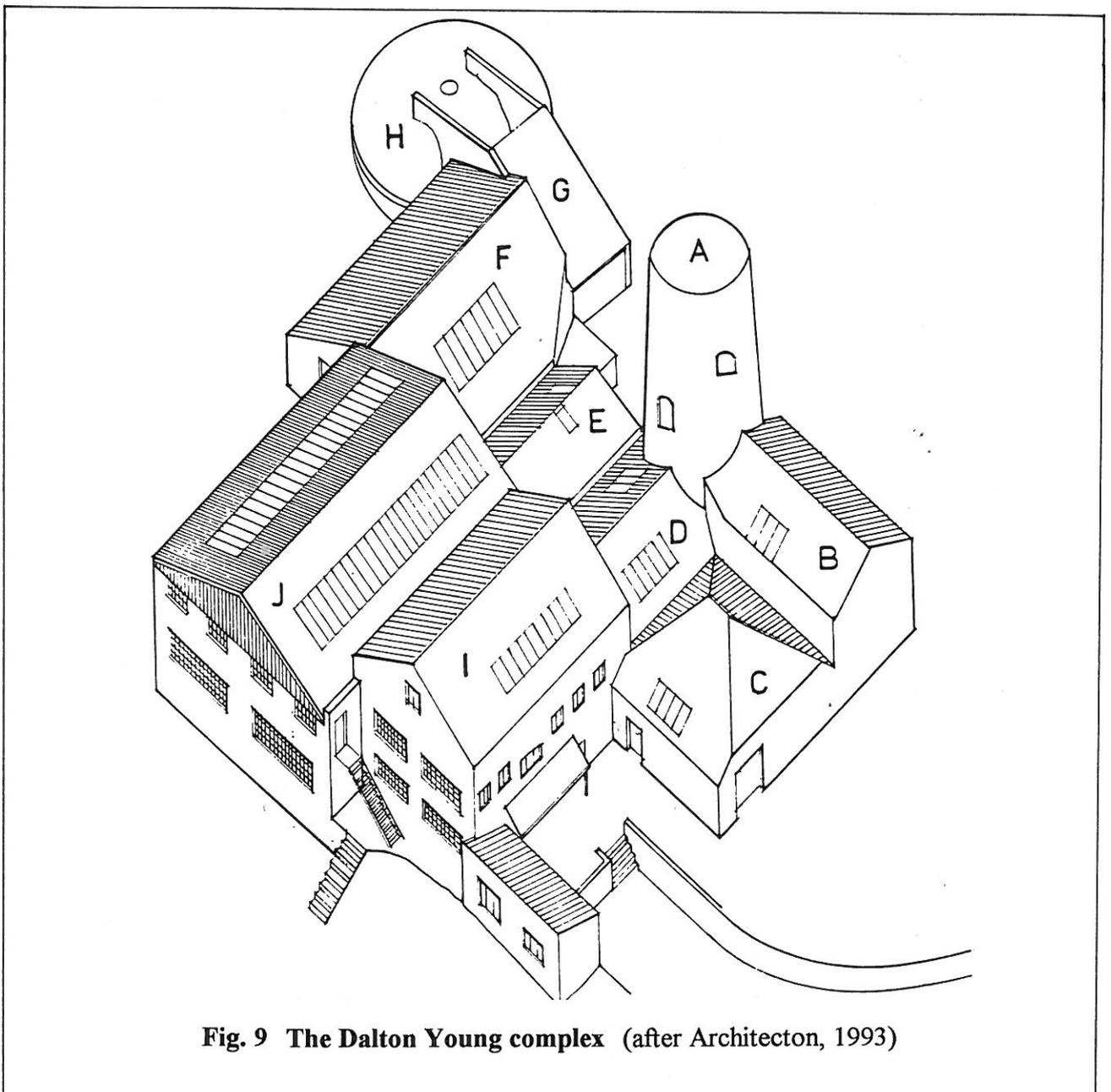


Fig. 9 The Dalton Young complex (after Architecton, 1993)

Recorded in the 1761 inventory and again referred to in 1767 (Glos.CRO) is a 'windmill and stamps'. This description indicates that the windmill operated some form of crushing device, probably to reduce copper ore to small lumps for smelting.<sup>10</sup>

### *The south-east range (B)*

This rectangular building is attached to the south quadrant of the windmill. The ground floor is built of a similar material to the windmill, but the second floor is of brick and clearly later. The building has a plain gabled roof that butts directly onto the windmill at the north. The ground-floor level is compatible with that of the windmill, but is some 0.5m. higher than that in the rest of the complex. The ground floor masonry includes moulded copper slag block quoins and jambs for the primary openings. Originally the building was single-storeyed and the tops of the masonry represent the height of the walls. The original stone gable is incorporated in the extension to form a second storey. A similar construction date to that of the windmill has been suggested, although constructional logic points to the building of the windmill first. The brick upper part was probably added in the late 19th century. The industrial use of this building may ultimately be resolved by establishing the purpose of the shafting slots into the adjoining building (C). Although the shape of the building suggests that it might have contained ore stamps driven by the windmill, the height might preclude this.

### *The south range (C)*

This mid 18th century range is built to the west of building B and shares a common west wall. It consists of an almost square building, approximately 8m. by 9m. internally. It is of one storey, open to the roof and is built of rubble. The roof has a tall hip with a short ridge and is orientated north-south. Internally the truss has been radically altered and the king-post has been removed. The upper sections of the truss have been replaced, perhaps at the time when the pantiles were removed. In parts of the building there are positions for bearings and shafting. Before the present concrete floor was laid there was some evidence to indicate that the building had been used for a horse-engine (pers. comm. Joan Day). Cartographic evidence of 1841 shows that there was an addition to this building to the south-east of about 12m. by 7m. The direct connection between this building and building B could mean that if stamps were there, then horse power may have been used when wind power was not available.

Champion's 1761 inventory included two horse mills with lofts over them. The horse mills are most likely to have powered edge runners which were used for crushing ore. They consisted of a pair of upright stones which were pulled or pushed in a circle by

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<sup>10</sup> The term 'stamps' must refer to a row of vertical drop-hammers, which were usually powered in the mid-18th century by waterwheels. These pounders would have been a heavier version of the vertical crushers employed in the Dutch wind-powered oil mills, and not previously recorded in England. Windmill-powered stamps for crushing ores were used later in the century in the north of England by the Macclesfield Copper Company formed by Charles Roe. There was some collaboration between Roe's son and William Champion's son, John (Day 1991).

horses. The Bristol company was using powered edge runners in the 1750s to break up copper ore. However, these heavy stones were much more suitable for crushing powder. With windmill-powered stamps available, Champion is more likely to have used his horse mills for crushing calamine.<sup>11</sup>

### ***The south central range (D)***

This single-storey range abuts the west side of the windmill and shares its south wall with building C. It is mainly of rubblestone, but the west gable is later and of brick. The 1841 Tithe map shows it extending into building I in which elements of its masonry may be fossilised. This would account for the later insertion of a brick gable. The north wall has a very large central opening. There is some evidence that shafting or machinery was used in part of this building. The masonry walls suggest a mid-18th century construction date, but the refinement of the arched opening into the windmill at the east end suggests that the windmill was initially open to full view on this side. The roof is of late 19th century date.

### ***The north central range (E)***

This single-storey range lies between D on the south, F on the north, and J on the west. Modern accretions adjoin the east gable. The two side walls (north and south) are of rubblestone. The west wall has been removed, and the east gable is of brick and later than the side walls. It all appears to be late 19th century, either an addition or replacement, and contains a central wagon opening flanked by two doorways. The roof is a plain gable structure similar to D with the openings to D from the south wall shared. In the north wall there is an inserted doorway leading to F. The Tithe map shows this building extending into J

### ***The north range (F)***

This is a wide single-storey range mainly constructed of Pennant rubblestone. At the north-east corner the wall rises over part of the 'icehouse' but is separate from it. In spite of this there is nothing stopping these two structures being contemporary, for the nature of construction of the icehouse is such that it would need to be an independent structure. At the south-east corner the building tapers towards G. The west gable is of brick, partly obscured to the south by building J. The Tithe map and 1881 plan do not show this building, but the north wall is of similar construction to the windmill. A title of 1889 confirms the whole building as being in existence, but terminating before building J. It

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<sup>11</sup> Horse mills were traditionally used on the continent to crush calamine to reduce it to powder and similar methods were used on Mendip in 1720. Calamine had to be reduced to a fine powder after calcining it to an oxide to make it suitable for brass production. Pairs of horizontal stones, similar to those used for grinding flour, were sometimes employed to powder the ore further. It is possible that the small Hole Lane Mill was used to complete the process after crushing under horse-powered edge runners (Day 1995).

must therefore have been re-built between 1881 and 1889. Because of the taper towards the ice house it is probable that this building was re-built in connection with the ice house when the latter was in use.

### ***The Ice House link block (G)***

This rectangular building is shown on the 1881 map as 'icehouse' and extends over the top of the ice house proper. It is built of two parallel rubblestone walls similar to other mid-18th century structures in the complex. The slag quoins incorporated in it emphasise its mid-18th century date. Its purpose is not clear, but it probably provided shelter for the access to the 'eye' at the top of the icehouse.

### ***The Ice House (H) (listed, grade II) (Plate 9)***

This is a circular structure of local Pennant sandstone with two wrought iron bands surrounding it. It is approximately 10.6m. in diameter and 6m. deep, the lower 3.5m. being below ground. The inside base is cone-shaped with a central drain leading to the brook. At the top is an oculus<sup>12</sup> with a later drain in the west wall. From its relationship to other buildings, it appears to date from the mid-18th century. The structure is on the parcel of land situated between the Siston Brook and part of the lake dam occupied by A.B.A. Transport (Bristol) Ltd.

The dome has a very similar profile to that of the inner dome covering the retorts of Champion's zinc-smelting furnace. In addition, the ground level for a zinc-smelting furnace would have been similar to that of the ice house. The condensation chamber would have been below ground just as the ice house has a large chamber below ground level. The similarity is most marked by comparison with the 1754 Angerstein sketch.

However, the interior fabric of the ice house shows no sign of metal residues, so could never have been used for smelting. It may be that an enlarged structure was projected to lessen fuel costs in the zinc-smelting process. Champion's eventual bankruptcy may have been the reason that it was never commissioned and was instead converted to become one of the largest ice houses in the country (Day 1995).

The area was described as 'a garden owned by Davidson and rented to Messrs Harvey, Johnson, Short & Short' in 1841.

### ***The south-west range (I)***

This is a three-storey range which has been heightened and extended north and south from the original building. The ground floor is contemporary with building D. There are connections at first-floor level with building J, a mid-20th century two-storey building adjoining F.

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<sup>12</sup> A round window normally in the roof

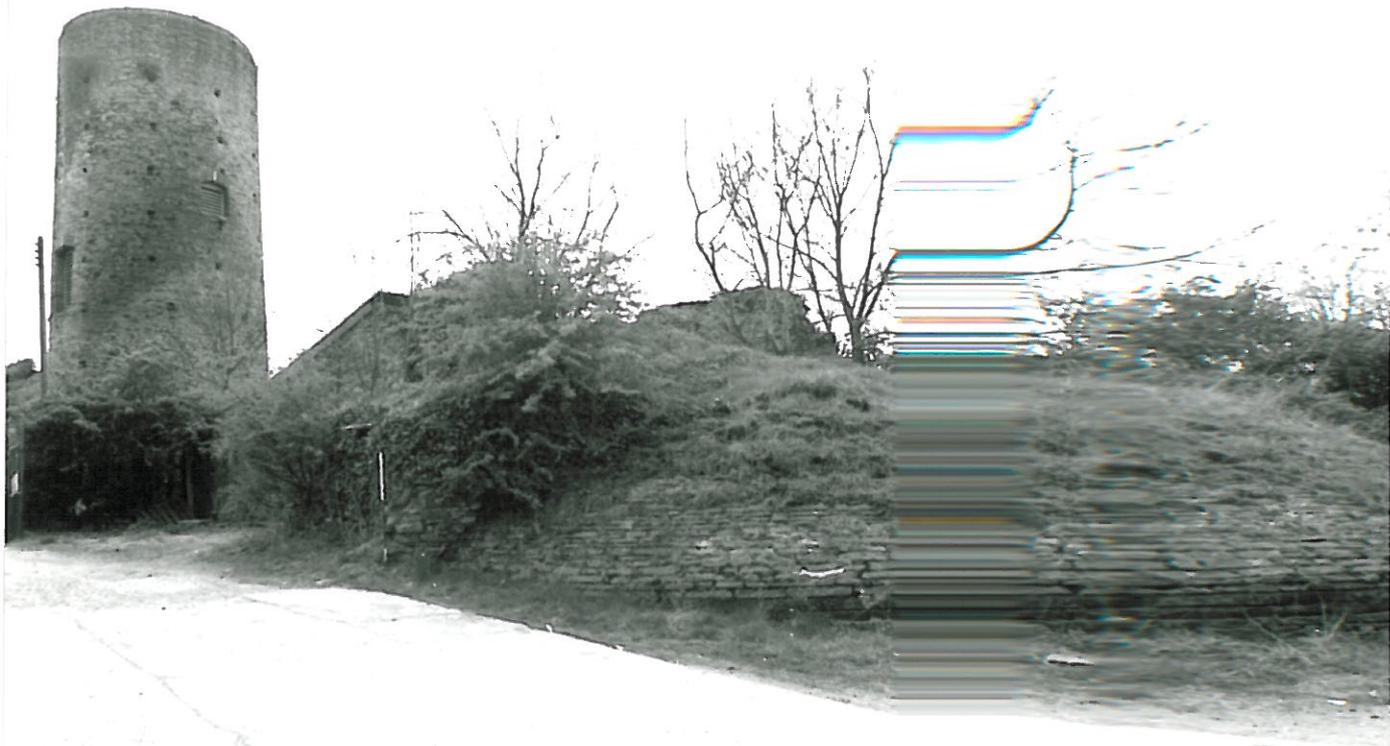


Plate 9. The Ice House and Windmill Tower



Plate 10. The Clock Warehouse from the east

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## **The Clock Warehouse** (listed, grade II) (Plate 10)

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The Clock Warehouse was originally Champion's pin factory, but later uses have involved substantial changes. The building is owned by Kingswood Borough Council and leased to the Clock Tower Trust.

The primary building is three storeys high, 6.5m. wide and approximately 17m. long. It is constructed of random-coursed rubble sandstone with some slag block quoins. The hipped roof is covered with pantiles. The five-bay east elevation has windows with brick surrounds and segmental heads, the glazing bars being of cast iron. The internal reveals are splayed with ceramic sills. The second bay from the north has been raised in the past to accommodate a gantry jib under a dormer gable<sup>13</sup>. The Clock is a later extension to the south of the primary block and projects slightly forwards. When this extension was built, the roof appears to have been altered and now consists of three open trusses with double mortices securing the hip braces into the two end trusses (north and south). The west wall of the top storey has four apertures approximately 0.7m. high and 0.6m. width. The arches are of brick. At the south end of the block there is a casement window with copper slag jambs and sill which may be original.

There is a two-storey mid-19th century extension (15.4m. by 3.7m.) with a catslide roof on the west of the earliest building that appears to incorporate remnants of an earlier wing. The west elevation now consists of four cast-iron windows at ground floor level with semi-circular brick headers and tile sills. The first floor has seven cast-iron windows with modern concrete lintels and tile sills.

Pin manufacture was an integral part of Champion's comprehensive production arrangements at Warmley in providing an end product for his output of brass wire. The 1761 inventory contains no mention of a pin manufactory, but it can be assumed that the reference to one in the 1767 sales advertisement relates to the Clock Tower building. A bell dated 1764, later stolen, was recorded in the 1950s (pers. comm. B. Little), which may indicate the date of construction of the Clock Warehouse. During 1767, a list of stock at Warmley included pins, and eye-witness accounts in 1767 and 1769 described pin-making at Warmley. Pin making continued until the mid-19th century after which the building may have been used by 'The Warmley Tower Potteries' and subsequently as a boot factory trading as Derhams (Day 1995).

Close to the Clock Warehouse lies a granite slab 1.8m. long by 0.9m. wide and 0.3m. deep. A groove indicates that a wrought-iron band was once strapped to it. This would have been used as a casting mould for brass.

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<sup>13</sup> A device for hauling goods up and down

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## **The weigh-house and tramway**

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Approximately 50m. east of the Clock Warehouse stands a rectangular red-brick building with a concrete slab roof that appears to date from the late 1940s. It is in two compartments. The smaller, westerly one, contains the balance for adjusting weights for a weighbridge. The eastern compartment has a 1.5m. wide door at the east end. The angle of the building suggests that it included a siding from the tramway that brought clay to Haskins works. It appears, therefore, to be a combined engine shed and weigh-house.<sup>14</sup>

The clay came through a late 19th century tunnel under Tower Road North. The eastern portal of the tunnel would have been north of number 42 Tower Road North. with the tunnel running under the present traffic island. Although part of a paved way can be seen close to the Clock Tower this appears to be too far north for the tramway that took clay to the *Drain Pipe Works* in 1881. When No 1 kiln was built between 1881 and 1889 the line had to be realigned on the west side of the road. A cutting was made to take the tramway close to the northern edge of No 1 kiln to processes being carried out further to the west.

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## **134-150 Tower Road North**

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These Victorian and Edwardian houses are good examples of the superior dwellings probably built by the Haskins for his managerial staff. Nos. 138 and 140 were built before 1880, with nos. 136, 142 to 146 following after 1889. Finally the two villas 148 and 150 were built after 1902. Number 148 was at one time used as a police station (pers.comm. A. Bryant).

Tanner House (no. 134), an imposing late Victorian house, has strong similarities with the fret work on late additions to Warmley House.

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## **The area to the north of the Clock Warehouse**

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This contains the 1986 extension to Warmley House.

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## **Tower Row car park**

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Between the Dalton Young complex and the eastern end of the lake there is a narrow car park close to Tower Lane, a new link road. This occupies the site of what was a terrace of 18th century workers' housing known as Tower Rank, demolished about 1966. The link road cuts across the area where the gardens and privies would have been.

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<sup>14</sup> A photograph (A. Bryant) shows a R. & E. Lister petrol 4-wheel industrial locomotive working on a 1 foot 8 inches gauge (0.5m.) on the east side of Tower Road North. This locomotive was either No 34024 (1949) or 4366 (1932, 2 feet converted to 1 foot 8 inches 1957); both were scrapped about 1960.

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### **The area of modern works (north side of Tower Lane)**

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The southern part of the site was cleared about 1966, and is now occupied by three firms - Lindman, Forkardt and Pfander - in a modern building surrounded by hard-standing. In the Champion period this area included the triangular sump pond, the suggested site of the battery mills, and the terminal of the eastern arm of the lake. The eastern part covers about half of the site of the later *Sanitary Pipe & Brick Works*.

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### **The area of modern works (south side of Tower Lane)**

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The area to the south of Tower Lane is bounded on the south by the Siston brook. It is now partly occupied by three modern works - Stearn, Avon Tiles and R10 Precision. To the east, a new bridge crosses the Siston Brook on the site of a pre-1841 bridge. A substantial stone wall runs from below this bridge to near a second, modern bridge adjacent to the roundabout at the junction of Tower Road North and Tower Lane. Copper-slag blocks present from approximately 3m. below the bridge, probably represent the retaining wall for the return or overflow that ran from the triangular pond to the Siston brook.

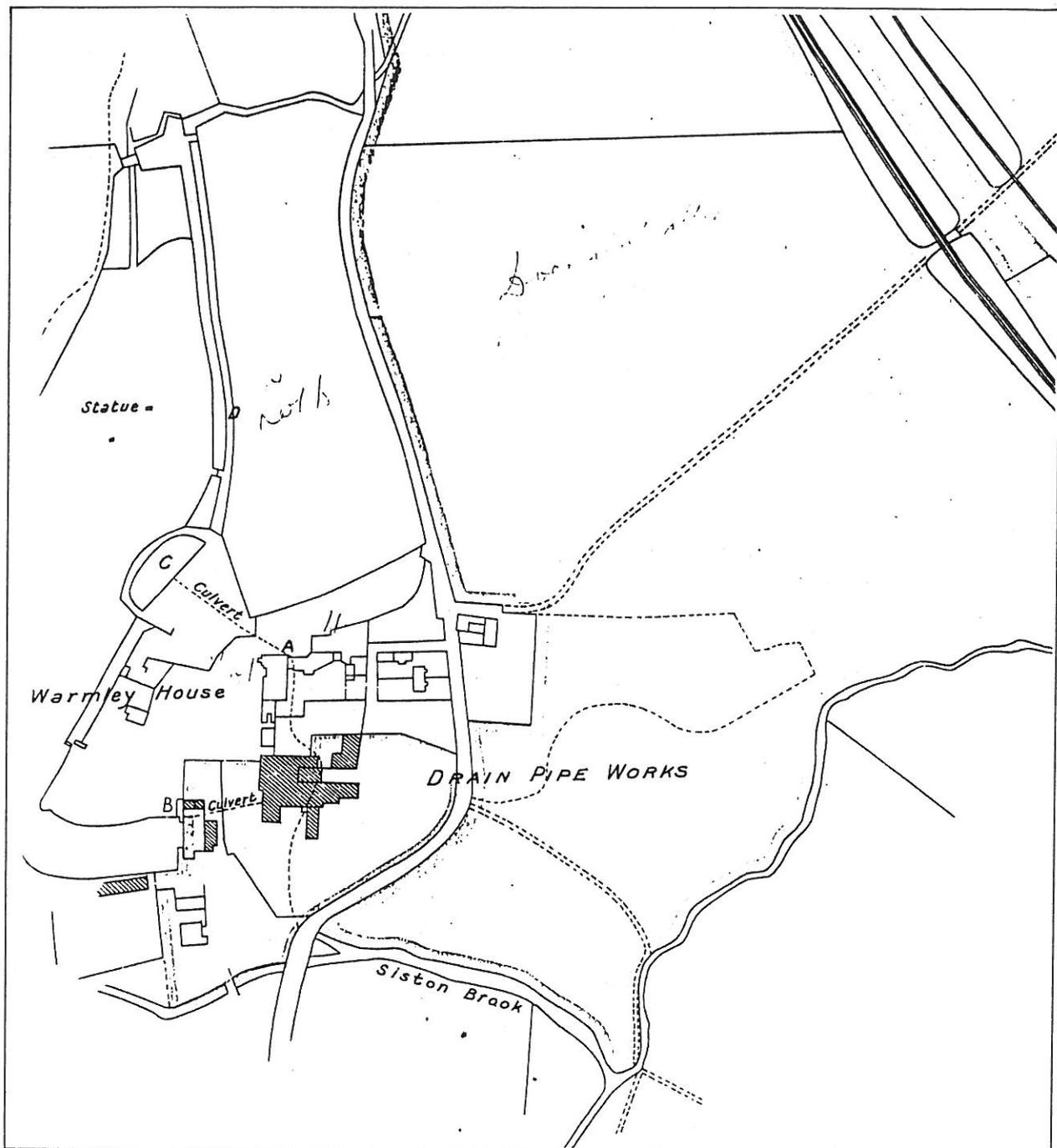
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### **Underground watercourses**

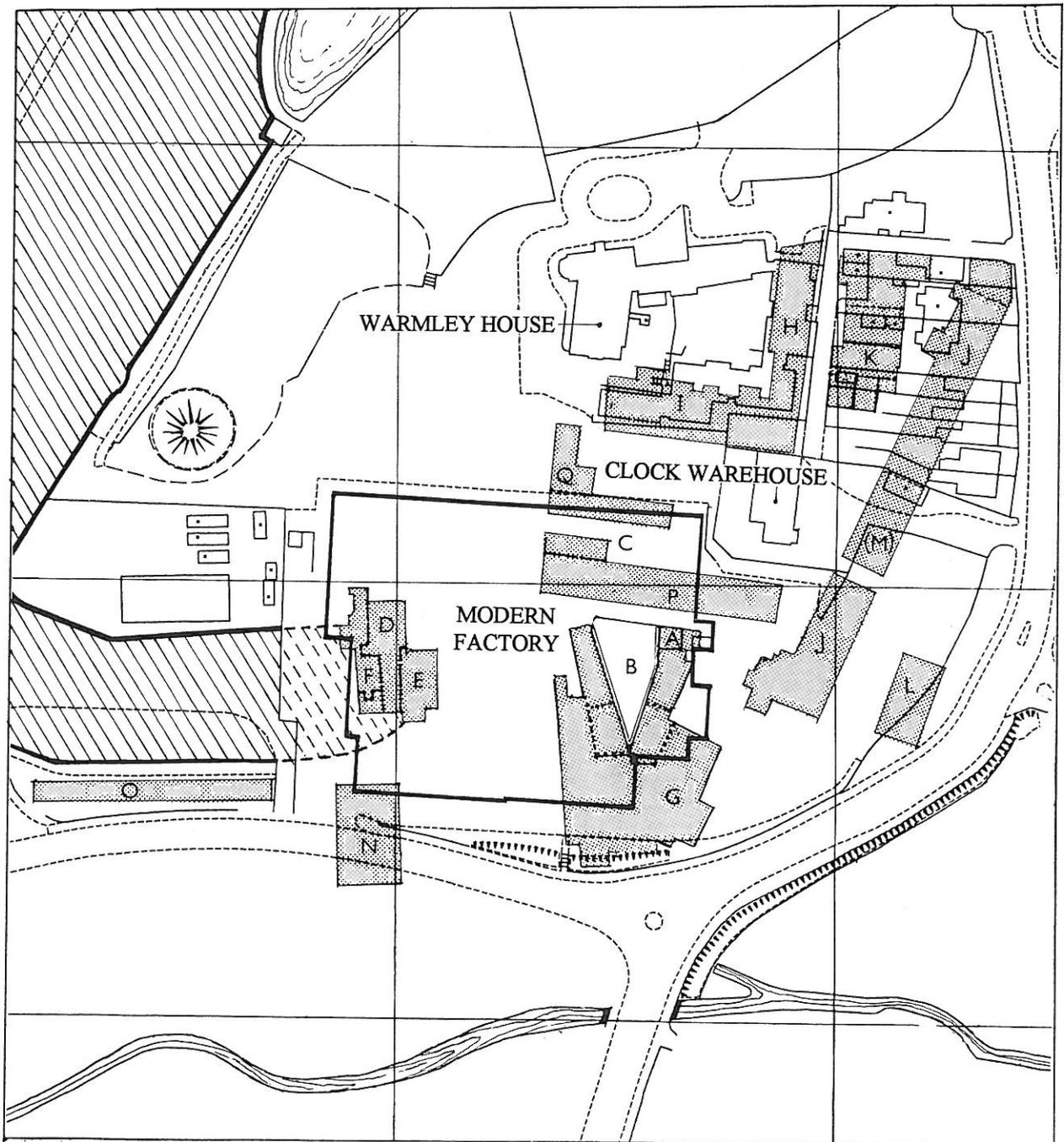
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Although the various underground watercourses cannot be seen they can still be considered as surviving structures. A few are known but many others doubtless remain buried. The title of 1889 shows a culvert leading from the middle of Echo Pond to the south-east corner of the lawn and on to north-east corner of Warmley House (Fig 10). From here it ran around the east of the house to terminate in the triangular pond. The title allowed Tower Mills Wool Company 'to draw or abstract water from the small [Echo] pond by means of a culvert (but not for turbines, waterwheels or other waterpower) . . . and to discharge water from the steam engines in the said business into the large Pond of Warmley House by means of culvert B.' Culvert B ran from the triangular pond directly into the lake. Another culvert has been explored from Echo Pond as far as the west lawn of the house. This has a cross-section with a pointed arch (photographs per A Bryant) and may have been for industrial purposes.

Two near-parallel culverts lead into the Grotto from the south, one at a high level to provide the cascade, and another running at a lower level. Originally, the lower one may have continued into the long bath and could have been for industrial purposes. A culvert runs from east of the greenhouse wall under the garden steps. It then turns at right-angles to emerge between the granite blocks in the chamber north of the *impluvium* of the Grotto. It does not appear to have had any other purpose apart from that associated with the Grotto. Another culvert runs north-south at the eastern end of the long Grotto passage. It may have served the cascade.



**Fig. 10** A map accompanying a title of 1889 showing culverts



**Fig. 11** Details of buildings shown on the tithe map superimposed on a modern outline map

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## 8. The demolished buildings

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### General

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None of the documentary or cartographic sources consulted have provided any firm indication of the exact location of any of Champion's processing areas. However, an assessment of the requirements of these processes together with a close examination of later maps and photographs and an appreciation of the site as a whole allows certain conclusions to be made.

There is no evidence to suggest that there was any large scale development on the site between Champion's bankruptcy in 1769 and the construction of the tithe map in 1841. In fact, the Bristol company that took over in 1769 is known to have run the works down. The large number of buildings and their general extent must, therefore, give a good indication of the extent of the works at the time of Champion. The apportionment to this map indicates that the 'spilter house, wire mills, pin factory' were dispersed throughout the whole of the southern part of the site.

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### Individual features of the Champion era

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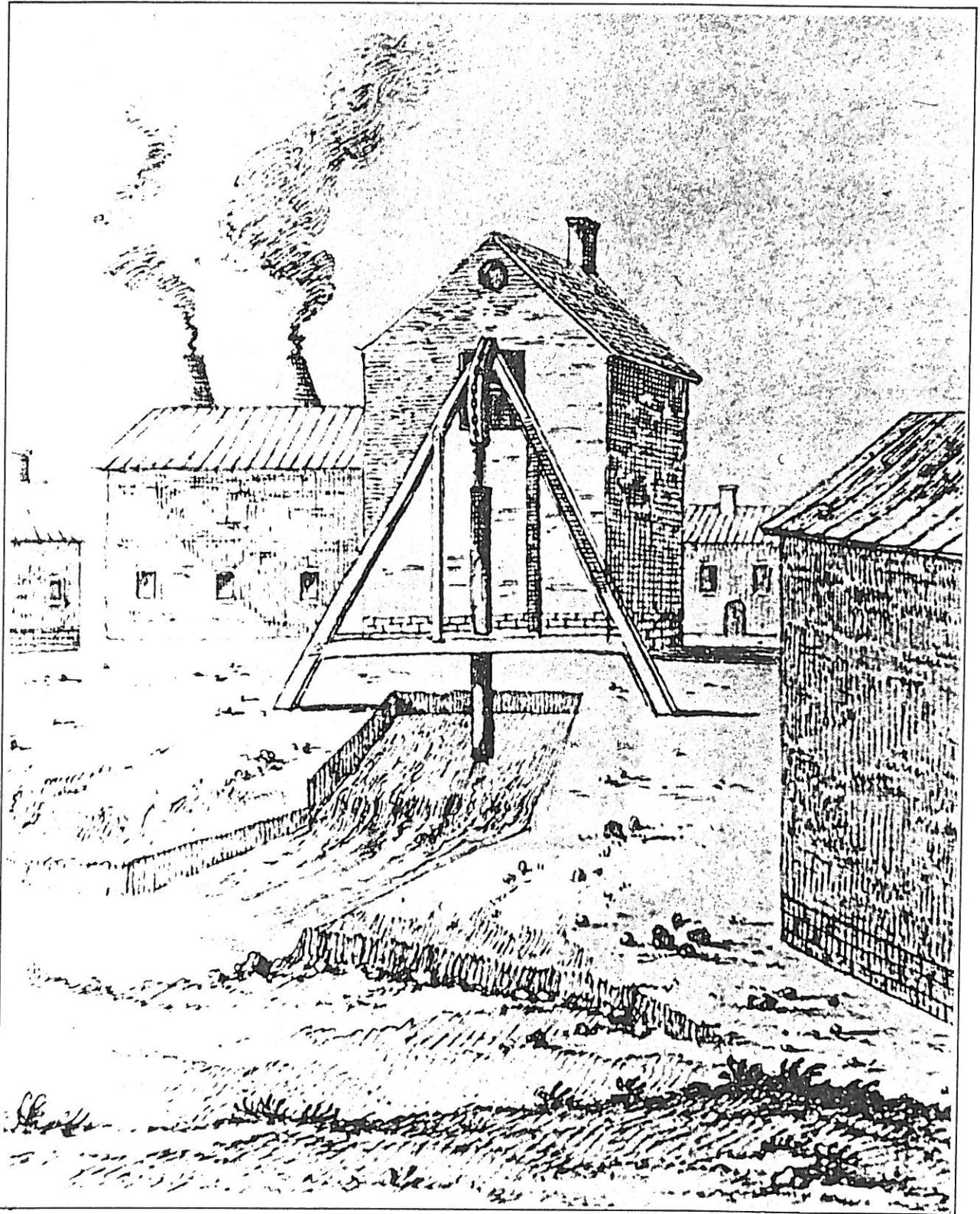
For convenience of description the buildings shown on the Tithe map have been superimposed onto an outline modern plan to give an indication of their relative positions (Fig 11).

#### *The Newcomen engine*

Angerstein's 1754 sketch of the engine (Fig 12), although lacking some accuracy, should not be discounted. He was an industrial spy and recording of features, rather than artistic impressions, would have been part of his expertise. Although he may not have understood fully the workings of a Newcomen engine (he was probably not able to obtain access to the engine house), nevertheless he clearly illustrates the lift via the arch-head with the water discharging over a sill or weir. The angle of the building on the right suggests the area as being the shape of the triangular pond area to the east side.

*'What is special about this mill is that it is driven by water, which is brought up from 3 fathoms [5.5m] by a Fire Engine and then runs into a wide reservoir: from this onto the wheels and finally to the Fire Engine to be pumped up anew.'*

Angerstein's observations of a 5.5m lift are borne out by the fact that the triangular pond must have been considerably lower than the lake. The overflow from the triangular pond would have returned to the Siston brook via the remains of the leat that still survives near the roundabout. Further to this, at the date the Newcomen engine was built, its boiler would have been constructed underground including the foundations of the engine house.



**Fig. 12** Angerstein's 1754 drawing of the Newcomen engine  
(Liverpool University)



**Plate 11. The possible battery mills and slitting mills after conversion to cottages. Taken from the south in the 1960s.**



**Plate 12. Tower Rank tenements from the south-west in the 1960s.**

The chances of remnants of this engine house, including the culverts that served it, surviving at a considerable depth, must be good.

The most likely site for the Newcomen engine is building A, next to the triangular pond B. This was a tall gable-ended building still present in 1960. The pond B probably acted as a sump for 'used' water from the water wheels and from the culverts associated with Echo Pond. From this pond the water would have been pumped to a higher level by the Newcomen engine. The site of the building and pond is underneath the eastern part of the modern factory.

The tall building C also had the appearance of an engine house and is another possible contender for the Newcomen engine but is unlikely because of its distance from the waterwheels of the battery mill and from the triangular pond. The site is near the northern end of the modern factory

### *The battery mills* (Plate 11)

The area adjoining the eastern terminal of the lake is the most likely position for the battery mills, slitting mills and wire drawing plant (buildings D, E & F), because they depended on the water power to drive the water wheels. Photographs taken before the 1960s demolition show three hip-roofed cottages with considerable alterations, and a three-storey building (D) which has the appearance of an engine house. The conversion to cottages took place before 1841. By 1889, the building on the lake side had been demolished and a photograph shows the cleared ground behind the three-storey building. The site is now under the western end of the modern factory complex. Champion does not list slitting mills in his 1761 inventory but, as he is known to have been using them at that time, it can be assumed that slitting was incorporated with rolling in this area (Day 1995).

The five battery mills and 12 hammers listed in 1761, probably indicate the use of five waterwheels operating 12 separate hammers. Three of these waterwheels may have powered 9 fast trip hammers shaping hollow-ware vessels, the other two wheels powering heavier hammers for flattening metal (Day 1995) or possibly one working the wire mill which needed less power. All would have been supplied by culverts running from the lake and ending in the sump.

### *The copper and brass furnaces*

A group of buildings immediately to the south of the triangular pond is shown on the Tithe plan. Most had been demolished by 1881 but a remnant (G), to the south-east of this complex, survived until at least 1902. This was clearly an annealing furnace (photograph supplied by A Bryant).

The area now underneath the nursing wing of Warmley House included the remains of a line of three brass furnaces (H) (Day, 1988). The inventory of 1761 refers to 15 furnaces and the remaining twelve are likely to have been in the vicinity of the remains discovered. They were probably associated with the 1841 line of buildings running directly north from

the Clock Warehouse. An associated rank of buildings (I) ran at right-angles from the north end of the Clock Warehouse. By 1881 most of these buildings had been cleared, the area to the north being marked by a boundary.

The placing of other furnace operations is more speculative and has been based on the fact that the smelting of copper sulphide ores would have resulted in the emission of offensive sulphur dioxide fumes. Such furnaces are, therefore, more likely to have been positioned down-wind from housing. Other coal-fired furnace operations, although less troublesome, are also likely to have been placed down-wind and away from low-lying land where flooding might occur. Areas used by the later ceramic works may have followed the site production of crucibles and bricks for the Champion works.

The tithe map shows a range of buildings extending from what is now the front garden of 136 Tower Road North through to the rear gardens of 148 & 150 (J). The southern part (M), which was still extant in the 1880s, may lie under the weigh house. A separate range (J) on the same orientation, lies to the south of M in open ground east of the triangular pond. The Haskins ceramic kilns 1, 5, 6, 7 and 8 which were built over much of this latter area and the 1880s tramway which cut through it will have caused substantial damage to the earlier levels.

### *The casting areas*

In the triangle formed by the range running north from the Clock Warehouse and the diagonal range, there is a rectangular range made up of five main buildings all shown in 1841 (K). This range lay in what is now the rear gardens of nos. 136 to 144 Tower Road North. There is the likelihood that brass casting went on in this area, close to the brass furnaces. The heavy granite slab by the Clock Warehouse which would have been used for the casting of brass, is unlikely to have been moved very far. Another slab is incorporated as a threshold in no. 140 and large fragments of granite can be found in some of the garden walls to the villas.

### *Zinc smelting*

The remains of a building (L), including vaulting, zinc silicate and crucible fragments were uncovered in advance of the construction of the modern wall running parallel to Tower Road North, and assigned to the period of Champions's works. (Parry 1994). The remains clearly represented the substantial building shown in 1841 and still in use around 1880, although a weighing machine had been added on the north side by then.

The main building survived into the 1880s but the cutting for the tramway must have come very close to it. In 1761 there were four furnaces for 'spelter' (increased to five by 1767) (Day 1995). As zinc smelting went on until 1850 under the Davidsons, it is possible that buildings L and M were used for this purpose. When zinc production ceased they become redundant and the tramway cutting completed their demise.

### *The annealing area*

A large rectangular building, N, is shown on the tithe map south of the suggested battery mills. This building is of industrial proportions and may have been associated with annealing, which would have needed to be close to the battery mills. Part of the outline of this building is shown in 1881 but by 1889 there were only two small buildings which were still extant in 1953.

### *Workers housing*

The 13 houses of Tower Rank (O) ran east from near the Dalton Young Complex to near the dam belonging to the eastern arm of the lake (Plate 12). The houses were demolished in 1968 but surveyed beforehand by Bristol Industrial Archaeology Society. The three-storey tenements, incorporated the use of copper slag quoins, a characteristic of mid-18th century buildings of the site. The Tower Rank houses were built to a similar design to those surviving at Kelston Mills, another Champion site (Day 1995). This area is now grass extending into the car park bordering Tower Lane. The sheds or privies now lie under Tower Lane and the gardens to the south side of it. Although these houses date from Champion's time (Day 1995) and were excellent examples of early dwellings provided by the employer for his workmen, their foundations would probably tell us little. With the eight additional cottages identified from the tithe apportionment, the 13 in the Rank would add towards Champion's total of twenty-five.

### *Other early buildings*

Two long buildings are shown in 1841 in the area of the later ceramic works. One of these (P) can be seen in plate 5 which shows the western end of this building. The other (Q) is shown in plates 7 and 8 and was probably totally destroyed when this area was cut into at the time of modern factory construction. Plate 11 shows other possible 18th century buildings.

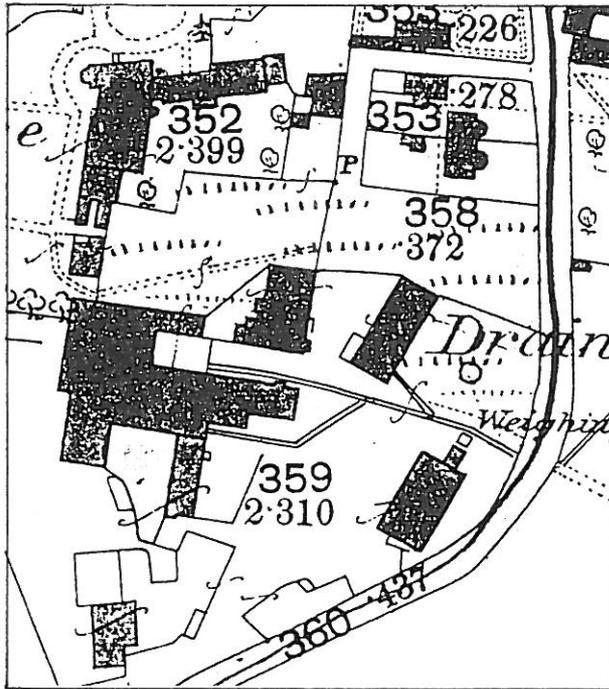
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### **Haskins ceramic works (Fig 13; Plates 13-15)**

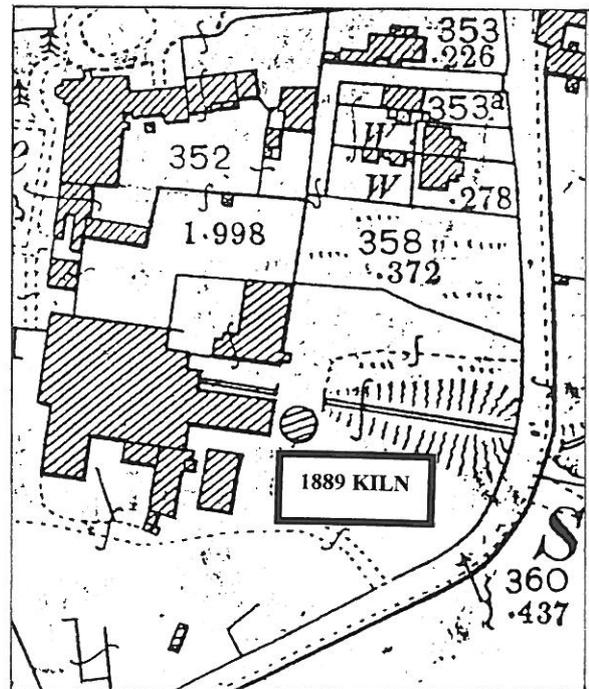
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By 1880, Haskins ceramic works occupied part of the area originally covered by Champion's enterprise. It appears to have utilised many of the buildings of mid-18th century character, with the addition of four beehive kilns in the open, and two rectangular buildings which also contained kilns. The two stacks completed most of Haskins undertaking.

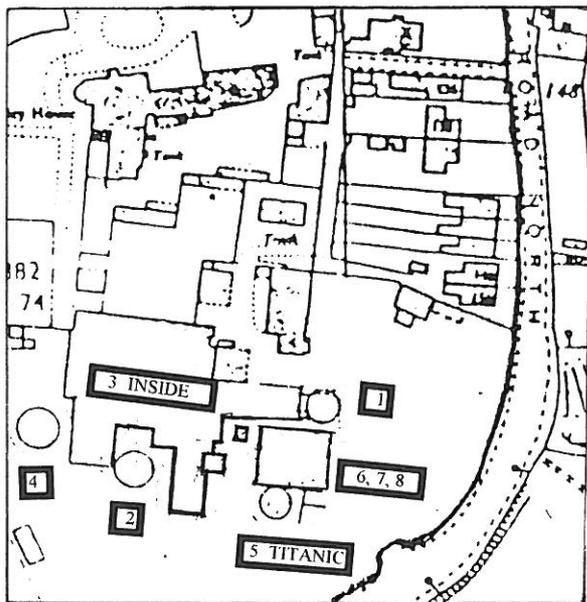
An aerial view (Plate 13) was taken from the north-east well before 1957 (possibly by a Bristol firm that specialised in this type of photography in the late 1920s). Tower Lane crosses from the top right to the middle left and facing it in the top right corner is Tower Rank. The tall hip-roofed building just below is probably a domestic building noted as such in 1841, although it has some resemblance to an engine house. The two-storey



1881



1889

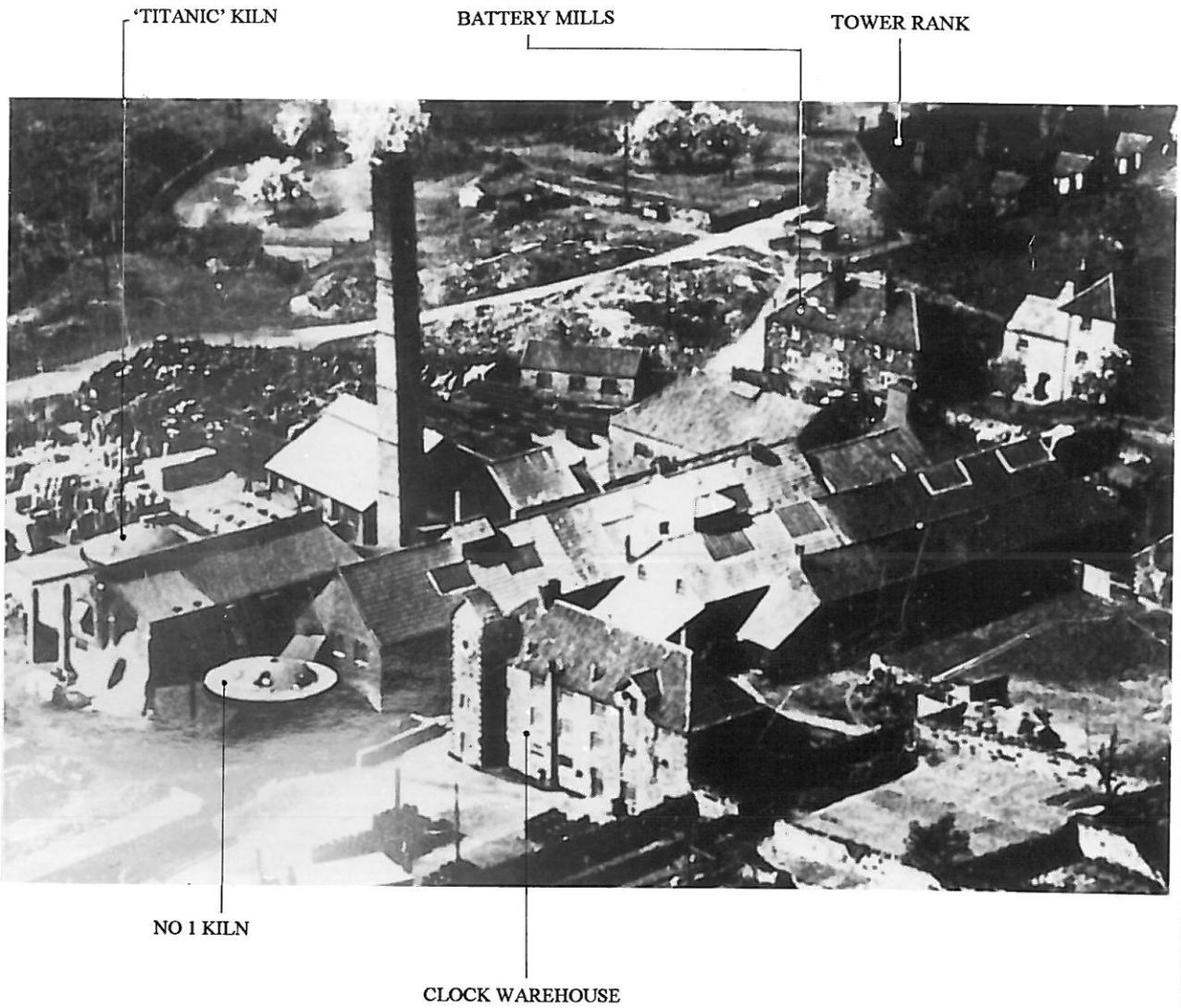


1920s



c.1960

Fig. 13 The development of Haskin's Pottery works showing the kilns



**Plate 13. Ariel view of the Haskins Pottery Works from the north-east.  
Probably taken in the late 1920s.**

building to the left of the 'engine house' is on the suggested site of the battery mills at the end of the eastern arm of the lake. It was converted into three domestic dwellings sometime before 1841. Two of the four beehive kilns are in the left foreground, the one nearest was present by 1889. The one behind was known as 'Titanic' presumably named before the 1912 shipping catastrophe. The stack to the right was the first to be constructed, the second, further west, was not built until about 1957 (pers. comm. Jim Ashley who started work at Haskins in 1953). Built after 1902, the Hoffman kilns to the left discharged into the older stack. To the right is a tall gable-ended building that could have been an engine house close to the triangular pond. If this building is an engine house, then it is in a favourable position to lift the water into the eastern arm of the lake. The two long buildings to the north of the stack are shown on the Tithe map but the hipped building to the east of the battery mills is not although it has all the characteristics of an 18th century building. The building in the centre foreground is the Clock Warehouse.

To the east of Tower Rank and south of the Dalton Young Complex lay three tenements, a school house, and two cottages with gardens. Most of these buildings now lie under Tower Lane and there are unlikely to be any remains. South of these, bordering on the brook, lay a further two cottages and gardens owned by Davidson and in 1841 leased to tenants. These lie under the factory at the south west of the site.

A row of six tenements and gardens owned by Davidson in 1841, but individually rented, were replaced by Tanner House and grounds (134 Tower Road North).

The linear track consisting of fused concrete and ceramic pipe fragments found during the excavation close to Tower Road North (Parry 1994) would seem to be part of the tramway which connected Haskins works with the level east of Tower Road North. As part was eventually in a cutting, remains can be expected.

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## **9. Preservation of the archaeological resource**

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### **The southern part of the complex**

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The extent of damage to the archaeological levels associated with the southern part of Champion's works can be assessed when it is appreciated that, originally, the whole area would have sloped gently down southwards to the Siston Brook. Indeed, it appears from a 1960s photograph that this was still the case until the area was cleared of buildings.

A close examination of relevant photographs indicates that Champion, in order to make best use of his sloping site, levelled small areas each time he needed a new building. Thus, from an archaeological point of view, the site would have consisted of a series of small platforms, each containing a building or process. This method of construction continued throughout the 19th and early 20th centuries with further small areas being levelled as required.



**Plate 14. The Pottery Works from the bridge on Tower Road North looking north in the 1960s. The later stack is to the west.**



**Plate 15. No. 2 kiln and its products from the south in the 1960s.**

The construction of Tower Lane and the modern factory to the north of that road involved much more substantial works. The whole area of the modern factory and its associated car park to the east is now an almost level platform. The deep cut along the northern edge of that site, which stretches eastwards from Champion's mound to the rear of the Clock warehouse yard, gives a visual indication of this change in level. The whole exercise was probably, in part at least, a cut-and-cover operation, with spoil being moved from the north to the south of the site, thus creating the embankment above Tower Lane.

The triangular pond, used as a sump, would have been underneath the centre of the modern factory. Remains of this, and associated culverting, and pumping arrangements, being very deep, are likely to have survived. In the western part of the factory area, the remains of the buildings thought to be the battery mills, would also have deep and complex foundations including waterwheel pits and culverts, traces of which are likely to survive. Apart from these features, any archaeological levels that still survive will be to the south of the area and could be very deeply buried.

The western entrance to the modern factory from Tower Lane slopes gradually upwards and may well have cut into part of the terminal dam of the eastern arm of the lake. The new access road running west to east as a ramp in front of the factory does not appear to have followed the line of any buried remains.

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### **The northern part of the complex**

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The remainder of the historic site, to the west, north and east of the modern factory area, has had relatively little modern disturbance and the quality of the buried remains is likely to be relatively uniform. Recent excavations have confirmed the presence of a substantial depth of these historic levels.

The Clock Warehouse building and its approach was built on a levelled platform cut into the natural slope. The houses (nos. 134-150) along Tower Road North are also built on slight platforms cut out of the slope and preservation of archaeological levels will, as a result, be variable and unpredictable in those areas.

The various cuttings for the tramway will have disturbed earlier levels. Indeed, two pre-1841 buildings were partly removed to make way for it - one in front of the Clock Warehouse and the other adjacent to Tower Road North.

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### **Garden archaeology potential**

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Although it has been suggested that the grotto could have been associated with industrial processes, no documentary evidence has been found. Water may have had to be lifted here to increase the sublime qualities of the grotto, but it would have been purely for this effect and not directly associated with a power source. However, the lower culvert might have had some industrial purpose associated with the building that was originally external to the west of the grotto area. Its distinct separation from the rest of the works might be

explained as an experimental workshop for Champion as part of the private side of the site.

The old kitchen garden area used by Kingswood Borough Council as an open store, is unlikely to contain any features of archaeological significance.

The suggested Heath House, is of interest as part of the layout of an early Victorian garden. Its extent could be tested by excavation to establish the front wall and the continuation southwards of the side walls.

The gardens doubtless suffered several changes in design with variations in flower beds, ponds, paths, and other features. Traces of these will doubtless remain buried and could be established by excavation possibly by a resistivity survey.

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## **10 Conclusions**

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The Warmley complex is a unique 18th century integrated industrial site which pre-dates Soho and the textile sites of Cromford, Belper, Styal and New Lanark where social control was synonymous with our understanding of the Industrial Revolution. Warmley not only contains an industrial complex, but has a pleasant aesthetic appeal with an outstanding house and garden. The family connections with the Darby family and the beginning of the Industrial Revolution are also of importance

There are buildings of many different periods on the whole of the Warmley complex. Some date to the time of Champion, others to later manufacturing operations and the remainder are relatively modern.

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### **Buildings and features of the Champion period**

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The landscape features and upstanding remains that can, with a reasonable degree of certainty, be attributed to the Champion period of use of the site include:

- \*Warmley House, stable block and grounds, including steps
- \*The Grotto
  - The mound
- \*The Chequered Wall
  - The leat and the Elm Walk
  - Echo Pond
  - The lake (edging walls and dam) & \*Neptune
- \*The Summer House
  - The Boat House
- \*Parts of the Dalton Young complex including the windmill tower, ranges B, C & D, and the \*Ice House
- \*Clock Warehouse

Those shown with an asterisk are listed buildings.

Warmley House, the entrance and the car park are a well-integrated group. The setting of the entrance introduces the vista of the house. The lamp posts provide an articulation to this as well as being interesting in themselves. The house retains many of its original features, both internally and externally and the connecting range to the coach house, although not entirely in keeping, is sufficiently low key to maintain the prominence of the house. The coach house has been rather thoughtlessly converted, but still retains much of its original form. The original entrance to Warmley House has an attractive sealed pedestrian entrance of Gothic form.

The garden is included in the Register of Parks and Gardens and is owned by Kingswood Borough Council. The various influences which helped create the garden make it of major interest to garden historians. The importance of the grotto as a structure is associated with the evolution of gardens and follies as a whole, and in particular its relationship to the nearby industry. The grotto complex requires further investigation to resolve the constructional phases and the possible early industrial use.

Much of the perimeter of the lake can be traced on the ground including the area near to the termination of its eastern arm. Although it is unlikely that the lake will be restored, it is important to preserve and enhance the perimeter so far as this is practicable.

The Summer House was originally a very attractive building which provided a grand entrance to the lake and a view point. Although somewhat disfigured by the modern accretions, it remains an important building of its period.

The boat house is not a particularly pleasing building as it presently stands. However when it had its hipped roof and was positioned half in the lake and just south of Echo Pond, it must have appeared as a kind of lodge between lake, pond and grotto. Its original purpose is unknown. It is not a listed building and does not fit in with listing criteria, but the eastern portion is within the area covered by the the Register of Parks and Gardens.

The Dalton Young complex is, at the time of writing, being transferred to a Museum Trust. It has been found to be basically structurally sound (Architecton 1993). Although its various functions are not yet fully understood, as a largely mid-18th century industrial complex, it contains a highly significant group of buildings. It is considered that they formed the basis of Champion's ore preparation processes using horse gin and wind powered stamps. These would have localised one process in a limited area of the works saving the water-power for the battery mills. Although there is some doubt as to the dating of the north range, the whole complex, with the exception of building J, must be associated with the era of Champion's brassworks. The compactness of the complex, with its variety of building types and roof lines will, with sympathetic restoration, continue to provide an attractive landmark.

The 'ice house' has been shown to be of mid-18th century date. If it was associated with Champion's metallic zinc processes it is unique and of international importance to the history of metallurgy. If it was an icehouse it is one of the largest known. Further study is needed to resolve this enigma.

The primary block of the Clock warehouse presents a typical 'factory' appearance. The east elevation, with its clock tower, irregular appearance, and pantile roof, is a significant feature in the landscape of the whole area.

The watercourses and culverts are of major interest. A detailed levelled survey of the complex could help to establish with more certainty the original location(s) of the Newcomen engine(s) and would enhance the understanding of the water supply system and its relationship to the grotto.

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### **Later Buildings**

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Only slight traces remain of the long occupation of the site for ceramic ware production. The factories and kilns have all been demolished and all traces above ground have disappeared. The Victorian/Edwardian houses (numbers 150 to 136 Tower Road North including Tanner House) are high quality housing presumably built for the key staff of the Haskins Pottery. The engine shed/weigh house, although not of any aesthetic value, has associations with the later period of Haskins Warmley Pottery.

Virtually all other buildings on the Warmley site are of modern construction and, apart from perpetuating the impression of industrial use, add nothing to the historical background. The most that can be said is that they are mainly of a relatively flimsy construction and in places could seal features of the earlier industrial periods.

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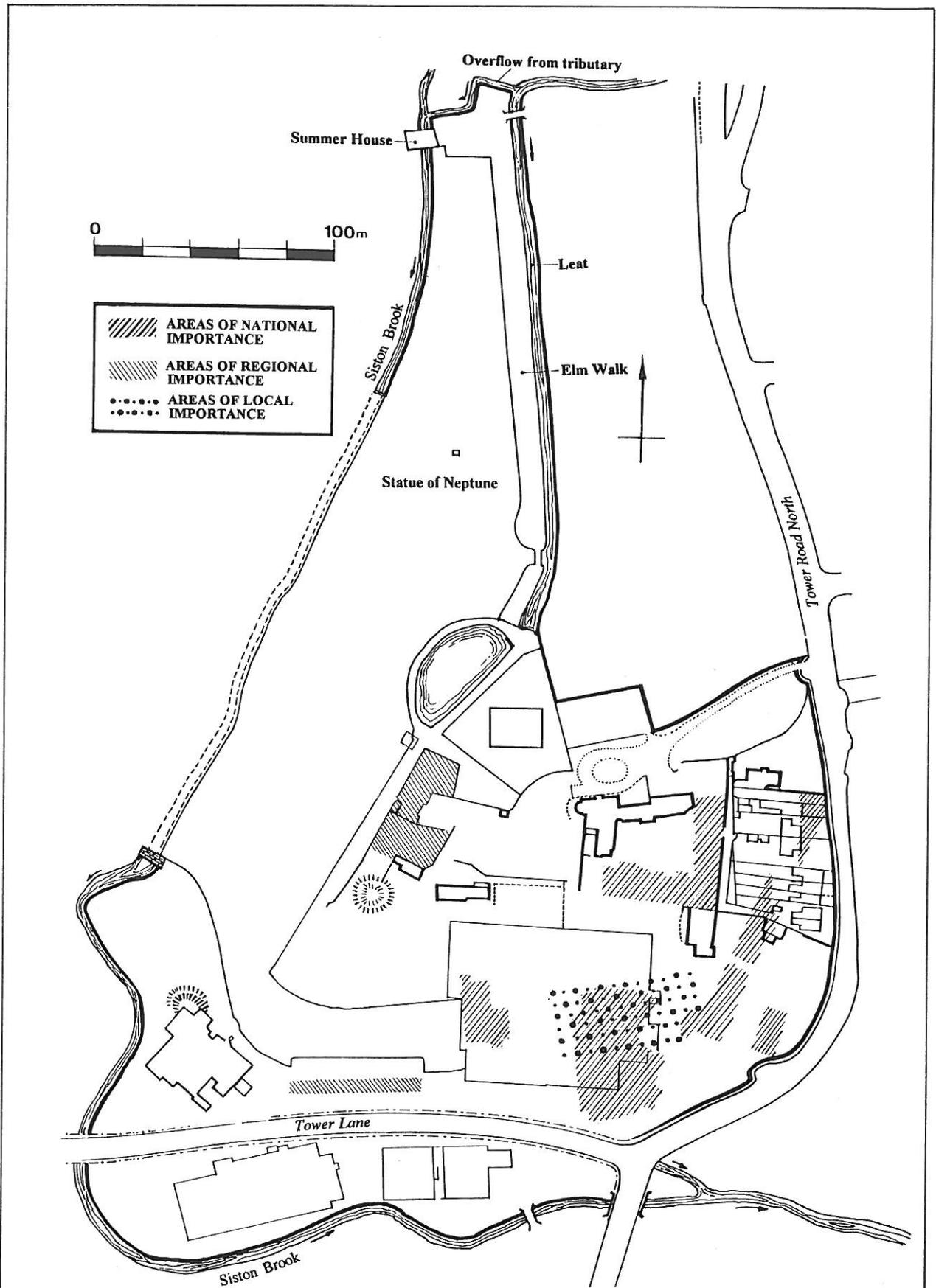
### **The buried archaeological resource**

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The buried archaeological resource can be considered under three main headings:

1. Areas of national importance.  
This comprises the areas associated with Champion's industrial processes.
2. Areas of regional importance.  
Buried garden features and workers housing of the Champion era.
- 3 Areas of local importance.  
Later industrial developments including the Haskins Pottery

The areas where buried remains of national importance can be anticipated are shown on fig 14. They include the suggested sites of the various processes that were in use during



**Fig. 14** A preliminary plan to give an indication of areas where archaeological remains can be expected.

the Champion period including the Nawcomen engine, the battery mills, the copper & brass furnaces, the casting areas, the zinc smelting areas and the annealing area.

The areas of local importance shown on fig 14 include areas where buried garden features are considered likely and the area where Tower Rank stood.

Much of the Haskins Ceramic Works was probably removed when the platform for the modern factory was excavated. Small areas around the factory are likely to produce remains of this phase.

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### **Artefacts of importance loose around the complex**

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The edge-runner on the lawn

The granite slab by the Clock Warehouse used as a casting mould

The considerable number of copper slag blocks<sup>15</sup> used throughout the site.

These are of three types - rectangular (0.22m x 0.47m x 0.24m)

triangular (0.22m x 0.47m x 0.38m)

triangular but with half-round top

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## **11. Situation and amenity value**

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Although the brief for this Report is to produce a Survey for Management and not a Management Plan, certain factors have emerged which might be of help in formulating a management policy for the site. These are submitted for consideration.

There is potential for tourism. Although car parking is somewhat limited there is some potential for improvement. The whole site is compact and accessible with some footpaths.

The site has a variety of interests including garden history, industrial archaeology and ecology.

The complex at Warmley is one of the few historical sites in the proposed unitary authority of South Gloucestershire and could become a focal point for the early brass industry. The precedent and experience of the Ironbridge Gorge Museum Trust makes this

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<sup>15</sup> The blocks were cast from molten material removed as waste from the melting processes of copper smelting. The sulphide ore from Cornwall used during the 18th century rarely contained more than 10% copper, requiring the remaining 90% waste to be eliminated either as gases or slag. This resulted in large amounts of material which caused disposal problems. From 1749 the Bristol company were casting of slag blocks into a building material to be convenient a practice which Champion continued. An illustration by Angerstein in one of his 1754 sketches made at Warmley, included the cast-iron moulds used to form the rectangular blocks (Day 1995).

site and others a smaller scale possibility for the south-west. Excellent communications are in place.

This survey for management has only touched on the large quantity of research material available, but not collated. It is hoped that any management plan will incorporate a full study of this material..

It is suggested that part of the Warmley complex may fulfil the appropriate criteria for scheduling as an ancient monument .

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## 12 The aesthetic appeal

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The historic and archaeological importance of the various areas of the site have been discussed, but the site also has an aesthetic appeal - an appeal that should be taken into account when deciding a management policy for the site.

The Grotto, garden and Echo Pond, although not unique, are of particular interest because of their close association with the mid-18th century industry close by. The garden has a whole tension between the artful and the capricious. It has been suggested (pers.comm David Lambert) that our understanding of 18th century philosophical ideas on the 'sublime' may be connected with a desire to live in close harmony with the heavy industry. Did the Darbys of Coalbrookdale, Matthew Boulton of Soho and Wedgewood of Etruria, all of whom deliberately chose to live by their industrial undertakings, have this desire? Was this the reason for the proximity and not wholly to keep an eye on the proceedings?

There are family links with Thomas Goldney, who built the celebrated grotto at Clifton, but this may have influenced the desire to create a grotto rather than the form it took. Champion employed a Newcomen engine from 1749 to circulate water back to the lake. That water was used within the grotto is not in question, the culverts that led to it might have been ancillary branches from the culvert main running between the triangular pond and the lake. If this were so, then this occurred some time before Goldney installed his Newcomen engine and it is quite possible that they compared notes and borrowed ideas from each other.

The Echo Pond, Elm Walk and Canal are all parts of a formal composition visible in the rococo paintings of Thomas Robins who worked extensively in this region at this date. It has been suggested that the grotto could have reminded the cultured of the description of Aeneas's descent into the Underworld. The boat house, perhaps a structure without utilitarian purpose, set among the smoke and fumes of the works, might have been a contrivance to give further illusions to the Aeneid

*'Charon: appallingly filthy he is, with a bush of unkempt  
White beard upon his chin, with eyes like jets of fire;  
With a dirty cloak draggles down, knotted about his shoulders.  
He poles the boat, he looks after the sails, he is the crew  
Of that rust-coloured wherry which takes the dead across*

(Virgil, *Aeneid*, Book 6. tr. C Day Lewis)

Echo Pond has aesthetic, as well as historic associations with the Royal Society. It was noted by Sir Joseph Banks for its echoing effects. It is only by keeping it in water, apart from aesthetic considerations, that the echoing qualities can be maintained. The substantial rooting of some plants may already have reduced its water-holding properties.

The Statue of Neptune, although poorly restored, has a considerable presence and was probably a further device of Champion's to bring about sublime qualities within his search for counterpoise between garden and industry.

The northern part of the lake, apart from the Statue of Neptune, is not an area of archaeological importance and could be left to develop its own ecology. This could provide a 'balanced' approach to the management of the whole site. Elm Walk, with its substantial ancient poplars, forms the eastern boundary of this area.

Although the industrial archaeological potential has been demonstrated, the aesthetic appeal and interest of the garden as a whole should also be appreciated as a major factor in the development of the site as a whole.

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### **13. Acknowledgements**

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Alan Bryant patiently assisted with access, advice and source material. Jessica Lawrence of Avon County Council provided much help and encouragement. David Whitehead, Stuart Harding and David Lambert helped with expert advice on the gardens and grotto. Ron Shoemith kept me from straying too far from the facts and Richard Morriss provided invaluable advice on building analyses. Sue Govan ensured that details on site were recorded accurately. Joan Day provided the details on the history of the site and the complexities of the brass industry. To these and all the others, too numerous to mention go my many thanks.

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