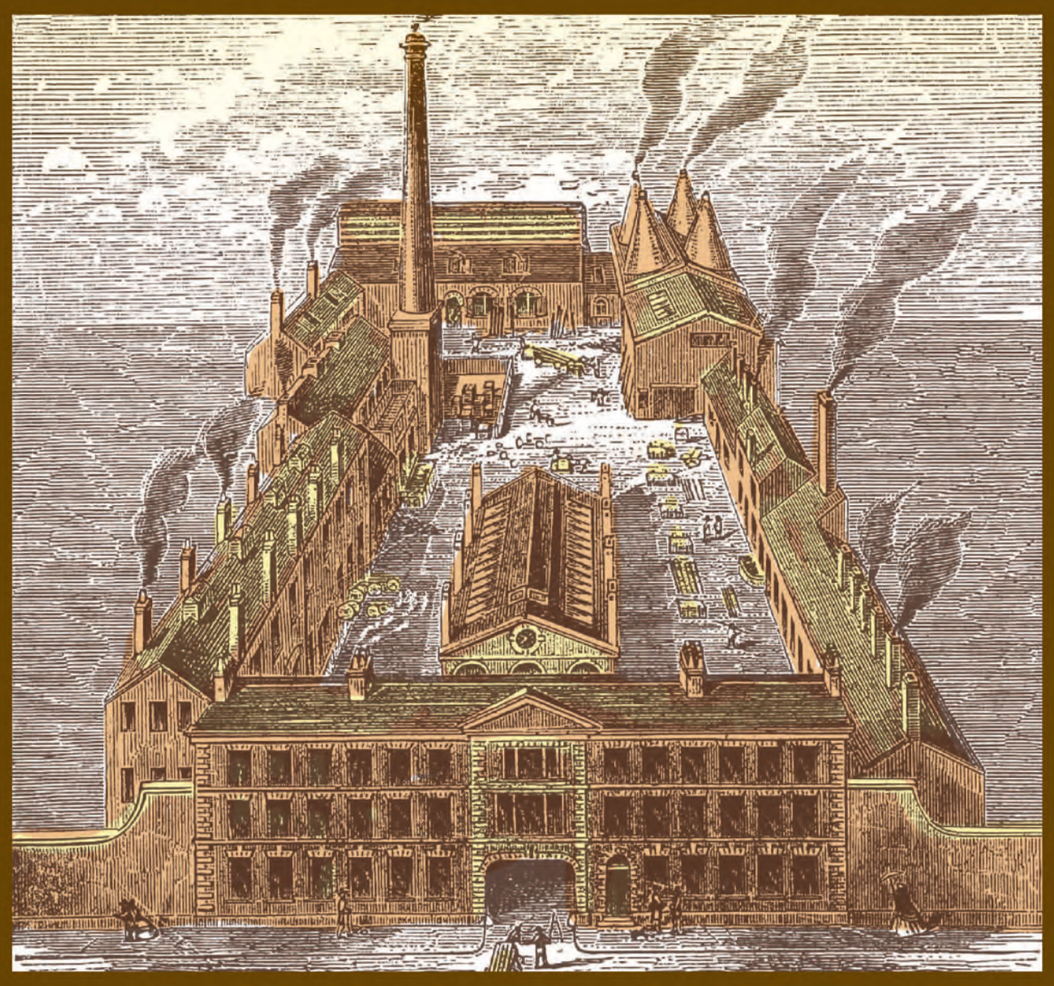
Steelworks, Crucible Furnaces and Workers' Housing

Archaeological Investigations at Hoyle Street, Sheffield

By Andrew B. Powell



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with contributions by
Phil Andrews, David Barker, Lucy Dawson, Roderick Mackenzie
and James Thomson

and illustrations by Rob Goller

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Front cover
Top – The Hoyle Street Works under excavation
Bottom left – The Hoyle Street Works depicted in a 19th century engraving
Bottom right – Mosaic in the lobby of the Titanic Works

Back cover
Top – Excavation of a possible crane base at the Hoyle Street Works
Middle – Dump of scissors at the Hoyle Street Works
Bottom – The cellar of Williams Hoole's crucible furnace, Malinda Works

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Abstract

A combination of archaeological excavation, building recording and documentary research undertaken at the Hoyle Street development site in Sheffield in 2007–8 revealed significant evidence for the crucible steelmaking which gave the town its world-wide reputation for steel products, particularly cutlery, in the 19th and 20th centuries.

Two crucible furnace cellars were excavated, one at William Hoole's steelworks (the Malinda Works) built by 1816, the other at the Hoyle Street Works probably built by 1832. A further three intact crucible furnace cellars were recorded at the Titanic Works, these being built between the second half of the 19th century and the early 20th century.

Buildings associated with related aspects of production were also recorded, particularly at the Hoyle Street Works, where part of a cementation furnace, producing the blister steel used in the crucible furnaces, was excavated. Infrastructure features, such as boiler and engine bases, a crane base and a silt trap were also identified.

Standing buildings at five works premises – the Roscoe Works, Malinda Works, Titanic Works, Australian Works and Progress Works – were subject to building recording, revealing their development over the 19th and 20th centuries.

These industrial complexes were located among the cramped housing of the local working population, and a number of cellars belonging to the back-to-back tenements and terraced houses were excavated, revealing evidence of possible cottage industry. A substantial clearance deposit revealed the range of pottery wares typically used by 19th century working-class households.

Location of Specialist Reports

The original specialist reports by David Barker (Ceramics) and Roderick Mackenzie (Slag and crucibles) are available online at www.wessexarch.co.uk/projects/hoyle-street.

Chapter 1
Introduction

Project Background

In 2006–8 archaeologists from ARCUS (Archaeological Research and Consultancy at the University of Sheffield) investigated a large development site in Sheffield (Fig. 1), which, during the 19th century, had been at the heart of the town's (and, from 1893, the city's) rapid industrial expansion, contributing to its world-wide reputation for innovative steel production and manufacture. A combination of historical research, building recording and archaeological excavation revealed the complex history of the site that in 1800 was still surrounded by fields on the town's north-western edge, but which soon after was swallowed up by steel works, foundries and workers' housing. Sheffield's burgeoning population provided the workforce for the series of industrial premises – Roscoe Place Works, William Hoole's Works (later Malinda Works), Hoyle Street Works, Progress Works, Titanic Works and Australian Works – which occupied the development site, and which were soon surrounded by the cramped terraces where their workers lived. The Titanic Works are Grade II Listed (as 60 Malinda Street).

South Yorkshire Archaeology Service (SYAS), archaeological advisors to Sheffield City Council, recommended that an Archaeological Desk-Based Assessment and Buildings Appraisal be prepared, to inform further planning recommendations. Subsequently, building recording and archaeological investigations were made a condition of both the planning permission and listed building consent granted by Sheffield City Council for the Opal Property Group Ltd to redevelop the site for student housing, retail space and offices.

The site, which lies south-west of the Shalesmoor roundabout on the city's inner ring road, occupies an approximately trapezoidal block of land covering 1.3 hectares centred on NGR 434760 388040, bounded by Hoyle Street to the south-east, Penistone Road to the north-east, Roscoe Road and Sudbury Road to the north-west, and Meadow Street to the south-west. It is bisected through its centre by Malinda Street, while Burnt Tree Lane formerly cut across the southern corner of the site.

The ground within the site is fairly level, sloping very slightly, from 60–55 m aOD, towards the River Don 200 m to the north-east. The underlying geology is mapped as Pennine Lower Coal Measures Formation – Mudstone and Siltstone (British Geological Survey online viewer).

Fieldwork Programme

The initial stages of archaeological work consisted of a desk-based assessment, which divided the site, for the purposes of study, into eight character areas (Areas A to H; Fig. 2) (May 2005), a buildings appraisal (Duckworth and May 2006), and an archaeological evaluation (Trenches 1–3 and 5–10: Trench 4 was re-designated as a watching brief) (McCoy and O'Neill 2007) (Fig. 2). The results of these led to the subsequent mitigation works, which comprised the excavation of three areas (Mitigation Trenches A–C) (Jackson and O'Neill 2009), undertaken in tandem with the site-wide recording of standing building remains prior to their demolition or renovation (Dawson 2008a–b; Dawson and Jessop 2009; Thomson 2009) (Fig. 2). In addition, a watching brief was maintained during the digging of trial holes as part of a World War II unexploded bomb survey of the site, and during the removal of spoil and artefacts from three crucible cellars at the Titanic Works.

Aims

The original aims of the archaeological works included determining the location, extent, nature and significance of surviving archaeological remains within the site, and providing information that enable them to be placed within their local, regional and national context. The aims of the building recording were to assess the historic interest of all standing buildings within the site, and their contribution to the character of the area, and to assess the extent of sub-surface disturbance caused by them.

Building Survey Methods

The levels of building recording were dependent on the significance of the standing remains, and based on recommendations in the building appraisal report (Duckworth and May 2006) and advice from SYAS and Sheffield City Council's Urban Design and

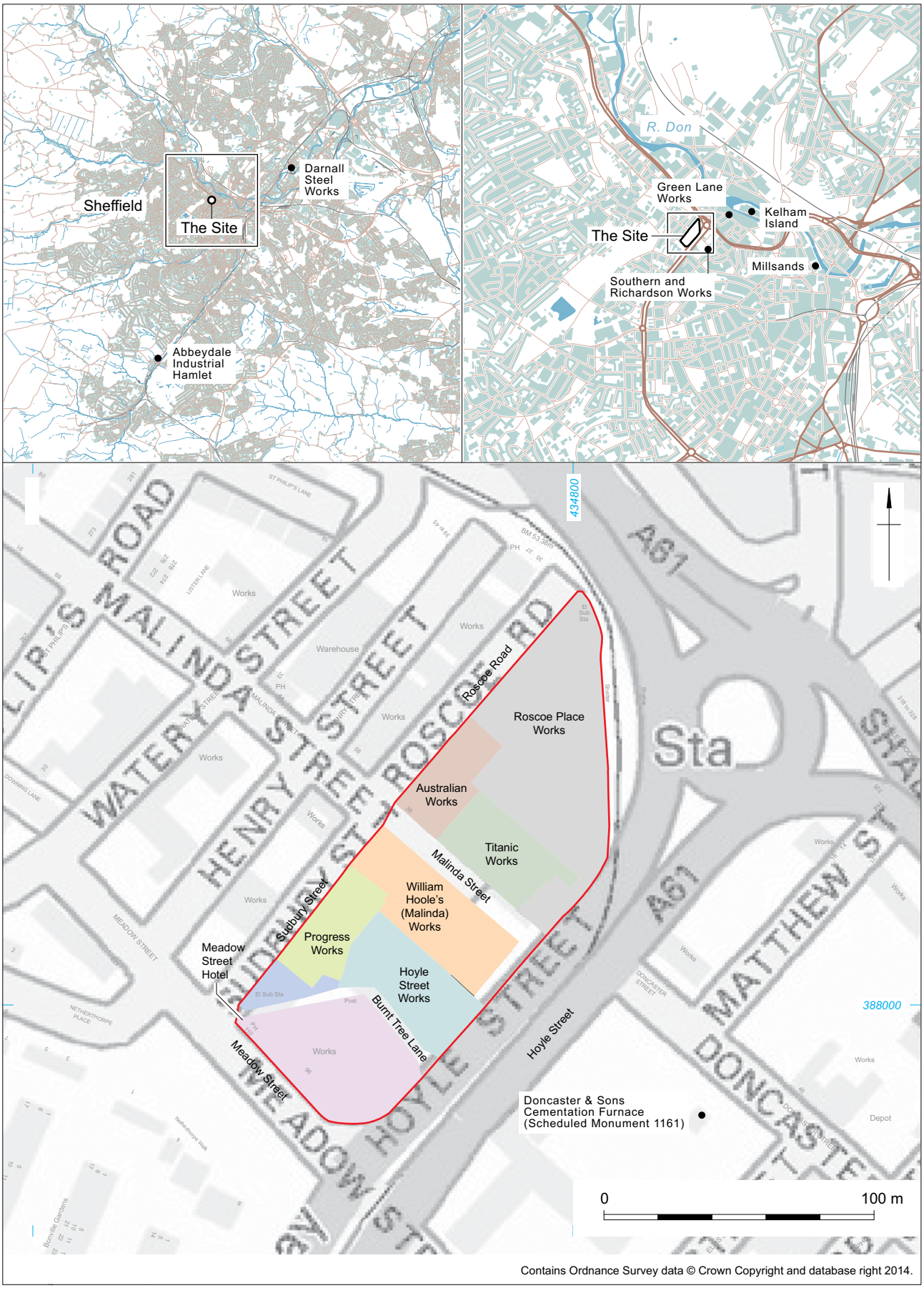

Figure 1 Site location, showing investigated works and selected sites mentioned in text

Figure 2 Site character areas (Areas A–H), evaluation trenches (Trenches 1–3 and 5–10) and excavations (Mitigation Trenches A–C). (Trench 4 re-designated as a watching brief)

Conservation (UDC) Team (now Urban and Environmental Planning).

No building recording was undertaken in Areas A and C (Fig. 2), the work there being generally limited to characterisation photographs to place the surrounding structures in context. Meadow Street Hotel in Area A (see Fig. 1), however, was subject to a more comprehensive photographic survey. Buildings in Area D (Progress Works) were subject to basic survey, comprising an outline ground-floor plan and a photographic record. The recording of buildings in Areas G and H (Australian Works) comprised the production of measured plans, showing features of historic/archaeological significance and phasing where appropriate, and a photographic record. Buildings in Areas B (Hoyle Street Works), E (Malinda Works) and F (Titanic Works) were subject to detailed surveys, comprising 1:100 phased ground and first-floor plans, 1:50 short and longitudinal sections, and photographic records.

Evaluation and Excavation Methods

The methods for the archaeological works were specified in project designs (McCoy 2006; O'Neill 2007; 2008), and conformed to briefs issued by SYAS. All mechanical excavation was carried out using a machine fitted with a toothless ditching bucket under archaeological supervision. A full written, drawn and photographic record was made of all features and deposits within the excavated areas. Structures, features and deposits were planned by hand and geo-referenced using GPS and Total Station instruments as appropriate. Artefactual material and samples were collected following agreed strategies, and all retained finds and samples have been assessed, catalogued and prepared for long-term storage. Selected categories of finds were subject to further analysis for this report.

Ten evaluation trenches, between 8 m and 20 m long, were proposed (Fig. 2), but Trench 4 was re-designated as a watching brief due to the unparalleled preservation of the crucible furnace cellars associated with the Titanic Works.

The degree of sub-surface preservation in Trench 2 led to the excavation of Mitigation Trench A, located between Trench 2 and the surviving structures to the rear of the Titanic Works.

Trench 6 was specifically targeted on the surviving extent of William Hoole's crucible furnace (built *c.* 1816), and led to the excavation of the immediately surrounding area (Mitigation Trench C).

Trenches 7 and 8 were opened following the demolition of standing buildings in the central

southern part of the site. The high degree of *in situ* preservation led to the excavation of Mitigation Trench B, positioned around the evaluation trenches and up to Burnt Tree Lane, effectively encompassing the full surviving extent of the Hoyle Street Works.

No further excavation was required in the areas of Trench 5, opened following the demolition of the overlying Australian Works building, or Trenches 9 and 10 south of Burnt Tree Lane.

Medieval and Post-Medieval Background

There is no recorded evidence for prehistoric or Romano-British activity in the vicinity of the site although, given the development of the area since the post-medieval period, it is unlikely that any significant sub-surface remains from these periods would survive.

Sheffield developed from possible Anglo-Saxon origins into an important administrative and commercial centre in the 12th and 13th centuries with a population of around 2000 (Hey 1998, 18). The association of Sheffield and its region with the metal trade, and specifically cutlery making, for which it would later be known around the world, was already emerging by this date, with the earliest surviving reference to the trade, to the cutler *Robertus le Cotelere*, dating to 1297 (Unwin 2002, 14). There is also a late 14th century reference in Geoffrey Chaucer's *Reeve's Tale* to a pilgrim who carried a 'Schefield thwytel' (whittle, or knife) (Wray 2000, 3).

The development of the area as a centre for metal trades was undoubtedly influenced by the area's natural supplies of iron ore, coal, sandstone for producing grindstones (Wray *et al.* 2001, 5) and by the ready availability of water power. Probably starting as a loosely organised cottage industry, the scale and sophistication of the trade grew as skills passed down through generations of craftsmen were mastered and refined. This is reflected in the growth of the industry in the 16th and 17th centuries as small, purpose-built industrial works began to develop along the River Don and its four major tributaries, exploiting the power of the river to drive their machines (Ball *et al.* 2006, xv). The organisation of Sheffield's metal trade during the 17th and 18th centuries was unlike other factory-based industries, with production in each stage of an article's manufacture being undertaken by a specialist craftsman.

There was a strong connection between agriculture and industry in Sheffield, with records of the 16th and 17th centuries indicating that many inhabitants supplemented their incomes by pursuing both industrial and agricultural activities (Ball *et al.* 2006, xv). Industrial development did not reach the Hoyle Street site, however, until the early 19th century. The site lay within the open arable land of Town Field and the common grazing land of Shalesmoor that formed part of the agricultural hinterland around the town (Scurfield 1986). The Town Field was an element in Sheffield's regular open-field system of unenclosed cultivation strips which were distributed between the townspeople in a way that necessitated cooperation between individuals (English Heritage 2011, 4). By the 17th century, however, this open-field organisation of agriculture was largely abandoned, and the Town Field was divided into several smaller enclosures (Scurfield 1986) allowing the land-owner or tenant to graze animals and improve the land in ways not formerly possible.

Roads and tracks radiated from the town to the smaller settlements. Burnt Tree Lane, which until the present redevelopment passed through the southern part of the site, preserved the route of a raised causeway or track to the small settlement of Upperthorpe (Smith 1962, 168). Other historic routes include Walkley Road (later called Infirmary Road) continuing north-west from Moor Fields, which follows an earlier route towards Walkley, and Allen Street which was previously known as Townfield Lane (Scurfield 1986) (see Fig. 3).

The population of Sheffield more than doubled in the second half of the 18th century, rising from approximately 13,000 in 1755 to 30,000 in 1791 (Universal British Directory 1791), and the town was rapidly expanding. This growth, driven by increasing demand for steel and its products, was matched by several significant developments including the local production of cementation or blister steel, crucible steel and Sheffield Plate (a form of silver plating and a cheap alternative to real silver household utensils) in the 1740s, and the introduction of steam power in the 1780s (Unwin 2002, 51), which allowed the industry, formerly reliant on water power, to expand away from the river valleys. This growth continued in the 19th century, and the development of cementation and crucible steel production saw an increase in capacity from 3,000 tons per annum in 1800 to 100,000 tons in 1865 (Barraclough 1976, 8–9). The expansion of the steel industry between the mid-18th and the mid-19th century was mainly due to the growth of relatively small businesses exploiting the good quality cementation and crucible steel readily available; by 1856 there were 135 such firms, mostly cutlers or other steel users (Linton 1956, 156).

During the 18th century new mixed domestic and industrial development began to spread north-west of the town's centre, into the Town Field area. Streets were formed in the Crofts area off West Bar Green, gently curving up the hill along the route of the furrows of the former open-field system and lined with closely built courts of back-to-back housing intermixed with industrial premises. By the late

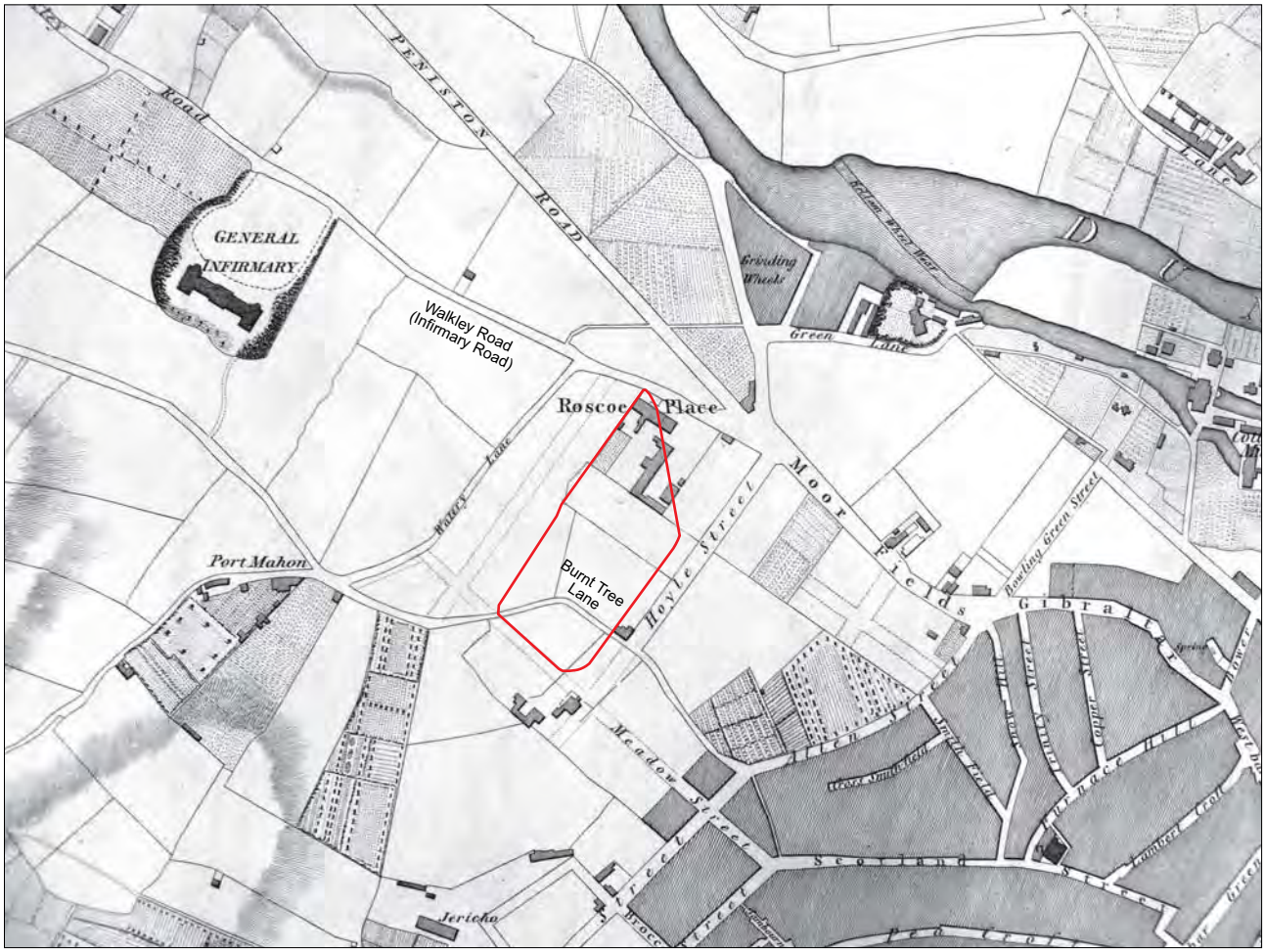

Figure 3 1808 Fairbank map of Sheffield (Sheffield Archives FC/She 9 L)

18th century the development had become more regulated, with a grid-iron pattern of streets laid out, although the development within the plots remained irregular. Most of the land in the Hoyle Street site was owned by two landholders at this time, with a large field to the east of Watery Lane owned by Robert Rodgers and the area to the south of Burnt Tree Lane owned by William Hoyle. By 1793 Hoyle Street and Meadow Street had been proposed for construction and the land assigned for development. Hoyle Street was laid out by 1808, whilst Henry Street and the north-western extension of Meadow Street were yet to be built (Fig. 3). The development of the site can be seen in a series of maps dating from the late 18th century through to the end of the 20th century (Figs 4–6); unless otherwise stated the maps referred to are those produced by the Ordnance Survey.

Crucible Steel Production

In order to provide some understanding of the most significant archaeological features uncovered during the works – the crucible furnaces at William Hoole's (Malinda) Works (in Area E), the Hoyle Street Works (Area B) and the Titanic Works (Area F) – a brief summary is given here of the crucible steel manufacturing process (Hiorns 1903, 345–53; Stoughton 1908, 87–93; Barraclough 1984).

The industrial development of crucible steel production in Britain, so crucial to growth of the Sheffield steel industry, stemmed largely from the work of an 18th century clock and lock maker, Benjamin Huntsman (1704–1776), who needed a uniformly high-grade steel for his springs, containing fewer impurities than found in 'blister steel', which was of poorer and less regular quality. Blister steel was the product of the cementation process by which carbon (from charcoal) was diffused into wrought iron bars placed in stone chests within a furnace. While this gave it greater strength and hardness, it was brittle and uneven in terms of its carbon content, requiring it to be to be hot-worked and reduced in section, by forging or, later, by rolling to produce different 'tempers' (carbon levels) for different products. In his experiments, first in Doncaster and later at Handsworth near Sheffield, Huntsman developed a process enabling him for the first time to cast steel ingots, using clay crucibles capable of

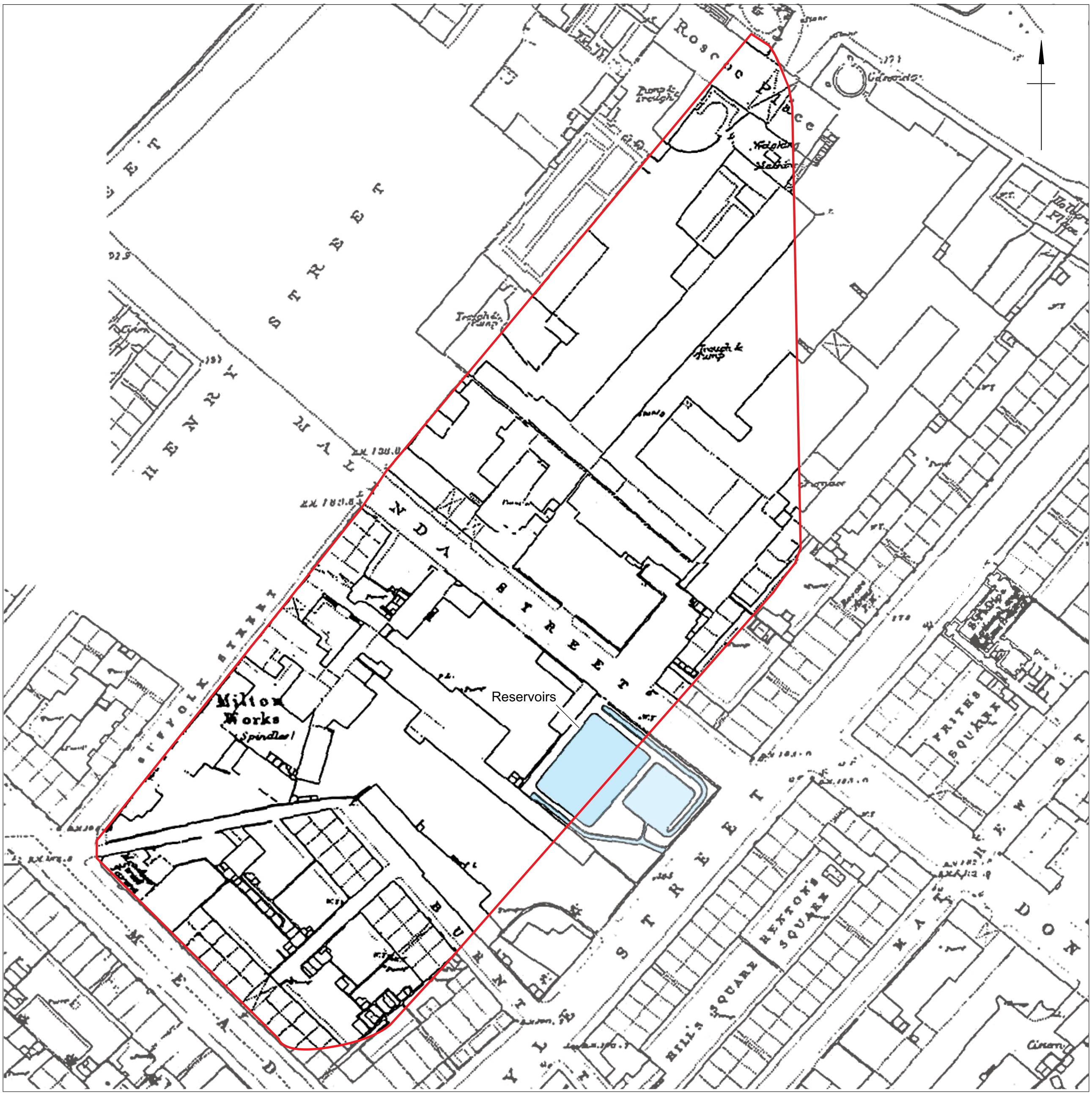

Figure 4 1852 OS map (Sheffield Archives)

withstanding the very high temperatures reached in the coke-fired furnaces.

As Huntsman's methods became established, crucible steel works took on a largely standard form (Fig. 7). Each work's 'melting shop' was built over a large arched cellar, which provided the reservoir of air needed to supply a draught to the row of 'melting holes' built into the melting shop floor, and into which the coke ash fell to be then cleared away. The cellar was, therefore, divided into a series of walled bays with sloping floors, or 'ash pits', below the grid of 'grate bars' at the base of each melting hole. In the back wall of each ash pit there was a cold-air flue feeding into the base of the chimney stack which was used to regulate the draught into the individual melting holes.

The upper structure of a crucible works comprised a number of components. The melting holes were sunk into the floor against the melting shop's back wall and chimney stack; originally these were circular, holding single crucibles, but by the second half of the 19th century the holes were elliptical, 1 m deep, and able to hold two crucibles. The holes were made of fire-brick lined with 'ganister', a coarse, refractory clay incorporating the ganister sandstone found in the upper Don Valley, as well as coke dust. The ganister lining, which was rammed around an elliptical wooden template (which was then withdrawn),

Figure 5 1890 OS map (Sheffield Archives)

needed replacing after several weeks' use. The holes' covers were raised slightly above the floor of the melting shop. A second flue, at the back of the melting holes, led to the chimney, the base of which was usually strengthened against heat damage by encircling iron bands.

Prior to a melt, two clay stands or 'cheeses', slightly less in diameter than the bottoms of the crucibles, were placed on the grate bars in the base of each hole; the grate bars rested on bearers built into the brickwork below the level of the cellar roof allowing them to be withdrawn in case of a crucible breaking. The crucibles were placed on the cheeses and covered with lids. For the first melt of the day ignited coke (from the annealing stove, see below) was spread over the grate bars, and when it was well alight, the holes were filled with coke up to the tops of the crucibles. When the crucible was at white heat, reaching a temperature of 1600 °C, the lids were lifted using long tongs, and they were filled, using a long wrought iron funnel, with broken bars of blister steel, along with a flux to collect impurities, and other alloying elements. When the coke had burned down the hole was refilled and allowed to burn down a second time, the progress of the melting being monitored by the 'melter'. When the charge was fully melted, the hole would be filled a third time, for the final, 'killing'

Figure 6 1953 OS map (Sheffield Archives)

fire, to ensure all the gases were dispelled from the molten steel.

When the melter was satisfied that the melting was completed, the 'puller-out' lifted out the crucibles using long tongs (Fig. 8). The 'teemer' skimmed off the slag from the surface of the metal and poured, or 'teemed', the molten steel into rectangular-section cast-iron moulds, made of two halves bound by iron rings, set upright in 'teeming pits' in the melting shop floor. Care had to be taken that the molten steel did not touch the sides of the mould until it reached the bottom, otherwise the metal would instantly set, creating serious flaws in the ingot. When the mould was nearly full, a clay sleeve ('dozzle'), heated white hot, was placed in the top of the mould and filled with more steel, which drained into the mould as the steel cooled and contracted, filling the resulting cavity. This section of the mould, or 'topping', was then hammered off, usually by the teemer and the puller-out, and was reused in the ingredients in a fresh melting.

Immediately after casting, any adhering clinker was cleaned off the crucibles and they were returned to the furnace ready for the next charge. The first melt generally took five to six hours, and succeeding charges around three hours. Each furnace would see

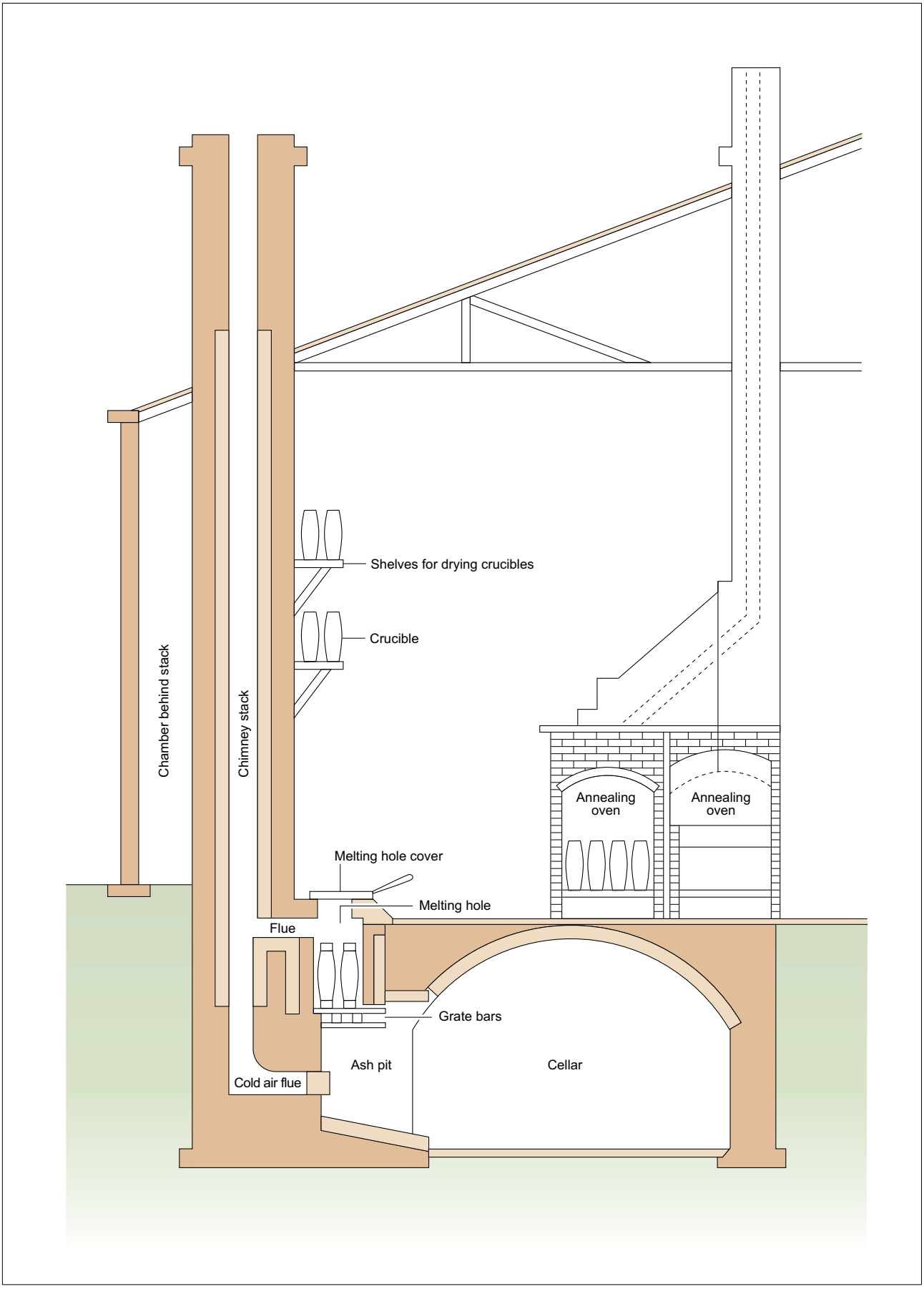

Figure 7 Schematic section of a crucible furnace (based on Hasluck 1900, 39)

Figure 8 Casting ingots, drawing the crucibles (Sheffield Local Studies Library Picture Sheffield s10815)

Figure 9 Making crucibles for melting, treading the clay (Sheffield Local Studies Library Picture Sheffield s10816)

three melts each day, taking approximately 12 hours in total. Three heats also represented the useful life of each crucible, after which they were discarded.

In addition to the melting room, there were other important components of the crucible works, including the 'charge room' where the raw materials were prepared and weighed. Much of the works was also involved in the production of the crucibles, of which a ready and regular supply was needed. These were made in the 'pot shop'. Their main ingredient was Stannington clay from the north-west of Sheffield, with additions of Stourbridge, Derby or sometimes China clay, as well as coke dust and 'grog' fragments from smashed used crucibles. The ingredients were mixed dry in a puddling pit or tray on the pot shop floor, and water was added until the mixture was saturated. The mixture was kneaded with bare feet for several hours, to drive out any air bubbles which would weaken the crucible (Fig. 9). Each day sufficient clay was mixed to make enough crucibles for one day's melting.

Key to the process were the thick-walled crucibles made of highly refractory clay which could survive very high temperatures without breaking. The vase-shaped vessels were moulded by placing a cylindrical block of the kneaded clay into a lathe-turned wooden 'flask', the inside surface of which formed the outer profile of the crucible, then driving in a wooden plug to form its interior. (This left a small hole in the base of the crucible; when the empty crucible was heated in the melting hole, refractory sand was thrown into its base, prevented from running out by the cheese below, which then fused, plugging the holes and joining it to the cheese). Once formed the crucibles were slowly air-dried for a week, before being placed on shelves over the melting holes in the melting room for ten days to a month, to complete the drying process. The day before they were to be

Chapter 2
The Steel Works and Other Industrial Buildings

Introduction

This chapter describes the results of the investigations at the six main Works premises that fall within the site, combining the documentary and cartographic research, the building recording evidence and the results of the archaeological fieldwork (evaluation, excavation and watching brief). Each section starts with what was previously known about the Works from maps, documents and trade directories etc, then describes those archaeological features and standing structures relating to industrial activity (domestic activity is described in Chapter 3). Buildings described below are identified by their Area and number, with their ground-floor rooms numbered with a G-prefix).

Roscoe Place Works

Area H, (and the north-eastern part of Area G), at the north-eastern end of the site (Fig. 2) included much of the area covered by the early 19th century Roscoe Place Works (Fig. 1). This area continued as an industrial site until at least the 1850s, but by 1890 the whole of Area H (within the limits of the investigated area) was being developed for terraced housing. Evaluation Trenches 1–2 and Mitigation Trench A (in Area H), and Trench 3 (in Area G) were excavated within the area of the Roscoe Place Works (Fig. 2); no building recording was required, as there were no standing buildings.

Background

The Roscoe Place Works, built in 1805–6 by Joseph Shaw and Robert Jobson as a fender manufactory, represents the start of the site's industrial development. They are shown on a map of 1808 (Fig. 3) as occupying a rectangular plot, at the north-east end of the site, surrounded by fields on three sides and fronting onto Walkley Road (as labelled on later maps).

At the northern corner of the plot was Roscoe Place, a building set back from Walkley Road, which may have housed the manager's residence. Later maps show a cart passage leading through this building from a small forecourt into a works yard behind. This yard, on the north-western side of the plot, was flanked to the south-east by a long works building running down the centre of the property. A gap between the two buildings (with a possible gate shown on a map of 1828) gave access to a second yard on the south-eastern side of the plot, which had two smaller buildings flanking its southern corner. Additional small buildings are shown around the yards on a plan of 1816 (Fig. 10).

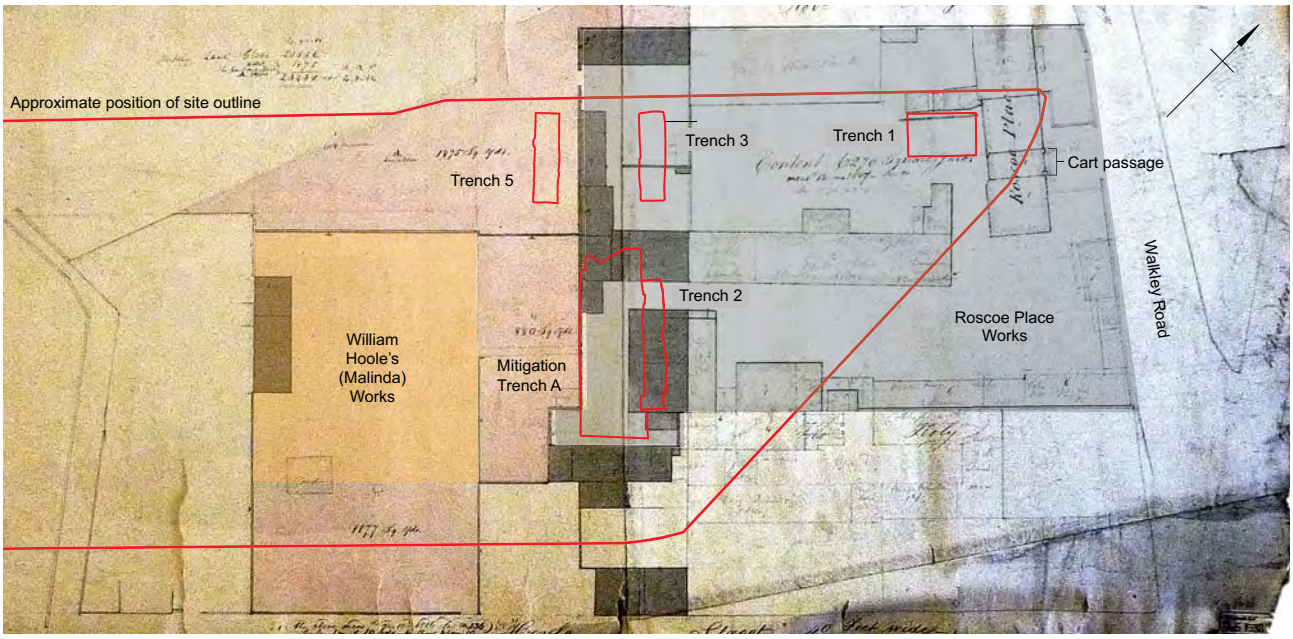

Figure 10 1816 Fairbank plan of the Roscoe Place Works (Sheffield Archives FC/She S 1332 L)

Figure 11 1813 token showing Roscoe Place Works (image from www.baldwin.co.uk)

Figure 12 Roscoe Place Works, Trench 1 viewed from the south-west

There are two contemporary depictions of the works, both of which view them from similar positions to the north-east. One is a sketch in a field book, dated 1807 (Fairbank FB 109, 50), belonging to the Fairbank family who practised as surveyors in Sheffield from about 1736 to 1848. The other is on the reverse of a One Penny Token issued by Roscoe Place in 1813 (Fig. 11). An interesting feature shown on the token is what appears to be an elevated walkway linking an upper-floor doorway in the eastern end of the Roscoe Place to another in the northern end of the long works building.

In the early 1830s the works were bought by Stuart & Smith, and a new foundry was built to produce cast iron stove grates. A valuation of the site in 1835 (Fairbank FB 238, 9–10) listed among its assets 'counting-house, warehouses, showrooms, coke house, fire iron and bronze shops, foundries, fettling and blacking shops, gas house, engine and boiler houses, smiths, boilermaker's fender, fly and joiners' shops and sheds', as well as a cow house, stable and gig house, and a grinding wheel and troughs, weighing machines, and a blacking mill. The 1852 map (see Fig. 4) shows the weighing machine just west of the gate between the two yards, as well as a circular gasometer just east of the Walkley Road entrance.

By the time of the 1890 map, the Roscoe Place Works had been demolished and was being replaced by terraced housing (see Fig. 5). Some of this, in turn, was demolished following World War II, probably due to bomb damage, and replaced by a *Saw Works* (see
Fig. 6).

Archaeological Works

Three evaluation trenches (Trenches 1–3) and Mitigation Trench A were located within the boundaries of the Roscoe Place Works (see Fig. 10), but few of the features recorded in them appear to relate to the works themselves; most relate to the later terraced housing on Roscoe Road and Jobson Road (see below).

In Trench 1, a length of covered brick drain, 0.5 m wide and capped with slabs of sandstone (Fig. 12), was revealed in the deep sondage cut along the centre of the trench (Fig. 59). Its date is not known, but it underlay the footprint of the later housing on Roscoe Road, and would have lain within the western yard area of the Roscoe Place Works, possibly associated with its main building on Walkley Road.

A brick wall (3012) running NE–SW across Trench 3 (see Fig. 60) corresponds closely to a wall, shown on the 1816 Fairbank plan (Fig. 10) of the Roscoe Place Works, which subdivides the south-western end of the works' north-western yard. Associated with the wall was a compact yard surface (3018). These were sealed by made ground and a yard surface associated with the later terraced housing on Roscoe Road. This trench also contained part of a sandstone-capped drain, partly underlying the footprint of the later housing on Roscoe Road (see below). The drain was aligned approximately east–west, and appears to run towards the position of a *Trough & Pump*, 6 m to the west, as shown on the 1852 map
(Fig. 4), and possibly another 30 m to the east.

A sondage cut in the north-western part of Mitigation Trench A revealed short lengths of two parallel brick walls 1.3–1.5 m apart, aligned NW–SE

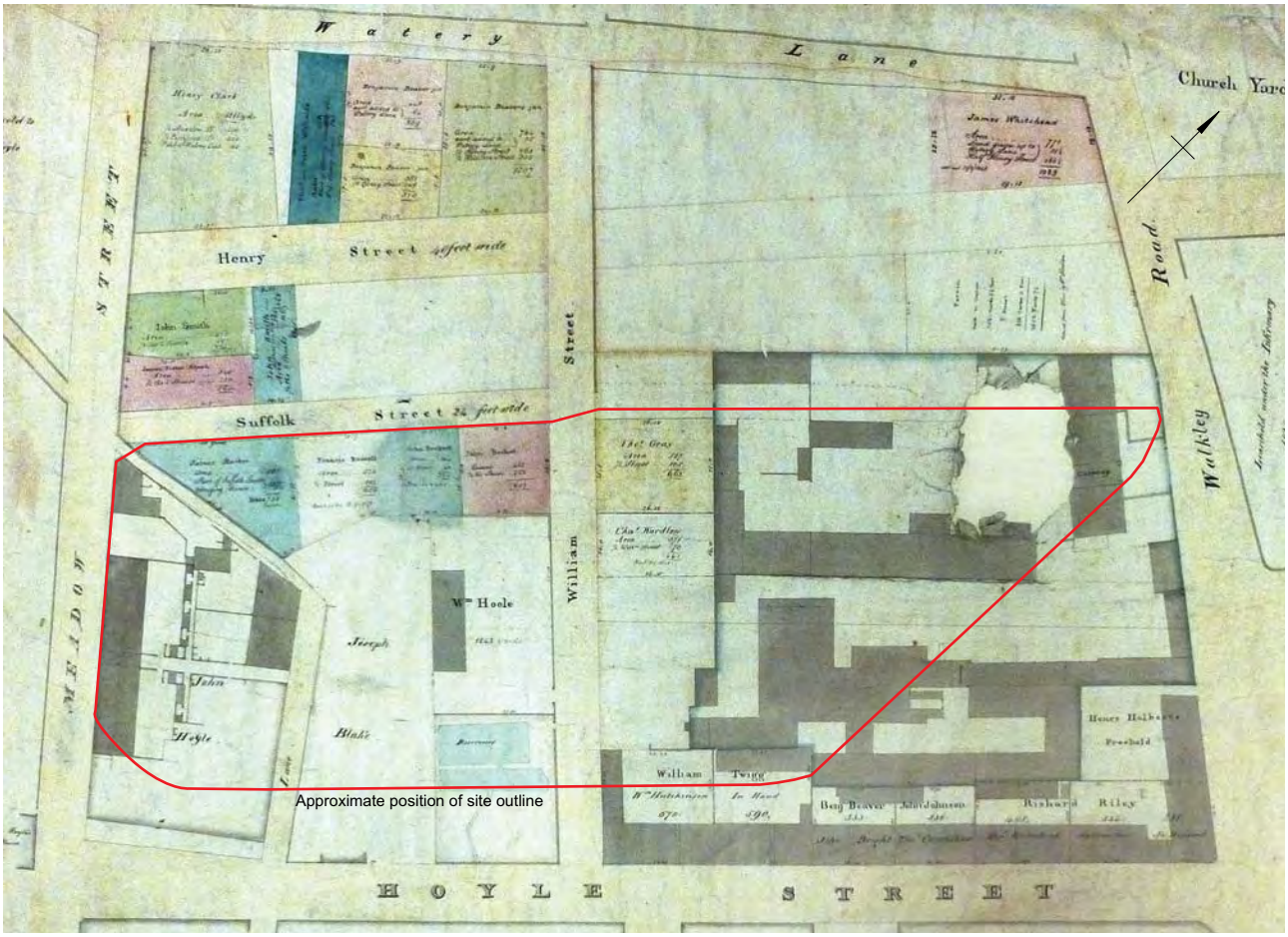

Figure 13 1828 Fairbank plan (Sheffield Archives FC/She S 1333 L)

(1152 and 1153) (Fig. 61). Wall 1152, 0.23 m wide and surviving to a height of 1.16 m, comprised four courses of red brick on a substantial sandstone foundation, while wall 1153, 0.43 m wide and up to 0.48 m high, consisted only of sandstone blocks; both were bonded with white lime mortar. These walls may be associated with a small building (4.1 m by 5.3 m), shown on the 1816 Fairbank plan (Fig. 10), abutting the south-east side of the central works building at its south-western end, and possibly the adjacent works' boundary wall; no other walls shown on the historic maps match these two features. It is possible that further short lengths of wall (1143 and 1215) may relate to the large building, shown on the same plan, to the north-east.

William Hoole's Works (Malinda Works)

Area E spans the central part of the site, on the south-west side of Malinda Street (see Fig. 2). It consists largely of the area of William Hoole's crucible steel works (later the Malinda Works) established in the early 19th century and first shown on the 1816 Fairbank plan (Fig. 10). At the time of recording the area contained six buildings arranged around a central courtyard, all of which were subject to detailed building surveys. Following their demolition, Trench 6 was targeted on the site of the original works building (Building E4; Fig. 17), revealing its crucible cellar preserved relatively intact directly below it. As a result the area of archaeological investigation was enlarged (Mitigation Trench B) (Fig. 15).

Background

The 1816 Fairbank plan (Fig 10) shows William Hoole's works as a rectangular parcel of land, with an entrance at its eastern corner on Hoyle Street, containing a single building against its south-west boundary, and a rectangular pond; the land to the north-west was unoccupied. By 1828, the rectangular parcel had been divided into two plots, their north-eastern sides taken in by the line of the newly laid out William Street (renamed Malinda Street by 1833); it was from William Street that the north-western of the two plots, containing a single works building labelled as *W^m Hoole* on an 1828 Fairbank plan of property at Roscoe Place, was accessed (Fig. 13). Subsequently,

Figure 14 Malinda Works, William Hoole's crucible furnace cellar after the evaluation, viewed from the east

the plot was shared by warehouses, a stable and a gig-house owned by J. H. Harder (Fairbank MB 393, 21), these possibly being the buildings shown on the 1852 map in the north-west and south-east corners of the yard (Fig. 4).

William Hoole's works were described in a rate book as consisting of a six-hole 'casting furnace', together with a 'coke shed, warehouse, etc.' (Rate Book 1836–7 SL2.1), and they were listed during the 1840s as 'merchants, steel refiners and file, saw, scissor, table, shoe and butchers' knife manufacturers'. During this decade Abram Brooksbank became a partner in the firm, and he took it over following Hoole's death in 1849. Brooksbank, whose trademark was a cannon and the word 'DEFIANCE', specialised in the manufacture of table knives and the more common types of folding knives, (such as lambfoot-knives), and his business prospered, acquiring a 'capital reputation and an ever-increasing connection' (Tweedale 1996, 164). Over the next 40 years, during which the works became known as the Malinda Works, a new building was constructed along the Malinda Street frontage, with a cart passage through it providing access to the yard. Brooksbank died in 1896, but the business continued to operate until 1932, when it was taken over by the Eye Witness Works in Milton Street (*ibid.*, 164). Between 1935 and 1953, the Malinda Works was substantially rebuilt, and extended to the north-west, replacing the housing and other buildings in that corner plot.

In 1828, Suffolk Street (renamed Sudbury Street by 1852) had been laid out in the formerly unoccupied land to the north-west, running south-west from William Street, and a number of properties are shown on its south-east side (Fig. 13). By 1848, the property on the corner of the two streets had been bought by Joseph Blake, who also owned the land south-west of the works site, and in 1852 it contained a row of eight back-to-back houses, and some form of works building behind them, probably the scissor manufacturer's workshop listed in White's 1845 trade directory at 7 Suffolk Street (Fig. 4). By 1890, the eight back-to-back houses had been converted or rebuilt as a terrace of four houses fronting onto Sudbury Street, and an additional two houses had been built to their rear, facing Malinda Street (Fig. 5).

By 1828 the south-eastern subdivision of the original plot (over half of which lies outside the site) was occupied by two linked reservoirs, either fed or drained by a curving drain running between them and Hoyle Street (Fig. 13); in 1835 it was known as *Reservoir Piece*. By 1846 this area had been bought by Joseph Blake who owned the adjacent plot to the south-west (later occupied by the Hoyle Street Works, below), and more substantial reservoirs were constructed (see Fig. 4). By 1890, the site of the reservoirs is shown as a vacant plot, and by 1905 it

was occupied by the crucible furnaces of Daniel Doncaster & Sons, steel manufacturers, who also had substantial works, incorporating cementation furnaces, on Doncaster Street (on the south-east side of Hoyle Street). Doncaster's furnaces were probably demolished in the 1970s.

Archaeological Works

As depicted on the 1828 Fairbank plan, the works building was rectangular, measuring 21 m by 7 m (Fig. 13). Its position corresponds to above-ground rooms G12, G13 (the crucible furnace) and part of G14, of Building E4 (see below; Fig 17). Following the recording of the standing structures, and their demolition, Trench 6 was positioned within the footprint of the furnace, revealing the lower part of its cellar relatively intact (Fig. 14). Ideally, this furnace cellar would have been preserved *in situ*. However, the approved development plans included an underground car park ramp at this location and could not be altered. Because of this, the cellar structure was subject to further investigation (Mitigation Trench B), with the trench being extended around the cellar to cover 150 m², revealing a number of associated external features (Fig. 15). The mitigation works involved emptying the cellar and the excavation of sondages in its floor at opposite ends and outside its rear (south-western) wall, the dismantling by hand of two blocked ash pits, and the excavation of a section through the cellar.

The furnace cellar

Although the 1828 Fairbank plan shows no building in the adjacent property to the south-west (owned by Joseph Blake), by 1852 there was a building of the Hoyle Street Works abutting the rear of the furnace, and this remained the case until the buildings were demolished. Following their demolition it could be seen that there was a 0.85 m wide gap between the Hoyle Sheet Works building and the stack of William Hoole's furnace forming a narrow, apparently covered chamber behind the stack (as in Fig. 7). A section cut through the back wall of the cellar showed that this did not extend below ground level. It is likely to have had a number of uses – for drying crucibles, for maintenance, and for insulating the heat of the stack from outside the works.

In its original form the cellar was constructed with eight ash pits, indicating the number of melting holes in the furnace above. However, the two at its south-east end had subsequently been completely blocked up with brickwork (Fig. 14). It is not possible to say how long after the original construction (by 1818) this happened, although in the earliest description of the works, in 1836–7, they were described as having just six melting holes (RB 1836–37 SL2.1). No evidence was recorded on the base of the two ash pits (following removal of the brickwork) to indicate that

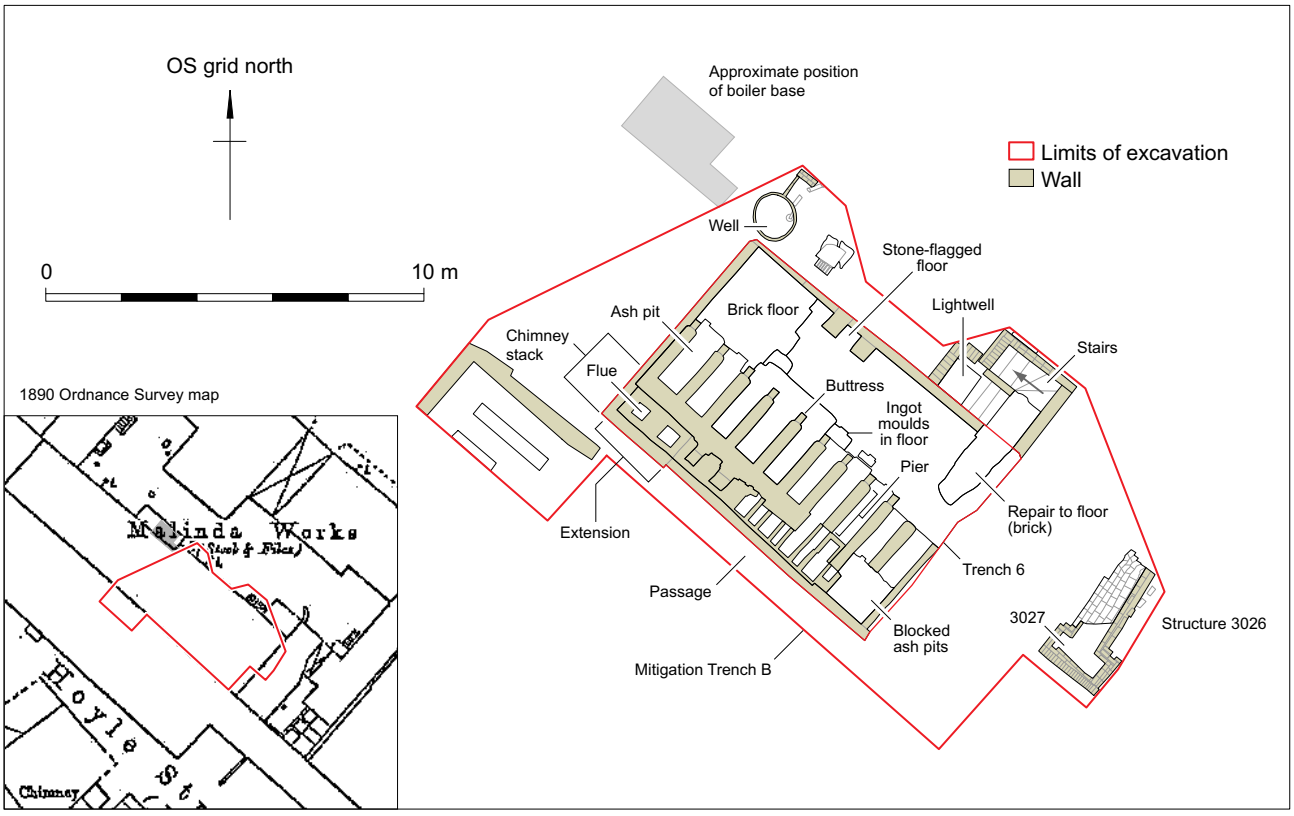

Figure 15 Malinda Works, crucible furnace cellar with detail of 1890 OS map (Sheffield Archives)

Figure 16 Malinda Works, boiler base viewed from the south-east

they had ever been used, but the reason for their being blocked is unclear.

It is possible that this blocking represents a design change implemented even as the furnace was being constructed, and that the chimney stack never extended as far as the south-east end of the building. This is perhaps supported by aerial photographs from 1948 and 1965, which show that by the end of its life the furnace had two chimney stacks protruding above its roof, that to the south-east, with what appears to be just three flues, being significantly shorter than that to the north-west, not extending as far as the south-east end of the building. If this is the case, it is possible that the pits were blocked to allow access from the melting shop above, both to the rear chamber, and to a doorway (later blocked) at the south-west end of the south-east wall which led into an adjacent ground-floor room (G12) (Fig. 17). Subsequently, however, the furnace was enlarged towards the north-west by the addition of two holes at the opposite end, giving the furnace its original capacity of eight holes. It is not possible to say for how long the furnace operated with only six holes before being extended.

The foundations of the stack were 1.6 m thick (1.7 m in the north-western extension) and built entirely of brick bonded with white lime mortar, and built up from the level of the cellar floor. In its original form, the cellar had been 6.8 m long and 5.8 m wide internally, but was extended to 8.8 m long. This enlargement is evident in a vertical joint in the brickwork of the north-east wall, as well as in a change from a stone-flagged floor (in places with inserted re-used ingot moulds) in the original area, to a brick floor at the north-west (Fig. 15). The two sondages showed no significant differences in the makeup of the clinker bedding for the floor at the two ends of the cellar.

The cellar was accessed from the courtyard by an external flight of sandstone steps in front of its eastern corner, which is depicted on the 1890 map. There was an area of brickwork repair to the cellar floor at the bottom of the stairs. Next to the entrance in the front cellar wall was a light well, and there may have been another towards the north-west end.

The 10 ash pits (including the two that were blocked and the two added later) were arranged along the full length of the cellar's south-western side, separated by brick piers. They were between 0.43 m and 0.68 m wide (average 0.53 m), and 1.6 m long. At their backs were the flues leading into the base of the chimney by which the flow of air into the melting holes was regulated.

The piers abutted, but were not keyed into, the front face of the chimney stack foundations. They were bonded with black ash mortar, and had single-bullnose bricks at their front ends giving them a rounded shape. At some point after the cellar's enlargement, angled brick buttresses had been added to the fronts of the piers, although there were none on the piers flanking the two blocked ash pits, and two more were missing towards the other end of the cellar. However, the additional piers at the north-west end also have these buttresses, perhaps demonstrating that the buttresses post-date the extension.

There were no surviving remains of the furnace's melting holes, the upper part of the cellar having been removed in the late 20th century. Nonetheless, the brickwork in the upper levels of some of the piers, towards the backs of the ash pits, had been heavily damaged by the heat from the melting holes immediately above them, and a number showed evidence of repair using more modern bricks. Similar repairs were evident in the backs of the ash pits, around the flues leading into the base of the chimney, where the lime mortar used in the chimney stacks had also been reddened by heat.

Apart from the flagstone floor, the only substantial piece of stone masonry within the cellar was a large block of sandstone set into the top of the pier at its north-west end. Two internal brick buttresses added to the front wall were later additions.

Well, boiler base and other external features

The mitigation excavation revealed a number of external features associated with the works (Fig. 15). Immediately in front of the north-west corner of the cellar was a slightly oval well, 1–1.16 m wide internally, lined with a single layer of red hand-made brick stretchers. It was abutted on its north-east side by a rectangular brick structure, possibly a drain or pump footing, which had a ceramic pipe entering its eastern corner. An 80 mm diameter iron pipe

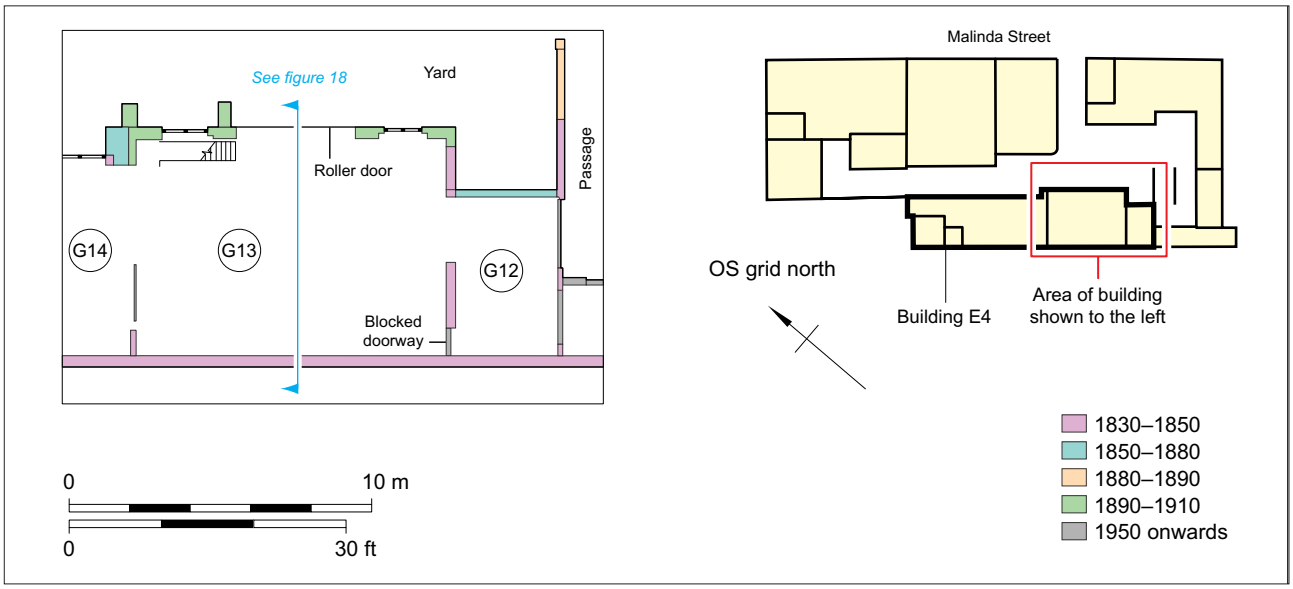

Figure 17 Malinda Works, plan of building E4 rooms G14, G13 and G12

leading into the well 1 m below the surviving top appeared to originate within this brick structure. A 'Pump' is shown on the outside of the furnace at this location on the 1852 map (Fig. 4). While the well lay outside the furnace cellar, it seems it would have lain just within the north corner of the late 19th century front elevation of room G13 (see below), with the brick 'drain' possibly outside. The well was sectioned by machine in order to establish its depth, but the base was not reached. It was filled with black clinker/slag (3001) within which were broken grindstones, glass bottles and jars, and other more recent material.

Immediately north-west of the well was the below-ground flue structure of a small boiler (Figs 15–16). It was 1.8 m wide and at least 3.6 m long (but extending north-west under a spoil heap of demolition rubble). Because it lay outside the excavation area its location was not precisely recorded, but its position corresponds with a rectangular structure (1.8 m by 5.3 m), shown on the 1890 map, built onto the front of the works building adjacent to the furnace (Fig. 15). The excavated remains comprised part of a rectangular brick structure, although slightly rounded at its south-east end, from which, at its south-west corner, the base of a chimney extended; the south-east end of the structure was not fully exposed. What was recorded consisted largely of the boiler's three flues – two along the sides with raised angled lips along their inner edges (on which the cylindrical boiler would have rested), and a deeper central flue.

It is not clear whether the structure held a Cornish or Lancashire boiler. Cornish boilers had a single tubular fire box passing through the water cylinder. The hot gases coming out of the back were passed first through the enclosed side flues, which would have reached approximately halfway up the side of the cylinder, then, at the front, down into the central flue before passing up the chimney. Lancashire boilers had two fire boxes, and two separate flue systems, with the exiting gases passing first down the centrally divided basal flue, then up into the side flues. The small
size of this structure, internally only 1.5 m wide, and the absence of a division in the central basal flue, would suggest that it was a Cornish boiler. However, even though the feature was heavily truncated and only partly excavated, it appears that it was the side flues, not the basal flue, which led to the chimney; this would make it more likely that it was a Lancashire boiler.

To the immediate south-east of the footprint of the original building, as depicted on the 1828 Fairbank plan, there was a T-shaped brick structure (3026), its narrow end level with the front of the building (Fig. 15). The brick walls (red brick and fire bricks) were bonded with black ash mortar, and laid around the inner edge of the bar of the 'T', and extended down its stem; it also had a brick floor, overlain by a reddish clay (3027). The function of this structure, which was heavily truncated, is not known.

Building Recording

The furnace building melting shop (Room G13) above the cellar underwent a series of alterations during the 19th and 20th centuries, and almost all of the original above-ground structural features of the furnace were removed in the late 20th century (Fig. 17). It was a tall, single-storey brick building with a pitched roof. Its north-east elevation, which appeared

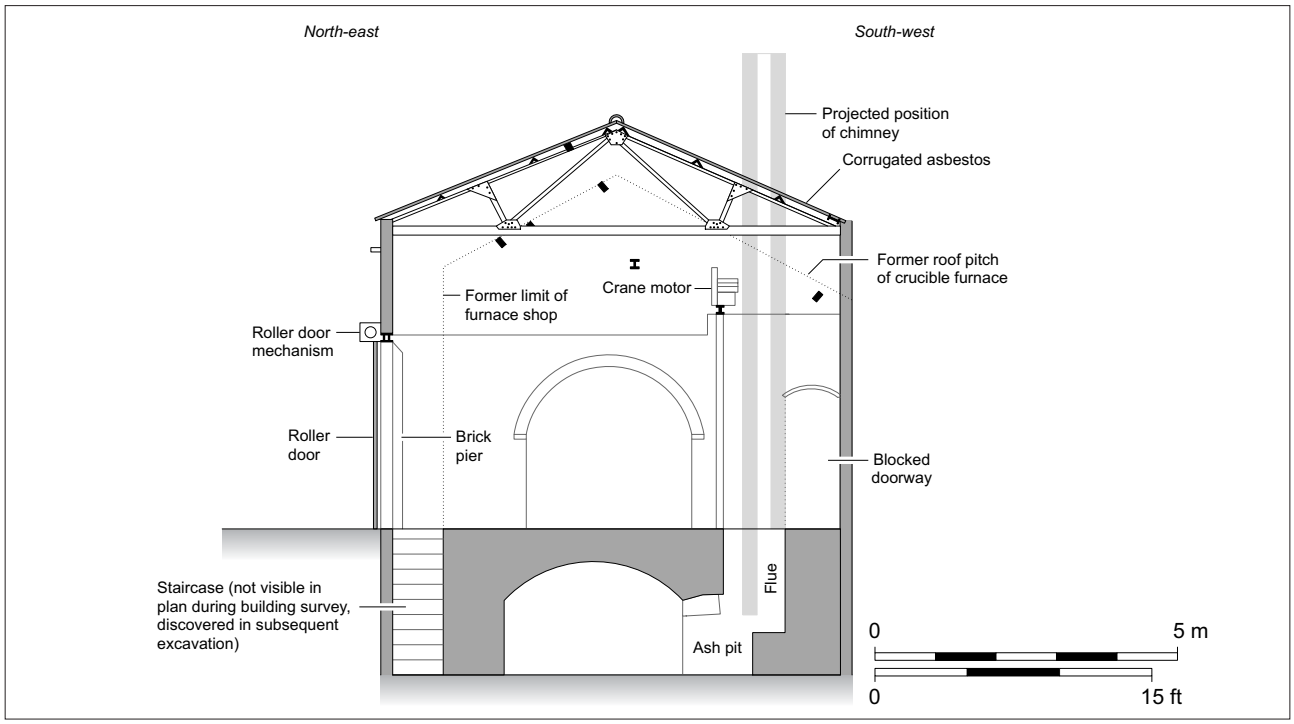

Figure 18 Malinda Works, south-west facing cross-section of building E4, cellar and room G13

to have been rebuilt in the late 19th century, 1 m in front of its original line, contained a central loading doorway and two large buttresses (Fig. 18). Attached to the north-west was a brick-built, two-storey structure with flat concrete roof, largely constructed in the early 1930s.

The smaller ground-floor room (G12) south-east of the furnace was possibly used as a pot room for the manufacture of the crucibles (Fig. 17). Early maps suggest that its front wall had originally been on the same line as that of the melting shop, but this appears to have been set back from that line between 1852 and 1880. This may have been when the doorway was blocked, and replaced by a wider arched opening linking the two rooms (see Fig. 18). This larger arched opening was an unusual feature. An example of such a feature elsewhere is found at the Darnall Works which had crucible furnaces constructed much later and on a far larger scale than William Hoole's. Although room G12 appeared to be the only surviving original ancillary space to the crucible furnace, the site expanded and the 1852 map depicted Building E as a similar footprint to that recorded at the time of the survey. This additional space would also have housed crucible furnace related processes, such as a charge room or drying spaces.

Hoyle Street Works

Area B lies between the William Hoole's Works (Malinda Works, Area E) and Burnt Tree Lane (see Fig. 2). It is bounded by Hoyle Street to the south-east and was flanked by the Milton Works (later Progress Works) (Area D) to the north-west. It was occupied by steel works named on the 1890 map as *Hoyle Street Works (Files)* (Fig. 5). At the time of recording, the site contained three ranges of buildings, aligned north-west to south-east, incorporating nine structures of varying dates, all of which were subject to detailed building survey. Following their demolition, Trench 7 was positioned in the area of the earliest known building in Area B (shown on the 1823 Leather map of Sheffield), and Trench 8 was positioned over the area's north-western boundary, mostly in Area D (Fig. 21). The high degree of *in situ* preservation led to the excavation of Mitigation Trench B, positioned around the evaluation trenches and up to Burnt Tree Lane, covering much of the north-western part of the Hoyle Street Works, and the southern part of the Progress Works (see below). A small area on the north-eastern boundary of the Hoyle Street Works was also exposed during the mitigation excavation at the Malinda Works (Mitigation Trench C).

Background

The 1808 Fairbank map of Sheffield (Fig. 3) shows a large property (encompassing Areas B and E) empty apart from a single building on the corner of Burnt Tree Lane and the recently laid out Hoyle Street (but outside the boundary of the site). Area B appears to have remained unoccupied until the construction of a second building on the north-east side of the Lane,

next to its prominent bend, as shown on an 1822 map published by Edward Baines. By the time of the 1832 Tayler map of Sheffield (Fig. 19), however, a number of buildings were arranged around the sides of the property, which probably had its entrance on Hoyle Street; these may have included the crucible and cementation furnaces later known to have been located at the north-west end of the property.

The 1828 Fairbank plan (Fig. 10) shows the property to have been owned by Joseph Blake, who by 1846 also owned the adjacent plot on Hoyle Street (south-east of William Hoole's works) containing the two reservoirs, and the property to the north-west along the south-east side of Suffolk Street. The Hoyle Street Works were established in 1842 by George Fisher, 'a business that under his management became far-famed and of world-wide reputation' as 'Manufacturers of Hand-cut Files, Refined and cast Steel for Engineers' Tools, &c., Chisels, Taps, Dies, Saws, Hammers and Smiths' Tools' (Anon. 1893, 114). By 1852, the works consisted of long narrow buildings along the Burnt Tree Lane frontage and the north and east sides of a large courtyard, with the L-shaped building to the south apparently fenced off from the main works (Fig. 17). The main entrance was a gate into the yard from Hoyle Street; there may have been a narrow, pedestrian access to the rear of the yard, at the corner in Burnt Tree Lane.

A good impression of the layout and appearance of the Hoyle Street Works in the second half of the 19th century is given by a publicity engraving published in 1893 in *The Century's Progress* (Anon. 1893) (Fig. 20). Although the date of the scene depicted is not known, the engraving shows that the works had been substantially enlarged, showing most (but not all) of the structures depicted in the 1890 map. Although there is probably some artistic licence involved, and the property was shown as more regular in shape than it really was (requiring some slight adjustment to the positions of some buildings) the image corresponds quite closely with the 1890 map (Fig. 5). The engraving shows cementation furnaces at the northern corner of the works, with a crucible furnace block, with a chimney stack extending its full length, adjacent along the north-western boundary. The buildings along the sides of the yard included forges and file and rasp workshops; a number of grindstones shown close to the building on the south-western side indicate that this contained the grinding rooms (or 'hulls'). The building on the Hoyle Street frontage, with the pedimented central section above the gateways entrance, housed 'convenient and commodious offices and warehouses' (*ibid.*, 114). Immediately behind the entrance was another workshop with skylights in its roof, and a clock in its front pedimented gable.

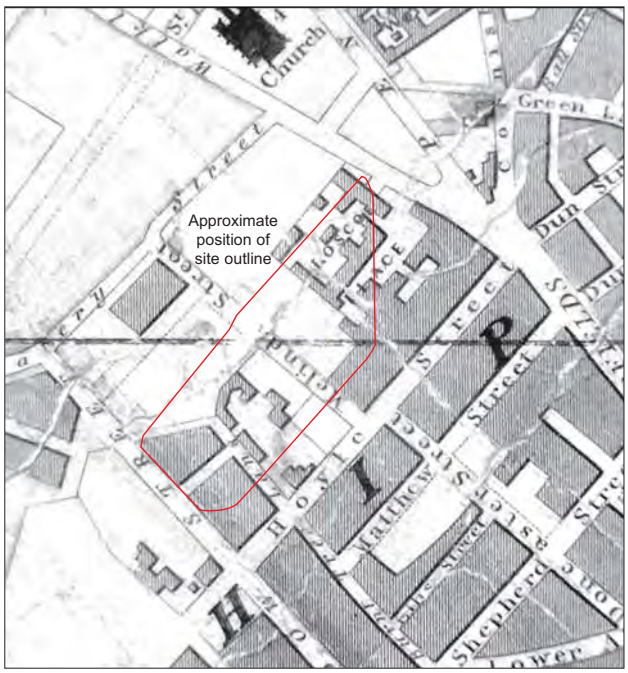

Figure 19 1832 Tayler map (Sheffield Archives FC/She 22 L)

By 1905, the crucible furnace building had been replaced by what appears to have been a long open-fronted structure filling much of the north-western corner of the property; Fisher & Co. were no longer listed in the 1906 White's Directory and the site's ownership is unclear. The works had been substantially rebuilt by 1923. A new steelworks building was constructed (or added onto existing buildings) at the north-west end, apparently occupied in 1925 by John Watts Ltd, cutlery manufacturers, which had its main entrance on Burnt Tree Lane. At the same time, several of the buildings at the southern end of the site were converted into open-fronted sheds, possibly associated with a builder's yard which occupied the Hoyle Street end of the property in the 1940s.

The site continued to be used as a builders' yard in the later part of the 20th century, shared with sheet metal workers in the 1950s and 60s. The 1953 map showed the site as a 'scissor works', and the building at the bend of Burnt Tree Lane was occupied by sports goods manufacturers (Fig. 6) and known as the Exelso Works (May 2005, 17). Most of the buildings were still standing in 1979, when the Exelso Works had been replaced by an upholstery works. The structures on the Hoyle Street frontage were demolished between 1992 and 1995, when the street was widened for the Supertram route.

Archaeological Works

The most easily recognisable excavated feature in Mitigation Trench B was the cellar of the crucible

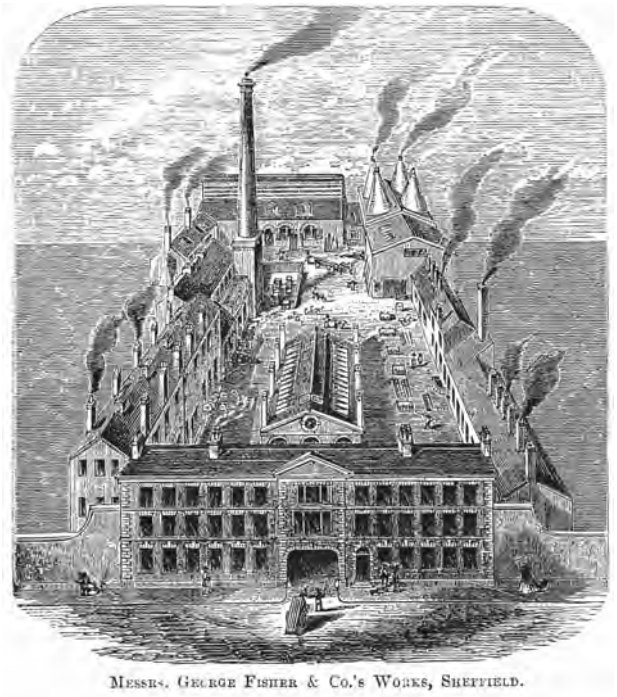

Figure 20 Engraving of the Hoyle Street Works (from The Century's Progress *1893)*

furnace of the Hoyle Street Works (Fig. 21). This building, orientated NNE–SSW, is clearly shown on the 1852 map lying at an angle to the main axis of the works, against the western boundary of the property. A building at this location is also shown on the 1832 Tayler map, although not on the 1828 Fairbank plan. This might indicate construction around 1830, but the Fairbank plan shows no buildings within this property, not even that shown on the 1823 Leather map, and it may be that Fairbank had no interest in surveying buildings on this property. If so, a date in the 1820s for the construction of the furnace is possible.

The furnace cellar

A building in the location of the furnace is shown on the 1832 Tayler map (Fig. 19); as shown on the more detailed 1852 map, it was rectangular in shape, measuring 11 m long and 4.5 m front to back (Fig. 4). By 1890, however, it had extended to the north, east and south, giving it a trapezoidal shape up to 22 m long and 8 m wide, with an additional short eastern extension along Burnt Tree Lane at the south (Fig. 21 inset). The engraving published in 1893, although not particularly accurate in this part of the works, indicates that this extension was a separate building, with two chimney stacks (Fig. 20).

The expansion of the furnace was evident in the excavation (Fig. 21). In its original form the front and rear of the furnace appear to be represented by sandstone walls 2026 and 8005, respectively. Towards its northern end wall 8005 was intact, but to the south it had been disturbed by the construction cut for a 20th century brick wall (2035) that bisected at an angle the southern part of the furnace. The sandstone rubble was apparently backfilled into the cut on its western side.

As at William Hoole's Works (above), the cellar had a chamber, here 1 m wide, behind the cellar, between the rear of the chimney stack's sandstone foundations (8006) and wall 8005 (Fig. 22). The chamber appears to have stopped just short of the northern end of the furnace, the sandstone chimney foundations turning outwards at that point, and narrowing the gap to the rear wall to 0.5 m. However, it is also possible that this marks the furnace's original northward extent. It is notable that the additional 1 m which the stack continues beyond that point (8007) was constructed with brick foundations, suggesting that it was a later extension. No trace of the original southern end wall of the furnace survived, due to later developments, including the construction of wall 2035.

The 1890 map shows that the furnace was subsequently extended to the north, east and south (Fig. 21 inset). At the east, the construction of walls 2024/5 and 2043 created a 1.5 m wide passage in front of the cellar's original wall (2026). There was an external flight of stone steps down into the passage. Also shown on the 1890 map was a small rectangular brick structure (2023) abutting the north-east corner of the building; it had a slightly sunken slate floor bedded with mortar on a layer of bricks (2192), and a drainpipe along the western side of its base.

As mentioned above, the extension at the northern end may have involved a short extension in brick of the chimney stack foundations (8007), possibly due to the addition of a couple of extra melting holes in the furnace above. It also appears to have involved the construction of a sandstone wall (visible on photographs but not recorded) abutting the outer face of 8007, running north from, and extending 2.5–3 m beyond, the original end wall (8006). This then turned inwards for 0.6 m, its end abutted by a brick wall running north-east beyond the edge of Trench 8. The area of the building north of the extended chimney stack was probably used for some other, albeit related, activity; a grindstone was found to the immediate north of wall 8007.

At the south, the furnace building was extended up to Burnt Tree Lane, the cellar vaulting built with the same width as before, as represented by wall 2042, and the front wall represented by wall 2043. However, later developments south of wall 2035 had removed any clear evidence that the rear chamber had also been extended, although it is possible that this is represented by a short length of brick wall (2040), with shallow foundations, 0.7 m to the rear of the chimney stack.

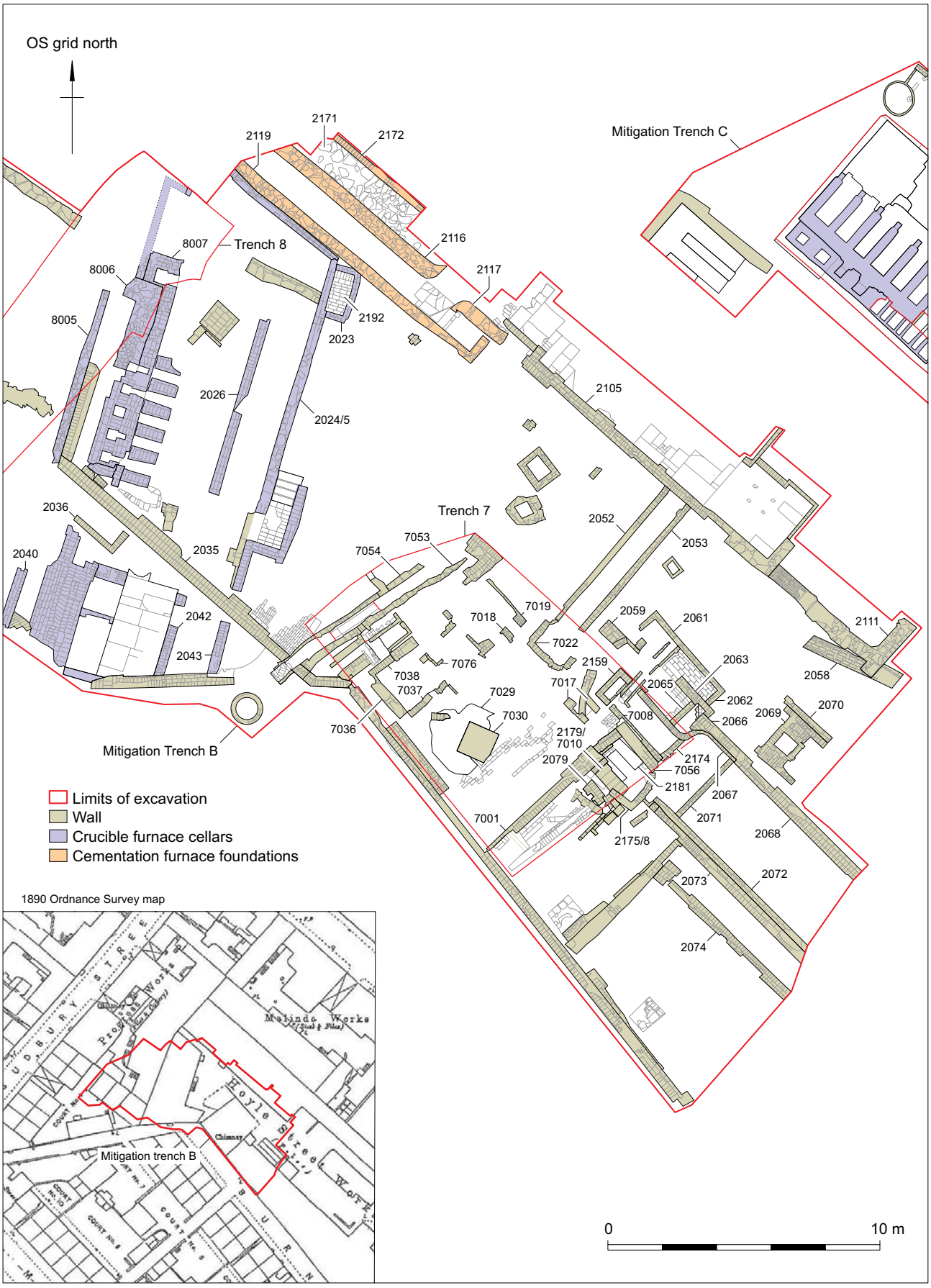

Figure 21 Hoyle Street Works, archaeological features referred to in text with detail of 1890 OS map (Sheffield Archives)

Figure 22 Hoyle Street Works crucible furnace cellar, viewed from the south

Figure 23 Hoyle Street Works north-east range, viewed from the north-west

Additional melting holes were added at the south, although it impossible to determine precisely either their original number, or how many were added. The bases of some of the chimney flues in the central part of the furnace survived (see Fig. 22), but elsewhere the stack had been heavily truncated with only its lower levels surviving. The piers between the ash pits in the cellar had been demolished after the construction of wall 2035, probably to increase the space available in the cellar; the only substantially surviving pier was that below a concrete bedding for staircase (2036) abutting the wall. However, although only the bases of the remaining piers survived in the stone slab floor, their regular spacing makes it possible to suggest that the extended furnace had up to 18 melting holes. The pits averaged 0.4 m wide and 1 m long; the piers were 0.5 m wide.

The north-eastern range

The engraving of the Fisher & Co. Works (Fig. 20) shows that the long building at the north-western end of the north-eastern range comprised two adjacent buildings, rather than one as shown on the 1890 map (Fig. 21 inset). The north-western part had four cone-shaped stacks protruding from its roof, indicating the presence of cementation furnaces used for the production ('conversion') of blister steel. While the distinction between these two buildings was evident in the archaeological remains, unfortunately only a 4 m wide strip of the north-eastern range lay within the Trench B excavation area, and only a small part of the cementation furnace building was exposed at its north end. Apart from the Derwentcote steel furnace, Co. Durham, built in 1720, the only other complete example of such a cementation furnace in Britain is that in Doncaster Street, Sheffield (Grade II Listed and a Scheduled Monument (SM 1161)), 100 m south-east of the Hoyle Street Works (Fig. 1).

The 1890 map (Fig. 21 inset) shows a narrow gap between the northern end of the enlarged crucible furnace building and the long rectangular building lying along the north-east side of the property. However, the engraving (Fig. 20) shows a small, single-storey building in this area. The excavation evidence does not entirely clarify this situation, and indeed renders it rather more complex. Abutting the northern end of the crucible furnace was a sandstone wall (2119) which continued 6 m beyond it to the south-east, before turning to the north-east at a right-angle, at the top of a flight of brick and sandstone steps. These led down to the end of what appears to be a 1 m wide passage, approximately 1 m below-ground-level, the other side of which was formed by wall 2116. This ran along the south-western side of the cementation furnace, with a doorway at the base of the steps (between wall 2116 and 2117) giving access into the furnace building (Fig. 23). The bottom step was angled towards the doorway and there was stone paving at the base of the steps. Wall 2116, also of sandstone, survived to a height of only 0.2 m, and to its immediate north-east was a 1.1 m wide strip of rough sandstone cobbles (2171), flanked by a parallel line of bricks (2172) along the edge of the excavation area.

This group of structures appears to represent the corner of a cementation furnace. Bricks 2172 probably lined the south-west side of a long narrow ash pit/central flue, which lay beneath the cementation chests (of which nothing survived) supported on a rubble base (2171) within the furnace chamber, with wall 2116 forming the base of the south-west wall of the chamber. It is possible that the 'passage' represents the sunken stoking area, with wall 2119 being the outer wall enclosing the furnaces themselves.

Parts of the adjacent building to the south-east were also revealed, in both Mitigation Trenches B

and C. The function of this building is not clear, although it is the only building shown in the engraving as having no chimney stacks. There was a 1 m gap between the south-eastern end of the sandstone wall (2117) along the side of the steps of the cementation furnace building, and a largely brick wall foundation (2105), on the same line, which marked the front to the adjacent building. This building, which was 16 m long and 8 m wide internally, had a sandstone-paved floor up to 1.5 m lower than the surrounding ground level. There appeared to be internal access between this and the cementation building to the north, at least on the south-west side. However, much of its central part lay between the two excavation areas, and there were few internal features to indicate its use. A small (3 m by 2.4 m) walled area towards its south-east end had two low sandstone blocks abutting one wall, each with pairs of metal rods protruding from the tops, which may have formed a machine base. Similarly, two brick settings in the floor in the northern corner of the building may also indicate the position of some piece of machinery.

The south-western range

The excavation of Trench 7, and the area immediately around it, revealed a complex arrangement of brick walls and other structures (Fig. 21), clearly reflecting the many phases of construction, use, alteration and demolition along the south-western side of works yard, as indicated by the historic mapping. It is not possible to identify all the buildings and other structures which these features represent, or to determine their function, but a number of key elements can be discerned (Fig. 24).

The 1852 map shows the south-west range running as far as the bend in Burnt Tree Lane, with what may have been a small square chimney (no trace of which was recorded) on its front wall (Fig. 4). The position of the front wall corresponds with that of wall 2074, which had a deep foundation of rough sandstone blocks, although it did not survive to the north-west, in Trench 7. However, drain 7053/7054 (see below) in Trench 7 is likely to have marked the extent of the range.

By 1890, however, the range had been shortened, its north-western end now possibly represented by wall 7001, beyond which there was an open yard, measuring 8–9 m by 10 m, which the engraving published in 1893 (Fig. 20) shows was bounded by a wall or fence along its north-east and north-west sides. At the same time the range had been extended 1.6 m further into the works yard, which the engraving shows was due to the addition, to its front, of a single-storey extension (topped by an open balcony), the front wall of which corresponds with wall 2073. The engraving also shows what appears to be an external flight of stairs, apparently leading down into a cellar below the extension.

Figure 24 Hoyle Street Works south-west range, viewed from the south

Figure 25 Hoyle Street Works chimney base area, viewed from the south-east

Chimney base

One of the most prominent features in the engraving, however, is the chimney at the northern corner of the range, lying slightly north-west of that on the 1852 map. It had a square base at least as tall as the adjacent buildings, topped by the long, slightly tapering chimney stack. As depicted on the 1890 map (Fig. 21 inset), on which it is labelled, it was 2.1 m square at its base, possible traces of which were recorded abutting (possibly overlying) the end of wall 7001, at a very slight angle. Its north-west and north-east sides are possibly represented by an L-shaped brick wall (7056), and its south-west side by a similarly angled brick foundation (2079) sealed below later floor levels and only partially visible (Fig. 21). There was no trace of a wall on its south-east side, which both the map and engraving show was abutted by the front of the extension (wall 2073).

Figure 26 Hoyle Street Works Lancashire boiler base, viewed from the south-east

Figure 27 Hoyle Street Works, scissors from scissor dump

The area of the chimney base underwent numerous alterations, presumably after its demolition. This included the construction of a concrete structure (2181) comprising a raised shelf around three sides of a rectangular (floor-level) slot, 1 m long and 0.4 m wide, vertical at the sides but steeply angled to the rear (Fig. 25). The shelves, which were 0.2 m high but varied in width, appeared to abut walls 7001 and 7056 to the north-west and north-east, respectively, and a flight of four brick and stone steps (2179/7010), with thick, shaped sandstone treads, descended onto the concrete floor. These varied in width, being narrowest at the rear, and widest (up to 0.5 m) on the north-east side. The lower steps had been partly overlain by a short length of wall (2178). The concrete was red, perhaps affected by heat, suggesting that this structure may have supported a small boiler, possibly fed by a metal pipe that protruded from the floor at the base of the steps. The concrete construction suggests that this is a relatively late feature, but it cannot be more precisely dated.

Lancashire boiler base

While the engraving shows what appears to be a flight of stairs, descending from the yard down in front of the south-west range, the 1890 map (Fig. 21 inset) shows more complex structures in this area. These comprise a rectangular structure 6 m long and 3 m wide divided longitudinally into three narrow compartments, with a flight of steps at its south-east end. The position of the rectangular structure corresponds closely with the archaeological remains of what appears to be the housing for a large boiler, immediately in front of the extension (Fig. 26). If it was accessed by the stairs to its south-east it would have been stoked from that end, but this lay outside the excavation area (as did another structure shown on the map to the south-east). The boiler housing measured at least 9 m long and 2.8 m wide internally, and was defined by wall 2072 (which abutted the outer face of the extension wall (2073) and wall 2068.

The boiler housing was not excavated to its base, but it probably housed a Lancashire boiler, where the gases exiting the two internal fire boxes first passed down a central flue under the water cylinder, then back along two side flues at a higher level before passing into the chimney. Lancashire boiler cylinders varied between 1.5–2 m in diameter, which would have fitted comfortably within this feature. If the boiler was under construction at the time of surveying for the 1890 map, it may be the three flues that are represented by its longitudinal divisions.

There was a small area of brick flooring at the north-west end of the boiler housing. It is possible that this represents the convergence of the side flues in front of the opening to the chimney flue. However, the brickwork was rough and uneven, made from reused bricks, and it may instead be associated with the creation of an irregularly-shaped compartment at the end of the boiler after it had been decommissioned. The brick flooring extended only between three later walls, one (2071) built across the full width of the boiler 1.7 m from its end, another (2174) later blocking the opening to the exit flue, and a third (2175), very roughly constructed, which curved around the (previously open) south-east side of the chimney stack, connecting to wall 2178

(above). This compartment is of uncertain function, but it was subsequently used, in the mid-20th century, as a dump for a large number of pairs of scissors (Fig. 27).

A question remains, however, as to the relationship between the boiler and the 1890 chimney. The inner face (2067) of wall 2068 curved around the boiler's northern corner, then curved back into a narrow rectangular exit flue, 3.4 m long, 0.9 m wide and 1.5 m deep, formed by walls 2159 and 7008 (the opening to the flue was blocked up at a later date). This flue, however, lay outside the footprint of the chimney as it appears on the 1890 map, instead abutting its north-eastern side (7056) at a very slight angle (Fig. 26); their relationship was not conclusively established.

One possibility is that that the exit flue was a later addition, and that the gases had originally flowed into the 1890 chimney from the western corner of the boiler. Some support for this is provided by the fact that the end wall of the boiler (a continuation of 2066) had apparently been cut through by the curving brickwork of wall 2067 (Fig. 28). In addition, the south-west wall (2072) of the boiler may not have extended its full length, leaving a possible opening at the western corner immediately in front of the chimney.

At some point between 1890 and 1905 it appears that the 1890 chimney was replaced by a new one, built directly over the exit flue; a 1.6 m length of wall (2059) on the same alignment as boiler wall (2068), 3 m to its north-west, may be the corner of the base of such a chimney. By 1905 the south-west range had been extended further into the increasingly narrow yard, now enclosing the area of the boiler and flue, and although no chimney is specifically indicated there is a protrusion, 4 m long, extending a further 1 m out from the range in approximately the corresponding position.

Boiler or engine base

Alternatively, the protrusion could be a brick structure adjacent to, and apparently contemporary with, the chimney flue with which it shared wall 2159 (Fig. 28). It may have been the base for a boiler, or perhaps an engine, but this remains uncertain. The structure, 2 m wide internally and surviving to a depth of 0.8 m, was divided into two parts, one being wider and possibly longer than the other. The wider part to the north-east, defined by walls 2159, 2066 and 2063, was 1 m wide internally, but of uncertain length (only 2.3 m of its length was exposed). It had a brick floor, and near its south-east end it was crossed by a wall (2065) surviving to only 0.3 m; the gap behind was not excavated. The north-east wall (2063) had been largely demolished, but its north-western end had a single-bullnose brick on the inside of its surviving bottom course. The narrower part of the structure, defined by walls 2061, 2062 and 2063, was 0.6 wide and 3.5 m long internally. This part may have been a later addition, as its south-eastern end wall (2062) only abuts wall 2063, but is tied into wall 2061. Also, the two parts of the structure had different patterns of brick flooring, although the end of wall 2063 clearly marks the point of access between them. It is unclear at what date, and for what reason, wall 2063 was almost completely demolished.

Figure 28 Hoyle Street Works, small boiler base, viewed from the north

Figure 29 Hoyle Street Works, timber and iron 'crane' structure under excavation

Features at the north-west end of the south-west range

A number of features were recorded in the area to the north-west of wall 7001 (Fig. 21), which in 1852 included the end of the south-western range, but which by 1890 was a fenced yard entered next to the chimney. By 1905 there was an open-fronted structure extending right up the north-west end of the property, and by 1923 it had become subsumed within the new, extensive steelworks buildings. These

Figure 30 Hoyle Street Works, silt trap with front wall removed, viewed from the north-east

features, therefore, are potentially of many different phases of construction and use. They include the very truncated remains of a partially rebuilt flue (7017, 7018 and 7019) running towards the position of the 1890 chimney.

A square timber and iron structure (7030) lay 1.5 m from the Burnt Tree Lane boundary wall, but at a distinct angle to both the lane and the surrounding buildings (Fig. 21). It comprised closely-spaced upright timbers tied together by two horizontal grids of iron rods, 30–50 mm in diameter (Fig. 29), passing through them (each grid having four rods running north–south and four east–west). The ends of the rods were welded to the inner faces of a square iron casing, 1.4 m square, 1.2 m deep, and its sides 30–50 mm thick. The casing, which had degraded wood on its inner face, appeared to have been set within a large sub-circular cut, 2.6 m wide, which had been backfilled around it with a light yellow/brown sandy gravel aggregate (7029).

The lower grid of eight iron rods was 0.15–0.2 m above the flat floor of the box which comprised compact gravelly clay, possibly the natural; the four rods running east–west were lower than those running north–south. The upper grid, also of eight rods, was 0.9 m above the lower grid. The vertical timbers, most of which had been squared, were 0.1–0.2 m wide; they were well preserved apart from immediately around the iron rods. The space between the timbers was filled with a black sandy clay, but its loose nature suggests that it had filtered in during the use of the structure; similar material sealed the structure.

The precise purpose of this structure is unclear, although the tying together of the timbers by iron rods welded into a heavy iron casing, which was buried at least 1.2 m deep in the ground and packed around with compact imported aggregate (its nearest sources would probably have been the Trent Valley, or Lincolnshire), was clearly designed to add stability and strength to some form of timber superstructure. The most likely interpretation is that it formed the base of a crane or derrick. It is possible that it was associated with a square brick structure, 1.6–1.8 m wide internally, to its immediate north-west (defined by walls 7036–8 and 7076) within which the clay natural showed signs of localised heavy burning.

The most north-westerly feature in Trench 7 was a stone and brick-lined drain (7053/7054), which may be a feature shown on the 1852 map (see Fig. 4) running along the north-west end of the south-western range. It ran towards a brick manhole outside the works boundary.

Features within the works yard

A number of features, including drains and brick manholes, were recorded in the works yard between the north-east and south-west ranges.

An arched brick culvert (2058), 0.6 m wide, ran diagonally below a short stub of sandstone and brick wall (possibly a buttress) which continued the line of the south-eastern end wall (2111) of the wider part of the north-east range (as shown on the 1890 map). Only 3.6 m of the culvert was exposed, as it continued beyond the excavation to the south-east, and below an unexcavated concrete floor to the north-west. It is possible that it was connected to the reservoirs in the adjacent property on Hoyle Street, both properties having been owned in 1846 by Joseph Blake, and the 1852 map (Fig. 4) showing that one of the reservoirs was connected by a channel to the north-east range. At what date the range was enlarged to its 1890 extent is not known, but the fact that the culvert was not demolished at that time, but had the buttress built directly over it, suggests that it was still in use.

Between the culvert and the base of the Lancashire boiler to the south-west was a much larger arched brick structure (2069) aligned north-east to south-west, 2.1 m long, 2.5 m wide and at least 1.5 m high, with a square opening (0.6 m square) in the centre of its roof (Fig. 30). Its north-eastern opening, which was blocked by a rough brick wall (2070) built immediately across its face (and not bonded to it), was fully exposed. Its opposite end, which lay 0.3–0.4 m from the boiler wall (2068), was not exposed and so it was not ascertained whether it was similarly blocked. The arch was filled almost completely with finely sorted yellow clay, sandy in the lower half but more silty and plastic above. It is interpreted as a silt trap to remove water-borne clay and silt particles, possibly before the water was fed into the adjacent boilers, to prevent damage to them and to reduce the frequency that they would need to be cleaned out.

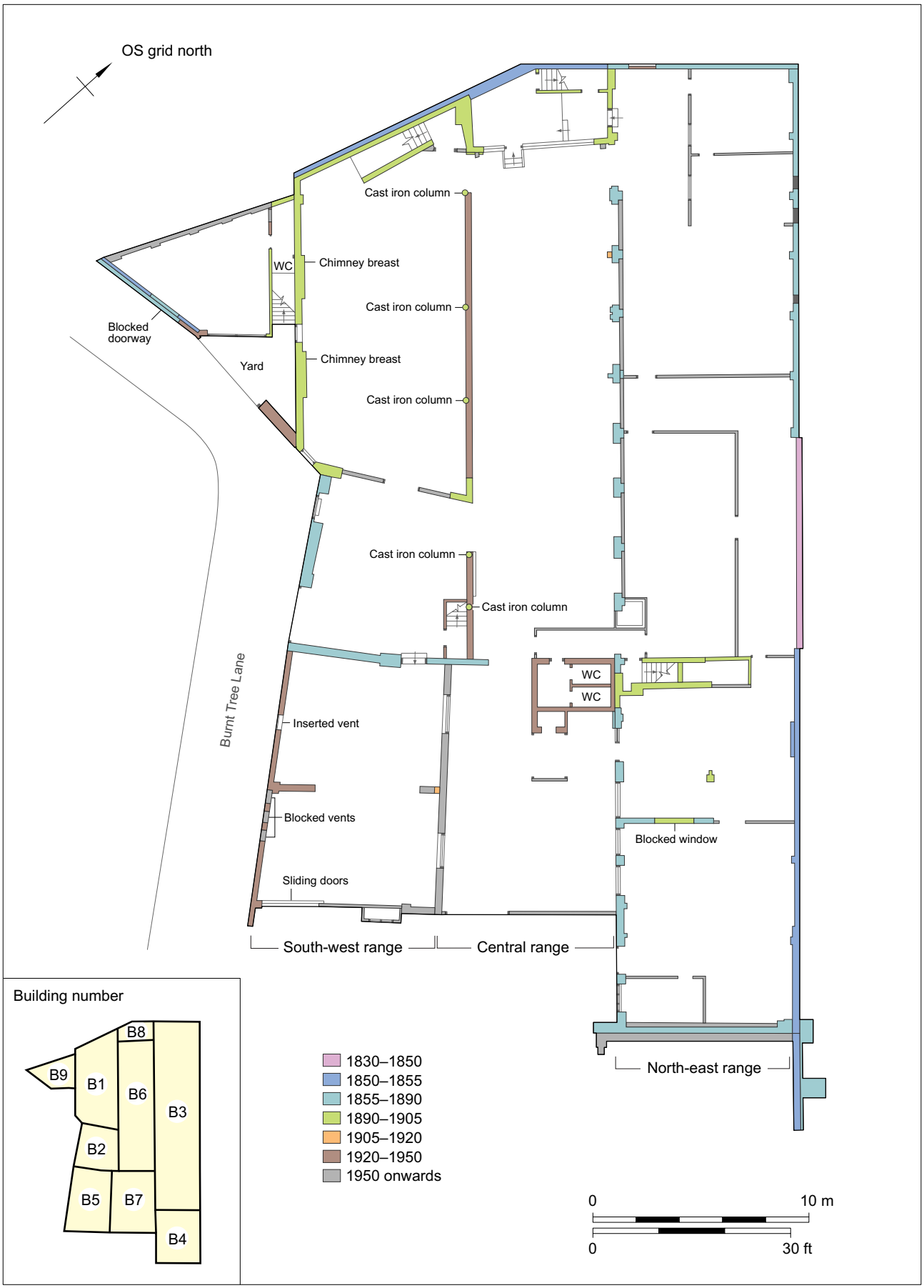

Figure 31 Hoyle Street Works, building recording, ground-floor plan

Figure 32 Hoyle Street Works, south-west elevation of buildings B1 and B2

Running perpendicularly south-west from the front wall (2105) of the north-east range was a 6 m long brick structure, 0.75 m wide internally, and 1.1 m deep, defined by walls 2052 and 2053, with a 1.3 m wide square structure (7022) at its south-west end. Its precise relationship with wall 2105 was not established due to the latter's heavy truncation, but it is possible that it housed a buried shaft or rope/belt drive from a steam engine on the other side of the works yard, providing power for machinery in the building.

Building Recording

At the time of recording there were three standing building ranges on the Hoyle Street site, incorporating nine structures constructed over seven main phases (Fig. 31). They represented only approximately half of the original factory complex, the open area to the south-east having originally contained a continuation of the north-east and south-west ranges, linked by a frontage range overlooking Hoyle Street. This principal range would have provided the main access into the works via a central cart passage. There was also once a freestanding building in the central yard, as depicted on the 1890 map and the engraving published in 1893 (Figs 5 and 20). These structures were demolished in the late 20th century for the construction of the Supertram tracks along Hoyle Street.

South-west range

The south-west range comprised three buildings (B1, B2 and B5). There was also a small building (B9) in the small triangular yard to its west.

Building B1

This building at the north-west end of the range, which first appears on the 1905 map, consisted of a two-storey brick-built structure. It had a distinctive Mansard roof and irregular angled gables, which appear to be as a result of the plot layout bordering the corner of Burnt Tree Lane and the angled boundary to the north-east (Fig. 32). This building gave the Hoyle Street Works a distinctive character and was an unusual building type in Sheffield.

The ground floor of its north-east elevation had originally been open-sided with cast iron columns to the works yard, and there were two large chimney breasts in the opposing wall, possibly for large industrial hearths. Interestingly, this type of building was probably more commonly used in later integrated works (Wray 2000, 50), as was the case here. The open sides would have also provided unrestricted movement of raw material and finished products. Open-sided forges were known to be present at Cyclops Works, Sheffield, around 1860. The concrete floors in B1 would have also provided a degree of fireproofing if industrial hearths were in use. It should also be noted that B1 was positioned at the rear of the works site, a common position for such activities, away from the quieter, 'higher status' front range on Hoyle Street.

At first-floor level the large amount of fenestration in the north-east wall, and a taking-in door in the south-west wall (Fig. 32), would suggest that this area was used as a workshop or warehouse. If used as a workshop, the craftsmen would have worked at a long wooden bench located against the fenestrated (north-east) wall in order to take full advantage of the natural light; there was a modern workbench against the north-east wall. However, there was no evidence of power in this room which could indicate that it was used as a warehouse/packing shop. The second floor/attic space had a wooden floor, indicating that it had contained no heavy machinery and it was probably used as storage/warehouse space.

Within the small triangular yard to the south-west, an external brick staircase to the first floor was probably added between 1920 and 1950, when a secondary access to the range was required due to the range becoming part of a separate firm.

Building B2

Attached to the south-east of Building B1 was a small two-storey brick structure. Although at first-floor level, its north-east wall and part of the south-east wall were contemporary with the north-east wall of Building B1, the south-west and south-east walls of the ground floor appeared to be of an earlier construction, corresponding with the walls of the structure shown of the 1890 map (Fig. 5). This was also indicated by the continuation and truncation of the south-east wall within the works yard, corresponding with the larger structure on the 1890 map. This area was probably used for either storage,

or as a workshop associated with the possible forge in Building B1. The ground floor was originally open-sided – a continuation of Building B1, with the same cast iron columns.

Located in its east corner, integral to the concrete ceiling, was a belting slot that continued to the site of a former electric motor on the roof. The belting slot and motor indicates that power was being provided to machinery located in the ground-floor room. At first floor, the room appears to have functioned as a small workshop which had large windows to provide natural light.

Building B5
This was a modern single-storey brick extension at the south-east end of the range. Its south-west wall was re-used from a structure shown on the 1923 map, although internally there were few historic features. Interestingly, the original structure was two storeys in height and was reduced in height and shortened in length in the mid-20th century.

Building B9
Within the small triangular yard to the west of the range, there was a late 20th century blockwork workshop built against the late 19th–early 20th century boundary wall. A blocked arched doorway in its south wall would have given direct access from Burnt Tree Lane during the early–mid-20th century, when the Hoyle Street works was occupied by several firms, dividing up the original layout.

Central range
This range consisted of Buildings B6, B7 and B8. Building B8, at the north-west end, was a small two-storey brick structure of mid–late 19th century date, first appearing on the 1905 map. Curiously, the floor level on the ground floor was higher than the surrounding ranges and yard, perhaps resulting from a use of the building, or as a result of the demolition of a crucible furnace which was originally located in this part of the works (Fig. 33). It provided an excellent view across the works and may therefore have been used as a foreman's/supervisor's office.

Building B6 resulted from the covering over of the rear part of the works yard by 1923. An original stone sett surface was exposed during the watching brief. Building B7, attached to its south-east end, was a single-storey extension built in the late 20th century, which enclosed an earlier brick-built toilet block dating to between 1948 and 1953.

North-east range
The north-east range contained two buildings, both dating from the mid–late 19th century – a tall single-storey workshop (B3) towards the north-west,

Figure 33 Hoyle Street Works, south-east elevation of building B8, overlooking the works yard

attached to which at the south-east was a lower, smaller building (B4).

Building B3
The engraving published in 1893 (Fig. 20) depicts a rectangular building with four conical cementation furnace chimneys projecting through the roof, and as noted above some archaeological evidence of these was found. It would appear that the surveyed building dated to the late 19th century and was built on the footprint of the earlier structure shown in the engraving. A cellar observed during the watching brief retained evidence for the use of mechanised power transmission, in the form of wall boxes and a brick-lined trench (2052/2053, see Fig. 21) which connected to the south-west range on the other side of the yard.

There was little evidence on the ground floor of the double-height room for the original function of the building, apart from a solitary wall box high up within the south-east wall. An earlier section of brickwork in the north-east wall, possibly dating from the early 19th century, contained horizontal timbers with numerous holes, possibly used for metal storage. The main features of the south-west wall were large full height windows overlooking the yard indicative of workshop use. During the watching brief at least one grinding stone was noted in the building's south-eastern room, and it is possible that there were originally more in the building.

Building B4
This formed a continuation of Building B3, attached to its south-east end. Its north-western part was the same height as Building B3 but its south-eastern part was lower, with the dividing gable reused from an earlier structure – probably that shown on the 1852 map, and the engraving published in 1893 (see Figs 4 and 20), as a narrow range, the original function of

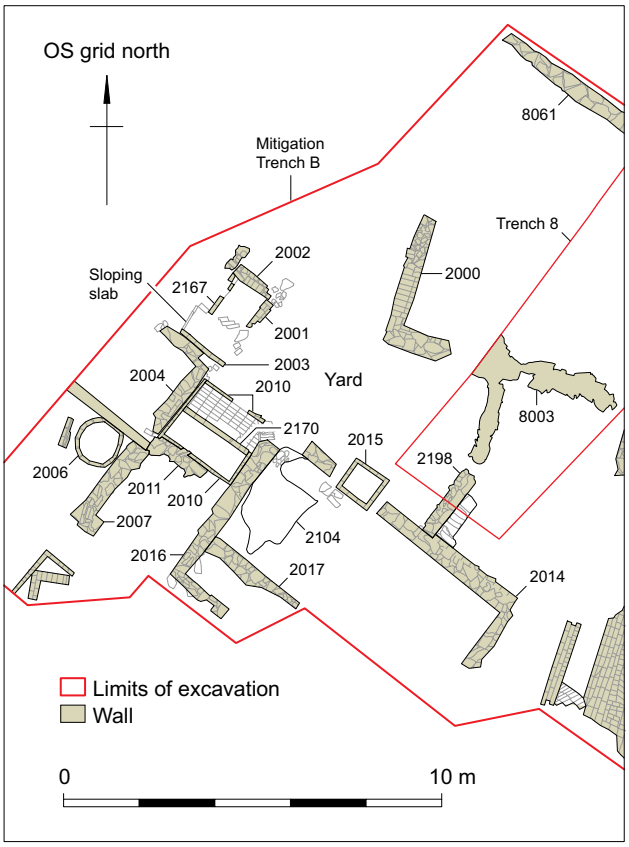

Figure 34 Progress Works, archaeological features referred to in text

which is unknown. The south-west wall of Building B4 was a continuation of the south-west elevation of Building B3. During the construction of B3, B4 was widened to correspond with it.

Progress Works

Area D, which lies north-west of the Hoyle Street Works (Area B) and adjacent to Sudbury Street (Figs 1 and 2), was occupied in 1890 by the *Progress Works (Files & Cutlery)*. Following the basic survey (outline floor plan and a photographic record), and demolition of the large single-storey building, dating to the 1960s, which occupied the site, Trench 8 was opened, spanning the boundary between Areas B and D. Subsequently, the south-eastern quarter of the Area D was exposed in Mitigation Trench B (Fig. 34).

The area to the south-west (Area C) was not subject to archaeological evaluation, although the southern edge of Mitigation Trench B extended just inside it. Some of the features at the western end of the trench, therefore, appear from the map evidence to have lain outside the boundary of the Progress Works, and relate instead to buildings around of a court (*Court No. 1* on the 1890 map; see Fig. 5) which together occupied much of this area.

Background

Sudbury Street is first shown on the 1828 Fairbank plan (named *Suffolk Street* until at least 1852), with three properties on its south-east side lying within Areas C and D (see Fig. 13), none of them apparently developed until between 1832 and 1838. By 1852, however, there were a number of buildings, surrounding three yards, two accessed from Suffolk Street, and one (triangular in shape) from the corner of Suffolk Street and Burnt Tree Lane (Fig. 4). The north-eastern of the two on Suffolk Street (which lay wholly outside the area of Mitigation Trench B), accessed via a cart passage, was occupied by a brass and silver foundry.

Next to it was the *Milton Works (Spindles)*, with access from the Suffolk Street frontage, which had buildings at its east, north and west corners. The number of occupants of the works listed in the trade directories suggests that the buildings comprised several workshops leased to self-employed cutlery outworkers, known as *little mesters*, highly skilled craftsmen working primarily for themselves, but also undertaking specialist outwork services for the larger cutlery manufacturers, such as grinding, handle making and polishing. The south-western (triangular) property had small buildings, probably workshops, along Suffolk Street, with a larger building along its boundary with the Milton Works, and with a walled yard along Burnt Tree Lane.

By 1890 the area had been substantially rebuilt, with the two yards accessed from Sudbury Street (both via cart passages) now belonging to the Progress Works (Fig. 5), the earlier building having been enlarged and added to, including a circular chimney at the northern end of the southern yard. The occupants of the works changed regularly through the late 19th and 20th centuries, but their layout changed little until after 1953. The large steel-framed building which occupied the site at the time of recording is shown on the 1979 map as *Cutlery Works*.

By 1890, the former street-front workshops in the triangular property to the south-west had been replaced by a row of back-to-back houses, broken by a cart passage into Court No. 1 (Fig. 5). There were also a number of buildings to the rear of the yard, including coal dealers listed in the 1876 and 1895–6 trade directories; the long building at the south of the yard may have been the bakery listed on the east side of Burnt Tree Lane in White's and Kelly's trade directories from 1876 to 1925. There was little change until after World War II, when the back-to-back houses were demolished and a warehouse was built along the north-eastern boundary.

Archaeological Works

A number of features were recorded which appear to correspond to works buildings in the Milton and Progress Works and, to the south-west, to the building on the north-eastern side of Court No. 1 (Figs 34 and 35).

A 5 m length of rough sandstone wall (8061) against the northern edge of the excavation corresponds approximately with the south-western wall of a building at the north-eastern corner of the Milton Works yard as shown on the 1852 map (see Fig. 4). It had been truncated at its south-east end by the cut for the northern continuation of the 20th century wall (2035; see Fig. 21). It does not appear to be related to any other excavated feature.

Two L-shaped lengths of truncated sandstone foundation (2000 and 8003) appear to form part of a building aligned with reference to the boundary between the Progress Works and the Hoyle Street Works to the east. They correspond approximately with the front walls of a building, and a possible internal wall, shown on the 1890 map on the eastern side of the Progress Works' southern yard. After 2.5 m the most southern wall (8003) changed direction slightly so that it ran (as 2198) perpendicular to the Works' south-western boundary, abutting wall 2014.

Also within the area of the Progress Works was a 2.5 m long, stone and brick structure which appears to have lain within a small L-shaped building shown on the 1890 map on the south-western boundary of the yard; if so, it spanned the whole width of the building. A short length of brickwork (2001) at the north-eastern corner of the structure matches the building's south-east-facing front wall. The structure was in two parts, its wider south-eastern part defined by a single-skin brick wall (2003) against the rear wall of the building, and a steeply-sloping sandstone slab at its north-west end. The narrower part, to the north-east, made of brick and stone (2001, 2002 and 2167), survived to a height of four courses above the clay floor. The function of this structure is unclear, but the surviving sloping sandstone slab suggests that the wider part may have been the pit for a large wheel, possible a grinding wheel or a fly-wheel for a piece of machinery.

The remaining structures, all with sandstone foundations, correspond to a building along the north-eastern boundary of the triangular property, adjacent to the Milton/Progress Works. On the 1852 map this is shown as a single long building, but by 1890 it is shown as divided into three parts (Figs 4–5). One of the excavated wall foundations (2016) matches the shared wall between the central and the north-eastern of these three parts. There was no trace of the other shared wall within this row, and walls 2014 and 2016 (whose foundations were cut into the natural clay) form what appears to be a single, undivided building, measuring 7.3 m by 4.4 m internally, with an internal wall (2017) creating a 0.8 m wide space inside the front (south-western) wall. The rear wall had subsequently been cut for the insertion of a concrete slab on which was square brick chimney base (2015). It is not clear to what uses this building may have been put, but there was a localised spread of clay (2104) in its northern corner, containing pieces of crucible, sandstone and brick, as well as sherds of pottery.

Figure 35 Milton Works/Progress Works, viewed from the south-west

Figure 36 Feature 2010, containing pottery-rich clearance deposit, viewed from the south-west

The narrower building to its north-west, defined only by its side walls (2016, 2004/2007), was divided laterally into two almost equal parts by a roughly built sandstone foundation (2011). The whole of the north-eastern end of the building was occupied by a rectangular, single-skin brick structure (2010), 2 m by 1.7 m internally (Fig. 36). This was divided longitudinally, by a single-skin brick wall (2170), into a 0.8 m deep pit with a concrete floor (at the south-

west), and a shallower (0.3 m deep) brick-floored area (at the north-east).

This structure is of uncertain function, but its fill (2101) contained a large assemblage of pottery dated predominantly to between the 1850s and the mid–late 1870s, possibly representing a 'clearance deposit' (see *Chapter 3*, below). This would suggest that the deposit was made around 1880, possibly at the time that the single building shown on the 1852 map was divided into three parts, as shown on the 1890 map, perhaps indicating a change of use, and the infilling of a feature that was no longer needed. Although the ceramic material in the deposit is clearly domestic in character, its source remains unclear.

To the immediate north-east of this building was a circular, single-skin brick well (2006).

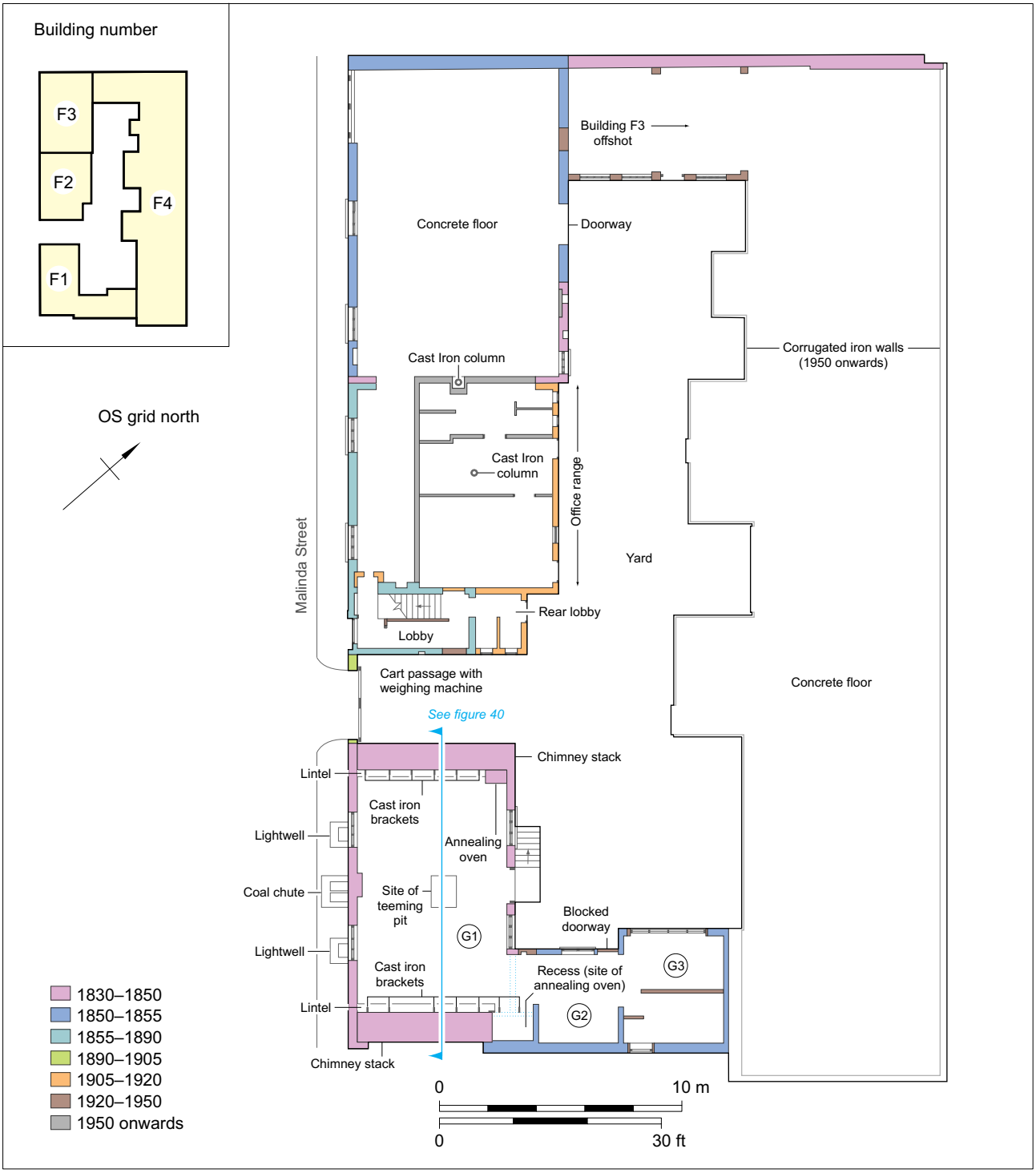

Figure 37 Titanic Works, building recording, ground-floor plan

Building Recording

The site comprised one large, single-storey steel-framed building, fronting Sudbury Street, built in the 1960s and a typical mid-20th century structure; it contained no historic elements.

Titanic Works

Area F fronted onto the north-east side of Malinda Street, lying to the immediate south-west of Roscoe Place Works (Area H), and south-east of Australian Works (Figs 1 and 2). On the 1890 map it is shown as occupied by the *Titanic Steel Works* (Fig. 5). At the time of recording the site contained three buildings fronting Malinda Street (F1–3), with return wings at either end, a central courtyard, and a long rear shed of 20th century date clad in corrugated iron (F4) (Fig. 37). The front range comprised a single-storey building incorporating two crucible furnace stacks (F1), a two-storey office range with a cart passage (F2), and a single-storey warehouse (F3). Because buildings F1–3 are Grade II Listed, and hence have been preserved, they were subject to detailed building recording.

It had been intended to open an evaluation trench (Trench 4) within the footprint of building F4 following its demolition. Because of structural concerns, the developers commissioned a Ground Penetrating Radar survey of this building. This found evidence of significant voids below ground level. A hole was made through the floor of F4 revealing the remains of a ground-level crucible workshop at its south-east end and its underlying cellar (Cellar 1), and a second crucible cellar (Cellar 3) at the north-west end. During the construction programme watching briefs were maintained and recording undertaken during the removal of spoil and artefacts from these cellars, and from a third extant crucible cellar (Cellar 2) under building F1. The layouts of the three cellars indicated that each furnace had a different design.

Background

The 1823 Leather map shows the land south-west of the Roscoe Place Works to have been unoccupied. By 1828, however, it had been bisected by William Street (by 1832 called Malinda Street), and the area of the site was divided into two plots, empty apart from two structures at the eastern corner, probably part of the Roscoe Place Works (Fig. 13). The smaller, north-western plot was owned by Charles Wardlow, but the larger plot to the south-east was unlabelled. The 1846 Fairbank plan of Roscoe Place shows the street frontage to have been *Purchased of Joseph Blake*, with the land behind *Purchased of Thos Blake*.

Figure 38 Mosaic in the lobby of the Titanic Works

In 1845 Charles Wardlow & Co., steel refiners, were listed in White's Directory at 32 Malinda Street; the subsequent occupants of the site (below) were listed in successive editions of the White's Directory (1852; 1868, 1876; 1895–6; 1906; 1912) and Kelly's Directory (1883; 1925; 1934; 1944; 1954; 1965; 1974).

The 1852 map shows the site to have comprised two properties (Fig. 4). The larger plot to the south-east consisted of a walled yard with a central entrance on Malinda Street, and a range of buildings along its north-east side which by this date may have included a crucible furnace (above Cellar 1). The plot to the immediate north-west consisted of a small yard accessed from Malinda Street through a cart passage at its western corner (in the same location as the secondary entrance to the later Titanic Works), and with two approximately L-shaped buildings occupying its southern and eastern corners.

In 1868, John Henry Andrew & Co, steel manufacturers, was listed at Malinda Street, possibly occupying the entire site, and it is likely that the surveyed buildings on the street frontage had been built by that date. By 1876, the works was occupied by William Mickelthwaite & Co, steel manufacturers, and was listed as the Titanic Works. These integrated works, now occupying both plots, are depicted on the 1890 map, and comprised buildings around two separate yards, after entering through a shared cart passage (at the location of the entrance to the former south-eastern plot) (Fig. 5). The smaller, south-eastern yard lay to the rear of building F1, while the larger yard to the north-west lay behind building F2 and F3; at the back of both yards was the rear range, later occupied by building F4 (Fig. 37). The map shows two external staircases which correspond to those serving Cellars 1 and 2 (under buildings F4 and F1, respectively).

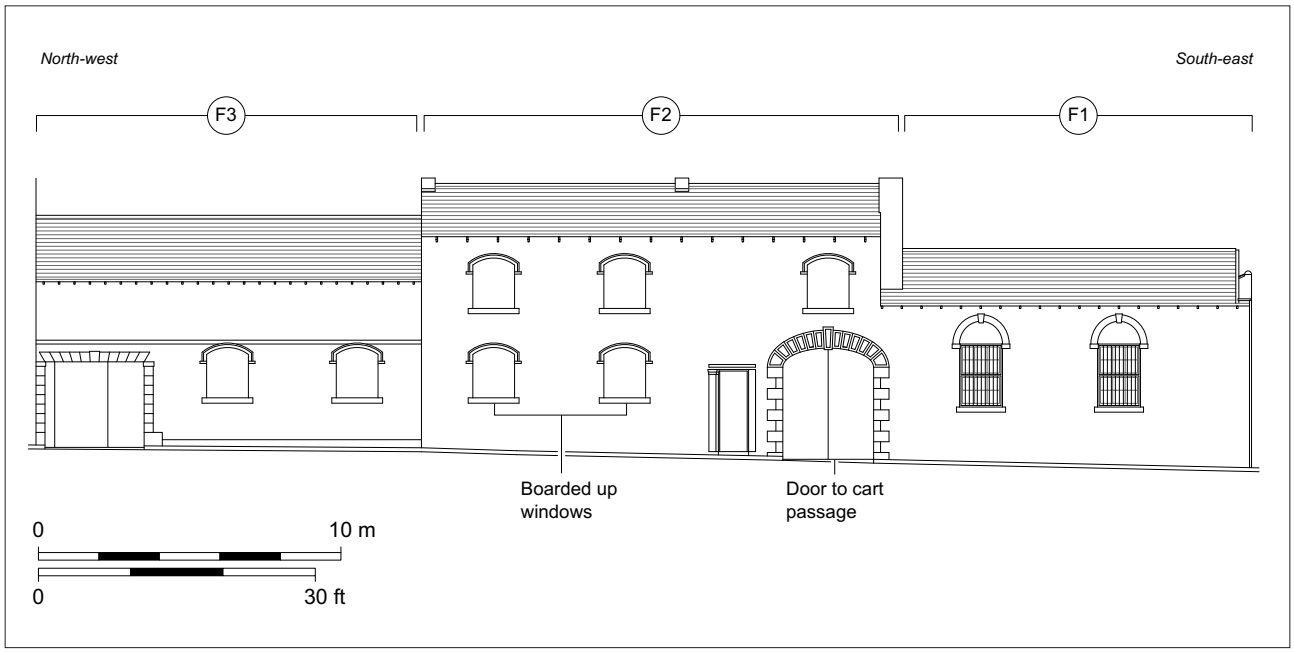

Figure 39 Titanic Works, building recording, Malinda Street frontage

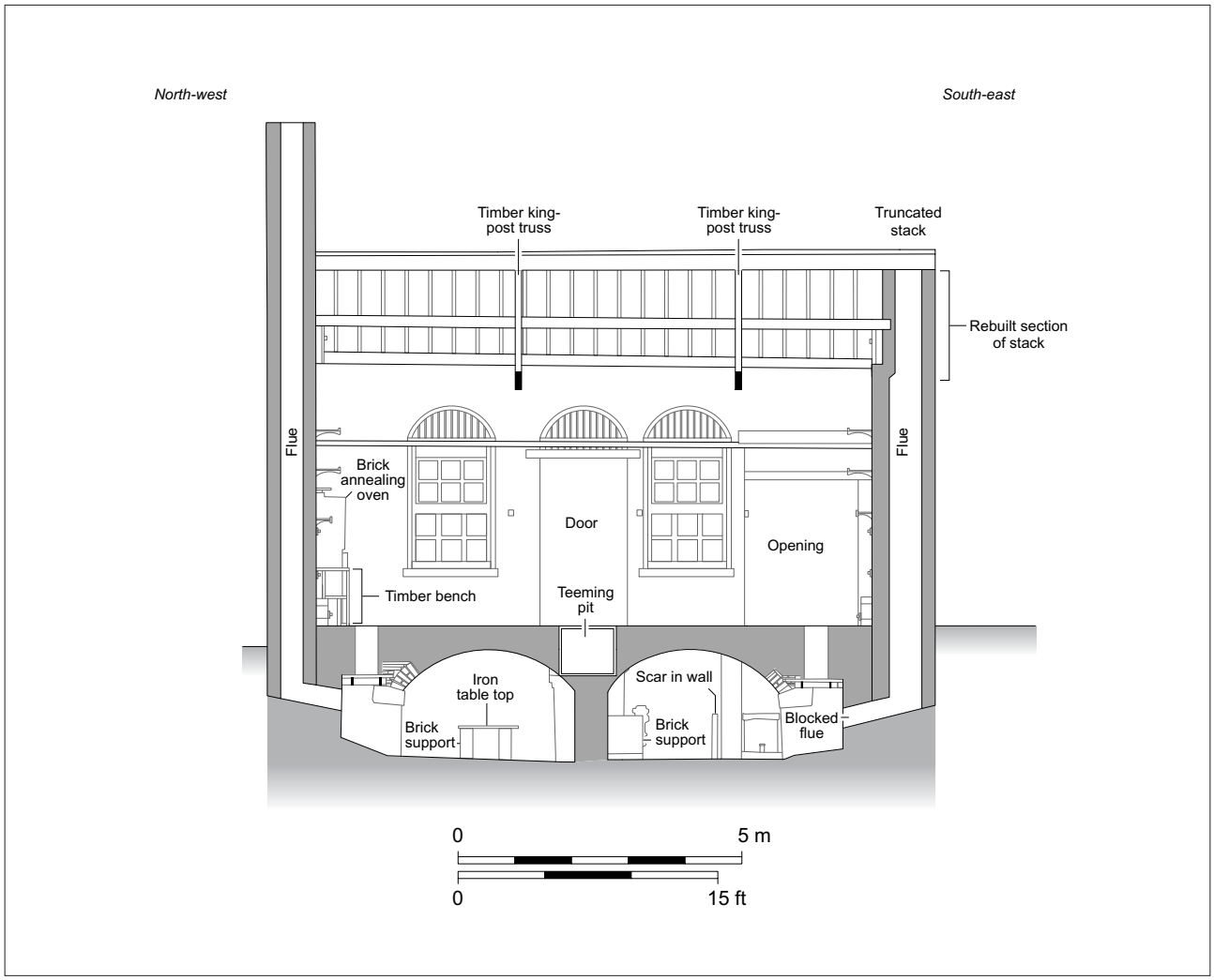

Figure 40 Titanic Works, building recording, south-west facing cross-section of building F1, room G1 and cellar

By 1895 the site was occupied by James Leigh and Sons, file manufacturers, although by 1906 it had several occupants, with James Eyre & Co. and Henry Burstal & Co., both steel manufacturers, listed at 24 Malinda Street. A further two firms, G.R. Jones & Co., steel rollers, and James Leigh & Sons, file manufacturers, were listed adjacent to 24 Malinda Street and is not clear whether they shared the same premises at this time. Their premises were listed as the Swedish Steel and File Works and the Avon Works respectively, but only a small works complex was depicted on the plot to the south-east of the Titanic Works in 1905. However, the presence of an *in situ* mosaic tiling with the name *G.R. Jones & Co. Ltd* set within the floor of the lobby of building F2 (Fig. 38), and the name stamped onto a timber joist within Cellar 3 and on crates located within Cellar 3 indicate that the firm was indeed occupying at least part of the Titanic Works, and later a substantial portion (if not all) of it. In 1912, Jones and Eyre were listed as the occupants of No. 24, but in 1925 Jones was again listed at an un-numbered works.

Jones, Eyre & Burstal were listed at the works until 1925, and in 1934 the premises were also the registered office of Kenyon Brothers, steel rollers. G.R. Jones & Co. and the Kenyon Brothers & Co. were then listed as the occupants through the majority of the 20th century, still being in residence in 1974. Between 1945 and 1953 the building located at the rear of the works was demolished and replaced with a longer corrugated iron shed used for castings (Fig. 37). The most recent company to occupy the works was Hollteck Co. (UK) Ltd: foundry division and Rolling Mill Guides Ltd.

Building Recording and Archaeological Watching Brief

The Titanic Works is Grade II listed, and located at 24 Malinda Street. It comprised four buildings set around a central works yard, three of them (F1–3) of mid-19th century date on the Malinda Street frontage, the fourth (F4), spanning the whole north-eastern side of the works, a steel-framed building of 20th century date (Fig. 37). The Titanic Works had three crucible furnaces.

Building F1 and crucible Cellar 2

This building was a rare double-stack crucible furnace, constructed in two phases between 1850 and 1890, located at the south-eastern end of the Malinda Street frontage (Fig. 39). Adjacent to it to the north-east was a small workshop with flagstone floor which was most likely a potting room (Room G2), and a further room which was a cart shed (Room G3) (Fig. 37). The furnace building was constructed of red brick with a pitched roof, and with chimney stacks at either end (Fig. 40). The north-west stack had been rebuilt above eaves level, whilst the south-east stack had been truncated and the gable rebuilt. Both stacks, however, had retained their iron straps within their lower half.

Figure 41 Titanic Works, building F1, detail of south-east crucible stack, showing ledge and shelf brackets

Internally Building F1 comprised a single large melting shop (Room G1), with a concrete floor which had presumably replaced the usual steel plates. A central recess within the floor corresponded with the location of a former teeming pit (Fig. 37). The melting holes had been bricked-up, with only the tops of the sandstone lintels being visible: six in each stack. There were also three rows of cast iron wall brackets on each stack which had originally carried shelving for the storage and drying of the crucibles (Fig. 41).

Interestingly, there were voids between the crucible stacks and the Malinda Street elevation, and separate iron bands had been bolted to the wall, encircling each of the crucible stacks, to tie the walls to the stacks.

The stacks and street elevation are interpreted as an original build, to which the rear potting shop (Room G2) and cart shed (Room G3) had been added as a single phase, probably replacing an earlier, smaller structure represented by uneven brickwork features at the north-east end of the south-east stack. Internally, annealing ovens were added to the north-east end of each stack, although that attached to the south-east stack had been removed and partially rebuilt to make a recess. The small brick flue abutting

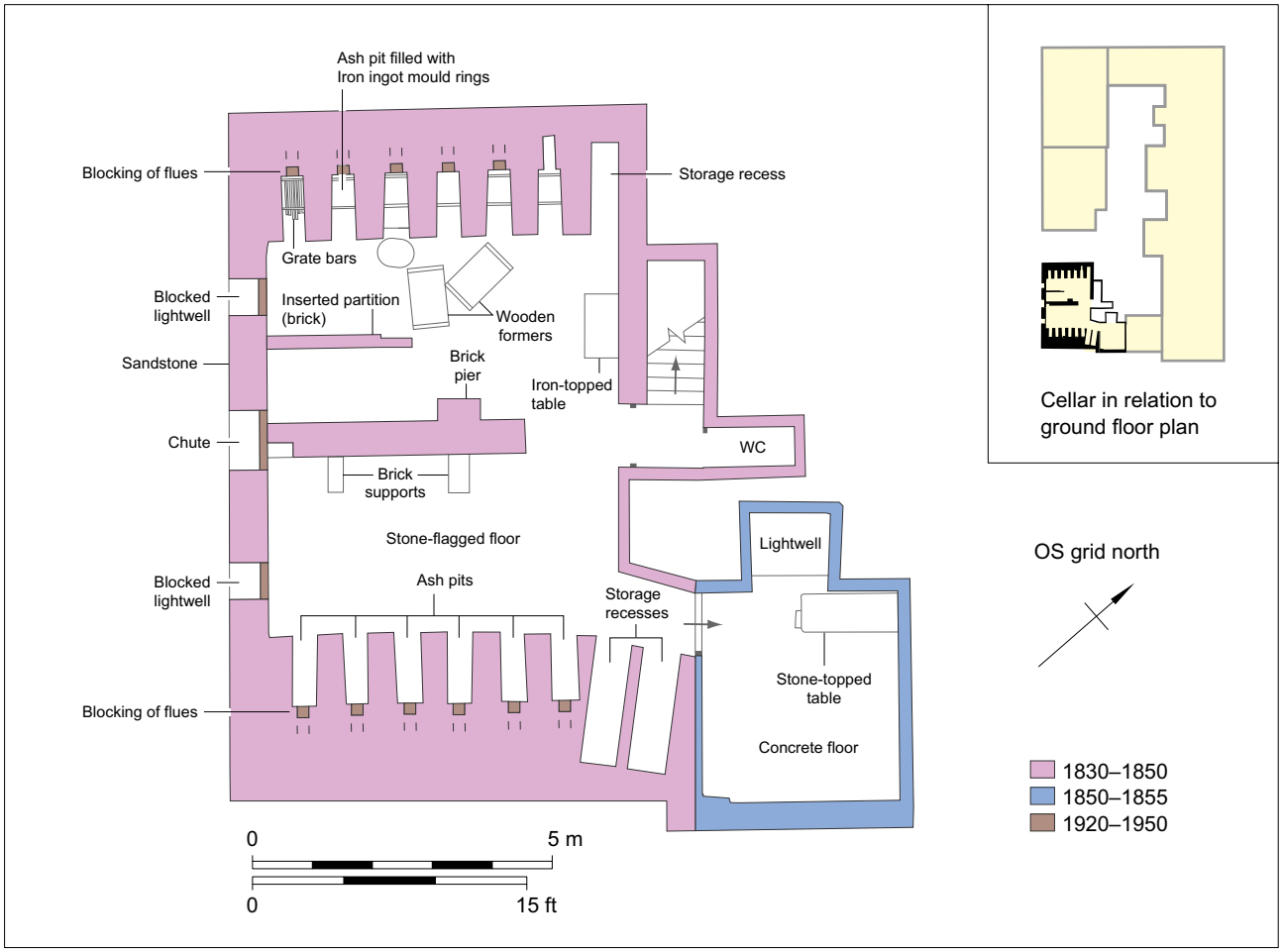

Figure 42 Titanic Works, plan of Cellar 2

the north-western stack, which was a later addition, was for the other annealing oven (Fig. 37). Subsequent alterations included the conversion of the cart shed to additional workshops or stores, with the replacement of its front and rear doors by windows, and the insertion of partitions. A courtyard door (later blocked) in the potting room, and the insertion of a wide opening between the potting room and the former cart shed may have occurred at the same date.

Access to the cellar from the courtyard was gained via an external stone staircase (at the bottom of which was a small toilet). The main cellar room was divided into two parts by a central brick partition, each side having a brick vaulted ceiling, and stone-flagged floors (Figs 42 and 43). There were six ash pits along the north-west wall, and another six along the south-east wall, all but one of which had their flues into the stack blocked with brick. A brick pier attached to the north-west side of the central partition encased the teeming pit in the floor above, and had an iron surround at its top.

There were three pavement openings at the base of the Malinda Street frontage, subsequently bricked up within the cellar. Two were lightwells for the cellar, one on either side of the central partition, while the wider, sloping central opening, largely behind the partition, would also have served as a chute for materials (coke, and sand and clay for crucible making). These features may also have facilitated the flow of air into the cellar necessary for the operation of the furnace.

A small recess in the northern corner of the cellar, probably used for storage, was positioned below the annealing oven on the floor above. There was a secondary, low brick partition at the south-west end, on one side of which was a large pile of clay and sand. In the south-east half of the cellar there were two low brick supports, possibly for a table, against the central partition. To the north-east of the ash pits, but at a slight angle to them, there were two adjacent brick-floored storage recesses.

Next to the storage recesses in the south-eastern part of the cellar there was a doorway that led into a smaller room, below the ground-level potting shop. It had a concrete floor and a large lightwell in its north-west wall. The ceiling was made up of timber joists carrying stone flags above. A transverse reinforced steel joist (RSJ) carried the south-west wall of the room above. It is likely that this room was used for

making crucibles, as next to the lightwell was a stone-topped table on brick supports.

Building F2
Adjacent to the furnace building was a two-storey office and store, of three phases, completed between 1850 and 1890 (Figs 37 and 39). The original street range was extended to provide an additional office above an enclosed cart passage. Keyed brickwork enabled the frontages of buildings F1 and F2 to be combined. A rear office range was also added, which required the removal of partition walls and substitution of cast iron columns and timber beams to combine the ground floor of Buildings F2 and F3 (below) as a single warehouse space. At some stage, the entrance lobby was altered, with a new staircase obscuring the fanlight, and the rear lobby was added, abutting the added rear range. During the watching brief, the remains of a weighing machine were uncovered beneath the cart passage.

Building F3
Located at the western corner of the site, this building was a tall, single-storey, brick-built warehouse range (Figs 37 and 39). It incorporated elements of an older 'L' plan structure, existing by 1852, but which was extensively rebuilt and enlarged with a new frontage to match the already existing adjacent office range (Building F2). There was a single, wide vehicular doorway, with small wicket door, within the principal elevation fronting Malinda Street, and a wide doorway to the rear yard. Attached to the building's north-east end was a low single-storey rear offshot with mono-pitch roof, the architectural style of which suggests construction during the 1920s or 1930s. This was a small workshop accessed from the works yard, and open to the north-east with Building F4. It overlay an ancillary room associated with the cellar of a third crucible furnace on the site (Cellar 3, below), although all of the upstanding fabric of the furnace had been demolished.

Crucible Cellar 1 and workshop floor (Building F4)
The archaeological observations at the south-east end of the 20th century shed (Building F4) (Fig. 37) recorded the remains of a ground-level crucible workshop with a row of 10 melting holes and its chimney stack along its north-east side; several of the melting holes had been blocked with redundant grindstones (cokes) (Fig. 44). The crucible cellar beneath the workshop floor was found to be intact, along with a second cellar room to its south-east, directly linked via an internal doorway (Fig. 45). As the smaller room extended over 2 m to the rear of the stack there may well have been a chamber behind the stack at ground-floor level.

Figure 43 Titanic Works, Cellar 2, north-west half, viewed from the north-east

Figure 44 Titanic Works, exposed roof of Cellar 1 with melting holes blocked by grindstones

The main cellar comprised two vaulted areas separated by four brick piers, with a stone-flagged floor (Fig. 46). The area at the front (south-west) was accessed via a doorway towards its south-east end, reached by an external stone staircase from the yard; there was a blocked lightwell towards the other end. The brick vaulted ceiling incorporated a mixture of intersecting cast iron supports at its north-western end, and timber supports at the south-east end.

The area to the rear also had a brick vaulted ceiling; timber lintels supported the ceiling between the four brick piers. There was a row of 10 ash pits along the north-eastern side, one below each melting hole in the workshop above, as well as two narrow, vaulted storage spaces within the northern corner of the cellar. Above each pit were the iron grate bars at the bases of the melting holes. All the flues in the back walls of the ash pits, leading into the crucible stack,

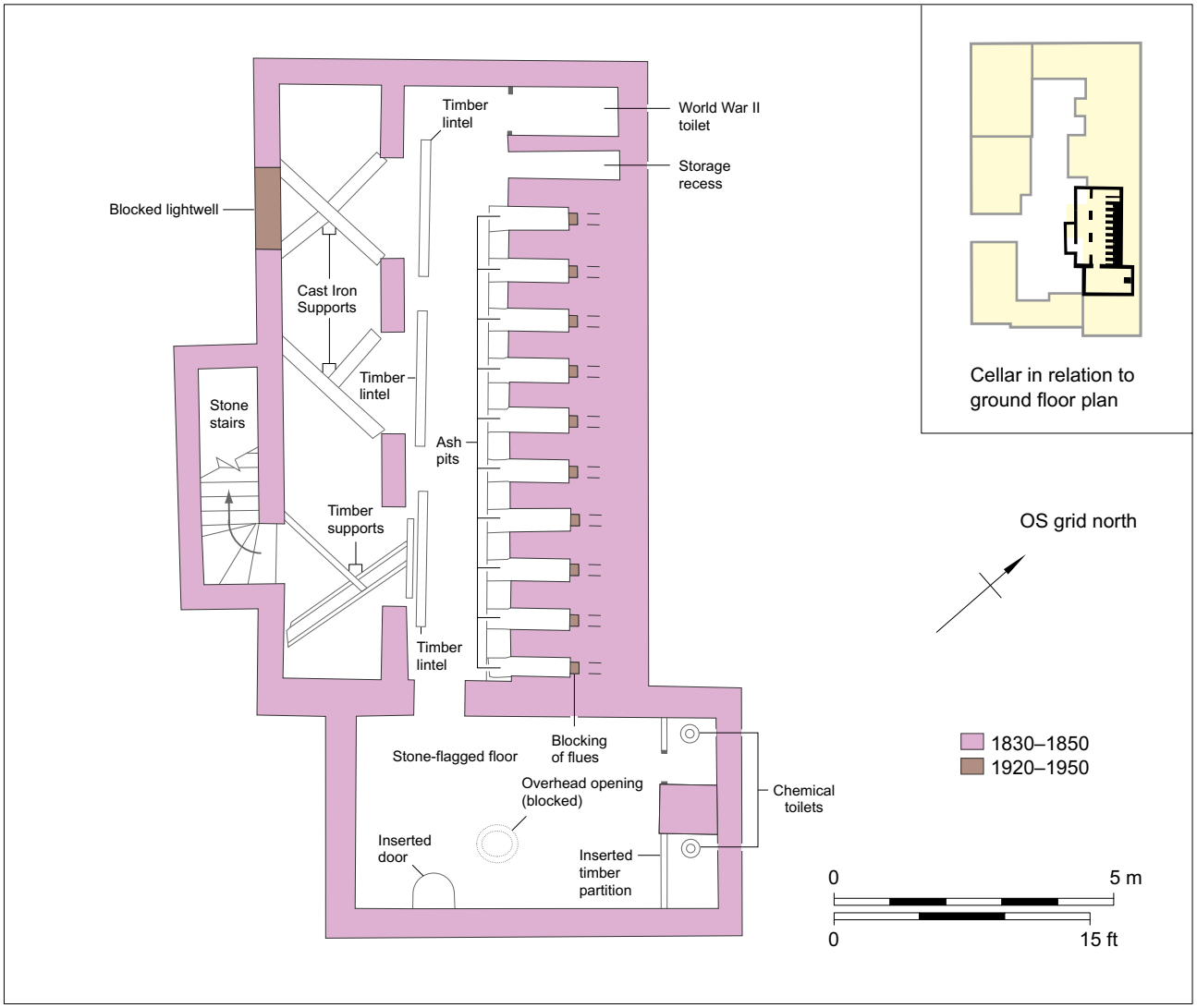

Figure 45 Titanic Works, plan of Cellar 1

had been blocked with brick. The ash pits were filled with debris, some of which included crucible production equipment, and charging pans. At the south-east end a doorway led into the smaller cellar room, which also had a brick vaulted ceiling.

Throughout the crucible cellar there were remnants of added timber benching set against the walls and the brick piers, dating from World War II when the cellar was used as an air raid shelter; the northernmost storage recess was then used as a toilet cubicle. Further benches in the smaller cellar room also date from this period, as probably did a secondary door inserted in the south-eastern wall to make access easier, and a possible air vent (blocked with concrete), in the southern corner. A large brick pier abutting the north-east wall created two recesses, each containing a chemical toilet. However, an off-centre circular opening (also blocked) in the vaulted ceiling may have once functioned as a drop from the workshop room above (Fig. 45).

Crucible Cellar 3 (buildings F3 and F4)

Cellar 3, a later addition to the Titanic Works, was also uncovered below Building F4, although a small ancillary room to the south-west, probably a pot shop, lay below the offshot of Building F3 (Fig. 47). Access from the courtyard was gained via an external stone staircase on the south-west side. Unlike Cellars 1 and 2, Cellar 3 comprised only a single vaulted space, which was supported by two brick piers that would also have encased the teeming pits above, and two short lengths of wall at each end (Fig. 48).

The cellar had a single freestanding crucible stack, with 12 ash pits (bricked up in the mid-20th century) on its north-east side. Behind the stack, at ground-floor level, there was probably a chamber, below which in the cellar there was a small space, 0.9 m wide, accessed via a vaulted passage beside the north-western ash pit. This compartment was filled with

clay, on top of a stone floor, held back by a large flagstone set on edge at its entrance. There was also a small recess in the south-east wall, beside the end ash pit, which had a blocked opening through the wall, and a blocked lightwell in the front (south-west) wall. Following the decommissioning of the furnace, probably in the 1950s, a brick base, presumably associated with later machinery in the building above, was built in the main cellar.

The pot shop was accessed by a doorway at the north-west end of the front wall, and had a ceiling of timber joists supporting the floor of the offshot building above, the architectural style of which would suggest that the crucible cellar was constructed during the 1920s or 1930s; one of the joists was stamped *G. R. Jones Co. Ltd Sheffield*, who were listed at the works until the 1930s. The pot shop had a large lightwell (divided in two and half-blocked), and a stone flagged floor at its south-east end, the rest of the floor being covered by an *in situ* iron puddling tray (Fig. 49). Adjacent to the lightwell, against the south-west wall, was an iron-topped table on brick supports,

Figure 46 Titanic Works, Cellar 1 viewed from the north-west

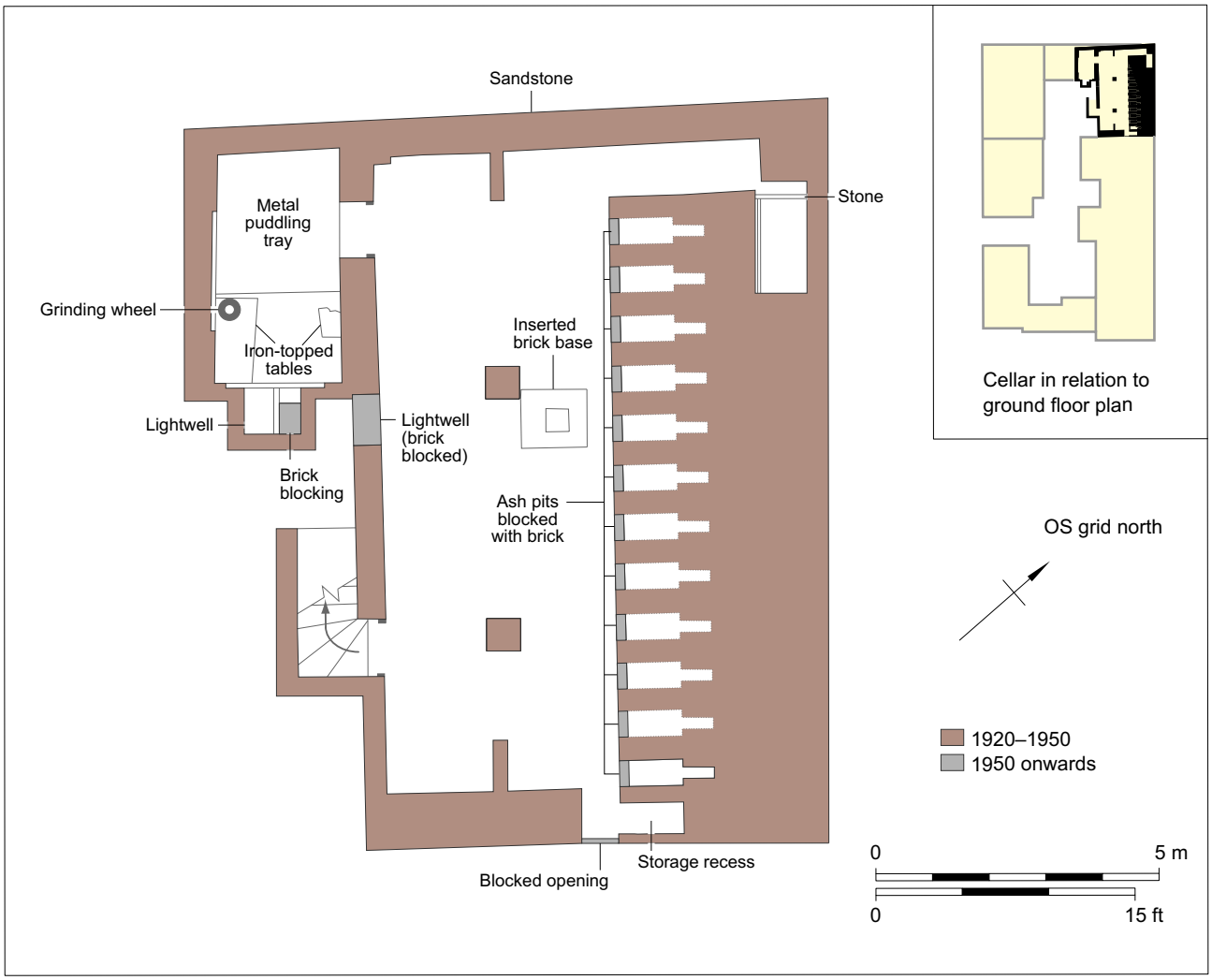

Figure 47 Titanic Works, plan of Cellar 3

Figure 48 Titanic Works, Cellar 3 viewed from the north-west

Figure 49 Titanic Works, Cellar 3 ancillary room with puddling tray and stacked grindstones

with a grindstone on top, and four more stored below; opposite, there was a smaller iron-topped table, beside which was a deposit of yellow and grey clay.

Australian Works

Area G comprises two parts – the northern part falling within the area of the Roscoe Place Works (see above), and the southern part (discussed here) by 1852 occupied by separate works. These works, referred to in White's Directory of 1906 as *Australian Works*, fronted onto the north-east side of Malinda Street (adjacent to the Titanic Works) on its corner with Roscoe Road (Figs 1 and 2). At the time of building recording they consisted of a *c.* 1940s three-storey workshop and warehouse range fronting Malinda Street and a U-shaped structure behind creating a central courtyard. Following their demolition Trench 5 was opened within the footprint of the works north-eastern range (Fig. 50).

Background

In 1816 the site lay within open fields immediately south-west of the Roscoe Place Works, and it was still undeveloped in 1828, after the building of William (later Malinda) Street, when it was owned by Thomas Gray. However, by 1854 the site was occupied by Jonathan Gray & Sons (saw and steel busk manufacturers), and it was presumably those sons, George Gray and Thomas Gray, who had taken over the works by the following year (with the street frontage purchased from Joseph Blake). The works are shown on the 1852 map as consisting of a building along the Malinda Street frontage, with a cart entrance towards the south-east end, and several smaller buildings along the north-west and south-east sides of the yard behind (Fig. 4). There was little change in 1890, by which time Roscoe Road had been laid out, although the buildings along the north-west side had been replaced by an open-fronted structure (Fig. 5).

The buildings to the rear of the works were rebuilt in 1903, extending along all sides of the plot. The building on the Roscoe Road side of the yard was a three-storey structure housing workshops and grinding wheels on the ground floor, with workshops and warehouse space above. In 1906, the site, by then listed (in White's Directory) as the Australian Works, was occupied by John Elsworth & Co. Ltd (steel saw and file manufacturers) 'in association with George and Thomas Gray', and the partnership continued until the late 1930s, when the layout of the site remained largely unchanged. In 1919 Elsworth bought the leasehold for the houses along Roscoe Road to the north-east of the works (Nos 11–43), and by 1925 had expanded the works into Nos 41 and 43, the valuations for which were worth less due to their proximity to the works (Bush V 269).

In 1941 Elsworth built a new three-storey range on Malinda Street, with smithing workshops on the ground floor, and office space at the north end of the first floor; warehouse space occupied the rest of the first floor and the second floor. Elsworth & Co was listed as the sole occupant of the Australian Works on both Malinda Street and Roscoe Road in 1944, but by 1954 they occupied only the Roscoe Road section, with the Pinking Shear Company being listed at the Malinda Street works. At some date after 1966 the three-storey building on Roscoe Road was reduced to two storeys, with a flat roof added.

Archaeological Works

Trench 5

The earliest feature in the trench was a small subcircular pit (5017) of unknown function at its north-west end, sealed by thick make-up layers (Fig. 50). One of these layers was a thick deposit of yellow clay (5009) which extended across the central and south-eastern part of the trench, and was cut by a number of other features.

These features included, at the south-east end of the trench, a substantial sandstone foundation (5007) lying perpendicular to the rear boundary of the works plot, possibly relating to the most easterly building shown on the 1852 and 1890 maps (Figs 4–5); it was connected to two smaller brick walls (5004 and 5006) to its south-east. A truncated brick wall (5003) in the centre of the trench lies in the area of the works where buildings are first shown on the 1905 map; this applies also to two other short lengths of wall (5002 and 5008) further to the north-west.

Also of note within the trench was a rectangular, vertical-sided pit (5010), 1 m by 0.8 m and 0.5 m deep, containing a complete grindstone resting on edge against the side of the pit, and several pieces of broken grindstone (Fig. 51). There was also a concrete machine base (5001) and adjacent wheel pit (5005), of probable 20th century date.

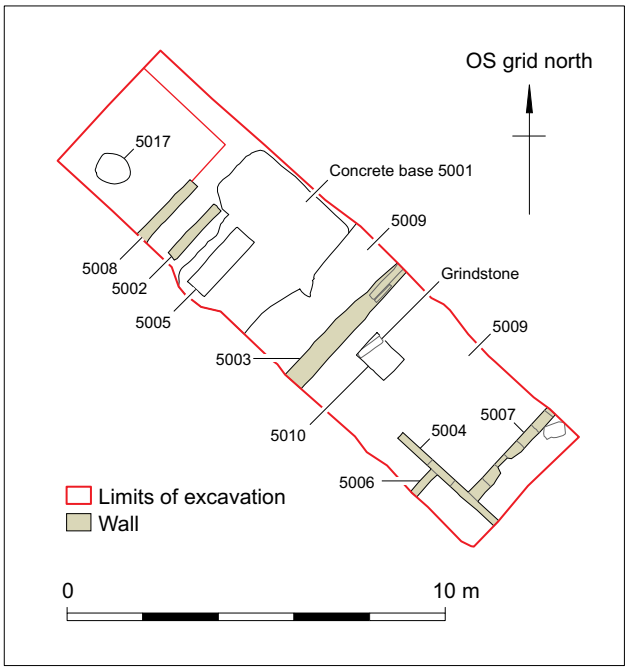

Figure 50 Australian Works, plan of Trench 5

Figure 51 Australian Works, grindstone in pit, Trench

Building Recording

Building G1

The earliest standing elements of the Australian Works comprised two 1880s terraced houses (Fig. 52). In the second quarter of the 20th century these were converted for industrial warehouse storage by the removal of their internal structure apart from their original party wall and fireplaces, and the roofing over of their rear yards to create extra workshop space. Walls were mostly bare brick with some fragments of plasterwork surviving. The original first floor had been removed and a modern floor inserted. No evidence of original stairwells had been retained, and due to a modern concrete floor at ground-floor level, no evidence for cellars was observed.

Building G2

A complex of brick-built, one- and two-storey workshops, dating to 1903, was arranged around the north-west, north-east and south-east sides of the works' small central yard (Fig. 52). It was originally of three storeys but later truncated and a flat concrete roof added. All its elevations had been altered, and a late 20th century workshop had been added in the north-west corner of the yard. The building's ground floor comprised a single workshop space, although evidence of insertions and blockings of openings demonstrated that earlier internal arrangements had been altered. The floor was a concrete surface with no evidence of any cellarage. The overlying floors were supported on RSJs, with a single cast iron column supporting the junction of RSJs at the angle of the range. The first floor had originally been open plan, but had latterly been subdivided with modern studwork.

The south-east range was also L-shaped in plan and comprised a single-storey workshop with a flat concrete roof, and a two-storey block at the south-west end, angled to allow access from the cart

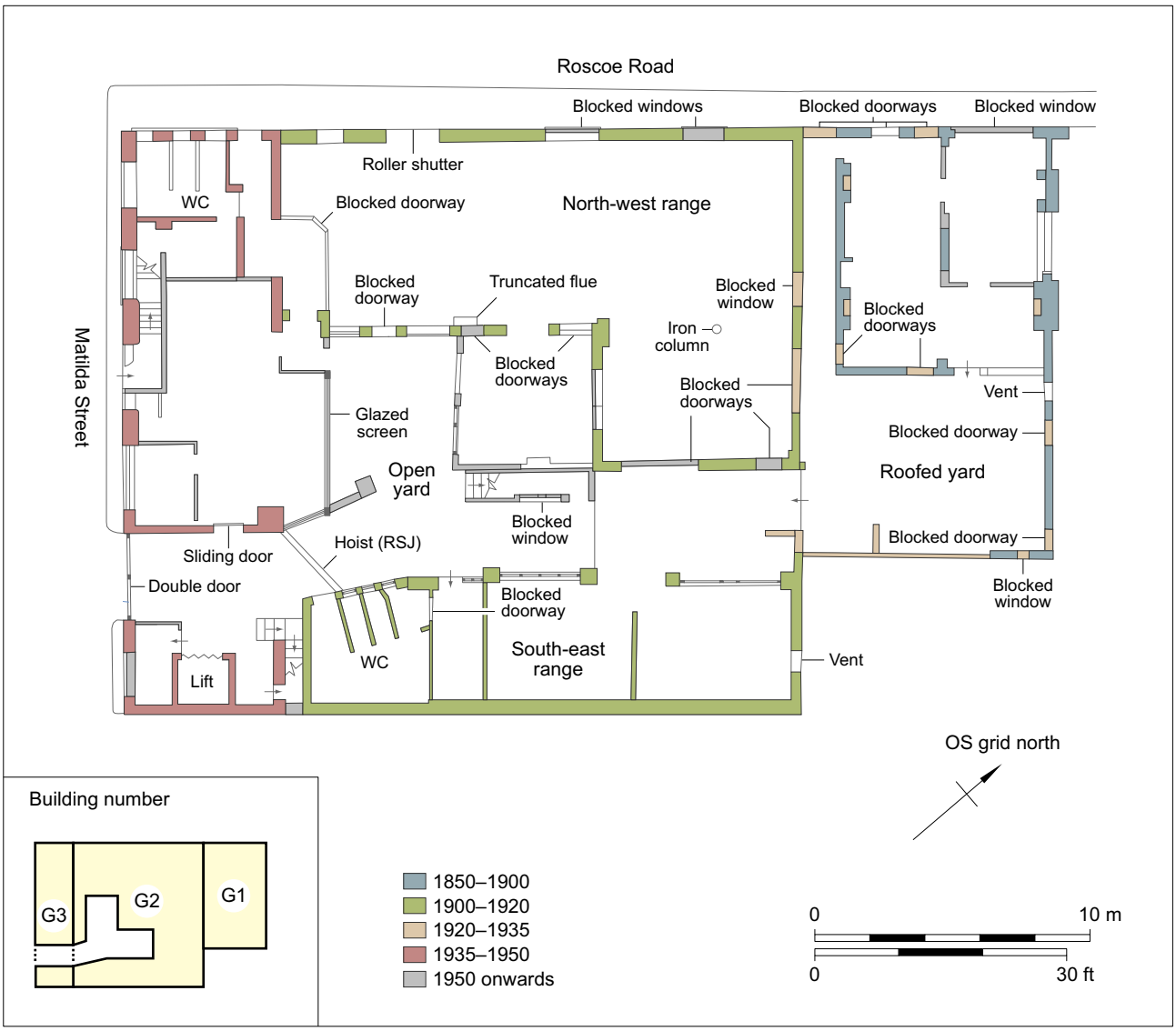

Figure 52 Australian Works, building recording, ground-floor plan

passage. Metalwork within the workshop was extensively corroded, and the room retained a strong chemical odour suggesting that it had been used for chemical processes such as etching. South-west of the workshop were secondary toilet and storage facilities, along with a stairwell leading to the first floor. Historic maps show a staircase to have existed here since the mid-19th century, related to the original Malinda Street range. It was subsequently adopted by Building G2 when it was constructed in 1903, and remained through the rebuilding of the Malinda Street Range *c.* 1940. The first floor of the range contained only a small office with toilet facilities.

Chapter 3
19th Century Domestic and Residential Properties

Much of the evidence for domestic housing came from Trenches 9 and 10 in Area A at the south-west of the site (on Burnt Tree Lane and Meadow Street), and Trenches 1–3 and Mitigation Trench A in Area H at the north-east (on Roscoe Road and Jobson Road) (Figs 1–2). Also in Area A was the Meadow Street Hotel, which was built in 1828 and continued in use as a public house/hotel until its closure in 2007; an archaeological photographic record, with accompanying sketch plans (Dawson 2008b), was made of the hotel prior to its demolition (see Figs 1 and 58).

Area A

Area A at the south-western end of the site is bounded to the north and north-east by Burnt Tree Lane (Fig. 2), and to the south-east and south-west by Hoyle Street and Meadow Street, respectively, the latter two roads laid out shortly after 1808, their proposed lines shown on the Fairbank map of that date. The site is shown as still unoccupied in 1823, but by 1828 it contained a number of plots, with blocks of housing fronting Meadow Street (this length originally called New Meadow Street) and on the bend of Burnt Tree Lane (Fig. 53). By this date the Meadow Street Hotel had also been constructed on the corner of the two roads.

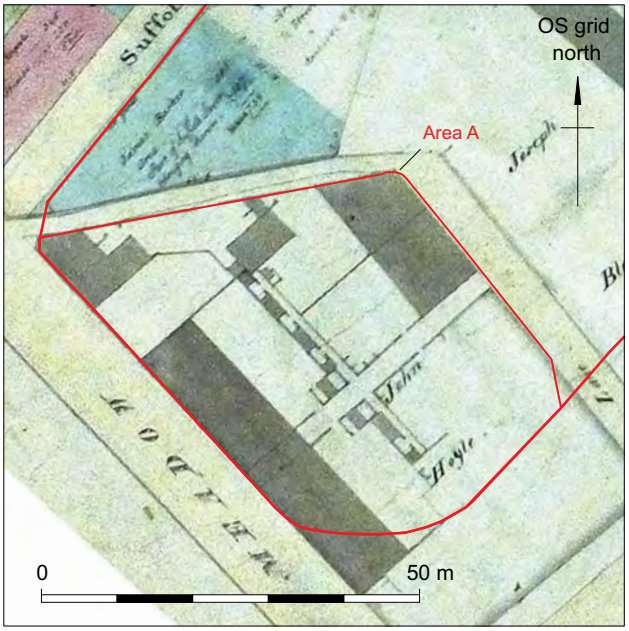

Figure 53 Area A on 1828 Fairbank plan (Sheffield Archives FC/She S 1333 L)

The block was divided by an alley running south-east from Burnt Tree Lane, which the 1852 map shows passing through a cart passage in the Meadow Street frontage (Fig. 4); a rear alley, with toilet buildings along its south-west side, crossed the first alley at right angles, dividing the interior of the block into four enclosed courts. By 1852 there was back-to-back housing along much of Meadow Street and Burnt Tree Lane (with larger terraced houses, outside the site, along Hoyle Street). By 1890 a vacant plot on Meadow Street, next to the hotel, had been filled with further back-to-back houses, but those south-east of the cart passage had been rebuilt as terraced houses (Fig. 5), several of which, by 1876, were listed as shops. There were a number of outbuildings, probably toilet blocks, along the walls dividing the rear courts.

There were few changes to the block in the early 20th century, but by 1953, many of the houses on Meadow Street and Burnt Tree Lane had been demolished, with only the terraced houses south-east of the former cart passage (Nos 82–92) still standing (Fig. 6). By 1975 only the hotel remained, most of the site being occupied by a large works building.

Burnt Tree Lane

Parts of four of the back-to-back houses on the south-west side of Burnt Tree Lane, to the north-west of the alley dividing the block, were exposed in Trench 9 (Fig. 54). The houses were 3.2 m wide internally, and although their front walls were not exposed, the historic mapping shows that they were 4.4 m front-to-back. Also uncovered was the 1 m wide cobbled path running down the centre of the adjacent alley. The layout matches very closely the 1890 map (Fig. 54).

The stone-flagged cellar below one of the houses (the front wall of which lay outside the trench) was emptied of demolition rubble, revealing that it had originally been divided into two parts, separated by a brick wall running perpendicular to the road (Fig. 55). Each side was accessed by a separate flight of sandstone steps, that of the north-western part, which belonged to the front house, curving round to the front, and that of the south-eastern part being S-shaped, and leading up through the back wall of the

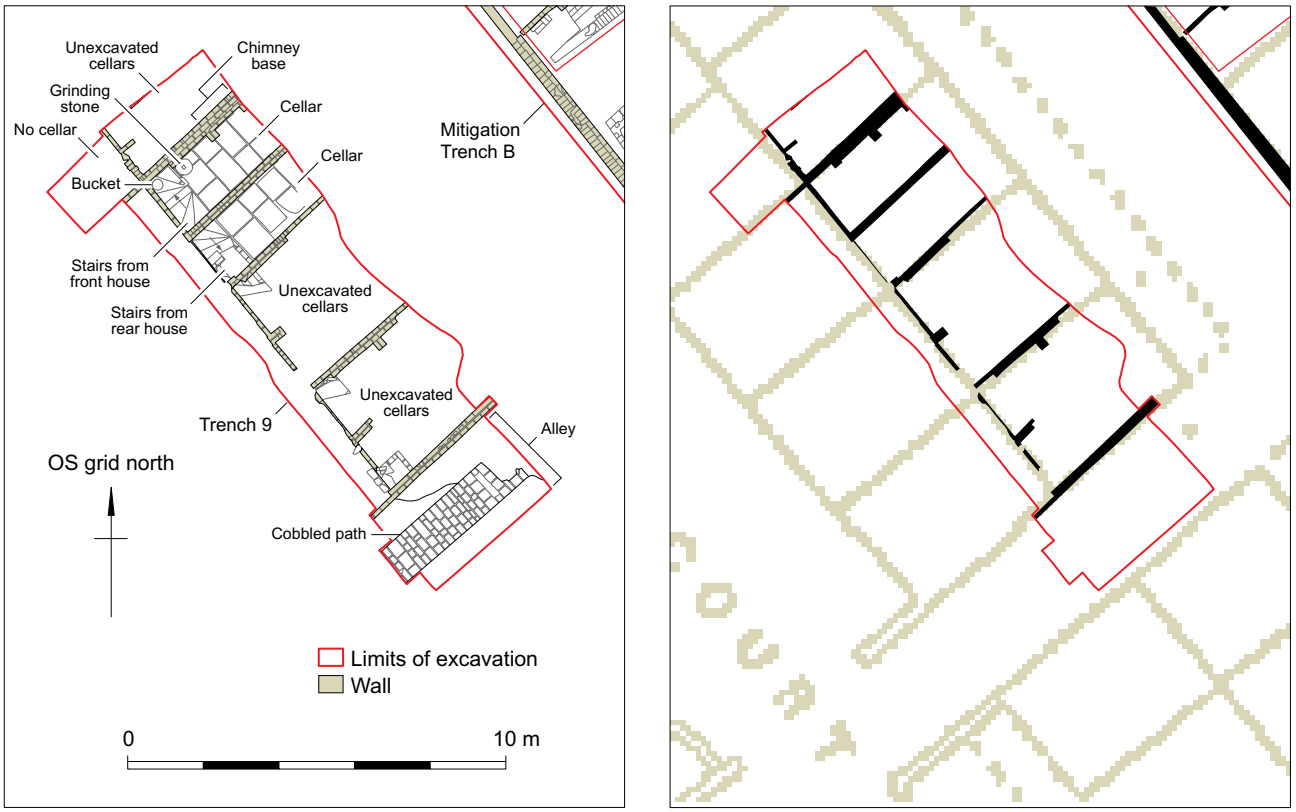

Figure 54 Area A, plan of Trench 9, with overlay on 1890 OS map (Sheffield Archives)

cellar to the house at the rear. This arrangement of cellars would have allowed both the front and rear houses to have been supplied with coal directly from the road via chutes. A sondage excavated in the rear house at the north-west end of the trench revealed that it had no cellar.

At some date the dividing wall between the two parts of the cellar had been largely demolished, and the flight of steps from the rear house was blocked with crude stonework, possibly indicating that the front and rear houses had been amalgamated into a single dwelling. A grindstone was found in the western corner of the cellar, and a bucket on its second-to-top step. Two brick buttresses, 0.9 m apart, against the north-western cellar wall probably indicate the position of the ground-floor fireplace and chimney within the house above.

Figure 55 Area A, Trench 9, cellars of back-to-back house on Burnt Tree Lane, viewed from the north-east

Meadow Street

No. 92

Part of a single terraced house fronting Meadow Street, shown on maps between 1890 and 1953, was exposed in Trench 10 (Fig. 56). This house, however, had replaced earlier housing dating from at least 1828, and shown in 1852 as a pair of back-to-back houses, flanked to the north-west by the cart passage giving rear access from the road (Fig. 4).

It seems likely, given the similar dimensions of the terraced house (minus its rear offshot room) and the back-to-back pair, that the two earlier houses had simply been converted into a single larger house, with a doorway cut through the south-east end of the party wall (Fig. 57).

The front of the building lay outside the trench, and only the north-west end of the rear wall of the cellar, below the front room (originally the front house), was exposed. However, the arrangement in that corner of the surviving steps into the cellar, and the stub of a dividing wall, indicates that the back-to-

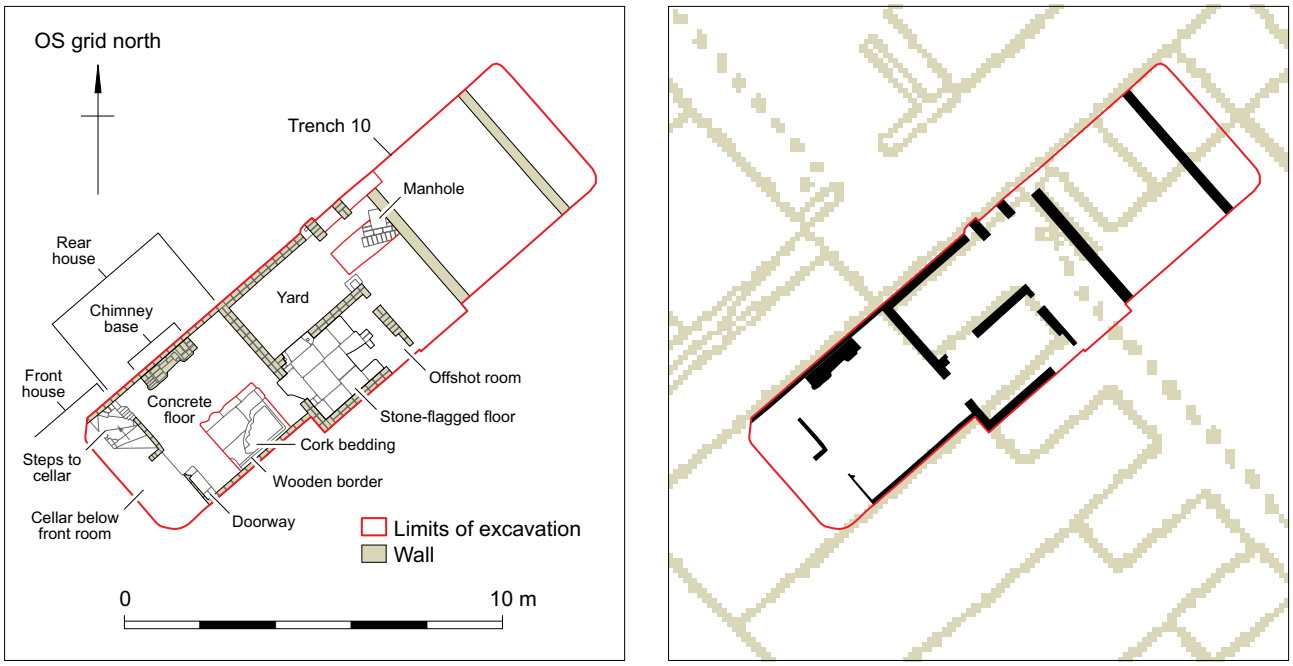

Figure 56 Area A, plan of Trench 10 plan, with overlay on 1890 OS map (Sheffield Archives)

back houses had the same cellar arrangements as those fronting Burnt Tree Lane (in Trench 9).

The rear room was 3.5 m square, with a fireplace in the middle of its north-west wall, and doorways at the south-east ends of its front and rear walls. It had a stone-flagged floor which continued through both doorways. Some of the flags exposed towards the eastern corner of the room were damaged and shattered through heavy wear.

Subsequently, a concrete floor had been laid over the flags within this room, apart from in an area 1.6 m by 1.8 m, defined by a wooden border, against the south-east wall. Here there were remnants of a slightly raised surface comprising a 0.11 m thick bedding layer of granulated cork held within a wooden lattice grid, topped by a thin (15 mm) surface layer of pink concrete, itself cracked and highly fragmented. The purpose of this feature is unclear, but it is possible that it represents the surface for some form of cottage industry undertaken within the house. The cork could have been an attempt to reduce vibration, which may have been partly responsible for the earlier damage to the underlying flags. Possibly contemporary with the laying of the concrete floor, the chimney was blocked with brickwork, and a gas fire installed. A blue and white patterned metal hearth plate lay on the concrete floor in front of it (Fig. 57).

The conversion of the two back-to-back houses to a single terraced house was accompanied by the addition of a 3 m long offshot room occupying the south-eastern side of the yard space to the rear; all five houses in this short terrace on Meadow Street had their offshots on their south-east sides. The room also extended 0.6 m into the yard of the adjacent house to the south-east, giving it an internal width of 1.8 m. There was no equivalent incursion into this house's yard, however. Between 1852 and 1890, the earlier cart passage on its north-west side had been narrowed from 2.7 m to just 0.7 m, allowing only pedestrian access, and the house was now flanked by a narrow structure of uncertain function built along the south-eastern side of the passage.

The offshot room, which also had stone flags on its floor, had a door in its north-west side giving access to the yard. There was a stone flag in the doorway, flanked by two blocks with doorpost sockets. The yard was surfaced with blockwork of grey tiles with diamond-patterned grooves. Overlying the tiles in the western corner of the yard there was a square stone slab, and there was a drain hole for a downspout in the eastern corner leading into a ceramic drain.

Figure 57 Area A, No. 92 Meadow Street terraced house, viewed from the south-west

Figure 58 The Meadow Street Hotel, viewed from the west

To the rear of the property was a tarmac surface, within which was a brick manhole. This manhole was at an angle to the surrounding properties, reflected by a similarly angled feature shown on the 1890 map. A slot cut through the tarmac revealed that the foundation of the rear wall of the offshot room was laid within a 0.5 m thick layer of made ground, overlying a black ashy layer sealing the natural clay, which was cut by a possible old land drain. There were two further walls, 3 m apart, beyond the rear of the property; that to the south-west corresponds with a wall shown on the 1890 map, while that to the north-east may be a wall shown on the 1953 map (Fig. 6).

Meadow Street Hotel

The Meadow Street Hotel was built by 1828 on the sharp corner of Meadow Street and Burnt Tree Lane (Fig. 1). The building was typical of a 19th century public house, although it was an early example, built before the public house boom later in the century. It was built when the economy was experiencing a deep depression after the end of Napoleonic Wars in 1815, and when the loosening of regulations on public houses was part of a wider trend towards freeing the economy from tariffs, duties and quotas. Parliament enacted a series of laws in the 1820s, including the *Alehouse Act* 1828, designed to widen access to the drink trade. In addition, the unpopular Tory government, formed in 1828, decided that liberalising the beer trade would be a popular move; this led to the passing of the *Beer Act* in 1830, which heralded the era of the public house.

As depicted in 1828 (Fig. 13), the building was originally L-shaped, but this had been added to by 1852 (Fig. 4). It was irregular in plan due to its corner position, and subsequently had further modern extensions to the rear. It was a two-storey building with attic and cellar. It was built of brick, although all but the rear elevations had been rendered, scored to imitate stone, and painted white. Both the cellar and the attic were located within the south-eastern half of the building only.

The principal façade of the pub was the south-west elevation fronting Meadow Street (Fig. 58). The north-west corner with Burnt Tree Lane was angled and contained the original raised lettering 'MEADOW. ST HOTEL'. All the windows had retained their original timber hung sashes, stone sills and flat arched lintels; the ground-floor window within the angled north-west corner was probably originally a doorway. To the rear of the building was a small yard; this had originally been larger, extending further to the north-east, with buildings at its far boundary which had probably served as toilet facilities.

The internal layout of the hotel had remained largely unchanged, although there had been alterations throughout the building during the mid–late 20th century, with the ground floor losing its original plan footprint due to the addition of modern extensions to the rear, to house toilet facilities. However, the general room layout had been retained. This comprised a central drinking corridor with rooms leading off either side. A small bar was positioned within the room to the south which would have been the 'public bar', while on the opposite side of the corridor were two further rooms, which had been opened up to one another, one serving as a 'tap room' and that to the rear as a 'smoke room'.

To the rear of the bar were the private quarters. A staircase led down to the cellar which was vaulted and contained two rooms, with a cellar drop to the south-west leading directly from Meadow Street. Adjacent to the staircase was a kitchen/parlour.

The staircase also led up to the first floor. This had retained the original footprint of the building depicted on the 1852 map, but the room layout had been altered by the insertion of a first-floor bathroom and toilet. There would have been at least four bedrooms, making up the hotel aspect of the public house. The attic contained a single room with a window to the north-west. Most latterly the upper floors of the pub had been reconfigured as private living quarters, occupied by the landlord.

Area H

By 1890 the Roscoe Place Works (as described above) had been demolished and terraced housing was in the process of being built along Roscoe Road, which had been laid out within the north-eastern side of the property (Fig. 5). By 1905 further housing had been built along new roads within the former property – Jobson Road, Jobson Place and Manell Terrace (Fig. 6). Between the maps of 1935 and 1953 the terraced housing on Roscoe Road was demolished, probably due to World War II bomb damage, and reverted to industrial use.

Roscoe Road

Nos 11, 13 and 15
A number of brick wall foundations were recorded along the north-western side of Trench 1, at a level 0.7 m above the earlier stone-capped drain (see Roscoe Place Works, above) (Figs 2 and 59). Two of the walls (1018 and 1019) represent internal party walls between the three north-eastern terraced houses shown fronting onto Roscoe Road on the 1890 map; their front walls lay outside the trench and their rear walls were not identified. Also recorded were the walls, parallel to the road, which flanked the flights of steps leading down into the houses' cellars.

No. 37
Trench 3 contained brick wall foundations most of which relate to a single terraced house on Roscoe Road shown on the 1890 map (Figs 2 and 60). These comprised the side and rear walls of the house, as well as those probably flanking the cellar access (although no steps were recorded). Short lengths of brickwork abutting the south-western wall probably represent the base of the chimney. The rear wall of the yard was also recorded, abutting which were the walls of the outside toilet block, which the 1890 map shows was connected to that belonging to the adjacent house to the north-west. Walls abutting the other side of the garden wall probably represent a similar outhouse belonging to the property to the rear on Jobson Road, built between 1890 and 1905.

Jobson Road

Trench 2 and adjacent Mitigation Trench A together covered an area of 420 m² flanking the south-eastern boundary of the Roscoe Place Works and, later, the south-western end of Jobson Road and the houses on either side (Figs 2 and 61).

The majority of the features recorded appear to relate to the cellars and foundations of the terraced houses at the south-western end of Jobson Road, first shown on the 1905 map. In front of the houses were pavements with regular sandstone kerbs; the tarmac road surface overlay layers of made ground and slag,

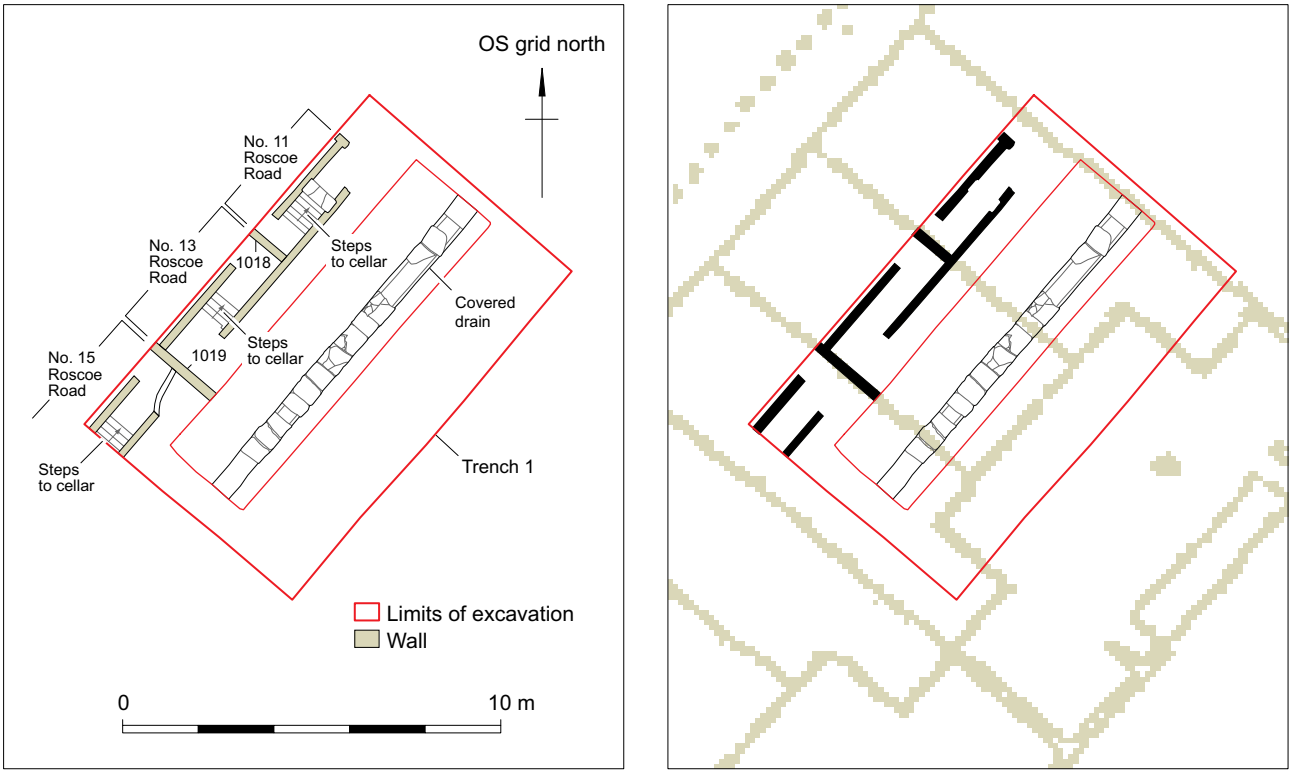

Figure 59 Roscoe Place Works, plan of Trench 1, with overlay on 1890 OS map (Sheffield Archive)

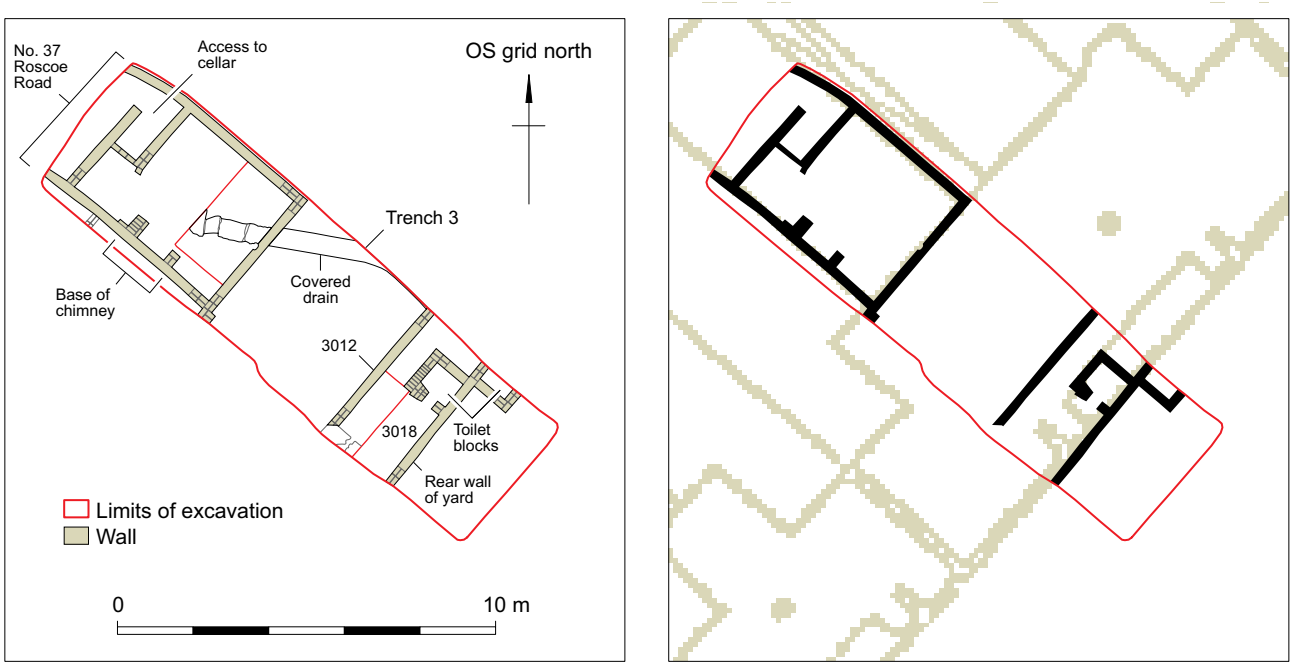

Figure 60 Roscoe Place Works (in Area G), plan of Trench 3, with overlay on 1890 OS map (Sheffield Archives)

Figure 61 Roscoe Place Works, plan of Trench 2 and Mitigation Trench A, archaeological features referred to in text

which in turn overlay parallel walls 1152 and 1153 (described above).

The 1905 map appears to show five houses on the south-east side of the road, between Manell Terrace and its dead end, but in subsequent maps up to 1953 only four houses are indicated. The full widths of Nos 33, 35 and 37 (as numbered in 1953) were recorded, and part of No. 39 (Fig. 62). On the other side of the road, the front walls of Nos 46, 48 and 50 were exposed.

The walls were built of a mixture of largely hand-made red brick, yellow fire-brick and irregular blocks of sandstone bonded with white lime mortar, much of this material probably recycled from the demolition of the earlier works buildings. The main external walls were substantial in their construction, and 0.5 m wide. However, a number of the internal dividing walls were somewhat crudely built; of note were a number of reused grindstones incorporated into the structure, such as two set upright in the back wall (1149) of the cellar of No. 35 (Fig. 63), and others laid flat on the walls of the No. 33 cellar (Fig. 64).

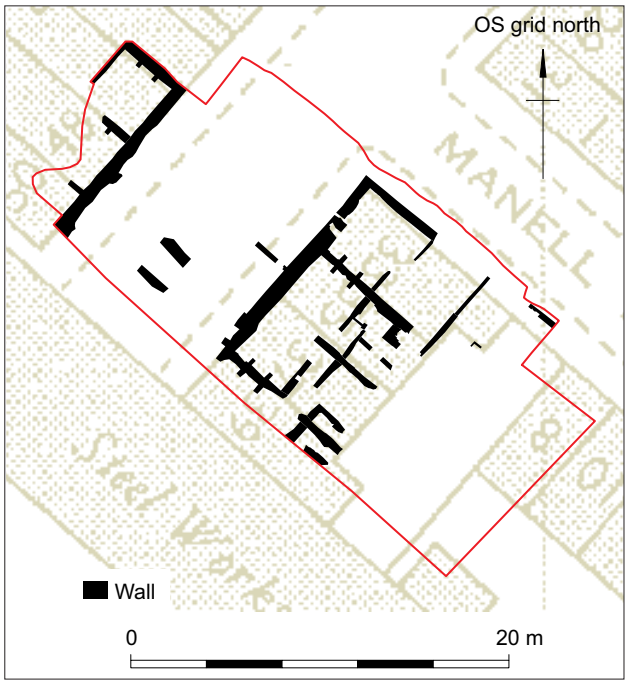

Figure 62 Area H, features in Trench 2 and Mitigation Trench A overlain on 1953 OS map (Sheffield Archives)

Nos 33, 35, 37 and 39

The brick-floored cellars at the fronts of Nos 33, 35 and 37 were exposed. The cellars measured internally 3.2 m square. The brick party wall (1212) between Nos 35 and 37 was only recorded towards the rears of their cellars where it flanked the flights of steps leading down into them (Fig. 63). It is possible that the rest of this wall had been knocked through to create a single, larger cellar; alternatively its demolition was contemporary with the demolition of the houses. The other two party walls, between the cellars of Nos 33/35 (1138) and 37/39 (1155), both had short lengths of brickwork abutting them on both sides, indicating the positions of the fireplaces in the houses' front rooms.

To the rear of the front rooms (and the flights of stairs leading down to the cellars), there were the ground-floor back rooms, within which there were small brick structures (1115 and 1114), 0.7 m wide and 2.3 m long internally, abutting the party wall of Nos 37/39; another (1130), in No. 35, abutted the party wall with No. 33. These faced the houses' rear walls. In No. 37 there were patches of sandstone flooring in the backroom and this small room. The rear walls were 8 m from the front wall. Outside the rear wall of Nos 33 and 35 there was an area of brick surface (1134).

Figure 63 Area H, cellars of Nos 35 and 37 Jobson Road, viewed from the north-west (note grindstones built into wall)

Figure 64 Area H, grindstones in cellar wall of No. 33 Jobson Road

Nos 46, 48 and 50
Only the cellars below the front rooms of the three houses on the north-west side of the road were exposed with the excavation area. These were similar in form and construction to those on the other side of the road, with sloping brick coal chutes in the centres of the front walls. It appears the cellars were linked by narrow doorways at the front ends of the party walls. These had subsequently been blocked using modern machine-made bricks.

Domestic materials

The manufacture on the site of cutlery and other items of domestic metalwork means that these items are well represented in the finds record, in many cases being recovered from the production sites, having probably never been used in a domestic context. Other classes of finds, such as pottery, glass, and clay tobacco pipes are likely to have been used in both domestic and industrial contexts. However, given the fact that the domestic housing on Jobson Road (in Trench 2 and Mitigation Trench B) and Roscoe Road (in Trenches 1 and 3) had been built on the site of the former Roscoe Place Works, reusing industrial materials in their construction, it is not always possible to ascertain in which type of contexts such 'domestic' material had been used.

Pottery

The site has produced 6,013 sherds of pottery, although it is notable that only 153 sherds came from the trenches in which the remains of domestic housing were uncovered. Almost two-thirds of the assemblage (by number of sherds – 3990 sherds, 66.4%) came from Mitigation Trench A, of which over three-quarters (3053 sherds, 76.5%) came from contexts within a 10 m wide area at the western end of the trench (falling within the triangular property (Area C) between Sudbury Street and Burnt Tree Lane) (Fig. 34); and of these, three-quarters (2,896 sherds, 75%) came from just one context – fill 2101 of feature 2010 (Fig. 36). This deposit has been fully analysed (Barker 2013) and is only summarised below.

The assemblage is wholly domestic in character, comprising a range of wares typical of 19th century working-class households. Most of the vessels are in refined white-bodied earthenware, and decoration is frequent, including all the common 19th century types, particularly the most popular printed patterns of the day – 'Willow', 'Asiatic Pheasants' and 'Broseley'. This reflects the state of the ceramics market, with standardised forms and decoration, in a range of ware types becoming increasingly widely available, and cheaper, from the late 18th century due largely to the growth of the pottery industry and improvements in communications. The national dominance of the north Staffordshire potteries is clear from the assemblage, but so too is the growing importance of regional industries, such as that in Yorkshire, producing Staffordshire-type wares.

Clearance deposit
The pottery from context 2101 stands apart from the bulk of the assemblage as a discrete entity with a high degree of uniformity in its range of ware types, vessel forms and types of decoration (Table 1). This material, most of which dates stylistically to between the 1850s and the mid–late 1870s, is indicative of a 'clearance group' (Pearce 2000, 144–5), comprising household items deliberately discarded *en masse*, usually in a single episode, with comparatively little residual or intrusive material, and sherds displaying little post-deposition abrasion or fragmentation.

A minimum of 367 vessels are represented in this deposit, overwhelmingly of white ware although there is a significant proportion in bone china, and smaller quantities of the other main mid–late 19th century ware types. Unsurprisingly, both Yorkshire and Staffordshire pottery manufactures can be identified from manufacturers' marks on some of the material. The vessel forms can be broken down into broad function groups (although a correlation between form and function cannot always be made), including tea-drinking, other drinking, dining, food preparation and serving, storage and health/hygiene. A small number of miscellaneous forms are also present, including ceramic figures, toys and flower pots.

Much of the assemblage is decorated, with the white wares bearing the full range of decoration types

Table 1 The pottery from Progress Works feature 2010 (context 2101)

	Teabowl	Cup	Saucer	Teapot	Bowl	Milk jug	Jug	Dish	Dish cover	Mug	Plate (dinner)	Plate (side)	Soup plate	Serving dish	Stand/serving dish	Toy (serving dish)	Baking dish	Pudding basin	Pudding cup/mould	Porringer	Potted meat dish	Paste pot	Butter pot/tub	Egg cup	Candlestick	Chamber pot	Ewer	Basin	Preserving jar	Jar	Bottle	Stew pot	Cover	Loaf pot	Milk pan/dish	Flower pot	Flower pot stand	Figure	Number disk	unid.	Total
Pearlware	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
under-glaze printed	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
shell edge	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
under-glaze painted	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
over-glaze painted	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Whiteware	1	-	3	-	3	-	1	-	-	3	-	7	1	1	-	-	1	4	1	1	2	1	-	-	-	1	1	2	2	5	-	-	-	-	-	-	-	-	-	41
under-glaze printed	-	13	17	-	3	1	11	4	1	6	19	19	3	3	1	-	2	-	-	-	-	1	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-	8	115
shell edge	-	-	-	-	-	-	-	2	1	-	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
under-glaze painted	-	2	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	3	9
over-glaze painted	-	1	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	4
sponged	-	1	1	-	2	-	-	-	-	5	1	-	-	-	-	-	2	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	14
industrial slipware	-	-	-	-	12	-	1	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	1	22
coloured glaze	-	-	1	1	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
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White Granite	-	2	1	-	-	-	2	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	9
Yellow ware	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
industrial slipware	-	-	-	-	1	-	2	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	7
moulded	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Rockingham	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Red ware	-	-	-	1	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	6
Drab ware	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Egyptian Black	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Blue stoneware	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Porcelain	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
over-glaze painted	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	4
moulded	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Bone china	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
under-glaze printed	-	8	7	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
over-glaze painted	-	13	13	-	-	1	-	1	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31
mould-applied	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
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Soft paste porcelain	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Parian	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	3
Pipe clay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1
Brown salt-glazed stoneware	-	-	-	-	-	-	1	9	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	2	1	2	4	-	-	-	-	-	2	23
Grey stoneware	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	-	-	-	-	-	-	-	-	-	5
Misc. stoneware	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
Coarse earthenware	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	4	1	1	-	-	1	8
Total	2	44	45	8	25	4	32	19	3	25	23	29	4	7	1	1	9	4	2	1	3	2	1	1	3	6	1	4	2	9	6	1	2	4	4	1	1	6	1	21	367

in use during this period. The most widespread are printed decorations, found on 135 vessels, of which the most common patterns are the 'Willow' and 'Asiatic Pheasants', in blue and light blue respectively, both of which were universally popular at this time and used almost exclusively on table wares. Other popular patterns represented include the scenic patterns 'Albion', 'Gem', 'Eton College' and 'Wild Rose', all of which also occur only on table wares. A number of pieces of tea-ware are decorated with an oriental temple landscape pattern, 'Broseley', which was the dominant pattern used on tea wares during the 19th century. Of particular local interest is a sherd bearing a green printed design with the partial inscription '[ ]2th 1864.' which features a scene commemorating the great Sheffield flood, or Dale Dike dam disaster, of 12 March 1864, possibly an example of the design depicting 'The Bridge at Hillsbro / All destroyed except one arch' (Griffin 2012, 142, nos 319 and 320).

Glass

A total of 440 fragments of glass was recovered from the site, of which 64% is from containers such as bottles or jars (Harvey 2009), the rest being window glass, and lampshade, tableware and decorative fragments.

There are 31 beer, wine, spirit, soda or water bottles, many of which had been made by local manufacturers. They include 'S. WARD & Co' beer or soda bottles, one from Trench 3, and another with an address of '262 Earsham Street', from the fill of the cellar of the Hoyle Street crucible furnace. Interestingly, S.H. Ward is listed as a 'brewers, wine & spirit merchants' in the 1893 Kelly's Directory, 1919 White's Directory and 1925 Kelly's Directory, but there is no mention of Earsham Street (in Sheffield), except in connection with Albert Lighton, a Mineral Water Manufacturer. It is possible therefore that these works became part of the Wards company sometime in the early 20th century.

Other Sheffield makers include a beer bottle from Truswell's Brewery, in the cellar of the house on Burnt Tree Lane (Trench 9), and a Meadowcroft beer bottle, a Revett & Co mineral water bottle, a 'Leonard Goddard' mineral water bottle and a bottle labelled 'Bradley & Co' all recovered from a single trial hole at the Titanic Works. Two crown finished water bottles embossed 'TOWER TABLE WATER' were retrieved from Cellar 2 at the Titanic Works. All these companies are listed in trade directories as operating in Sheffield in the 19th and 20th centuries, each within a few kilometres of the site.

National brands are also represented, such as a beer bottle embossed 'JOHN SMITH'S / TADCASTER' which was recovered from the fill of the cellar of No. 33 Jobson Road; John Smith's brewery, founded in 1847 in Tadcaster, North Yorkshire, is still in business today. Other identifiable brands are of companies founded in the 20th century. Older looking wine or beer bottle fragments were observed infrequently throughout the assemblage, with potentially free blown or heavily patinated fragments being found, for example, in the fill of the cut for wall 3012 (Trench 3; Fig. 60), possibly shown on the 1816 Fairbank plan (Fig. 10) of the Roscoe Place Works (see above), and within feature 2010 and well 2006 at the Progress Works (Figs 34 and 36).

Eleven comestible containers were recovered, including two Henderson's Relish bottles of possible 19th or early 20th century date, although the brand is still in production today. There was also a moulded jar, which would have contained cockles or mussels, embossed with the name 'LA Parsons', a company set up in 1947 to take advantage of seafood pickling opportunities in Burry Port, Wales.

There are 14 medicine bottles, many of which have plain prescription or bead finishes. One small jar is embossed with 'MACLEAN BRAND / STOMACH POWDER' and would have contained a mid-20th century product used to ease 'heartburn, flatulence or acidity' (History World website). A complete ribbed cobalt blue poison bottle, recovered from the Titanic Works, is machine-made and likely to be of 20th century date.

Clay Tobacco Pipe

A total of 602 clay tobacco pipe fragments were recovered from the site, comprising 111 bowls, 477 stems and 14 mouthpieces, most of them of 19th century date but a few being earlier (White 2009). The earliest, a bowl stamped with a single letter 'H', probably dates to *c.* 1690–1730; it was residual in the cellar of the Hoyle Street crucible furnace. The two others with stamped marks can be attributed to Fiolet, a prominent pipe producer from France, and are of 19th century date. Moulded marks appear on three fragments. The earliest consists of the initials 'JP' on either side of the spur of an early–mid-19th century bowl; the other two are on mid–late 19th

Chapter 4
Discussion

Chronology, Morphology and the Ordering of Space

The Development of the Site

During the course of the 19th century, the area of the site changed from enclosed farmland beyond the north-western edge of the town of Sheffield, as depicted in Fairbank's 1795 *A Map of the Parish of Sheffield*, to a densely settled industrial landscape, now closer to the town's centre than to its rapidly expanded limits. The development of the site can be clearly seen in the series of maps spanning the 19th and 20th centuries (Figs 3–6). It was not a simple progression, however, from rural landscape to industrial cityscape. While industrial developments and changing patterns of housing meant that the character of the site, both as a whole and in its specific locales, was continually evolving, some features of the physical environment remained unchanged for long periods.

The most enduring features surviving from the late 18th century were the lines of some of the roads, such as Burnt Tree Lane curving through the south-west end of the site and Infirmary Road (originally Walkley Road) defining the site's north-eastern end, as well as a number of field boundaries. Burnt Tree Lane, in particular, whose name perhaps evokes its originally rural setting, survived the large-scale imposition of a rectilinear grid of streets, as did the line of the field boundary running north from near the bend in the lane (Fig. 3). Together these two features created the awkward angular corner at the rear of the Hoyle Street Works which continued to influence the disposition of housing and industrial premises right up until the recent redevelopment of the site.

The Fairbank map of 1808 shows that the new street grid was already being planned at the start of the 19th century, with parts of Hoyle Street and Meadow Street already laid out (Fig. 3), to be followed, by 1828, by William (Malinda) Street and Suffolk (Sudbury) Street, and by 1890 by Roscoe Road. So when, in 1805–6, Joseph Shaw and Robert Jobson built the Roscoe Place Works on farmland beyond the limits of the town, the planned expansion of the town was already in motion, and they picked what would then have been a prime location beside a junction on the main road leading north-west along the Don valley. The River Don and its tributaries had provided power for Sheffield's steel mills in the early post-medieval period, and water power reached its high point in the late 18th century, although continuing in use through the 19th century (and even into the 20th century) (Ball *et al.* 2006). By the 1780s, however, steam power was playing an increasing significant role, initially supplementing water power rather than replacing it, but also enabling the steel industry to expand away from the town's watercourses. Within a decade much of the land surrounding the Roscoe Works had been sold, both for industry – such as for William Hoole's crucible furnace established by 1816 – and for housing; by 1830 there were rows of houses along Infirmary Road, Hoyle Street, Meadow Street and Burnt Tree Lane.

The late 18th century residential and industrial expansion of the town was facilitated and financed by a system of leases, by which the large landowners divided their properties into building plots for which they levied a ground rent, with subsequent developers then charging their own increased rents for their new buildings, with further additional tiers of subletting above that. It was a system well suited to the independent little mester craftsmen who rented space within the larger works buildings (South Yorkshire Historic Environment Characterisation Project). A notable feature of these developments, however, is the absence of any apparent zoning, with industrial works, often comprising buildings around central courts, and high-density residential properties, often built back-to-back around domestic courts, vying for space within the same street blocks. This proximity clearly had some advantages both for the industrialists and their workers, with people living within walking distance of their work place, but the predominantly back-to-back housing was very cramped and the concentration of steel furnaces and related industries must have made this a noisy and noxious place to live.

When Henry Hoole bought the Roscoe Place Works in the 1880s, he moved its production to his nearby Green Lane Works (Morley 1997, 119) and sold the Roscoe Place site in 1888. One motive may have been that the land the works had occupied now had far greater value for housing; by the turn of the century the former works site had become almost entirely residential, with new houses along Roscoe Road, and the recently laid out Jobson Road, Jobson Place and Manell Terrace. By 1890, therefore, the

main industrial premises within the site were concentrated within a relatively confined core area, comprising those works flanking Malinda Street (Titanic Works, Malinda Works and the (later-named) Australian Works), and the Hoyle Street Works and Progress Works to the immediate south-west (Fig. 5).

While there were developments within some of the works premises during the first half of the 20th century, this balance of housing and industry remained largely unchanged until after the World War II. Sheffield suffered heavily from German bombing raids in December 1940, and post-war reconstruction left the site looking very different, as shown on the 1953 map (Fig. 6). All the housing on the south-east sides of Roscoe Road and Sudbury Road was demolished, as were all the back-to-back houses on Meadow Street and Burnt Tree Lane. Within the site only the terraced houses on Jobson Road, Manell Terrace and Meadow Street remained. These areas of housing were replaced by an array of steelworks, and tool and cutlery manufacturers, as well as other light industrial premises, and their spread continued in the second half of the 20th century, the small islands of housing ever-shrinking and eventually disappearing from the site by the 1970s, leaving the site with a wholly industrial and commercial character.

The Organisation and Development of the Works Yards

During the industrial revolution, the earlier mode of production by independent skilled craftsmen working from their homes or workshops continued alongside that by factory workers, the two often complementing each other. This was particularly the case in Sheffield's cutlery and tool trades, where the tradition of little mester production involved different parts of the manufacturing processes being undertaken by different specialist artisans, although often grouping their workshops together. The little mester system continued even after the establishment of the larger works, such as the Hoyle Street Works, which were less factories than aggregations of rented out craftsmen's workshops, set alongside the steel producing furnaces, and exploiting the power of steam (Adams 2012, 15).

The late 19th century engraving of *Messrs. George Fisher and Co.'s Works, Sheffield* (Fig. 20) shows the Hoyle Street Works' pedimented office building looking out onto Hoyle Street, but giving access to what appears to be an enclosed and well-regulated and integrated industrial complex. Although largely hidden from view, the industry and organisation are clearly evident in the smoke rising from the works' tall chimney stack and from the furnaces, forges and other buildings which ring the yard. Such sanitized and idealised depictions of industrial works, in which the workers are notable for their almost complete absence, are a common feature of Victorian desire to represent their industrial concerns as solid and respectable institutions.

In many respects the arrangement of the Fisher & Co. property was typical of late 19th century works yards, but this was something that had evolved over time. At the earliest and largest of the works within the development site, Roscoe Place, the layout of the original buildings indicated that it had not been planned with a central yard design (Fig. 4). Instead, the long central building split the property into two parts, eventually creating two enclosed yards. Only the yard to the west was directly accessed from Walkley Road, through a cart passage leading from a small forecourt; that to the east was accessed through a second, internal gateway. Such multi-courtyard works premises are found on greenfield sites starting in the 18th century (Belford 2004, 51–4).

Central yards, however, were typical of 19th century works associated with the metal trades in Sheffield (Wray 2000, 46), and their development can be seen at all the other works investigated on the site. In 1816 William Hoole's works consisted solely of the furnace built against the south-west side of a large plot of land accessed through a narrow entrance to the east on Hoyle Street (Fig. 10). By 1828, the plot had been divided into two, with the furnace now lying against the rear boundary of the otherwise empty north-western property, accessed from narrow gateway near its eastern corner on the recently laid out William Street (Fig. 13). By 1852, however, there were new buildings around the sides of the property, looking into what was becoming a well-defined walled yard, now with its entrance in the centre of its Malinda Street frontage (Fig. 4). By 1890 the yard was completely surrounded by works buildings, increasingly encroaching on the yard space, and access was now gained through a cart passage (Fig. 5).

A similar pattern is seen at the larger Hoyle Street Works, which developed from a number of small buildings, only some of them connected in 1832 (Fig. 19), arranged around the sides of the yard, including the crucible furnace and possibly also the cementation furnaces at the far back of the property. As at the Malinda Works, it was in the period between 1852 and 1890, when the buildings were incorporated within long ranges, that the works' imposing Hoyle Street frontage and arched entrance were built.

This courtyard arrangement had obvious practical benefits, in that buildings housing different stages in the production and manufacturing processes were all easily accessible from each other, facilitating the movement of people, materials and products. It also

enabled power to be more easily distributed within the works. The tall chimney shown on the engraving of the Hoyle Street Works indicates the central position of the main boiler producing steam power to drive the grinding wheels and other machinery, and the excavation uncovered a below-ground housing for the transmission of that power across the yard to the north-east range. By the end of the century such steam boilers were being replaced by more powerful gas engines, and electric power.

Other less functional motivations for the development of courtyards have also been suggested. Paul Belford (2004) has argued that in many respects such industrial premises mimic the courtyard layouts of both medieval monasteries and university colleges, suggesting on the one hand order and control, and on the other rational intellectual and scientific progress. In addition to the courtyard 'cloister' or 'quad', the works have prominent entrance gates controlling access, and tall chimneys which, like steeples or bell towers, were visible from outside the perimeter walls.

The appropriateness of this mixed symbolism for the new technology of crucible steel production is reflected in the wording of a 1760 partnership agreement between John Love and Thomas Manson of Sheffield to produce crucible steel, which talks of 'the Art, Trade, Mystery and Business of Running and Casting Steel' (Sheffield Archives, Tibbitts Collection, TC200 (4 December 1760)). The 'mysteries' of steelmaking remained closely guarded secrets, protected within these enclosed industrial cloisters. Steelmakers were extremely protective of their recipes, '...considerable secrecy and controversy surrounded most new developments. Large numbers of patents were filed and industrial processes were carefully guarded as the inventors strove to establish international recognition and create wealth' (Keown 1985).

The idealised image of the organised works yard, however, is in marked contrast to the more squalid courts behind the cramped tenement houses, containing the shared toilet blocks ('privies') of the back-to-back dwellings, and accessed by narrow alleys ('ginnels') without imposing entrances.

Over time, constrained by their boundaries, these works buildings could only expand inwards, continually reducing the size of the yards and their usefulness as working spaces. At some point after 1850 a free-standing workshop building was built in the wider, south-eastern end of the yard of the Hoyle Street Works, just inside the entrance, but it had been demolished by 1905. Eventually, the entire north-western end of the yard was covered over (Fig. 33).

Conditions of Work

While the publicity engraving of the Hoyle Street Works was designed to show the industry in its best light, the reality of the working conditions in the Sheffield steel industries was very different, and in the second half of the 19th century Sheffield became centre of militant union activity. In the engraving a few workers can be seen active in the yard, but the interiors of the furnace buildings and workshops are out of sight. Such workplaces were inherently dangerous, both from the hazards of the furnaces – molten metals, heat and fumes – and from the other metalworking trades and associated industries.

One condition, referred to as 'Grinder's Asthma', suffered by the Sheffield cutlery workers in the mid-19th century, was described by a local doctor, Dr. Knight (quoted by Friedrich Engels in his *The Condition of the Working-Class in England in 1844* [1892]):

> *They usually begin their work in the fourteenth year, and if they have good constitutions, rarely notice any symptoms before the twentieth year. Then the symptoms of their peculiar disease appear. They suffer from shortness of breath at the slightest effort in going up hill or up stairs, they habitually raise the shoulders to relieve the permanent and increasing want of breath; they bend forward, and seem, in general, to feel most comfortable in the crouching position in which they work. Their complexion becomes dirty yellow, their features express anxiety, they complain of pressure on the chest. Their voices become rough and hoarse, they cough loudly, and the sound is as if air were driven through a wooden tube.* (Engels 1892, 203–4)

One response to such dangerous working conditions, and the failure of the political and social reforms sought by Chartist movement of the 1840s, was the so-called 'Sheffield Outrages', a series of explosions and murders committed in the 1850s and 1860s by a small group of militant trade unionists, which led in 1867 to the Government appointing a Royal Commission of Inquiry. In 1871 the legal status of trade unions was recognised following the passing of the *Trade Union Act*.

There had been few restrictions on the employment of children until the Children's Employment Commission of 1862, which dealt mainly with the iron, steel and cutlery industries of Sheffield (HMSO 1863). However, small workshops and home workers (which included most people in the cutlery industry) were not covered by laws until 1878.

Even after that date, however, many of the old works premises remained hazardous places. The dangers of the increasingly cramped conditions at the Progress Works, for example, where by 1890 little remained of the already small yard of the earlier Milton Works, were tragically demonstrated by events

on 14 December 1921, when a fire broke out in one of the little mester cutlery workshops, owned by a Frederick Dyson. As reported in the *Sheffield Daily Telegraph*, the fire may have been caused by a spark from an emery wheel igniting xylonite (celluloid) dust. Celluloid, used to make cutlery handles, is highly flammable and the fire spread rapidly through the workshop, completely destroying its upper floors. The four-storey building, which fronted onto Sudbury Street, was described by the newspaper as 'a veritable death trap', having only two exits, both into the yard behind:

> *The Progress Works in Sudbury Street are typical of many in Sheffield. It contains four storeys, which are reached by means of narrow wooden staircases. The windows are of the latticed type, close together, and afford little opportunity for escape for anyone trapped in the building. An old structure, and containing a great deal of highly flammable material, it is not surprising that once the flames started they spread with great rapidity, and that in a very short time the occupants of the building were running here and there almost choked by the xylonite fumes and blinded by dense smoke* (*Sheffield Daily Telegraph* 16 December 1921).

Workers jumped out of the windows into the yard, or escaped across the roofs of adjacent buildings, or climbed down impromptu fire ladders rigged up by local residents on the street. The newspaper reported that 'in view of the terrific rapidity with which the flames spread, and the fact that a large number of workpeople were engaged there at the time of the outbreak, it is surprising that most of them succeeded in escaping' (*Sheffield Daily Telegraph* 15 December 1921). Four, however, died, three of them in the flames and one later, having fallen down the stairs in the escape. They were named as Ivy Ibbotson, aged 16, a pen and pocket knife wiper; Frederick Foster, aged 57, a table-knife hafter; Tom Clark, aged 62; and his son Thomas Clark, aged 39, who left a widow and seven young children.

Technological Aspects of Production

Furnace Development

The industrial buildings (and building remains) on the site whose functions are most clearly evident were the five crucible furnaces, represented in all cases by their cellars, but in one case also, at the Titanic Works, by a surviving furnace building with its two chimney stacks. While various cartographic and documentary sources indicate the changing uses to which some of the other buildings were put, in few cases was this evident in either the archaeological remains or from the building recording.

No 18th century crucible furnaces are known to survive. The earliest example on the site was that built by William Hoole, at some date before 1816; the last was that represented by Cellar 3 at the Titanic Works which is considered to date from the 1920s–30s, well over a century later. What is remarkable is how few differences there were in the essential form of the five furnaces, reflecting an industrial process which had likewise remained largely unchanged. The functions of the different parts of crucible furnaces, and the stages of crucible steel production, have been described above, and it is clear that despite the many other technological, social and economic changes that took place during the 19th century, the work of a 20th century melter, puller-out or teemer would have been easily recognisable to a crucible furnace worker from a century earlier.

It is possible that four of the five furnaces recorded had ground-floor chambers behind the stacks, although the evidence was largely circumstantial given the general lack of surviving structures above the cellars. A sectional view of a crucible furnace from *Cassell's Cyclopaedia of Mechanics* (Fig. 7), shows such a 'chamber behind the stack for drying crucibles, storing charcoal, etc.' (Hasluck 1900, 39). A similar design is found in the furnace at the Abbeydale Industrial Hamlet, Sheffield (Fig. 1), a rural, stone-built structure, as opposed to these red-brick urban furnaces, and in the crucible furnace at Darnall Works, Sheffield.

There were nonetheless a number of differences. Significant later modifications involved the creation of additional space in the furnace cellars. One such feature, found in the subsequent enlargement of the Hoyle Street Works furnace (between 1852 and 1890), but apparently not in its original layout (nor in William Hoole's furnace), was the construction of a 'passage' space at the front of the cellar between walls 2024/5 and 2026 (Fig. 21). How this extension was vaulted is not known, and it is unclear how many access points there were between the passage and the main part of the cellar – at least 6.6 m of the dividing wall was unbroken. In the later Cellar 1 at the Titanic Works, this division of space between the two parts of the cellar, both of which were vaulted, was less clear, comprising just wide brick columns with three arches between them (Fig. 45). By the time of Cellar 3 at the Titanic Works (the latest cellar), this division of space has all but disappeared, the cellar containing just two narrow brick columns supporting its single-vaulted ceiling (Fig. 47).

A more notable development was the rare double-stack furnace above Cellar 2 at the Titanic Works (Figs 40 and 42). This design may have been chosen because, unlike all the other furnaces recorded, which

were positioned along the rear boundaries of the works properties, this was located on the street side. The furnace had to be accessible from the yard, and rather than having a single long stack along the street frontage, one of the two shorter stacks backed onto the entrance passage and the other onto a wide unoccupied area to the south-east of the works.

There were also some differences in scale – William Hoole's furnace originally had just six melting holes, while the double-stack furnace above Cellar 2 in the Titanic Works had 12, and the expanded Hoyle Street furnace had up to 18. It is likely, however, that the scale of crucible steel production within the development site was constrained by the limited availability of space within these works properties. When in the early 1870s the Sandersons expanded their Darnall Steel Works, on still-open land to the east of Sheffield (Fig. 1), they built new furnaces containing 180 melting holes (Barraclough 1984, 104–6; Harman and Minnis 2004, 200). Such large-scale production is likely to have had a significant impact on the viability of the smaller works within the confines of the town, even those like the Titanic Works which managed to fit three furnaces, containing a total of 34 melting holes, within the relatively small Malinda Street property.

Another development was the addition, in variable arrangements, of ancillary cellar rooms in the later furnaces. William Hoole's furnace had no ancillary cellar rooms (Fig. 12), and the same appears to have been the case at the Hoyle Street Works (Fig. 21), and it is likely that other essential process, particularly crucible-making, were undertaken at ground-floor level. The dimensions of the Hoole furnace as depicted in 1816 suggest that from the start there had been additional rooms at either end of the melting room. The situation is less clear at the Hoyle Street Works due to later truncation, although on the 1890 map the furnace building extended well beyond the footprint of the cellar, and included a small offshot room at its southern end.

In contrast, all the furnaces at the Titanic Works had small rooms leading off the main cellar (as well as other small storage spaces). The largest of these was at the end of Cellar I (Fig. 45), although its later use as a World War II air raid shelter had led to the removal of most of its internal features. Some fittings, however, remained in the ancillary rooms accessed from the eastern corner of Cellar 2, which had a large stone-topped table positioned below a large lightwell (Fig. 42). The clearest indication of the function of these rooms for crucible-making, however, was found in Cellar 3 (Fig. 47). A doorway at the north-west end of the cellar's front wall led directly into a cast iron puddling tray, for mixing the clay used for making crucibles, which occupied over half of the room's floor area. At the end of the room, where there was a lightwell, there were two iron-topped tables against opposite walls, the larger with a stack of grindstones below, indicating the use of these rooms also for storage.

Other Buildings

While the Titanic Works included three furnaces within a relatively confined space, the single furnace in the Hoyle Street Works was located to the rear of a larger plot of land which it shared with a range of buildings undertaking other related industrial and manufacturing processes. Although little of the other 19th century buildings at the Hoyle Street Works survived within the excavated area, the engraving shows that the works included cementation furnaces in the north-east range, and it appears that part of the base of one of the (four) furnaces was exposed in the excavation (Fig. 21).

The engraving also shows a building in the south-west range with grindstones stacked outside suggesting that it contained the grinding rooms (or 'hulls'), where knives (and other edge tools) were shaped, sharpened and polished using stones of varying coarseness. The grindstones, set in water-filled troughs to cool the wheel and reduce dust, would have been turned by leather belts, connected to shafts powered by a steam engine (Beauchamp 2002, 55). The grinders, who from the early 18th century had formed a separate specialist craft within the industry, sat above and behind the wheel, which rotated away from them.

Contemporary trade directories indicate the range of related specialist trades undertaken within the works. However, many of the recorded standing buildings across the whole site were of relatively modern conversion or construction, containing few if any structural features to indicate particular industrial functions.

The surviving cast iron columns on the ground floors of two buildings (B1 and B2; Fig. 31) in the south-west range of the Hoyle Street Works reflect the fact that they were open-fronted in the 19th century, providing unrestricted movement of raw materials and finished products. Building B1 had two large chimney breasts in its rear wall, probably for large industrial hearths, and concrete floors which would have provided a degree of fireproofing if industrial hearths were in use; open-sided forges were known to be present around 1860 at the Cyclops Works, Sheffield. The large number of windows overlooking the yard in the floor above, and the presence
of a taking-in door in the rear (street-side) wall (Fig. 32) suggest that this area was used as a warehouse/packing shop; the lack of evidence for power suggests it was not a workshop.

Building B2, however, had an integral belting slot in one corner that continued up to the site of a former electric motor on the roof providing power to machinery on the ground floor.

Industrial Infrastructure

The excavation at the Hoyle Street Works in particular uncovered important elements of the works' industrial 'infrastructure'. While some of the features excavated could not be readily identified, due to almost two centuries of building and rebuilding, the excavation demonstrated some of the complex workings and inter-relationships required in the operation of a 19th century steelworks. These included the base of a large boiler room, probably containing a Lancashire boiler, and other boiler bases and flues and a possible chimney base. There was also the brick housing for a probable belt drive running below the works yard from an engine on the south-east side to power machinery in the north-east range (Fig. 21).

Other infrastructure features recorded included the iron and timber possible crane base close to the Burnt Tree Lane boundary wall of the Hoyle Street Works, and the remains of a weighing machine uncovered during the watching brief beneath the cart passage at the Titanic Works.

Also at the Hoyle Street Works was a silt trap for the water supply. With industry having expanded away from the river valleys from the late 18th century, a reliable supply of water was essential for the running of the boilers and many of the production processes, and in 1852 there were still two reservoirs adjacent to the Hoyle Street and Malinda Street Works (Fig. 4). The dangers inherent in the running of large steam boilers, however, are reflected in the relative frequency with which boiler explosions were reported. On the 25 August 1855, for example, *The Spectator* reported that there had been two fatal boiler explosions that month in Sheffield, at the Tower Mills and the Hartford Steel Works, Wicker.

The importance of removing silt from the water was highlighted by another explosion, on 1 November 1899, of a large Lancashire boiler at the Southern & Richardson cutlery manufactures on Doncaster Street, just 120 m to the south-east of the Hoyle Street works (Fig. 1). One of the boiler's fire boxes was blown out at the front, instantly killing the three workers in the fire-hole, while four of the six men and boys working in a goffing shop (where blanks were struck) on the other side of the yard were killed by flying brickwork from the flues and by scalding steam and water; many others were injured. The explosion was caused in part by the failure of a water gauge that was so clogged up with mineral deposits that it gave an incorrect reading (http://www.chrishobbs.com/sheffield4/sheffieldboilerdisaster1899.htm).

The *Sheffield and Rotherham Independent* reported the incident on November 2, 1899, noting that:

> *Sheffield well water is, as is well known, heavily charged with ochre, and lime, and other matter, which are regularly deposited on the plates inside the boiler. This necessitates frequent cleaning of the inside. As the deposit eats into the metal, every fresh cleaning means a thinning away of the plates where a deposit has been. The result of this on the inside of the boiler is that 'pits' or depressions are left where the deposit has been cleared away, and the strength of the boiler to resist pressure is proportionately lessened.*

The Residues of Production

In addition to the structural remains recorded during the archaeological excavations and building recording, a range of artefacts relating directly and indirectly to aspects of steel production and associated manufacturing were recovered, along with samples of industrial residues. The most significant sources of these materials were the intact cellars at the Titanic Works, some of which had simply been abandoned when the furnaces had been decommissioned. A watching brief was maintained as the cellars were emptied of the accumulated debris, but although much of the contents were photographed *in situ* they were not subject to archaeological excavation and the finds were not recorded.

Although 32 kg of crucible fragments were recovered from the excavations, no complete crucibles were found. Due to the nature and routine operation of the crucible steelmaking process, used crucibles were typically discarded away from the furnace, and complete used crucibles are seldom, if ever, recovered from what could be described as their primary context, ie, the melting hole of a crucible furnace. However, fragments of used crucibles are an extremely common find in made ground contexts on former industrial sites within Sheffield (Mackenzie 2013).

The materials and equipment used for the making of the crucibles were found, however. In Cellar 3, there was a pile of clay in the small compartment behind the stack, accessed via the vaulted passage at the northern corner of the cellar; the clay may have been stored here until it had broken down to the correct consistency for making crucibles. There was also a large pile of clay and sand in the north-western half of Cellar 2, on one side of the low brick partition and below the central blocked lightwell or chute; nearby were a number of the wooden flasks used for

making the crucibles. Other objects found among the debris in Cellar 2 included a crucible lid, and numerous 'cheeses' on an iron-topped table at the north-east end (Fig. 65), as well as wooden formers for manufacturing dozzles, and the elliptical templates – looking like oval barrels – around which the ganister linings of the melting holes were rammed (Fig. 66). On the stone-topped table within the ancillary room were an iron ring used to form the rim of the crucible, and a curved iron plate, pairs of which were used to lift the crucible off the stand.

All the recovered crucible fragments were of similar size – 190 mm tall and with an internal diameter of 120 mm at the opening and 80 mm at the base (1.4 litres), with an average wall thickness of 25 mm (Doonan 2009). The lids recovered, made of the same material, were flat on their undersides and convex on top, with a maximum thickness of 40 mm, and diameters extending on average 20 mm over the rims of the crucibles; some showed a slagged impression where they had vitrified and become attached to the top the crucible.

Only a small number of crucible fragments had traces of any metallic residues, in the form of small spots of corroded metal adhering to their slagged inner surfaces (Mackenzie 2013). Only one fragment, from feature 2010 (context 2101) at the Progress Works (Fig. 34) provided a sample of analysable metal and this proved to be plain carbon steel, with approximately 1.0 to 1.1% carbon and no detectable alloying elements present. This is not surprising as carbon steel accounted for the majority of crucible steel production in Sheffield until the 20th century. Archaeological evidence of early alloy steelmaking in 19th century Sheffield is extremely rare, and only one site in Sheffield, the former Osbourne steelworks, has produced evidence of alloy crucible steel (Mackenzie 2009).

Few other objects and materials were found relating directly to the production of crucible steel. A charging pan and a number of ingot moulds were recovered from the site, and one ash pit in Titanic Works Cellar 2 was filled with iron ingot mould rings. A number of apparently improvised tools used in the metallurgical process were found, covered with a layer of built-up of slag and iron, but only small amounts of metal were recovered during the excavation. Five shoes, which had leather uppers but wooden soles designed to protect the workmen's feet from the intense heat of the furnace, were found in the two storage recesses in Cellar 2.

The main evidence for other manufacturing processes were the numerous grindstones, found both *in situ* and redeposited or reused within industrial and other contexts. Some, for example, had been used to block the melting holes of Cellar 1 at the Titanic Works (Fig. 44) when the furnace was

Figure 65 Stacked 'cheeses' in Titanic Works Cellar 2

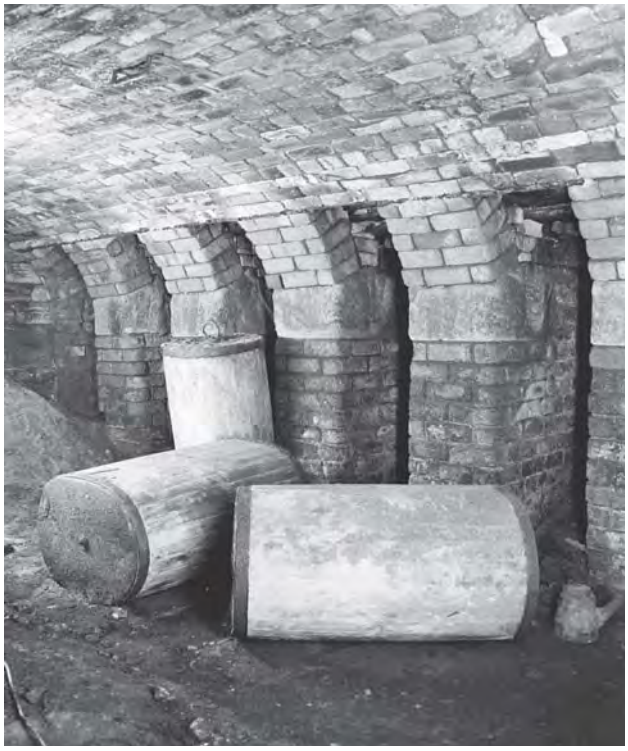

Figure 66 Three elliptical templates for the linings of melting holes in Titanic Works Cellar 2

Figure 67 Grooved grindstone

decommissioned. Others, notably, were found reused in the construction of domestic housing on the site of the former Roscoe Place Works (Fig. 64); one was also found in one of the cellars of the back-to-back houses on Burnt Tree Lane (Fig. 55). Grindstones of many different sizes were recorded (Figs 51 and 67), perhaps reflecting the wide range of steel products (such as cutlery, scissors, pocket knives, files etc.) manufactured on the site, although discarded grindstones are commonly found throughout Sheffield.

The Nature of Living Conditions

Working-class Housing

Over the course of the 19th century the population of Sheffield grew from around 60,000 to 450,000, the rate of growth increasing in the second half of the century (GB Historical GIS). As the town expanded into the surrounding countryside, the developers of greenfield sites sought to maximise their returns by laying out a grid pattern of streets, and building cheap back-to-back houses (Rodger 1995, 29–30). Such houses, probably two or three storeys high, along with cellar and attic space (Fig. 68), allowed the developers to build as many dwellings as possible along a given length of street. The earliest mapped houses excavated within the site were those shown on the 1828 Fairbank Plan on Meadow Street and Burnt Tree Lane (Fig. 13); these are shown on the 1852 map as comprising such back-to-back dwellings (Fig. 4).

Half the houses looked onto the rear communal yards which contained the shared outside lavatories, water pumps and stand-pipes serving also the street-front dwellings. Only the occupants of the rear houses had direct access to these yards; those living in the front houses had to go down the narrow alleys running back from the streets which broke up the rows of dwellings. Part of one of the toilet blocks was recorded abutting the yard's rear wall behind the terraced house at No. 37 Jobson Road (Fig. 60). A cholera epidemic in Sheffield in 1832, which resulted in the deaths of over 400 people, was almost certainly due to the squalid and insanitary conditions in which working-class families lived.

Parts of the cellars survived of the houses on Burnt Tree Lane, and these were shown to underlie only the houses fronting the lane. They were, however, divided into two halves, reached by two flights of steps, one from the front house, the other from the rear (Fig. 54). The cellars were probably used for storing coal delivered via chutes on the street frontage, and there were fire-places in the rooms above. The Burnt Tree Lane frontage lay outside the excavation area, but such chutes were recorded in the early 20th century terraced houses on Jobson Road, at the north-east of the site (Fig. 61).

The ground-floor rooms of the back-to-back houses, for which there was no surviving evidence of internal divisions, measured internally just 3.2 m wide by 4 m front to back, representing very cramped living conditions. The map evidence indicates that many of these houses continued to be occupied during the first half of the 20th century, only being demolished after World War II. By then, however, the dividing walls in the cellars had been demolished and the flights of steps from the rear blocked, possibly indicating that some of these houses had been converted to single dwellings.

Much of the housing shown on the 1852 map in the surrounding area consisted of back-to-back dwellings, although there were terraced houses on the opposite side of Meadow Street and around the corner fronting Hoyle Street, some of the latter having ground-floor shops (Fig. 4). However, due to the passing of a bye-law in 1864 prohibiting the construction of back-to-back houses, all the new houses in the period of rapid building towards the end of the 19th century, following the demolition of the Roscoe Place Works – for instance along Roscoe Road and Jobson Road – were terraced houses (Craven 1993, 67). Nonetheless, there was only limited replacement of back-to-back houses with terraced houses, although this did occur along a short length of Meadow Street, where not only were the two former houses combined, but the new terraced houses also had offshot rooms to the rear (Fig. 5).

If the larger terraced houses reflect higher status dwellings, there remained, at least until World War II, a degree of social diversity in the local population. However, there was evidence to suggest the continuation of some form of domestic industry within the excavated terraced house on Meadow Street, in the form of the slightly raised 'cork' bedding which appears to have taken up a large part of the front room.

Figure 68 Back-to-back tenement houses, floor plans and elevation

Residues of Domestic Life

The relatively small assemblage of artefacts recovered from the excavated houses provides little further information about the living conditions of the working-class population. This is supplemented to some degree, however, by the finds of pottery, glass, clay tobacco pipes and other materials found more widely across the site, some of which was probably brought into the workplace by the employees from their homes. These indicate the types and range of products, from both local and more distant sources, that were available to, and regularly consumed by, the local working population.

One notable group, however, was the large pottery assemblage (Barker 2013), representing some kind of clearance deposit, dumped in feature 2010 at the north-western end of Mitigation Trench B (Fig. 36). Such clearance deposits dating to the later 19th century are few in number, largely due to changes in the way in which domestic rubbish was discarded, with the increased use of communal refuse dumps. The construction of sewers and the advent of flushing toilets removed the need for cess pits which, at the end of their lives, were frequently backfilled with domestic waste.

Clearance deposits provide the nearest thing to a complete picture of a household's ceramics, with direct evidence for the range of material in use shortly before the time of disposal. Moreover, this example dates to a period for which there are few substantial excavated domestic assemblages and whose working-class material remains have received little specialist scholarly attention. This deposit is by far the largest of its type from early-modern industrial Sheffield, and its importance is the greater for the close dating of the material and the completeness of many of the vessels present.

While the quantity of material suggests that it represents more than a single household, it is unclear what quantity of ceramics a 'typical' urban working-class household might have owned in this period (Barker 2013). It is impossible to know whether the numbers of different vessel forms (Table 1) should be regarded as excessive for a single household – even if eight teapots might seem on the high side! However, whether it derives from one or multiple households, the homogeneity of the ceramics suggests a shared material culture, with wares derived from the same limited range of sources.

The date of the materials (1850s–1870s) suggests that the deposit was made around 1880, perhaps during the significant reorganisation of this part of the site – the Milton Works were being replaced by the Progress Works, and the group of small workshops to their south-west were being replaced by back-to-back housing. However, there is no obvious indication from the map evidence as to the likely source of this material.

The high proportion of decorated wares in the assemblage is noted, as is the fact that the most common form of decoration – printed decoration – is also the most expensive. Even though the presence of various pottery faults were noted in the group, giving the impression that the material does not comprise the best quality wares, it appears that considerable care was taken to have a range of types available, appropriate for use in the various domestic and social situations for which they were required. The presence of items of German porcelain points to a desire to acquire the appearance of quality in the latest style, but at the lowest price.

The large number of tea wares reflects the popularity of tea as a beverage, with the teapots including a mixture of older, curated vessels – perhaps for best use – and cheaper, hard-wearing vessels in Rockingham ware and blue glazed earthenware. The presence of a good number of tea wares in bone china suggests that a special significance was attached to tea drinking, and that some wares may have been reserved for use on special occasions. There are few identifiable milk jugs, of which the two definite examples are of bone china, and no other items that can be linked with tea drinking with certainty.

Meal times involved the use of a range of plates in different sizes, and in most of the popular designs of the day, usually in sets of a kind. The tableware forms are functional, with no items whose function was more decorative. There are no soup tureens, no sauce tureens or cruets, while soup plates are few in number. Bowls are well-represented, but it is difficult to be certain that they were used in tea drinking as slop bowls, and those with banded slip or sponged decoration were almost certainly not used in this way. There are mugs within the group, but few vessels indicating the drinking of spirits apart from two large grey stoneware bottles which may have been spirit bottles.

Other items are also illuminating. The figure of an angel standing before a crucifix, which may belong to a holy water stoup, together with a jug bearing the figure of a prophet or similar, may hint at the religious affiliation of the owners of these pieces; a number of other figures were represented, probably for display objects. Two pieces of bone china 'gift ware', while certainly functional, hint at wider contacts or movements of family members. These are the items bought as presents from particular holiday (or other) destinations, which identify their source in inscriptions. A mug has the inscription in gold 'A Present from / […]ington Quay' (possibly Bridlington Quay), and a cup has the inscription 'A Present / from / Liverpool', also in gold. Although probably not

expensive items, they remind us that people did travel, and were keen to show that friends and loved ones were thought of on such occasions.

The presence of children is indicated by six marbles in a white earthenware body, five of them with thin glaze sheens. A possible pipe clay figure has a perforation through what may be the upper arm/shoulder, which suggests that it was articulated and so may have been a toy, or doll, rather than a purely ornamental piece.

Conclusions

The excavations and building recording undertaken at Hoyle Street have provided an increasingly rare opportunity, as brownfield regeneration continues apace, to investigate a relatively large area within the city – one that illustrates well Sheffield's industrial past, in particular the introduction and expansion of crucible steelmaking and associated specialist crafts. The results, combined with the finds and, especially, the documentary evidence, provide a vivid picture of the 19th century growth and later 20th century decline of steelmaking in this part of Sheffield, as well as something of the lives of the workers and their families who were engaged in the various trades.

From agricultural fields on the periphery of Sheffield, rapid growth in the first half of the 19th century, continuing through the second half and into the 20th century, saw the area built up with a dense patchwork of industrial premises and housing, a pattern that did not remain fixed but which saw changes in ownership, the layout of works and accommodation, the scale of production, and sometimes what was being manufactured. By the late 19th century the area was fully built up, with no open space other than the factory yards and spaces where premises had been demolished ahead of new factories and housing, for example at the Roscoe Place works.

The Hoyle Street site was not unique and the 1890 map, for example, shows the surrounding area punctuated with steel-, file and cutlery works amid mainly back-to-back housing and associated enclosed courts (Fig. 5). However, the opportunity to investigate such a number of crucible furnaces, in particular the group of three relatively well preserved examples of different dates at the Titanic Works is unusual, and the Hoyle Street Works provide another example of an integrated works where blister steel was produced in cementation furnaces for conversion to crucible steel in the same premises, and where files (and later scissors) were an important product. It represents a good example of some of the small to medium sized works established in the first half of the 19th century, contrasting with the larger complexes to the east at Kelham Island and Millsands (Fig. 1). These both lay next to the River Don and had originated earlier, in the 18th century, utilising water power in various ways, before this was superseded by steam power, which was always the source of power at the Hoyle Street Works and other factories in the vicinity.

The 19th century development at Hoyle Street fell towards the end of a period when there was widespread population increase, urbanisation and industrial development within Britain, a vigorous commercial economy existed and rapid growth in home and overseas markets was experienced. Sheffield was pre-eminent at this time in the production of high quality steel, cutlery and edge tools, and demand was considerable, particularly in America between the Napoleonic War and the American Civil War. However, though some works moved out to larger more spacious premises on the periphery of the town, with room for expansion, many goods continued to be manufactured in small workshops supplied by crucible steelworks nearby, and the division between domestic craft and smaller factory or workshop production was not always clear-cut. Individual elements within cutlery production, for example, were often undertaken by specialist craftsmen renting small premises or space within larger premises, rather than all the processes being undertaken in a single integrated works.

Some of these practices continued into the 20th century, although by this time crucible steel production was increasingly supplanted by bulk steelmaking processes utilising the newly developed Bessemer and Open Hearth processes that had been introduced into Sheffield during the second half of the 19th century, largely to meet the demand for steel rails. However, the large volumes produced by these new processes were not of the same high quality as that from the crucible steel method, required for cutlery and edge tools in particular, and both cementation steel and crucible steel continued to be made, with an output of 120,000 tons of crucible steel recorded for 1873 (Barraclough 1976, 8–9). In fact Sheffield was never a major bulk steel producer and its importance always lay in the more specialist steels. Production of crucible steel continued through the 20th century, but its manufacture by the Huntsman process in crucibles had by now been largely superseded by co-fusion or direct carburisation methods, cutting out the requirement for cementation steel which was needed to feed the crucible process. With these changes, and increasing

foreign competition, came the progressive closure, abandonment and demolition of most of the works within the central part of Sheffield and clearance of much of the terraced housing, to be followed by a new phase of commercial development.

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A programme of archaeological works at the Hoyle Street development in Sheffield revealed significant evidence for the crucible steelmaking which gave the town its world-wide reputation for cutlery and tools in the 19th and 20th centuries.

Two crucible furnace cellars, at William Hoole's Works and the Hoyle Street Works, were excavated, and three intact crucible cellars were recorded at the Titanic Works. Structures associated with related aspects of steel production were also excavated, particularly at the Hoyle Street Works, including part of a cementation furnace, boiler and engine bases, a crane base and a silt trap.

Standing buildings at five works premises – the Roscoe Works, Malinda Works, Titanic Works, Australian Works and Progress Works – were also recorded and, combined with documentary and map research, revealed their development through the 19th and 20th centuries.

The steelworks were located among the cramped housing of the working population, and a number of cellars and ground floors of the back-to-back tenements and terraced houses were excavated, revealing evidence of possible cottage industry.

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