

THE VULCAN IRON WORKS, LANGLEY MILL

By NEIL DRANSFIELD and CHRIS MOORE

with a contribution by

LORRAINE MEPHAM and illustrations by ROB GOLLER
(Wessex Archaeology, Sheffield Office, Unit 6, Riverside Block,
Sheaf Bank Business Park, Prospect Road, Sheffield S2 3EN)

SUMMARY

Extant and former buildings associated with the Vulcan Iron Works were investigated through a programme of historical research, building recording and archaeological trenching in advance of a new supermarket development at Heanor Haulage, Langley Mill.

The Vulcan Iron Works was constructed by G. R. Turner in 1874 and produced world-renowned railway rolling stock through to the 1960s. The investigations identified seven broad phases of development. The primary drive engine location, machine bases and presses were found, together with evidence for re-melting and forming of wrought iron, steel and possibly brass, suggesting that the Works may have had a cupola furnace for re-melting cast iron.

The excavations also investigated the sites of a Wesleyan Methodist chapel and two rows of terraced housing, providing an insight into the community context of the Vulcan Works. A small group of locally produced stoneware vessels recovered during the investigations is also reported here.

INTRODUCTION

Between January and May 2010 Wessex Archaeology investigated the site of the former Vulcan Iron Works at Langley Mill, Derbyshire, in advance of a new supermarket development. The site, centred on NGR 445054 347210, covered an area of 3.37ha in the centre of Langley Mill to the east of the Midland Railway (Fig. 1) occupied by standing buildings and open yards associated with the former Vulcan Works. A programme of historical research, building recording, archaeological evaluation trenching and mitigation excavations aimed to record surviving elements of buildings and structures and enhance understanding of the development of the Works and its associated buildings.

THE VULCAN IRON WORKS

Research at the Derbyshire Record Office and the Local Studies Libraries in Matlock, Eastwood and Heanor, at the CORUS Records Centre and at British Steel, has provided the following overview of the historical development of the Vulcan Works.

In 1868 George R. Turner and Robert Pender (or Pinder) commenced the manufacture of small engineering items for local collieries and repair of railway wagons on land to the west of the Midland Railway (Heanor Observer 1968). In 1874, Turner constructed the Vulcan Iron Works on a new site to the east of the railway (*ibid.*), shown as an undeveloped field

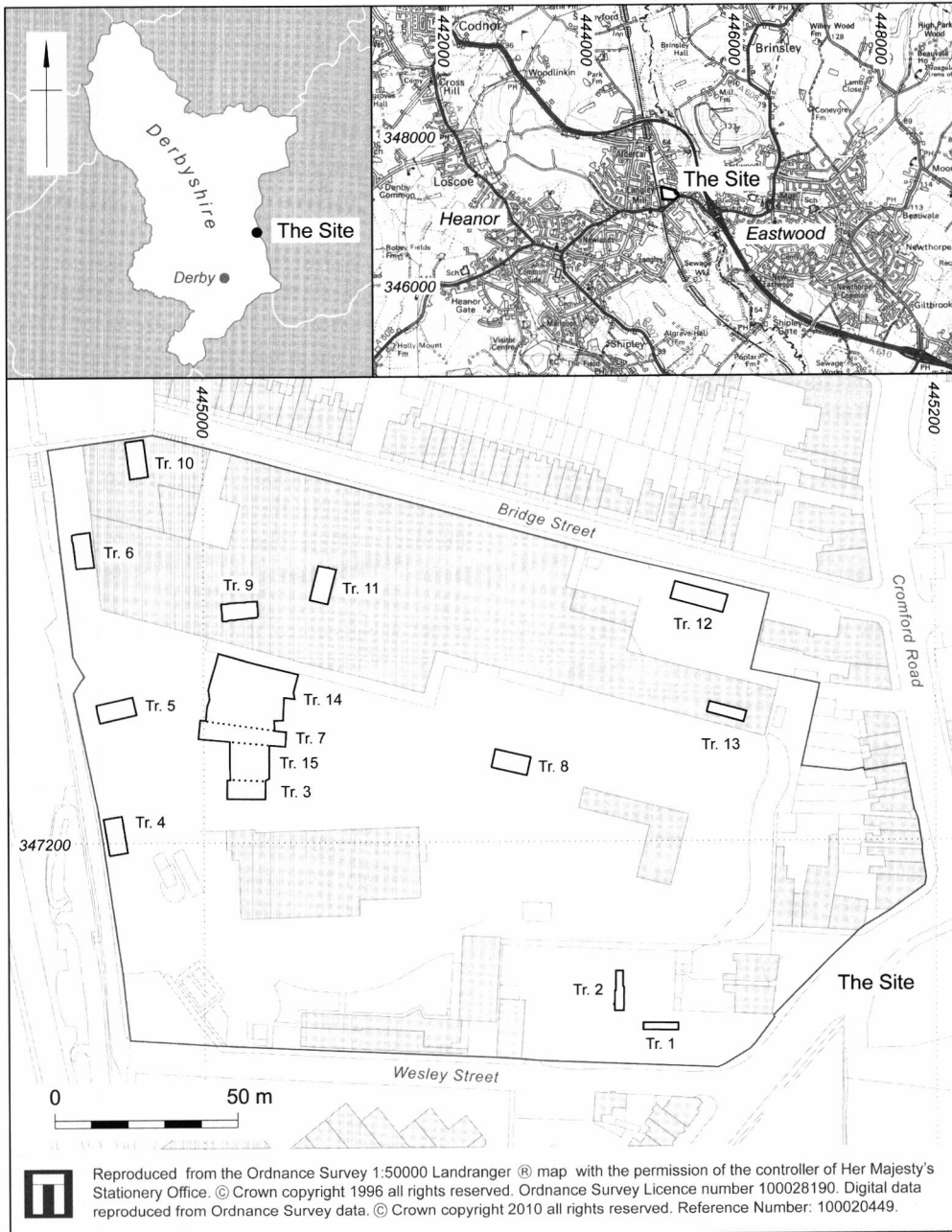


Fig. 1: Site location and excavation areas.

on an 1873 map of land sold by the Midland Railway Company; Pender (Pinder) continued in business on the original site, known as the Langley Mill Engineering, Wheel and Wagon Works.

Described as a brass and iron founder on a plan of 1877 (D.R.O., D4156/1/3), G. R. Turner's first order was for 100 wheelbarrows, followed by an order for 50 railway wagons (Heanor Observer 1968). Turner's subsequently concentrated largely on the production of railway rolling stock and is listed in Kelly's 1891 directory of Derbyshire as 'carriage and wagon wheel manufacturers'.

The 1881 Ordnance Survey (OS) map (Fig. 2) shows the site surrounded by back-to-back housing along Bridge Street, terrace houses along Victoria Terrace and a Methodist chapel on Wesley Street. The 1900 OS shows significant expansion of the works with several large buildings and its own railway infrastructure, and the incorporation of buildings at the south-west of the site shown as part of the adjacent Station Works on the 1881 map.

G.R. Turner died in 1893 and the business continued under his son, Tom Newsum Turner until 1903, when the firm became a limited company (Bradshaw 1911; Heanor Observer 1968). Turner's listing in Kelly's 1908 directory remained unchanged from that in 1891; however, historic photographs dating from 1902/1903 show that the company also described themselves as 'van builders' and 'motor body builders' with a 'chief office' address at 105 Kentish Town Road N.W. (London), although by 1903 the Langley Mill address only was in use (D.R.O., D4156/36/1).

By the time of Kelly's 1925 directory, G.R. Turner was listed as 'manufacturers of railway rolling stock and mining machinery'. The Vulcan Iron Works was not mentioned in the 1925 entry, nor in the 1941 directory. Only two entries were listed for adjacent streets, suggesting that the properties to the north and north-west of the works consisted largely of domestic housing. Between 1916 and 1936, the housing along Victoria Street and a section along the south side of Bridge Street were demolished to make way for further expansion of the works.

The decline in demand for railway wagons led to the company being taken over by United Steel Companies Ltd in 1958/9. Operating as part of a group subsidiary, the United Steel Structural Co Ltd., the works continued to produce railway rolling stock until 1961, as well as fabricated steelwork. Extensive modernisation took place during this period, and the works became nationalised as part of British Steel in 1967. Redpath Dorman Long acquired the site in 1970 and used it to develop the company's radio-controlled cranes. The works closed in 1974.

THE ARCHAEOLOGICAL INVESTIGATIONS

Methods

Fifteen trenches of varying size were excavated (Fig. 1). Eleven trenches investigated the former Vulcan Iron Works (Tr. 3–11, 14 and 15); two investigated the site of the Methodist chapel (Tr. 1–2); and a further two the site of former terrace houses along Bridge Street (Tr. 12) and Victoria Street (Tr. 13). Made ground was present across the site, varying between 1m and 5m in depth, overlying Carboniferous Middle Coal Measures. Modern surfaces and made ground were removed by machine down to the top of the first structural horizon, prior to hand excavation. Extant historic buildings and structures were photographed and recorded to English Heritage Level 2.

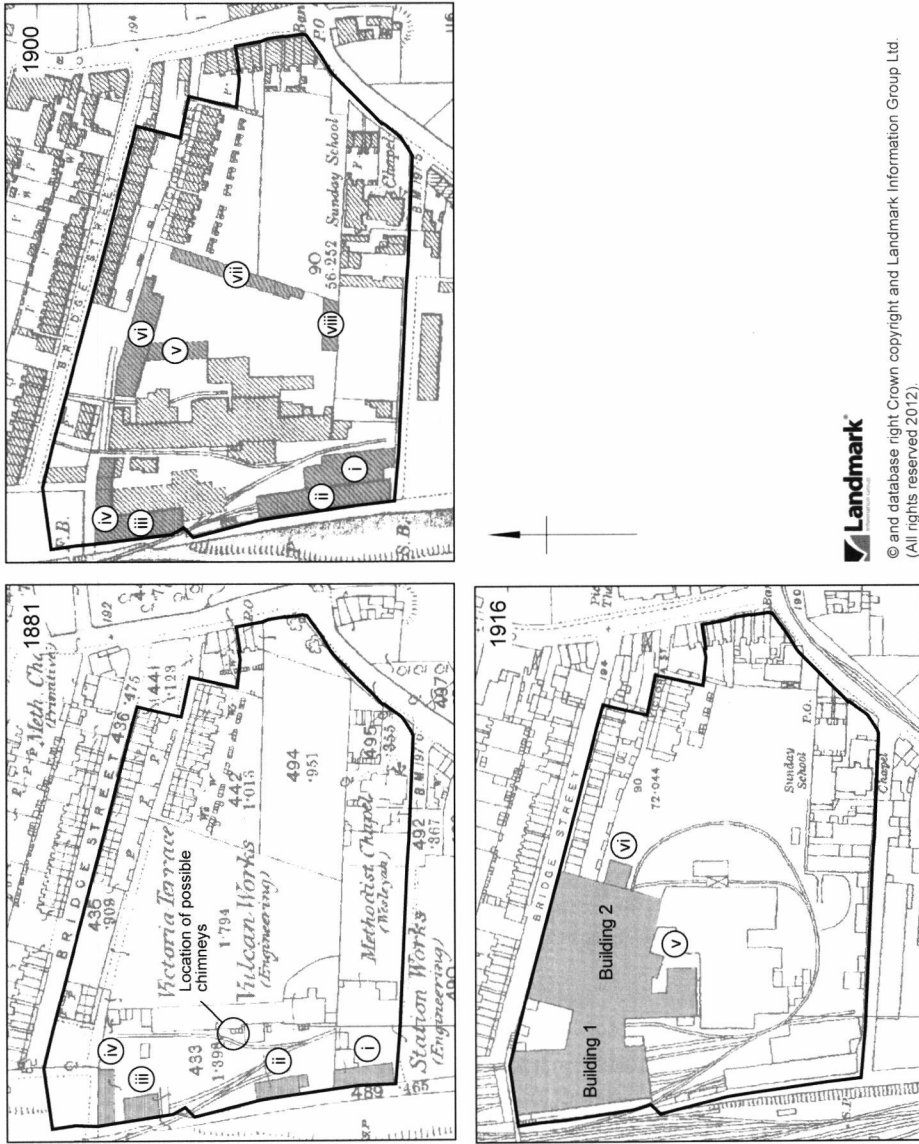


Fig. 2: 1881, 1900 and 1916 Ordnance Survey maps showing former buildings i-viii and extant buildings 1 and 2.

Results

The excavations at the Vulcan Works uncovered the northern two-thirds of the main factory building as depicted on the first cartographic evidence of the site in 1881. The range of processes taking place at the factory is known from documentary evidence (see above), and photographic evidence shows some of the range of products produced there (see below). The archaeological investigations provide an insight into the locations of these processes within the building itself and allow some consideration of the likely process flows within the works. The building recording programme further bolsters understanding of the development of the works and the processes undertaken there. From the combined documentary and cartographic evidence, building recording and archaeological trenches, seven principal phases of development may be identified:

Phase 1: 1874 – 1881

Phase 2: 1881 – 1885

Phase 3: 1885 – 1900

Phase 4: 1900 – pre 1903

Phase 5: pre 1903 – 1916

Phase 6: 1916 – 1938

Phase 7: post 1938

Phase 1: 1874 – pre 1881

The early Vulcan Works factory building

Excavations revealed that the initial Vulcan Works factory building of 1874 was considerably shorter than that depicted on the 1881 OS map (Fig. 2), measuring 10.5m wide x at least 24.75m long. The archaeological trenches identified east and west walls, with an open end to the north (Fig. 3). The walls were constructed from handmade, unfrosted red brick bonded by a light grey cement mortar, using a pier and panel method. The brick panels would not have been full height, allowing cool air from outside to flow through the hot interior of the building whilst reducing construction costs. The two walls, being truncated at the same upper level, were evidently built on a slope; the western wall consisted of five courses on a three course stepped foundation, whilst the eastern wall consisted of at least twelve courses. The difference in the ground level within the factory building and that to the east was at least 1.3m, indicating a lower terraced area beyond the building. The excavations revealed an entrance towards the north-west corner; this was still evident on the 1917 fire insurance plan of the foundry.

Structure A and associated features – engine bases, flues and wheel housings

Within this initial building on the western side of the factory were a number of structures probably related to the primary drive mechanism within the works (Fig. 3). A substantial subterranean squared brick hot air flue topped by sheets of cast iron overlain with what appeared to be heavily heat affected ganister was exposed just to the south of Structure A. Hot air from this flue may have heated water in a vertical boiler and steam engine, possibly located on Structure A; three small square structures depicted on the 1881 OS map of the factory may indicate the location of a series of chimneys along the western edge of the building, corresponding with the location of the flue (Fig. 2).

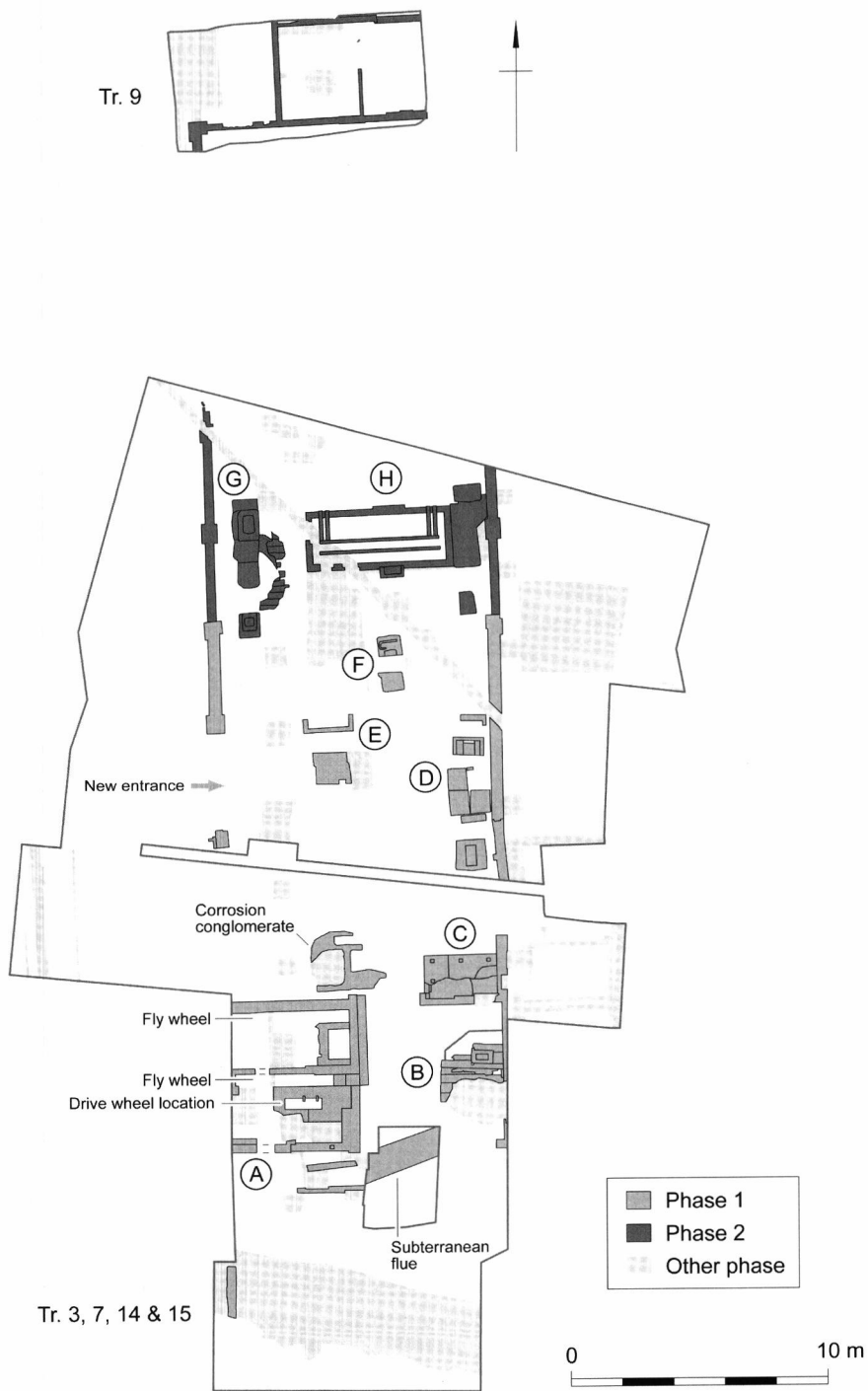


Fig. 3: Phase 1 1874-1881 and Phase 2 1881-1885 foundry buildings.

To the immediate north of flue Structure A comprised a series of vertical brick walls and flat brick surfaces, probably linked to the western wall of the factory (Fig. 3). The main superstructure of Structure A consisted of three east-west vertical walls forming the southern, central and northern walls, with an external eastern wall. Between the southern and central cross walling was a flat brick surface, set within which was the partial remains of a sloping concrete wheel housing (Fig. 3; Plate 1). Fixing bolts located around the wheel housing suggested the location of machine feet. Between the flat brick surface and the vertical walling to the north of Structure A were two voids, approximately 4.65m long x 0.45m wide. A sloping brick surface uncovered in the southern void suggests that the voids were larger wheel housings, possibly for fly wheels driven from a smaller drive wheel located within the flat brick surface.

Structure B – heavy press

Along the eastern wall of the first phase building were three large structures. The most southerly of these (B) comprised substantial timbers surrounding a rectangular concreted block with a raised central surface (Fig. 3), probably representing the percussion dampener of a steam hammer or press, the southern holding foot and anvil having been removed later. The structure was located too close to the eastern wall of the factory to successfully pass lengthy rolled material through it and is more likely, therefore, to have been involved in the pressing of specific, smaller items. Metal residues suggest that some brass fittings, possibly for carts, were produced at the works.

Structure C – base of heavy turning lathe

To the north of the heavy press (B), Structure C comprised a brick surface with fixing bolts set within the surface (Fig. 3). The south of this surface was contained within a rectangular walled surround keyed into the eastern factory wall, with an oily swarf material overlying the surface indicating that a machine was located here. A conglomerate of corroded deposits, apparently formed around an object subsequently removed, was consistent with sweepings from a ‘fettling’ (finishing) shop, suggesting that Structure C may have been the base of a heavy turning lathe.

Structures D and E – machine bases

To the north of Structure C a series of probable machine bases comprising walls and sandstone blocks (Structure D), a U-shaped brick wall and a brick built machine base (Structure E) are of uncertain function.

Structure F – base of possible cupola furnace

Structure F, comprising two sandstone blocks containing recesses and fixing bolts in the upper surfaces, was located just within the open ended northern limit of the original factory building. Archaeometallurgical analysis showed a higher abundance of scale from samples closer to the blocks, suggesting that this was an area where metal was being formed and the sandstone blocks may, therefore, have supported a small cupola furnace.

Phase 2: pre 1881 – 1885

New buildings on the western boundary of the site

Phase 2 sees the development of the layout of the factory to that shown on the 1881 OS



Plate 1: Phase 1, Structure A: concrete wheel housing and flywheel pit.



Plate 2: Phase 2, Structures H and I with linking H-beams.

map (Fig. 2), with four buildings (i, ii, iii, iv) evident along the western boundary wall. The southernmost of these (i) was originally part of the Station Works while the second structure (ii), at the south western edge of the original Vulcan Works boundary, was a smaller rectangular building of unknown function. Excavations revealed that the north-western corner building (iv) was open fronted to the south with a series of brick built columns along its southern edge.

Northern extension of the early factory building

The east and west walls of the Phase 1 factory building were extended to the north (Fig. 3) with new walling constructed from handmade, unfrosted bricks in the same pier and panel method used in the first phase, although narrower than the original walling and on a slightly different coursing level. At the northern end of the extension a smaller room, possibly an office, was appended to a substantial northern end wall. The construction cuts for the extension truncated substantial quantities of industrial waste, presumably derived from the first phase of the factory's operation.

Structures G, H and I – steam presses and associated machine

Within the new extension three new structures were built. Initially, a second steam press G was located along the western wall (Fig. 3), with two outer blocks relating to feet fixings and a central block and timbers representing the anvil and percussion dampeners. A third press I was also installed at the eastern edge of the factory, to the immediate west of which was a large rectangular brick structure H with fixing bolts and a small sandstone block positioned centrally. Two central H-beams resting on supports at either end (Fig. 3; Plate 2) lay centrally between the two holding feet of press I and structure H may have allowed the transportation of heavy material to and/or from the press itself, possibly assisted by a centrally mounted machine.

There was no evidence that the original machinery from the first phase became disused at this stage, and it may be assumed that this machinery continued in use as the factory developed.

Phase 3: 1885 – 1900

Eastern extension of the factory building

Between the 1885 and 1900 OS maps the central part of the eastern external factory wall appears to have been partially demolished. Abutting the first phase wall, an east-west aligned wall was constructed (Fig. 4). The wall returned to the south, forming a new external eastern wall and was faced to the north, suggesting that the lower terraced area to the east of the factory building was still extant. Within this eastern extension lathe C appears to have been partially demolished and replaced by two concrete machine footings K, incorporated into the extant remains of the demolished lathe and eastern wall.

Between the new eastern wall and Structure K, three 3.25m long horizontal iron H-beams (Structure J) set on edge perpendicular to the wall formed two parallel runners similar to Phase 2 Structure H, perhaps serving as guide rails for transporting or lifting heavy material between the walling and the new machine K (Fig. 4). The H-beams were laid on a mortar and brick foundation within a clinker made ground deposit that served to bring the internal level of this new extension to the same as that of the earlier factory floor.

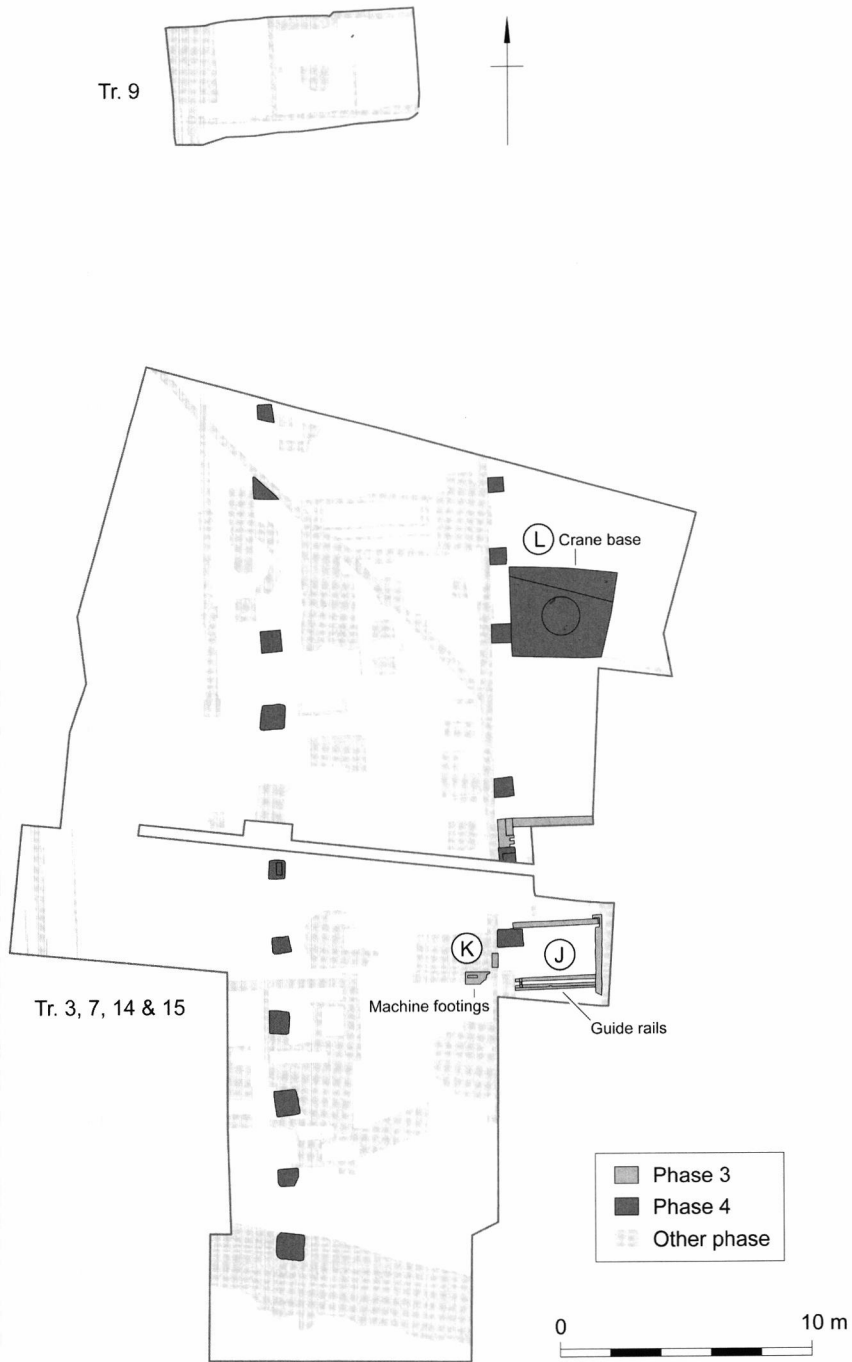


Fig. 4: Phase 3 1885-1900 and Phase 4 1900-1903 foundry building.

Phase 4: 1900 – pre 1903

Other works buildings in the western, northern and eastern areas of the site

By 1900, the OS map (Fig. 2) shows considerable development of the factory with four new buildings (v, vi, vii and viii), two of which (v, vi) form a T-shape structure at the north of the site; walling uncovered in the northern section of Trench 11 may have formed part of the northern wall of this shed. Two further sheds (vii, viii) are visible along the eastern and south eastern edge of the Vulcan Works. Excavations in Trench 8 suggest that the eastern building was insubstantial, probably a long shed. The two existing buildings (i & ii) along the western edge of the site, incorporating the former Station Works building and the enlarged south-western shed, were joined to form one long shed. The excavations revealed a pair of railway lines, suggesting that this may have served as a finishing area for products prior to despatch via the adjoining rail network.

The two former buildings at the north-west corner of the site (iii & iv) were incorporated into an L-shaped building, with extensions to its western and southern sides. Excavations in Trench 5 recovered two stanchion bases and the previous rail track at the southern end of the structure, suggesting that the new extension was open sided with columns supporting the roofing.

Modification of the central factory building

The eastern wall of the main factory building appears to have been demolished. The excavations uncovered two rows of concrete stanchion bases, one just to the east of the western wall and one row abutting the eastern side of the eastern wall (Fig. 4). A large concrete crane base (Structure L) was installed abutting one of the eastern stanchions, and the lower terraced area to the eastern side of the former building was made up with considerable deposits of industrial waste (clinker).

Phase 5: pre 1903 – 1916

New buildings

A large rectangular building replaced the former T-shaped structure at the north of the site, extending up to the southern edge of Bridge Street into once apparently vacant land to the north (Fig. 2, Building 2). The new building appears to have been arranged around a central corridor with bays to the north and south. The northern bay possessed at least two, and probably four, riveted lattice girders transversely spanning the bay. The lattice girders, which had a rail mounted on top and likely functioned as a type of travelling crane or hoist, were only evident in the northernmost of the two original bays extant in Building 2, indicating that heavy lifting of metal or pouring associated with heavy casting or rolling may have taken place within this section of the building. Vents in the roofing of the northern bay may indicate the locations of exhaust gas extraction.

The cartographic evidence shows further alteration to the north-western building (Fig. 2, Building 1), with the removal of the south and western extensions and the linking of this structure to the main factory building and possibly to the external, western wall. Building 1 consisted of two bays, the eastern bay containing two pairs of rail tracks in an open sided building supported by cast iron columns. One of the timber roof trusses showed markings (possibly Baltic Timber markings) inscribed 1890, although whether this refers to a timber felling date or an order number, etc. is unknown.

It is apparent from the cartographic evidence that the spaces around and between former buildings were gradually enclosed. The archaeological trenches showed massive truncation across the former buildings and two separate concrete layers, with many unidentifiable concrete machine bases encountered in the majority of trenches, probably relate to this phase.

Phase 6 (1916 – 1938) and Phase 7 (post 1938)

Within the final modern phases, the cartographic evidence shows continued development of structures at the works. More notable among these are eastern extension of the '600ft. bay' in Building 2, the extension of Building 1 across Bridge Street and the enclosure of space around the central part of the older factory footprint.

Discussion

The site was doubtless selected by Turner for his new works to take advantage of the Midland Railway, in common with other factories in the vicinity such as the Station Works to the south of the site and the Midland Foundry to the west of the railway. Ordnance Survey maps (Fig. 2) show the development of an extensive group of sidings to bring materials to and from the individual sites, with the internal rail system at Vulcan Works linked to these to give direct access to the rail network.

Processes and machinery

The documentary evidence shows that Turner's moved swiftly from its first order for wheelbarrows to production of heavy rail wagons. Whilst it is not clear whether the works was at this early stage either casting and forging iron or steel on site, or whether pre-cast materials were brought in from outside for assembly, this rapid change in manufacturing direction would have necessitated changes to the internal infrastructure of the works and substantial overhauls to create bespoke machinery. This is reflected in the cartographic and archaeological evidence for the rapid extension of the original Phase 1 factory building through Phases 2 and 3.

Although some of the structures could not be identified with certainty, it is possible tentatively to suggest a process flow through the Phase 1 factory building. Re-melting or forging of material in a cupola furnace F may have taken place within the open end of the building, with materials transported here from the main railway via the internal rail track located along the western side of the building. It is possible that the two unidentified structures E and D may relate to shaping or rolling of material from the cupola, with the moulded product then finished or 'fettled' at heavy lathe C. The press B, opposite steam engine A, could have been involved in further shaping or other processes prior to finishing at a location further to the south, beyond the limit of excavation. No evidence for casting of metals was uncovered during the investigation, and casting and heavy forging presumably took place in the (unexcavated) southern part of the factory system. In the absence of direct evidence for these latter heavy activities, the archaeological evidence, in particular the comparatively small machine bases, tends to suggest that the works at this time may have been engaged with the pressing of bespoke items for manufacture, rather than the heavy hammering involved in the forging process.

The 1902 valuation (D.R.O., D4156/3/1-2) confirms that by Phase 4 the Vulcan Works comprised three main elements – a foundry, an engineering works and an assembly production line. Although there is no accompanying map and hence it is not possible to be specific about the layout of the site, the range of workshops and ancillary buildings listed is typical of an

engineering works of the period, comprising both free-standing and interconnected structures arranged around a series of yards. Overall operation of the site would have been under the direction of a manager and a series of foremen working from offices throughout the site. General management, sales and orders would have been controlled from the General Office, fiscal control and wages in the Cashiers Office and dispatch of completed products in the Forwarding Office.

The presence of a Pattern Making Shop and Pattern Shed confirms that moulds were prepared on site for making castings in the foundry. Casts would then be finished in the Fettling Shop prior to assembly. A saw mill on the site may have prepared wood for use in manufacture of rolling stock and wagons as well as for constructing wooden sand moulds for casting. Assembly used products made in both the foundry and three Smiths' Shops, with further processes undertaken in the Punching Shop, Drilling Shop, Plating Shop and Spring Shop. The inventory also lists a rolling mill, which would have been capable of creating either flat sheets of metal or, more likely for use in wagon manufacture, rolled sections of bar to differing profiles and thicknesses.

The works was initially steam powered, as was the norm in the later 19th century, and the excavations uncovered both possible boiler bases and steam pipe runs. The 1902 valuation (*op. cit.*) lists multiple pump houses, engine houses (one located underground) and a boiler house. Steam is likely to have remained the principal power source prior to the introduction of electricity to Langley Mill in 1911; steam power is likely to have been phased out during Phases 5 and 6 of development of the works. The internal rail network would have been used for moving heavy items and completed rolling stock, however the presence of a stables and cart shed is a reminder that, as was typical of the period, transport within the works and locally within Langley Mill would have been by horse and cart.

Products and markets

In the mid 19th century increasing demand for railway materials had led to over-production resulting in a severe market depression, and many factories had abandoned the production of railway materials for other growing sectors, such as the new large scale public amenities prompted by the Public Health Act 1848. By the 1870s the economic situation had improved and the construction of the Vulcan Works in 1874 enabled G. R. Turner to benefit from the recovery in demand for fabricated steel products for the rail industry.

The Vulcan Works developed rapidly as the demand for rolling stock continued to grow. The works entry in 'Industries of Nottingham and the Midlands Business Review' (c. 1890, D.R.O. L6619) refers to forgings in iron and steel and castings in iron and brass as specialities of the works, and records what purports to be a successful innovation:

"Mr Turner some fifteen years ago [i.e. soon after the founding of the Vulcan Works] ... introduced to this country and the foreign markets his light portable railway with all its minute details... complete railways are made and equipped, from a gauge of sixteen inches up to a metre... supplied with wagons suited to the particular industry required. The Portable Railway has been extensively exported to all parts of the world... India, China, Japan, America, Asia, Australia, Africa..."

The review entry also refers to medals awarded to works products at a number of exhibitions in Europe, India and Australia and, whilst this type of journal might be expected to emphasise



Plate 3: G. R. Turner ballast wagon with Vulcan Works beyond, 1903. Reproduced by permission of Derbyshire County Council, Derbyshire Record Office (D4156/36/1).

the success and renown of the firms it reviewed, it is clear that the works produced a wide range of railway rolling stock and plant for a worldwide market. Photographs from the G.R. Turner Ltd collection (D.R.O., D4156/36/1) show some of the range of products claimed to be produced (e.g. Plate 3), while Bradshaw's Railway Manual of 1911 describes the company's products:

"[G. R. Turner] manufactures all descriptions of Railway Rolling Stock; Railway Chairs, Switches, and Crossings; Turntables from 3ft. 0in. diameter to locomotive size, and plant of every description for English Railways. Large contracts for similar classes of work for Government, Colonial and Foreign Railways, and the Gold and Diamond Mines of Australia and South Africa, are also executed under the inspection of the leading London and Westminster Engineers.

"Colliery Plant of all description is a speciality... including complete installations of picking and sorting belts, creepers, shakers, tiplers, and engines, with housings for same in wood and steel and corrugated iron; haulage wheels and gearing; pit trams and tipping wagons; drums etc.

"Castings in brass and iron; wheels and axles, forgings and general engineering work also occupy a prominent position amongst the firm's manufactures".

During the First World War, the works expanded further whilst under the control of the War Office. The site was used for the construction of vehicles including cabling machines, mechanised trench-excavators, light railway carriages to convey men and munitions to the trenches and, towards the end of the war, rolling stock for the French railways. The production

of railway rolling stock and mining machinery continued to dominate production at the Vulcan Works until the decline in demand for railway wagons led to the company being taken over by the group United Steel Companies Ltd in 1958/9.

Community context

The growth of Langley Mill, as with many villages within the 'D.H Lawrence Corridor', has its origins in the Industrial Revolution, early 17th century drilling for water having revealed rich seams of iron ore and coal. The extension of the Midland Railway in 1847 led to significant expansion of local industry, including Pickersgill & Frost, Lovatt's (the Langley Mills Pottery), the Langley Mill Gaslight & Coke Company and, from 1868, Messrs. Turner and Pender's iron works. The population of Langley Mill expanded significantly and the village became a major source of work for the surrounding area. This expansion of Langley Mill's industrial base was accompanied by the construction of workers' housing, some of which survives today, together with other community facilities. The investigations at Heanor Haulage explored the archaeological evidence for both housing that formerly stood within the site boundaries, and the former Methodist chapel on Wesley Street.

The terraced housing to the north of the works, along Victoria and Bridge Streets was built prior to 1881 and was probably demolished prior to 1966, when the Vulcan Works expanded into this part of the site. Bridge Street first appears on an 1873 sales plan, but it is not clear if this shows extant or proposed structures. By the 1881 OS map, both Bridge Street and Victoria Street are shown developed with housing. Later trade directories list only two entries for streets within the site; Oliver Moore, wheelwright, is listed at Wesley Street in 1925 and Mrs. Gertrude Fox, shopkeeper, of no. 46 Bridge Street, is listed in 1941; this suggests that the properties to the north and north-west of the works consisted largely of domestic housing. The archaeological trenches showed that the houses on Bridge Street were constructed in pairs to differing methodologies and dimensions, perhaps by differing factory owners to accommodate their own work forces.

Few archaeological traces of the houses fronting Victoria Street survived in the archaeological trenches due to severe truncation from expansion of the Works in the mid 20th century. The 1916 OS map shows land forming part of Victoria Street in use as yardage for the works, the western block of houses along Victoria Street having apparently been demolished, and by 1938 the remaining houses had been replaced by the eastern expansion of the factory's northern range and an apparent escarpment or cutting in the north-eastern corner of the works. The housing along the south side of Bridge Street, at the northeast corner of the site, was knocked down during the mid 20th century.

The Methodist chapel on Wesley Street was built prior to 1881 and demolished in 2000. Cartographic evidence indicates that a Sunday school was appended to the north of the building by 1900, probably necessitating the partial demolition and relocation of the chapel's original apse, and an eastern extension was added in 1911 (Ripley and Heanor News 2000). The archaeological trenches revealed the western, northern and eastern walls of the chapel, including the eastern porch and entrance surface and internal brick floor supports. A small group of locally produced stoneware vessels recovered from this part of the site and described in the Appendix included a large number of inkwells.

By 1895 the Vulcan Works employed some 350 hands (Bulmer 1895; Heanor Observer 1968) many of whose families would have lived in the adjoining streets of terraced houses and attended the local chapels and Sunday school. The works' entry in 'Industries of Nottingham

and the Midlands Business Review' (c. 1890) records that "A very large number of experienced and skilled workmen are employed, in connection with whom there are sick [sic] and benefit clubs, assisting materially to improve the condition of the workmen, and showing the proprietor's regard for the welfare of his men" (D.R.O., L6619). Whilst the review entry is naturally favourable to the employer a degree of concern for the welfare of the workforce is nevertheless apparent. The Vulcan Works and its workforce would doubtless have formed a significant community and neighbourhood within Langley Mill.

CONCLUSIONS

The combination of historic research, building recording and targeted archaeological investigations, whilst by no means comprehensive, enables a working understanding of the development and function of the Vulcan Works during the late 19th and early 20th centuries. The structural development of the factory from its initial construction through to the early 20th century has been identified including the dimensions, materials and building style and technique used in the construction of the original factory building and its subsequent extensions. The cartographic evidence illustrates the expansion of what was clearly a successful works and the archaeological results confirm this, with additional alterations apparent between the dates of the OS map editions confirming the rapid pace of change necessitated by the continued demand through the first 50 or more years of the factory's life.

The archaeological work has identified internal features within the factory, including machine bases and waste deposits, which together allow a possible process flow within the earliest phase of the works to be postulated. The location of machinery and working areas within the early phases of the works suggests that the factory buildings at this time were mainly involved in the production of rail or mining products. Although evidence for casting and the necessary rolling machinery capable of producing the lengthy bar necessary for railway wagon frames or wheel making structures could not conclusively be identified, there was clear evidence for the re-melting, smelting and pressing and finishing ('fettling') of products, including brass as well as iron.

Documentary evidence shows that by Phase 4 (1900–1904), the Vulcan Works was a substantial integrated factory complex combining a foundry, an engineering works and an assembly production line within the site. Manufacturing on the site encompassed preparation of moulds, the casting, rolling, smithing and finishing of metal parts, and final assembly. The works was evidently engaged in the pressing of metal fitments as well as the manufacture of finished railway goods and metal fabrications and the documentary evidence in the form of trades directory entries and advertisements makes clear that the works provided manufacturing services to a range of customers, in addition to sustaining a high-profile market base for railway and mining products for both British and foreign customers. The works by this time was a substantial limited company and plainly enjoyed considerable success. One of a number of major manufacturing employers in Langley Mill, the works and its workforce would have formed a significant community within the town.

APPENDIX

The Stonewares

By Lorraine Mephram

Introduction

A total of 93 sherds of stoneware was retained from the site, representing a sample of approximately 10% of the total encountered. The majority of this group appears to comprise waste production material, including obvious 'wasters', from the Langley Mill pottery on the opposite side of Wesley Street, to the south of the site.

The Langley Mills pottery

The Langley Mill factory was founded in 1865 by James Calvert, a chemist and druggist in Belper, Derbyshire, possibly at least partly as a means of manufacturing containers for his own wares. The pottery was first known as the North Shipley Pottery, and James Calvert quickly established contracts with ginger beer and jam producers in Lancashire. James entered into partnership with his son William in about 1878, and the pottery's title became J. Calvert & Son. In 1883 William Calvert entered into a partnership with the brothers Albert and John Lovatt, as Calvert & Lovatt; by this time the pottery was producing 'art wares' as well as utilitarian items. Albert and John Lovatt took over the pottery in 1895, and the business continued as Lovatt & Lovatt until 1930, when it was acquired as a subsidiary of James Oakes & Co. (Riddings) Ltd, although still trading as Lovatt's Potteries Ltd. Decline in sales led to a buy-out in 1959 by Joseph Bourne & Co. Ltd. The pottery continued to market decorative wares alongside domestic wares throughout its life, finally closing in 1982 (Giblin and Giblin 2002, 7–15, 50, 91, 93, 127, 157).

The vessels

Most of the vessels within the retained sample from the site are salt-glazed (mid to dark brown), although some have feldspathic 'Bristol' glaze (beige to grey) and some combine the two. Feldspathic glazes, introduced in the 1830s, were applied in liquid state, in contrast to the salt glazes, which were achieved by throwing salt into the kiln during firing, which then volatilised and coated the vessels (and indeed the whole interior of the kiln).

1. Eight vessel forms are represented here by complete or nearly complete examples (types 1–8), and two more forms by more fragmentary pieces (types 9 and 10). Examples of types 1–8 are shown in Plates 4–6, and totals by type are given in Table 1. Small, squat, cylindrical ink bottles with conical neck and narrow rims. Salt-glazed exterior. The most common form present (33 examples); the discarded portion of the total stoneware assemblage encountered on the site consisted primarily of these vessels.
2. Taller cylindrical ink bottles, probably with similar rim/neck forms. Salt-glazed exterior.
3. Small cylindrical ink bottle or polish pot with slightly concave neck and beaded rim. Salt-glazed exterior.
4. Conical ink bottle with short neck and narrow rim. External grey 'Bristol' (feldspathic) glaze.
5. Cylindrical ink bottle with slightly concave neck and expanded rim with pinched pouring lip. External grey feldspathic glaze.
6. Small, squat, cylindrical jar with external groove below rim. Salt-glazed exterior;

- internal grey feldspathic glaze.
7. Polish pot (or blacking bottle); cylindrical body, slightly concave neck and beaded rim. Salt-glazed exterior.
 8. Ginger beer bottle; cylindrical body with slightly concave neck and collared rim; one example only, 'waster' (rim/neck slumped over into top of body). Salt-glazed exterior.
 9. Large extract jar, cylindrical, with external groove below rim (for lid attachment). External grey feldspathic glaze with yellow ochre dip over rim; decorative rouletted band below lid attachment groove.
 10. Possible extract jar, rim sherds only survive; cylindrical body with beaded rim. Salt-glazed exterior.



Plate 4: Stoneware vessels, mainly type 1; in front row examples of (left to right) types 5, 3, 4 and 2.

The complete ginger beer bottle waster (type 8) bears a customer's name (Townshend of Salford). No direct parallel for this has been found, but John Townsend [sic] is listed in Slater's Manchester and Salford Directory for 1895 as a 'brewer of hop bitters, stone brewed ginger beer etc. and wine merchant' with addresses in Greengate and Broughton Road, Salford. There is a second customer's mark, of Belle Vu[e] (unknown location) on a ginger beer bottle or polish pot base.

One bottle base from (either a polish pot or ginger beer bottle) bears the stamp of James Calvert, 'Vitrified Stone Ware Manufacturer', at the North Shipley Pottery. The stamp is unfortunately faint on the right hand side and it cannot be determined whether it reads 'Langley Mills' (used from 1865 until at least 1870), or 'Langley Mill', a later variant used until 1878 (Giblin and Giblin 2002, 160).



Plate 5: Stoneware wasters; (front) type 1; (rear, left to right) types 8 and 7.



Plate 6: Stoneware vessel, type 6 cylindrical jar.

Form	Description	No. examples
1	Small, squat, cylindrical ink bottles	33
2	Taller cylindrical ink bottles	1
3	Small cylindrical ink bottle or polish pot	1
4	Conical ink bottle	1
5	Cylindrical ink bottle with pinched pouring lip	1
6	Small, squat, cylindrical jar with external groove below rim	8
7	Polish pot (or blacking bottle)	1
8	Ginger beer bottle	1
9	Large extract jar	1
10	Possible small extract jar	2

Table 1: The stonewares: totals by vessel form.

Discussion

Although the source of the other vessels cannot be proved, it seems certain that most if not all were also Langley Mill products. Five of the vessel forms can be paralleled within the utilitarian range produced between 1865 and 1883 (types 1, 2, 6–8: Giblin and Giblin 2002, 11, 14), although production continued during the later partnership of Calvert and Lovatt (1883–95), and three forms appear amongst the range produced after Albert and John Lovatt took over the pottery in 1895 (types 3–5: *ibid.*, 77). Production of the utilitarian wares continued under Lovatt & Lovatt Ltd until 1930, and then under the ownership of James Oakes & Co. (1931–59: *ibid.*, 120).

A directly comparable range of forms was produced by the Fulham Pottery under Charles Bailey between 1864 and 1890 (Green 1999, figs 138–9), and several appear in the illustrated catalogues of James Stiff & Sons of Lambeth, or Doulton & Watts, both from 1873 (*ibid.*, 361–8), but here, as at Langley Mill, production continued well into the 20th century. Without pottery marks, the vessel forms can rarely be closely dated.

In this instance, one group of vessels appears to be broadly contemporary with the early period of production of these stonewares. These came from context 4, the made ground and yard surface associated with the original Methodist chapel (on 1881 OS map); this context contained the vessel bearing James Calvert's stamp (1865–78), and vessels of types 1, 2 and 6. Other contexts producing stoneware vessels were all stratigraphically later and most represented post-demolition deposits.

Despite being just one of a number of stoneware producers in Derbyshire and Nottinghamshire, the Langley Mill pottery clearly established wide-ranging contacts. The only identifiable contact here is from Salford, but other examples from elsewhere confirm that Langley Mill products travelled across the country (Giblin and Giblin 2002, 78). Askey, for example, lists Lovatt & Lovatt period bottles (1895–1930) as the fourth most commonly found today, below Bourne of Denby (Derbyshire), Price of Bristol, and Doulton of London (Askey 1981, 192).

Acknowledgements

The project was commissioned by Asda Stores Ltd and monitored for Amber Valley Borough Council (AVBC) by Steve Baker of Derbyshire County Council Environmental Services Department. The project was managed for Wessex Archaeology by Oliver Jessop and Chris Moore. The building recording was undertaken by Lucy Dawson and Chris Swales, documentary research was by Mark Stenton and Lucy Dawson, and the archaeological fieldwork was directed by Neil Dransfield. Dr. Rod Mackenzie assessed and commented on the archaeometallurgical evidence. Plate 3 is reproduced by permission of Derbyshire County Council, Derbyshire Records Office (D4156/36/1).

REFERENCES

Primary Sources

- Derbyshire Record Office (D.R.O.), D4156/1/3, 1877 Plan of land at Langley Mill.
 D.R.O., D4156/3/1–2, G. R. Turner Inventory and Valuation of Loose and Fixed Plant (1902).
 D.R.O., D4156/36/1, D4156/37/1–10, D4156/31/1–15, Photographs from the G.R. Turner Ltd collection (1900–1960).
 D.R.O., L6619, Industries of Nottingham and the Midlands Business Review (undated extract c. 1890).

Secondary Sources

- Askey, D. (1981) *Stoneware Bottles from Bellarmines to Ginger Beers 1500–1949*. Brighton. Bowman Graphics.
- Bradshaw, G. (1911) *Bradshaw's Railway Almanack, Directory, Shareholder's Guide and Manual*. Bibliobazaar Reproduction Series (online).
- Bulmer, P.T. (1895) *History, Topography and Directory of Derbyshire*. Preston, T. Bulmer & Co. (via openlibrary.org).
- Eastwood & Kimberley Advertiser (1974) *Visions of Boyhood: a native of Langley Mill looks back* – article dated 25 January 1974.
- Giblin, J. and Giblin, J. (2002) *Langley Mill Pottery: its history and its wares*. J & J Giblin Publishing.
- Green, C. (1999) *John Dwight's Fulham Pottery: Excavations 1971–79*. English Heritage Archaeol. Rep. 6.
- Heanor & District Local History Society (1987) *Heanor – then and now*.
- Heanor Observer (1968) *Centenary celebrations – G. R. Turner, Langley Mill* – article dated 31 October 1968.
- Kelly (1891) *Kelly's Directory of Derbyshire, Leicestershire & Rutland and Nottinghamshire*. London. Kelly & Co.
- Kelly (1908; 1925; 1941) *Kelly's Directory of Derbyshire*. London. Kelly & Co.
- Ripley and Heanor News (2000) *Time for Capsule Opening*. Johnson Press Newspaper Group – article dated 20 April 2000.

The Society gratefully acknowledges the financial support of Asda Stores Ltd in the publication of this paper.