



John Knowles & Co. Mount Pleasant Works WOODVILLE WOODLANDS

Archaeological Investigation and history of the works



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Cover picture

The pipeyard, Mount Pleasant c.1950

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**John Knowles & Co.
Mount Pleasant Works
WOODVILLE WOODLANDS
(NGR SK 3111 1840)**

Archaeological Investigation and history of the works

Report

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Site Work

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John Knowles & Co.
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(NGR SK 3111 1840)

*Archaeological Investigation and history of the
works*

1. Summary

The project was undertaken in accordance with a requirement from Derbyshire County Council that a scheme of archaeological work needed to accompany any development of the site.

The main aims were to assess the surviving industrial archaeology and interpret the results in conjunction with the John Knowles & Co. archive.

Undergrowth was removed to reveal industrial features relevant to the development of the firm. Detailed records were made of the surviving archaeology.

Using the company archive an analysis was made of the company's development and the features uncovered during excavation were placed in context.

The features recorded related to distinct periods in the company's development, and reflect changes in demand for the company's products which in turn relate to social and technological developments.

Rapid recording was also undertaken on the site of the former Albion Works (NGR SK 3157 1828) and an area of former mine working known as 'Humps and Hollows' (NGR SK 3184 1842).

2. Introduction

Archaeological Investigations Ltd. was commissioned to undertake a program of investigation into the surviving industrial archaeology on the northern half of the site of John Knowles Mount Pleasant Works in Woodville.

The site straddles the border of Leicestershire and Derbyshire and is situated between Burton-on-Trent and Ashby-de-la-Zouche (fig. 1). It is centred at SK 3111 1840.

A rapid record was also made of the site of the former Albion works (Appendix 4) and an area of former mine working known as 'Humps and Hollows' (Appendix 5).

The work was undertaken in accordance with a requirement from Derbyshire County Council on behalf of South Derbyshire District Council that a scheme of archaeological work needed to accompany any development of the site. The scope of the work was agreed and a proposal produced that reflected this.

Site work was conducted between the 19th December 2005 and 13th of January 2006.

The results of the fieldwork have now been assessed in conjunction with the John Knowles & Co. archive, which comprises company accounts, legal papers and personal letters relating to the operations of the company between 1853 and the mid 1970's. This archive was kindly made available to Archaeological Investigations Ltd. by Mr. Keith Kirby, a former Works Manager of John Knowles & Co. who rescued the papers during the demolition of the works in 1993. Mr. Kirby sadly passed away during the writing of this report in March 2006. Where the archive has been referred to in the text a reference is given with the prefix ID. The company archive is fully catalogued in Appendix 1.

Mr. Kenneth J. Crockford has also provided invaluable information on the operation of the works. Mr. Crockford worked in the research department of John Knowles & Co. between 1951 and 1991, and during an interview conducted in May 2007 provided much of the information included in this report relating to the history of the company during the latter half of the twentieth century.

In this report an attempt has been made to outline the chronological development of the company using primary sources and relate this to the results of the fieldwork.

3. Historical account

The Mount Pleasant works manufactured a variety of ceramic products utilising the local clay resources. The firm was founded in 1849 and began producing firebricks and stoneware pipes. During the twentieth century ceramic goods for use in the steel industry and radiants for the production of gas fires became the dominant products (fig. 2).

3.1. Knowles 1849 - 1871

The founding of the firm of John Knowles and Co. in 1849 seems to have occurred through good fortune and opportunism on the back of social and industrial revolution. John Marsden Knowles is best remembered in the company that took his name, but it was his earlier occupation of railway construction that led him to Woodville. It was whilst tunnelling between Castle Gresley and Moira for the Midland's Coalville to Burton-on-Trent line that Knowles came across a bed of fire-clay. When his contract under Robert Stevenson (Co-creator of the "Rocket" locomotive) finished in 1849, Knowles erected a kiln on the land.

According to a document produced for the centenary of the company in 1949 (ID 91) Knowles commenced mining fireclay by "very primitive methods" and produced firebricks, some of which were sold to the Railway Company, disposing of others to the iron and steel producers in Sheffield and the Midlands.

The earliest surviving company records list some notable customers. One of the first customers appearing in the 1853 sales book (ID 44) is that of Spear & Jackson of Sheffield, who continued to purchase clay from John Knowles & Co. throughout the 1850's. The major steel firms of the era are also regular customers. Johnson Cammell, owners of the largest steel works in the world at Dronfield ([www.1](#)) were customers (fig. 3), as were Thomas Firth & Sons, producers of the first true stainless steel in 1913 ([www.2](#)).

Finding a ready sale for his firebricks and fireclay, he leased a further area of clay and bought additional land (ID 24), finding as he progressed with extraction of the clay resources, seams of surface or shallow clays as well as the deeper seams of fireclay. The surface clays, being different in character from the fireclays, were found to be very suitable for the manufacture of high grade stoneware pipes, so he then turned his attention to their production, extending his works, building more kilns and finding wider markets for his products.

Realizing that London was a vast potential market owing to the advancement of sanitary engineering, particularly with regard to sewerage disposal, he opened an office in St. Pancras in 1863 from which to market his goods (ID 91).

Table 1 (ID 27) gives an impression of the Mount Pleasant Works prior to the death of John Knowles in 1869.

It would appear from the number of kilns employed that pipe manufacture had become the focus of the enterprise, taking over from the production of firebricks which the business had been founded upon. The majority of entries in the 1870's sales book are for pipes (ID 161,162)

After the death of John Knowles in 1869, the business was continued by his wife, Sarah until her death in 1871. A further building inventory from December 1870 (Table 2) illustrates the shift to pipe production, although firebrick production was still important enough for the company to construct a new kiln between 1867 and 1870.

6 Pipe Kilns
 1 Chimney Pot Kiln
 3 Fire Brick Kilns
 Offices Complete
 1 Chimney Pot Room with Modlers Room above
 2 Old Hovels adjoining chimney pot room
 3 New Hovels join old hovels to boundary of Granville Estate
 3 Pipe hovels extending from clay mill to fire brick kilns
 1 large hovel with bend and siphon room
 1 small room for garden tiles
 Engine house, store room above, large chimney stack and 2 boiler seats
 New carpenters shop, smiths shop and engineers shop with 2 stoves
 complete
 Old stable and office, smiths shop
 Pipe machine building, 2 stoves, grinding shed, pugging shed with fine clay
 rooms above and small engine house and salt shed.
 Pugging room for brick clay

Table 1 – Inventory of works 31st December 1867

8 round sewerage pipe kilns with patent attached
 4 round brick kilns with patent attached
 1 round chimney pot kiln
 1 small round kiln for enamelled bricks
 1 old large round kiln for C. pot making
 1 small round red brick kiln
 1 large square brick kiln (old)
 Lower and upper offices
 1 room with modellers and chimney pot makers room above
 2 brick hovels with drying rooms above
 3 brick hovels adjoining above
 2 S. pipe hovels
 1 S. pipe hovel and drying room above
 1 large S. pipe hovel and drying room above
 1 small room for junctions
 1 room for fire clay mill machinery, and engine house and store room above, large
 chimney stack and three boiler seats
 Grinding shed with fine clay rooms above
 Small engine house and pipe machine and pug mill rooms and salt house
 Engineers shop and Smiths shop and carpenters shop with 2 large store rooms
 above
 1 Boiler seat and chimney adjoining above
 1 weighing machine and house
 Old stables, corn stores and store rooms adjoining
 1 small cabin for firemen

Table 2 – Inventory of works 31st December 1870

3.2. The Hassle brothers (Plates 1 & 2)

During an Extraordinary General Meeting of the Company held on November 21st 1919, John Hassall defended his record as company Chairman (ID 109). Following attacks from shareholders within his own family, he made the following statement...

“I wish to bring before the meeting the following particulars compiled for the information of the late Mrs. Knowles’ Residuary Legatees and embracing the period since October 11th 1871 to September 30th 1918. These particulars show the results accomplished out of a practically bankrupt business listed below:

- Value of Real Estate £4,165.0.0
- Government Valuation for duty on each share £144.15.4
- 5 years of supply of fireclay only left.
- Henry Knowles resigned as a trustee in 1876 and started the ‘Albion Clay Co. Ltd.’ in competition with John Knowles & Co.
- T.H. Adcock died in 1886 when John Hassall was left sole Executor and Manager.

Profit made on £4,165 and paid out as below:

- To Legatees up to 1918 - £88,848.19.3
- Equals annual return on Capital of 45.37% and in addition Works have been almost entirely rebuilt, enlarged and old worn out plant renewed.
- To Bankers for interest on money borrowed on securities deposited by myself to enable the business to carry on - £37,731.9.11

Had the legatees found the requisite capital they would have received this sum instead of the Bankers. The return on the Capital value of each share equates to £86.13.2 or 60%.”

‘The above named results have been secured almost entirely by the influence and labours of myself who alone has run the great financial risks that have been necessarily incurred to accomplish them.’ (*JK&Co. General Minutes 1908-1943 ID109*)

John Hassall’s self-proclamation as the saviour of John Knowles & Co. is largely justified. During his tenure as Company Chairman (1871-1928) the company flourished due to his business acumen and foresight.

According to the terms of her will, after her death on October 11th 1871, Sarah Knowles wished for the works to be carried on under the management of her trustees Thomas Hassall Adcock, Henry Knowles and John Hassall, for the sole use and benefit of her 28 legatees (ID 27). Although a generous legacy to 28 of her ‘closest’ family members, the will would prove a poisoned chalice for the ambitions of the three men chosen to carry out her wishes.

Letters written between various solicitors attest to the malcontent that existed between the trustees as early as 1874. Legal correspondence instigated by one of the legatees, John Spencer, raised concerns that two businesses had been started by some of the trustees in competition with John Knowles & Co. 'It appeared that trading property left in their charge must in a few years be much deteriorated (*Spencer Solicitors, bill, 18 April 1874 ID 27*)'.

It is apparent from the description of a meeting between Mr. Adcock, Mr. Hassall and their Solicitor that Mr. Adcock had entered into partnership with a Mr. Cull and had formed the Woodville Company which in Wrights Directory of 1874 was listed as a Brickyard located in Smallthorns. During the meeting on May 9th however, Mr. Adcock stated his intention to sell his share of this business and showed a letter he had received from his business partner, Mr. Cull, calling upon him to disconnect himself from the partnership as 'the restrictions they had been subject to had much interfered with the working of the Woodville Company'. As no further mention of the Woodville Company or Adcock's business interests appear in the John Knowles Company archive it is assumed that his partnership with Mr. Cull was indeed terminated, and Thomas Adcock remained a trustee of John Knowles & Co. until his death in 1886.

During the same meeting on May 9th 1874 it was decided that a letter should be written to Henry Knowles offering him retirement from the trusteeship 'upon him entering into an agreement not to carry on or be concerned in any business of a similar kind in which the name of Knowles should appear'. Henry Knowles agreed to these terms and left John Knowles & Co. in 1876 to start the Albion Clay Company Ltd. with his business partner Hosea Tugby. He was replaced as trustee by Thomas Spencer, the legatee that initiated legal action against him over his conflicting business interests. Spencer continued in the role of trustee until his death in 1896.

John Hassall's 57 years as Chairman of John Knowles & Co. are marked by his attempts to increase his share holdings in the company. A Chancery Proceeding legal document dated January 10th 1901 refers to a previous order dated March 9th 1896 whereby;

"It is by consent ordered that the applicant (John Hassall) by the said order...be discharged (from his duties as executor). And it is ordered that all further proceedings in the action be stayed."

(ID 27)

This ruling would appear to give John Hassall the power to purchase shares in the company without incurring a conflict of interest. In 1896 he purchased the shares of H. Adcock for £2000 and paid £5000 for the interests of J W Adcock, his sister and his mother, also paying out a further £750 to insure the life of J W Adcock, so as to guarantee the life annuity now in his name.

As the numerous legatees died off, Hassall appears to be the only member of the company to have the financial resources or will to take over the available shares. The only challenge to this comes with the death of Sarah Adcock in 1912 and the subsequent squabbling over the distribution of her shares (ID 64). At her death Sarah Adcock was the holder of 400 B shares and 20 A shares, her original share of the

legacy left her upon the death of Sarah Knowles in 1871. As executor of her will, her nephew J W Adcock under the articles of association of the company must first distribute the shares amongst the A shareholders depending on their willingness to purchase. Only if there were no takers was Adcock at liberty to sell the shares on the open market. Setting the price at £2,500 and a time limit of six months, J W Adcock offered the shares to the current shareholders that were eligible to purchase; Mrs. Le Gros, Mrs. Mellor and John Hassall.

After Mrs. Mellor stated that she did not wish to purchase, and Mrs. Le Gros failed to reply, John Hassall stated that he was not willing to pay £2,500 but would pay 'something closer to their true value'. There is no further correspondence on the matter in the company archive until 1921, at which time Mrs. Mellor had changed her mind and now wished to buy the shares. The shares were offered at £2,000 but John Hassall was only willing to buy at £1350. He makes the point that according to article 27 Mrs. Mellor is only entitled to own one twelfth of the available shares (her current share of the company's A share capital). In the opinion of the firms accountants, Wykes & Co. of Leicester, Mrs. Mellor was setting up a fictitious battle for the shares with John Hassall. In January 1922 John Hassall made a formal offer of £3 per share for Sarah Adcock's shares. One month later J W Adcock replied that John Hassall had missed the six month window of opportunity to purchase the shares, and that the shares had been sold at a more favourable figure (ID 64).

After a period of confusion as to who had purchased the shares, John Hassall received a letter from Percy Mellor, who revealed that he had purchased the shares from J W Adcock for £1600. Hassall's reply is incredulous, informing Mellor that he saw no advantage to the company in this and referred to him as a stranger. Amazingly Hassall states that he would 'take steps that would materially affect the welfare of the concern in the future' (ID 64) if the transaction went through. In future correspondence with his solicitor it was revealed that John Hassall meant that he would withhold the mineral extraction rights from the company which were held in his name.

In April 1922 Sarah Adcock's 400 B shares were transferred to John Hassall, followed by the transfer of her A shares to him in September (ID 64). The Company Archive is silent on the mechanisms behind this transfer, but it can be assumed that John Hassall had invoked Clause 31 of the articles of association, whereby,

"The Directors may refuse to register a transfer to any person whom they consider undesirable to admit as a member."

(ID 112)

Running concurrently with the saga regarding Sarah Adcock's shares is another share battle involving John Hassall. During 1913 Elsie Criswick appeared desirous to gain some income from her 400 B shares and entered into negotiations with John Hassall. Wykes & Co. advised Hassall to offer Mrs. Criswick a £100 annuity for her shares, a fair deal considering the unlikelihood of her receiving anything in way of dividends on her shares during her lifetime. Nothing further is recorded on the matter in the company archive so it can only be assumed that Mrs. Criswick did not accept Mr. Hassall's offer.

Elsie Criswick died in February 1919. Under her will George and Mary Le Gros were Trustees, Executors and also the main beneficiaries. At an Extraordinary General Meeting of John Knowles & Co. held on November 21st George Le Gros attended and claimed to vote as Executor of the late Elsie Criswick (ID 109). The Chairman on the advice of H J Taylor who was present disallowed his claim under the company's articles of association. It is recorded in the minutes of that meeting that George Le Gros then 'retired under protest'. The following month Mr. Le Gros demanded that dividends be paid on the estate of Mrs. Criswick and threatened legal action.

In a personal letter dated October 5th 1920 Mary Le Gros informed John Hassall that she wanted rid of her shares (ID 64). Launching a very personal attack on the Chairman she voiced her dissatisfaction with the management of the business and disgust with the lack of a dividend payment 'considering the size and standing of the works'. Le Gros is clearly upset with the way that Elsie Criswick was treated by John Hassall in her lifetime, referring to the expenses he allegedly claimed for his daughter to travel to visit the dying Mrs. Criswick. Ultimately the root of her malcontent appears to be the huge salary he himself received while the legatees continued to receive no dividend.

In October, John and William Hassall made a joint offer for the shares of Mrs. Criswick of £3.2.6 per share. If Mrs Le Gros did not accept this offer then the matter would go to arbitration. The following month, after Mrs. Le Gros had attempted without success to gain access to the company accounts, the Hassall brothers withdrew their offer for the Criswick shares and the matter headed for arbitration (ID 64). No further mention of the matter appears in the company archive.

Through borrowing and investing John Hassall managed to obtain 20.5% of the company's A share capital and 54.5% of the B share capital by the time of his death in August 1928 (ID 199). His detractors pointed to the lack of dividends paid on their shares and his (at times obsessive) approach to acquiring available share capital for himself, that verged on bullying out competitors in the case of Percy Mellor. His words during the Extraordinary General Meeting of 1919, however, do ring true. It was indeed his personal investment in John Knowles & Co. that brought the company back from the brink of bankruptcy in 1872, and it was his determination that stood in stark contrast to the apparent apathy and lack of involvement exhibited by the majority of the other shareholders at that time and thereafter. While some complained of the return they received on an inheritance, John Hassall commanded a large salary on the back of over fifty years of hard work and personal financial risk.

Attached to a bundle of John Hassall's legal papers relating to the estate of Sarah Adcock is a newspaper clipping entitled 'Distant Relatives';

"The most painful experience that a man can well undergo is that of being confronted suddenly by a distant relative...Most of us find ourselves born into a world apparently peopled by a legion of cousins and -fatal word- connexions...For such life is not without its anxieties."

The Times 30th June 1914 (ID 64)

3.3. Works expansion (Fig. 4)

Although very little exists in the company archive to detail the rebuilding programme undertaken by John Hassall, the First and Second edition Ordnance Survey maps of the area illustrate the expansion of the Mount Pleasant Works between 1883 and 1901. Comparing the building inventory produced in 1870 with the First Edition map of the site there would appear to be little development of the site in the years 1870-1883, the number of kilns for example only increasing by three, from sixteen to nineteen. If we compare the 1883 situation with that of 1901 however, the transformation is obvious. Thirty round kilns are now used on the site and a large tunnel kiln has been constructed. The railway sidings have been redeveloped and many smaller alterations and redevelopments have taken place across the site.

Redevelopments between 1901 and 1923 included the addition of three new kilns and the redesigning of the pipe department. The Steel Goods department had also been extended.

Additions to the plant between 1923 and 1937 were dominated by the redevelopment of the Radiant department in 1935 and construction of a new fireback store adjacent (Archive ID 95,188).

3.4. Technological innovation (fig. 5)

The John Knowles & Co. illustrated catalogue of 1888 includes six pages promoting the benefits of 'Hassall's Patent Safety Pipe Joint' (fig. 6). The purpose of the joint was to provide a thoroughly waterproof seal to prevent sewerage escaping from the pipe, or ground water entering. The spigot and shoulder are formed so as to create a recess into which cement can be poured to create a seal. Clearly a successful design, the joint was recommended by the Borough Engineers of Warrington, Westminster, Sheffield and Nottingham. 'The Nursing Record' of 1872 in reporting the re-drainage of St. Bartholomew's Hospital remarks that 'Special care has been taken to achieve the best results. Hassall's Patent Safety-Jointed Pipes are being used throughout the entire work.' The design was patented by William Hassall in 1884 (Patent No. 4357/1884) and its popularity is evidenced by the number of other firms which made it under license (Archive ID 176)). The name of Parker & Hassall of Nottingham appears above John Knowles & Co. in the listing of suppliers of this pipe design, but the connection between the two firms is unclear.

In July 1906 'an improved pipe joint' was patented by Joseph Henry Haywood, a foreman bricklayer of occupation road, Woodville (Patent No. 16469/1906 ID 63). The invention was designed to provide a cheap and effective form of waterproof joint, by tapering the spigot and creating a chamber in the shoulder of the pipe where cement could be poured to create a tight seal (ID 153). This method of jointing was cheaper than the bitumen joint. The design appears to be a simplified version of the Hassall Joint.

A 1909 indenture named Harry Stuart Hassall and William Henry Simpson as the Licensors of patent number 16469/06. The indenture granted John Hassall (The Licensee) permission to ‘make or cause to be made, use, exercise, and vend the said invention’. The Licensee also had the absolute right and liberty to grant a license to any company or firm for the manufacture of the articles affected. It appears then that Hassall & Simpson had purchased the intellectual rights for the invention from Joseph Haywood and were trading as the ‘Free Flow Pipe Company’. Whether they were producing pipes themselves or simply profiting from licensing the patent is not clear. In addition to the agreement with Knowles & Co., a license was also held by Sutton & Co. of Overseal, but there is a suggestion that this might have been revoked due to it having been in competition with the interests of Knowles (ID 63).

The Free Flow Pipe Company would appear to be a subsidiary of John Knowles & Company. The most obvious indicator of this was that Harry Hassall was the son of John Hassall. A large amount of sensitive paperwork relating to the Free Flow Pipe company, including the firm’s bank pass book are contained within the Knowles company archive (ID 85). Records concerning the company date between 1907 and 1934. Harry Hassall died in 1921, at which time John Knowles Hassall, his brother took over the ownership of the Free Flow mark.

An indenture dated December 1925 named John Knowles Hassall and Andrew Harris of Woodville as the patentees of an ‘Improved nozzle for ladles used in pouring molten metal (Patent No. 224/113/1923)’ For a period of sixteen years they held full power, sole privilege and authority of making, using, exercising and vending the invention. The indenture gave John Knowles & Co., sole, full and exclusive license to make, use, and vend the invention. For this the patentees received one shilling per nozzle produced (ID 63).

3.5. Radiation Ltd.

Under the terms of his will, John Hassall’s shares in John Knowles & Co. were left under the trusteeship of Harry James Taylor, who was also appointed the new Chairman of the company. A particularly tragic story unfolded surrounding John Knowles Hassall (Plate 2). After the death of his father, and perhaps seeing himself as the heir apparent, Knowles Hassall was particularly disappointed at being denied control of his father’s stake in the company. His bitterness was made clear through his treatment of the new Chairman, and Harry Taylor was adamant that John Knowles Hassall should ‘not in any way interfere with the company or its management’. Indeed Taylor was desperate to be rid of the shares he held in trust to avoid all the resentment;

“To be told I am robbing a man of his birthright is more than I will stand.”

(ID 199)

Legal opinion dictated that Harry Taylor must allow John Knowles Hassall the first option to buy any portion of the shares he offered for sale (ID 199), furthermore he must give him time to raise the finance, even though Hassall was heavily in debt

(owing his father's estate over £10,000) and had no chance of raising sufficient funds. Taylor's hands were tied.

After joining the works in 1951, Ken Crockford recalls being told a story involving the two men that had gone down in company folklore. An employee had requested permission to blow the works hooter to signal the end of a shift. Mr. Taylor had refused permission but Mr. Knowles Hassall instructed the employee to go ahead and blow it. Mr. Taylor sacked the man on the spot. It is to be hoped that the man was reinstated later! Whatever the truth in the story it does illustrate the power struggle existing within the company following the death of John Hassall.

John Knowles & Co. had been supplying gas fire radiant products to Radiation Ltd. throughout the 1920's. From their vast works in Aston, Radiation Ltd. manufactured gas fires and cookers for the consumer market, and soon became Knowles' most important client (ID 62).

In June 1929 John Knowles Hassall offered to Radiation Ltd. information relating to a design William Hassall was working on to combat the drying effects of radiant elements (ID 199). Radiation Ltd. ridiculed Knowles Hassall's attempt at industrial espionage and forward a copy of the letter to Harry Taylor to 'keep him informed as to what is going on'.

By November Knowles Hassall's plight had become even more desperate and he committed himself to an asylum. According to legal papers informing Harry Taylor that Knowles Hassall has executed a power of attorney to sue for moneys due from the estate of his father;

"John Knowles Hassall has been certified to be insane by two medical men whilst other medical men are of a contrary opinion."

(ID 199)

With Radiation Ltd. looking to invest in Knowles, there was certainly a sense of embarrassment regarding the antics of the former Chairman's son.

Matters reached a dramatic conclusion during the summer of 1931. On July 19th John Knowles Hassall threw himself under the Manchester to London Express train (Archive ID 175/201). He had married three weeks earlier. In the John Knowles Company minutes book was an entry dated five days before John Knowles Hassall's suicide resolving that Messrs. Fishers be instructed to write to Mr. J K Hassall asking for the repayment of the loan due from him to the company (Archive ID 108).

In September 1928, the Chairman of Knowles, Harry Taylor outlined a way forward for the partnership between Knowles and Radiation Ltd (ID 199). Identifying the inefficient methods that existed in producing refractories, transporting them to Radiation Ltd. for finishing, then transporting them to their point of sale (which was often closer to their point of manufacture at Mount Pleasant than Radiations Works), Taylor suggested that a portion of Knowles Works be set aside for use by Radiation Ltd., and any new buildings that were necessary be constructed. In return for this Radiation Ltd. would advance to Knowles £30,000 out of which the bank could be paid off and £5,000 would be earmarked for making the Works more efficient.

Knowles & Co. would undertake to make and deliver to Radiation Ltd. a minimum of 80% of the goods required by them that were capable of being produced at Mount Pleasant.

To safeguard Radiation Ltd. against Knowles & Co. breaking the agreement due to the company being bought out, Taylor suggested that the shares held by him as trustee of John Hassall be offered to Radiation Ltd. (assuming that J. K. Hassall was not in a position to buy) at a price fixed by the auditors. In effect Taylor was suggesting that Radiation Ltd. should take over John Knowles & Co. by acquiring the firms share capital;

'Any attempt made by two firms to bring about closer working arrangements, when they are not in competition must result in the stronger firm getting such a grip on the weaker that its chain of strength does not develop a weakness.'

It appears from the company records that Radiation Ltd. did not take over Knowles' share capital but did clear the company's overdraft and take over a large part of the Works.

In January 1929 Knowles & Co. entered into an agreement to produce Gas Fire Radiants exclusively for Radiation Ltd. In the case of Fire Bricks they were allowed to continue to supply the Parkinson Stove Co. Ltd. and A. Bell & Co. Ltd. although any changes of design that were supplied to these companies were to be submitted to Radiation first and permission granted.

Between 1936 and 1938 investment at Mount Pleasant centred on the extension and redevelopment of the Radiation department.

3.6. Post-war development (Plates 3-7)

Analysis of the development of John Knowles & Co. prior to the 1920's has largely relied upon personal correspondence and legal papers. More comprehensive accounting methods adopted in the early 1920's provide more comprehensive data allowing for closer analysis of the firm's economic performance (fig. 7&8).

Information relating to income and expenditure reveals stagnation in the firm's growth between 1923 and 1935. Income remains fairly constant around £90,000 per annum, exceeding expenditure by approximately £2,000 per annum over the same period (ID 46,190)

In 1936 the company experienced a 28% increase in income on the previous year. Between 1935 and 1938 income increased by 37% in total (Archive ID 100, 103). According to correspondence at the time it would appear that this upturn in the company's fortunes was a result of a nationwide rearmament drive initiated by the perceived threat of Nazi Germany. By analysing the sales of each department as a percentage of total company sales, the effect of the war on market forces can be seen. In the period up to 1939 the stoneware pipe department had been far and away the main earner for the company, at its peak in 1931 the department accounted for 59% of

the company's sales. Falling to 43% in 1934 the department recovered some ground and accounted for 50% of total sales in 1938, possibly due to the development of airfield drainage in the immediate pre-war period, attested by personal letters in the company archive (ID 193/194).

The shift in production caused by World War II is dramatic. Stoneware pipe sales fell from 50% of the company's total production in 1938 to 4% in 1944. Over the same period the steel products division goes from accounting for 8% of sales to 33% (35% in 1945). The firebricks department which accounted for 11% of total sales in 1938, accounted for 24% of the company's turnover in 1944.

The effect of World War II on John Knowles & Co. can be seen through their correspondence with Radiation Ltd. during the period. Even prior to the outbreak of hostilities Knowles & Co. complained of margins being less than they used to be and 'it only being by the very closest watch on costs that we were able to make anything in the way of profit out of bricks and radiants.' In April 1937 Knowles wrote to Radiation Ltd. requesting a 4% increase on radiants to cover rising costs. In November 1939 Knowles requested a 10% increase on the price of radiants, and outlined the increased costs they were facing;

'Wages have increased...Since 1936 the cost of principal grade coal has increased by more than 50%... China Clay prices are up...Rail rates have increased by 5%. Cardboard for packaging has become almost impossible to obtain and prices are 60-70% higher...The price of sawdust has doubled.'

(ID 62)

The 1940 balance sheet was the worst since 1928, a combination of restricted sales and a shortage of skilled labour affecting the company's turnover. The Refractories Council refused permission for Knowles to increase prices on general sale goods due to the financial troubles faced by Knowles not being an industry wide phenomenon. Demand was exceeding supply for refractory products and many companies were doing exceedingly well. The reason that some firms were not competing according to Knowles was that;

'the losers, like ourselves, are not really laid out for 100% refractories, and their, and our effort to be patriotic...means losing money'

By March 1941 Knowles had been forced to ask Radiation Ltd. for three price increases in the space of three years. The Ministry of Supply had approved a 32.5% increase in the price of refractories since the outbreak of war, Knowles however were content to request of Radiation a 20% rise in the price of Gas Bricks and 30% on radiants. The goodwill between the firms during this time appears to be very strong. Knowles asked for no more than their increased costs and Radiation Ltd. was very gracious in accepting their demands.

Income declined from £122,507 in 1938 to £84,714 in 1940 and expenditure exceeded income in each year during this period. The 1940's however are an extremely strong period in the growth of the company. Investment remained high throughout the decade and the company income more than tripled (ID 104,191).

The 1950's appeared to be the first period in the company's history where income significantly outstripped expenditure. The profit margins however were cyclical, the company experiencing boom and bust on three occasions during the decade. Income continues the trend of the 1940's and rises sharply until 1952, a minor downturn in income during 1953 preceded a surge in profits up to 1956. A 21% decrease in income between 1956 and 1958 was followed by a 44% rise in income between 1958 and 1960 (ID 104). While the traditional staples (stoneware pipes and firebricks) of the company showed a gradual decline as a percentage of total sales during the 1950's and early 1960's, the gas fire radiant department expanded at an astonishing rate. Accounting for just 11% of total sales in 1957, the department accounted for 54% of the company's turnover in 1965 (Archive ID101).

It is likely to be this reliance on radiants that destabilised John Knowles & Co. By the mid 1950's the gas industry was in decline. Coal, the raw material for gas production was becoming more expensive and the demand for gas was falling. The introduction of new products such as the convector fire in 1965 went some way to arresting the decline, but competition from the electric fire was challenging the demand for gas fire radiants.

3.7. Natural gas conversion

The national conversion to natural gas started in May 1967 near Burton-on-Trent, making John Knowles & Co. one of the first companies to experience the changeover. The gas board changed the plant over from producer to natural gas and in their desperation to make the new system a success offered Knowles & Co. a low, five year fixed price per unit. Natural gas had a higher calorific value and could be controlled far more easily than producer gas. This combined with the excellent financial terms made the changeover beneficial to the Works itself.

The effect of the natural gas conversion had impacts beyond a change in fuel source. For companies such as Radiation, the changeover involved working around the clock to convert their appliances to work with the new fuel source. Virtually overnight their whole range of products became obsolete.

While the close technical relationship with Radiation Ltd. had been at times enormously beneficial to Knowles & Co., it also caused difficulties at Woodville. From at least 1951 (when Mr. Crockford started work at Woodville), Radiation Ltd. had always manufactured the moulds that Knowles & Co. used to produce radiants. In the late 1960's however, Radiation Ltd. closed their mould shop and Knowles was forced to look elsewhere for a supplier. The relationship between Knowles & Co. and Radiation Ltd. broke down and was eventually terminated by mutual consent in the 1970's. Companies such as Cannon and Flavel had been asking Knowles to produce radiants for them for a number of years, but the company was tied into an exclusivity agreement, so was unable to do business. Now that this agreement had ended, Knowles & Co. were forced to seek out new business.

Mr. Crockford believes that the company was quite robust and the end of its close relationship with Radiation Ltd. did not affect Knowles too severely. The company

penetrated markets with Flavels, Maines and Economic (a subsidiary of Braby) and supplied fire bricks to Parkray for their smokeless fuel stoves. Gloworm (later owners of Radiation Ltd.) were also clients.

3.8. The Dyson years (1970 – 1997)

The second half of the 20th century saw a marked reduction in kiln numbers. The site was recorded as having a total of 38 kilns in 1949. By 1965 only 26 kilns were recorded, by 1969, a further five kilns had been decommissioned representing a 45% reduction in kilns over a 20 year period (ID 95). According to Ken Crockford, this decline in kiln numbers was an attempt to achieve greater efficiency rather than a downturn in fortunes. He recalled three large beehive kilns being constructed in the 1950s which comfortably fired the same number of pipes as the nine small kilns that they replaced. While Knowles may have had a part to play in the stoneware pipe market during the 1950s and early 1960s, there certainly were problems by the late 1960's. In 1969 the pipe department closed (ID 68). In a personal letter to what appears to be a former employee, J.F. Trevor writes;

“What we have done is to close down the pipe department simply because it was losing too much money and so far as one could see would continue doing so. It caused a local shock and me a lot of worry, but it had to be done. Now we shall concentrate on the radiant and refractories side as a smaller unit.” (ID 183)

Ken Crockford believes the end of stoneware pipe production at Knowles' was caused by one major factor – Hepworth. The pipe making process was an extremely labour intensive process. Labour costs were compounded by the demands of the customers, who each wanted pipes produced to their individual specifications. In the late 1950s, Hepworth had entered the underground drainage market, acquiring companies in the midlands and the north of England. By producing pipes in vast quantities, using efficient, modern tunnel kilns, Hepworth managed to corner the market. Rather than producing pipes to customer's specifications, customers were soon forced to buy pipes to Hepworth's specifications. It was not only Knowles that could not compete, the impact was felt industry wide. Within ten years Hepworth had destroyed the competition.

Fortunately, the loss of the pipe department coincided with a surge of orders for steel rod covers which the beehive kilns (recently converted to natural gas) were ideally suited to. Even so, well over 100 people had been made redundant in 1969.

The following year J&J Dyson made a bid for John Knowles & Co. (ID 201). There is a suggestion that Dyson did not want any involvement with the production of stoneware pipes, and the loss of the pipe department the previous year had actually made Knowles a more attractive proposition to the Sheffield based firm. In April 1970 a resolution for Dyson to purchase all the shares in John Knowles was passed at a general meeting. G. Hassall recommended to shareholders that in recognition of his exemplary service each shareholder should transfer 5% of their new shares in the Dyson Group to J.F. Trevor.

After 121 years, the name of John Knowles & Co. was no more.

Although no longer trading under the Knowles name, the plant appears to have enjoyed some success during the 1970s. According to the Dyson company accounts, Mount Pleasant made a profit of £132,947 in the financial year up to 1978 (ID 48), and the plant had survived its former competitor Ensor which had been forced to close its Woodville plant in 1975 after structural defects were found (ID 201). The increased profitability of the plant would appear to have been achieved through downsizing and a shift in production focus. The downsizing was to continue;

Changes in Steel goods technology culminated in the closure of this department in 1981. The 'sliding gate' technique of molten steel transfer took over from the ladle in the 1970s. This meant that fireclay refractories were no longer needed to the same extent, and rod covers became redundant. The government restructuring of British Steel by Sir Ian McGregor in 1980 led to a further reduction in demand for refractory products. With Dyson already producing refractories at their works in Stannington, steel goods production was moved away from Mount Pleasant. Domestic goods production moved to Stannington the following year.

Ken Crockford took early retirement in 1991. Fibre was quickly taking over from clay as the dominant material in radiants, and he felt his expertise in clay technologies was no longer as relevant to the new era of radiant production. The grand works of John Knowles & Co. were also no longer relevant. In 1993, with the plant decimated, the Radiant department became the last department to leave the south side of Mount Pleasant and relocate to the Dyson factory on the north side of Occupation Lane.

The southern works were demolished in 1997.

4. Results of excavation

4.1. Method

The main aims of the fieldwork were to reveal and record the extent of surviving structural remains and to gain a greater understanding of the development of the John Knowles works.

The fieldwork focused on a beehive kiln base, a tunnel kiln base and a drying shed floor which were identified during a site visit in 2000 (fig. 9).

Once the features had been located it was necessary to remove the plant growth and debris covering them using spades, and to carefully clean the features so that they could be adequately recorded.

Detailed photographs were taken of the features using 35mm colour film and 35mm black and white film. Publication photographs were also taken using 120mm medium format film.

Accurate plans were made of the features at a scale of 1:20.

A JCB excavator with breaker attachment was used on site on the 11th of January to dig trenches through the centre of both the beehive kiln base and the tunnel kiln base. The purpose of this was to provide an insight to how the structures worked during their operational life. The sections were cleaned and recorded. The bases of two further beehive kilns were also exposed by the excavator using a toothless bucket.

Work carried out on the 'drying floor' in the Northeast corner of the site (plates 8 & 9) involved cleaning, photography, and drawing a representative area in both plan and section.

The site was scoured for different types of construction material and two samples of each brick type were recovered for the archive (Appendix 2).

On the 13th of January an E.D.M. survey was carried out, plotting the location of all surviving features on the site (fig. 9)

4.2.1. Beehive Kiln (fig. 10)

The base of Beehive Kiln 1 (BHK1) measured 7.40m in diameter and was built of brick. Surrounded by a cobbled surface, it was flanked by two further Beehive kilns uncovered during excavation. BHK2 to the east measured 11.60m in diameter and BHK3 to the west 7.40m.

The outer wall was approximately 1m thick and was supported around the outer circumference by 1.2m wide buttresses, only the foundations of these were still present. The buttresses were spaced approximately 1m apart.

The interior of the Kiln was divided into 5 equal areas by sunken brick channels, the ends of which converge at the centre of the Kiln. Each section had a different brick pattern to the next, which might suggest different phases of construction. Indeed, in the westernmost section there was clear evidence for multiple phases with an irregular stone paving built directly over a brick surface. These phases of construction might have all occurred within a relatively short period. Ken Crockford recalls a regular program of clean out and repair taking place on the beehive kilns. They were regularly patched and occasionally the whole floor was taken up and replaced.

The sunken brick channels which divided the interior floor area were filled with a soil and ash deposit which showed clear evidence of the presence of heat. The soil deposits were bright in colour along their length suggesting heat transference in the presence of oxygen along these routes. The channels terminated at the inner circumference of the Kiln in U shaped structures constructed from brick, which seem likely to be the source of the fire.

The 1883 Ordnance Survey first edition map shows a circular kiln of the correct dimensions in the same location as BHK1 so it is possible that BHK1 was one of the earliest kilns on the site. Mr. Crockford doesn't recall kilns being demolished and

then rebuilt on the same spot, so it is possible that BHK1 was originally built prior to 1883. The latest evidence we have for a working kiln being present at this position is an aerial photograph taken of the site prior to 1975. The kiln is not present on any photos taken after 1975. According to Ken Crockford, a rebuilding program was started during the mid 1950's to replace up to nine of the small beehive kilns (e.g. BHK1) with three large kilns which were capable of firing the same amount of material. Plate 13 shows one of these kilns (BHK2) in a derelict state after the crown collapsed and reduced it to a pile of rubble. The kiln was rebuilt at some point prior to 1975 and then demolished again when the site was levelled in 1993.

The eastern edge of the Kiln was heavily disturbed with large voids 30cm deep. A trench positioned in the area of this disturbance revealed that from this point an arched tunnel travelled beneath the base of the kiln and re-emerged in the centre of the base. Samples of brick taken from the inside of the tunnel revealed that it had been subjected to extremely high temperatures. It seems likely that this void signifies the position of the chimney at the eastern edge of the kiln and the tunnel linked it to the kiln chamber. Downdraught kilns work on the principle that hot air gathering at the top of the kiln chamber will be pulled down through the product to be fired by the draw created by the chimney (Plates 10-13). In the case of this kiln, it appears that the hot gases were drawn down and directed into the central flue by the five sunken brick channels in the floor of the kiln. The gases would then travel through the underground flue and be released into the atmosphere through the chimney stack. Kiln temperature was controlled by dampers which were opened fully to begin the firing process and gradually closed to build the core temperature within the kiln.

Within the flue chamber were bricks that appear to have been salt-glazed. As they formed part of the demolition backfill it is not possible to say whether they were fired in the kiln or were deposited in the flue during demolition of the kiln. Also present were tubes of fired clay that would in their unfired state have been blanks for producing early radiants (prior to 1950). The most likely explanation for their presence is that the unworked blanks have been fired and then used as spacers between the products being fired in the kiln.

4.2.2. The process

After the product had been formed from clay it was dried on the drying floor before being transported to one of the kilns in a wheel barrow. The workers had a far more difficult task transporting the pipes; not only were they more delicate than bricks, the pipe room was located up a flight of stairs, which the pipes had to be carried down to reach the kilning yard. Bricks were located on the lower levels of the same building (fig. 9).

Generally individual kilns had designated tasks; a pipe kiln was always a pipe kiln, a brick kiln always used for bricks. Beehive kilns were used to fire Stoneware pipes, bricks, domestic and steel work goods. Early radiants were fired in beehive kilns but the process was abandoned due to the fragility of the radiants. Pipes were stacked vertically in the kiln, separated from one another by saggars. Once the kiln had been loaded the doorway was sealed by building a brick wall known as a wicket. Coal fires

were then lit in each of the fire holes (after 1967 a large proportion of the beehive kilns were converted to work on natural gas). A flue damper was used to control air flow through the kiln. At the start of the firing process the damper was left fully open to induce the maximum draw on the fires. Once the fires were established the damper would be progressively lowered to build the temperature within the kiln. The firing process for a beehive kiln could take up to eight days. Allowing for cooling, emptying and cleaning, the average turnaround for a kiln was fourteen days. Salt to glaze the pipes was shovelled onto the fires in the final stages of the firing process, when the temperature was uniform throughout the kiln.

4.3.1. Tunnel Kiln (fig. 11)

The remains of the tunnel kiln covered an area of approximately 40m x 11m. The floor plan was comprised of both brick and concrete, suggesting different phases of development. The southern end of the floor plan continued beneath a mound of earth, so the full extent is not known in this direction although John German's map of 1937 suggests that the building extended for a further twenty metres. Two sets of rails ran north to south through the structure. The width of each rail was approximately 60mm, and the two rails within the pair were positioned 800mm apart. The westernmost set of rails occupied the full length of the kiln before running under the mound of earth to the south. The easternmost rails ran for half the length of the kiln before being lost in an area of heavy disturbance. It is assumed that they would originally have continued for the same distance as the westernmost set of rails. Travelling west/east across the northern end of the building was another set of rails at a different gauge (90mm) to the north/south set of rails.

Deleted:

4.3.2. The Process

The radiant department was located above the tunnel kiln. Radiants were loaded onto the kiln cars, which prior to entering the kiln sat upon a wheeled platform which allowed the cars to move between the two sets of north/south rails.

Pushing gear controlled the movement of seventeen cars through the tunnel kiln. At any one time, eight cars would sit in the preheat, five cars would be in the firing zone and four cars would be cooling.

The preheat can be considered the final stage of the drying process. It is common in most tunnel kilns for this area to recycle the gases created during the main firing process to heat the product up to 400°C to expel any excess moisture that could lead to cracking.

Once the drying process was complete, the product could continue into the firing chamber. Fourteen gas burners (seven each side) entered the chamber at eye level, directing their flame alternately, above and below the kiln cars. The temperature at the beginning of the firing zone was 800°C, rising to between 1060°C and 1080°C by the end. A section through the floor of the kiln at this point revealed two abutting, arched tunnels running beneath the rails. Within the tunnels an unmortared, lattice-

work tower of bricks had been built to act as a radiator for hot gasses. The subterranean tunnel chamber was linked to the firing chamber by vents in the floor. It seems probable that this allowed the heat produced in the firing chamber to be recycled for use in the preheat phase.

The final stage of the tunnel kiln progression was the cooling chamber. A fan was used to maintain a wall of heat around the product to prevent it from cooling too quickly.

Once a car had exited the kiln it would be pushed onto a wheeled platform and then transferred to the easterly set of north/west rails running down the outside of the tunnel kiln. Here the fired goods would be unloaded and the cars reloaded to begin the process again. The kiln usually operated on a two hour turnover, but when orders were needed quickly this could be reduced to one and a half or even one hour.

Company records suggest that the floor plan uncovered was that of Tunnel Kiln No. 2 constructed in 1936/37 as part of the Radiation Department extension. During 1937 combined investment in the radiation department, tunnel kiln and gas producer plant accounted for £15, 871 of company expenditure.

The kiln was converted from producer gas to natural gas in 1967 by the Gas Board Research Department. An earlier oil fired tunnel kiln was originally used for firing early radiants. It is not known when this kiln was decommissioned.

Tunnel Kiln 2 as an integral part of the radiation building represents the later development of the Knowles plant as it shifted focus from its traditional products of firebricks and stoneware pipes to the production of gas fire radiant products, accelerated through the investment of Radiation Ltd in the 1930's.

5. Assessment

With reference to the written scheme of investigation (Boucher 2004) the following points should be noted;

Section 3.4 (III) – A photographic record of the former Albion works was carried out and is included as Appendix 4 of this report.

Section 3.5(IV) – It was not possible to survey and produce an earthwork plot of the Humps and Hollows area. Once the vegetation had been cleared it became apparent that the area was unsafe due to the presence of mine workings.

Section 3.6 (V) – Photographic sections of the bell pits in the humps and hollows area were taken by the client and are included as Appendix 5 of this report.

6. Conclusion

The firm of John Knowles & Co. was by no means unique. An equally worthy story could be found in the histories of the other major sanitary ware manufacturers of the area. Mount Pleasant may however prove to be the last chance to archaeologically record this aspect of Derbyshire's past, with the added benefits of an extensive company archive and eye-witness accounts to produce a comprehensive picture of this company and the methods used.

The fieldwork has produced a record of some of the more significant surviving remains on the site and where possible supporting documentary evidence from the archive has been used to establish their history.

It seems likely that BHK1 is the same kiln present on the 1883 Ordnance Survey map and may relate to the earliest phase of the company's development. The Tunnel Kiln is easier to date, as its construction is recorded in the company archive.

What is particularly satisfying regarding the structures we have been able to record is the two distinct phases they represent in the history of John Knowles & Co. The Beehive Kiln is testament to the early years of the firm when John Knowles seized upon the market opportunity created by the 1848 Public Health Act to produce stoneware pipes and sanitary wares. The tunnel kiln represents an altogether different period in the company's history when the demand for gas fired products was high and Knowles were able to take advantage of this through collaboration with Radiation Ltd. However, it is possible that this collaboration proved to be both the saviour and ultimately the undoing of the firm. By tying their fortunes so closely to the fortunes of Radiation Ltd., John Knowles & Co. was unable to adapt to changing market forces as they had done in the past. As a subsidiary to larger firms, Knowles became an entry on a balance sheet, rather than the family business it had started life as. When the balance sheet no longer looked attractive, the sentiment no longer existed to carry the firm on.

7. Bibliography

Boucher, A. (2000). *Woodville Woodlands. East Midlands. Archaeological Desk-top Study*. Archaeological Investigations Ltd. Hereford. **HAS 477**

Websites consulted

([www.1](http://www.dronfield-jun-derbyshire.sch.uk)) www.dronfield-jun-derbyshire.sch.uk

([www.2](http://www.sheffield-made.com)) www.sheffield-made.com

Appendix 1 – John Knowles & Co. – Material contained within company archive

<i>ID</i>	<i>Document type (loose, book, brochure)</i>	<i>Description of document</i>
1	Book	Register of Additions to plant 1922 - 1959
2	Loose	Addition to plant 1949
3	Loose	Addition to plant y/end 1951
4	Loose	Addition to plant y/end 1952
5	Loose	Additions to capital assets, y/end 1953
6	Loose	Additions to plant, y/end 1954
7	Loose	Additions to plant, y/end 1955
8	Loose	Additions to plant, y/end 1956
9	Loose	Additions to plant, y/end 1956 -rough copy
10	Loose	Additions to plant, Year ending 30/9/ 1957
11	Loose	Additions to plant, Year ending 30/9/ 1958
12	Loose	Additions to plant, Year ending 30/9/ 1958 - rough copy
13	Loose	Additions to plant y/end 1959 (rough copy and typed)
14	Loose	Additions to plant y/end 1960 (rough copy and typed)
15	Loose	Additions to plant y/end 1961(draft and typed)
16	Loose	Additions to plant y/end 1962
17	Loose	Additions to plant y/end 1963
18	Loose	Additions to plant y/end 1964
19	Book	Plant additions, oct 1967 - 1976
20	Book	Plant additions, oct 1965 - 1967
21	Lose	Agreement of reoccupation of land 1872
22	Lose	Ad for John Knowles
23	Lose	Article (for speech) on manufacture of pottery industry 1977
24	Lose	Agreement of land purchase, 17th April, 1861
25	Lose	Agreement, National Coal Board, 6th Oct.
1959		
26	Lose	Absenteeism - note on
27	Bundle	Accounts - Inland Revenue 1871 (Detail no 1)
28	Lose	Agreement 30 Dec 1922 w. map
29	Bundle	Burton on Trent Golf Club - folder w. lose
papers		(Detail no. 2)

<i>ID</i>	<i>Document type (loose, book, brochure)</i>	<i>Description of document</i>
	Leaflet	Burial of the Dead, J K Hassall
	Leaflet	Burial of the Dead, J K Hassall
	Bundle	Balance sheet 30th September 1912
	Bundle	Balance sheets - 3 books: 31st March 1959, 30th September 1959; 10th Feb. 1960
	Bundle	Balance sheets - 24 books from 1935 - 1958. Also a few lose papers
	Bundle	Balance sheets - 37 books from 1928 - 1959
and	Bundle	Balance sheets - 10 books from 1924 - 1934
		lose balance sheets
	Book	Copying book Dec. 1863 - Sep 18 1873, lettes, accounts, orders
	Book	Copying book Sep. 1873 - July 1874, lettes, accounts, orders
1965	Booklet	Capital Expenditure Oct 1964 - 30th Sep.
	Chequebooks	From 1930 - 1952 (Detail 3)
	Lose	Letter to Camborne School of mines, 26 June, 1992
July	Lose	Letter from Camborne School of mines, 7 1992
	Lose	Letter to Camborne School of mines, 14 January 1992
	Book	Day Book, July 1853 - Dec 1863
	Book	Day sales book, Jan 1972 - July 1973
	Book	Day book summary, 1921 - 1933
	Booklet	Deposit account book, Mrs L. Hassall, 1909 -
	Lose	Dysonrefractories Ltd, annual accounts 1977 -
	Lose, letter	Duties, listing receipts of duties, 1901
	Lose	Deeds, schedule of, 1st Dec 1904
	Lose	Deeds, schedule of, 22 Nov 1904
	Lose	Dyson; ltr to Dyson from Record Office, 17th Feb. 1992
	Lose	Dyson; ltr from Moira Furnace, 19 June 1989
	Lose	Conveyance of a close of land
	Catalogue	Catalogue, Illustrated & price list, 1900
	Leaflet	Circular 6/86, from Dept. of Environment
	Leaflet	Company Progress since sep. 1928 - March
	Catalogue	Catalogue and price list, 1903
	Brochure	Clay craft brochure

<i>ID</i>	<i>Document type (loose, book, brochure)</i>	<i>Description of document</i>
	Catalogue	Catalogue (illustrated) & price list 1888, John Knowles & Co.
	Catalogue	Catalogue (illustrated) & price list 1900 John Knowles & Co.
	Bundle	Correspondance (Detail 4)
	Bundle	Correspondence re patents, lease, various 1872 - 1913. (Detail 5)
	Bundle	Correspondance re. Sarah Adcock, deceased. (Details 6)
	Lose	Donington Extension 26 July 1977
	Lose	Donington Extension, summary of estimated clay quantum
	Lose	Drawing by John German & son, drg. No KO
Han	Folder	(Detail 7) Demco Working committee from 1979 - Oct. 1979. Folder w. lose papers
Estate	Folder	Lord Donington, Auction. Portions of the of Lord Donington, 29th Oct. 1919
	Lose	Directors Notes, notes on directos
	Drawing	Drawing of cast iron columns 1899
	Lose	Deeds - schedule of deeds. Letter file with lose documents
1920	Bundle	Debtors & creditors, from Sep 1914 - June
	Book	Deposit account book
	Book	Deposit account book
	Book	Deposit account book (white)
	Book	Experimental pipe clay mixtures, kiln test firerings, stoneware pipe & clay notes
	Envelope	A 4 brown w. adr. Lose
1906	Lose	Extension to offices at Mount Pleasant Dec.
	Bundle	(Detail 8) Employees Provident plan
paper	Bundle	(Detail 9) Executors papers in dark brown
	Lose	Freeholds - schedule fo properties, estate of late Sarah Knowles, 24th Jan. 1901
Free	Booklet	Free Enterprise, booklet on "The assault on Enterprise"
	Brochure	Flammable liquids, 1972
	Bundle (brown paper parcel)	(Detail 10) Free Flow Pipe Company
	Large envelope	(Detail 11) Envelope containing documents on "Gwen, the locomotive".
and	Book	The Geology of the country between Derby Burotn on Trent
	Envelope	Empty white envelope on Gwen

<i>ID</i>	<i>Document type (loose, book, brochure)</i>	<i>Description of document</i>
89	Leaflet	History - "A brief history of Knowles"
90	Folder	Harold Hooley - empty pocket for
photographs		
91	Leaflet	History; "A brief history of Knowles,
Centenary		year 1849 - 1949
92	Lose	Helmets - correspondence re steel helmets,
Aug		1941
93	Folder	(Detail 12) "Jack the locomotive" -
94	Envelope	(Detail 13) Marked Knowles
95	Book	Plan Account Ledger (4) 1934 - 1974
96	Booklet	"List of Distinguishing marks" 2 copies @30
97	Lose	Long Serving members of staff, Egbert Harold Hall, 1945
98	Lose	Letter w. photos from J. James to Mr W
Kirby,		Dyson
99	Leaflet	Laboratory report, sep. 1955
100	Booklet	Monthly Income & Expenditure record, July - Sep. 1939 incl.
101	Booklet	Monthly Income & Expenditure record, ct.
1962 -		1975
102	Book	Memorandum & articles of Association 5/2
1908		
103	Book	Monthly record - departmental sales &
tonnage		1947 - 1966
104	Book	Monthly record - of income & expenditure
oct		1922 - 1962 + lose pages
105	Lose	Memoranda re new pits
106	Book	Memorandum of deeds, 1871
107	Brochure + lose	Mineral tramways project
108	Booklet	Minutes, Directors meeting 1930 - 1943
109	Booklet	Minutes, General 1908 - 1943
110	Lose	Midland pipe association, agreements, 1888, 1902, 1906
111	Lose	Memorandum of Agreement 1/7/1895
1906	Booklet	Memorandum & articles of Association 5/2/
113	Booklet	Memorandum of Association of the British Ceramic Research association, 27/4/1948
114	Lose	Machinery cards
115	Lose	Map of Albert village
116	Lose	Mechett lecture, 1953
117	Booklet	Memorandum & article of Association of
Ketley		

Brick Company, April 1890

<i>ID</i>	<i>Document type (loose, book, brochure)</i>	<i>Description of document</i>
118	Lose	Map, Oakthorpe and Donisthorpe
119	Booklet	Memorandum & articles of association, 1908
120	Book	National Coal Board, report vol I
121	Book	National Coal Board, report vol I
122	Lose	Narrow Gauge Railway Society
123	Lose	Narrow Gauge Railway Society, ltr re article 25/8/1991
124	Lose	Narrow Gauge Railway Society, ltr 9/2/1992
125	Lose	Narrow Gauge Railway Society, from Richard Faermer
126	Lose	Narrow Gauge Railway Society, from J Knowles
127	Folder	(Detail 14) National Association of Clayworks Managers
128	Envelope	(Detail 15) Narrow Gauge Railway - general things
129	Lose	Newspaper articles WWII, 1958, 1961, 1964,
130	Note pad	Blank note pad from Dyson (only 1 page to
131	Booklet	Openhole Wages, tonnage & cost per ton raised 1946 - 1953 incl.
132	Booklet	Openhole Wages & tonnage May 1946 - Nov.
133	Brochure	Product catalogue 1954 - Knowles for pipes
134	Brochure	Product catalogue thomas Wragg & Jons, Ltd. Stoneware pipes
135	Brochure	Product catalogue, Woodville Sanitary pipe & fire brick manuf.
136	Brochure	Product catalogue, 1948, Turner & Linsey
137	Brochure	Product catalogue, 1966, Red bank
138	Brochure	Product catalogue, Modren Machinery, Rawdon machines
139	Brochure	Product catalogue, James Woodward Ltd. Swadlincote, June 1939
140	Brochure	Product catalogue, Church Gresley Stoneware pipes and fittings
141	Brochure	Product catalogue, ohn H Turner & Lisney Ltd., 1932
142	Lose	Pits haulage equipment
143	Lose	Presses purchased by Radiation Ltd.
144	Lose	Plan on conveyance, permatrace paper
145	Brochure	Product catalogue, vitrified clay pipe & fittings, Nov. 1967
146	Leaflet	Project report - planning dept. oct. 1979

<i>ID</i>	<i>Document type (loose, book, brochure)</i>	<i>Description of document</i>
147	Folder	Photo inside folder w. good sishes to
Chairman		
148	Lose	Proforma balance sheet (notes on)
149	Booklet	Pipe laying principles
150	Drawing	Patent "Accessible" - large drawing
151	Bundle	Summary profit & loss, 31/8 1921 Statements of various departments
152	Bundle	Balance sheets / profit & loss 1911 - 1919
153	Envelope	Patent documents 1906
154	Packet wrapped in brown paper	Private vouchers 30/9 1922
155	Bundle	Pension schemes (1939 - 1941) Welfare fund, deeds, Notes on pension funds
156	Packet wrapped in brown paper	Private vouchers, 30/9/ 1922
157	Booklet	Rates advisory committee, railway rates and charges, 1920
158	Envelope	Radiation Agreement, letter 1929
159	Leaflet	Rawdon Machines
160	Book	Salaries book no 2
161	Book	Sales book Oct 1 1872 - Dec 31 1874
162	Book	Sales book Aug 4th 1870 - Sep 30 1872
163	Book	Salaries book no 4, sep 1903 - Sep 1907
164	Book	Salaries book no 5, Oct. 1907 - Sep 30 1913
165	Book	Stock account for insurance, Dec. 1884
166	Leaflet	Staff dinner Menu card Nov. 11 1949 (2
copies)		
167	Leaflet	Staff works dinner menu card 18th Jan 1951
168	Leaflet	Staff dinner menu card 17th Nov 1971
169	Leaflet	Staff dinner menu card 15th Nov 1972
170	Leaflet	Staff dinner menu card 28th Nov 1973
171	Leaflet	Staff dinner menu card 22 Jan 1974 (2 copies)
172	Lose	Suspense
173	Lose	Suspense
174	Booklet	Safety tables & memoranda, The factories act 1937
175	Book	Scrap book, lose papers, aricles
176	Envelope	Notes from a thesis on the Sanitary pottery industries 1840 - 1914. Prepared by Janet Spavold 1978. Lose hadnwritten notes. Refelctions on the coal mining industry 1961
177	Booklet	Staff rules, 1963

<i>ID</i>	<i>Document type (loose, book, brochure)</i>	<i>Description of document</i>
178	Booklet	Share holdings, March 1940
179	Book	Record of Trade, dec. 1928 - Sep 1948
180	Lose	Telegrams
181	Lose	Telegram. Copy of teleg. Rom J Hassall to B. Gay Wilkinson jan 24 1901
182	Lose	Tenancies, list of London tenancies
183	Envelope	To J F Trevor, w. newspaper cutting
184	Lose	Note w. staff members present at J. F. Trevors appointment as MD 1/3 1953
185	Booklet	Booklet on corporation tax, 1967
186	Lose (Bundle)	Various: letters, documents tied together
187	Booklet	Vitrified clay pipes & fittings, Nov. 1967
188	Booklet	Valuation of company, April 1937
189	Folder	Folder containing Various documents, paper cuttings
190	Book	Weekley summary of sales book 1925 - 1942. (sticker on book w. 21)
191	Book	Weekley summary of sales book 1933 - 1955. (sticker on book w. 25)
192	Lose	Wages, list of names & wages, Sep. 1903
193	Envelope	(Detail 16) Wartime records, envelope full of
all		sorts of documents
194	Envelope	(Detail 17) Wartime Records II, envelope full
of		various wartime documents
195	Lose	Wartime records: order for civilian duty
196	Booklet	Air raid precautions, feb. 1939
197	Booklet	Preliminary memorandum on the organisation
of		air raid precautions 1939
198	Booklet	Wartime pamphlet no. 22, re. Geology dec. 41
199	Bundle	(Detail 18) Wills - of various
200	Folder	Works Centinary papers
201	Folder	Records relating to Ensor agreements
202	Plan	Eagle Star Insurance plan of works 1972
203	Plan	Undated plan of eastern part of site
204	Loose	Letter from Inspector of mines 1887
205	Loose	Letters (2) regarding Sarah Adcock shares
206	Loose	Chronology of works printed in early 1990's?
207	Bundle	Costs per ton 1901 - 1920

Appendix 2 – Site Archive

The following will be held at a suitable repository yet to be decided. All material will carry the site code

WWD05

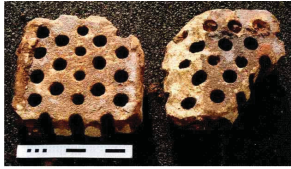
The archive will contain;

- 1 Copy of this report
- 1 Transcript of interview with Mr. Kenneth Crockford
- 4 pages of notes provided by Mr. Kenneth Crockford
- 16 A3 pages of photographs from company archive annotated by Mr. Kenneth Crockford
- 1 CAD plot of visible earthworks at Mount Pleasant in 2006
- 3 sets of 36mm Black and White negatives and photographs
- 3 sets of 36mm Colour negatives and photographs
- 1 set of medium format colour negatives and photographs
- 2 sets of colour prints (Albion Works)
- 1 set of colour prints (General and documentary research)
- 1 set of black and white prints (Albion Works)
- 2 samples of flue deposits from BHK1
- 1 bag of ceramic saggars found within base BHK1
- 1 sherd of salt glazed sewer pipe found within flue of BHK1
- 19 site drawings on drawing film and paper
- 10 photographic registers
- 1 page of notes detailing samples and small finds
- 1 drawing register

Appendix 3 – Brick Catalogue

Bricks were collected from the site of the Mount Pleasant Works during a site visit in 2004.

Due to the demolition of the site it is not easy to determine which were used in the construction of the buildings and which were products of the John Knowles Company.



Type 1 (Holey Boy)



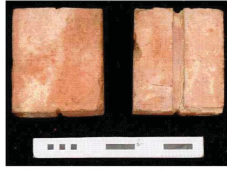
Type 2



Type 3



Type 4



Type 5



Type 6



Type 7



Type 8



Type 9



Type 10



Type 11



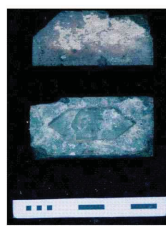
Type 12



Type 13



Type 14



Type 15



Type 16

Appendix 4 - Building Record – Former Albion Works Site

A rapid record was made of the upstanding structures on the former site of the Albion Works during site visits made by Andy Boucher in August 2000 and Simon Mayes in 2005. Photographs (P) referred to in the text and a plan of the works (Figure D) can be found at the rear of this appendix.

Background history of the works

The Albion works was established by Henry Knowles and Hosea Tugby in 1872 and 1874. Henry Knowles left the Mount Pleasant works to set up in competition. The works produced salt glazed pipes using downdraught kilns.

Downdraught kilns operated with an underground flue linked to the kiln by a perforated floor and linked to a chimney. A single flue might link a number of kilns to one chimney. The point at which salt was thrown on the fires to provide the glazing was judged by the colour of the ware and therefore it must have been possible to see into the kilns during firing.

After the pipes were cooled the sockets were coated with “gallymac” which was used for sealing the pipe joints and was similar to bitumen. Coins used to wipe the material into pipe joints used to clog up tills in the area (White 1984).

The 1920 geological survey (HMSO 1920) states that the main fire clay was exceptionally thick at this location and, after the removal of bullions of iron, was regarded as relatively homogeneous. In this case only the main fireclay was used for refractories, but clunch and bottle clay were also extracted and used. The methods and formulae for the production of various products are also described in this survey with main fire clay being ground for steel crucibles and firebricks for gas retorts. The former is ground dry with no additions, whilst the fire bricks have the addition of 25% burnt firebrick, it is also noted that they had not tried the addition of silica sand to the products.

The site was worked by both opencast and deep mining. It was noted that the clay at the base of the opencast was as good in quality as mined material and those reserves extended eastwards from the site over an area measuring “some thousands of acres”.

Between 1881 and 1887 the partnership broke up with Knowles continuing at the Albion site. By 1912 this was very successful with forty-four beehive and four bottle kilns (Spavold 1981a).

Plans exist which show a large number of underground shafts running off the west side of the clay hole between 1930 and 1945 (Dcro D4888/1-3).

(A. Boucher 2000)

Building N (Figure A,B) (P05/97-30)

The largest surviving building on site was rectangular in plan and measured 67m by 34m. It was built after 1901 and was present on the 1923 Ordnance Survey map.

The building lay on a northeast-southwest alignment and was composed of a cast iron structure with a brick built outer skin. The outer skin was not load bearing but was simply pinned to the iron frame by means of iron tie bars, the ends of which were visible on the exterior of the building.

The single pitched roof had a gradual slope of approximately 1:70 and was supported by the cast iron structure of the building.

Phase 1

The southeastern elevation gave the clearest indication of the building's original form. At first floor level 23 apertures were present which alternated between two different styles.

Type 1 apertures were rectangular with a brick arch head and measured approximately 1.6m by 2m.

Type 2 apertures were rectangular but far more elongated than Type 1. They measured 3.5m by 1.20m.

The distribution of Type 1 apertures at first floor level was duplicated at ground floor.

Four Type 1 apertures and two type 2 apertures on the southeastern elevation were covered by hinged wooden doors. There was no evidence for any previous fittings so it is likely that these doors were an original feature. There was no evidence for glazing in any of these apertures.

The ground floor level of the northwestern elevation was largely obscured by phase 2 alterations to the building. The exception to this was the southern part of the elevation where a large (7m by 5m) aperture allowed access to the building, which at this point was single storey but double height as the first floor did not extend into this end of the building. Excluding this area, the remainder of the first elevation followed a similar pattern to the southeastern elevation with alternating Type 1 and Type 2 apertures. It was noted however that the opposing sides of the building were not a mirror image of each other as Type 1 apertures were found opposite Type 2 apertures.

The northeastern elevation followed a similar pattern of alternating Type 1 and 2 apertures. A larger opening, probably a doorway was present at the northwestern side of the elevation.

The southwestern elevation contained one first floor, Type 2 aperture at the southern corner of the building and a broad doorway beneath it. Towards the centre of the

elevation, at first floor level, was a large (7.5m by 3m) aperture of uncertain function with a smaller opening to the side.

Interior

The ground floor of the building was originally an open plan space with regularly spaced cast iron pillars supporting iron girders which in turn supported the first floor above (P075). At the southeastern end of the building, the large aperture on the northwestern elevation provided access to a loading/delivery bay which had a raised platform to the rear. No columns or first floor were present in this area.

Two small internal staircases provided access to the first floor. The column arrangement here replicated that of the ground floor.

Phase 2

This phase was characterised by the bricking up of the majority of the apertures. As previously mentioned, six of the Phase 1 apertures were retained with hinged wooden doors, the remaining 28 however were sealed up. On the other elevations five apertures in total had been modified to create windows, the rest had been bricked up.

On the southeastern elevation three apertures had been converted into sliding doors. The northernmost of which gave access to an internal ramp (discussed below).

On the southwestern elevation the doorway on the ground floor was partially bricked up and an iron-framed window inserted.

The large aperture into the loading bay area had been reduced in width by the construction of a concrete block wall within the phase 1 frame. Two windows and a door had been inserted as part of the modifications.

Interior

A concrete block wall was constructed separating the loading bay area from the remainder of the building. At the opposite end of the building pillars were removed and a ramp was constructed providing access to the first floor.

Phase 3

Although considered a separate phase, it is likely (considering the construction techniques and materials) that Phase 3 occurred relatively soon after the Phase 2 alterations.

An extension was constructed in brick along the northwest facing elevation of the building. The extension was one storey high and approximately four metres wide. The northwestern elevation of the extension had an array of sixteen apertures and a central doorway. On the northeastern elevation was a doorway and on the southwestern

elevation was an external staircase leading to the flat roof of the extension. At this point a door had been inserted into the phase 1 fabric at first floor level.

Phase 4

Further alterations were made to the window arrangements of the extension, with some apertures being partially bricked up and smaller windows inserted.

It is quite possible that Phases 2, 3 and 4 all happened within a short space of time or even as a single phase of development.

Discussion

The building which in its final phase of use was used as a store by Hepworth Ltd., was originally constructed as an integral part of the works. The original functions of the building are likely to have been both the forming and drying of products prior to firing.

It seems likely that clay was brought into the loading bay via cart or motorised vehicle and unloaded directly onto the raised platform.

The forming of the pipes took place on the ground floor. The unfired products were then taken up to the first floor and arranged on the floor to dry before being fired. It is not clear how the pipes were taken to this level. There is a possibility that a hoist was used to lift the pipes up a level in the unloading bay where the first floor terminated. However, evidence from the Mount Pleasant works (Section 4.2.2) suggests that pipes were more commonly moved between floors on men's shoulders. During the earliest use of the building, access to the first floor was gained via two small staircases.

It is probable that the Type 2 apertures served a very specific function in the clay drying process. The kilns used to fire the clay pipes were located all around the structure, the closest rank of kilns being within 5 metres of the Type 2 apertures (Figure C). It seems likely that the apertures were designed to be elongated to take maximum advantage of the heat rising from the kilns during the firing process. During a kiln firing, the wooden doors on the apertures could be opened to allow the heat from the kilns to enter and thus aid the drying of the next batch of pipes due to be fired. The recycling of heat was a common occurrence in the manufacture of ceramic products, a more sophisticated version of this process occurs within a tunnel kiln (Section 4.3.2).

It is possible that the Type 2 apertures could also have been used to transfer the pipes from the drying floor to the kiln which would have been far more efficient than transferring them to the kilns via the narrow staircases of the building. The addition of the ramp during phase 2 would have made the process of transferring products between levels far easier, however, this addition coincides with the blocking up of most of the apertures, and a likely change of use for the building to a storage area.

The subsequent phases of the building are likely to relate to its later use as a stores. The blocking up of most of the apertures would have allowed very little natural light

and ventilation into the building. This would have led to unsuitable working (and drying) conditions but an environmentally stable area for the storage of goods.

Building H (P05/97-17)

The Laboratory first appeared on the 1923 Ordnance Survey and was therefore broadly contemporary with Building N. The building measured 26m by 10m in plan. Various brick types were evident in the elevations and there is a suggestion that the building was originally smaller, then subsequently extended in a southwesterly direction and the pitch of the roof increased. The distribution of the various brick types however, did not appear to relate to construction phases. A more plausible explanation is that the building had been built with whatever bricks were to hand, but to a set design. Therefore firebricks of one depth and length were juxtaposed with building bricks of entirely different dimensions. This piecemeal building technique is not entirely surprising considering the likelihood that firebricks were being produced on the site, and wasters would offer a cheap method of construction.

Building W (P05/97-31)

The weighbridge building was not present on the 1923 Ordnance Survey map. Measuring 2.5m by 2.5m it was constructed of local brick and had a corrugated tin sloping roof. Its windows were bricked up towards the end of its life. A sign on the southwestern elevation suggests that its final use was as a store for hazardous chemicals.

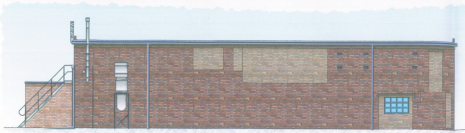
Building L (05/13-16)

The current 'Main Shed' building appeared to be have built after 1950 judging by the materials used in its construction. The double apex roof was finished with corrugated asbestos and the machine made bricks were uniform in colour and size. The building measured 21m by 18.5m.

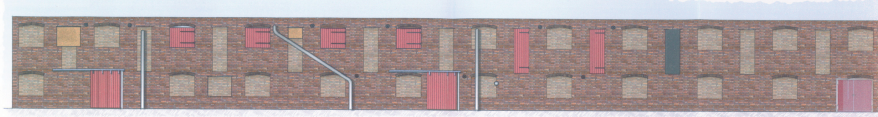
A building on the 1923 Ordnance Survey map occupies the same footprint but no trace of that building remained.

Building F (05/97-27)

Parts of this small administration building were present on the 1901 Ordnance Survey map. It was probably replaced between 1901 and 1923. (See Boucher 2000 for further discussion).



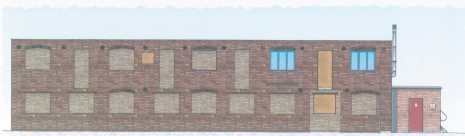
West Elevation



South Elevation



North Elevation



East Elevation

File A

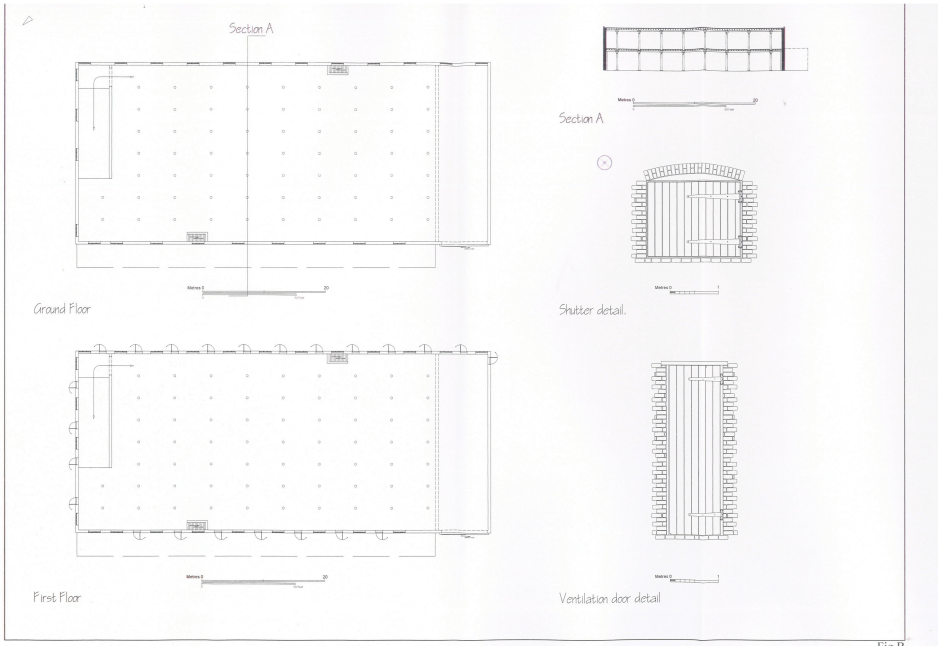
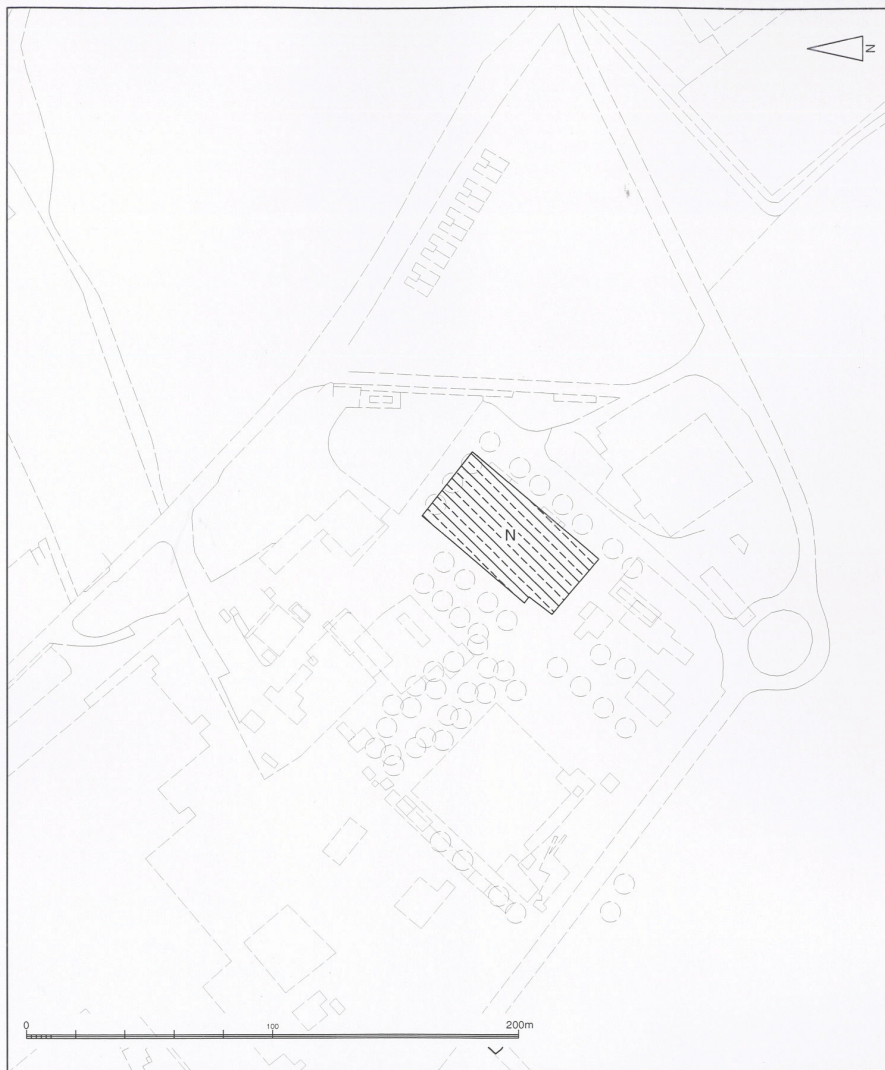


Fig.B



Albion Works - Kiln layout in relation to building N

Figure C





P05/13-07



P05/13-09



P05/13-10



P05/13-14



P05/13-15



P05/13-16



P05/13-19



P05/13-27



P05/13-31



P05/97-17



P05/97-18



P05/97-27



P05/97-28



P05/97-29



P05/97-30

Albion Works - Contact Sheet 1



P05/97-31



P05/99-06



P05/99-07



P05/99-13



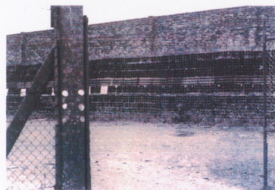
P05/99-14



P05/99-15



P05/99-17



P05/99-18



P05/99-19



P05/99-20



P05/99-21



P05/99-23



P05/99-24



P05/99-25



P075

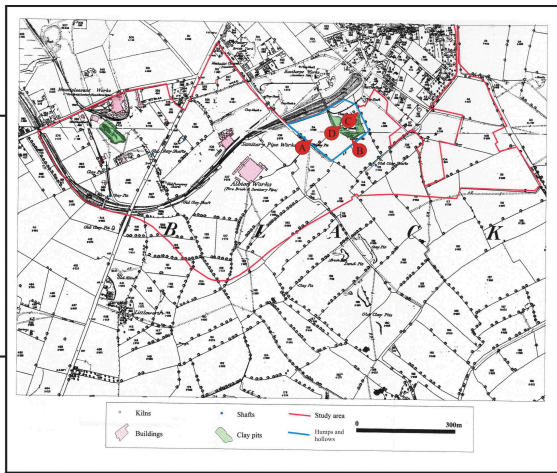
Albion Works - Contact Sheet 2

Appendix 5 – Humps and Hollows

The following photographs were taken by the client in the area known as ‘Humps and Hollows’.

Photographs A, B and C give a general overview of the area.

Photograph D shows the bases of bell pits excavated for coal extraction for use in the kilns of the local sanitary ware companies.



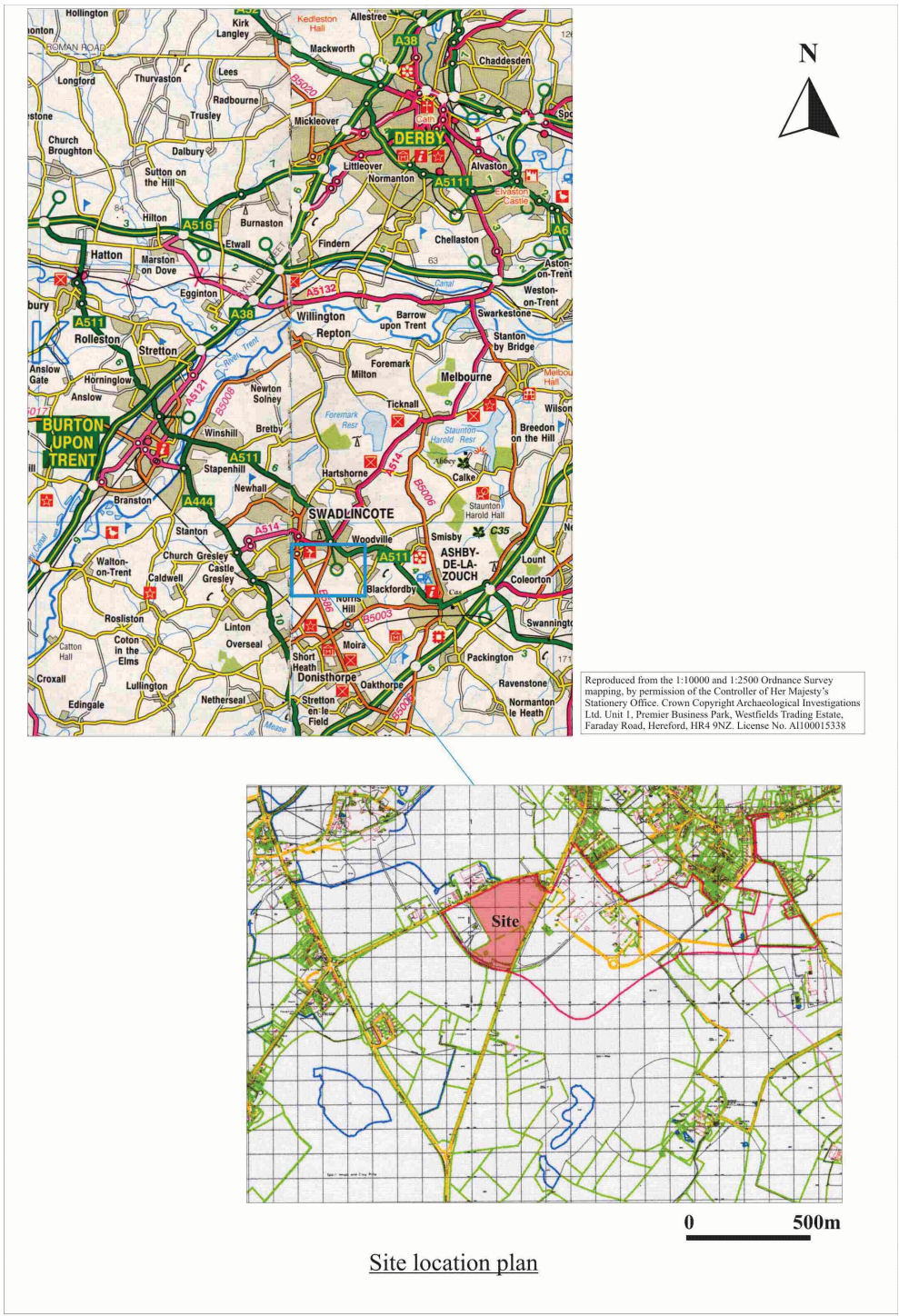


Figure 1

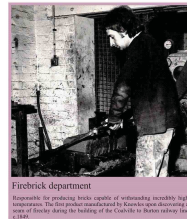
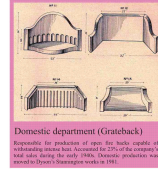
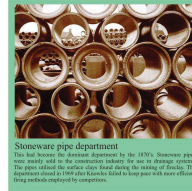
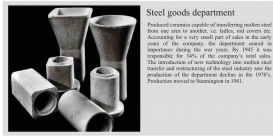
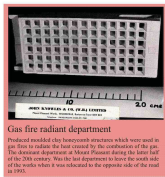
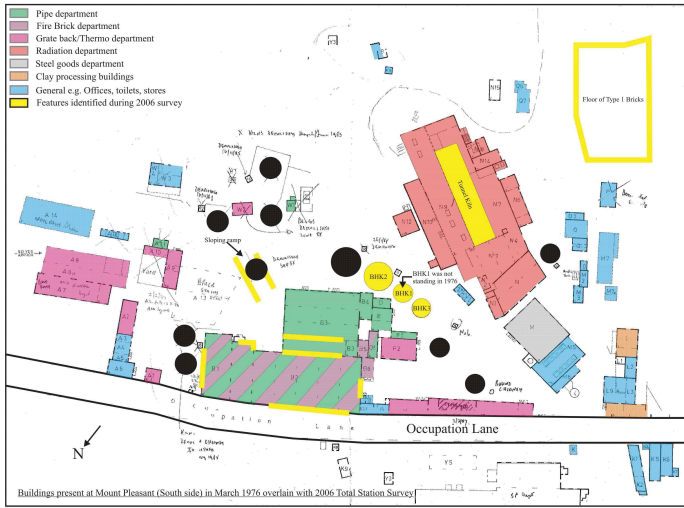
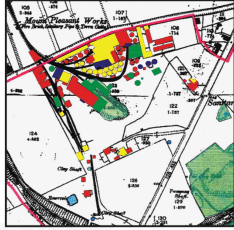
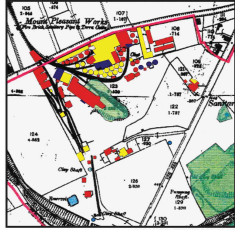
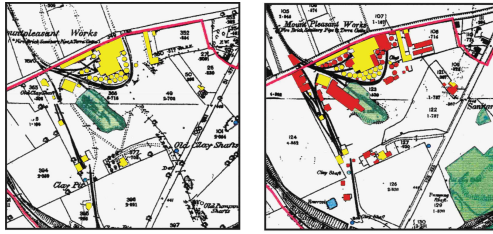


Figure 2

Oct 3	William Claibornish	Sheffield	Oct 8	Wm Whitmarsh	Sheffield
3000 Fire Bricks	65/-	6 10 -	10.18.0 Clay	12/-	6
Callam & Johnson	Sheffield	11 th	Agnew Bagger	Sheff	
600 Fire Bricks	44/-	1 5 3	5.9.0 Clay	c 24/-	7
Johnson Cammell & Co	Sheffield	10 th	Wilson Haultworth & Co	Sheff	
3000 Fire Bricks	65/-	9 15 -	4 Tons of Clay	24/-	12
John Crowley & Co	Sheffield	7 th	Spears & Jackson	Sheff	
1000 Fire Bricks		3 5 -	10.17.0 Clay	24/-	13
1.10.0 Ground Clay	24/-	1 16 -	William Whitmarsh	do	
4 Cases	4/-	12 -	10.14.0 of Clay	c 12/-	6
		£ 47 10 -	John Wardlow	do	
Rich ^d Staley	Medway		5.7.0 of Clay	24/-	6
10 Lumps 22 lbs	1/-	14 -	Shotton place & Co	do	
5 do 10 lbs	1/-	2 6 -	5.2.0 of Clay	24/-	6
		£ 6 6 -	Wilson Haultworth & Co	do	
George Mutton	Cheltenham		4000 Fire Bricks	63/-	12
1 Load Brick Clay		10 0 -			
By Cash 10/-					

Extract from Sales Day Book (ID 53) - October 1853

Figure 3



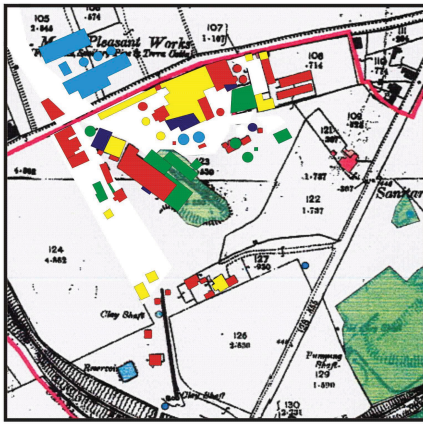
Development of main works

- 1883
- 1901
- 1923
- 1937

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0 300m

Figure 4a



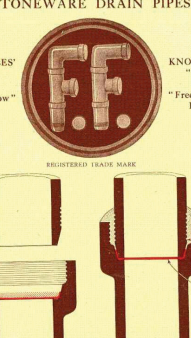
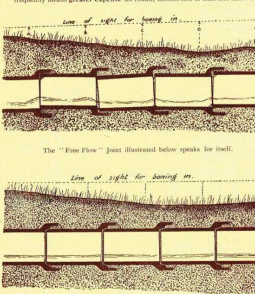
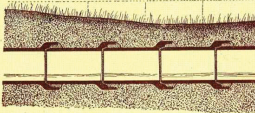
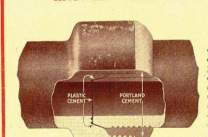
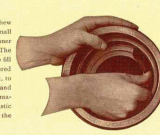
1976

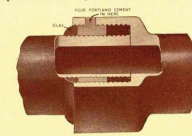
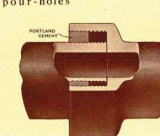
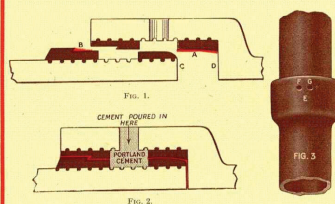


1987



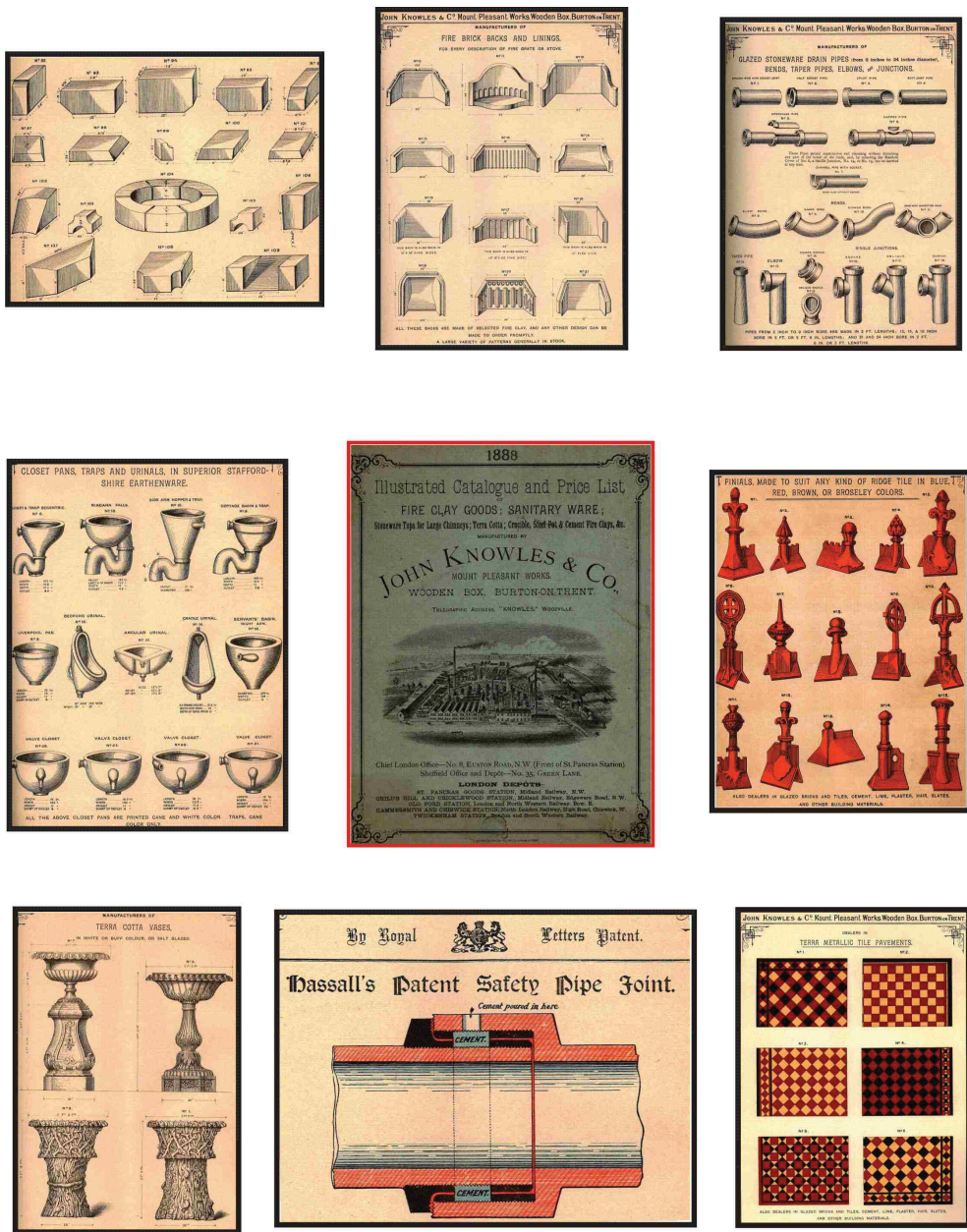
Figure 4b

<p style="text-align: center;">"VITRIFINE" <i>Registered Trade Mark</i></p> <p style="text-align: center;">STONEWARE DRAIN PIPES</p> <p style="text-align: center;">KNOWLES' "F.F." or "Free Flow" Pipe.</p>  <p style="text-align: center;">REGISTERED TRADE MARK</p> <p style="text-align: center;">Fig. 1 Article No. K12 Fig. 2</p> <p style="text-align: center;">The Plastic Cement for these Joints is supplied without extra cost.</p> <p style="text-align: center;">LONDON AND KNOWLES WOODVILLE <i>ESTABLISHED IN 1877</i></p>	<p style="text-align: center;">"VITRIFINE" <i>Registered Trade Mark</i></p> <p style="text-align: center;">KNOWLES' "FREE FLOW" PIPES</p> <p>The ordinary joint involves one or other of the risks here shown, although every pipe has been properly "bedded in" at the points A, B, C, D and E. This frequently means greater expense, and, besides, loss of time and material.</p>  <p style="text-align: center;">The "Free Flow" joint illustrated below speaks for itself.</p>  <p style="text-align: center;">Should any further information or samples be required, we shall be pleased to forward same on application.</p> <p style="text-align: center;">LONDON AND KNOWLES WOODVILLE <i>ESTABLISHED IN 1877</i></p>	<p style="text-align: center;">"VITRIFINE" <i>Registered Trade Mark</i></p> <p style="text-align: center;">STONEWARE DRAIN PIPES</p> <p style="text-align: center;">Fitted with KNOWLES' "FREE FLOW" JOINT</p>  <p style="text-align: center;">Article No. K12</p> <p>The illustration shows very clearly the principle of Knowles' "Free Flow" joint. Its simplicity and cheapness make it unquestionably the best proposition for all drainage schemes, from the point of view of both economy and efficiency.</p>  <p>The illustration of the handwork shows the usual method of applying the small amount of plastic cement to the inner socket of the "Free Flow" pipe. The chief purpose which this serves is to fill the slight crevice between the tapered socket and the tapered inner socket, to prevent the penetration of Portland cement into the crevice while the permanent joint is being made. The plastic cement is supplied free of charge with the "Free Flow" pipe.</p> <p style="text-align: center;">See also pages 4 and 5.</p> <p style="text-align: center;">LONDON AND KNOWLES WOODVILLE <i>ESTABLISHED IN 1877</i></p>
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<p style="text-align: center;">"VITRIFINE" <i>Registered Trade Mark</i></p> <p style="text-align: center;">STONEWARE DRAIN PIPES</p> <p style="text-align: center;">FITTED WITH HASSALL'S SINGLE-LINED JOINT With deep sockets and pour-holes</p> <p>Knowles are the Original Makers of Hassall's Joints</p>  <p style="text-align: center;">Article No. K14</p> <p style="text-align: center;">For method of jointing, see page 9</p> <p style="text-align: center;">HASSALL'S SINGLE-LINED JOINT With ordinary sockets and no pour-holes</p> <p>Knowles are the Original Makers of Hassall's Joints</p>  <p style="text-align: center;">Article No. K15</p> <p style="text-align: center;">For method of jointing, see page 9</p> <p style="text-align: center;">LONDON AND KNOWLES WOODVILLE <i>ESTABLISHED IN 1877</i></p>	<p style="text-align: center;">"VITRIFINE" <i>Registered Trade Mark</i></p> <p style="text-align: center;">STONEWARE DRAIN PIPES</p> <p style="text-align: center;">HASSALL'S DOUBLE-LINED JOINT</p>  <p style="text-align: center;">Article No. K13</p> <p style="text-align: center;">KNOWLES ARE THE ORIGINAL MAKERS OF THIS FAMOUS JOINT</p> <p style="text-align: center;">Its reputation was made by Knowles with "VITRIFINE" STONWARE</p> <p style="text-align: center;">Made in all the usual diameters—2 ins. to 24 ins.</p> <p style="text-align: center;">LONDON AND KNOWLES WOODVILLE <i>ESTABLISHED IN 1877</i></p>
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Extracts from 1954 Knowles London Catalogue (ID 133)

Figure 5



John Knowles & Co. illustrated product catalogue 1888 (ID 60)

Figure 6

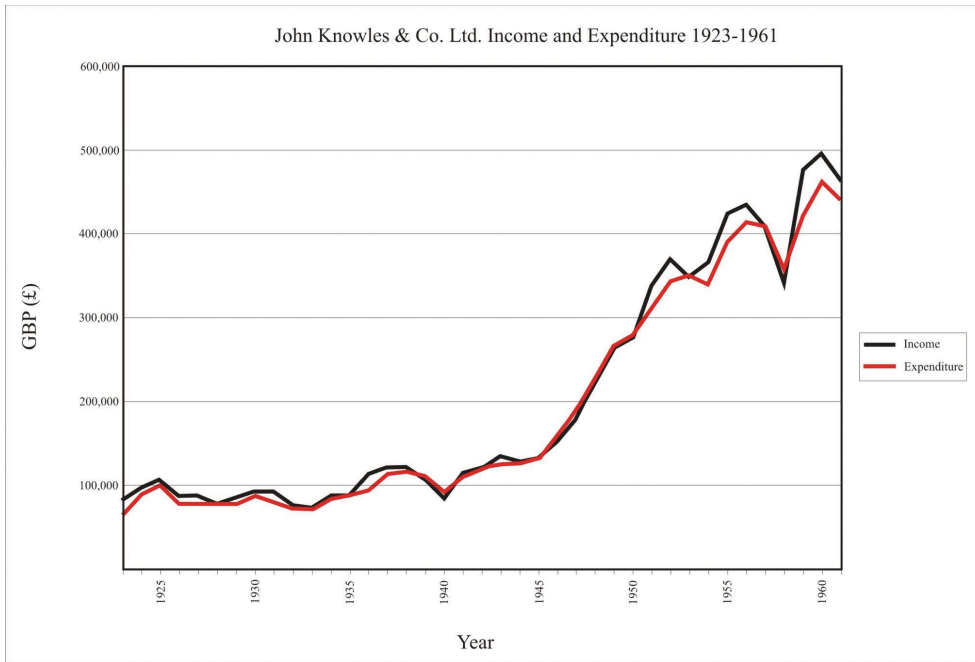


Figure 7

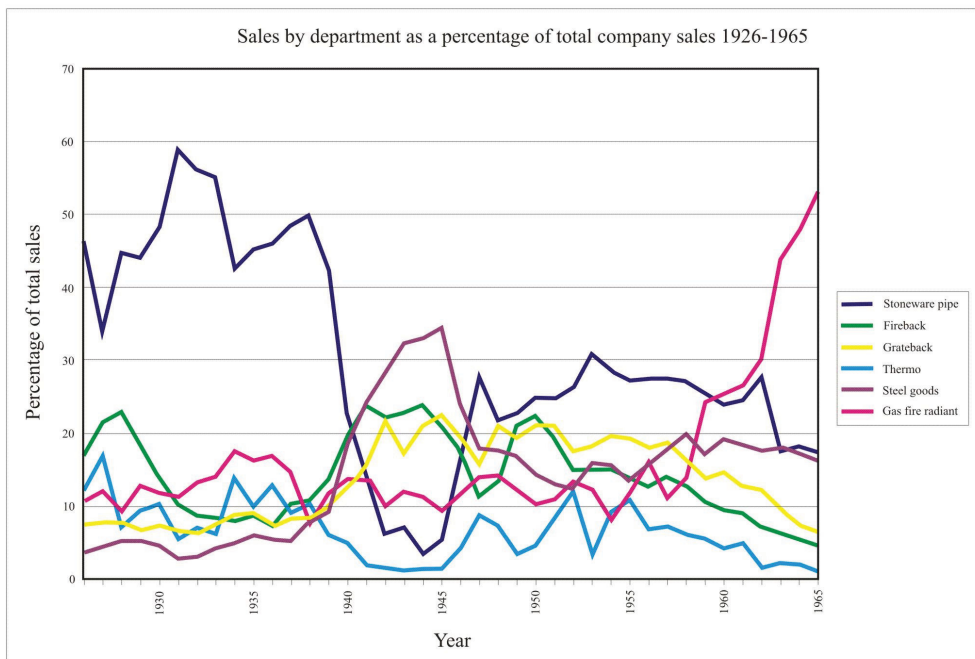
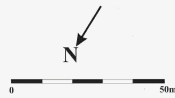
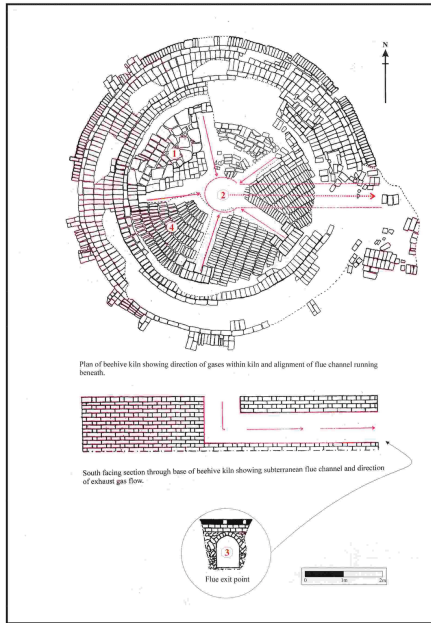


Figure 8

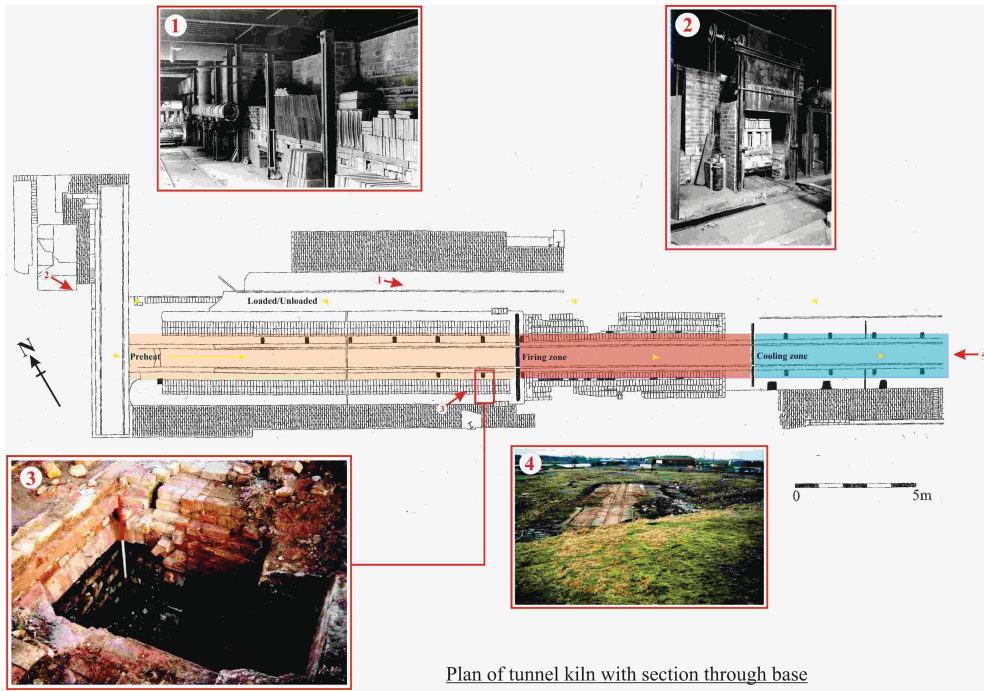


Areas of Archaeological Investigation

Figure 9



Plan of Beehive kiln (BHK1) illustrating exhaust gas flow



Plan of tunnel kiln with section through base

Figure 11

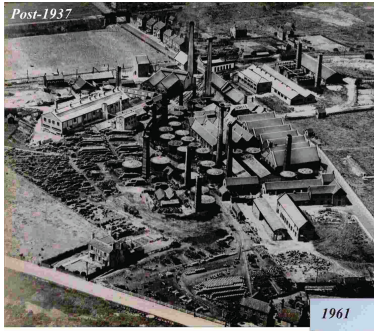


Plate 3

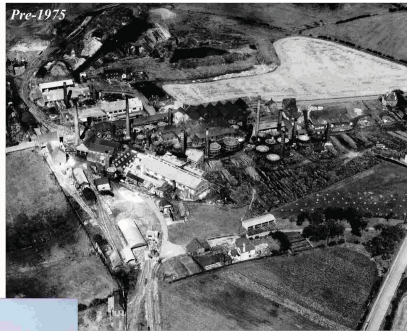


Plate 5



Plate 4

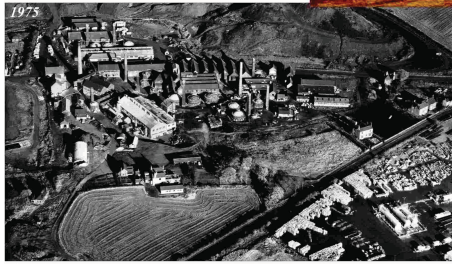


Plate 6



Plate 7



Plate 8. Bricks drying on hypocaust floor



Plate 9. Section through Drying Floor

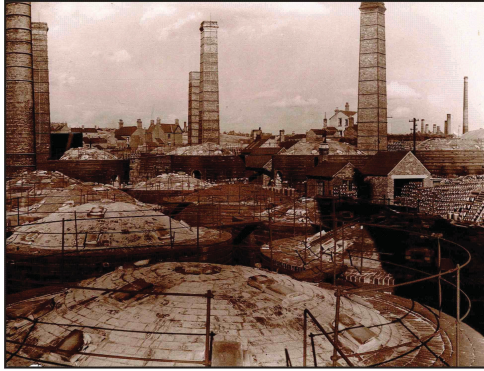


Plate 10. View across works. Date unknown.

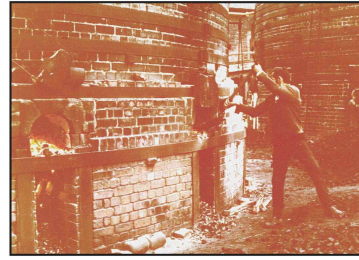


Plate 11. Firing a Beehive Kiln 1968

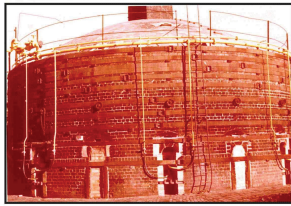


Plate 12. Gas fired Beehive Kiln. c. 1970



Plate 13. BHK2 post-demolition/collapse 1975