Association for Industrial Archaeology
44th Conference, Telford 2016

Industrial Archaeology Tour Notes
for Shropshire and Beyond

Shropshire and Beyond – Tour Notes

44th Annual Conference of the Association for Industrial Archaeology

Saturday 10th September

11.00-13.00 Tour A: Apley Park Home Farm
Tour B: Broseley Clay Tobacco Pipeworks
Tour C: Wappenshall Canal Basin

Sunday 11th September

13.00-18.00 Tour D: The Lilleshall limestone mining landscape
Tour E: Ditherington Flaxmill Maltings; Leighton Furnace
Tour F: RAF Museum Cosford, The Conservation Centre and the Cold War Gallery

Monday 12th September

9.00-18.15 Tour G: Burleigh Pottery, Middleport; Cheddleton Flint Mill; Mill Meece Pumping Station
Tour H: Kidderminster Carpet Museum; Severn Valley Railway restaurant, bar or café; Kidderminster Railway Museum; Drakelow Tunnels

Tuesday 13th September

9.00-17.30 Tour I: Newman Brothers Coffin Works; Evans Silver Works; Birmingham Jewellery Quarter tour
8.30-17.30 Tour J: Aga Foundry, Coalbrookdale Company; Snailbeach lead mining sites

Wednesday 14th September

9.00-17.30 Tour K: Thomas Telford's roads and canals in North Wales
Tour L: Clee Hills industrial landscape; Wrickton Mill and Charlcotte Furnace

Acknowledgements

The Notes have been prepared by the Conference organising team: David de Haan, Steve Dewhirst, Shane Kelleher, John Powell and Ian West, with additional notes by David Adams, Glynn Barratt, Tim Booth, John McGuinness and Kelvin Lake. Design by Steve Dewhirst, maps by John Stengelhofen.

Published by the Association for Industrial Archaeology, Ironbridge Gorge Museum, Coalbrookdale, Telford, Shropshire TF8 7DQ; printed by Telford Reprographics.

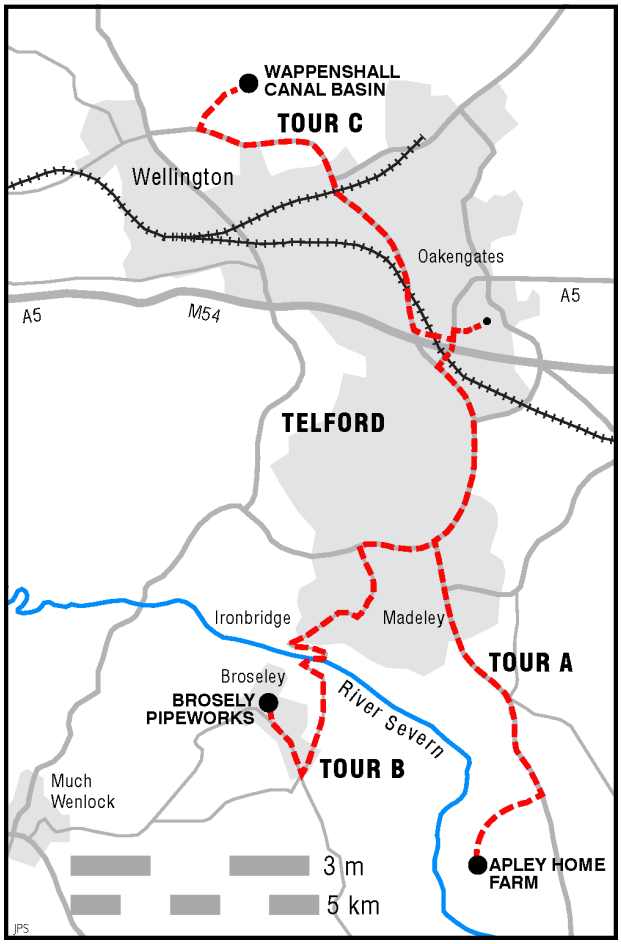
www.industrial-archaeology.org

Tour A

Saturday 10th September

Apley Park Home Farm

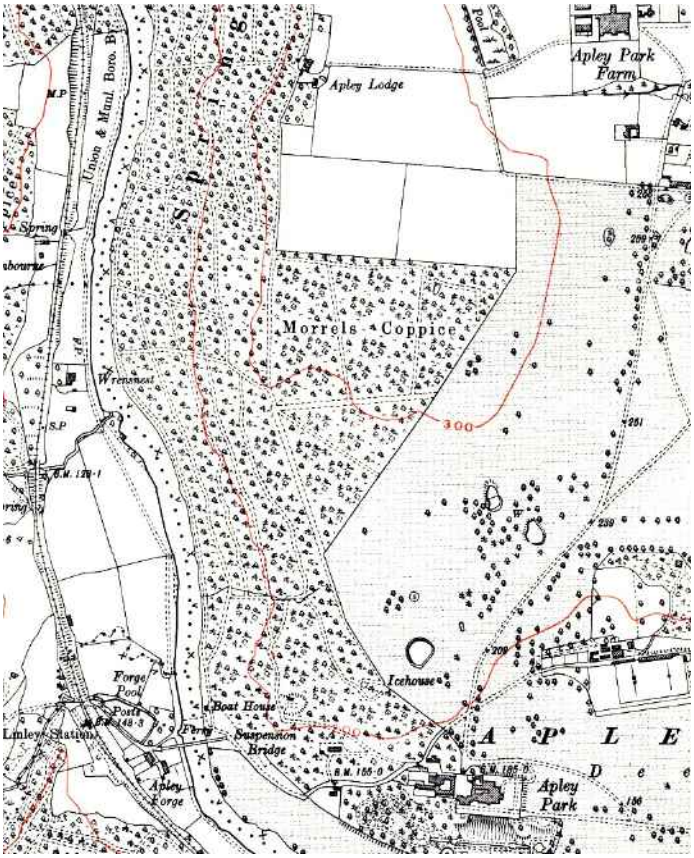
Please note that this is still a working farm; floor surfaces are uneven and may be slippery, so care and stout footwear are required. For safety reasons, delegates are requested to remain on the ground floor, as the upper storey has many unprotected gaps in the floors. Animal faeces can carry dangerous infections so delegates should wash their hands thoroughly after the visit before consuming food or drink and should take care handling soiled footwear.



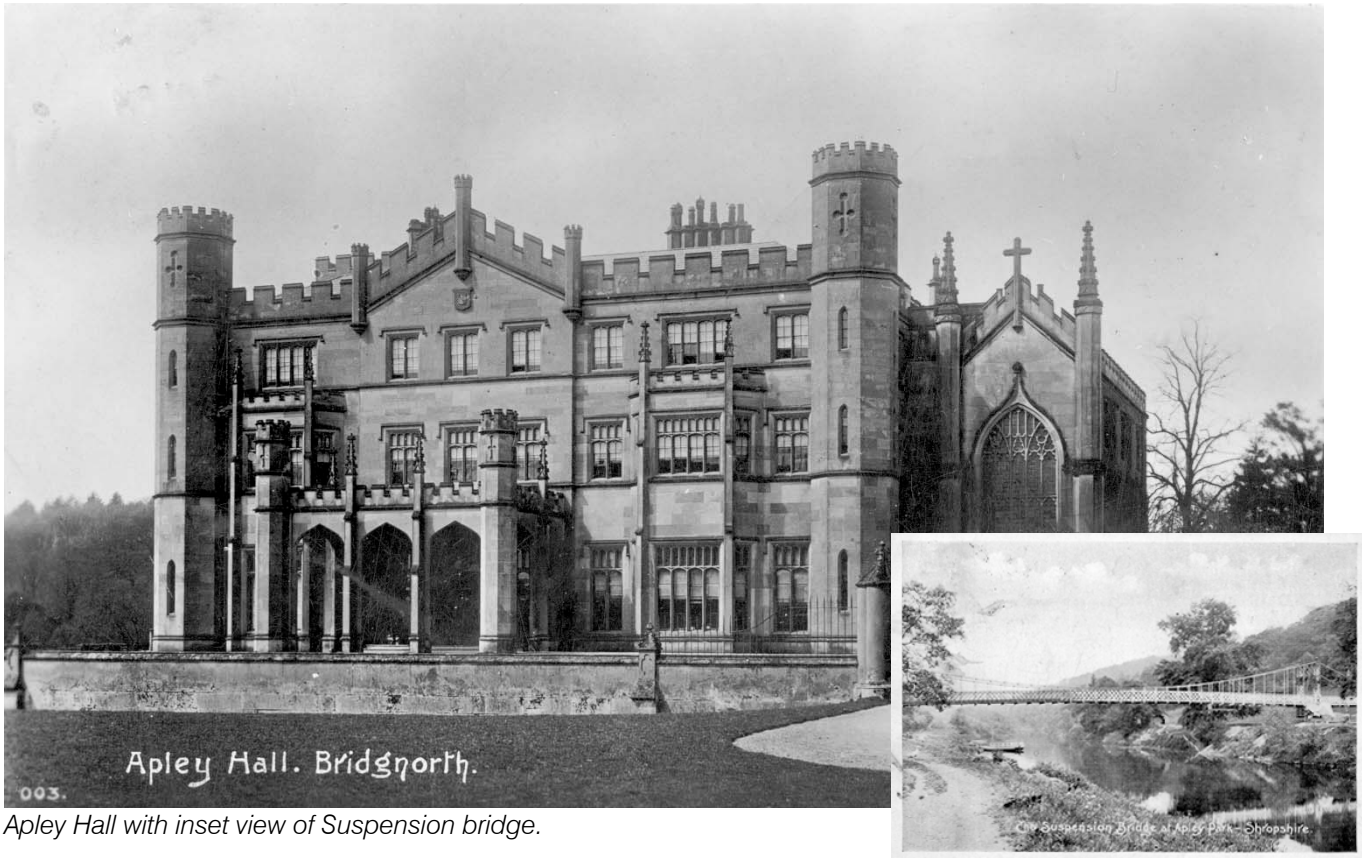
Apley Park Home Farm (SO 714996)

Apley Park is located 10km south of Telford, on the east bank of the River Severn. The house, also known as Apley Hall, should not be confused with Apley Castle, a 19th century mansion, now demolished, built in the grounds of a former medieval castle, which is on the northern edge of Telford. The first house at Apley dates from the 18th century but this was largely obliterated by a much larger neo-Gothic mansion built for the Whitmore family between 1811 and 1820. Whitmore objected to the construction of the Severn Valley Railway and as an appeasement the line was built on the south side of the Severn and a station constructed at Linley. The estate had been in decline for some years when it was sold in 1868 to the industrialist William Orme Foster, head of John Bradley and Co which owned many ironworks, mines and other undertakings around Stourbridge and the Black Country. Foster set about modernising the house and its estate, building a gas works before 1874. Water to the house was provided by hydraulic rams situated on the lower dam of the disused Wrens Nest Forges. Communication with Linley Station was via a private ferry which lasted until 1905 when Foster built a single track suspension bridge.

The house is considered by many experts to have been the main inspiration for P G Wodehouse's Blandings Castle. The last member of the Foster family to live there died in 1960, after which the house became a boarding school, which closed in 1987. After a brief period as a single dwelling once again the house and adjacent service buildings were converted into apartments about 12 years ago. The surrounding estate, however, is still owned by descendants of the Foster family, Lord and Lady Hamilton, at least one of whom is hoping to accompany us on our visit around the farm buildings.



1925 OS Six-inch (Shropshire LI.SE) showing Apley Park Farm, the Hall (Apley Park), Suspension Bridge and Linley Station. National Library of Scotland



Apley Hall with inset view of Suspension bridge.

The Home Farm is dated 1875, part of William Orme Foster's early burst of modernisation. It is a perfect but largely overlooked example of the Victorian 'high farming' movement, in which wealthy landowners built state-of-the-art farm complexes, partly as show-pieces for their peers but mainly to demonstrate the benefits of modern farming methods to their tenants. Such model farms typically included steam-powered machinery and housing for farm animals designed to facilitate the delivery of fodder and the removal of waste for use as fertilizer.

The main feature of the farm complex is a large building housing a series of covered yards for cattle, and stabling for horses. Adjoining this on the N side is a range of storage sheds for equipment and different types of fodder, with a projection which housed the steam engine and boiler. These buildings are the focus of our visit, with the main cattle building being notable for its lamella timber roof structure supported on cast iron columns, and its raised passageways along which small carts transported the animal feed. To the east of the farm buildings are an elegant farm manager's house and a farm office building, which may originally have included a weighbridge. To the west of the main buildings was a range of single-storey buildings, possibly pigsties, which have been demolished.

Late-19th century photograph of south front of main farm building. © Apley Estate

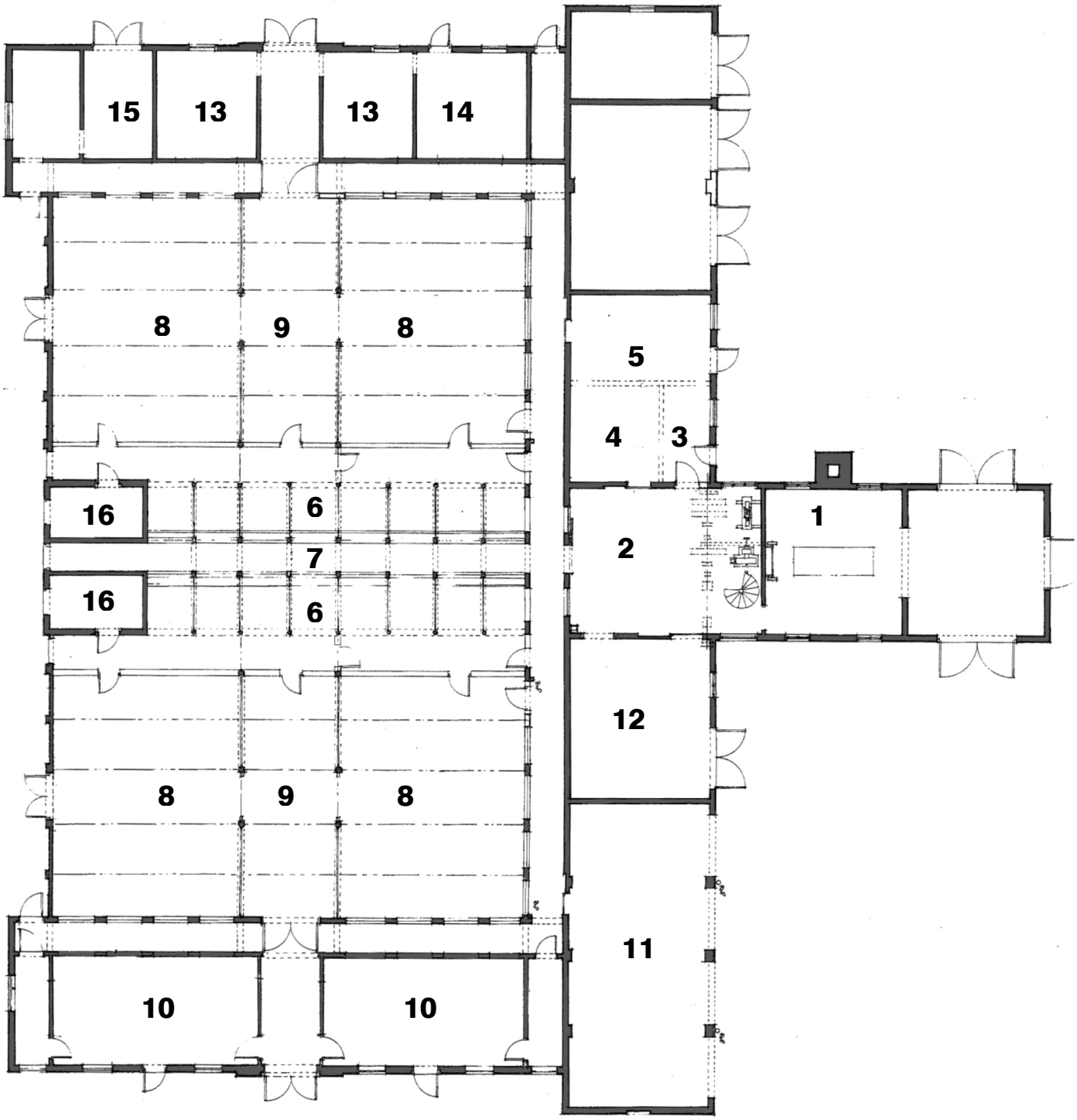
An 1875 plan shows the proposed original use of the various parts of the main building. The surviving remains show some variances from this plan, particularly with respect to the location of the steam engine, which suggests that later alterations were made.

Further Reading:

Wade-Martins, 1991 *Historic Farm Buildings*. London: Batsford

Wade-Martins, 2002 *The English Model Farm: Building the Agricultural Ideal, 1700–1914*. Macclesfield: Windgather Press in association with English Heritage

http://apleyestate.co.uk/



Plan of the main building with uses taken from the original plan. From a drawing by Matthew Knight

1 Threshing Shed
2 Mixing House
3 Engine House
4 Chaff
5 Hay
6 Cattle
7 Feeding Passage
8 Feeding Passage
9 Driving Way
10 Horses
11 Cart Shed
12 Turnips
13 Loose Box
14 Fat Cattle
15 Gig House
16 Calves

Tour B

Saturday 10th September

Broseley Clay Tobacco Pipeworks

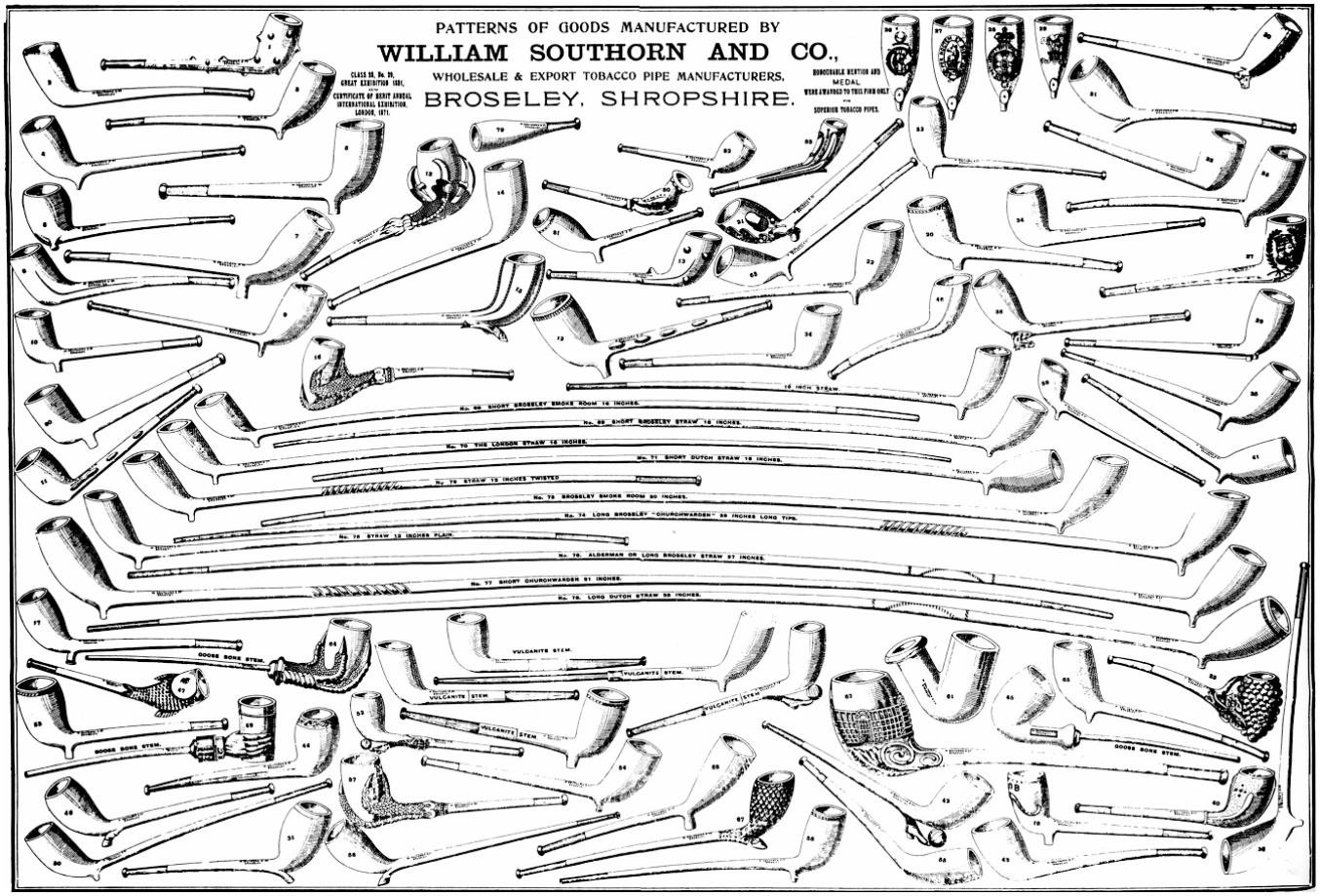
For location and route map see Tour A

Broseley Clay Tobacco Pipeworks
(SJ 671022)

On the hill top south of the Gorge a mile from the river is Broseley, a settlement far older than Ironbridge. John Wilkinson had an ironworks here from 1756 and brick and tile works were scattered all over the area from as early as 1618, but the town was best known for its clay tobacco pipe industry which began around 1600. Initially using the local white clay, a century later they began to bring Devon clays up the Severn and sold pipes to a national market. Never a large scale industry, most of the 50 pipeworks in the town were small domestic businesses until the early 1800s, after which factories began to be the norm.

Among the larger works were those belonging to the Southorn family, whose first Broseley factory opened in 1823 under William Southorn (c1792-1853). His pipes were displayed at the 1851 Exhibition and at that time he had a workforce of 36. By the end of the 1860s they were producing about 1,500,000 pipes a year and by 1881 employed 70 workers. That year Roland Smitheman (1834-1903) established the Crown Pipeworks on King Street, which was taken over in 1930 by the Southorns until it closed in 1960. It survives today as the Broseley Pipeworks Museum, part of the Ironbridge Gorge Museum.

Smitheman adapted existing buildings rather than having a purpose-built factory. The oldest part of the King Street works dates from around 1700 built for agricultural use and is thought to have become a textile factory by 1792. Cottages were added in the 1840s which were subsequently turned into workshops with a bottle kiln attached. The makers were almost always women. A gem of the interpretation is a 1938 film that had been shot in the works showing the making of 'long straw' pipes. It allows visitors to see the skill involved in rolling the 'dummies', threading a wire up the stem to make the air passage, loading them in iron moulds to control the final shape and size, and fettling or trimming the pipes to remove the seam left by the mould. In 1921 Eva Parry received sixpence for trimming 15½ dozen pipes and earned 7 shillings a



The range of clay pipes produced by William Southorn junior in the 1870s. Ironbridge Gorge Museum.

Harry Southorn and two female employees firing and finishing Broseley pipes.
Shrewsbury Chronicle 12th August 1932

Moulding a "Churchwarden".
Shrewsbury Chronicle 12th August 1932

Bottle Kiln. This was converted from updraft to downdraft during the 20th century. D de Haan

week, which equates to 2,604 pipes made in that time. Ida Bennet earned 7s 6d per dozen in 1952 at a weekly wage of £2 15s. Though the bottle oven is small each firing produced between 8,000 and 10,000 pipes.

The whole complex was listed grade II in the early 1980s and was acquired by the Ironbridge Gorge Museum Trust in 1991 to be preserved as a time capsule. It was still just as it was when it had been abandoned in 1960 so everything was carefully recorded and then removed while the building was made sound. The museum's archaeology team did the recording, having previously done the same exercise for the Smith & Pepper works in Birmingham's Museum of the Jewellery Quarter. Some of the floor joists and boards had to be replaced and extra columns were inserted to strengthen the structure before the contents were reinstated in exactly the same place they had been before. Great care was taken to preserve the atmosphere, so unlike usual museum practice the walls were not re-plastered or re-painted, graffiti remained untouched and the original electric wiring of the test kiln remained dangerously exposed and dangling across a room (albeit disconnected). The museum opened in 1996.

Further Reading:

Vanns, Michael 1996. *Broseley Pipeworks: Clay Tobacco Pipe Museum*. Ironbridge Gorge Museum Trust.

Hayman, Richard and Horton, Wendy , 1999. *Broseley Pipeworks,* Industrial Archaeology Review Vol. XXI 1999 Issue No .1

Atkinson, D.R., 1975. *Tobacco Pipes of Broseley Shropshire.*

Tour C

Saturday 10th September

Wappenshall Canal Basin

For location and route map see Tour A

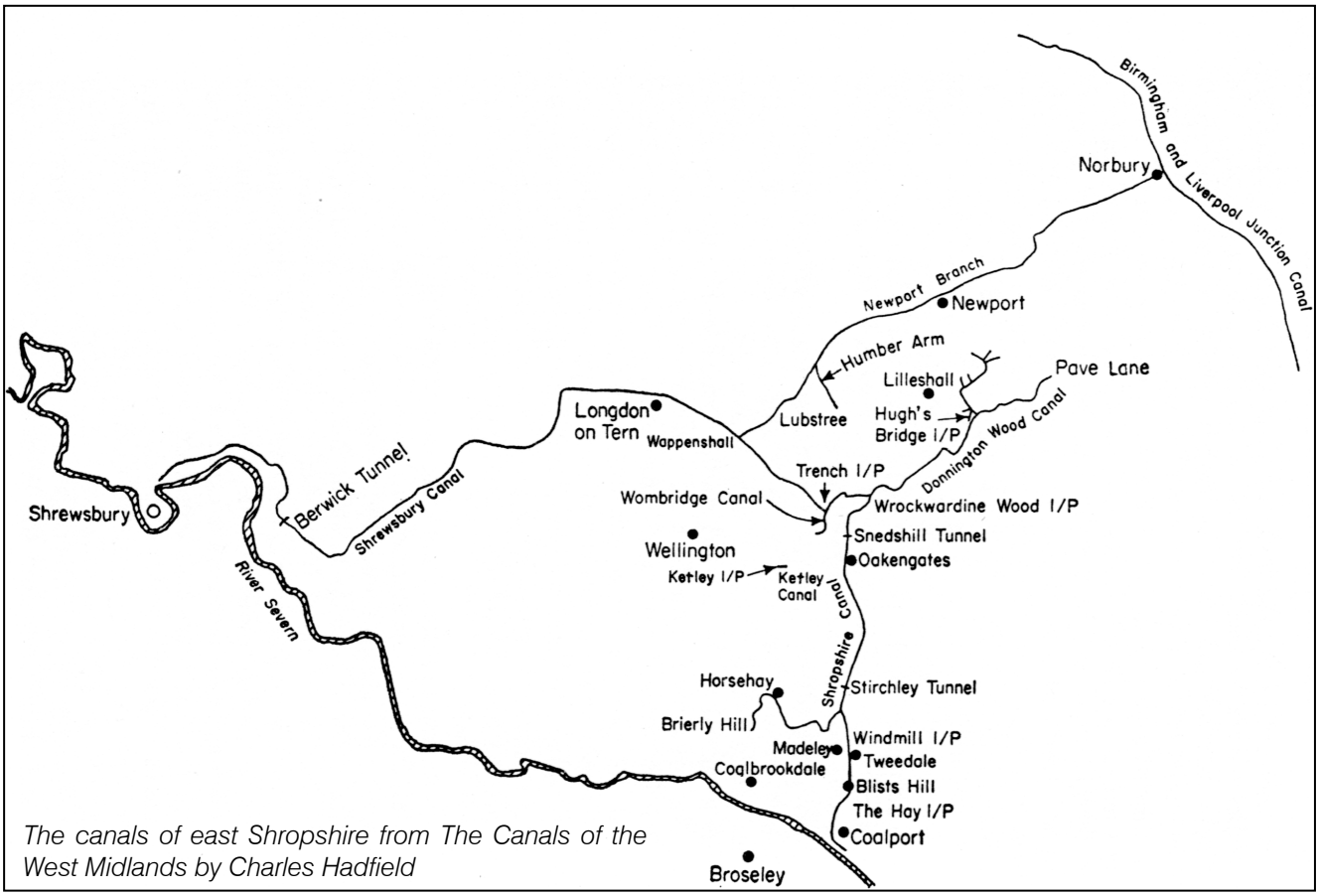
Wappenshall Canal Basin (SJ 663145)

East Shropshire's remarkable advances in the iron industry during the eighteenth century were matched by equally significant developments in its transport network, such as the introduction in Coalbrookdale of the world's first iron flanged wheels in 1729 and the first use of iron rails in 1767. The area was also served by an extensive network of canals, a brief history of which sets Wappenshall in context.

The first canal to be built was the Donnington Wood Canal. It was built in 1768 by Lord Gower, brother-in-law of the Duke of Bridgewater, in partnership with John Gilbert, the Duke of Bridgewater's agent, and Gilbert's brother Thomas. The canal was more than 5 miles long, and carried coal from Donnington Wood northwards to a wharf alongside the road at Pave Lane, south of Newport. A branch was later built at a lower level to serve quarries at Lilleshall and Pitchcroft. It was initially connected to the main line by a tunnel and shaft system which was later replaced by an inclined plane.

In 1788 the Wombridge Canal, less than two miles in length, was constructed to connect with the Donnington Wood Canal. This was built by the celebrated Shropshire ironmaster and entrepreneur William Reynolds. At around the same time, he completed the short Ketley Canal, to carry coal and ironstone from the Oakengates area to his ironworks at Ketley. This was notable as being the first British canal to use an inclined plane for raising and lowering boats from one level to another. An illustration of this inclined plane appears in the portrait of William Reynolds currently on display in the Museum of Iron in Coalbrookdale, and also on token coinage issued in the area at the time.

The three canals mentioned thus far were all private ventures, but in 1789 work began on an ambitious scheme to connect them all with the River Severn. This was the Shropshire Canal, which attracted financial backing from many local industrialists including the Darbys and John Wilkinson. At the northern end, an inclined plane at Wrockwardine Wood connected with the Donnington Wood Canal. From Oakengates it headed southeastwards towards the Severn. There were two more inclined planes, one at Windmill Farm near Stirchley, and one at The Hay which lowered the canal to run parallel with the river at Coalport, where a new town was subsequently developed. A branch over



The canals of east Shropshire from The Canals of the West Midlands by Charles Hadfield

Wappenshall Junction, Shrewsbury Canal. This photograph, taken in 1964, shows the canal junction at which the Shrewsbury and Newport Canal, coming in from the right, joined the earlier Shrewsbury Canal, from left. Wikipedia

two miles long left the canal at Southall Bank for Coalbrookdale, where it terminated at Brierly Hill. A tunnel and shaft system was built here, but like that on the Donnington Wood Canal, it was later replaced by an inclined plane. The Shropshire Canal was opened in 1792.

The Shrewsbury Canal was constructed to carry coal from the East Shropshire coalfield to the county town, though again there was no direct link into the River Severn. It was connected to the existing network by means of yet another inclined plane, at Trench, and then proceeded westwards, via Wappenshall, through sparsely populated countryside. Its significant features included locks with guillotine gates, a tunnel with a towpath at Berwick, and the cast iron aqueduct at Longdon-on-Tern, designed by Thomas Telford after he replaced Joseph Clowes as engineer in 1795. It opened throughout in 1797.

All the above canals were built for small, rectangular tub boats made of wood or iron, the sole surviving example being the one on display at Blists Hill Victorian Town, alongside a surviving stretch of the Shropshire Canal. Boats worked singly or in trains of several boats tied together. Although successful and profitable, the East Shropshire network remained isolated from the national canal system for another 30 years, and it wasn't until 1835 that a branch from Norbury Junction (on the Birmingham & Liverpool Junction Canal - later the Shropshire Union) was built via Newport to Wappenshall. It was at this time that the surviving warehouses were built, and Wappenshall was transformed into a transhipment point of considerable importance until the railways eventually took away its trade.

The survival of the buildings can probably be attributed to their comparative isolation, though other canal warehouses in the area were demolished or, in the case of the wooden one from Newport, re-erected at Blists Hill (now serving as a Sawmill). Ambitious plans to re-open the canal from Norbury Junction to Shrewsbury include the restoration of Wappenshall (aided by AIA funding) which is seen as a vital step to increasing public awareness and interest, as well as attracting additional funding.

Further Reading:

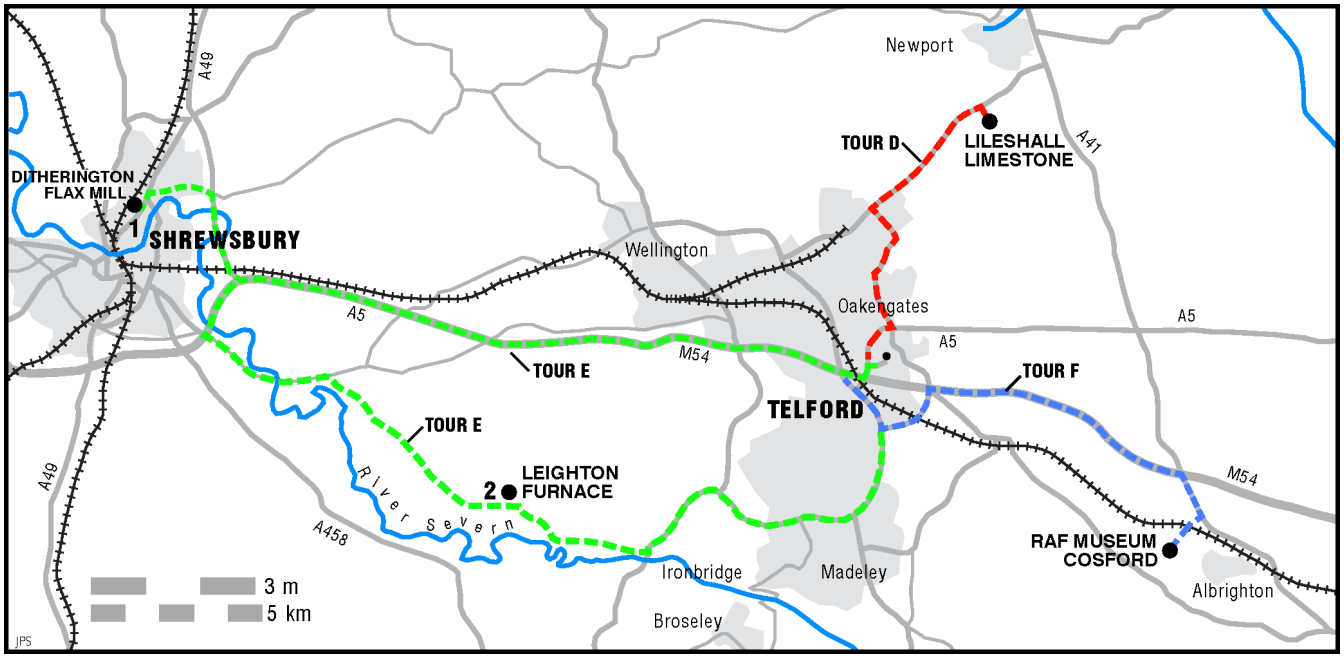
Morriss, Richard K., 1991. *Canals of Shropshire*, Shropshire Books

Clarke, N., 2015. *Waterways of East Shropshire,* Amberley.

Tour D

Sunday 11th September

The Lilleshall limestone mining landscape

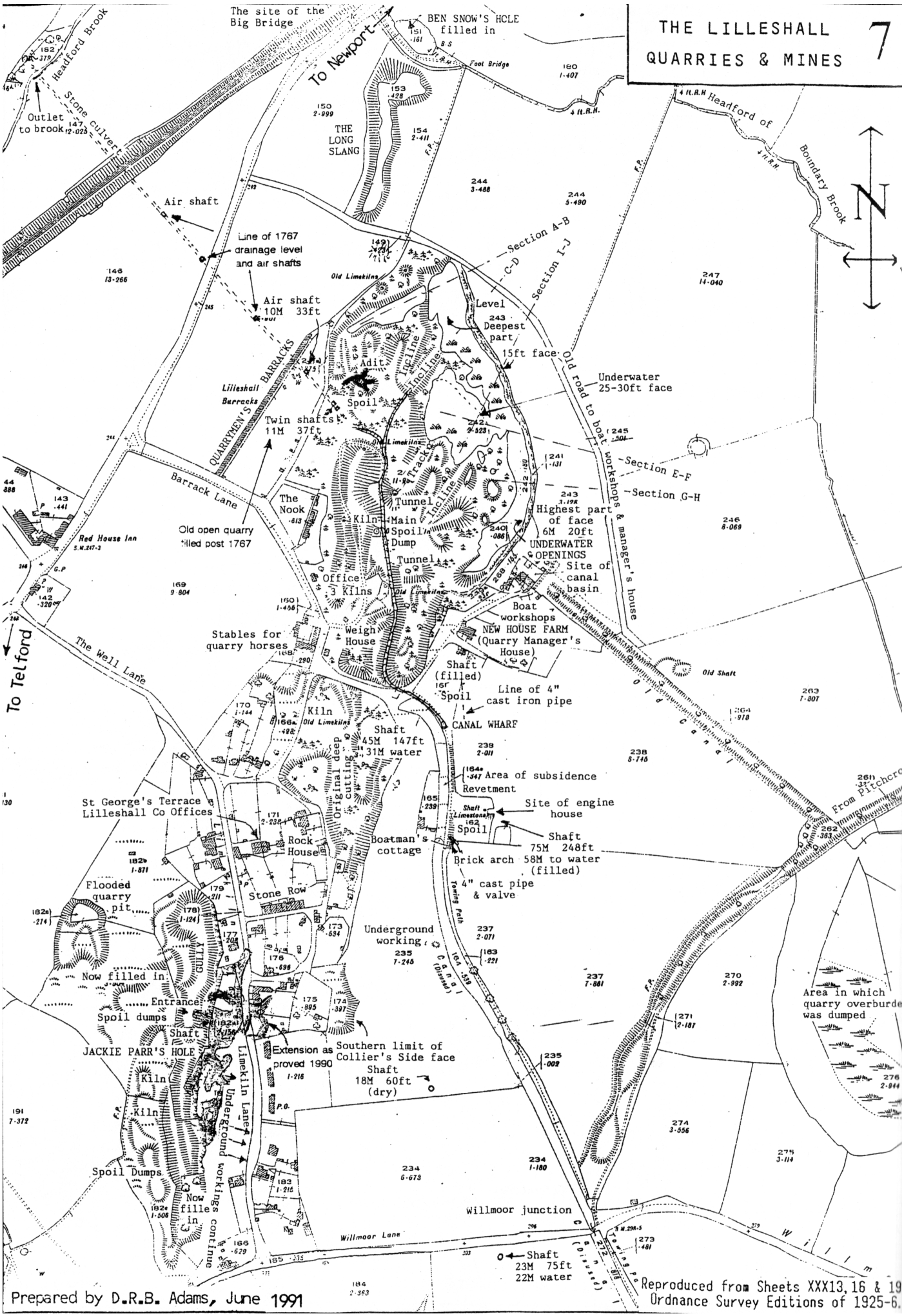


Lilleshall Limestone (SJ 735165)

The volcanic mass of Lilleshall Hill with its prominent monument to the Dukes of Sutherland, stands out of the East Shropshire Plain. It is Pre-Cambrian in origin and, with the Wrekin, amongst the oldest rocks in Europe. In later periods, the area was covered by shallow seas in which limestone was deposited and, later still, by deserts affected by earth movements and glacial erosion. The Lower Carboniferous Limestone outcrops to the east of the hill and it is split by a number of major faults. The limestone occurred in four beds and, although the shallower ones could be worked by opencast methods, deep mining was required to work the lower ones. The lower deposits made a good hydraulic cement which set under water and large quantities were used in the building of Liverpool Docks.

It is not known when men first began to cut the limestone as a building material but the adjacent Lilleshall Abbey was certainly built from it in the 12th century. Following the Dissolution of the monasteries in the 1530s, the estate was bought from the government by the Leveson family who had made their fortune in the Wolverhampton wool trade. The family immediately set to work to economically exploit the land which had suffered much neglect during the latter monastic days. Land was drained, communications were improved by causeways across the marshy ground on the Weald Moors, and general agricultural improvements were made. The family opened coal, iron and limestone mines, particularly in the area which is now north Telford. Virtually all these enterprises were contracted out to partnerships who worked the mines with varying success.

Although the earliest reference to limestone working in Lilleshall was in 1625, it wasn't until the 18th century that industry generally began to predominate. Sir John Leveson (1675-1709) became Earl Gower in 1746 and the industrial story really began when his son Granville Leveson Gower (1721-1803) became the second Earl in 1754. He took an active interest in the efficient running of the local estates, namely Sherrifhales, Lilleshall, Donnington Wood, St Georges, Priorslee, Wombridge and Snedshill. His brother-in-law was Francis 3rd Duke of Bridgewater, the originator of the first canal to be constructed in the country, which carried coal out of his Manchester mines. Through him, Earl Gower was introduced to the brothers Thomas and John Gilbert, the latter having had much experience in the cutting of the Bridgewater canal. At that time there were over 250 small pits extracting limestone in the Lilleshall area with varying degrees of efficiency. The Earl's agricultural improvements had led to an increased demand for lime and the expanding local iron works demanded limestone as a flux. The Earl was thus persuaded that it would be more efficient to operate the limestone extraction directly, so he and the Gilbert brothers formed the Lilleshall Partnership in 1764 to do this. The Earl also took over iron furnaces


THE LILLESHALL QUARRIES & MINES
7
The site of the Big Bridge
BEN SNOW'S HOLE filled in
To Newport
Headford Brook
Stone Culvert
Outlet to brook
THE LONG SLANG
Headford of
Boundary Brook
N
Air shaft
Line of 1767 drainage level and air shafts
Air shaft 10M 33ft
Section A-B
C-D
Section I-J
Level
Deepest part
15ft face
Underwater 25-30ft face
Old road to boat workshops & manager's house
Adit
Incline
Spoil
Lilleshall Barracks
QUARRYMEN'S BARRACKS
Twin shafts 11M 37ft
Section E-F
Section G-H
Barrack Lane
The Nook
Kiln
Tunnel
Main Spoil Dump
Tunnel
Highest part of face 6M 20ft
UNDERWATER OPENINGS
Site of canal basin
Red House Inn
Old open quarry filled post 1767
Office
3 Kiln
Boat workshops
NEW HOUSE FARM (Quarry Manager's House)
Stables for quarry horses
Weigh House
The Well Lane
To Telford
Shaft (filled)
Spoil
Line of 4" cast iron pipe
CANAL WHARF
Old Canal
Kiln
Shaft 45M 147ft 31M water
Original deep cutting
Area of subsidence
Revetment
St George's Terrace
Lilleshall Co Offices
Site of engine house
Rock House
Boatman's cottage
Shaft 75M 248ft
Brick arch 58M to water (filled)
Flooded quarry pit
Stone Row
4" cast pipe & valve
Underground working
Now filled in
Entrance
Spoil dumps
Shaft
JACKIE PARR'S HOLE
Extension as proved 1990
Southern limit of Collier's Side face
Shaft 18M 60ft (dry)
Area in which quarry overburden was dumped
Kiln
Kiln
Limekiln Lane
Underground workings continue
Spoil Dumps
Now filled in
Willmoor junction
Willmoor Lane
Shaft 23M 75ft 22M water
Prepared by D.R.B. Adams, June 1991
Reproduced from Sheets XXX13, 16 & 19 Ordnance Survey Editions of 1925-6.

at Donnington Wood and thus he had a vested interest in producing and delivering limestone as cheaply as possible.

The new partnership soon recognised that a better communication system was required between the widely dispersed sites and in 1765 began the construction of a canal, completed two years later, the second in the country. It ran from Pave Lane to the Earl's furnaces at Donnington Wood, a total of 8.8km (5.5 miles) and was known as the Donnington Wood Canal. The quarries in Lilleshall village were improved including one which had been abandoned and flooded by the 18th century, now expanded into what became known as Colliers Side Quarry. This expansion entailed the removal of a large quantity of overburden to access the limestone. To get rid of this, a length of canal was dug to a nearby kettle hole and the spoil taken here in tub boats to fill in marshy ground and make it suitable for agriculture. The quarry workings were linked to the main canal near Hugh's Bridge by a branch canal which was unfortunately 18 metres lower. To overcome this, the branch canal went under the main canal in a tunnel with a shaft to link the two. Boats would be moored underneath the shaft and a crane lifted pallets of stone up to other boats in the canal above.

Although some quarries could work the two shallowest limestone beds by opencast methods, to reach the lower beds it became necessary to mine the limestone since the cost of removing the overlying strata was too great. This also applied where shallower beds dipped downwards and the overburden increased proportionately. The mines were worked on the pillar and stall system which left 25% of the limestone behind as pillars to support the roof.

Some of the limestone was converted to quicklime on site by burning it in kilns. These consisted of 7.5 metre deep shafts with a grate at the bottom connected to the outside by a horizontal service tunnel. They were fuelled by coal carried on the canal from the nearby Donnington collieries. The limestone and fuel were stacked at the shaft bottom, the fuel set afire and the whole thing left to burn for several days. A draught was sucked in along the tunnel and up the chimney shaft to increase the fire temperature. After the fire had died down, the lime could be broken up into small lumps for transport. Transport of limestone and coal to the kilns themselves was originally by horse and cart but these were later replaced by waggonways with 'L' shaped cast iron rails. Since the quicklime becomes caustic when wet, it was not advisable to transport it by rail. As a result, it was usually stored by the kilns and picked up by customers themselves.

Some of the limestone was converted to slaked lime for cement and local land improvement schemes; the

Restored lime kilns and bridge in quarry.

majority, however, was sent to be used as a flux in the iron furnaces. It was transported on the canal in long lines of tub boats which were 5.9 metres long, 1.9 metres wide and 1.2 metres deep (20ft x 6ft x 4ft). Due to the intricate network of canals in the area, this meant that it could usually be transported directly from the quarry to the iron works without being transhipped. The quarries at Colliers Side originally worked the shallower beds opencast but the workings were eventually continued underground with inclines linking them to the tramways above. The extracted waste material was used to build great embankments across the quarry in which kilns were built, as well as two tunnels for access. Tramways ran along the top of the embankment to feed the kilns and to carry material to the canal. Shafts from 45-75 metres deep were also sunk to work the lower beds and an open trench west of Limekiln Lane was continued underground.

The Lilleshall Partnership was creating a profitable business from the Colliers Side quarries and this was not unnoticed by the neighbouring Leeke family. Their land was in the parish of Church Aston but they were landowners rather than industrialists. Their main venture was at Blackberry Bank Mine, which had originally been worked from the 17th century, and they sunk shafts over 36 metres deep. Pumping engines, probably of the Newcomen type, were erected but they were less successful than they expected. This led them to leasing the exploration rights to the Partnership who had linked Blackberry Bank Mine to their canal system by 1798. By this time, however, the mine was almost worked out and several 120 metre deep shafts had been sunk to the east at what was to become the Pitchcroft Mine. By 1800 the mining industry of the area was at its fullest extent but the Partnership was almost finished. Both the Gilberts were dead and Earl Gower was 79. The younger son, Lord Granville Leveson-Gower, acquired all the shares in the Partnership and formed the Lilleshall Company in 1802 with John Bishton, James Birch, John Onions and William

Excavation of Pitchcroft Winding Engine.

Phillips. The Blackberry Bank Mine was abandoned and other quarries and mines around Lilleshall were finished by the 1830s. Although twin exploratory shafts 213 metres deep were sunk at Crow Hayes, work now concentrated on the Pitchcroft Mine.

This mine worked in a restricted area but may have produced over a million tons of limestone during its life. In 1846, the Stafford-Wellington railway was built and this passed right by the main shaft of the mine. A short branch was built to the mine and this made it much easier to transport limestone to the Donnington furnaces. In 1860 a disaster struck when water was found to be rising through the floor in old workings. This rapidly became a flood and the workings had to be abandoned when the pumps could not keep pace with the inrush. No human lives were lost but the pit ponies could not be rescued and they were left to their fate, the rotting carcases polluting local water supplies for some time afterwards. It was estimated that over 300 gallons of water per minute were entering the mine and portable pumps capable of removing 400 gallons per minute were brought in. Within days, however, the inflow had doubled and the mine was lost. It is believed that exploratory workings had passed through the Brockton Fault and found workable stone at a different horizon, this then being left until required. Beyond the fault, however, was the North Shropshire aquifer and over a period the pressure would have built up until the water eventually burst into the workings. Tunnelling through this fault would have been like drilling into the bottom of a full bath. Once this had happened then nothing could have saved the mine. It became necessary to find reserves elsewhere and attention turned to the Willmoor Mine. This was originally called Sour Leasow Pit and had begun as twin exploratory shafts 60 metres deep, rapidly expanding to meet the local needs for limestone. The mine was finally abandoned in 1883 but produced about 188,000 tons of limestone during 21 years of working. It averaged 7,500 tons per year which was taken to a small basin on the nearby canal and carried in tub boats to the furnaces. Its demise was due to the fact that the Company could bring in limestone cheaper from Wenlock Edge and Nantmawr near Oswestry, despite the extra distance involved.

Thus ended the industrial history of Lilleshall and the surrounding area. All mine buildings and equipment were removed and the dumps planted with trees. The workings flooded and the shafts were capped with brick 'beehives'. The tramways were removed and the canal system became derelict, part of the main course being filled in during the construction of the Lilleshall Hall drive in 1896.

David Adams

Further Reading:

Adams, David, 2007 .*The History of Limestone Mining in Church Aston and Lilleshall, Near Newport Shropshire*: *Account No. 25*: Shropshire Caving and Mining Club.

Tour E

Sunday 11th September

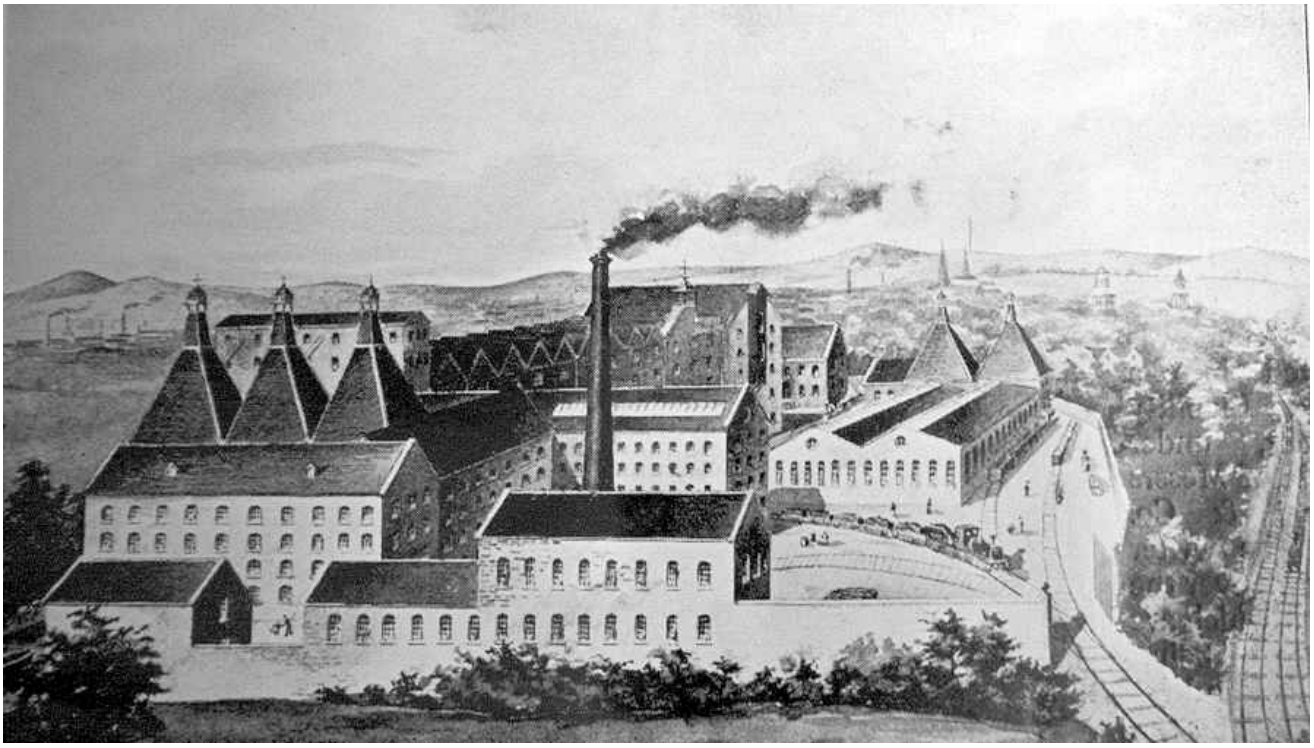
Ditherington Flaxmill Maltings and Leighton Furnace

For location and route map see Tour D

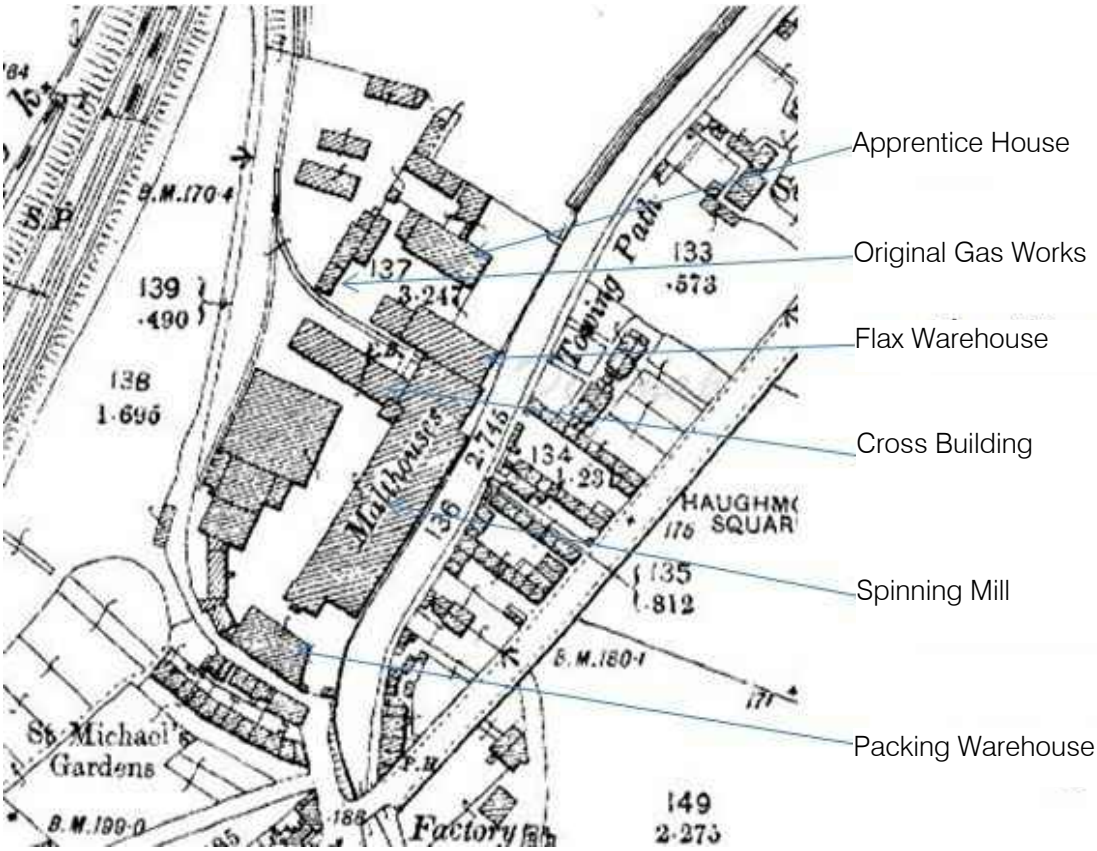
1. Ditherington Flax Mill (SJ 498138)

Ditherington Flaxmill Maltings stands alongside the course of the former Shrewsbury Canal, approximately 1.5km north of Shrewsbury town centre. It was built for flax spinning in the last decade of the 18th century. The Spinning Mill itself has been described as 'one of the great monuments to the British industrial revolution', being the world's first fully iron-framed building. The site was converted to a maltings in 1897, an activity which ceased in 1987. Ditherington is the subject of this year's Rolt Lecture, given by John Yates who, as a Buildings Inspector for English Heritage (latterly Historic England), has worked for many decades to preserve this unique site. John will also be one of our guides on this tour.

John Marshall, son of a linen merchant, established a flax-spinning business in Leeds in 1791 and, in 1793, seeking to expand his enterprise, he entered into partnership with the brothers Thomas and Samuel Benyon, wool merchants in Shrewsbury who, like Marshall, were Unitarians. A fourth person joined the partnership in 1796: he was Charles Bage, a surveyor who had worked with Thomas Telford and who had many contacts amongst local iron-masters. The partners' decision to build a spinning mill in Shrewsbury in 1796 was taken only months after a serious fire virtually destroyed one of their Leeds mills, which must have inclined them to seek a fire-resistant design. Textile mills, constructed with timber floor and roof members, filled with flammable material and lit with oil lamps and candles had become such fire hazards by the end of the 18th century that insurance companies refused to cover them. Early attempts at fireproofing mostly relied on shielding the timber components with iron sheets but the first serious attempts at replacing the wooden structural components with iron were made by William Strutt, a member of another Unitarian textile-manufacturing family, from Belper, Derbyshire. In the early 1790s, the Strutts built a number of mills and warehouses using cast iron columns and stone floors supported on brick arches. However, timber continued to be used for the beams and other structural components supporting the floors and roof. Charles Bage corresponded at length with William Strutt before producing a design for the spinning mill at Ditherington which eliminated timber altogether, using flanged cast-iron beams to support the brick floor arches. This revolutionary design, produced when the understanding of the structural properties of cast iron was in its infancy, provided the blueprint for most new industrial buildings for many decades, until steel-framing took over in the late-19th century. Consequently, the spinning mill at



Undated drawing of site (possibly conjectural) after conversion to a maltings. The buildings in the foreground housed the later gas works.



Plan of site in 1902, based on OS 1:2500, showing some of the key buildings.

Ditherington has sometimes been described as 'the world's first skyscraper'.

The spinning mill, which was operating by 1797, has five storeys, and is approximately 53m long and 11.5m wide. Power was originally provided by a 20hp Boulton & Watt steam engine, housed at the south end of the building, which was augmented by a 40hp engine supplied by Fenton, Murray & Wood, at the north end, in 1800 (Matthew Murray having formerly been one of John Marshall's employees in Leeds). The cast-iron columns inside the mill have a distinctive cruciform cross-section and, on some floors, the central rows have integral brackets which supported the bearings for line-shafting. The five-storey Cross Building (used for flax preparation and other ancillary processes) and the Packing Warehouse were added around 1801. During the next decade, several other buildings were constructed, including the Dye House, Flax Warehouse and Apprentice House. Ditherington Mill was one of the earliest buildings in Britain to have been lit by gas, with a Boulton & Watt gas plant installed in 1811; the buildings which housed this no longer survive. This was abandoned in favour of gas from the public supply around 1826 but this proved unsuccessful so a new gas works was built in 1832 on land to the north of the present site boundary.


The Spinning Mill, undergoing external repairs in 2015. The canal ran along the front of the building.

Flax spinning ceased at Ditherington in 1886 and the mill's contents were sold off, but the site itself remained redundant until it was bought by local maltster William Jones in 1897 and converted into a maltings, with

Ditherington prior to the demolition of the grain silos in 2014.

the malting floors housed in the Spinning Mill and Cross Building. After World War II (during which the site served as a barracks for infantry trainees), two large concrete grain silos were erected. The maltings closed in 1987 but by then the site's significance to construction history had been recognised. As early as 1950, the American architectural historian Turpin Bannister identified the Spinning Mill as the world's first fully iron-framed building and it is now listed Grade 1; most other buildings on the site are listed Grade II or II*. As the site fell into decay through the 1990s, English Heritage and the local authority worked with a succession of developers to seek a sustainable future for the mill buildings. Each one failed, causing English Heritage (now Historic England) to take the unusual step of acquiring the site and carrying out urgent work to arrest the structural deterioration of the main buildings. In 2010 the Friends of the Flaxmill Maltings was set up and has since been highly successful in increasing awareness of the significance of this site in the local community and beyond. With the aid of a grant from HLF, the post-war silos have been demolished and some of the ancillary buildings converted to create a visitor centre, which opened in 2015. The public can now tour parts of the iconic Spinning Mill, while the Friends, Shropshire Council and Historic England continue to work with a number of partners to find a sustainable future for the main buildings.

Further reading:

Giles, Colum and Williams, Mike (eds), 2015 *Ditherington Mill and the Industrial Revolution*. Swindon: Historic England

http://www.flaxmill-maltings.co.uk/

2. Leighton Furnace (SJ 498138)

On the way back to Telford, we hope to have time to call in at the Kynnersley Arms in Leighton, not (just) for a beer but also to view the remains of a charcoal-fuelled blast furnace, perhaps dating back to the 17th century, in the pub's cellar, along with remains of a corn mill. This site was the subject of a *Time Team* episode in 2002.

The first furnace was built around 1630 by Sir Richard Newport on the site of a corn mill. From 1681 it was operated by the same partnership as the nearby Willey furnace and in 1717 it had an annual output of 200 tons. The last record of the furnace is in 1763 when shot was sold to the the Darbys of Coalbrookdale and it probably closed soon afterwards, eventually being converted back into a corn mill.

Leighton Furnace watermill gearing.

Further Reading:

Riden, Philip, 1993. *A Gazetteer of Charcoal-fired Blast Furnaces in Great Britain in use since 1660.* Merton Priory Press.

http://www.thekyn.co.uk/

http://etheses.bham.ac.uk/248/1/Hayman04PhD_A1a.pdf

Tour F

Sunday 11th September

RAF Museum Cosford;

The Conservation Centre tour and the Cold War Gallery

For location and route map see Tour D

RAF Museum Cosford (SJ 793051)

Cosford airfield near the Shropshire / Staffordshire border was built in 1938 to house No 2 School of Technical Training which opened in August 1938, followed by No 9 Maintenance Unit. Detachments of training aircraft from other airfields came to Cosford from 1941 when their airfields became too muddy. The Air Transport Auxiliary also worked from here from 1941 ferrying aircraft to their operational units, with No 12 Ferry Pilot Pool being staffed entirely by women for a period from 1943. The training element still continues today and next door over on the main camp is the Defence School of Photography, residential schools for recruits plus on the airfield a couple of local flying clubs, notably that of the University of Birmingham.

In 1979 a branch of the Royal Airforce Museum was established near the runway to house some of the collections from the sister site at Hendon and later became known as the Cosford Aerospace Museum. The name referred to the fact that the collection included missiles as well as military aircraft. The first of the commercial aircraft (a Viscount) from the British Airways Collection arrived in April 1976, followed by a VC10 in 1979, a Boeing 707 in 1981, a Trident in 1982, and the last arrival was the BAC 1-11 in March 1993. The museum displayed many of the aircraft in three exhibition galleries – effectively hangars with planes on the floor – as well as some large planes outside.

In 2001 the conservation workshop moved from Cardington, Bedfordshire into a new hangar, to serve both Cosford and Hendon. The new Michael Beetham Conservation Centre opened in 2002 and has a core management team of 12 full time technicians supported by four apprentices and volunteers. They began by restoring a small Sopwith Dolphin (all wood and wires), then a Tempest, a Vampire, a Hampden and a Mohawk. Since then an F111, Kestrel, Pioneer, several Spitfires, Fw190, Battle, EAP and an MH 53 are

Aerial View of Cosford Museum in 2000 before construction of the Cold War gallery.

Restoration of the Dornier Do 17. Express and Star

among the ones have passed through, leading on to more complex projects such as a Vickers Wellington Mk10B bomber and a Handley Page Hampden TB. They also provide the technical support for the movement or suspension of aircraft and large exhibits.

AIA Conference delegates will be looking at the current major project, the restoration of a German Dornier-17 bomber, nicknamed 'the flying pencil', which was recovered from the sea bed on Goodwin Sands in June 2013. This bomber was one of 400 that participated in the Battle of Britain, during the course of which nearly 200 were destroyed. This one was shot down on 26th August 1940 and is the world's only surviving example, though more than 1,500 were built. They had a crew of four and carried a maximum bomb load of 2,000lbs. It is now in three large sections which have been treated with citric acid solution to stabilise the effects of 83 years in salt water. Each section is in a microclimate controlled by dehumidifiers.

In 2006 British Airways withdrew their funding and from then on the museum concentrated on RAF aircraft. There are over 70 aircraft at Cosford and the most dramatic displays are in the National Cold War Exhibition which opened in 2007 in an iconic building designed by Fielden Clegg Bradley Architects. This phase was built at a cost of £12.5m and has 18 aircraft, many of them suspended in flying attitude. There are also nuclear missiles and tanks, as well as themed interpretation 'pods' on aspects of the Cold War.

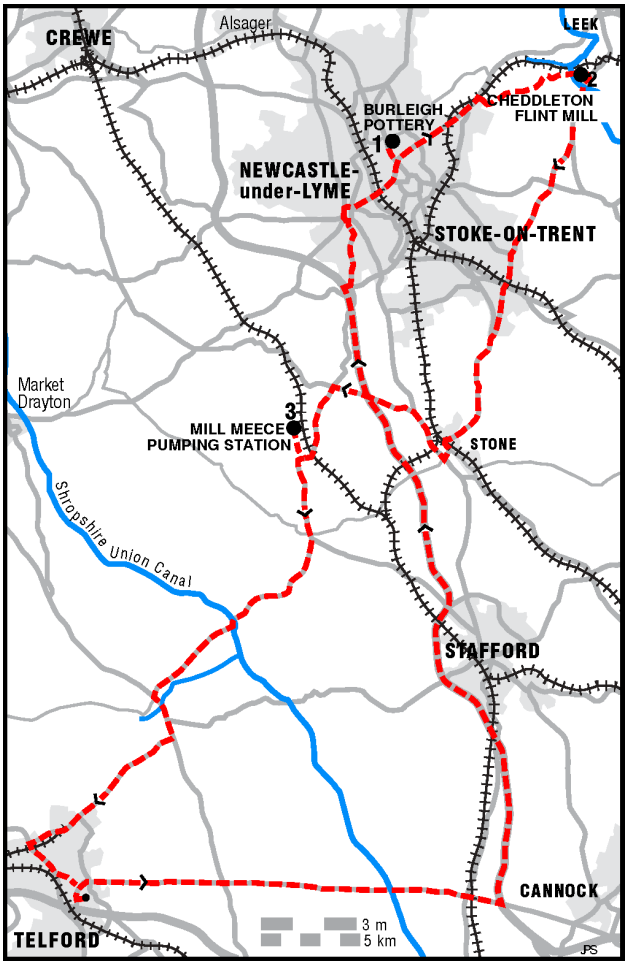
Further Reading:

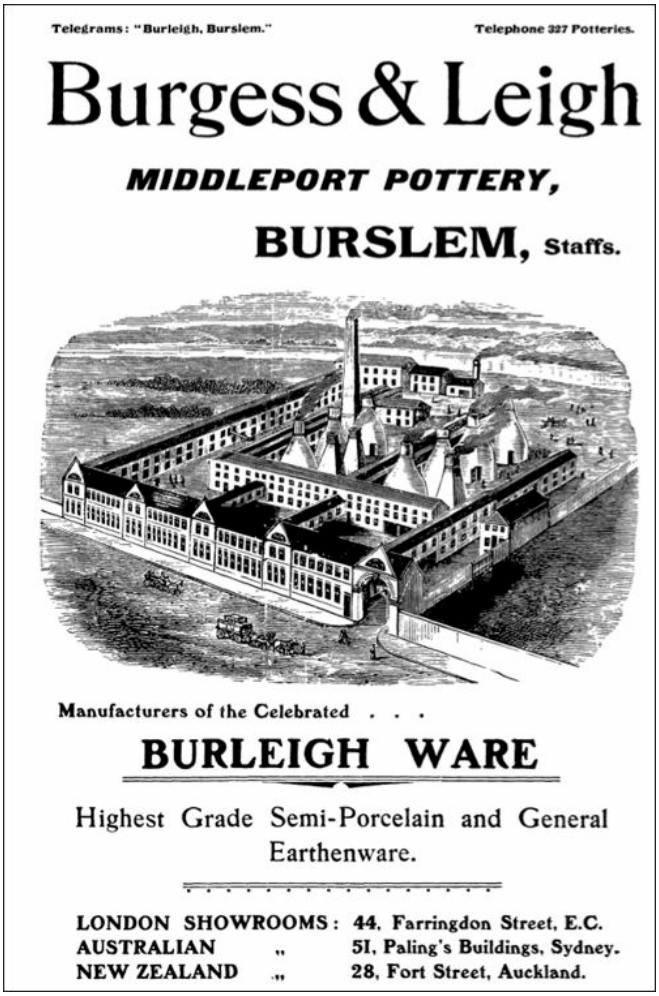
http://www.rafmuseum.org.uk/cosford/things-to-see-and-do/conservation-centre.aspx

Tour G

Monday 12th September

Burleigh Pottery, Middleport; Cheddleton Flint Mill; Mill Meece Pumping Station

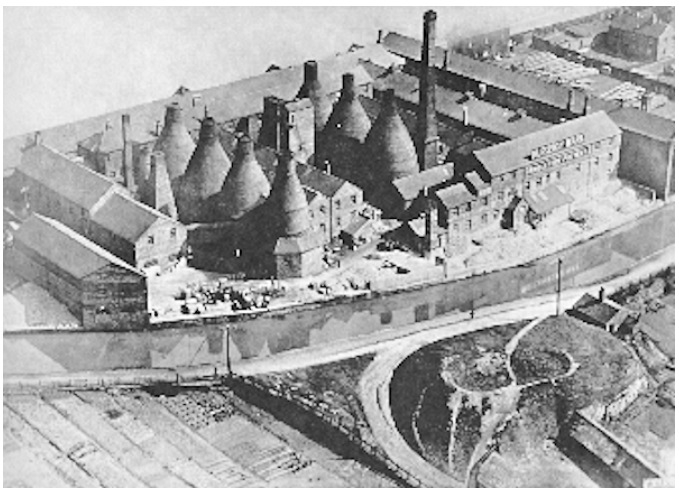




Advertisement from 1907 Staffordshire Sentinel Business Reference Guide to The Potteries, Newcastle & District.

1. Burleigh Pottery, Middleport, Burslem (SJ 860493)

Burgess & Leigh were established in 1862 and their new Middleport Pottery opened in 1889 as a model factory alongside James Brindley's Trent & Mersey Canal of 1777. It was built for Frederick Rathbone Burgess and William Leigh and streets of housing soon grew around the pottery which at its height in 1939 employed around 500 people. The factory was designed by Absalom Reade Wood (1851-1922) with three large biscuit bottle ovens and four glost ones, so was known locally as the Seven Oven Works. Only one remains, the rest being demolished in 1956 when the Clean Air Act came into force. The steam engine survives in situ and has recently been restored. It was built by local engineer William Boulton in 1888 to drive the clay preparation machinery. A vertical dryer or 'mangle' tower was added in 1920 which is still in use. A gas-fired tunnel kiln was installed in 1949 and another in 1951, both of which were replaced in the mid 1960s. The entire works was listed Grade II* in 1979. The canal was



Aerial view of the works, c1920.

designated a conservation area in 1988 and the Middleport-Longport section is a Townscape Heritage Initiative.

In June 1999 the factory went into voluntary liquidation and was bought complete by William and Rosemary Dorling who save the business and concentrated on reviving the range of 'Burleighware' using the original moulds they found in the lofts and the original transfer printing plates. In 2007 the pottery was on the 'Buildings at Risk' register and an English Heritage grant helped fund repairs to the surviving bottle oven and roofs. Sadly, in 2008 the Dorlings fell victim to a fraud at the hands of the company's accountant but in 2011 the Prince's Regeneration Trust stepped in and saved the works for a second time, re-opening it in 2014 after a £9m restoration programme.

Further Reading:

http://www.thepotteries.org/potteries/burgess.htm

https://www.burleigh.co.uk/

Coupe, Elizabeth R.,1998. *Collecting Burleigh Ware: A Photographic Guide to the Art Deco Tablewares of Burgess and Leigh*

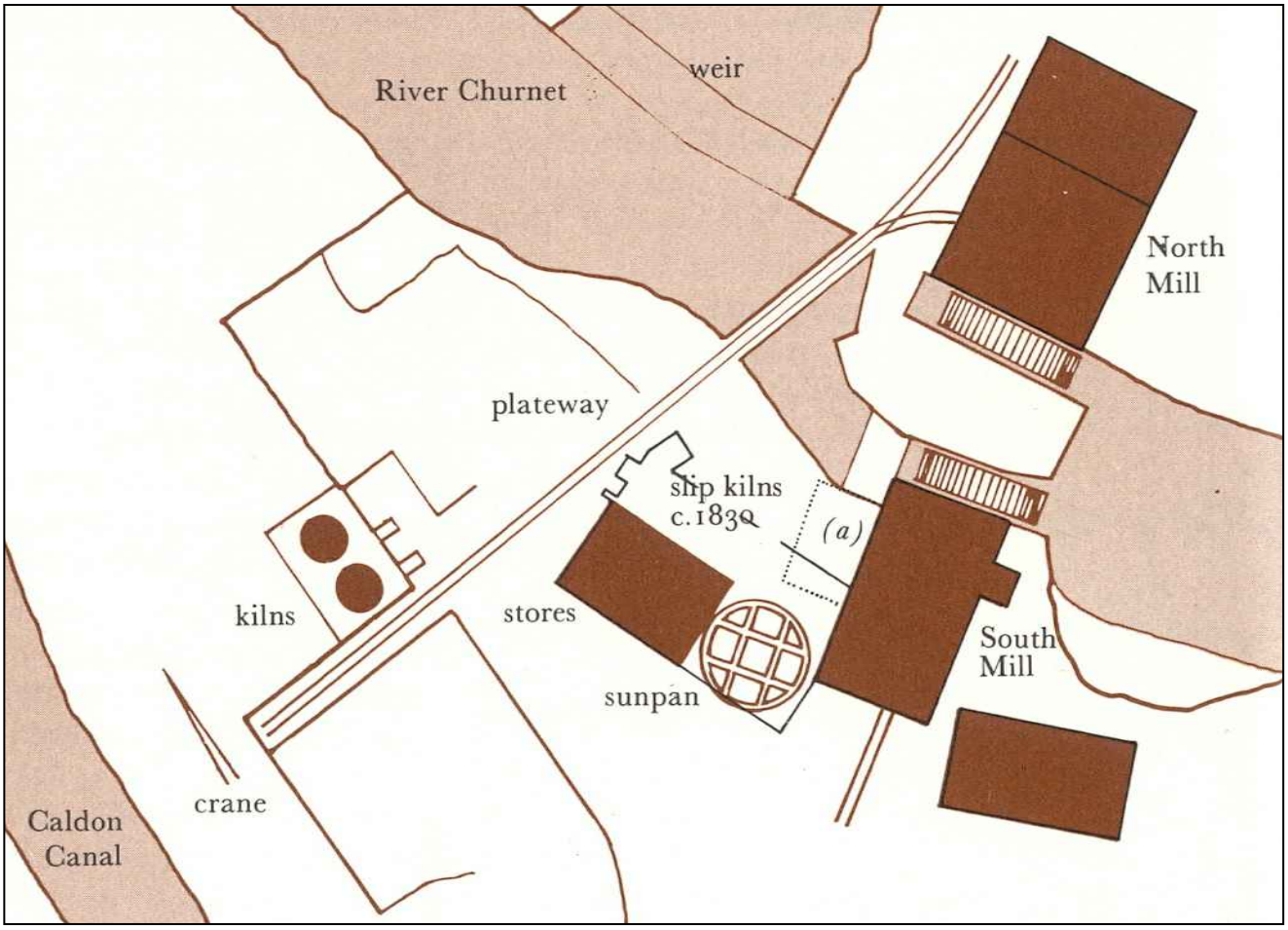
2. The Flint Mill, Cheddleton, near Leek

(SK 972562)

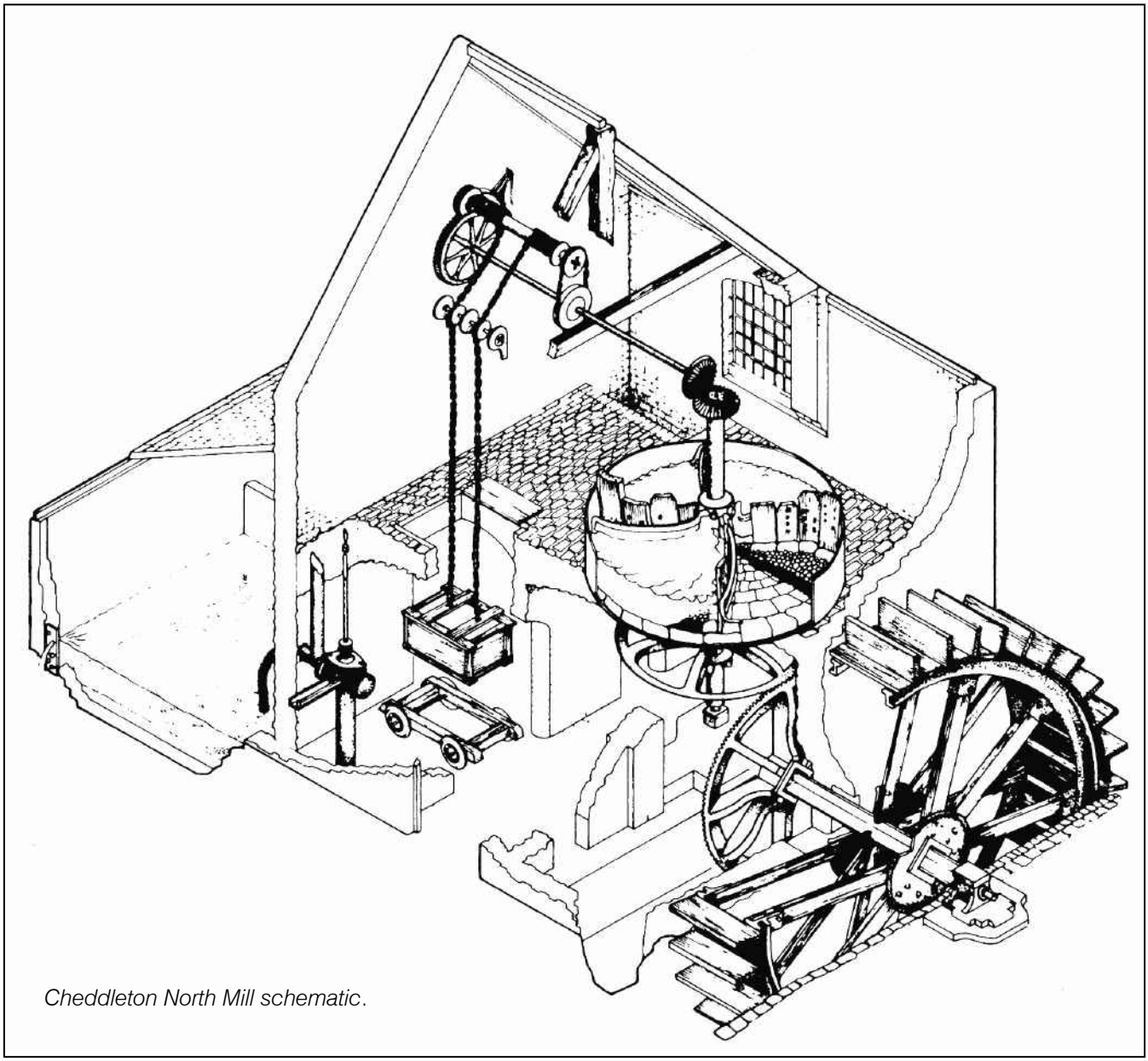
A corn mill was recorded on this site in 1253 and around 1765 it was converted to grind flint for the pottery industries. This material was added to the local Staffordshire clays to produce a white glaze, but soon became a key constituent of the body for earthenware production in the Potteries, amounting to about one third of the material. Cheddleton Flint Mill is located on the River Churnet where it flows close to the road from Sandon to Leek that was turnpiked in the early 1760s. It soon became served by James Brindley's Caldon Canal which opened in 1778 as a branch of the Trent & Mersey Canal.

Prior to grinding the flint was calcined to 1,000°C in the canal-side kiln. This was then ground in water on the upper floor of the mill in a horizontal pan where iron arms pushed Derbyshire chert stones round over the flint. The resulting slip was run into a settling ark and then pumped onto a drying kiln to evaporate off the moisture. The mill stones can be seen in operation in the South Mill, driven by a 20ft 5in undershot waterwheel.

There are two mills side by side at Cheddleton. The North Mill of around 1783 is largely preserved as it was when built as a flint mill, while the South Mill is



Cheddleton site plan, from Robert Copeland's 'A short history of pottery raw materials and the Cheddleton Flint Mill', 1983.



Cheddleton North Mill schematic.

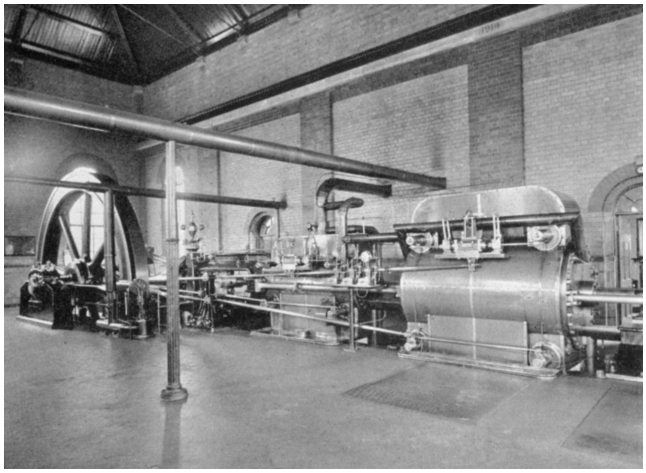
built on the foundations of the 1235 corn mill. It now houses exhibits related to flint grinding, including a 100hp drop valve reciprocating engine built by Robey & Co of Lincoln, which was originally installed at the Minton Works in Stoke in 1928 and bought by the museum for £90 in 1970. Cheddleton Flint Mill became an independent museum trust in 1967 entirely run by volunteers and all the buildings were Listed Grade II* in 1996. The last major restoration was done in 1998-2000 with assistance from a Heritage Lottery Fund grant.

Further Reading:

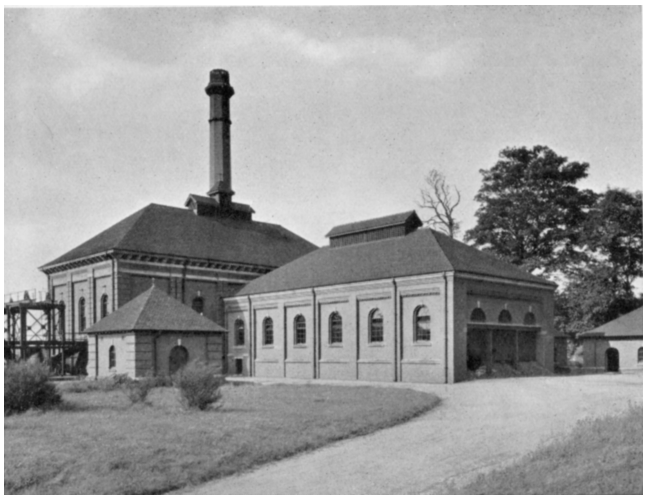
Copeland, Robert, 1983. *A short history of pottery raw materials and the Cheddleton Flint Mill.*

3. Mill Meece Pumping Station, Cotes Heath (SJ 830339)

As the Potteries conurbation grew so did the need for water, which was solved by the Staffordshire Potteries Water Works Company establishing a series of pumping stations within 10 miles of Stoke beginning in 1849. Among these were Hatton (1907) and Mill Meece (1914), both within a few of miles of Eccleshall, tapping into aquifers in the underlying sandstone. In 1909 a successful test borehole was sunk at Cotes Heath to 1,242ft and Mill Meece pumping station was built next to it designed by the architect William Campbell of Hanley in 1913. The contract for an engine and boilers was awarded to Ashton Frost & Co of Leeds for £10,401 and the compound rotatory engine was in steam in November 1914, though pumping was halted during the war. The works was extended in 1927 by the addition of a near identical engine linked to a new well, but as Ashton Frost had ceased trading it was supplied by Hathorn Davey of Leeds for £11,230. Mather & Platt electric pumps were added in 1937 in a new building and a further set in 1951, but the twin steam engines remained in service as a back-up until December 1979.



Horizontal Compound Tandem Rotary Steam Pumping Engine in 1914.



Mill Meece pumping station c1928.

Because the site is a working element of the regional water supply the buildings are maintained by Severn Trent Water Authority and in 1978 the Mill Meece Pumping Station Preservation Society was established to maintain and run the steam engines. A major overhaul of the flues and chimney was completed in 2015 and work began on the boilers that year, these two key elements having put a temporary halt to running the steam engines since 2013. The Hatton Pumping Station was converted into apartments in 2008.

Further Reading:

http://www.millmeecepumpingstation.co.uk/

Duncan, I.G.T.,1978. *Mill Meece Pumping Station, Nr Stoke-on-Trent, Staffordshire: A Record of Its Construction and Operation*

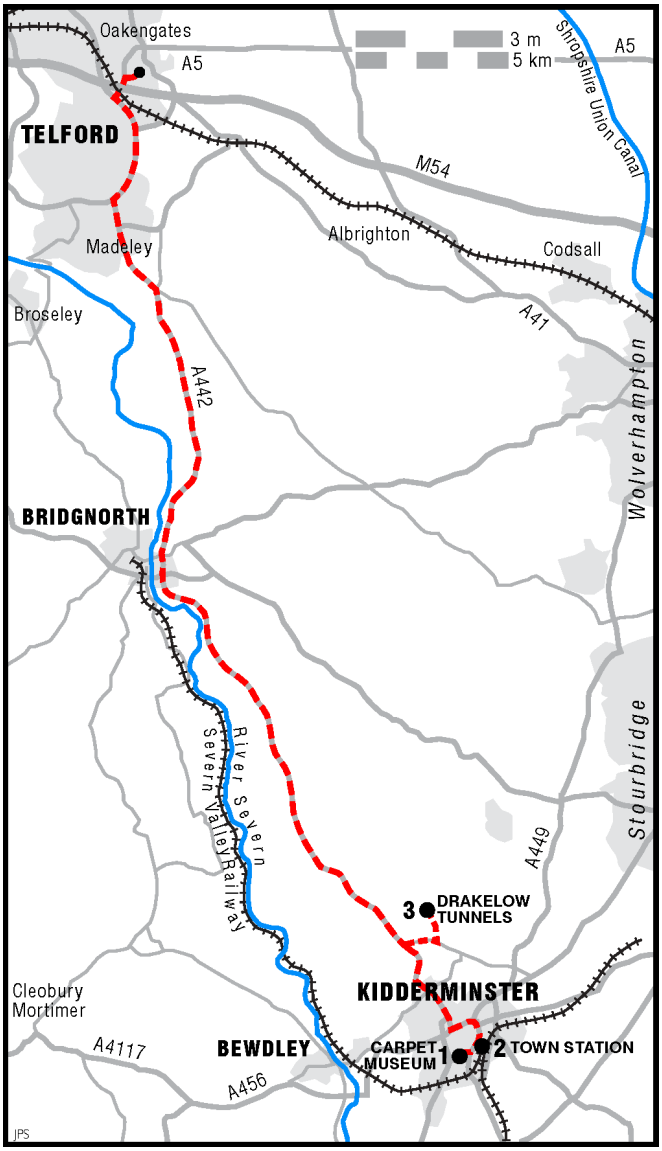
Restoration of the Mill Meece boilers, September 2015. D de Haan

Tour H

Monday 12th September

Kidderminster Carpet Museum; Kidderminster Railway Museum; Drakelow Tunnels

Please note that Drakelow tunnels are cold and have uneven floors. Delegates are required to wear warm clothing and stout footwear. This visit is not suitable for wheelchair users. The tunnels are lit by electric light via a generator, so delegates are advised to bring a torch in case of generator failure.

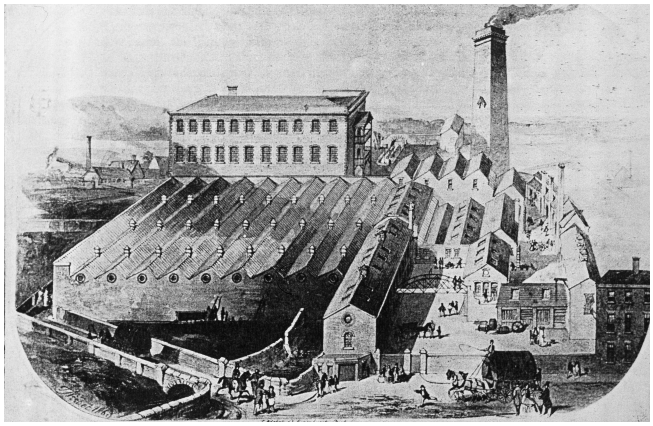


Museum of Carpet, Kidderminster
(SO 834764)

In 1968, Pevsner described Kidderminster as 'a town uncommonly devoid of visual pleasure and architectural interest', but he was no fan of industrial buildings, so failed to appreciate the beauty and grandeur of the town's numerous carpet mills. Many of these have since been demolished but the remains of this industry, which totally dominated the area for 150 years, are still much in evidence. During the 18th century, carpet making developed in a number of locations in Britain – notably Wilton and Axminster in the southwest and Halifax in West Yorkshire – but by the start of the 19th century, Kidderminster had become the country's major centre for this industry, a position it still holds despite the decline in demand for carpet in the late 20th century and the increasing dominance of lower-cost imports.

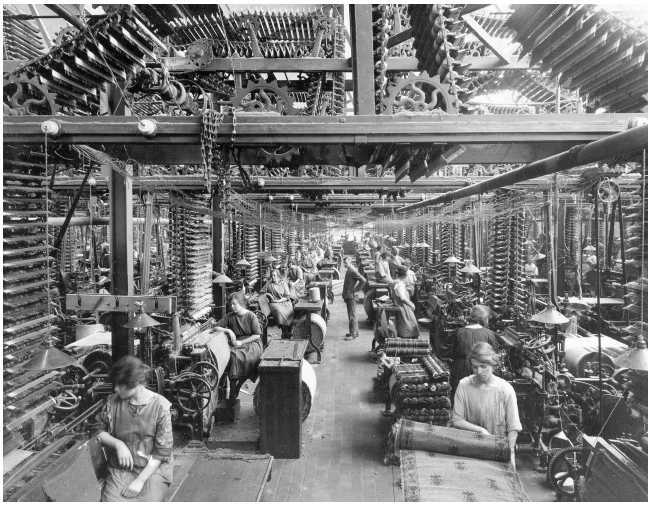
View of Kidderminster c1930.

During the 17th century, Kidderminster became known for the production of thick woven woollen cloth which was often used as a floor covering. In the 1730s, local weaver John Broom led the expansion and specialisation of the industry with the manufacture of Belgian-style looped-pile carpets, possibly using weavers brought over from Brussels. In 1784 there were 10 carpet manufacturers with 300 looms, rising to 23 manufacturers and 2,000 looms by 1822. Kidderminster's growth was greatly assisted by its central location and the good transport links provided by the Staffordshire & Worcestershire Canal, which opened in the 1770s.



Brinton and Lewis's Carpet Works, Kidderminster, 1863 (courtesy of the Museum of Carpet).

Until the middle of the 19th century, carpets were entirely woven on handlooms, either in the weavers' own houses or in small loom shops, using yarn which was produced elsewhere. The introduction of steam-powered looms in the 1850s prompted the growth of large integrated factories, incorporating spinning, dyeing and weaving, such as that of Brinton and Lewis, and the landscape was soon dominated by massive weaving sheds, with their characteristic north-light roofs.



Weaving Axminster carpet at Carpet Trades, Kidderminster, 1923 (courtesy of the Museum of Carpet).

After several decades of stagnation around the end of the 19th century, Kidderminster's industry blossomed in the 1930s, meeting a growing demand for carpets in houses and commercial buildings. In the 1960s there were 25 companies employing around 15,000 people but the 1970s saw the start of a decline due to increasing competition from lower cost tufted carpets, using synthetic materials and often imported from overseas. As with other remnants of Britain's textile industries, the manufacturers which have survived have done so mainly by specialising in higher quality products. Today, the town has five carpet companies, employing fewer than 500 workers.

Stour Vale Mill, 2015, after conversion to the Museum of Carpet.

Most of the weaving sheds have been demolished but some of the distinctive office and showroom buildings along street frontages have survived. The Museum of Carpet provides an excellent example of this pattern. Stour Vale Mill was built in 1855 for Woodward, Grosvenor, a company founded in 1790 and absorbed in the Brinton Group in 2003. When production on the site ceased, the manufacturing buildings were demolished to make way for a Morrisons supermarket but the Grade 2 buildings along Green Street became a home for the Carpet Museum Trust, founded in 1981 to collect artefacts and archives relating to the industry which dominated the town.

Further Reading:

Thompson, Melvyn, 2002. *Woven in Kidderminster*,

Thompson,Melvyn, 2012. *Mills and Tall Chimneys of Kidderminster 1850-2010.*

www.museumofcarpet.org/

Kidderminster Town Station (SO 838763)

The Severn Valley Railway (SVR), by virtue of its history and landscape, is one of the most popular of Britain's preserved steam railways and has been visited twice before during previous AIA conferences. On this occasion, however, we are using its Kidderminster terminus as the base for an extended lunch stop. The SVR's line, once part of the Great Western Railway, closed to through traffic in 1963 and finally ceased operating in 1970. The section between Bridgnorth and Bewdley was re-opened as a preserved steam railway in stages through the 1970s with the extension to Kidderminster completed in 1984. The original station in Kidderminster had been demolished (leaving a small modern station on the national rail network) so the SVR built an impressive new station, known as Kidderminster Town, in Victorian style, based loosely on the design of the GWR station at Ross-on-Wye. Construction of the platform canopies was only completed in 2006.

Adjacent to the SVR's station is the separately-run Kidderminster Railway Museum, housed in a former railway warehouse, the ground floor of which was used for grain, whilst the upper floor stored wool for the carpet industry. The ground floor of the museum contains a large collection of railway artefacts from all over Britain and the upper floor will be housing an exhibition of railway paintings as well as its usual collection of photographs.

The location offers a number of options for lunch. The SVR has a real ale bar, with a large refreshment room next door. There is a small café within the Railway Museum and there are other cafés, a pub and chip shop across the road from the station.

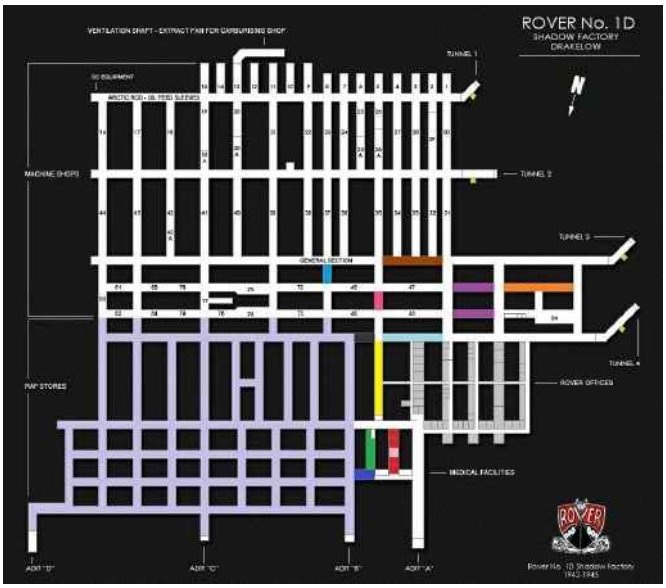
Further Reading:

www.svr.co.uk/

www.krm.org.uk/

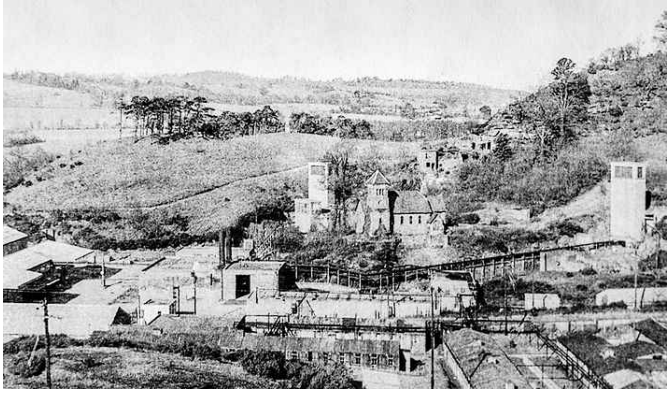
Drakelow Tunnels (SO 821811)

Drakelow Tunnels is a former underground military complex beneath Kingsford Country Park, 3km north of Kidderminster. The tunnels were built in the period 1941-1942 as a 'Shadow Factory' for the Rover car company. The Shadow Factory scheme was devised in 1935 as the threat of war increased, as a means of increasing aircraft production. A number of factories were built all over Britain, some adjacent to existing motor industry plants and others on green-field sites, close enough to existing factories to utilise the skilled engineering workforce that existed in the area. Most of these factories were housed in conventional north-lit sheds but Drakelow was unusual in being located underground. Over 5km of tunnels provided almost 25,000m^2 of factory space, which was mainly used to manufacture engine parts for the Bristol Aeroplane Company. As well as the tunnels, a number of surface buildings were constructed, including a boiler house, coal and oil stores, and a fire station, and the complex took over the existing school building. These were all demolished in the 1980s.



Plan of Rover Shadow Factory (courtesy of the Drakelow Tunnels Preservation Trust).

Engine component production in No 3 Tunnel, 1942 (courtesy of the Rover Archives and Drakelow Tunnels Preservation Trust).



Surface buildings in the 1950s (Courtesy of Mr J S Preece and Drakelow Tunnels Preservation Trust).

After WWII,the tunnels began producing parts for tank engines until 1958 when the tunnels were handed over to the Ministry of Supply (later the Ministry of Works) and used for storage. In 1961 the Government converted half of the tunnels into a top secret facility, designated Regional Seat of Government (RSG) 9. This was one of 13 sites around the country from which national and local Government and key public services would operate in the event of Nuclear War. These facilities were designed to accommodate up to 350 personnel, and be capable of operating independently for several months. The staff operating the RSG were chosen by the Regional Directors of Civil Defence and were drawn from the police, fire brigade, medical profession, the armed forces and the Civil Service. The RSGs served as hubs for the emergency communication network which provided telephone and telex links to central government and to emergency services, local government, military bases and other public services in the region.

In 1980, a review of civil defence provision determined that the existing RSGs had insufficient protection against nuclear attack, which resulted in some rationalisation and upgrading of the remaining sites. The tunnels at Drakelow were fitted with blast doors and air locks were installed to bring the complex up to full nuclear bunker status. Drakelow continued in use until the end of the Cold War and, in 1993, the Ministry of Defence decommissioned the RSG network and Drakelow was sold. Since 1993, the Drakelow Tunnels Preservation Trust has been restoring the entire complex to its original condition to become the largest Cold War Museum in the UK. It is also the largest underground space in the UK open to the general public.

Further Reading:

Drakelow Tunnels http://www.drakelow-tunnels.co.uk/index.php

Stokes, Paul , 1996. *Drakelow Unearthed: The Secret History of an Underground. Complex*http://www.stokes277.freeserve.co.uk/pages/du.html

Subterranea Britannica http://www.subbrit.org.uk/

Tour I

Tuesday 13th September

Newman Brothers Coffin Works; Evans Silver Works; Birmingham Jewellery Quarter tour

After leaving the University campus we will join the M54 which we will follow eastwards passing the new Jaguar Land Rover Engine Manufacturing Centre at i54, located between Junctions 3 and 2, before heading south towards Birmingham on the M6. We will leave the M6 at Junction 6 where we will navigate our way through the Gravelly Hill Interchange, better known as Spaghetti Junction, and on to the Birmingham Jewellery Quarter, which is located to the immediate northwest of Birmingham City Centre.

The Birmingham Jewellery Quarter is Europe's largest concentration of businesses involved in the jewellery trade and produces around 40% of all of the jewellery made in the UK. It is remarkable for its plethora of converted houses, factories and specialist buildings associated with jewellery and metalworking. Designated as a conservation area in 1980, it is home to over 200 listed buildings and has been described by English Heritage as a 'national treasure' and a place of unique character. These attributes have seen it added to the UKs Tentative List of sites for World Heritage status in 2010. It is also a European Route of Industrial Heritage (ERIH) anchor point. As a tangible reminder of Birmingham's great tradition of metal manufacturing, which gained it the reputation as the 'Workshop of the World', the Birmingham Jewellery Quarter is a rare and special place and a unique historic environment in England.

Delegates will have an opportunity to have expert guided tours of two of the area's newest and remarkable industrial heritage 'attractions'. Both the Newman Brothers Coffin Works, which is operated by the Birmingham Conservation Trust, and the J.W. Evans Silverworks, which is run by English Heritage, are 'time-capsule' museums, and are highly evocative and representative of the significant industrial history of the area. In addition, an experienced blue badge guide, a former Ironbridge Institute student and Birmingham Jewellery Quarter specialist, will lead an industrial-themed walking tour full of interesting architecture, social history and famous names.

Newman Brothers Coffin Works, Fleet Street

Newman Brothers was originally a brass foundry business established in 1882 by Alfred and Edwin Newman. Initially operating from premises in what is now the Eastside area of Birmingham, their business was based on casting an assortment of metal articles, in this case principally cabinet furniture from molten brass. By 1894 they had moved to new premises at 13-15 Fleet Street in the Jewellery Quarter, which was designed by the Birmingham architect Roger Harley. This relocation also represented a change of focus as they were now listed as 'Coffin Furniture Manufacturers' and specialised in the production of general brass furniture. This necessitated only a slight change in their production line as the manufacture of coffin furniture was a natural extension of the jewellery and 'toy' trades and their many ancillary trades, using not only the same materials, but also incorporating the same skills and processes to produce various metal goods. The production of coffin furniture, which covers a wide range of products such as handles, breastplates, crucifixes, and decorative ornaments in addition to shrouds and robes, would have represented a more lucrative trade than general brass founding. The works would go on to produce coffin furniture from electro-brass, silver plate, nickel plate, and latterly from resins with oxy-silver, copper, and bronze finishes. In its time in operation it produced coffin furniture for the funerals of such luminaries as Joseph Chamberlain, Winston Churchill, and Princess Diana.

Workers outside the Newman Brothers Works in 1912 (Courtesy Birmingham Conservation Trust).

The Newman family's stewardship of the factory continued until 1952 when Horace Newman, then the main director shareholder, died. The company was subsequently managed by a small group of shareholders until 1989 when it was taken over by its last owner, Joyce Green, who had gradually worked her way up from her original role as the company's Office Secretary in 1949. When the company ceased trading, Joyce tirelessly campaigned to save the building and turn it into a museum. After a few false dawns her dream became a reality thanks to the work

of the Birmingham Conservation Trust, who were successful with a funding bid from the HLF. The contents were recorded and carefully removed by archaeologists from the Ironbridge Gorge Museum Trust for safekeeping before the buildings were carefully conserved and renovated. The contents were then returned to the site and sensitively rationalised and positioned to create a highly evocative visitor experience. The Newman Brothers Coffin Works reopened in its current iteration as a museum and heritage 'attraction' in October 2014 to critical and popular acclaim.

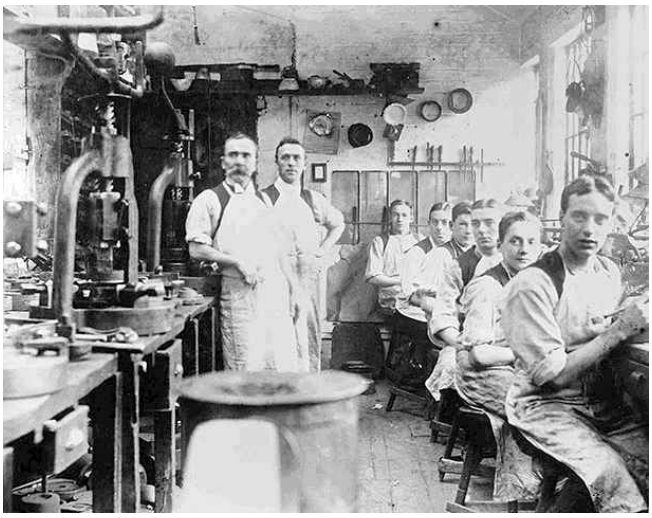
Cover of an undated Newman Brothers Pattern Book (Courtesy Birmingham Conservation Trust).

The Grade II* listed works was originally arranged around a sub-rectangular courtyard. However, only the front range, comprising the warehouse, workshops and office, and a three-storey workshop survive. Of particular interest are the battery of four drop stamps, 'the big stamp' for the production of breastplates, and a goods hoist. Further adding to the special ambiance is the Shroud Room with its line of Singer sewing machines illuminated by the large windows of the building frontage.

Ladies working in the shroud room at Newman Brothers (Courtesy of Birmingham Conservation Trust).

Evans Silverworks, Albion Street

The J. W. Evans Silverworks is one of the most complete surviving historic factories in the Birmingham Jewellery Quarter. Founded in 1881 by Jenkin Williams Evans, it remarkably remained within the Evans family for four generations until it closed in 2008. The works originally produced dies and tools for the silverware industry before diversifying into the production of silver goods. J. W. Evans gradually took over four three-storey former terraced houses, now all Grade II* listed, and is probably one of the best preserved manufactories operating from former domestic premises in the area.



Workers at the J. W. Evans Silverworks in 1905 (Courtesy English Heritage).

When J. W. Evans closed in 2008 English Heritage stepped in to rescue the site. Following completion of a repairs programme, which was underpinned with archaeological recording undertaken by archaeologists from the University of Birmingham, the site re-opened as a 'time capsule' museum in 2011.

The workshops retain a great deal of historic machinery and equipment which provide an insight into the processes which took place there. These include a battery of hand operated dead-weight stamps, several

An undated photograph of ladies working at J. W. Evans Silverworks (Courtesy English Heritage).

batteries of power-assisted stamps, fly presses, and thousands of dies. The site also contains a great deal of unsold stock, the company archive, and pattern books.

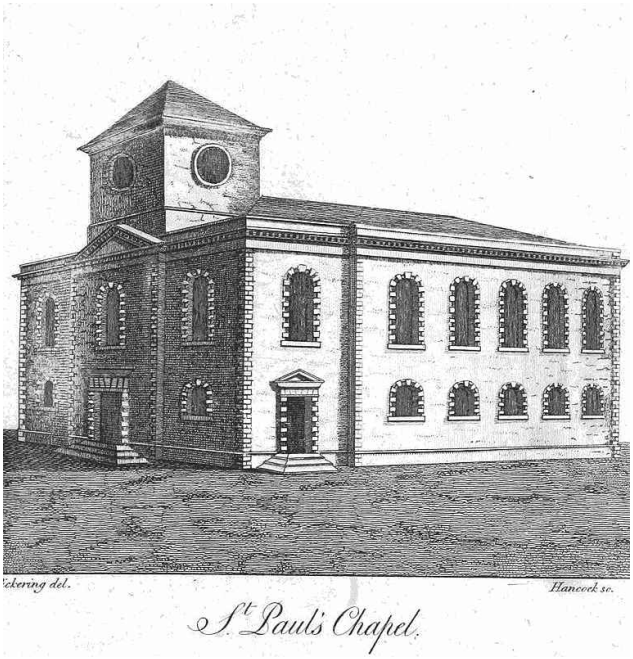
The surviving contents and the buildings themselves serve to demonstrate the traditional silversmithing trade that took place in the Jewellery Quarter. Within each of the rooms machinery, tools and products in various states of completion can be found, representing the different stages of silverware production and the workmanship that went into them.

Walking tour of the Birmingham Jewellery Quarter

The walking tour of the Birmingham Jewellery Quarter will take in many of the area's interesting and important industry-related sites and will also introduce the delegates to the area's rich architectural heritage, fascinating social history, and the famous names who lived, worked or died there.

Highlights include the former Smith & Pepper factory (now the Museum of the Jewellery Quarter), an excellent example of a small purpose built jewellery manufactory of the early 20th century, which during the 1920s was known for producing snake-style bracelets and jewellery with Egyptian motifs that grew in popularity after Tutankhamen's tomb was discovered in 1922. Delegates will also visit Warstone Lane Cemetery, whose interred include the renowned japanner, printer & typographer John Baskerville, and William Chance, glass manufacturer and innovator based in Smethwick; the former Albert Works, W.E. Wiley's pen factory which also comprised a Turkish bath; and the Birmingham & Fazeley Canal, cut between 1784 and 1789, and comprising a flight of 13 locks within the Jewellery Quarter, are other key points on the route.

Other points of interest *en route* include the Grade I listed St. Paul's Church, the 'jeweller's church'. Built in 1779, and located in Birmingham's last surviving Georgian Square, popular legend has it that the congregation of this elegant stone church at one time included Matthew Boulton and James Watt, who occupied pews 23 and 100 respectively.



1809 engraving of St Paul's Church before the spire was added. William Hutton.

Engraving of Warstone Lane Cemetery. AB Johnson

Further Reading:

Bowden, C., 2015. 'Newman Brothers, coffin furniture works, Birmingham' in *Industrial Archaeology News* 172, 8.

Cattell, J. et al, 2002 *The Birmingham Jewellery Quarter. An Architectural Survey of Manufactories.* English Heritage.

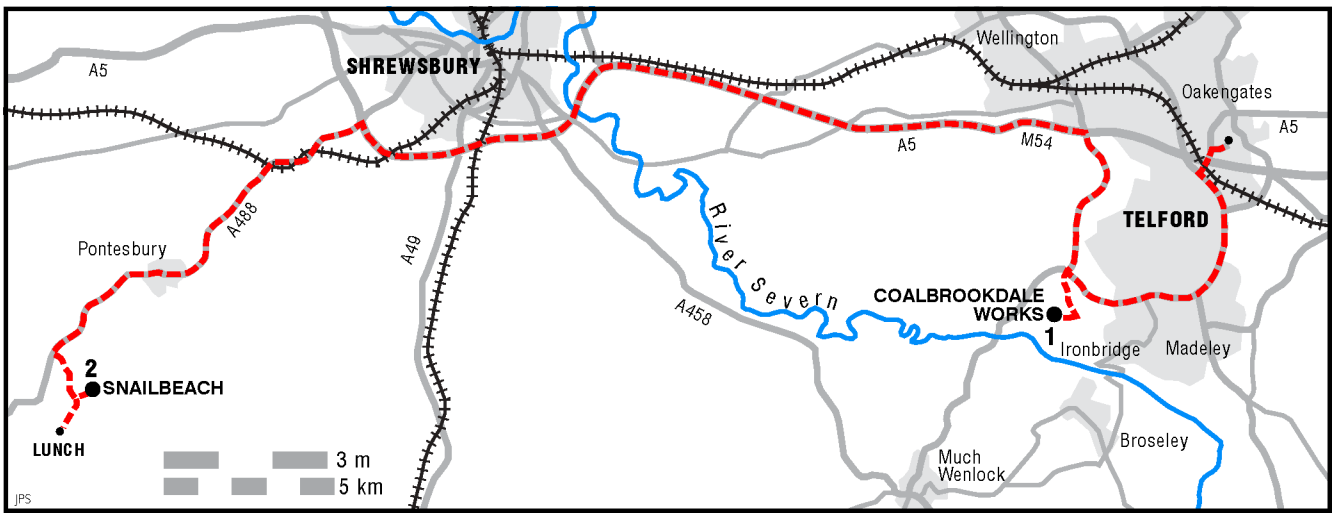
http://www.coffinworks.org/

http://www.english-heritage.org.uk/visit/places/j-w-evans-silver-factory/

Tour J

Tuesday 13th September

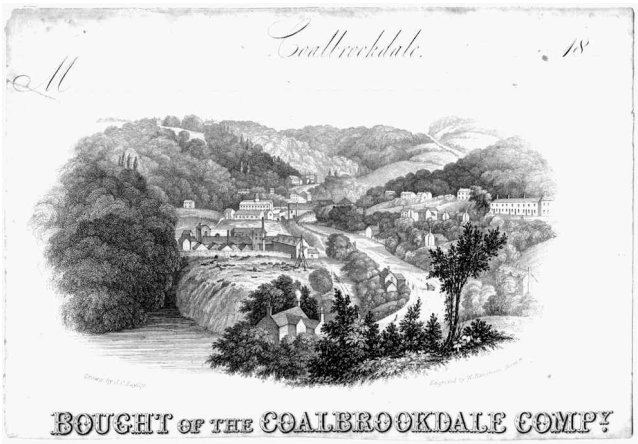
Aga Foundry, Coalbrookdale Company; Snailbeach lead mining site



The AGA tour is in a working foundry so health & safety is of vital importance. Delegates will be provided with hi-vis jackets and ear protection. Everyone must wear trousers so their legs are protected. The company have a limited supply of steel-toed boots but not enough for all of us, so please bring your own if you can. To keep the foundry tour group to a safe size only half of the delegates will go round the works at a time. The rest will visit the historic water courses adjacent to the works and then the groups will swap over.

AGA Rangemaster Works, Coalbrookdale, (SJ 667045)

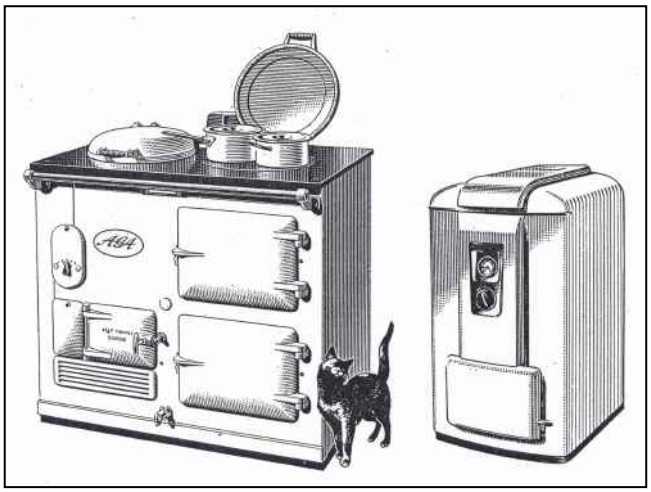
The Coalbrookdale Works were established in 1708 by Abraham Darby I (1678-1717) when he leased an existing charcoal furnace and adapted it to use coke. The business was successful enough for him to build a second one – known as the New Furnace – around 1715, the site of which lies somewhere within the AGA Works. Thus our visit takes us to a working foundry where ironmaking has continued unbroken for 307 years. The foundry tour is limited to 20 at a time, during which the rest of the group will have a chance to see some of the remains of the 17th and 18th century works, notably the Upper Forge (SJ 669041) which was in use by the 1530s. It had a steelmaking furnace in 1620 and an iron forge by 1668, which in turn was replaced by another one around 1753. A couple of hundred yards to the south is a cylinder boring mill behind the 1638 Rose Cottage, while opposite is the dam and water management sluices for the many furnace pools of the Calde Brook (from which we get the name Coalbrookdale).



The Works in 1844, engraved by John Cox Bayliss (1812-66), with the Upper Forge Pool in the foreground. Ironbridge Gorge Museum.

By the 1930s the main products of the Coalbrookdale Works were cast iron and stoves and pumps. The Coalbrookdale Company Ltd had become part of the Allied Ironfounders Group in 1929, a subsidiary of which was AGA. The Swedish physicist Gustaf Dalen (1869-1937), managing director of AGA (an acetylene gas company in Stockholm), had been experimenting with cookers in 1912 when an accident robbed him of his sight. A Nobel prize-winner that year, Dalen went on to develop the perfect solid-fuel cooker in 1922 which was clean and efficient, and as controllable as a gas cooker. It depended on sound principles of physics, Swedish iron and excellent thermal insulation using kieselguhr (a heat resistant padding known in the manufacture of explosives since 1867). It was thermostatically controlled and also provided circulated hot water to the house. Production of AGA cookers began under licence in 1932 with the castings made in Coalbrookdale, while the enamelling and assembly work was done at their works in nearby Ketley. By 1951 the company had sold 101,500 of them. They also produced the Rayburn from 1946, which proved to be even more popular, selling over 270,000 over the next twelve years.

A 1932 advertisement for the new AGA range.



The 1950 AGA alongside the 'Agamatic' boiler, introduced in 1950.

In 1991 Coalbrookdale installed a second-hand DISAmatic casting line, a large integrated machine that took up a considerable part of the foundry floor and thus brought an end to individual floor-moulded castings of anything other than a very small size. In August 2000 they added a new DISAmatic 230 line to double their capacity. It covers all the processes from sand preparation to finished castings in a computer-controlled assembly. One or both of these machines will be in production on our foundry tour. Several film clips of the DISA process are on YouTube where there are even more on the AGA cooker, including one of them being made in the Coalbrookdale foundry.

Allied Ironfounders were absorbed into the Glynwed Foundries Group in 1969 and in 1997 they in turn became part of the St Gobain Group. In July 2015 AGA Rangemaster Ltd was acquired by Illinois-based Middleby Group.

Further Reading:

http://www.agaliving.com/buying-an-aga/about-us/history

James T., *Aga: The Story of a Kitchen Classic*.

Snailbeach Underground tour: The mine is level with shallow standing water on the way in which is why wellingtons are required. There are a couple of places where the roof is low. If you have a hard hat and headlamp please bring these.
The walking tour is over rough ground so suitable footwear is required. There is an optional walk into a tramming level which is dry and has good headroom. If possible bring a torch.

Snailbeach Mine (SJ 374921)

Introduction

The area to the South-west of Shrewsbury, a triangle effectively bounded by the A49 to the east, the A489 to the South and the B4386 to the West has been extensively mined for coal, limestone and metalliferous ores for hundreds of years.

Coal Mines

The coal mines of the Shrewsbury coalfield were generally small shallow pits, particularly around Asterley. They worked thin coal seams in the Upper Coal Measures (typically 18" thick) producing relatively poor quality coal for local use and later as fuel for the steam engines and smelters associated with the adjoining metal mining area. A five foot thick bed of limestone associated with the coal measures was also worked for agricultural use.

Although small mines, the first 'Fire engine' in South Shropshire (probably an atmospheric steam engine) is recorded as being installed at a coal mine near Asterley in 1775. At Pontesford Colliery in 1793 Probert, Lloyd, Jones & Co., installed a 33" Boulton & Watt beam pumping engine in what is thought to have been a timber engine house. (Working barrels of the pump 11" diameter at the 65 yard level, then 6" diameter to the 75 yard level).

However, once transport routes were improved, most of these mines closed, particularly with the opening of the GW-LNW branch line in 1861, allowing better quality coal to be brought in.

The deeper mines to the North and East of Pontesbury made use of the railway and the last of these 'Hanwood & Moat Hall' finally closed in the 1940s.

Metal Mines

The metal mining area, effectively centred around Pennerley, is fairly small and compact compared with other ore fields in Britain. However it has had a very long working history. The Romans are known to have worked sites in the Hope Valley with large surface stopes around Roman Gravels attributed to them. Several pigs of lead bearing the stamp of Emperor Hadrian have also been discovered in the area. No early smelting sites such as boles have yet been discovered on the Stiperstones, but there is an area at the Roman city of Wroxeter (reputed to be the fourth largest Roman city in Britain) which has been identified as a metal working area.

The metal mines were initially quite progressive – there were nine single acting Boulton & Watt engines at work in the area pre-1800. The peak of metal mining in the ore field was effectively the 1850s to1884, although underground prospecting didn't finally ceased until the 1960s.

The mineralization occurs mainly in the Mytton Flagstone and gritstones along the Stiperstones ridge and to the west of Shelve. These are sedimentary rocks laid down about 450 million years ago in the early Ordovician period.

Over time these deposits were folded, faulted and eroded with mineral rich waters percolating through fissures (possibly during the Devonian period, about 380 million years ago) cooling and depositing various minerals. Baryte, witherite and calcite in the upper parts of the veins, galena, calcite and quartz below them and deeper still sphalerite, calcite and quartz. Copper should, in theory, be deposited even deeper still, but this has not been proven – although copper has been worked around the edges of the ore field.

The main minerals worked in the area have been the ores of lead, zinc, witherite, barytes, calcite and a little copper and fluorspar.

Snailbeach Mine

Snailbeach was the most important mineral producer in the area. In the mid 19th century it was described as being "the richest lead mine per acre of ground in Europe", between 1845 and 1913 it produced 131,900 tons of lead ore, plus other minerals – over half the ore produced in the area. It was considered one of Britain's most famous lead mines along with Van, Millclose, and Allenheads.

The near vertical single Snailbeach vein runs East-West for approximately 1,000 yards (1 km). The vein outcropped at around 800 ft. (247m) above sea level. The deepest part of the mine workings was 552 yards (505m) below George's (Old) shaft collar [aod: 810ft. (~250m)]. Although pumps were installed the mine was considered a dry mine. According to the last engine driver, Alfred Hewett, the engine only had to work for 5 hours in the summer to keep the mine dry for 24 hours and only 7 hours pumping was required in the winter.

It is not known if the Romans worked any outcrops at Snailbeach, although a Roman lead pig was found at Snailbeach Farm along with tools and pottery in 1796. The first documentary evidence of mining on the site is in the sixteenth century, but it was not until the late eighteenth century when the Snailbeach Mining Company was formed that major exploitation started.

Overall view of Snailbeach Mine, c1900. From left to right can be seen, on the hill, the boiler, winding, pumping and winch houses, the Count House below and beneath that the coal hopper, timber yard and two-storey office. Behind the steam plume is the compressor house with chimney (1881) alongside, just visible. The crusher and chimney are to the right of the steam plume with the dressing floor and sheds in front. Behind, above the sheds can be seen the Old Shaft headframe with engine house (1872) and smoking chimney behind it. To the left is the miners' dry (with roof vents), low workshop and alongside the day level from which a tramway exits and sweeps round into the crusher house. To the right of the headframe are the blacksmiths' shops, in front of which is the small two-storey office overlooking the dressing floor, In front and below the blacksmiths are the double-loco sheds, a train of wagons the Snailbeach District Railway and below all this the ore-house. Ivor Brown

The range of mineral found in the veins at Snailbeach mine are:

Common

Baryte	– barium sulphate ($BaSO_4$)
Calcite	– calcium carbonate ($CaCO_3$)
Galena	– lead sulphide (PbS_2)
Iron Pyrites	– iron sulphide (FeS)
Quartz	– silicon dioxide (SiO_2)
Sphalerite	– zinc sulphide (ZnS)
Witherite	– barium carbonate ($BaCO_3$)

Rare

Cerussite	– lead carbonate ($PbCO_3$)
Chalcopyrite	– copper/iron sulphide ($CuFeS_2$)
Pyromorphite	– chloro-phosphate of lead ($3Pb_3P_2O_8.PbCl_2$)

Recorded but not seen

Fluorspar	– calcium fluoride (CaF_2)

The main ores worked were galena and sphalerite and the gangue minerals baryte and calcite with some witherite. The Country rock at Snailbeach is Mytton Flags and gritstone.

Snailbeach Mine, a brief chronology

1761 Leased from the Marquis of Bath by Thomas Powys (a local man) for 5 years, extended for a further 6 years in 1766.

1782 Leased by Thomas Lovett of Chirk for 21 years – the mine's fame dates from this period.

1783 December: Lovett signs a 'Deed of Partnership' with 7 others to form the Snailbeach Mining Company. This company worked the mine until 1911.

1784 Lovett leases the Nags Head coal mine at Pontesford.

1797 The mine is now 180yds deep. A beam engine is erected to pump up to 112yd. level. An adit 1,200 yards long from Wagbeach on the Hope Brook driven to intersect the 112 yard level to allow a 31ft. (9m) waterwheel at the adit portal to aid pumping via flat rods laid along the level.

1820s Black Tom shaft sunk 40 yards on a parallel vein discovered 160 yards North of the main Snailbeach vein.

1850s Peak output of 3,500 tonnes ore mined annually, smelted at the Snailbeach mill in Pontesford.

1857,1858 Stephen Eddy from Skipton, Yorkshire appointed as agent at £100 per annum + 5% of profits up to £4,000 and 7½% above that.
James Ray Eddy (son) soon takes over, completely refits the mine generating a 10-fold increase in profits.
He re-modelled the dressing floors, replaced the flat-rod drainage system with a 61" diameter cylinder, Cornish beam pump on Lordshill (completed 1858).

1859 Chapel Shaft sunk by neighbouring landowner (Earl of Tankerville) to try and exploit the Snailbeach vein - without success, due to a geological fault. Chapel shaft collar 62m above George's shaft.

1862 New Smelt Mill built about a mile from the mine. Horizontal winder (former ship's capstan) installed at Chapel Shaft.

1863 Old Smelt Mill at Pontesford abandoned, new reverberatory mill completed.

1870 James Ray Eddy resigns as agent, Henry Dennis (Ruabon) takes over - spends over £10,000 refurbishing mine and buildings - 8 new jigs, 4 buddles in a large shed (1872) and reservoir, fed by leat.
Most of the buildings seen today date from the 1870s.

1872 Horizontal winder installed at George's (Old) shaft, shaft deepened to 252 yards and widened for man riding.

1873 Crushing engine rebuilt and connected to jiggers in 1876.

1877 Snailbeach District Railway constructed, unusual gauge of 2ft. 4" (71cm), from Minsterley along a route surveyed by Dennis in 1873. Snailbeach mine connected to the railway via a branch from Crows Nest. A locomotive shed built on the mine site and railway extended around the site to allow coal wagons to be winched up an incline to Lordshill engine house.

1881 Another period of major development with the introduction of compressed air. Up to this point miners used picks and hammers, hand drill rods and gunpowder. Ore was raised in underground winzes by hand winch.
A compressor house and chimney built beside the portal of 'Landing level' to provided power for pneumatic drills and winches.
Ore hauled from Lordshill 'Engine' shaft in kibbles, (wrought iron barrels) and tipped into wagons to be sent along 'Landing level' to the crusher house. Engine shaft was over 462 yards deep, but hauled material from the main tramming level at 342 yards.
Underground a large shaft sunk from 342 yard level to 552 yard level.
Small steam engine installed in the wooden building at Black Tom

1884 Lead prices plummet and company makes its first financial loss. Company liquidated and reformed in a smaller way.

1895 All underground exploration stopped. Miners worked ground already laid open by Henry Dennis.
Smelt Mill closed and partly demolished.

1900 Halvans Company formed to re-work the waste heaps and Black Tom shaft (sunk 1820).

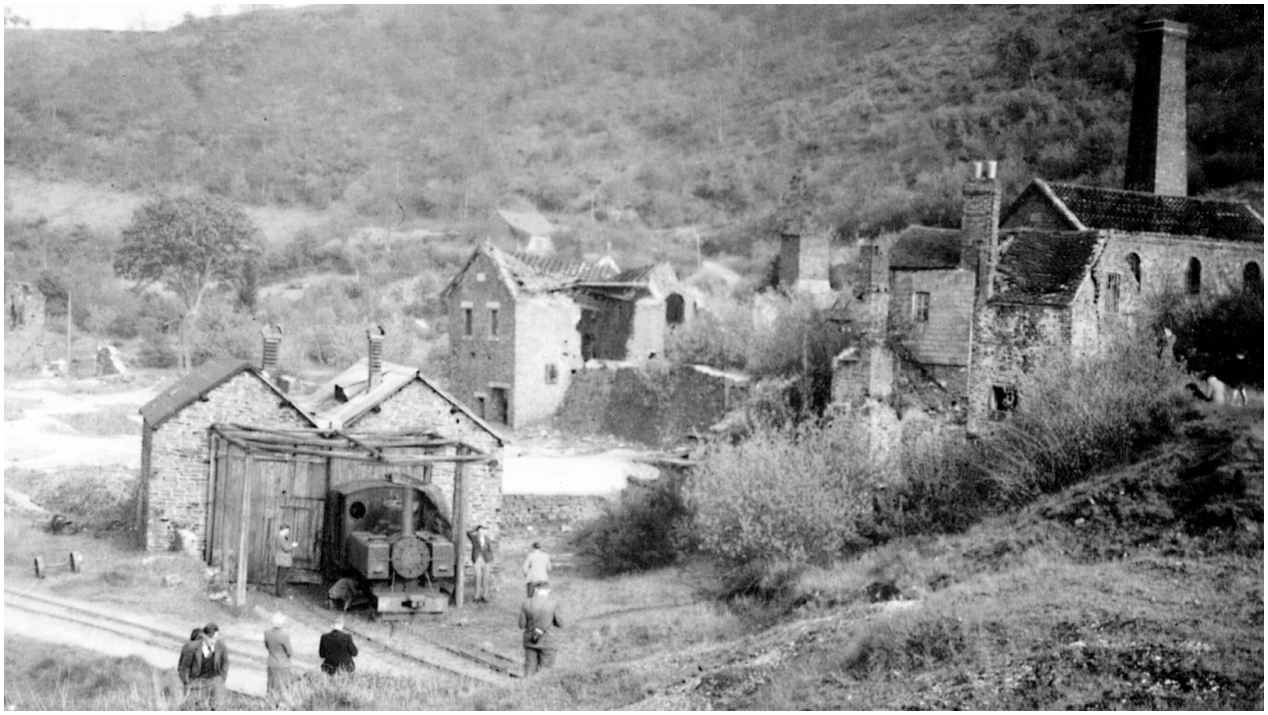
1911 Lordshill pump stopped, workings allowed to slowly flood to 112 yard 1evel – where it drained via the Wagbeach adit.

Upper parts of the mine worked for baryte to be used for oil rig drilling mud and barium meals until 1955 (accessed via Perkin's/Robert's level).

1960s -70s Waste tips worked for pebble-dash.

Snailbeach and District Railway

Opened in 1877 this 2ft. 4in. narrow gauge line linked the Snailbeach Mine with the main line at Pontesbury. An extension to Pennerley was never built. The chairman of the railway was Sir Henry Dike Dennis who owned brick works at Ruabon and was associated with the Glyn Valley Railway.



Snailbeach District Railway engine shed in 1949 with ex WD Baldwin tank engine outside. In the background are the roofless crusher house and to the right the compressor house. Bernard Roberts

Although initially profitable transporting 14,000 tons of minerals per year, the closure of the Tankerville Consoles group of mines in 1884 reduced the traffic by nearly two thirds. The later closure of Snailbeach mine was to some extent offset by the opening of a granite quarry at Habberley, two miles from Pontesbury.

In 1923 it became part of the Colonel Stephens group of light railways. By this time the main customer was Shropshire County Council who used it to transport stone from their quarry at Callow Hill. The railway was eventually leased to the council and in the latter years they used a Fordson tractor to haul the wagons, the line finally closing in 1959 when an access road was constructed to the quarry.

Fordson tractor hauling wagons between Callow Hill quarry and Pontesbury.

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Cookson, A., *Snailbeach Mine in the 1760s*, (British Mining No.71, Memoirs 2002, Northern Mines Research Society).

http://shropshirehistory.com/mining/mines/pdf/Snailbeach%20Railways.pdf

http://shropshirehistory.com/mining/mines/pdf/Snailbeach%20Lead%20Mine%202008.pdf

Tour K

Wednesday 14th September

Thomas Telford roads and canals in North Wales

The development of roads in North Wales differs from the rest of the UK in that their main purpose was to enable travellers and goods to pass rapidly through the area. The aim was to reach Holyhead and the ferry to Ireland. There are and always have been two alternatives, either to go from Chester along the North Wales coast or across country from Shrewsbury and Oswestry. Prior to the development of the Holyhead Road by Telford both of these routes were undeveloped and both had to cross the Conway River. Before Telford the only bridge was at Llanwrwst, which is about half way between Conway and Telford's bridge at Betws-y-Coed. Telford's improvement of the cross country route was to remain the major route for two hundred years until the improvement of the Coast Road in the 1980s.

Telford's other great work in the area was his construction of the Ellesmere & Chester canal (now the Shropshire Union Canal) over the Rivers Ceiriog, at Chirk and the Dee at Froncysyllte, through the high ground at Chirk and including the feeder canal from the weir on the Dee at Berwyn. A number of tramways were constructed as feeders to the canal and to the later railway.

After leaving the University campus we join the M54 and then follow the new course of the A5 trunk road. En route we cross the River Severn twice. On the second occasion the old stone bridge at Montford Bridge can be seen on our right.

We join the Telford road just south of the canal crossing at Grid Reference SJ 299344. The road and canal contour round Chirk Bank, the road descending to the bridge across the Ceiriog and the border to Wales. The old route went over Chirk Bank descending steeply to the bridge adjacent to the Bridge Inn. Eyton-Jones in *Telford in the Dee Valley* says

> 'Today's motorist, entering Clwyd from the Shrewsbury direction, has already traversed a section of Telford improvement, the new road from Gobowen, running parallel in part with the Ellesmere Canal, to the Bridge Inn. Immediately before the inn, the old route trails down from Chirk Bank, a steep incline showing the type of improvement needed to ease the journeys of coaching traffic.'

Time permitting we will stop short of the Ceiriog River and walk downhill past the Bridge Inn through a kissing gate and into a field from which we have a good view of the Chirk aqueduct and the railway viaduct.

Returning to the coach we cross the river and ascend the Telford aligned road through Chirk, after which we leave the Telford Road for the Pontcysyllte World Heritage Site, passing through an area so full of industrial heritage that it could occupy a full day's exploration on its own.

We shall have a full hour here which should allow time for a walk across the aqueduct on the cantilevered tow path, a visit to the information centre and for those more energetic a walk downhill from the coach park to the road bridge from which a good view can be had of the aqueduct.

Chirk Bridges in 1848 with the Railway Bridge in the foreground and Aqueduct in the background. George Pickering

The original intention had been for the canal to be extended to the North East to Chester, which would have provided a source of water. The solution was to channel water from the River Dee via a canal on the North bank of the river from a weir at Berwyn. We shall follow the course of the Llangollen canal to its source. Both lime and slate were quarried in the hills to the North of the road and transported by tramway to the canal for onward distribution.

After a short stop at the Horseshoe Falls we will return to Llangollen crossing the Dee. The pre-Telford road wended its way through the narrow twisty streets of the town. At the top of Bridge Street we will turn right on to what was in effect the Llangollen by-pass.

The principle features to be observed as we proceed along the historic route are the toll houses which had distinctive sunburst gates all now removed, the mile posts now few and far between, the dry stone walls, some of which are considered to be original and the semi-circular walled depots for stocks of road stone to facilitate repairs to the road surface.

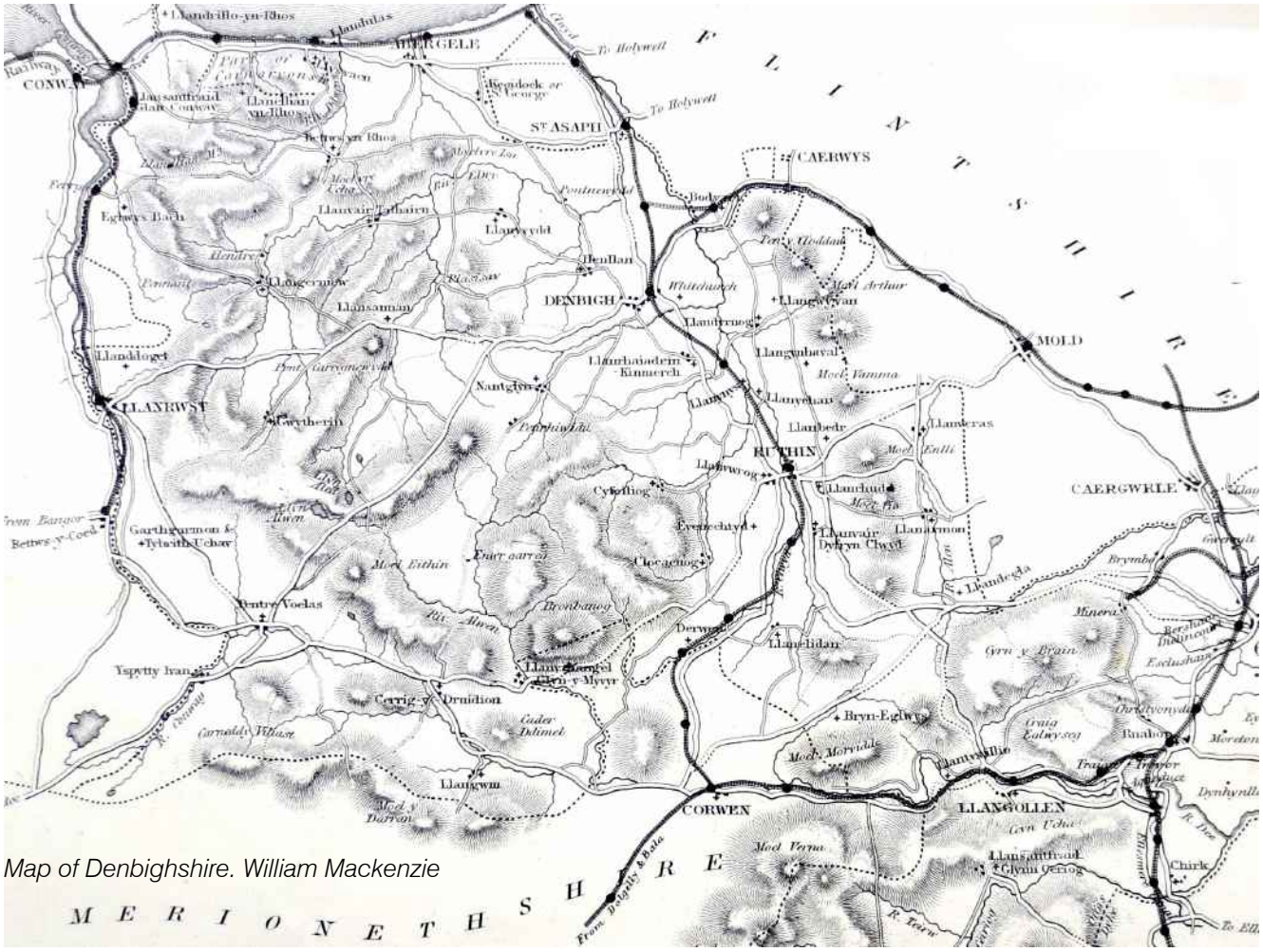
We shall pass toll houses at Ty Isaf SJ 167422, Druid SJ 022439, and Hendre Isaf SH 850513. There are two milestones between Llangollen and Froncysyllte, one South of Cerrigydurudion, one on the Cerrigydurudion by-pass, and two to the west of Cerrigydurudion. The major civil engineering works comprising embankments and bridges will not be visible from the coach.

Over the years the road has been widened and or straightened in various places. In addition in recent years the road has been completely realigned in two places. The first is at the bridge over the River Alwen, by the Rug Estate just west of Corwen SJ 053437. Here the old road and bridge can be seen between the new road and the estate retail complex. The second is between Dinmael and Ty Nant SH 993445, where the road has been straightened through a major new cutting.

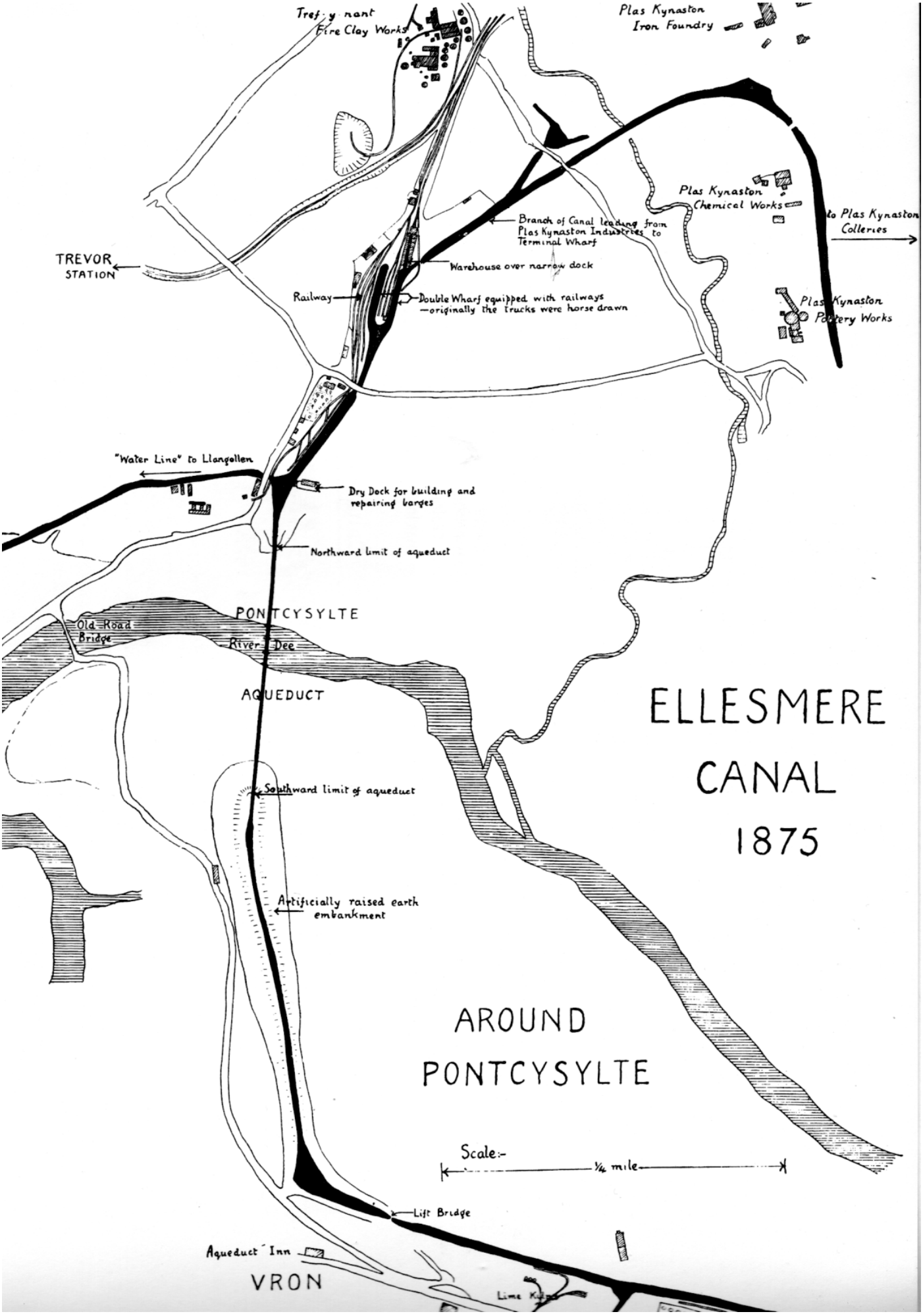
The improvement of the road led to the development of inns with the associated stabling. One of the most remote of such inns was the Prince Llewellyn Inn at Cernioge SH 906505. While the inn remains in part as the farm house to the south of the road the stable block is very visible to the north. In *Thomas Telford's Holyhead Road*, Jamie Quartermaine and others say:

> 'On the north side of the road is a purpose-built stable block set within a stone-walled yard. It is of rubble stone with a low, hipped roof. Of two storeys and four bays, it has an external

Milestone at Cerrigydrudion.



Map of Denbighshire. William Mackenzie

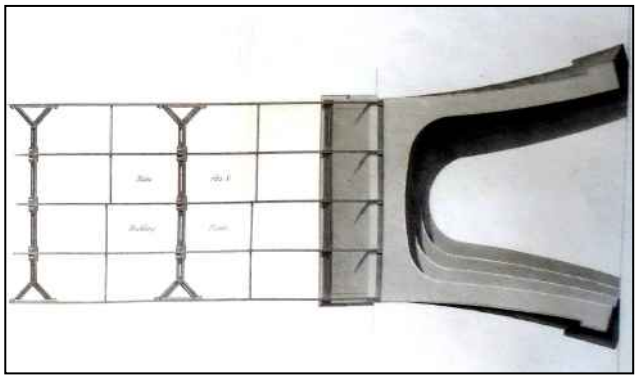


Edward Wison

staircase to the south and a later extension to the north. The roof runs down to the rear to cover what appears to be a coach house with a large opening with a flat lintel. The main east elevation has four openings at ground floor, three of which retain their arched heads and wooden Gothic tracery. These gave access to two stables from which the pitched stone floors, drains, and the hay mangers survive. The sockets for six stalls for horses can be made out. At the height of the coaching era there was stabling for 69 horses.'

From Pentrefoelas we follow the Conway River as it wends its way down towards Betws-y-Coed, crossing the river twice the most dramatic being at Padog SH 839515 where the river Eidda joins the Conway.

The only Iron bridge on the mainland section of the road is at Betws-y-Coed, where the road again crosses the Conway as it turns north and the road continues north-west. This is the famous Waterloo Bridge SH 798546, cast by William Hazledine and inscribed 'This Bridge was constructed in the same year the battle of Waterloo was fought'. The use of the word 'constructed' is ambiguous and can mean either made or erected. Since the bridge was not in fact delivered to site until 25 July 1816, we must take it to mean that that was when the casting of components commenced.



Section of the grade 1 listed Waterloo Bridge. It has a span of 105ft. and was cast at Hazledine's Plas Kynaston foundry near Pontcysyllte. Thomas Telford

On the return journey we will leave the main road for Rhydlydan and Plas Iolyn SH 882504, where we will see one of the sunburst toll gates now used as a farm gate.

After viewing the gate we will return to the main road and a few miles past Corwen take the turning for Glyndyfrdwy Station SJ 151428. While the station buildings together with the signal box and level crossing gates are of interest we will also see the remains of the slate tramway. The tramway terminated on an embankment parallel to the railway siding to facilitate easy transfer of slates. Alun John Richards, referring to the Deeside quarries says:

'Output from these quarries was carried to the main line by a most unusual means, 2' 6" gauge, wooden railed Deeside Tramway. This line originally connected Deeside quarry with the main road at Glyndyfrdwy by way of the Nant y Pandy mill so sited to obtain water power for sawing slate blocks.

The line was extended south in iron rail up to Moelfferna in the late 1870s, and at about the same time, north to Glyndyfrdwy station, doubling its length to almost 3 miles. Whilst the date of original opening is disputed, it is certainly not earlier than 1850s by which time the use of wooden rails sheathed in iron is bizarre. The unusual gauge may have been due to coal mining influences.'

Deeside and Moelferna quarries transshipment wharf at Glyndyfrdwy in 1946. In 1947 the tramway was replaced by road transport, the quarries finally closing in 1960. J. I. C. Boyd

After leaving Glyndyfrdwy we will make a short stop at Ty Isaf toll house and weigh house SJ 167422. The weigh house is one of only two remaining the other being at Lon Isa, south of Bangor. The weigh house at Ty Isaf was allowed to become derelict in the 1970s but was subsequently restored to its current state.

We shall return following the Telford road between Llangollen and Chirk. Two milesstones can be seen on the south side of the road on this stretch.

Further Reading:

Telford in the Dee Valley, *Clwyd County Council,* 1989

Quartermaine, Jamie, Trinder, Barrie and Turner, Rick 2003. *Thomas Telford's Holyhead Road,*

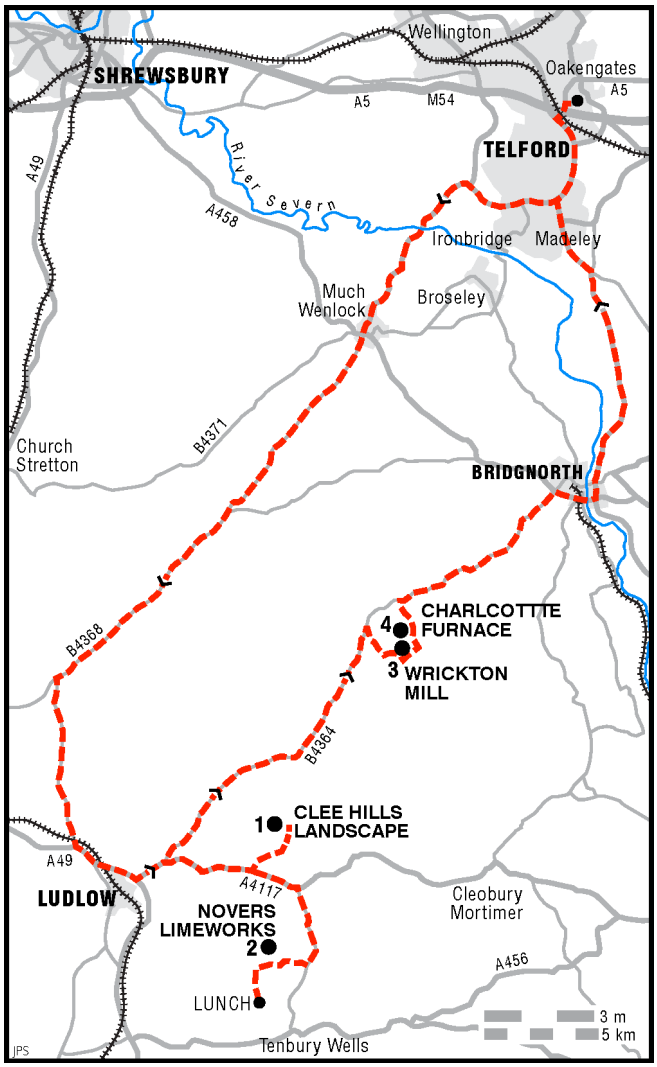
Richards, Alun John, 2001. *The Slate Railways of Wales,*

Tour L

Wednesday 14th September

Clee Hills industrial landscape; Wrickton Mill; Charlcotte Furnace

The Clee hills are over 1,700 feet high and are very exposed. If inclement weather is forecast please make sure you bring suitable clothing. There is some rough ground so suitable footwear is also required. The Novers trip is through woodland which can be wet underfoot and there may be a short trip into the limestone level.



1. Clee Hill Industrial Landscape

Since the Middle Ages the importance of the Clee Hills has been closely tied to their geology and has focused on the extensive mineral resources existing here coal, ironstone, limestone and dhustone (dolerite).

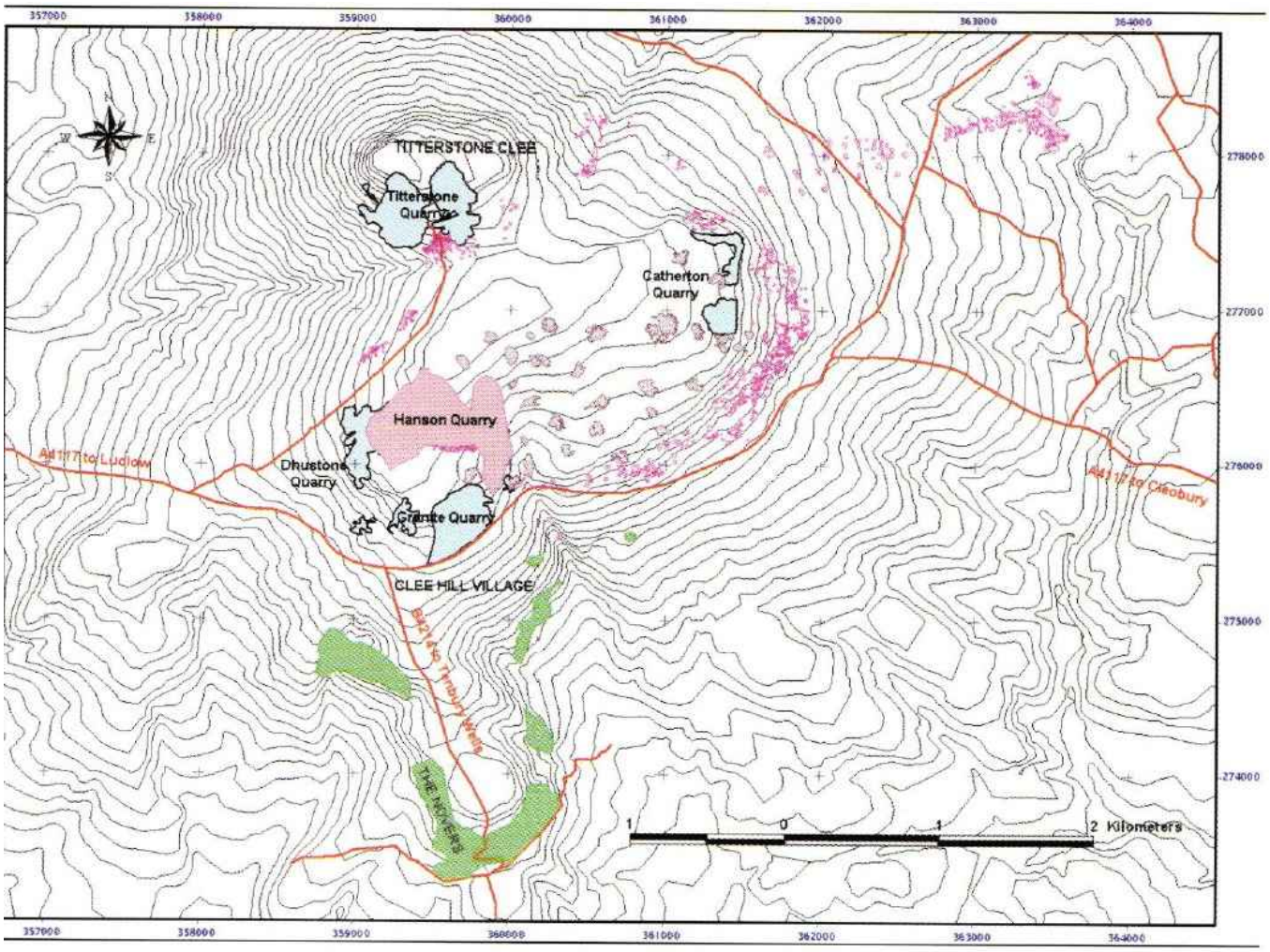
In the medieval period coal and ironstone were being mined, with the iron processed by workers in Ludlow. The first deposits to be exploited were near the surface and exist around the flanks of Clee Hill extending eastwards to Catherton Common. The ground here is pockmarked by the numerous shallow shafts, known as 'bell pits', and trenches, associated with low mounds of spoil. These simple underground workings were invariably cramped and poorly ventilated. The demand for coal and ironstone continued to grow resulting in large tracts of land cut by bell pits and covered with spoil, but by the 18th century the shallow reserves became depleted and shallow mining became unprofitable.

The extraction of limestone had certainly begun by the 16th century. The most accessible outcrops were quarried first, on the north eastern and south western slopes of Clee Hill. By the late 18th century the focus had shifted to the southern slopes of the hill. In most cases the stone was quarried, but occasionally it was mined. The limestone was burnt using coal, in kilns situated close to quarries. Lime was used as fertilizer and for making mortar. Technological developments in iron working meant that limestone was commonly used as flux to draw off impurities from the iron during the smelting process. At Oreton, south of Clee Hill, 'Clee Hill Marble', a form of limestone, became valued as a high-quality building stone.

Other industries became established in the area during the 17th and 18th centuries - glass working, pottery manufacture, brick and tile making, and paper making. The success of these industries depended on investment to capitalise on developing markets, advances in technology and availability of suitable energy sources - water, charcoal and coal.

Coal output rose steadily on the Clee Hills during the 18th and 19th centuries fuelled by the demands of industry and the domestic market. In order to satisfy these needs new methods of mining were developed to get to the deeper seams. Drift mines, where tunnels were driven into the hillside to follow the coal and ironstone seams, were sometimes dug. More commonly, deep shafts were sunk with the aid of sophisticated winding gear. Increased output led to the formation of large spoil heaps close to the pit heads, which survive as large flat-topped mounds with radiating fingers of spoil. Many of these collieries were served by a network of tracks to transport the coal from the hill. A significant number of these tracks still remain. Another distinctive aspect of the area are the former houses of miners, often constructed of dhustone.

Economic factors concerning accessibility of the coal from under the dhustone and its transportation resulted in the decline of the industry in the late 19th century and



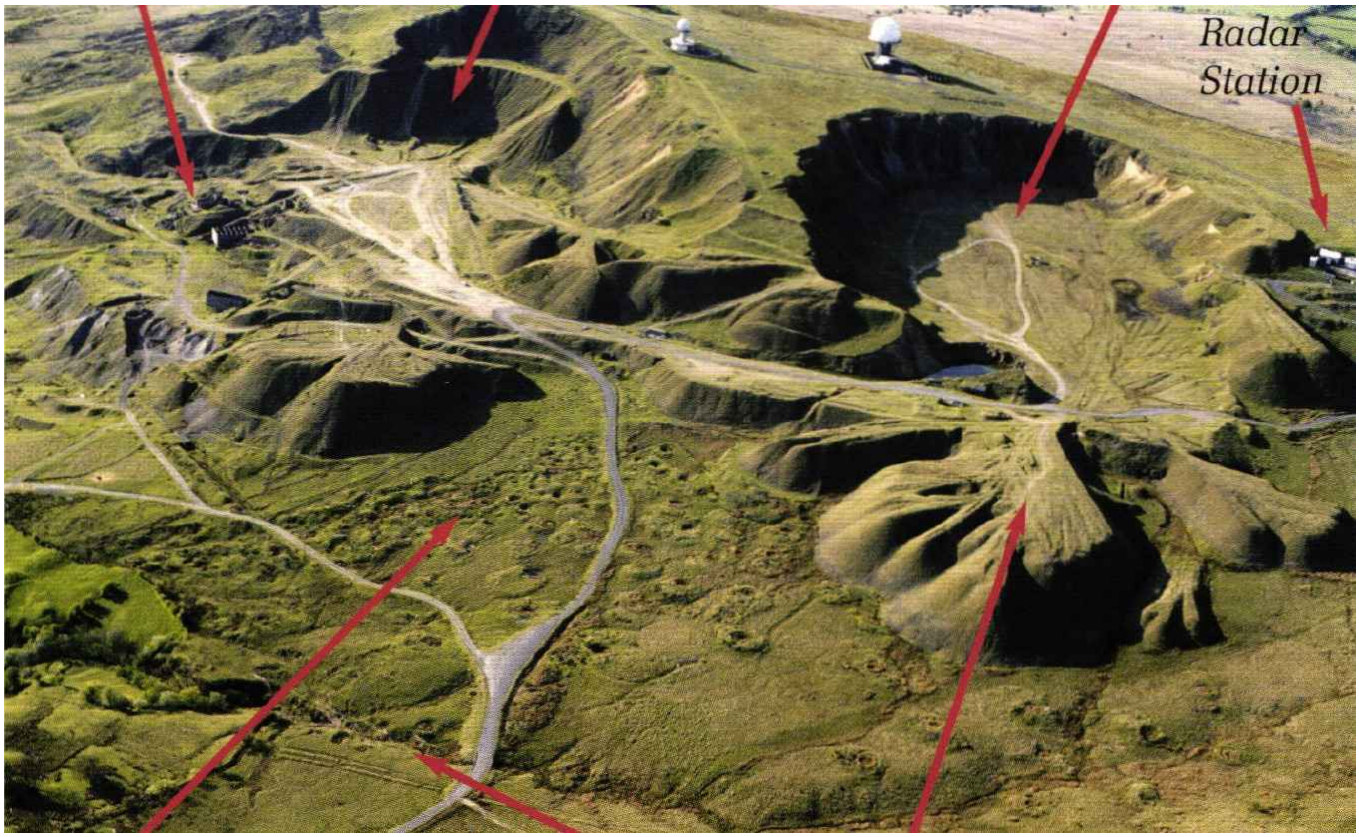
Titterstone Clee extractive industries past and present. The active Hanson Quarry is now part of Midland Quarry Products. The disused quarries are light blue, working quarry in pink, coal workings in magenta and limestone quarrying green. ©Birmingham University

its eventual demise in the 1920s. The longevity of the mining industry on the Clee Hills and the nature of the surviving remains, have led to the formation of a landscape where changes in organisation and technology can be fully appreciated. It is rightly regarded as one of the best-preserved historic mining landscapes in Britain.

During the late 19th century the Clee Hills saw dramatic changes stimulated by the construction of the Ludlow to Clee Hill Railway in 1863. While coal mining was declining, the quarrying of dhustone quickly established itself as the major industry on the hills. Dhustone is hard and durable, and is ideal for certain types of construction, as blocks or as aggregate, or as roadstone, whether as chippings, or as setts and kerbstones. There were three principal quarrying areas - to the north of Cleehill village, on Titterstone Clee Hill and on the north eastern edge of Clee Hill. From these quarries huge amounts of stone were extracted and massive spoil heaps were created. Long inclined planes were built to get the stone from the quarries near Clee Hill and on Titterstone Clee to the railway terminus at Bitterley Wharf. In the case of the quarry at the north eastern end of Clee Hill an aerial ropeway was built to Ditton Priors. The courses of much of this transport infrastructure survive well and in the quarry at Titterstone Clee substantial and impressive remains exist of the plant used for crushing and sorting the rock. A reservoir fed by Benson's Brook was created to drive turbines producing electricity for some of the plant. This hydro-electric scheme is one of the oldest in the country and the dam survives largely intact.

The quarrying industry in this area was sustained by a dramatic influx of workers and their families, coming from Leicestershire, Devon, North Wales and Ireland. In response to this, rows of terraced houses (a new architectural form in the Clee Hills landscape) such as those at Bedlam and Horseditch, were built to accommodate the new arrivals.

The amount of dhustone quarried declined significantly in the early 1960s. It was at this time that the vestiges of the associated rail system closed. The only quarry now operating in the area is the Hanson plc Clee Hill Quarry, which employs a small labour force - a mere fraction of the number working in the quarries a hundred years ago. The changes that have occurred to this industry over a relatively short period of time have left an enduring legacy - earthworks and structures which are regarded as some of the most important in the history of modern quarrying.



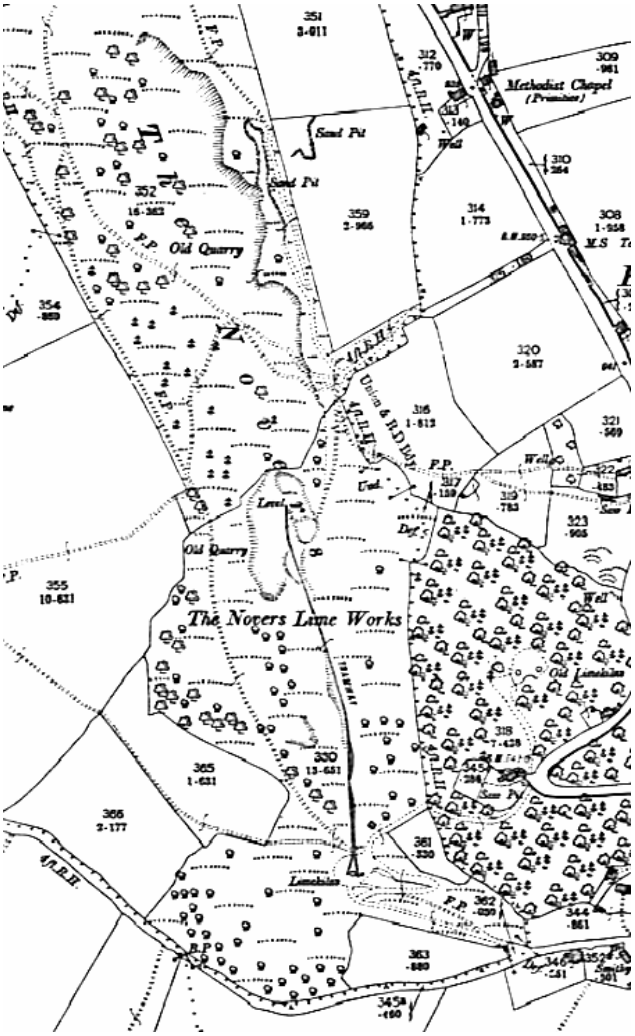
2. The Novers Limeworks (SO 563737)

The surviving earthworks and structures at the Novers Limeworks woodland clearly represent a very full record of the industry and is unique upon Titterstone Clee Hill, surviving elements comprising early opencast workings, surviving lime kilns, a tramway and incline, and a drift mine. The earliest workings comprise a series of scooped quarries running along the west face of the hill, four in all within the Novers, linked by a perimeter track-way with cuttings running into the quarried interior. There are no stone exposures visible, suggesting either subsequent slumping and erosion or that the whole of the available shallow limestone was removed.

These early quarries are now heavily vegetated with regenerated mixed woodland and provide a valuable wildlife habitat. The earthwork and spoil remains provide a record of the phasing of the workings and from the presence of limestone burning waste, may also contain evidence of early kiln sites.

Following this initial open workings phase there was a drift mine driven in from the bottom of the lowest quarry on a NNW orientation. This latter episode appears designed to continue the industry once the close to surface limestone resources had been exhausted.

The mine entrance lies at SO 5963 7375 and survives well, with a stone built entrance arch 1.8m wide. The entrance continues as a barrel vaulted tunnel running roughly NNE for some 20m before being blocked by a fall. It seems probable that the tunnel dips beneath



From OS 1:2500 map, 1903.

this quarry following the limestone into the hill. Further survey work is required to fully establish this relationship.

Jenkins writing in 1983 gives an account of a conversation with Jim Reynolds a member of the Reynolds family who had worked the mine from the mid 19th century to around 1911. Mr Reynolds recalls as a boy taking food to the mines and that the tunnel extended for perhaps a mile into the hill and that on the hill above the mine was a ventilation shaft with a ladder, down which the miners would descend to the quarry face (Jenkins 1983).

From the mine entrance a causeway with an average width of 1.8m, probably constructed using spoil from the drift mine, runs roughly SSE for some 135m over and through the earlier open workings to end at the top of a steep incline at SO 5966 7359. This gravity incline, 1.8m wide runs for some 74m south to end at SO 5966 7352 (now the entrance way to Kiln House).

At the southern end of the incline is a flattened area between the end of the incline and the two kilns which lie at SO 5966 7350 and SO 5967 7350. This would have been the work area above the charge cones. To the west, centred at SO 5961 7351 is an extensive area of spoil tipping which is probably waste material from the construction of the drift mine. It seems clear that considerable effort was made to construct this mine and from the amount of spoil that is present today, that it is likely to extend for some considerable distance into the hill. There is a second much smaller arched structure at SO 5965 7354 which may also be a drift mine entrance.

The two substantial lime kilns are constructed into the south slope of the hill. The western kiln has a central cone, in-filled and today recognisable only by a shallow dished hollow 8m in diameter and 0.5m deep This is flanked by two large barrel vaulted discharge vaults of stone construction in an excellent state of preservation, visible below the cone hollow.

The top of the more easterly kiln was excavated some time in the 1980s as a project by a local group of historians. This has exposed a substantial stone and brick cone some 8m in diameter and 10m deep. Below the cone is a stone built buttressed archway leading into two barrel vaulted chambers large enough to allow unloading of the processed lime into a cart of some type. The archway is however now blocked by a fall of earth and the remains of the root and trunk of a felled ash tree. The tree has fallen this year and is leaning against the inner face of the arch. There is a danger that this substantial weight pushing against the inner face of the kiln arch could push the arch wall out of alignment, or even cause a collapse. There is therefore an urgent need to remove the tree at the earliest opportunity and to consolidate any structural damage.

These two kilns are thought to be the last phase of the lime works, designed to be fired continuously over a three month period (information C Richards). They clearly represent the remains of a substantial local industry. Below and south of both kilns is a flat work area, which leads into the remains of a hollow way, which would have once linked with the lane to the south.

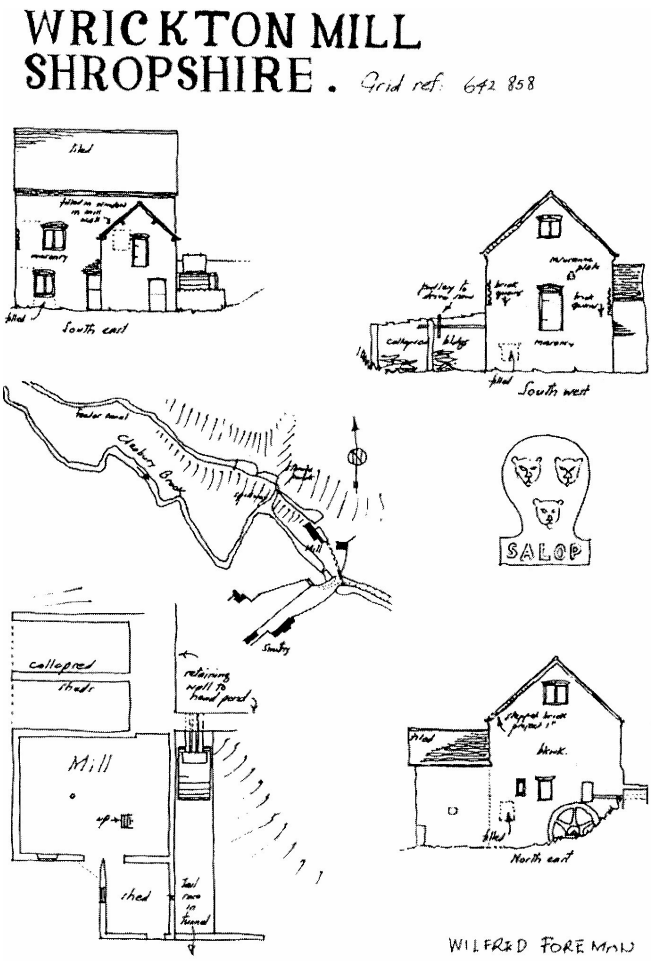
The site was purchased by Titterstone Clee Heritage Trust in September 2010 with grant aid from Ludlow District Council, Natural England and local contributions. Since 2010 the wood has been slowly opened for public access with scrub clearance opening old walkways linking the archaeology of the site. Old coppice is in the process of being brought back into a managed cycle supporting a small charcoal burning venture. The site is used as a wildlife reserve managed to maximise biodiversity and as a educational and recreational resource for local schools and groups.

Further reading:

Jenkins, A. E., 1982. *Titterstone Clee Hills, Everyday life, Industrial History & Dialect*

3. Wrickton Mill (SO 642858)

There have been watermills at Wrickton since the 13th century though the present building dates from the 18th and 19th centuries. The mill was worked commercially until 1950 after which it was partly used to house cattle and store feed. Restoration commenced in 1979. The mill's water supply comes from a long leat which leaves Cleobury Brook at a weir by Charlcotte Furnace. This provides sufficient head of water to work an overshot



Wriickton Mill.

wheel 9ft 3in diameter by 5ft 9in wide. The wheel is thought to have been installed in the 1830s, as was the machinery for two pairs of stones. A third pair of stones was added in 1863, driven by a layshaft which replaced the drive to a clover mill in an adjoining building. There are two pairs of French stones and one pair of Peak stones, all 4ft diameter. Two auxilliary drives from the crownwheel worked the sackhoist, a bolter and a circular saw in an outbuilding though the bolter and saw have been removed.

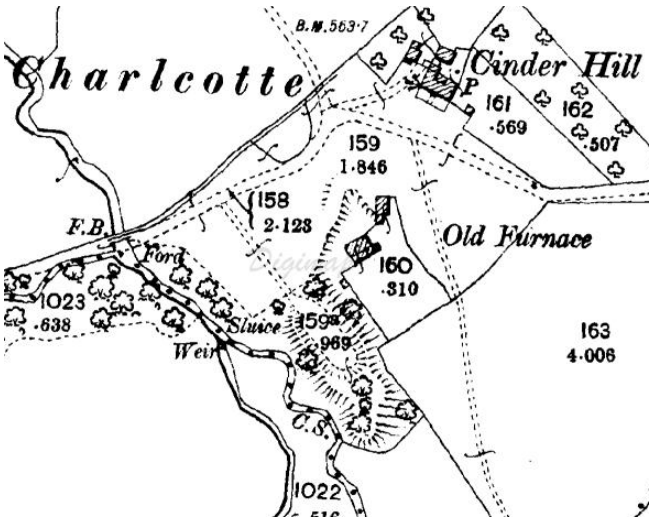
Further reading:

Booth T., 2011. *Watermills on the River Rea in South Shropshire,*

3. Charlcotte Furnace (SO 638861)

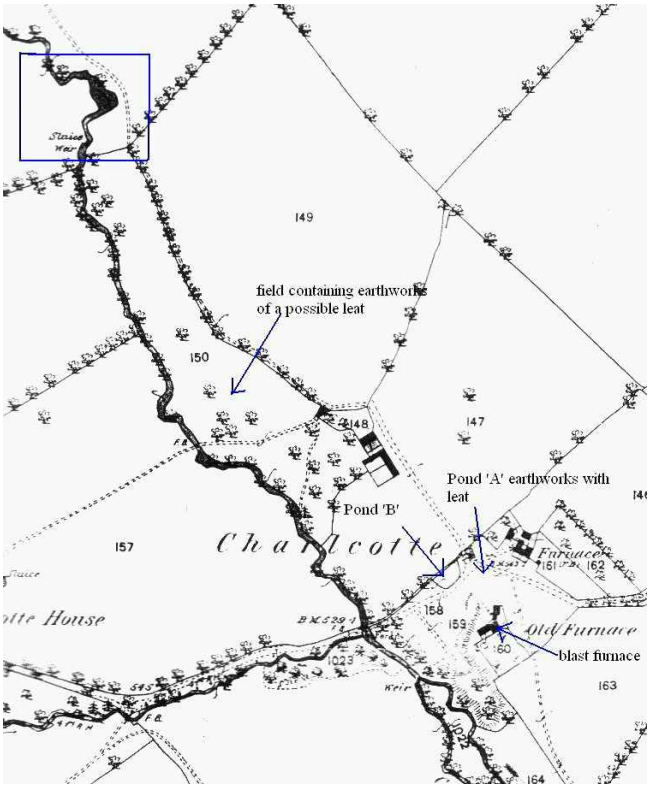
Please note that the ground around the furnace is uneven and may be slippery, so care and stout footwear are required. Cattle are often grazed on the site and animal faeces can carry dangerous infections, so delegates should wash their hands thoroughly after the visit before consuming food or drink and should take care handling soiled footwear.

Charlcotte lies in the parish of Aston Botterell in Shropshire, 10 km south-west of Bridgnorth and 18 km northeast of Ludlow. Here lie the well-preserved



Detail from 1903 1:2500 OS map.

remains of a charcoal-fuelled blast furnace, probably dating from the early 18th century. It is one of many sites utilising water power from Cleobury Brook, a tributary of the River Rea. The site was extensively researched and recorded by students at the Ironbridge Institute about 14 years ago and Historic England have plans to undertake restoration and interpretation in the near future.



Water supply features, based on 1883 1:2500 OS map.

A number of 20th-century histories include the statement that 'the Childes of Kinlet…were interested in the iron trade from 1670 to 1750, being connected with the little furnace at Charlcott, near Bridgnorth and at Boulden' but no source for this claim can be traced. The most detailed published work on the history of the site is that by N Mutton, which is based mainly on a detailed examination of the manuscripts of the Knight family. Mutton describes how the manor of Charlcotte was sold by the Yate family in 1712 to Richard Knight, owner of a furnace and forge at Bringewood, near Ludlow. Mutton's conclusion is that there was no furnace at Charlcotte prior to 1712. The blast furnace at Charlcotte appears in a document produced in 1717 on behalf of Sussex iron-master John Fuller, entitled 'A list of all Furnaces and Forges in England and Wales with a computation of what iron they are supposed to make one year with another'. The potential annual output of Charlcotte is given as 400 tons, which is about average for the fifty-six furnaces listed. Mutton's analysis of the accounts suggest that the maximum annual output was 763 tons, in 1754; the last year of production was 1777. It is likely that the furnace grew increasingly unprofitable due to dwindling sources of ironstone and charcoal in its immediate vicinity and the high cost of transporting iron away from this remote

Charlcotte Furnace stack.

location. Also, by the second half of the 18th century, iron produced in charcoal-fuelled furnaces had been largely overtaken by that from coke furnaces, which was much cheaper to produce.

The furnace stack, built of red sandstone, today stands about 6m high, set into the slope running down towards the stream to SW. A charging ramp provided level access for carts carrying raw materials from the NE side. The casting arch is on the SW face and the blowing arch is on the NW side. Between the furnace and the stream are large quantities of characteristic glassy charcoal iron slag. The development of the water supplies to the wheel which drove the furnace's bellows is particularly interesting. Approximately 400m upstream along Cleobury Brook are the remains of a sluice, and the line of the original leat can be traced in the field to east of the stream. It is believed that this leat also supplied a paper mill which stood approximately 200m upstream of the furnace. There is evidence of a small pond (Pond B in the plan opposite) immediately upstream of the furnace. However, there is also much clearer evidence of another pond (Pond A) in front of the farmhouse, at a higher elevation than the original leat and pond. It is believed that the leat supplying this pond was a later construction than the original, and followed the line of the present track NW from the furnace, from a weir approximately 1km upstream.

Charlcotte Furnace bosh.

Further Reading:

Mutton, N., 1966, *Charlcot Furnace 1733 – 1779*, Historical Metallurgy Group Bulletin, No. 6:pp 18-48

Hulme, E. W., 1929, *Statistical History of the Iron Trade of England and Wales 1717 – 1750.* Transactions of the Newcomen Society, Volume 9, 1928-9:pp 12-35

In addition to the sources cited above a detailed description of the site, including its history and the development of its water sources, is contained in an unpublished report produced by students at The Ironbridge Institute in 2003. For more information, please contact Ian West.

Other Shropshire Sites

Ellesmere Canal Depot. SJ 400342

Water Tower, Ditton Priors RN Armaments Depot. SO 612891

Asterley Windmill. SJ 372075

Grange Colliery Tandem Headgear, Telford. SJ 720114

Morris & Co. Shrewsbury SJ 491131
John M (Geograph)

Longdon Aqueduct. SJ 617156 Chris Allen (Geograph)

Coleham Pumping Station, Shrewsbury. SJ 492119

Hoffman Lime Kiln, Llanymynech. SJ 268211

Kinlet Colliery Winding Engine House. SJ 738818