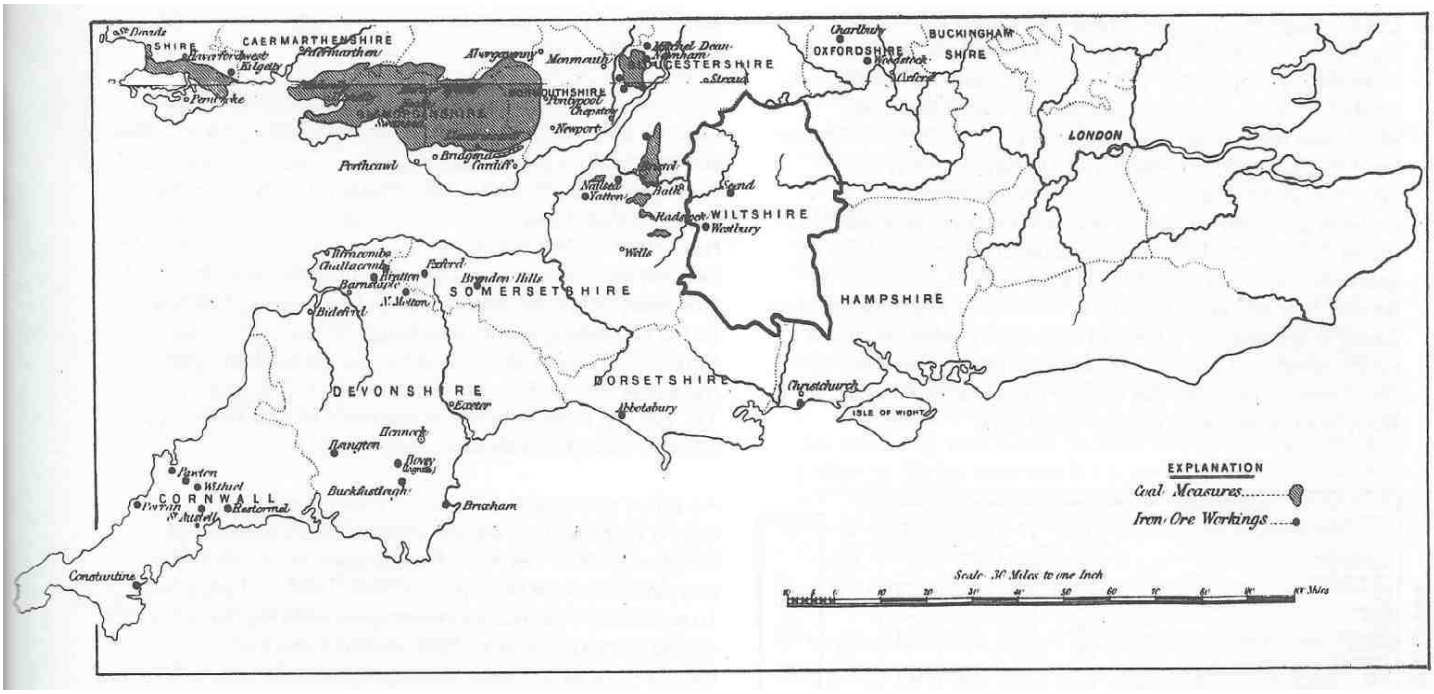
The Iron Industry in Wiltshine,1856 | 1939

Roy Day



The National Scene

'The form of iron-ore known as brown hematite, existing abundantly in this country in the Lias, Oolitic and Lower Greensand formations, has in recent years given rise to the important iron-producing districts of Middlesborough, Northampton and Wiltshire.'

These words were written by Richard Meade for *The Coal and Iron Industries of the United Kingdom*, published in 1882. With hindsight he was being more than kind to Wiltshire for although Redcar reminds us of the great days of Middlesborough, the skyline at Scunthorpe is there for all to see, and Corby is currently in mind at the British Steel Corporation, the Wiltshire iron industry has vanished almost without trace.

The map, also from Meade reminds us that iron was once mined, albeit in small parcels, from Cornwall to the Oxfordshire boundary and that Somerset, Gloucestershire and Wiltshire, each made a significant contribution to the overall development of the United Kingdom iron industry. This account deals with iron-ore mining and subsequent smelting, which took place between 1856 and 1939, in an area which is now agricultural Wiltshire but which, when it began, was amongst the most modern iron-producing areas in the country.

During the 19th century Britain was hungry for iron. In 1806 the output from UK iblast furnaces as 258,206[1] tons. By 1835 it had risen to one million tons[2] and by 1850 to two and a half million.[3] Inevitably there were recessions but the upward trend continued throughout the century reaching 9,400,000 tons in 1899. By 1906 it had passed the ten million mark.[4]

Geographically the shift of production was interesting.[5] At the start of the century, South Wales with 31%. Shropshire with 21% and the Black Country with 19½% dominated the picture and looked likely to continue to do so Indeed by 1830, despite a decline around Coalbrookdale, the same three districts provided 86$^{3}/_{1}$% of the nation's pig-iron. From then on the situation changed. At mid-century, Scotland with 29% (it never achieved more) was a significant factor but by 1880 the north of England had the majority stake (51%), a situation which has not changed much since. As South Wales and the Black-Country struggled to retain . outputs during the 1840s-60s, against inevitable diminution of local ore resources, they began to buy ore and later pig-iron from several new iron-producing areas including Somerset and Wiltshire. Gloucestershire, mainly through activities in the Forest of Dean, also 'exported' raw materials to these districts.

During 1854, the statistical returns from the various mineral and metalliferous mining areas became more regularised by the establishment of a quasi-official organisation directed by the Geological Survey and administered by Robert Hunt.[6] The resulting *Mineral Statistics* enable us to see the interplay between the old and new iron producing districts and show the emergence of Wiltshire industry. The *Mineral Statistics* returns depended for their accuracy on individual mine and smelter owners sending annual totals and, in common with all new systems, took a few years to settle down. By 1859 Wiltshire returns, for ore and manufactured iron, assume a regular pattern and show that 28,993 tons of ore and 5,500 tons of pig-iron had been mined/smelted in the county. By the following year the two figures had risen to 76,201 and 21,875[7] and it becomes apparent that Wiltshire was a serious contender in the supply of part of the country's iron requirements.

When Prince Albert gave support to the concept of a great

international exhibition to be held in 1851, he initiated events which reverberated through British trade and industry. included among the items in the Exhibition Schedule was Class 1, Section C/1a Raw Materials[8] which eventually resulted in nearly 500 examples of British iron-ores[9] being collected by John Percy of the Royal School of Mines. They needed to be analysed for comparative value, a process which was made possible by a donation of £500 from Samuel Holden Blackwell, iron-master of Dudley whose brother, John Kenyon BlackwelI,[10] selected the samples. The analyses were carried out by well known men, amongst them Edward Riley, works chemist at Dowlais who examined a specimen, later to be classified as 'exhibit 13 in section 4 (brown haematites, chiefly from the oolite) which came from Seend in Wiltshire.[11] Comments added by John Percy and which could well have been quite significant, remarked on the similarity between the Wiltshire ore and those originating from Northamptonshire and Oxfordshire.

The original Seend analysis

TABLE IV.—BROWN HÆMATITES, CHIEFLY FROM THE OOLITE—*continued.*

	9.	A. D. 7.	A. D. 8.	A. D. 9.	C. T. 10.	C. T. 11.	C. T. 12.	E. R. (D.)[1] 13.
Sesquioxide of iron	56·20	-	26·01	3·19	44·67	58·10	55·21	53·43
Protoxide of iron	trace	33·29	10·54	12·34	0·96	-	-	-
Protoxide of manganese	0·20	1·11	0·69	trace	0·44	0·66[2]	0·95[2]	1·60[2]
Alumina	2·43	4·42	12·35	3·36	7·85	3·00	2·75	4·19
Lime	0·49	0·50	trace	34·82	9·29	4·15	0·45	0·84
Magnesia	0·17	7·06	4·13	1·67	0·60	0·36	1·15	0·72
Potash	-	-	-	0·18	-	-	-	-
Silica	-	1·10	1·36	2·13	0·48	-	-	24·81
Carbonic acid	-	24·79	0·16	31·92	6·11	1·08	-	trace
Phosphoric acid	0·84	0·22	0·26	0·26	0·55	1·49	0·42	0·87
Sulphuric acid	-	trace	trace	0·10	-	-	0·16	-
Bisulphide of iron	-	0·13	0·13	0·06	trace[3]	-	-	trace[3]
Water hygroscopic	1·10	-	-	-	16·31	16·46	13·11	13·61
Water combined	9·74	0·54	6·02	1·76				
Organic matter	-	0·08	0·19	trace	-	-	-	-
Ignited insoluble residue	29·07	24·09	21·61	7·36	13·10	13·73	25·15	-
	100·30	99·32	99·98	99·15	100·32	99·78	99·35	100·07
Ignited insoluble residue.								
Silica	The insoluble residue consisted of silica with a little iron.	17·58	21·28	6·18	11·86	11·70	19·65	1·42
Alumina		3·27	2·67	0·61	1·25[4]	1·95[4] Of the 11·70 of silica 7·45 was in combination, and 4·25 existed as sand.	4·95[4]	0·19
Sesquioxide of iron		3·31	-	0·18	-		-	0·05
Lime		trace	trace	0·05	trace		0·25	-
Magnesia		0·81	0·22	0·04	-		trace	-
Potash		0·29	0·38	-	-		-	-
		25·09	24·55	7·06	13·11	13·65	24·85	1·66
Iron, total amount		33·34	28·28	34·65	11·98	31·04	40·67	38·65	97·44

[1] E. R. (D.) indicates that the analysis was made by Mr. Riley at Dowlais. [2] Estimated as carbonates. [3] Sulphur. [4] With trace of iron. [5] Estimated as MnO^2. [6] With traces of iron and lime.

At the time of the 1851 Exhibition the Black-Country and South-Wales iron industries were suffering from declining iron resources and men like Blackwell and Riley were probably looking for additional supplies. Tomlinson's *Cylopaedia* (1856) devoted considerable space to this subject and commented that, 'The clay ironstones of the lias are only only just beginning to be added to our iron-making resources. They furnish an example of the unexpected development of natural wealth arising from the facilities afforded by railroads . . . Mr Blackwell has recently shown the vast extent and importance of the silicious [sic] iron-stone from the oolite near Northampton.'[12]

One can speculate on the effect of the Northamptonshire ore field on South Wales. In February 1852,[13] the Welsh ironmasters were given first-hand information about the extent and richness of the Northamptonshire iron-ore and how it could be transported by rail to the Black-Country smelters. By then, there was an undoubted demand for additional iron-ore and/or pig-iron in South Wales and Staffordshire and by then, there were railway links between the Wiltshire iron-ore fields and Bristol, and the Midlands.

The Wiltshire Industry, Seend Developments

Prior to 1856 a Mr J E Holloway, described as a coal and iron merchant from Christchurch in Hampshire," bought a piece of land near the Bell Inn at Seend in Wiltshire and started to strip it for ironstone. He had previously been mining for iron at Hengisbury Head (near Christchurch) but coastal erosion has caused him to abandon this. At Seend his experience was put to good use for he raised some 4,000 tons of ore which was sold to the Tredegar Iron Company in South Wales.[15]

Holloway's success resulted in William Sarl, of Cornhill in the City of London, bidding for the mineral rights at Seend and obtaining leases for three parcels of land owned by Wadham Locke.[16] This committed him to an annual rent of £469.10 and royalty payments of £2,020 in a full year. Nevertheless, Sarl had every reason to be satisfied for in the succeeding twelve months from signing the leases in November 1856, he made a profit of between £5,000 and £6,000 by selling iron ore to South Wales and the Black-Country. This was achieved after he had sub-contracted the extraction to Rowland Brotherhood of Chippenham at 1/- per ton with a minimum payment of £25 (500 tons) whether or not this amount-was raised.[17]

At about this time Brotherhood himself was involved in the setting up of an iron mining and smelting company at Westbury, about ten miles from Seend and in his, so far unpublished, autobiography writes: ‘Twelve of us, known to each other, formed a Company to build works and smelt the iron-ore at Westbury Station, and I made the sidings, fittings etc also the large boilers, blast tubes, hoists, furnace bands and other works'.[18] This marked the start of the construction of the Westbury Iron Company, the relevant paragraph being written early in 1857.

The ore sales achieved by Sarl, approximating to three times the cost of winning, increased his determination to exploit the Seend ore. During 1857 he was actively encouraging the creation of a limited liability company for smelting Seend ore, an action which apparently was not entirely altruistic in its motives.

The *Devizes Gazette* of 5th November 1857 carried an article about Seend ore announcing that the successful mining activities of the previous twelve months had prompted two groups of 'prospectors' to consider setting up works to smelt the ore in situ. One of these groups (the other apparently came from Westbury but could not have included Rowland Brotherhood as we shall see) were proposing to float a company known as the Great Western Iron Ore, Smelting and Coal Company Limited. They had already organised themselves into a working body with four provisional directors (three local and one from Liverpool) and invited ‘Persons favourable to, and desirous of joining the Company, to meet the shareholders at the Bear Hotel, Devizes at one o'clock in the afternoon on Saturday, 7th November 1857 when every information connected with the undertaking will be laid before the Meeting and an allocation of Shares will be made’.

This share allocation was based on selling one thousand shares valued at £50 each to raise an initial sum of £50,000 which would be used as follows: Purchase of land and leases, cost of contracts, plant and machinery at £17,500, cost of erecting four blast furnaces capable of yielding 150 tons of pig-iron per week at £12,400 and labour (working capital) of £20,100.

To encourage subscribers, profits attainable were estimated

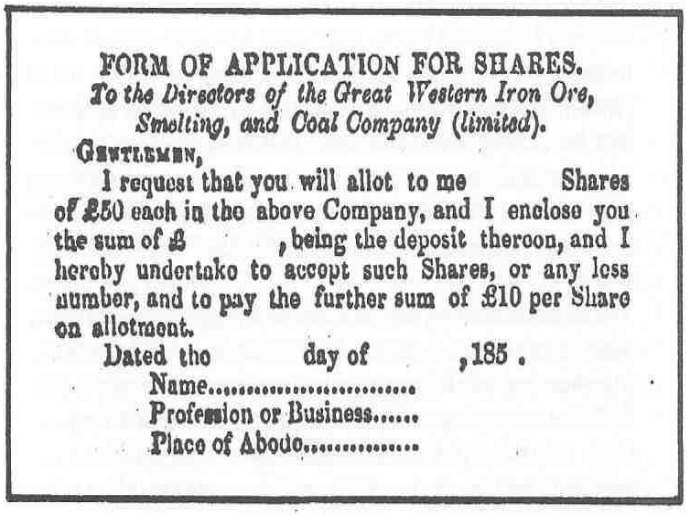
as £31,380 in a full year or a 62% return on capital. This was based on producing 30,000 tons of pig-iron per year (576 tons per week) at an average cost of £2.16s.7d per ton and selling it at £3.17s.6d per ton. As iron made from Seend ore during 1857 had apparently already sold at up to £5.0s.0d per ton and average 1857 prices for Welsh pig were £3.15s.0d per ton, this seemed reasonable.

The Seend smelting consortium had appointed Arthur Davies, a Merthyr Tydfil consulting engineer, to report on geological and iron-smelting aspects. He gave evidence of how easy the Wiltshire ores would be to 'fuse' in the furnace, how 20 tons of Seend ore, smelted at John Bagnall's works near Bilston (in the Black-Country) had produced 10 tons 18 cwts of pig and 2 cwts of castings, a reduction rate of 44%, validated by an independent witness, Henry Hart of Newnham in Gloucestershire. He also gave the result of a further analysis carried out by John Mitchell FCS of Bishopgate Street, London and ended his report by saying 'There will be four and a half million tons of iron-ore beneath your field'. Davies had also investigated the costs involved in producing pig-iron at Seend (with very similar results to those prepared by the 'prospectors') and he used Welsh coke in his calculations. This may possibly have been because he had easy access to Welsh coke prices but it seems likely that it reflected a difficulty which had already beset the 'Great Western' men.

An essential ingredient for the successful smelting of iron-ore in the blast-furnace is load-bearing coke, a supply of which the Seend prospectors just did not have available to them. It will appear, later, how dominant, as far as coal supplies were concerned, the rival iron company at Westbury were. But be that as it may, the Seend 'prospectors' were very concerned over this aspect of their plan.

A scheme was prepared by Josiah Harris, one of the original prospectus signatories who searched for a source of coking coal and found it, 196 miles from Seend, in North Wales at Ruabon. There he claimed to have discovered a valuable mineral laden property in the Trefor and Dolydd area and negotiated a 'long lease' on 500 acres of land.[19] A contract was agreed with the Great Western Railway Company to carry coal from there to Seend at 7/16th of a penny per ton/mile, plus broad gauge transfer charges, etc, in the iron company's own wagons. It must be emphasized, that as far as is known, there was never any connection between the GWR and the Wiltshire company which carried a similar name and that this agreement came into being because it fitted well with the GWR's plans to increase their freight traffic from North Wales.[20] To make the scheme more productive it was envisaged that, after being emptied at Seend, the trucks should be loaded with Wiltshire ironstone and returned to Ruabon, where this could be smelted in furnaces to be built by the Great Western Iron Ore, Smelting and Coal Company.

This information was presented to the meeting at Devizes on 7th November 1857 and had the desired effect. According to the *Devizes Gazette* (19 November 1857) 'A meeting of about twenty gentlemen . . . was held at the Bear Hotel on Saturday last and so satisfied were they that the project is capable of yielding a large profit, that the whole of the capital (£50,000) was at once subscribed. As a matter of interest a further press report eighteen months later revealed that only 815 shares (£40,850) were taken up at the Bear Hotel meeting, but nevertheless the 'prospectors' had been successful in obtaining local support.



FORM OF APPLICATION FOR SHARES.

To the Directors of the Great Western Iron Ore, Smelting, and Coal Company (limited).

GENTLEMEN,

I request that you will allot to me Shares of £50 each in the above Company, and I enclose you the sum of £ , being the deposit thereon, and I hereby undertake to accept such Shares, or any less number, and to pay the further sum of £10 per Share on allotment.

Dated the day of ,185 .

Name.....

Profession or Business.....

Place of Abode.....

One can, reflect on how unhappy some members of the now-confirmed board of directors must have felt as ominous rumblings had already been heard. Once the prospectus had been prepared, and before the Devizes meeting, the 'prospectors' had approached Rowland Brotherhood to 'Do all the work . . . as at Westbury and also to make coal and iron-ore wagons to the extent of £10,000.' Quoting again from Brotherhood's autobiography he says: 'The day was named for us to meet in Devizes, to ratify the agreements but as I did not like the look of the two strangers, I made some little private enquiries in London and Ruabon . . . All seemed to be going well until it came to the agreement with me when l told them that not a single thing would be done by me until I had been down and had a look at the coal in the [Ruabon] pit. I had before seen the old merchant (who had been introduced as a person willing to put money into the project) as a cad in a scheming office in the City . . . There was a great noise, but it was agreed to meet and go down the pit at Ruabon which we did and soon found it was a dead sell, and the whole thing burnt up... Some little time after another company was got up at Seend and I did all the work for them as at Westbury.'[21]

By June 1859 the iron company owed Sarl some £4,000 in rent and royalties,[22] although the *Mineral Statistics* indicate that 4,103 tons of ore valued at £1,950 were extracted during 1858, compared with the 5,719 tons raised at Westbury.

ln July 1859 at the Wiltshire Summer Assizes, Salisbury, before Mr Baron Bramwell, it was stated that one of the original promoters, Mr James Huby, manager of the North Wiltshire Banking Company, Devizes and bankers for the iron company had personally bought two and a half acres of land at Seend for £500 and sold it to his own Company for £2,500.[23] Later that month, the local press under the heading 'The road to ruin' reported that the 'land laiden with minerals at Ruabon and sold to the Great Western Iron Ore, Smelting and Coal Company Limited by Josiah Harris for £10,000 had been disposed of for £600 having first been assessed as a 'mineral property' by a Mr Beckett, who described it as 'worthless'.[24] Not unreasonably Josiah Harris was called upon to explain and, during the ensuing legal proceedings, said he had paid £50 for a pre-purchase valuation at which the mineral rights had been priced at £18,000. Subsequent investigations indicated that this

valuation had been for £5,000, and that the person carrying it out had been a Mr Beckett.[25] During July 1859, Combes and Bracher, auctioneers of Bath and Devizes announced a sale of iron-ore and partly built furnaces at Seend. There were no buyers.[26]

In September 1859, in the Bristol Bankruptcy Court, William Sarl applied for re-possession of the works at Seend and, on October 5th 1859, the Great Western Iron Ore, Smelting and Coal Company Limited was declared bankrupt with assets of £309.0s.9d in cash plus an uncompleted smelting site and liabilities of £43,401.15s.7½ .[27]

The re-possession settled, William Sarl began to re-establish Seend as a viable enterprise. By 7th January 1860 the first blast-furnace was lit, and within three weeks had produced 200 tons of pig-iron. At least this seems to indicate that those members of the team responsible for actually constructing the plant must have done a workmanlike job, placing contracts with reputable people.

Sarl talked of a second furnace being 'in blast very shortly'. After commenting that the iron produced from his furnace was as good as any from Welsh and Black-Country smelters at 60/- to 70/- per ton, said that his statement, 'that Seend iron would be as good as could be produced anywhere in the United Kingdom', had therefore been completely vindicated. He was now writing on notepaper headed: Sarl and Company Ironworks, and was considering building a third furnace, the date was February 1860.[28]

Westbury established

The Westbury iron industry started in a completely different manner, being carried out quietly and efficiently. The fact that there had been no need to seek finance in the market place, meant that most people first knew about it when work on site was actually starting.

As at Seend, there is a record of iron being found, perhaps noticed would be a better word, a few years before large scale extraction began. The Victoria County History states that ironstone was discovered when the Wilts, Somerset and Weymouth Railway began shallow excavations between North Bradley and Westbury. A date of 1841 is quoted but this cannot be substantiated. The line received the Act of Authorisation on 30th June 1845,[29] with the fourteen mile section from Thingley, near Chippenham, to Westbury being opened on 5th September 1848.[30] However, the 'discovery', whenever it may have been made, does not seem to have caused any excitement.

More interesting is a statement made by George Greenwell, mine manager to the Countess of Waldegrave‘s Radstock Coal Company, who presented a paper to the South Wales Institute of Engineers in 1858 entitled 'On the Ironstone of Wilts and Somerset'.[31] In it Greenwell claimed that he 'accidentally found' the ore in the Coral Rag a short distance south of Westbury Railway Station some three years earlier. If this is so, and it appears to be confirmed by Down and Warrington in their research into the Somerset Coalfield,[32] this marks the start of the Westbury Iron Company. Greenwell claimed with justifiable pride that he was 'the first person to attribute a commercial value to the discovery' and he did, in fact, become a Director and Secretary of the Company when it was founded in 1857.

The South Wales Institute of Engineers was formed at Merthyr Tydfil in October 1857[33] and Greenwell, who came to Radstock from Durham, regularly took part in the Institute's affairs. Consequently he would have been friendly with the giants of the South Wales iron industry, such men as William Mendalaus of Dowlais, George Parry of Ebbw Vale and, of course, the Seend ore analyst, Edward Riley. He would have been aware that the South Wales iron masters were looking for additional sources of ironstone and pig and would have known that if the ore could be taken out of the ground at Westbury, there would be little difficulty in disposing of it. In fact the Mineral Statistics record that over 5,000 tons of ore were mined in 1856, the year before’ the Westbury Company was formed and this probably went to South Wales.

Greenwell's fellow directors included Rowland Brotherhood,[34] Charles Holloway, Mr Peldridge, Stephen Steeds, John Rees Mogg and W B Naish,[35] most of whom were connected with collieries in the Radstock and Coleford areas. It is not difficult to see why they were successful, as all of the coal owners were practical businessmen with experience in working the geologically tortuous and economically precarious Somerset coal pits.

On Monday 13th April 1857 a newspaper commented[36] 'A large number of labourers commenced removing the topsoil which varied in depth from two to three feet. The mine is in close proximity to the railway station and offers many advantages . . . The discoveries have already enhanced the price of the land in the immediate neighbourhood . . . [and] will prove to be one of great value and benefit to the inhabitants of Wesbury.'

Mr W B Naish of Ston Easton, near Radstock was elected Chairman and on Wednesday 5th August 1857 he laid the foundation stone of the blast-furnace complex,[37] which seems to have been the first indication that local people had that smelting would actually take place on the site.

Less than a year later the Westbury Iron Company's two blast furnaces were 'officially' tapped, although they had previously produced some iron. At 3.30pm on Wednesday 14th July 1858 (an hour and a half late because of a 'slight' breakdown’) the 'red-metal’ flowed for the first time in public, a cannon was fired and the Bradford-on-Avon Brass Band struck up. Later that day there was a dinner for about 40 gentlemen at the Lopes Arms Inn, presided over by Mr W B Naish, with Mr William Ferris (Chairman of the Great Western Iron Ore Smelting and Coal Company) amongst the guests. The entire Westbury work-force of some 70 men, was also entertained to an excellent repast at a local hostelry.[38] In August 1858 a slight problem was reported by the *Wiltshire Times*. The furnace stacks had developed cracks owing to 'using [them] before they were sufficiently dried and seasoned to the heat’. Such incidents were at the time not unknown. The local press talked of 'pulling down and completely rebuilding after being rendered useless'. In a less sensational footnote, the reporter added 'that the delay in operations will' be more serious than the cost of repairs'.[39] A little under two years later the Wil*tshire Independent* told its readers that there was, in the Westbury Iron Company, 'A brisk little business with 250 tons a week of pig-iron consistently being produced from two furnaces'. The information came from Mr T H Anderson, manager of the works and the date was 10th May 1860.

Coke Supplies

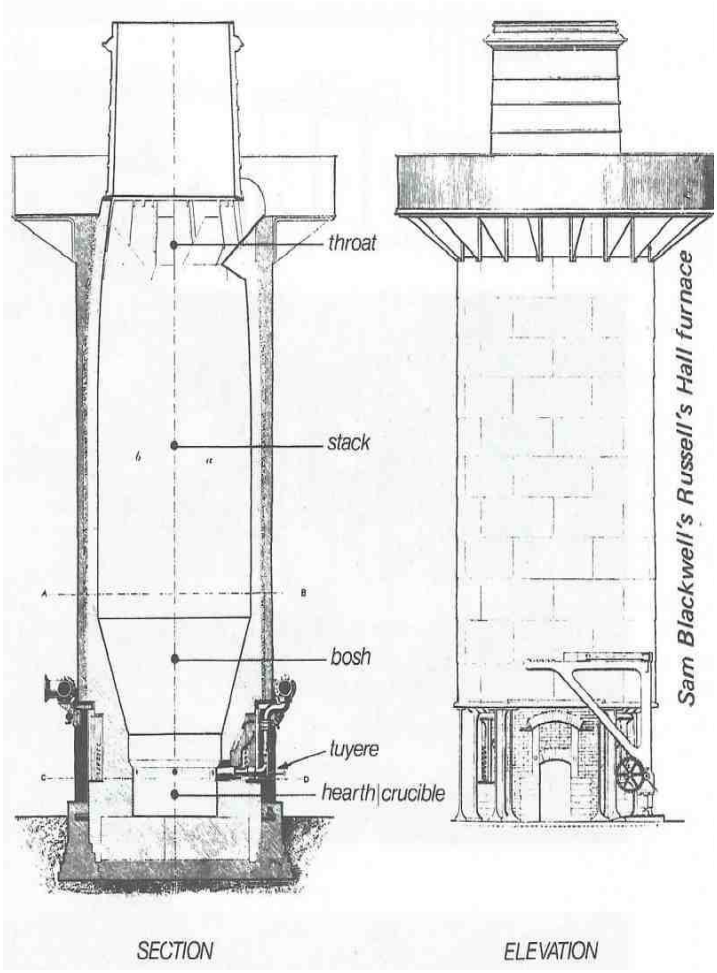
To produce iron in a blast furnace one needs four basic ingredients, iron-ore, which both sites had in abundance, limestone, which could be quarried within a very short distance in both cases, about six tons of air per ton of iron produced, and coking coal. We have seen the extraordinary lengths which the Seend Company had to go to in order to indicate a source of coke for its potential production. From the start, the men responsible for floating the Westbury company were involved in the business of winning coal but even so, the provision of considerable quantities of coke of a consistent quality with no delays in delivery must have posed a problem. A blast furnace is a voracious animal. The requirement was initially met, by the purchase of Newbury colliery near Coleford and the construction of a broad gauge railway line from the pit-head and its nearby coke-ovens to the GWR freight line running from Radstock to Frome. As there was no requirement for a formal agreement with the GWR, the exact date of this line has not been established, but Down and Warrington quote 'about 1857 and certainly by 1864'.[40] In view of the efficient way in which the pre-planning was carried out and the fact that Newbury is known to have belonged to the Westbury Iron Company by at least 1860, I suggest that the acquisition of both the colliery and its attendant feeder line were part of the original plan. Later in the working life of Westbury, when it was producing around 500 tons of iron a week, coke consumption was quoted as 700 tons/week, but even in 1858 the company would have required about 350 tons/week.

Once the output from the Westbury furnaces had increased the Company probably had difficulty in satisfying their coke requirements from Newbury and its near neighbour, Mackintosh colliery. In 1864 there were only four pits working in the Vobster area with a total daily production of about 290[41] tons of raw coal, which, had it all been carbonised, would have only resulted in around 200 tons of coke.[42] The Newbury/Mackintosh combination, which for statistical purposes was regarded as one colliery, was fairly big and it would seem reasonable to assume its share of the combined production figures as half of the available total. Even so, working seven days a week (which the coal-mines probably did not do) the iron-works could only just have achieved their 700 tons/coke/week requirement, a potentially difficult situation. Some time after 1864 the Westbury Iron Company spent £7,000 sinking a new shaft at Moorwood,[43] near Downside Abbey, where incidentally there is also a record of clay-ironstone being worked, but mine-flooding prevented this from succeeding.[44] It is also mentioned that they bought coke from South Wales.[45]

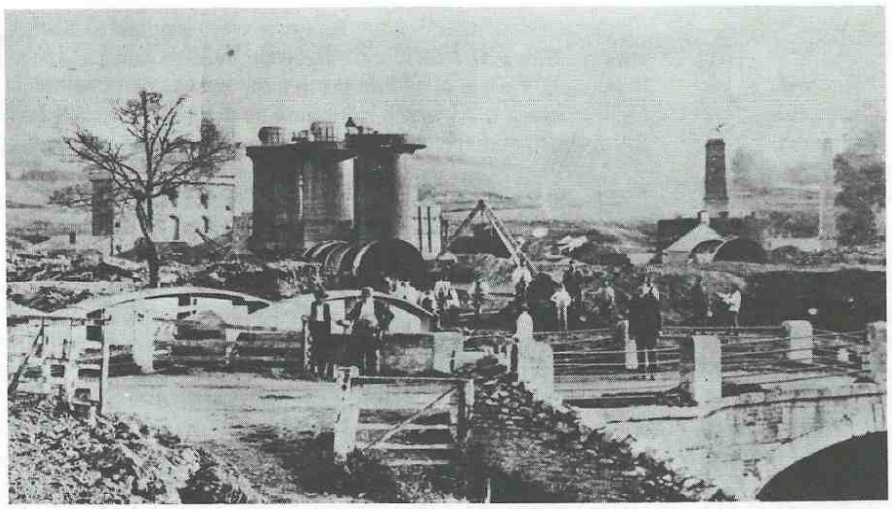
The Plant

Prior to 1830 blast furnace design had stagnated. In 1832 John Gibbons, a very experienced Black Country iron-master erected a new furnace at Corbyn's Hall, near Brierley Hill,[46] pioneering a new design with a round, rather than square, crucible and steeper boshes (see diagram). Gibbons had previously noticed that square hearths invariably became round with use, and boshes became steeper. His successful innovation started a phase of furnace building, during which this type of 'Staffordshire furnace' became dominant throughout the industry, erected in all the 'new' iron-producing districts.[47] Such furnaces were erected at Seend and Westbury, the former being attributed to Samuel H Blackwell[48] who, it will be remembered, was responsible' for introducing Wiltshire ironstone at the 1851 International Exhibition, and starting the Northamptonshire iron industry.

Blackwell's participation could explain an apparent omission, for examination of a contemporary picture of the Seend works indicates that the furnaces did not have the 'bell and hopper' apparatus for sealing the furnace top after charging. Developed by George Parry of Ebbw Vale in 1850, this had been generally introduced to improve fuel economy and furnace production, but Blackwell had been troubled by the production of 'white iron' (hard, brittle and difficult to machine) in a furnace of which he had charge, and which had been fitted with a bell and hopper.[49] At the same time Seend was being equipped, S H Blackwell built himself a furnace at Russell's Hall ironworks near Dudley, which bears a considerable resemblance to his Wiltshire design.

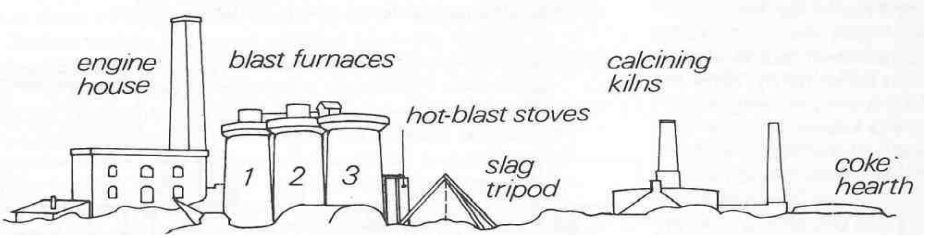


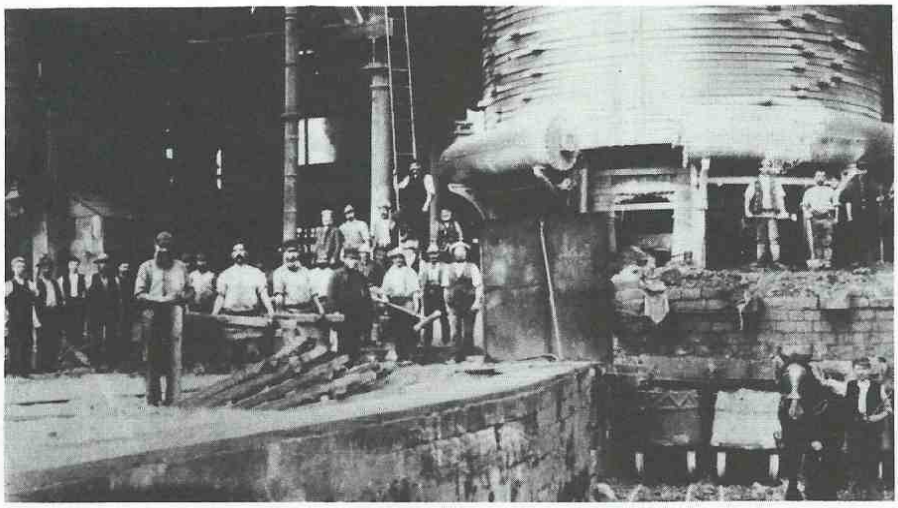
Both Seend and Westbury had hot-blast installations from the start. Before Neilson had patented his method of heating the air blown into the furnace (1828) the blast introduced through the furnace tuyeres (nozzles in non-technical language) had been at ambient temperatures. Opinion was divided as to the respective merits of cold or hot blast but there was no doubt that it significantly lowered coke consumption.[50] However, the early hot-blast stoves were a mixed blessing. They contained a hundred feet, or so, of 18 ins diameter cast-iron pipe, cut into convenient short lengths doubled back and forth, and joined by 'U' bends and flanges. With uncompensated expansion and contraction they almost always leaked. John Percy, enthusiastic as always about this innovation, admitted that



Seend 1871

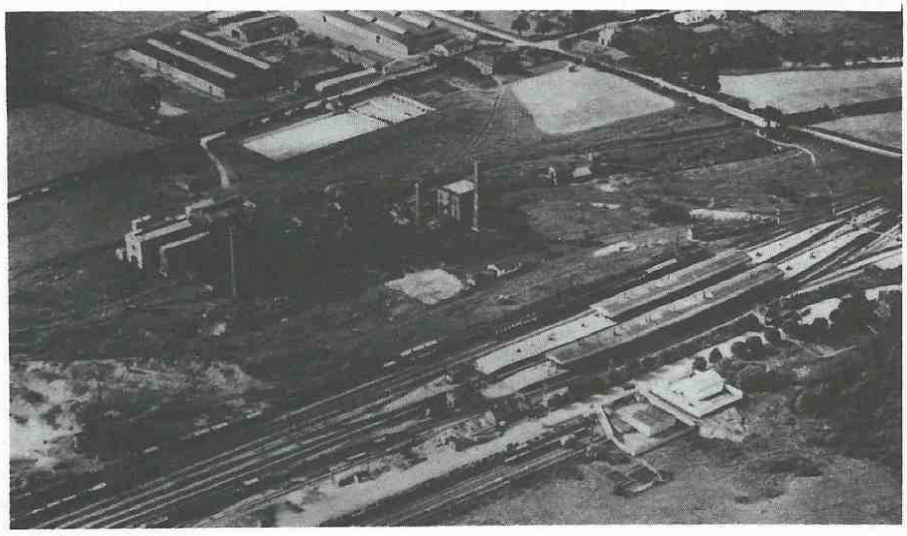
The iron-works at Seend photographed from a vantage point near the road bridge over the Kennet and Avon canal in about 1871. This would have been during the period the works were run by the Malcolm brothers and the third furnace, noted by the Mineral Statistics in 1871, was not completed. It probably never was.





Westbury 1880s

A picture from the Wiltshire Archaeological and Natural History Society's collection in the Devizes Museum. It is undated, is likely to have been taken during the 1880s and shows the 'Westbury blast-furnace crew'. The furnace is of banded brick construction and the strong men (left centre) are probably holding pig patterns, made of wood, a lot lighter than the usual 1 cwt (50 kg) pig but equally impressive in a photograph.



Westbury 1929

A picture of Westbury taken by Aerofilms on 21st June 1929 giving a general impression of the area occupied by the furnace plant. There is only one blast-furnace left, the site has a general air of dereliction with partly dismantled Cowper hot-blast stoves and abandoned slag-bogies. The tall buildings, behind the left-hand chimney stack would have housed the sinter plant.

'A difficulty had now crept in unawares, destined to be highly mischievous and to test the ingenuity of a whole generation of furnace managers'.[51]

In the Black Country, however, by 1851 Martin Baldwin of Bilston had produced a new design of pipe stove 'Very greatly superior to any others as far as freedom from fracture or leakage of joints.[52] Samuel Blackwell installed Baldwin stoves at his Russell's Hall iron-works near Dudley whilst a further improved version (with a brick core) was installed at Allaway's iron-works at Cinderford in the Forest of Dean.[53]

The man supervising the erection of Seend was Frederick. Vernon Smith, brother of Josiah Timmis Smith of Schneider and Hannay's, Barrow-in-Furness[54] and himself a hot-blast stove innovator.[55] It seems reasonable to assume that the two brothers would have discussed hot-blast problems and likely that modified Baldwin stoves were purchased for Seend.

The air blast at both Seend and Westbury, was provided by a steam driven beam engine and one can only speculate as to the makers. Samuel Griffith of Wolverhampton, well known as a 'trade journalist' visited Seend in April 1861[56] and wrote of a '120 horse power blast engine, substantially erected on the most modern plan, working with beam, flywheel, and slide valves , three boilers . . . being used to generate the steam'. At Westbury however there was apparently seven boilers producing the steam at 40 lbs/ sq inch and a beam 26ft in length with a flywheel about 24 ft in diameter. Neither of these descriptions are helpful in identifying the type of installation but in John Percy's *Metallurgy of Iron and Steel* (1864) there is an engraving showing an engine, made by the Haigh Foundry Company of Wigan, which is described as 'an example of the kind of blast apparatus most commonly used in this country for iron-smelting furnaces. It is a condensing beam engine with a 24 ft diameter flywheel and a beam some 30 ft long. lt drew steam from **seven** boilers (including one for stand-by and cleaning purposes) and worked with steam 30 lbs/sq inch above atmosphere,[57] which is not so very different from the 40 lbs/sq inch mentioned at Westbury. The Haigh engine could have been similar to those used in Wiltshire.

At both Seend and Westbury the furnace charge of iron-ore, coke and limestone, was taken to the furnace throat by means of a vertical lift, carrying iron hand-barrows. It was a water-balance lift at Seend,[58] with water supplied from the blowing engine condensate pit, and mechanical at Westbury with its own small engine.[59]

Coke from Newbury Colliery, near Vobster, was taken direct to the smelting area at Westbury until the production of iron outstripped the resources of the Newbury and Mackintosh pits and coke ovens. From later illustrations it is known that there were two banks of coke ovens at Westbury which were probably built after 1870 as, until then, the beehive type of oven was almost universal. Seend however, must always have had a problem with fuel supplies. William Sarl's difficulties with coke probably became well known as, in May 1860, the lease of Old Grove Colliery, near Timsbury, was offered to the Seend company who declined it.[60] Sarl did, however, negotiate a contract for the supply of coal and Old Grove is reported to have bought five tons of iron rails from Sari. On a 25" Ordnance map (e. 1880) a circular object annotated as a coke-oven is shown adjacent to the broad gauge connection to the GWR. It seems to be too large for a type of contemporary circular fire-brick coke-oven described as about 10 ft in diameter but, at that time, the coking of coal in circular piles of around 30 ft diameter was quite usual. These were often called 'coke-hearths' or 'coke-fires' and this was one of the ways S H Blackwell produced coke at his Russell's Hall iron-works.[61]

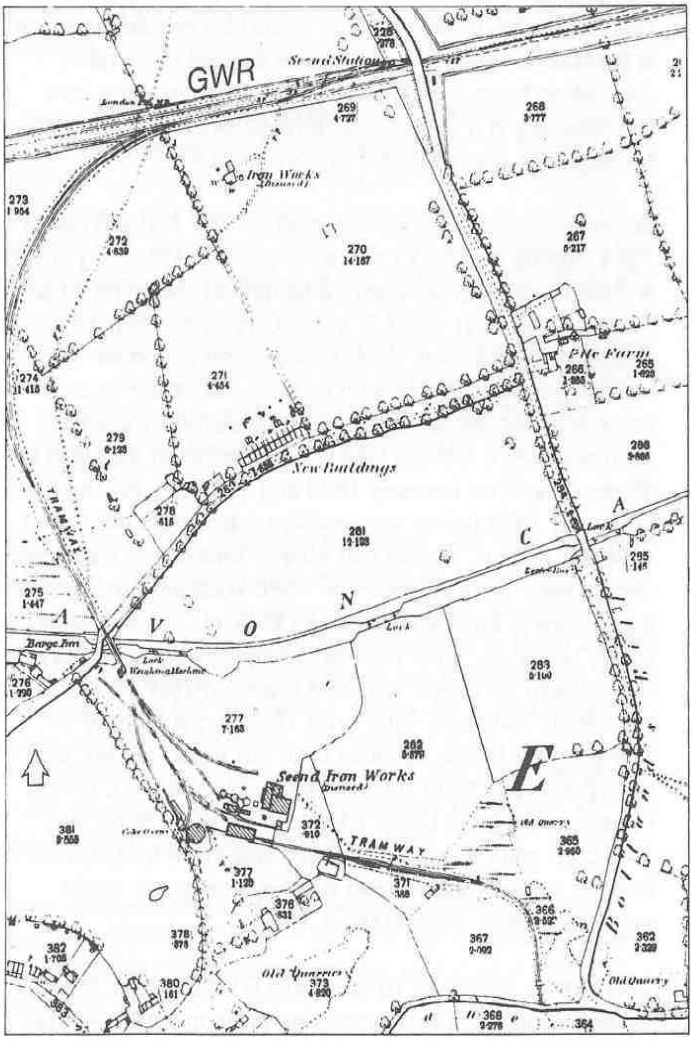
Seend's Fluctuations and Closure

Within sixteen months of the first successful cast at Sarl's furnaces another attempt was made to raise capital. This time (June 1861) the target was £100,000 in £5 shares, the objective being the building of three more blast-furnaces, coke-ovens and housing for his workers. A new company was formed, to be known as the Wiltshire Iron Company and amongst those quoted as Directors were Sir R W Camden, Col Hay and William Neal, MP. S H Blackwell was principal manager.[61] No details have been discovered of this venture but the company must have fallen into dispute with Mr Wadham Locke. On the 10th September 1863 Locke wrote to his friend William Cunnington of Devizes: 'The iron-ore is now to be let in any quantities or sold, and now is the time for your friend to come and see me. The deputation from the Wiltshire Iron Company came here last Saturday and we did not come to terms. . . the furnaces are no use to them without my ore lands.[63]

Six months later a notice appeared in *The Time*s 8 March 1864, stating that an Extraordinary General Meeting of the Wiltshire Iron Company would be held at the office of Sir Robert Camden at Cornhill in the City of London on Thursday 24th March 1864. A resolution would be considered requiring the iron company at Seend to be voluntarily wound up under the provisions of the Joint Companies Act, 1882. There are no records of Seend in the *Mineral Statistics* between 1862 and 1871 but for the years 1865 and 1866 (when presumably under direct control of Wadham Locke), 42,266 and 40,917 tons of ore respectively were raised. On 3rd September 1868 Wadham Locke wrote a particularly interesting letter to William Cunnington, in which he stated, 'That the works employ approximately 60 men and that there are three blast furnaces. It is significant that from 1862 until 1871 as the *Mineral Statistics* quote two furnaces built but none in blast, and only then was a third furnace recorded. Possibly a further remark in Wadham Locke's letter is relevant for he said: 'The blast engine (which he added was of 84 hp fed from six boilers) has only ever blown two furnaces but it could easily be altered to blow three'.[64]

There was a change in 1870 when a Glasgow firm, Messrs Malcolm and Coy began operating the iron-works.[65] They lasted for less than three years, however, and on 7th January 1873 the *Devizes Gazette* reported the failure of William and Samuel Smythe Malcolm of 19 St Swithins Lane, Glasgow with liabilities of £350,000 presumably accruing from their other business interests.[66] A month later the *Devizes Gazette* commented that 'Work has been resumed at Seend iron-works which employs 300 men and the furnaces are in full blast.[67] Later that year the works were

taken over by Richard Berridge, a partner in Sir Henry Meux and Company's London Brewery and a Mr Osborne Alids, private secretary to Richard Berridge, was installed as iron-works manager. It is not clear how a brewery man came to be involved in iron production but his interest must have been short lived. The *Mineral Statistics* have an ‘estimate of 500 tons of ore extracted' down for 1874 and after that silence. In the Wiltshire County Record Office there is a notebook which begins enthusiastically in September 1875 to record tonnages of iron-ore extracted from the Bradley and East End quarries. The entries dwindle, and cease a mere ten months later (June 1876) but even so they only total 3,107 tons and with the **monthly** variation of between 185 and 574 tons, it is obvious that no furnace could have survived. In 1888 a steam launch the Little Sabrina, made the journey from Bradford-upon-Avon to Devizes along the Kennet and Avon canal and her Log records: 'Saturday 5th May . . . at Seend there is the melancholy spectacle of iron-ore smelting furnaces falling to ruin'.[68] In October 1889 'Machinery and plant . . . engines, boilers, steam and water fittings etc.' were offered cheap on the 'Dismantling of Seend iron-works' and on application to T W Ward on the site at Seend or Fitzalan Chambers, Sheffield.[69]



From OS First Edition 25 inch sheet XXXIII/15 surveyed 1885

In 1905 a firm based at Midsomer Norton, near Radstock, bought the property and extracted ore for some considerable time, certainly until well after the 1914-18 war, sending most of this to South Wales. Press cuttings in the Devizes Museum Library indicate that there was some activity at Seend until as late as 1939. These show that the 'New Seend ironworks', as it was called, began operations in 1921, 1922, 1928 and 1936 (when it was opened by the Westbury Iron Company) and closed in 1922 (twice) and 1923 and 1939. None of these activities had any effect on the iron industry but occurred because of a secondary use for the ore as a purifying agent for gas works. Until quite recently, cyanogen compounds present in town-gas produced the traditional way in retorts from coal, were absorbed in oxide of iron.[70] There are scattered records of ore from Seend quarries being so used until the 1960s and at Westbury from 1920. The ore was calcined and despatched to London, Liverpool, Birmingham and Swansea etc for use in gas-purification plants.

Steady Progress at Westbury

As might have been expected after its carefully-planned start, the Westbury Iron Company continued more soberly. For twenty years, from the time that the Westbury furnaces first came into blast, it is difficult to find iron-works news in the local papers, in itself an indication that nothing untoward happened.

On 1st February 1872 a block of shares in the Westbury Iron Company valued nominally at £2,500, formerly the property of the late Mr H J Smith, were sold by auction at the Commercial Rooms, Bristol, for £3,005,[71] and this in a year before Seend went bankrupt, yet again.

There was a set-back in March 1877 when a fall in pig-iron orders resulted in wages at the Westbury Iron Company's works being reduced,[72] and by August of that year the *Wiltshire Times* was reporting only two of the four furnaces in blast.[73] (the *Mineral Statistics* had recorded only two in blast in 1875, this situation continuing until 1882), and in 1878 the newspaper described tales of hardship in the . town.[74]

At the beginning of 1880 there was a 'revival of trade', the iron works took on 40 to 50 extra men and there were rumours of an increase in wages.[75]

In 1884 both the *Bristol Times and Mirror* and the *Warminster Journal*[76] carried articles about the Westbury ironworks and which provided evidence of several technical advances which had been made since iron-smelting started. There had originally been two blast-furnaces in 1857, a third was added in 1862 and a fourth in 1866.[77] Then about 1882 two of the quartet (perhaps the original two) were replaced by one larger furnace and this only was working when the press reports were made. It was producing 400/500 tons per week. The early cast-iron pipe stoves had been supplemented by three Whitwell regenerative stoves, capable of heating the blast to around 600°C. The GWR was taking the bulk of the slag as track ballast, with a little also going to road-ma king contractors. The site covered 400 acres, with the furnace complex occupying about 12 acres, the Company's capital was £90,000, and they employed 200 men, and no women.

According to the *Bristol Times and Mirror* reporter, the furnace 'make' was about 140 tons. With the main GWR lines running within a few hundred yards of the pig-beds getting the iron away was no problem and, apparently it was quite usual for a tapping to be loaded

and despatched the same day to Staffordshire, South Wales or local foundries, with the bulk going to the Midlands.

In 1891 workers at the iron mines struck for a ¼d a ton increase on their basic wage of 2½d per ton, returning to work when the Directors agreed to consider raising the rate if earnings dropped below 3s.6d per day.[78]
Ten years later a shiver went through Westbury when the iron works closed. In February 1901 the *Wiltshire Times* reported that 'It is stated on, we believe, good authority that the Westbury Iron Company have decided to close their iron-works, temporarily at least.[79] In this they are only following the example of many other iron works throughout the country who have had to close due to foreign competition and an increase in the cost of materials. A large amount of men are in this instance affected.' On 21st February the official announcement came: 'Meetings of the directors and shareholders have been held in Bristol and it was decided that it was not possible to continue business owing to liabilities. It has been decided to continue the working of the collieries at Coleford for the time being, and it is hoped that a new Company may be formed in the future'.[80]

The furnaces were 'blown out', 180 men immediately became unemployed and the loss of wages, amounting to over £250, which was mostly spent in Westbury brought an air of gloom to the town. It seems typical of the Company that the assets of the stricken Company were amply sufficient to pay creditors 20/- in the £1.[81]

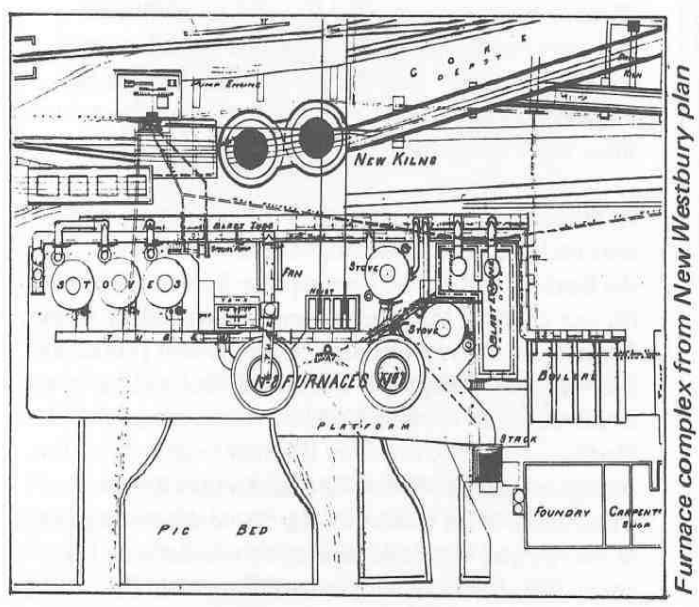
This was done, and very soon moves were underway to start a new company. On 12th December 1901 a public meeting was held at which Mr William Henry Laverton, the chief local landowner and public benefactor, announced that a small group of local men (J Calloway, G H Knight and himself) had a plan whereby it would be possible for the physical assets of the iron works to be purchased at a 'break-up' price of £9,500. £5,000 had to be found by the end of that week and the remainder by the close of the year. There would need to be a further £10,000 as 'working capital' but if the first sum could be realised, he and others, would arrange the rest.[82]

The New Westbury Company

There were no difficulties. £1,500 was promised by the close of the meeting and two days later the fund had topped £4,000.[83] The iron works was saved and negotiations began immediately to find new owners. In September 1902 satisfactory arrangements were made with a new group of business men; in June 1903 the 'New Westbury Iron Company' was formally registered,[84] the works 'competely overhauled with electric light fitted throughout' and on the 11th October 1903 the wife of Mr J E Fisher, the new works manager, from Cardiff, 'turned on the blast'. The Westbury iron works and its two hundred strong labour force, were' back in business.[85]

When the original Westbury Company went into voluntary liquidation they did not immediately give up working the Newbury and Mackintosh coal mines, but probably did so soon afterwards. Mackintosh had been quiescent since 1895 and it is likely that Newbury ceased winding temporarily sometime after 1901 with both collieries being sold to John Wainwright and Company Limited.[86] Presumably the new owners of the iron works made arrangements to guarantee their coke supplies but in any case the whole colliery complex was now operating under new management.

An undated plan gives details of the iron works site, either as it was, or was projected, some time after the New Westbury company took over. There are only two furnaces shown but with the five hot-blast stoves also indicated they could not have used more than one furnace. It is customary to run hot-blast stoves in groups of three and, probably from the 1880s until production ended in 1920, there was never more than one blast-furnace at work. The furnace sold in 1939 was of about 16,000 cubic feet capacity (the 1860 furnaces being about 6,000 cubic feet) and this would probably have had a potential of well over 600 tons/week.



Furnace complex from New Westbury plan

A period of relative stability followed until the outbreak of war in 1914. In 1917 *Kelly's Wiltshire Directory* states that Westbury produced 24,470 tons of iron representing a weekly make of 470 tons of iron, almost exactly the figures indicated by the 1884 reports. In company with so many other iron works, the period following the end of hostilities was difficult. By 1920 iron smelting had ceased and the only activity appeared to be the mining of ore which was calcined, crushed, screened and dispatched in ' covered wagons to gas-purification plants.[87]

On 21st June 1929 Messrs Aerofilms took an aerial picture of the site which looked very dead indeed. There are four slag bogies parked behind the slag bank at the bottom left and two of these appear to be full. Presumably there must have been some sort of caretaker service, for it was almost ten years later before any steps were taken to dispose of the hardware, and activity was observed on the site during the 1930s.[88] In February 1939 a catalogue was issued by two firms of auctioneers giving details of 268 lots,[89] comprising the whole of the iron works plant, equipment and ancillaries. These ranged from a solitary blast-furnace (18' 6" diameter at the bosh by 82' 0" high) to a Remington No 10 typewriter and an eight-day wall clock. Also included were three 24" gauge and two standard gauge steam locomotives. Curiously enough this catalogue may also give a clue to the ending of company iron-ore working at Seend for Lots 238 and 239 are stated to be lying at the Iron Ore Working at Seend

and include 24" gauge side-tip wagons and a quantity of track. One of the 24" gauge steam locomotives in the Westbury auction was insured until the end of June 1937 and the two standard-gauge locos to a similar date.It would have been possible, though perhaps tedious, to tranship the ore from Seend to standard gauge trucks on the GWR Melksham - Devizes line and work them away from there but in any case the catalogue supports the suggestion that Westbury was involved financially with Seend from about 1936.

The Work Force

When Seend and Westbury became iron-making districts in the 1850s one of the problems which must have faced both companies was finding skilled workmen. There would have been plenty of general labour available but blast furnace operations require specialist experience and, for this, the Wiltshire iron-masters needed to go to the established iron-working areas. The 1861 Census Returns for Seend and Westbury show that they did just that and one can imagine there would have been many strange dialects in those Wiltshire villages in the mid 19th century.

At Westbury, James Sadler (age 56) and William Danks (34) were both recorded as blast-furnacemen. Both came from the Black-Country, Danks having been born at Bilston and his four children, the youngest only 3 years old, at Tipton. Three moulders were recorded, Joseph Wilson (Yorkshire) Sydney Jones (Shropshire) and Alfred Thomas (Clerkenwell) whilst the boiler fireman, Watkins Prosser, came from Merthyr Tydfil. Richard Gray (Newcastle-upon-Tyne) was an engine-fitter and one of the blast-furnace Keepers (responsible to the owners for the day-to-day management of the furnace) was David Baxter, born at Bath. At first glance this seems surprising but at 58 years old Baxter would have gained a deal of experience, possibly in the Forest of Dean, South Wales or the Midlands.

Seend, one is tempted to say inevitably, had a more scattered picture. There were several Irish furnace-workers whilst two men who could have been key workers, Benjamin Hyde (35) from Sedgley, near Dudley and his brother, John Hyde (46) born at Brierley Hill, lived in a cottage very near the smelting site, Ben with his wife from Kidderminster and a 6 year old son born at Rowley Regis. in the Black Country

Inevitable Failure

Seend and Westbury were established to produce cast-iron at a time when there was a national shortage. From the available records it seems that the largest part of the production of both works was taken by the Staffordshire (Black Country) and South Wales iron-trades as foundry or pig-iron, although both districts could also have taken some raw ore, during the early and later stages.

Seend was badly managed financially, may well have been under-capitalised originally, (as even the £50,000 originally sought was only two-thirds of the initial Westbury capital) and it was not sufficiently resilient to weather market fluctuations.

Westbury was quite different and was remarkably consistent There were a few problems in its early life due to the high-silicon content, with George Parry of Ebbw Vale Ironworks commenting adversely on the weakness of Westbury iron under impact, whilst William Menelaus of Dowlais said that it 'worked to a bad yield in puddling'.[90] But iron-masters generally came to terms with high-silicon iron, and by the peak years of Westbury men such as C Wood of Middlesbrough and J E Stead, chemist of Bolckow Vaughan, had produced evidence that silicon pig could be used to advantage.[91]

Why then did the Westbury company fail. The complex reasons for the nationwide dispersal of small, local iron-producing units are beyond the scope of this article but when Henry Bessemer and Sydney Gilchrist Thomas took Britain into the steel age, decline was inevitable. Low-cost foreign ore which could only be taken into the deep-water ports in addition to the fall in demand for wrought (puddled-pig) iron, combined to drain the life blood from such places as Westbury, whilst nationally, pig-iron production, which had risen to 10¼ million tons in 1913 declined steadily until 1937. With an enormous availability of scrap and an influx of cheap foreign steel, there ensued a highly redundant capacity and a 20% level of unemployment in the British iron and steel industry in the 1920s. The decline and eventual closure of Westbury was unavoidable and irreversible.

But between 1856 and 1885, after which year the Mineral Statistics ore returns for Wiltshire were combined with Oxfordshire and Rutland and became impossible to quantify, over two million tons of iron ore valued at £580,496 were taken from the ground at Westbury.[93] The blast furnaces continued to work for 33 years, the iron mines for at least a further 15, with the site contributing much to the prosperity of Wiltshire in general and the town of Westbury in particular.

The Industrial Archaeology

After a noisy start followed by a short, tempestuous working life, Seend was abandoned as an iron-smelting site. This had the result of fossilising the internal transport features which can still be traced quite easily. Early in its life Seend iron-works had a tramway from the main iron-stone quarry to the blast-furnace complex, and this can be followed without difficulty.

It has an easily identifiable over-bridge (ST 936 611) under which horses used to haul ore wagons from the quarry to the top of a self-acting inclined plane. From here the full wagon descending pulled up an empty truck to the waiting horses whilst the un-coupled loaded wagons were then moved to the smelting/calcining area at the bottom of the slope. All this can be visualised from the grassy embankments. Similarly, the broad-gauge branch line which took the pig-iron away and also brought coal/coke into the works, can be walked for its entire length.

The furnace remains are a different matter. When a blast furnace comes to the end of a campaign, that is, a periodduring which it is continually producing iron, it is 'blown out'. Afterwards the liquid mass below the level of the tapping hole eventually becomes solid, a mixture of metal and refractory forming a conglomerate which has traditionally become known as 'blast furnace bear'.[93] These

masses were often a considerable weight and_examples taken from a furnace, of the size of those at Seend, have been found to be about 25 tons each.[94] Using the post-1870 picture as a guide, and viewing the present day scene from the Kennet and Avon Canal bridge, it is possible to locate the bases of the Seend furnaces and substantial amounts of "bear'. These alone give a fairly reasonable guide to the situation of all three furnaces as they are probably in their original positions. It would have been difficult to move them. Ferris Towers stands alongside the site, a perpetual reminder of the first chairman of the Great Western Iron Ore, Smelting and Coal Company Limited.

The site of the Westbury Iron Company works was well placed both for internal and external transport requirements. From the start there were no difficulties in moving coal and coke, limestone or pig iron. Consequently when the iron works was no longer, the site was used for alternative purposes and nowadays is part of a thriving industrial estate. Some time after the 1939 auction A E Farr, a Westbury-based firm of civil engineering contractors founded in 1906,[95] moved in using a part of the site as their plant depot..This use of the blast furnace area has made difficulties for any identification of remaining Westbury Iron Company smelting structures. There is now almost nothing which can be established with certainty as belonging to the iron industry era. The writer was given free access to the site in 1969 and spent many hours wandering and pondering with Aerofilm's picture and the New Westbury Iron Company plan. I think I found parts of the sinter-plant structure (which may still be there) and got quite excited to unearth and photograph a cast iron column end. Later Keith Gale dryly commented that it could well be part of the blast furnace structure but would 'conveniently fit in with any suggestion made about it'. He was right of course. I stopped looking. Perhaps the only positively identifiable remains are large ponds near Westbury station which are the water-filled remains of shallow pits created when iron ore was removed.

There is more to see at the colliery sites connected directly with the iron company. At Newbury (ST 696 498) the coke ovens and headgear have gone, demolished in 1950, but there is a good example of a limestone beam-engine house and a less good brick built horizontal winding engine building. The line of the railway link to the GWR at Mells Road can be traced quite easily for most of its length and indeed for the last few hundred yards (ST 713 572), is still in use within the Associated Roadstone Company's works. Further west at Moorewood (ST 642 496) the horizontal engine house is used as part of a residential site and it is possible to trace sections of the tramway.

What we do not know, and possibly never will, is the impact that Wiltshire iron must have made on the iron-based manufacturing firms in the area. Many firms would have benefitted from the availability of a local iron-producing industry and there must be bollards, bridges, cranes and gate-posts still existing in the district, paying tribute to the men who won iron-ore from the lower greensand and coral rags of Wiltshire fields.

Acknowledgements

This article was prepared from information obtained from three main sources. Press-reports and contemporary letters were collected by William Cunnington of Devizes in the 1860s and are preserved in the Library of the Wiltshire Archaeological and Natural History Society at Devizes. I am indebted to Mrs Pamela Colman (the Librarian), Dr Geoffrey Moore and Miss Linda Lamb, for patient searches and for revealing the existence of several photographs.

The second source is the published volumes of Mineral Statistics, which are, however, not easy to consult in continuous runs. Here I received invaluable assistance from Miss Ina Oblatt ofthe institution of Mining and Metallurgy and from the Department of Printed Books, National Library of Wales, Aberystwyth.

The third source, given unstintedly, was the vast store of information on iron~making matters possessed by Keith Gale. However basic my queries, Keith received them with uniform patience and Black-Country good humour, following his off-the-cuff answers with meticulously written comments. I am also grateful to many people for their contributions including Ken Rogers and his staff at the Wiltshire County Record Office,John Chandler of the Wiltshire Library and Museum Service, John Powell and David Pollard of BIAS, Richard Farr of A E Farr Limited, Sydney Leleux, Phil Thornton and Mike Cantle.

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