5.2 The Industry of the Forest of Dean

The Forest of Dean is a beautiful area of hills and valleys, most colourful with all its varied trees - softwood and hardwood, conifers and deciduous. Perhaps 100 sq.miles in extent.

It has a most interesting and complex industrial history. It has been an important industrial centre since Roman times. This can be detected as one walks around. Industrial archaeological interest is very strong. Old excavations may be Roman iron mines; lines of sleeper stones are old tram roads; bare or wooded peaty hills are old spoil-tips; stone erections are old ventilation shafts for mines or railways; heaps of rubble covered in grass are just recognizable as old blast furnaces. One still finds "free" coal-mines.

The historical industries are (in order of importance)

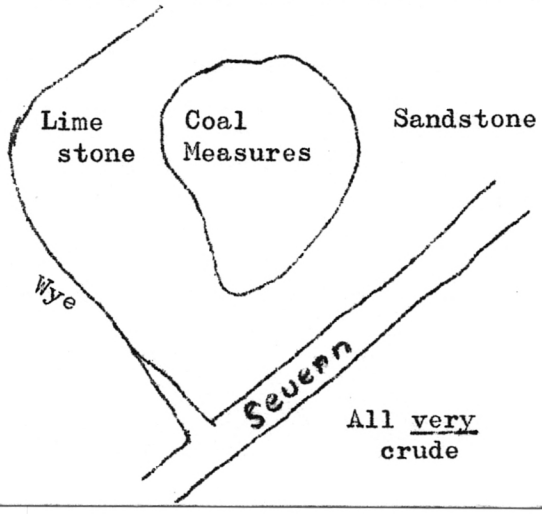
Iron	Timber
Coal	Agriculture
Stone	
Subsidiary Charcoal	

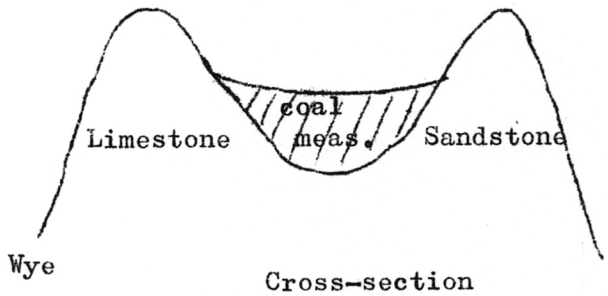
mutually antagonistic

The mineral industries arose because of the very special circumstances that everything needed for the early iron industry occurred locally

- haematite (iron ore of high quality)
- wood for charcoal
- limestone for flux
- water for power

Very crudely the geology is a saucer of coal measures enclosed on the surface by limestone or sandstone in which the iron ore occurs, especially abundant near the surface (but has been worked down to 900 feet at Shakemantle)





Cross-section

It is certain that the Romans and the Anglo-Saxons produced iron here. Since 1086 the Forest has been well-documented. In that year it became a Royal Forest, administered primarily for game, and later for the timber. Iron working was a very subsidiary, and often disapproved, activity until the early 18th century.

Until the end of the 14th century, the iron "works" were just portable forges, moved from place to place. The iron ore was reduced in a "bloomery" furnace, in which crushed iron ore was mixed with charcoal and a flux and burnt as well as possible with a draught provided by the wind. It was thus usual for these works to be sited on the hill-tops where the ore occurred. A tough, spongy "bloom" of iron collected at the bottom of the fire, covered by slag. This was reheated and hammered in the forge to drive out the slag, the process being repeated as often as necessary.

During this period, and in spite of the vested interest of the Crown in the timber and game, the FOD became the main centre of iron production in Britain throughout the 13th century. By 1282 there were 60 bloomery-forges in the Forest.

In the 14th century, severe competition arose from the rival iron industry of the Sussex Weald (which was nearer the London market), so that by 1317 there were only 43 bloomery-forges in FOD.

In Tudor times there was a policy of Naval expansion which demanded oak for shipbuilding and was thus very seriously antagonistic to the use of oak for making charcoal. In 1559 it was decreed that no timber should be felled to make charcoal for iron-smelting (in the FOD but also elsewhere). The FOD was so important in the supply of oak for ships that the Commander of the Spanish Armada of 1588 had orders to destroy the FOD whatever else happened. This anti-iron attitude resulted in a reduction of the number of forges to only 6 by 1635. On the other hand, the ironworks were by now larger. The furnace had a stone body about 22 ft square, and the blast was water-wheel driven by two pairs of bellows 18' x 4'.

Since the ironworks now needed a good water supply for power, we find their location has changed from the hill-tops to the valleys by the streams. (See Map 1 of Baber). The iron ore now had to be hauled to the works.

The Civil War of 1642-9, together with the sale of the mineral rights along with much of the Forest to Sir John Winter in 1640, effectively

hindered the industry; and at the Restoration in 1660 royal opposition increased to such an extent that by 1674 all iron works were destroyed and mining ceased.

It is at this point that coal seriously enters the scene. Still no way had been found of using it in iron-making, but there was plenty of other demand. Coal-mining was not inimical to the preservation of timber for ship-building, and so was encouraged, even though iron-making stopped.

It is now that we find a most interesting system arising - that of the Free Miners. For an account of the working of the system - which exists even today - see the separate typed sheets. The first session of the new Court of Mine Law was held in 1663 and set up the first list of 48 free miners. They had their own rules and discipline. A special meeting-place was built - the Speech House - which exists still, but as a very nice Trust House Hotel. The Court meeting room is used as a dining room normally, but is used for meetings of Free miners and Verderers.

As the coal mining proceeded, mines got deeper and began to consume large quantities of timber for pit-props of considerable bulk. The colliers were entitled to use waste timber, but by 1735 they had resorted to all sorts of tricks to get additional timber - e.g. boring holes in trees to make them die and become waste, and getting round the Forest officers. So things were tightened up again. The Mine Law Court ceased effectively to function in 1754. By this time the mines had extended so much that the protective distance between them had been increased to 1000 yds.

It was also in 1754 that the first water wheel was erected for pumping out a mine in the FOD.

The importance of FOD timber for ship-building declined during the 18th century because there were by then other sources, e.g. Windsor Great Park and the N.American colonies.

Another change during this period of slackening of the Forest Laws was the general encroachment on to Forest land. Whereas at around 1700 there were only six cottages within the Forest, by 1792 there were 589.

Now, due to these and other circumstances (such as the decline of the Sussex iron making due to exhaustion of their timber), there was a resurgense of the FOD iron industry. It was largely due to the Crown's restrictions on the use of timber in previous centuries that the FOD now found itself in a most favourable position. So by 1777 there were 8 furnaces, each much larger than before, giving an output of around

550 tons/annum each. Thus the FOD was wonderfully placed as the Industrial Revolution came in with its increased demands for iron.

Moreover, during the 18th century the Darby family at Colebrookdale in Shropshire had been developing the use of coal (as coke) instead of charcoal in iron smelting. It was necessary to coke the coal to get rid of the sulphur content (which spoilt the iron) and Abr.Darby I did this in 1709, while Abr.Darby II was able to use coke to make iron good enough for forging in 1750.

Coal also became of importance in iron making as the use of steam power for blowing the blast furnaces developed. 1776-John Wilkinson used a Watt engine for this purpose.

Thus a change came over the iron industry in general - coal became the prime factor in locating the industry, not timber and water. Thus many new ironworks developed in the coalfields of England and other countries, and the older iron districts faded out.

But the FOD was exceptional. Not only did it have everything for the iron industry before the coal era, but it lay on a coalfield producing coal which coked well. So it was able to proceed smoothly to the new era and remain prosperous. But so easy were the old processes that the FOD was slow to change to coal - coke first used for smelting in FOD in 1795, at Cinderford, but not commercially successful. In Parkend in 1799, but water power still used for blast. Consequently FOD industry did not develop and expand as was the case elsewhere:-

	No. of iron furnaces in Wales	Shropshire	FOD	% of Britain's output of pig iron produced in FOD
1777	-	-	8	-
1788	8	3	-	20
1839	122	29	10	1.5

The FOD did keep up with general development of the tinplate industry. First tinplate works 1817 at Lydbrook, 1851 at Parkend.

The FOD iron ore was still adequate in the 19th century, and over 4 million tons were mined during the second half of the 19th century.

The FOD iron industry as a whole was virtually brought to an end by Bessemer's invention of his steel-making process in 1856. This needed an

ore with a low phosphorous content, and the FOD ores were not suitable. By 1875 the iron-smelting industry of FOD was near enough dead; by 1893 it was dead. The tinplate industry lasted much longer, the Lydbrook works not closing to 1920 and the Redbrook works not till the 1960's. The Lydney works may still be operating, though with Scunthorpe steel.

The FOD iron mining died rapidly at the end of the 19th century, and finally came to an end in 1925.

The FOD coal mining lasted a bit longer, but the last big colliery (Northern United) closed in the mid 1960's and now only the free miners are left.

Transport in the FOD

The resurgence of industry at the end of the 18th century raised a serious transport problem. Hitherto the local roads had served, not well, but perhaps adequately, for the relatively few coal waggons, etc. But they were quite hopeless for the new traffic. They were by the end of the 18th century impassable in winter, and dangerous at all times. Huge teams of horses were required for the coal waggons. This was uneconomic. £10,000 spent on repairs did little good. So an agitation arose for a railway or tramway.

There were many proposals, but the system as built in 1810 was essentially that planned by John Rennie, the famous engineer who was brought in as consultant. It was the Severn and Wye Railway and Canal Co. (3'6" gauge). In addition, at the eastern side of FOD there was the Bullo Pill Railway Co., also built in 1810.(4' gauge). Other tramways were also built.

The S & W joined Lydbrook on the Wye above Monmouth to the Severn at Lydney. It was a hilly line, with an inclined plane up from the Wye to the hill above, then steep gradients, a tunnel at Mirystock, many sharp bends to keep to land contours. A number of branches connected the main line to pits and works in side velleys. The southern part of the line followed the Cannop Brook. About 25 miles.

The S & W system included a ship canal from the Severn to Lydney - just about 1¼ miles - with a sea-lock at its end, to take ships up to 200 tons (later 400 tons).

The Bullo Pill Ry ran from Bullo Pill (a small harbour on the Severn) to Cinderford, with branches. It had a long tunnel under Haie Hill. Became

the FOD Railway Co. in 1826.

The order of magnitude of the traffic was roughly thus:- (annual figures)

S & W Rly:	100,000 tons	stone and good coal	2/- per ton toll
	60,000 "	inferior coal	1/- per ton toll
BPR - later FODR:	50,000 "	coal	3/- per ton toll
	Other materials less		

Wharfage at Bullo Pill, 70,000 tons - 3d. per ton.

On both railways the track was ⌊ iron plates laid on and spiked to stone sleepers weighing 160 lbs each, 14" square x 7" thick. Nails 5" long, $\frac{1}{3}$ pound weight.

The tramways were public - could be used by anyone on payment of appropriate toll.

It was later decided to convert the tramway's main lines to steam railways. Also other railways were built. The FOD Rly was converted in 1854, the S & W in 1868/9, both broad gauge (7 ft). (In 1864 the S & W had introduced steam locos on the tramway, so this was very short-lived). Both lines eventually became standard gauge (4'8$\frac{1}{2}$"), and the FOD Rly became part of the GWR. It had been purchased by the Sth Wales Rly in 1849 and the SWR was absorbed into the GWR. The S & W remained independent until 1894, then was purchased jointly by the GWR and Midland Rly and run by a Joint Ctee.

The famous Severn Bridge was built in 1875 - 1879 and taken over by the S & W together with the line from Lydney to Berkeley Road.

Since the 1930's the railways have been closing down, and the FOD line is practically the only one still operational. Some of the tramway branches survived as such until after World War II - still horse-worked.

5.2 Forest of Dean - contd.

FOD SUMMARY

AD 1282 60 bloomery-forges

1317 Sussex competition - FOD only 43 b.forges

1635 Naval expansion → only 6 forges (but larger)

1674 all iron works destroyed: mining ceased.
coal seriously enters scene

1663 - 1754 Court of Mine Law

1750 - 1792 slackening of Forest laws
Resurgence of FOD iron industry

1777 output 550 tons p.a.

1709 A. Darby I used coke in iron smelting

1750 A. Darby II used coke for forging

1795 Coal first used in iron production in FOD

1817 First FOD tinplate works at Lydbrook

1856 Bessemer steel process invented

1875 FOD iron-smelting nearly dead

1925 FOD iron mining dead

1960 + FOD coal mining nearly dead.

5.2 Forest of Dean - contd.

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