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THE BULLETIN OF THE ASSOCIATION FOR INDUSTRIAL ARCHAEOLOGY

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COVER PICTURE

Fox Brothers' Tonedale Mills, Wellington, Somerset (see Photo Feature) Photo: RCHME © Crown Copyright)

Culverts at Cyfarthfa

Richard Hayman

A system of culverts built to feed waterwheels at the Cyfarthfa Ironworks at Merthyr Tydfil was revealed and explored in 1995 in advance of a planned road. The evidence reinforces the importance of water power at the site two centuries ago .

'The triumph of fact over probability' was how Benjamin Malkin described Merthyr Tydfil in 1803, a town that in under 40 years had grown from an isolated village to become the largest town in Wales and the nation's leader in iron manufacture. In a place scoured by historians and archaeologists in search of industrial heritage, Malkin's epithet perfectly describes the chance discovery of a system of culverts linking the former Cyfarthfa Ironworks with the Glamorganshire Canal.

Attention was drawn to the culverts in 1995 by Mid Glamorgan County Council who proposed a new relief road in Merthyr, and found that the route passed over a stone-lined chamber, close to the River Taff, which has two culvert entrances within it. MGCC asked the Ironbridge Gorge Museum Trust Archaeology Unit to investigate the extent and historical context of these culverts, and to evaluate the archaeological implications of the new road.

The culverts are solidly-built with pennant sandstone on a bedrock foundation, and are barrel vaulted. Fortunately most of the system is about 2m high and walkable. From the sluice chamber a main culvert continues for over 450m, ending at Cyfarthfa's lower works, now redeveloped for light industrial use. The culvert's variable dimensions show that it was built piecemeal using a cut-and-cover technique. Its end branches into five subsidiary culverts, of which one is brick-built, and clearly a later addition. The whole system is remarkably well preserved - only a short section has been rebuilt in brick, probably in the late nineteenth century when a road was built over the top.

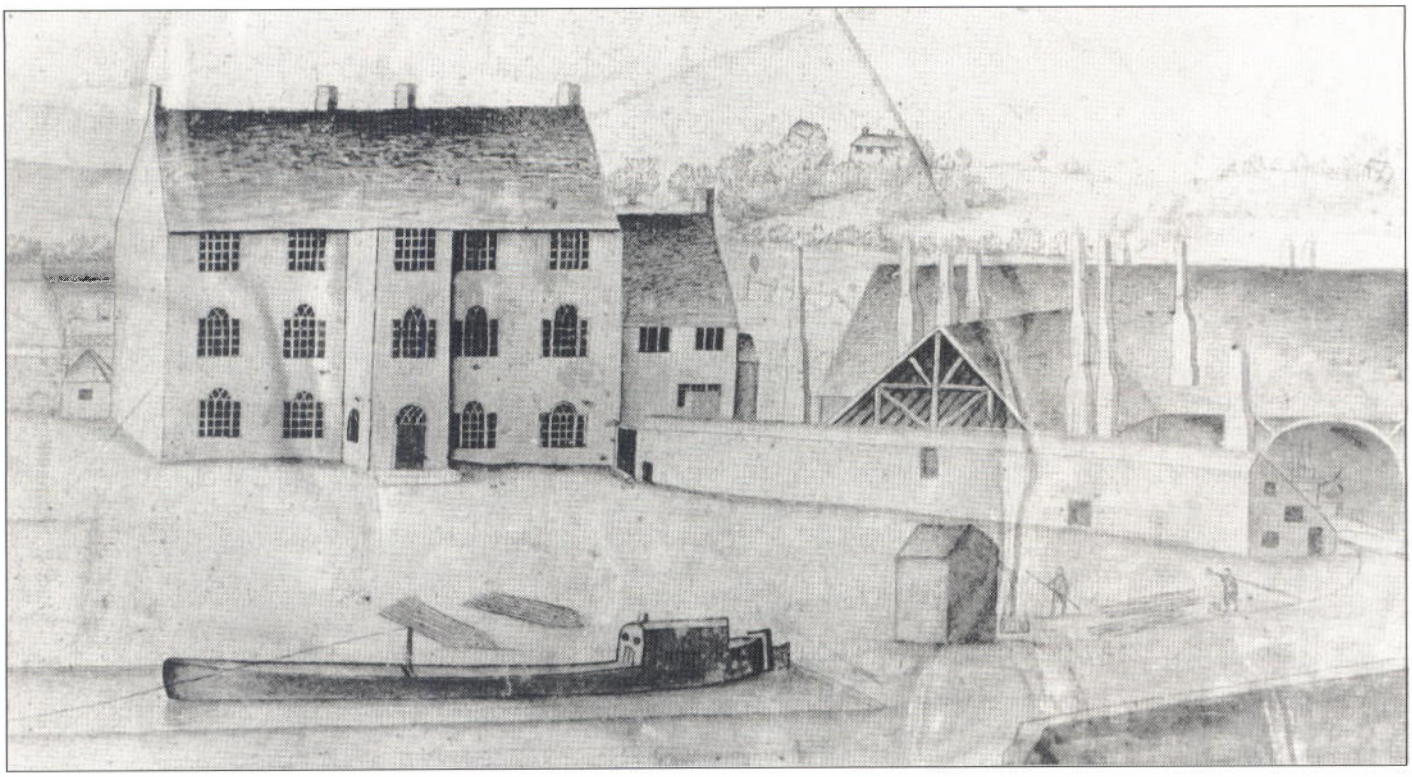
The second main culvert extends from the sluice chamber for only 14m, where it has collapsed, probably caused by the building of a housing estate above in the 1980s. However, there is good evidence that it continued at least as far as a lock on the canal, where it fed the canal with water.

In 1849 it was reported that water from the River Taff 'is conveyed into the iron works ... at Cyfarthfa; passes through the works, being made use of in all the different processes for making iron, and then into the Glamorganshire Canal.' The five subsidiary culverts therefore appear to represent the tail races of the waterwheels at the lower works. Water was conveyed along the main culvert to the open chamber where, by means of sluice gates, it could be directed to the canal or the river.

The precise date of the system is less easy to pin down, although it must have been built in the 1790s. The Glamorganshire Canal was built in 1790-2. The culvert system appears to have linked up with the original head of the canal, which was subsequently extended into the Cyfarthfa Works at the behest of Richard Crawshay, owner of the works and the dominant faction on the Canal Committee.

Since the system is evidently integral with the lower works, the date of this works is crucial. Cyfarthfa had been founded in 1765, but did not achieve any prominence in the trade until after 1786, when Richard Crawshay gained control. A year later he was only the second manufacturer to obtain a licence to produce wrought iron using Henry Cort's puddling process, patented in 1783 and 1784. Crawshay spent the next five years modifying the process to make it commercially viable, and by 1793 claimed to have invested £50,000 in developing the works. The investment paid off. By 1800 Merthyr Tydfil had become a nationally recognised phenomenon, Richard Crawshay was the undisputed 'king of the iron trade', and Cyfarthfa remained the world's largest ironworks until it was overtaken by neighbouring Dowlais in the 1830s.

Tail races meeting to form the main culvert *Photo: IGMTAU*



The lower works at Cyfarthfa, drawn by William Pamplin c1801. In the foreground is the extended head of the canal, and on the left is Cyfarthfa House, home of Richard Crawshay
Drawing: Cyfarthfa Castle Museum & Art Gallery, Merthyr Tydfil

A list of ironworks drawn up in 1794 held in the Boulton and Watt Collection, Birmingham Reference Library, records puddling and balling furnaces, and a rolling mill driven by a 20ft diameter waterwheel. Four years later James Watt junior made the first specific reference to Cyfarthfa's lower works. At that time it contained three 20ft waterwheels, for rolling, shingling and planishing (a finishing process whereby hammers were used to produce a flat, smooth surface to the bar iron). Given that the survey revealed four integral watercourses these probably represent three tail races and a bypass channel. The corresponding description of Cyfarthfa's upper works in 1798 suggests that the 20ft wheel mentioned in 1794 could only have been at the lower works. Therefore it is likely that the lower works with its tail races and culverts system had been built by 1794, and the culvert system was probably integral with the building of the canal.

The culvert system is not the only surviving archaeology at Cyfarthfa. Six of its seven blast furnaces still stand, as do the four blast furnaces and a restored engine house of its subsidiary works at Ynysfach, now HQ of the Merthyr Tydfil Heritage Trust. In addition to a tramroad from the limestone quarries which passes over Pont-y-Cafnau, one of the world's first iron bridges, are two leats that carried water to the works. Cyfarthfa was built near the confluence of the Taf Fawr and Taf Fechan, and stone-lined watercourses can still be seen alongside each of these rivers. Later, an additional water supply was provided by the large pond in the grounds of the Crawshay mansion, Cyfarthfa Castle, although its ornamental appearance belies its more prosaic function.

In 1849 it was noted that 'the waterwheels could not be replaced by steam engines without remodelling the whole of that part of the works.' This reliance on water has a twofold significance. In the 1840s Merthyr suffered an ecological disaster when the rain-drenched Welsh hills failed to provide its population with adequate clean water. Part of the problem was blamed on the ironmasters whose demand for water was prodigious, and whose power was more or less absolute. The culvert linking the works to the canal may have been an ingenious engineering solution, but it is also a symbol of the squalid consequences which ensued for the town's population, for which the ironmasters were more responsible than they cared to admit.

The Industrial Revolution is usually seen in terms of technological progress, but the archaeology at Cyfarthfa challenges such an oversimplification. In the 1790s, when an average blast furnace in Shropshire blown from an engine produced nearly 30 tons of pig iron a week, a single waterwheel at Cyfarthfa blew three furnaces which could produce up to 60 tons a week each. Of course, steam engines were slowly introduced at Cyfarthfa, but the notion of 'obsolete' technology is at odds with the commercial success of a works which did not become antiquated until the second half of the nineteenth century.

The historical significance of the culvert system is sufficient argument for its preservation. At the time of writing no decision has been taken on how this is to be achieved, although the proposed new road affects only a small part of it.

Conference

Problems of Identification and Protection of Industrial Sites in Urban Areas

A Conference to be held at the University of Leicester December 15th–17th 1996

Organised by the Association for Industrial Archaeology

Sessions will look at new legislation relating to industrial monuments and archaeology in towns; urban landscapes; the problems an urban landscape poses for the archaeologist; the interaction between the developer and the industrial archaeologist.

Act now if you wish to attend – send for details and enrolment by 1 September 1966

It may not be too late to submit a short paper. Please contact:
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