Archaeologia Cambrensis 159 (2010), 1–52

PRESIDENTIAL ADDRESS

The Heads of the Valleys: 250 years of landscape change

Delivered at the 156th Annual Summer Meeting, held at Ebbw Vale in August 2009

By Richard Keen

I am deeply conscious of the honour of being invited to serve as President of the Cambrian Archaeological Association, I do so with the full awareness that I am treading in the footsteps of many revered and renowned experts so am very conscious of my task in hand.

The landscape history of the Heads of the Valleys and the deep river valleys running southward to the coast of south-east Wales is complex. This paper can do little more than provide an overview of the cultural and landscape changes that took place in the area from the mid eighteenth century onwards. I do not claim to be an archaeologist, neither can I claim to be a historian, so I am not quite sure where that leaves me, except that I hope I have gained some knowledge and understanding over the past forty years of exploration and investigation of the locality covered in this address. It gives me the opportunity to reflect on what I consider to be one of the most important historic landscapes in Wales.

The Heads of the Valleys of South Wales is an area that has held great fascination for me ever since I first read the novel *The Rape Of The Fair Country*[1] by Alexander Cordell; a publication that stimulated a generation (and more) to begin to realise that the probed and prodded *blaenau* were places where the richness of industrial activity were writ large. The late Professor Gwyn 'Alf' Williams said in his seminal work *The Merthyr Rising*, that 'Alexander Cordell remains and will remain a power in the land and historians of Wales owe him a great debt for what he has done as much as for what he has written'.[2] I am sure that with all of us someone or something sparked our interest in history and archaeology. It was Cordell with me.

I am also very aware of the debt that I owe to so many other individuals who shared with me their knowledge and love of the locality. Foremost among these is D. Morgan Rees, the first Keeper of Industry to be appointed at the National Museum of Wales in 1959 and with whom I was privileged to work in the 1970s before his untimely death in 1978. It was he who guided me through the historic evolution of the Heads of the Valleys (and beyond) and through the complexities of its landscape. There are, of course, many more besides but time and space does not allow me to pay them adequate tribute.

Much has been written about this area over the past forty years and I have drawn upon some of these rich resources to help to gain a greater understanding of the complex physical and cultural changes that have affected the landscape over the past two hundred and fifty years.

To be excessively pedantic, the title of this address should be two hundred and fifty-*two* years of change as it was in 1757 that the first coke-fuelled ironworks in south Wales was established at Hirwaun.[3] Although not the most successful of the 'northern' ironworks there is still a surprising amount visible on site and a recent campaign by a group of local people has resulted in the area being saved from intensive development.

A sale notice dated 1813 refers to 'Two Well Constructed Furnaces' along with 'A Capital Blast Engine on BOLTON and WATT'S Improved Principle' and 'TREVITHICK'S STEAM ENGINE' and a list of all

Figure 1

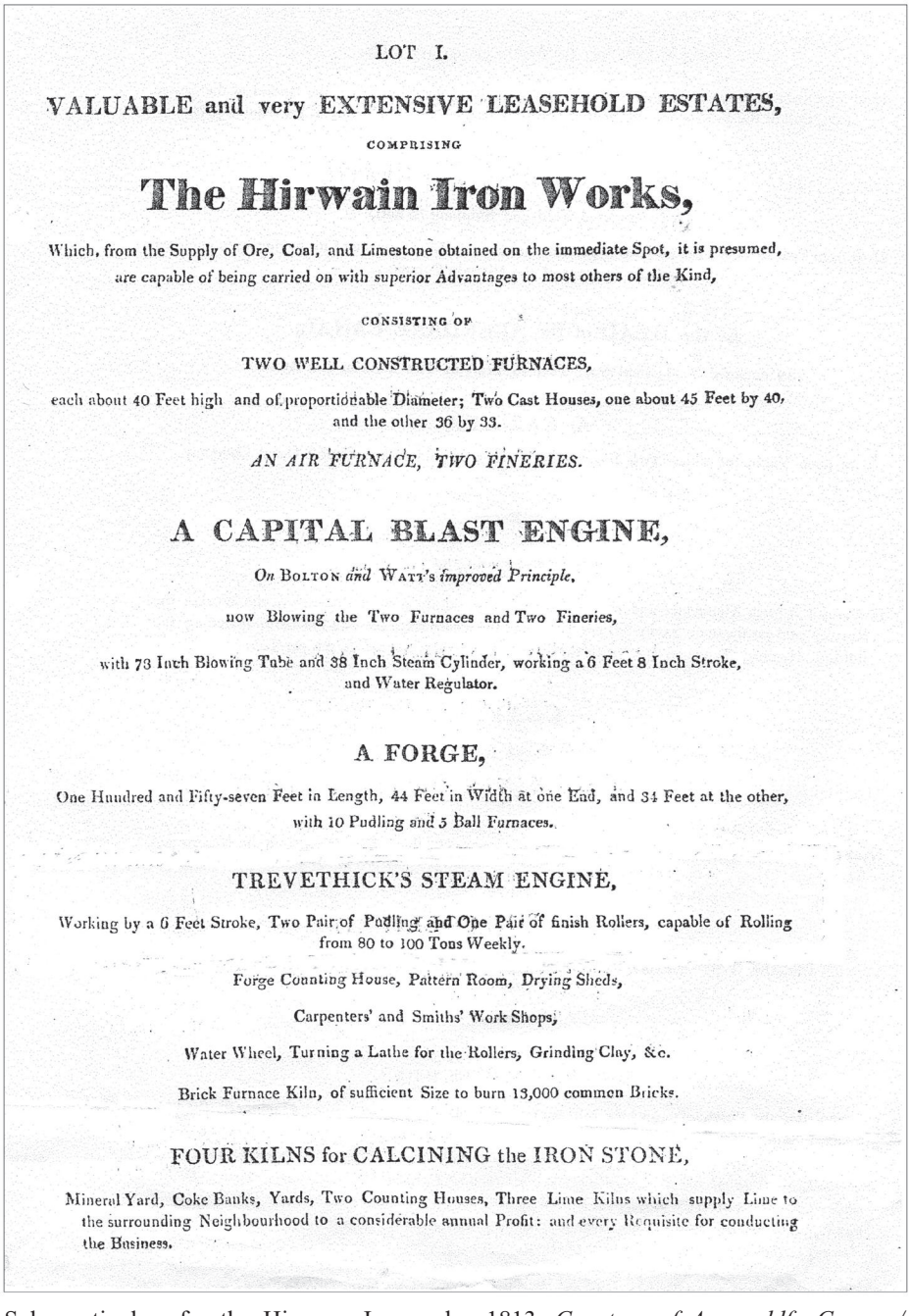
Outline geological map of the study area

the works buildings, workers' housing, coal levels, limestone quarries and the important tramroad links to both the Glamorganshire and Neath canals (Fig. 2). This single document, in microcosm, highlights the changes that were being wrought along the narrow northern strip at that time.

It is a small insight into the general industrial development that was taking place across many parts of Britain as the population doubled between 1780 and 1851. Industry began to replace agriculture as the dominant economic driving force. The demand for arms, armaments and the equipment and machinery for the evolving industries and infrastructure accelerated. The south Wales iron industry developed and expanded to meet these demands.

Hirwaun was a link in the chain of ironworks that developed from the mid eighteenth century onwards across the Heads of The Valleys and included the iron making centres of Aberdare, Merthyr Tydfil, Rhymney, Tredegar, Ebbw Vale and Blaenafon along with other smaller places. The industrialisation of the area can be divided into two approximate periods. The first from 1750 to the mid nineteenth century was

Figure 2



LOT I.

VALUABLE and very EXTENSIVE LEASEHOLD ESTATES,

COMPRISING

The Hirwain Iron Works,

Which, from the Supply of Ore, Coal, and Limestone obtained on the immediate Spot, it is presumed, are capable of being carried on with superior Advantages to most others of the Kind,

CONSISTING OF

TWO WELL CONSTRUCTED FURNACES,

each about 40 Feet high and of proportionable Diameter; Two Cast Houses, one about 45 Feet by 40, and the other 36 by 33.

AN AIR FURNACE, TWO FINERIES.

A CAPITAL BLAST ENGINE,

On BOLTON *and* WATT'S *improved Principle,*

now Blowing the Two Furnaces and Two Fineries,

with 73 Inch Blowing Tube and 38 Inch Steam Cylinder, working a 6 Feet 8 Inch Stroke, and Water Regulator.

A FORGE,

One Hundred and Fifty-seven Feet in Length, 44 Feet in Width at one End, and 34 Feet at the other, with 10 Pudling and 5 Ball Furnaces.

TREVETHICK'S STEAM ENGINE,

Working by a 6 Feet Stroke, Two Pair of Pudling and One Pair of finish Rollers, capable of Rolling from 80 to 100 Tons Weekly.

Forge Counting House, Pattern Room, Drying Sheds,

Carpenters' and Smiths' Work Shops,

Water Wheel, Turning a Lathe for the Rollers, Grinding Clay, &c.

Brick Furnace Kiln, of sufficient Size to burn 13,000 common Bricks.

FOUR KILNS for CALCINING the IRON STONE,

Mineral Yard, Coke Banks, Yards, Two Counting Houses, Three Lime Kilns which supply Lime to the surrounding Neighbourhood to a considerable annual Profit: and every Requisite for conducting the Business.

Sale particulars for the Hirwaun Ironworks, 1813. *Courtesy of Amgueddfa Cymru / National Museum Wales.*

dominated by iron manufacture and the second phase from the 1850/1870s until the end of First World War by steel manufacture and the mining of coal on a massive scale. The twentieth century saw the decline of the smokestack industries along the Heads of the Valleys as iron and steel-making moved to the coastal belt and the long, painful, demise of coal mining that continued until its death blow in the 1990s.

The period immediately before and certainly after the Second World War heralded a number of economic and social changes as the monolithic industries of coal and iron and steel gave way to other forms of economic development. Given the dire circumstances of the area after the long years of depression and neglect, the need for economic regeneration was paramount. Vast amounts of capital were required to begin any form of regeneration. An understanding of the plight of the area may be gained from a report by the Parliamentary Political and Economic Planning Unit published in 1939. It recommended that Merthyr Tydfil be completely abandoned and the total population moved to other locations near the coast or in the Vale of Usk.

The post-war period saw the closure of hundreds of collieries in the two decades after 1945 and the further decline of the metal industries with sites either being demolished or, more often than not, simply left to decay. This situation left the area with a rich legacy of sites and locations where until the 1970s and 1980s it was possible to see so much of the remnants of industrialisation.

The Second World War had an important influence on the physical and cultural landscape of the area as strategic decisions resulted in the establishment of places of production of essential materials. A case in point was the Aluminium Factory built in the parkland of Rheola House in the Vale of Neath in 1939. Only one of the buildings (built in 1964) remains yet its scale (180,000 square feet of covered space) provides an indication of the size and amount of investment required to begin to replace the former heavy industrial base.

The need for the large-scale production of munitions resulted in the construction of Royal Ordnance Factories at Hirwaun, Bridgend and Glascoed. The Special Areas Act 1934[4] saw the development of the Treforest 'Trading Estate' as it was commonly known. Such places began to provide employment for dispossessed male industrial workers and importantly for female labour. This helped to instigate an important cultural change in the role of women in industrial south Wales. The traditional role of females mainly in the home, service or retail changed as new work became available providing opportunities for financial and cultural independence.

A veritable raft of legislation that included the Special Areas Acts (1934–37), the Distribution of Industry Act (1947) and the return of the Labour Party to power in 1945 provided the impetus for a revival in employment prospects as new factories were built in the northern outcrop towns of the south Wales coalfield. Among the companies to arrive were Hoover Ltd (1945) and Thorn Electrical Industries (1951) in Merthyr Tydfil and the Dunlop Semtex factory[5] in Brynmawr built between 1947 and 1953. Such were the interwar conditions in the town that the Quaker movement created the 'Brynmawr Experiment'[6] in 1929 to try and provide some employment. With the exception of a handful of buildings such as the Hoover factory in Merthyr Tydfil few mid twentieth-century factory buildings remain as their sites have been reused for other purposes.

Diversification across the region became the byword and new production units required much-improved means of communication. One of the key factors in enabling the northern outcrop to industrialise in the eighteenth and nineteenth centuries was the provision of effective and viable means of transportation. The same applied in the twentieth century and from the 1960s onwards road building and improvements accelerated as rail transport declined and tracks were abandoned.

The topographical constraints of upland zones and deep, narrow valleys placed great demands on the early engineers who met the challenge with sometime quite astonishing solutions. The construction of the canal systems north/south along the floors and lower slopes of the valleys and their supporting complex

Figure 3

The Aluminium Works at Rheola photographed by the RAF on 31 May 1954. The works occupied some 50 acres immediately alongside the former main A465 road. In the landscape, they overwhelm the John Nash house to the north. East of the works are the estate stables and Home Farm. Thomas Hornor produced a series of views of the house and the estate that he described as 'an attractive feature in the landscape whose prevailing character is repose and seclusion'. That changed in 1939 when the British Aluminium Company established its works. The site was chosen because of its relative remoteness yet accessibility to reasonable transport systems and sufficient supplies of electricity and water. The works closed in 1982 after an extended period of slow decline. The Neath canal can be seen immediately alongside the road and the Vale of Neath Railway in the lower right hand corner of the photograph. *From the Collections of the National Monuments Record of Wales: © Crown copyright: MoD, 1954.*

networks of horse drawn tramroads must be one of the most impressive feats of late eighteenth- and early nineteenth-century engineering.

Steam power was applied to some of these tramroads but the restrictions on gauge limited the volumes carried and therefore constrained expansion.[7] The opening of standard gauge lines such as the Taff Vale Railway from Cardiff to Merthyr Tydfil in 1841 and the improvement in locomotion contributed to a rapid expansion in railway construction. The railway engineers deserve a special mention because by means of embankments, viaducts, tunnels and cuttings they were able to negotiate routes along the approximate north–south alignment of the valleys. Importantly, they also cut across the grain of the land, linking valleys and crossing along the edge of and even across the Brecon Beacons in response to the demand for links to the rich coal measures and their markets. One of the most impressive examples of railway engineering is the Hengoed (also known as Maesycymmer) masonry viaduct. Completed in 1857, the track bed is carried on a curve supported by sixteen arches 130 feet above the river. Now part of the Sustrans National Cycle Network it was built to carry the Taff Vale extension of the Newport, Abergavenny and Hereford Railway.[8]

Figure 4

The great curving sweep of the sixteen arch viaduct (1857) that carried the Taff Vale extension of the Newport, Abergavenny and Hereford Railway dominates the valley at Maesycymmer. The last train crossed in 1964. The viaduct is 130 feet high and 284 yards long. The viaduct is now part of the Sustrans National Cycle Network. On the floor of the valley alongside the river are the preserved buildings of a woollen mill opened formerly as a corn mill in 1750 then later converted to textile manufacture. The photograph was taken 9 June 2006.

Until the second decade of the twentieth century railways provided the most effective means of inter-valley and wider communication. The road systems, some of which still approximately follow routes of pre-industrial agricultural tracks and toll roads, were used mainly for local communication. There were, of course, exceptions as well-established through routes existed. The road up the Taff Valley from Cardiff is an example although the lack of bridges along its length provided challenges to eighteenth- and nineteenth-century travellers. Little wonder, therefore, that remarkable feats of engineering such as the high arch at Pontypridd received so much attention from visitors.[9] In the late nineteenth century main roads through the valleys were hemmed in by steep slopes, winding rivers, terraced housing and were further hampered by many low railway bridges. Along the Blaenau the roads twisted and turned, rose and descended on their tortuous routes through the towns and villages.

Few roads crossed the valley ridges and it was not until the early twentieth century that some of the valleys were interlinked by metalled roads. Crossing the mountains between Rhondda Fawr and Hirwaun and the links into Ogmore and Afan valleys required snaking, well-engineered gradients. Conditions laid down by the Ministry of Transport required that the work was to be carried out by contract with the labour force recruited from the local labour exchanges and that 75 per cent of those employed were to be ex-servicemen.[10]

The present A465 Heads of the Valleys road has reduced the travel time and completed in 1966 (a programme of upgrading and improvement has continued since then) is a good demonstration of mid twentieth-century road engineering, particularly the soaring arch over the Taff Gorge. Providing a vital link with the M4 to the west and the M50 to the east the A465 has been the catalyst for the development of industrial, business and retail parks along its length. This cross-country link is now joined by new road systems that have been built through the valleys in a continuing attempt to improve communications on the north–south axis.

Changes in the economy of the area have, inevitably, wrought changes on the landscape. Greater personal and public wealth and the technological ability to literally move mountains have transformed large areas of landscape. The disaster at Aberfan on 21 October 1966 was one of the reasons for one of the greatest exercises in landscape reformation in Britain and the advent of advanced hydraulic systems and their application to massive machines made the process of opencast mining and land reclamation on a huge scale even more viable. The products of land reclamation and opencast mining has been the availability of space for industrial, business and retail parks and, during the last quarter of the twentieth century, the phenomenon of the Country Park.[11] Such processes have had a marked impact on public perception of landscape. The two decades after Aberfan saw the removal of much of the locality's industrial heritage. Perhaps it was the combination of the memory of the dreadful disaster and the legacy of the dire years of depression when industry was so strongly associated with social degradation and deprivation that provided the impetus for such wholesale obliteration.

However, it is not only on the large-scale that change has been marked. The appearance of new building materials, the demand for improved housing, the exponential increase in DIY and house improvement and, of course, the use of the private car have produced change that may be measured on a small, local scale but cumulatively has had a substantial impact upon daily life. Alongside these has been the influence of centralised retail and leisure outlets that usually demand new road systems and in many instances occupy the sites of former industries.

All too quickly and almost unnoticed the private car has impacted on everyday life with new housing developments requiring parking spaces for perhaps two or more cars per family. The terms 'hammerhead', 'cul de sac' and 'vision splays' are now in everyday usage in planning decision-making.

The present day landscape is, of course, a direct inheritance of the process of industrialisation that began in the eighteenth century.

Figure 5

The soaring arch carrying the A465 over the former limestone quarry at the Taff Gorge north of Merthyr Tydfil is a very good example of mid twentieth-century road design and engineering. Prior to its completion in 1966, travel along the Heads of the Valleys was tortuous and slow with the original road dipping and winding through the towns and valleys, and the steep, winding section through the Clydach Gorge was notorious for slow moving traffic. This bridge spanning the Taff Fechan is one of the most spectacular along the route and its completion was not without its challenges. When the abutments (that spring from the side of the gorge) were being constructed, it was found that the limestone on which they are mounted was perforated by large cavities. These had to be backfilled with concrete to stabilise the rock faces. Photographed July 2010. *Photograph: Richard Keen.*

Why the Heads of the Valleys should have attracted the attention of the iron-makers is, simply put, because of its geology. Indeed, most of the early industrial exploitation across Wales was as a consequence of what lay below the ground, assisted and hampered by the climate and topography. This is certainly true of the Heads of the Valleys.

The great south Wales coalfield reaches from Pontypool in the east to the extremes of Pembrokeshire where the coal measures disappear under the sea at Newgale. Although there were many notable places in Wales where industrialisation played an important landscape and cultural character-changing role, it

was from Hirwaun to Blaenafon either side of the present A465 where the first intensive industrialisation took place. It was here that the initial large-scale industrialisation of Wales evolved from the foundation of the first coke fuelled ironworks at Hirwaun.

Along this northern outcrop of the south Wales coalfield syncline was found coal, iron and limestone in great abundance for the manufacture of pig iron on a large scale. A cross-section of the geology of south Wales reveals the close proximity of these materials; outcropping to the north are bands of Millstone Grit and Carboniferous Limestone. Further to the north is the great mass of Old Red Sandstone of the Brecon Beacons National Park and to the south the Pennant Sandstones. The Old Red Sandstone,

Figure 6

Two bridges at Cefn Coed y Cymmer cross the river, and the Gurnos Tramroad. The earliest crossing at right-angles to the river was made of timber and replaced by the present stone bridge in the mid nineteenth century. Because of its dangerous condition, the bridge was closed to heavy traffic in 1910 after the construction of its replacement, the skewed ferro-concrete structure alongside. That this bridge is still in use carrying a very busy road is a testament to the engineering skills of the time and the use of, what was then, an innovative construction technique and material. The photograph taken in July 2010 is from the old bridge. To the left of the river running underneath the arch is the track bed of the Gurnos Quarry tramroad. *Photograph: Richard Keen.*

limestone and Pennant series were used for building materials and have done much to form the character of the built environment of the study area.

Limestone was a very important commodity. In addition to being used for building in the form of stone, mortar and lime washing it was also used as a flux in the iron-making process and as an important additive to the fertilisation of acid soils of the uplands. Lime washing was important for the weather protection of houses and as an antiseptic especially during outbreaks of contagious disease.

Within the area a variety of coals were available, each one with its particular application. The semi-anthracite seams near Hirwaun were deep mined as recently as 2008 until the closure of Tower Colliery and there is still a market that is being met by small mines and opencast working. It was the massive deposits of bituminous and steam coals that were so vitally important to fuel the industries. The Aberdare Valley was particularly famous for its rich steam coal deposits. Bituminous coal tended to be found to the south of the coal basin although 'it is important to bear in mind that in their properties, as well as in their geographical distribution, the varieties of coal by almost imperceptible gradations blend one into another'.[12]

In addition to the changing nature of coals in a lateral direction across the coalfield there are also changes vertically with the Upper Coal Measures producing gas and house coals; high quality coking and manufacturing coals from the Middle Series and the Lower Measures producing the best steam coals.

The upper series were the first to be exploited simply because of relative ease of access and by the limited technology available. The deeper productive seams were accessed later in the nineteenth century as mining techniques and technology improved.

It was the happy combination of iron stone deposits in close proximity to the easily accessible upper coal measures that provided the key to industrial development. Quite simply, within a relatively narrow band of countryside all the raw materials were readily available in abundance to serve the industrial demands of the time.

Although Wales is generally described as a temperate zone, the Blaenau is known to be prone to extremes of climatic conditions with very high levels of rainfall, prolonged periods of snow and ice and sometimes high winds. The highest places along the Heads of the Valleys are over 600 metres with some of the settlements above the 400 metre mark.[13] This was a point noted by a journalist in the *Morning Chronicle* sometime between 4 March 1850 and 26 April 1850, 'Dowlais, standing 1,000 feet above the sea, would be (presuming no counteracting influences at work) a healthy place'. The comment in parenthesis is a telling statement considering the conditions that applied at the time when the average life expectancy in Merthyr Tydfil was a mere seventeen-and-a-half years.[14]

The A465 road acts as a rough dividing line between industrial and rural south Wales. In places, the division is clearly marked. Southwards, the rivers flowing through the narrowing valleys twist, turn and sometimes conjoin to eventually outflow into the channel. North of the road rise the Brecon Beacons characterised by their steep glaciated Old Red Sandstone escarpments, incised valleys and moraines.

To stand on the ridge top between Troedyrhiw and Bedlinog, just north of an approximate centre line across the coalfield in south-east Wales, and look east and west the observer would be hard pressed to realise the intensity and concentration of industrial exploitation that took place in the narrow valleys except perhaps for the large, grassed mini mountains that are survivals of the colliery waste tips that once dotted the ridges. Look north and south, however, and a different picture emerges. Southwards, the serried ranks of stone and slate terraces are visible, concentrated on the valleys floors and clinging precariously to the steep contours. Northwards, the town of Merthyr Tydfil sprawls in a wide V-shape where the valley opens into the lower slopes of the Beacons.

Viewed in the early nineteenth century the town presented a spectacle to the visitor that could be both astonishing and horrifying. The artist Thomas Hornor (1785–1844) wrote:

Figure 7

In this watercolour dating from about 1817, Thomas Hornor clearly enjoyed the challenge of depicting the industrial processes at the Penydarren Ironworks at night. Shafts of light pierce the dark sky like futuristic searchlights and the interior of the buildings glow and flare with heat and energy. He was not too concerned about technical correctness as some of the machinery, as shown, could never have operated. What he does with great skill is to capture the character of iron-making in Merthyr Tydfil at the time, although the amount of equipment and castings scattered around perhaps acknowledge the fallen capitals and pillars of the views of classical antiquity than the reality of a functioning ironworks. In the centre background, he shows the great Dowlais Works glowing and smoking on the high slopes above the town. *Courtesy of Amgueddfa Cymru / National Museum Wales.*

> At night the view of the town is strikingly singular. Numbers of furnaces and truly volcanic accumulations of blazing cinders illuminate the vale which, combining with the incessant roar of the blasts, the clangour of the ponderous hammers, the whirl of the wheels, and the scarcely human aspect of the tall gaunt workmen, seem to realise without too much aid from fancy many of our early fears.[15]

His was a conscious decision to visit the town to experience burgeoning industry in the raw and he was certainly not disappointed as at the time Merthyr had overtaken Swansea as the largest town in Wales.[16] In 1801 there were 7,705 inhabitants rising to some 46,000 by 1851.[17] Had he visited some fifty years earlier making his way northwards from the coast an altogether different scene would have presented itself. Then the lowland area was dominated by agriculture with its richer soils and more equitable climate supporting a series of large estates and mainly tenanted farms on which were raised cattle and arable crops. The farms of the uplands located on the thin acid soils and much more prone to heavy rainfall often operated at a subsistence economy based on sheep rearing.

Figure 8

The Clydach Ironworks photographed in May 2009. Opened by 1795 the works were perfectly located to take advantage of the substantial supplies of coal, iron ore and limestone that were available close by. The steep slopes of the valley side were pierced by both coal and iron levels and the overlaying limestone outcrops were exploited on a large scale. There is much to be seen on site including the bases of the furnaces, a waterwheel pit, engine foundations and a rare example of the remains of a charging house. It was through the arch shown above that the barrow loads of raw material were tipped into the furnaces. This was not a haphazard procedure and the amounts were carefully measured and weighed before being tipped sequentially into the furnace mouth. The Clydach works are also important because they show a works that never expanded into steel manufacture. The furnaces were last operated in 1861. *Photograph: Richard Keen.*

Industry was, however, in evidence in the lower reaches of the some of the valleys. At Pontygwaith a charcoal fuelled furnace had been established in 1583 by Anthony Morley, an ironmaster from Sussex. Other 'charcoal' furnaces and forges were in operation prior to the 1750s including those at Pontygwaith south of Merthyr Tydfil, Cwmamman in the Dare Valley, and in and around Pontypool, a town that must be regarded as the first industrial town in Wales.

Iron forges were in operation there in the fifteenth century but the area rose to industrial prominence under the guidance and entrepreneurial activity of generations of the Hanbury family who established furnaces, forges and tinplate works. In Pontypool the revolutionary method of converting bar iron into sheets by rolling was documented by Edward Lhuyd in a letter dated 15 June 1697, 'One Major Hanbury of this Pont-y-Pool shew'd us an excellent invention of his own, for driving hot iron (by the help of a Rollling Engin [sic] mov'd by water into as thin plates as tin'.[18]

South Wales provided all that was required to manufacture pig iron in small quantities by the exploitation of the local supplies of iron ore, the thickly wooded valley sides for charcoal and plenty of fast flowing streams and small rivers to provide the motive power.[19] The success and function of the early iron furnaces were subject to the 'tyranny of wood and water'.[20] Because of the vast quantities of timber required to smelt each ton of iron ore and the huge quantities of water required to drive the waterwheels that, in turn, powered the bellows to blow air into the furnaces, often the operations were constrained to brief 'campaigns' that could last for as little as eight weeks. The lack of good roads through the difficult terrain also limited the development potential of the remote furnaces.

Abraham Darby's successful smelting of iron using coke at Ironbridge in 1709 provided a vital catalyst for the Heads of the Valleys to emerge as one of the most important industrial localities in Britain. Between 1757 and the 1840s the area was transformed as firstly small clusters of houses became villages and those villages later expanded into towns focused on their particular ironworks. By 1830 south Wales was producing 40 per cent of all British pig iron.

The Clydach Gorge near Abergavenny can be seen as a microcosm of the history of iron manufacture in that it never made the transition to steel-making. Compressed within the narrow confines of the steep-sided valley the raw materials were easily available including large quantities of wood when the furnaces were fuelled by charcoal, and a network of packhorse roads and tramroads. Demarcating the northern edge of the coalfield, along the southern slopes of the valley seams of coal and iron outcrop and the entrances of drift mines remain. Vast worked limestone deposits alongside and overlaying the coal and ironstone also extend northwards across the width of the A465 road that cuts longitudinally through the valley.

The remains of the Clydach Ironworks, located on the floor of the valley where it flattens out after its steep descent of 335 metres, are impressive and rare in south Wales in that there is a deal of built evidence of the charging house[21] located above the remnants of the furnaces. There is a very good example of a waterwheel pit from which power was derived to activate the bellows pumping air into the furnaces via the tuyères.[22]

Iron-making in the valley was established by the Hanbury family of Pontypool when they opened the Llanelly furnace in the seventeenth century—it was in production by 1684— followed by a forge that was operating by 1717. The forge continued to operate for the next one hundred and sixty years or so outliving its furnace that had closed following the opening of the Clydach Ironworks before 1795. Clydach House a short distance from the site of Llanelly Furnace was the home of Francis Lewis, 'Clerk to the Furnace'. It bears his family coat of arms and the date 1693.

South Wales has a good collection of cast iron bridges[23] and one of the best is Smart's Bridge built in 1824 to carry a tramroad to the Clydach Ironworks. Supported by well-built masonry abutments the cast iron members are decorated with Gothic arches.

Figure 9

Smart's Bridge (1824) providing access into the site of the preserved ironworks at Clydach Gorge. Photographed June 2009. This is a very good example with its decorative 'gothic' arched decoration and ribbed surface to provide traction for horse traffic. The are a number of good examples of cast iron bridges in south Wales including Pontycafnau (Merthyr Tydfil), Brute's Row (Blaenafon), Robertstown (Aberdare) and Trehearne Terrace (Maesteg). *Photograph: Richard Keen.*

The topography of the area presented the road, tramroad and railway engineers with huge challenges. The Hafod Arch[24] on the Clydach Railway is part of a high embankment built to carry the tramroad down the gorge to the canal at Gilwern.

The tramroads built under the terms of Acts of Parliament required to authorise the construction of the canals are examples of quite complex engineering and construction including routes that linked with the Brecknock and Abergavenny Canal and with Blaenafon. Part of the route of one of the tramroads above the Clydach Gorge was utilised by standard gauge railway engineers when a spectacular route climbing high on massive masonry embankments and curving tunnels on the southern side of the valley was opened in the 1860s. The abandoned track is now used partly by road vehicles and other sections are footpaths.[25]

The manufacture of iron was a complex process and the production of an iron pig, a basic product in itself, required an array of skills and activities. From the winning of the raw materials, their transportation

to the places of production, their transformation from coal, iron ore and limestone into iron, the secondary process required to add value by making a range of products, then the moving of those products to the markets required intervention on the landscape of an unparalleled nature.

Alongside that critical path of manufacture were the vital support trades, industries and activities for the supply of foodstuffs, the health and well being (or otherwise) of the communities and the social, political, economic and cultural interaction that was part and parcel of the formation of the first large-scale industrial society in Britain. By the census of 1851 there were more people engaged in or dependent upon industry in Wales than in agriculture and this statistic was largely dependent on the industrial expansion along the northern outcrop.

As the century progressed so industrialisation intensified as iron and steel (after the 1860s) manufacture was firstly supplemented then overtaken by coal mining. Both mainstays of the local economy being supplanted throughout the twentieth century as economic factors changed the nature of industrial production on a world scale.

It is the analysis and investigation of these processes, communities and their changes over two hundred and fifty years that is vital to give us a perspective on the twenty-first-century communities.

MAKING THE CHANGES

The production of iron required many stages and each one of these invoked changes to the landscape. Iron ore and coal were won by shallow open cast excavations, driving levels (sloping tunnels) into the hillsides to reach the narrow upper seams, by sinking shafts or by simply the removal of topsoil often by scouring or hushing[26] involving the sudden release of impounded water to remove the overburden and reveal the deposits close to the surface. This process had been in common use in metalliferrous mining in Wales.

Early forms of mining required hand tools, limited amounts of explosives and horse power. Raising coal from the deeper pits required mechanical application and one of the most favoured along the northern outcrop was the use of the water balance pit. It was a straightforward procedure that could only be operated where there was free drainage in the mine.

The sinking of deeper pits required steam power for access, raising coal and for pumping and ventilation. A rich variety of engines and appliances were used ranging from the most simple single cylinder engines to those of substantial size and efficiency. At Glyn Pits near Pontypool are winding and pumping engines of great rarity and importance. These include a Rotative Beam Engine—a stone plaque set into one wall bears the initials C.H.L (Capel Hanbury Leigh) and the date 1845—and made by the famous Neath Abbey Works. Nearby is an outstanding example of a vertical, flat rope, steam winding engine of a similar date.

It is important to emphasise the importance of the application of steam power to a wide range of industrial processes. In addition to coal mining, steam engines drove blowing engines used to blast air into iron furnaces, they powered rolling mills and as the nineteenth century progressed were increasingly used for surface locomotion on tramroads and railways. A number of companies specialising in the production of steam engines and their repair and maintenance developed across the coal field.[27] One of the best-preserved examples of a spectacular colliery winding engine dating from 1875 is at the Hetty Shaft of the Great Western Colliery[28] in Hopkinstown. Its comparison with the winder at Glyn Pits demonstrates the technological and engineering advances of the intervening thirty years.

By the early decades of the twentieth century electric power was being increasing introduced to mining particularly for winding and operating air compressors. Gradually, but certainly not entirely, the surface

Figure 10

The so-called ‘patches’ evolved as a consequence of the interlocking and overlapping network of opencast excavations and shallow mining for coal and ironstone along the Heads of the Valleys. It was not uncommon for areas of the mineral deposits to be allocated to private individuals or small groups of workers who would contract to supply the local ironworks, thus demonstrating examples of early entrepreneurial mining activity. These relict landscapes were virtually obliterated during the 1970 and 1980s under the massive land reclamation programme. This aerial view taken on 19 October 1992 shows one of the few remaining areas. An intensively worked outcropping coal seam can be seen at the top of the photograph. In some instances the haphazard exploitation of the easily accessible coal and iron deposits resulted in wasteful and short term dumping of waste material over potentially workable deposits.

Figure 11

The Cwmbyrgwm water balance lift (now on display at Big Pit Mining Museum) shown in its original location in 1967. The operation of the lift was straightforward. A full tank of water and empty tram offset the weight of a full tram of coal and empty tank. The rate of descent and ascent was controlled by the brake drum on the large wheel. Standing to the left is William Edmund Jones who photographed mining scenes both above and underground in the Pontypool area in the early decades of the twentieth century. The water balance lift was popular along the Head of the Valleys in the nineteenth century where large quantities of water were readily available and where the topography allowed for free drainage mining. *Courtesy of the Roger Worsley Archive.*

arrangement of the deep mines changed as steam power was replaced. Many of the existing nineteenth-century mine buildings, some chapel-like in appearance, were adapted to accommodate the new machinery. In the large mining operations such as Penallta, owned by the Powell Duffryn Steam Coal Company, massive engine halls were built. The head frame and engine hall of 1906–09 remain although not the machinery. This is an important building as there are few examples of twentieth-century purpose-built coal mining structures left in south-east Wales.

Until the mid nineteenth century most of the coal (with a few notable exceptions) mined in south Wales was used within the iron industry although the ‘sale coal’ trade, as it was known, had been developing from the advent of bulk transportation via the canal system. The ‘mother’ of the coal trade is reputed to be Lucy Thomas who with her husband, Robert, took on the lease in 1824 of Waun Wyllt Colliery near Merthyr Tydfil selling coal to households in Cardiff and Merthyr. It was, however, George Insole who

Figure 12

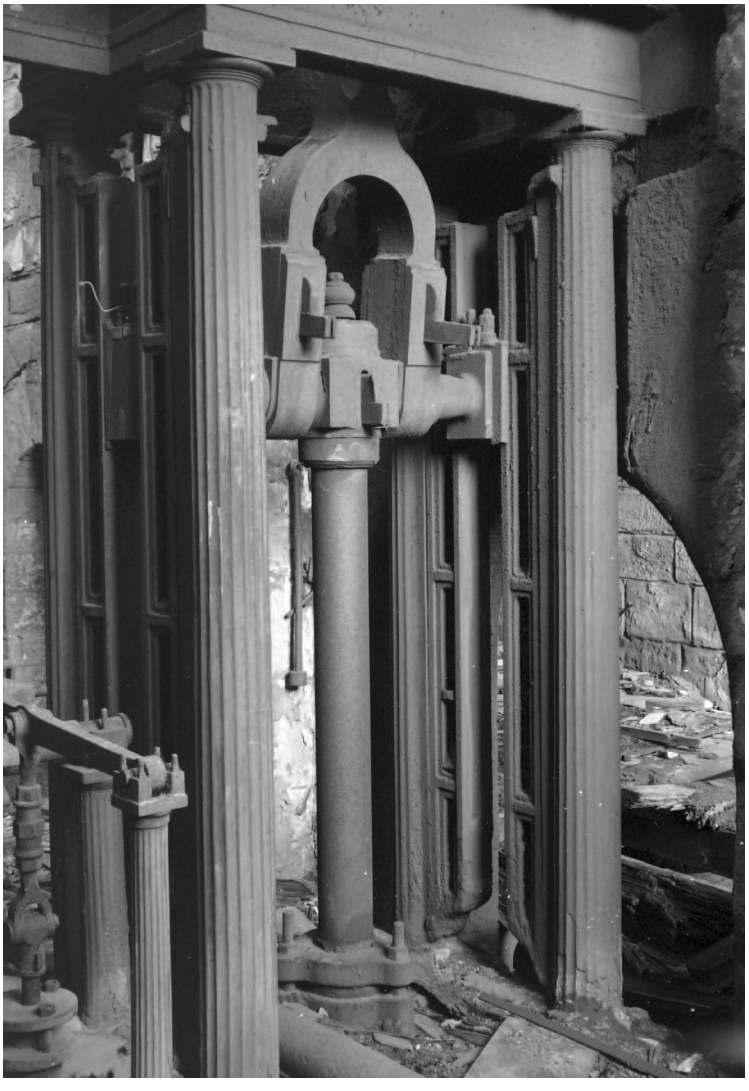
The complex at Glyn Pits near Pontypool is of particular interest and significance in terms of colliery engineering. De-watering and shaft winding was by a beam engine made at the Neath Abbey Ironworks in 1845. It is still *in situ* and is one of the best examples of its type remaining in the south Wales coalfield. Photographed in 1967. *Courtesy of the Roger Worsley Archive.*

realised the potential of the sale coal trade by exporting 3,000 tons of coal to London-based coal merchants in 1831.[29] This was the precursor of a trade that transformed the economic face of south Wales in the second half of the nineteenth century. It is a well acknowledged fact that the emergence of Cardiff as the eventual capital city of Wales was as a consequence of the millions of tons of coal that passed through its docks. The same applied to other ports from Newport in the east to Burry Port in the west.

Even during the heyday of iron manufacture, coal mining was evolving as an industry in its own right and as early as 1818 the Tredegar Iron Company was producing more coal than it required to supply its iron furnaces. By 1823 Newport was the main south Wales coal port handing 256,795 tons, a figure that was to rise to 617,177 tons by 1847.[30] The opening of new docks in Cardiff in 1839 and their connection via the Taff Vale Railway opened along its full length to Merthyr Tydfil in 1841, and then deep into the valleys of the Rhondda in 1856, heralded a period of growth that has seldom been equalled. From a population of some 1,800 in 1800, Cardiff had by the turn of the nineteenth and twentieth centuries a population of about 160,000 and was the most important world trading centre for coal. The first £1 million transaction is reputed to have taken place in the Cardiff Coal Exchange in 1901.

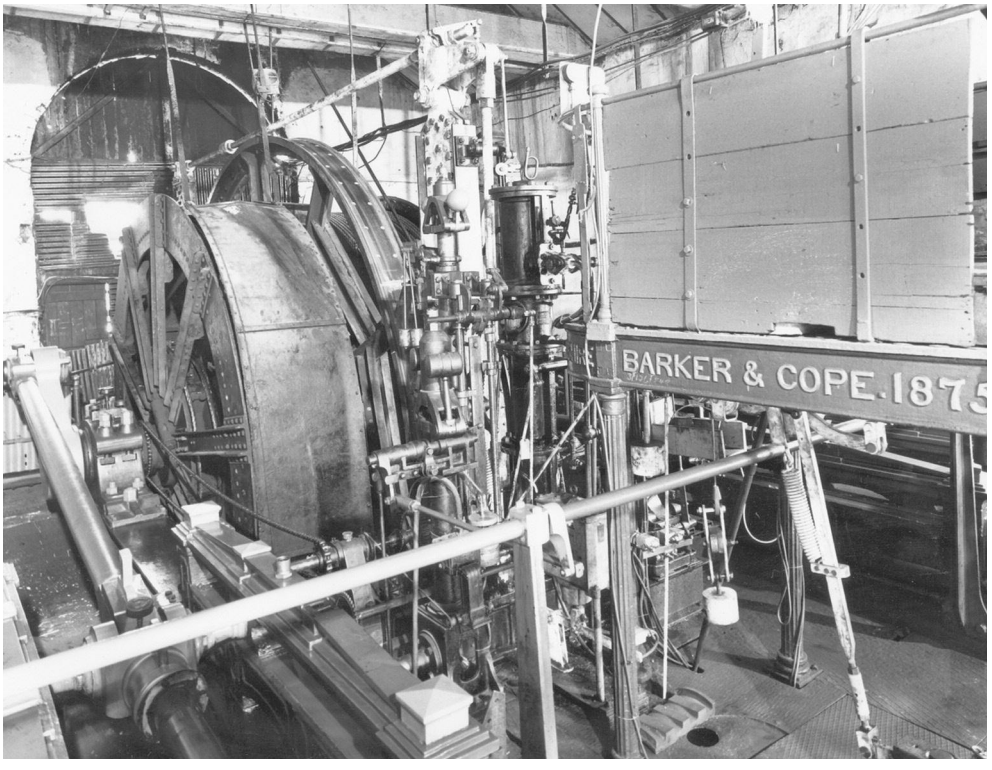
The steam coal industry expanded after the mid nineteenth century. Particularly after a report by De la Beche and Lyon Playfair[31] regarding the ‘dry, smokeless steam coal of the Aberdare Valley’, that

Figure 13



This is a superb example of steam-powered vertical winding engine that drove a flat-rope winding drum. In an interview with W. E. Jones who worked at the Glyn Pits aged fourteen years he recalled how the flat rope was painted white at intervals that marked the various landing levels in the pit shaft. The winding engine man had made two long brass handles that were fixed to the controls so that he could stand in the door way of the engine house watching the flat rope wind and unwind and thus judge when to open the steam valves or apply the brakes. '. . . the Winder wasn't paid by the Company, but he was paid by the men. They used to stop it from their pay to put in the Winder's Fund. Sometimes he would let them down fast or jerky and they'd say 'No money for his fund' so then he would let them down twice as fast next time until they paid up. A kind of blackmail, wasn't it?'. *Courtesy of the Roger Worsley Archive.*

Figure 14



Preserved steam winding engine, built by Barker & Cope of Kidsgrove in England in 1875, at the Hetty Shaft of the former Great Western Colliery at Hopkinstown, near Pontypridd. The small complex is owned by Rhondda Cynon Taff County Borough Council but is being cared for by a group of volunteers. *Courtesy of Pontypridd Town Council.*

influenced and convinced the Admiralty and the Merchant Marine of the superior qualities of south Wales coal. This presaged the beginning of the coal trade evolving as a major industry in its own right.

The Cynon Valley was founded on coal mining and iron-making. In Aberdare are good examples of early nineteenth-century iron furnaces complete with their Blowing Engine House and associated buildings that have been preserved and reused.[32] From the mid nineteenth century coal mining dominated its economy and helped differentiate it from its larger neighbour. Whereas Merthyr was a town dominated by 'English' ironmasters and agents, Aberdare's mining industry was created largely by Welshmen many of whom hailed from the local area. This resulted in subtle changes in the landscape with the early appearance of public buildings and a park born out of a social cohesion between local entrepreneurs and Nonconformist ministers. Conflicting politics in Merthyr Tydfil slowed the appearance of their public buildings although privately endowed structures had made an early appearance and were plentiful. This was to change by the turn of the nineteenth and twentieth centuries with the construction of a number of public buildings including the Town Hall (1897), St Tydfil's Hospital (1853–1900) and the YMCA (1911).[33]

Figure 15

The International Colliery, Blaengarw photographed on 23 November 1954 by the National Coal Board. This photograph perfectly reflects the time and place. Taken less than ten years after nationalisation the colliery dominates the landscape both physically and economically. Adjacent to the upcast and downcast shafts are the winding engine houses, the workshops, the tram circuits and the other surface arrangements of a typical colliery. Rail sidings link to the main line and the ranks of two storied workers' housing occupy the lower slopes of the valley sides. In the middle distance is a pre-industrial farm. The hillsides at the time are free of forestry plantations that were planted to ensure self-sufficiency in timber after the shortages of the First World War. Also of note is the absence of parked cars on the roadsides. *Courtesy of Amgueddfa Cymru / National Museum Wales.*

The mining of coal on a large scale created its own particular type of landscape change as the deeper more productive seams were sought in the middle and southern sections of the coalfield. Besides sloping adits (the term probably dervived from the Latin *aditus* meaning an approach or access) driven into the hillsides, shafts were sunk to reach the deep and productive steam coal seams from collieries that dotted the floors of the valleys. The pits were linked via sidings to the main railway lines.

The physical character of the narrow river valleys constrained building to mainly linear developments following and crossing contours in serried ranks of concentrated housing punctuated by chapels, public

houses, workingmen's institutes, schools and churches. The archetypal coal mining environments are the Rhondda valleys where within the two valleys running more or less northwards from Porth were crammed, at their peak in 1923–24, with a population of 167,000.[34] Rhondda Fawr under ten miles in length and Rhondda Fach below seven saw one of the most intensive and rapid concentrations of immigration and expansion in British history.[35]

Figure 16

Copied from a 35mm colour slide taken in 1979, this image demonstrates the challenges of house building in the narrow confines of the coal mining valleys. To reduce building costs the terrace sweeps and curves down the hillside in a continuous unbroken roof line. In the background is one of the many stone quarries that provided the bulk of the building material. By the last decade of the nineteenth century, bricks were increasingly used for door and window surrounds and, of course, the roofs covered in high quality durable slate from north Wales. These terraces are so commonplace they are often overlooked as being of historic importance yet this example at Pontygwaith in Rhondda provides a vivid illustration of the skills and expertise required to build in the challenging topography of the mining valleys. The undulating contours along the lower slopes were quickly covered with the snaking terraces yet the demand for accommodation was such that rows like this were built against the grain of the land. Some of the early housing in the coal mining valleys was built by the coal owners, most of whom were all too happy to relinquish that duty to private builders as the demand for accommodation increased. There are, however, a few examples remaining built by Building Clubs. The inter-war and post Second World War period saw a substantial increase in local authority house construction. *Photograph: Richard Keen.*

MARKS ON THE LAND

Prior to the massive land reclamation of the 1970s and 1980s a vast area of land alongside the A465 road had been previously excavated and turned over by generations of male and female workers. Now most of these traces have been swept away, although there are occasional reminders in the form of blocked adit entrances and the characteristic 'finger tips' or 'crow's feet' tips of colliery waste. Large areas of landscape were worked by the so-called 'patching' process whereby coal seams close to the surface were exposed by the simple expedient of removing the topsoil.

Often, the organisation of coal and iron stone extraction on the patches and in the shallow mines was carried out by the contractor system whereby an individual would contract with an ironworks company or a coal merchant to delivery a given amount of coal at an agreed price and timescale. Contractors sometimes subcontracted this work to individuals or small groups.

Coal mining and industry in general attracted attention in the nineteenth century after the publication of the 1842 Royal Commission on the Employment of Women and Children under the age of ten in underground coal mining. It took several more decades before the practise finally ended although even as late as 1890s it was still possible for young boys to be employed:

> I started in 1890, I worked January, February and March and the act came into force that you couldn't work underground until you was eleven. Well I wasn't ten. I went back to school for six months, one half day I missed in that six months, I realised that school was easier than working underground … six bob a week and half of that was going in oil to fill your lamp.[36]

The second half of the twentieth century saw the increase in opencast mining along the Heads of the Valleys as the upper measures were reworked using large machinery. Among the best-preserved examples are the so-called 'Canada' tips that form part of the World Heritage Landscape above Blaenafon. They consist of a series of deep trenches that were worked in the 1940s by soldiers from the Canadian army as part of the war effort. They may be the earliest remaining examples of opencast mining in Britain.[37]

Opencast mining is still active in the area and one of the largest and highly controversial sites is Ffos y Fran east of Merthyr Tydfil that has a weekly output of approximately 20,000 tonnes. Elsewhere former open cast sites have been landscaped. The earlier schemes produced large grassed areas that often did not reflect the local environment and in their making removed substantial evidence of former industrial activity.

The fortunate juxtapositioning of massive deposits of limestone along the northern outcrop resulted in intensive quarrying with some of the workings reaching a substantial size. Depending on the deposition of the workable beds, the stone was worked from high vertical faces by the use of hand drills and explosives and exploiting the natural joints and fissures. Stone quarrying was a vital part of the industrialisation process and the abandoned quarries are now important elements in the relict landscapes providing, in some instances, significant habitats for plant, mammal and insect species.

Some of the quarries were extensive and the abandoned workings can be very visible as many of the quarries were opened along the tops of the ridges. Quarrying was a hazardous occupation not so much in terms of industrial accidents but more as a consequence of ailments derived from working in such exposed environments.

Some quarry complexes actually supported their own separate communities such as Cefn Coed, north of Merthyr Tydfil and Trefil above the Sirhowy Valley. The small isolated community of Trefil grew from the end of the eighteenth century and still retains its distinct sense of place derived from its isolation and dependence upon a single industry. It is reputed that one of the natural caves nearby was used for the storage of arms before the ill-fated Chartist March on Newport in 1839.

Figure 17

William Clayton a photographer of Iron Street, Tredegar took a series of images of iron stone and tip workers in the 1860s. If working in the open exposed mines and quarries was not enough then the long hours and hard, brutalising work added to the harshness of the lives of many at the time. Yet in spite of all that, this young woman retains a sense of dignity and femininity in articles of her clothing. The decorative ruff around her neck and her woollen hat, sometimes described as a 'Welsh wig' contrast with her food tin, her water 'jack' and her hands that bear witness to many hours hard labour. The *Bristol Mercury* for 29 April 1865 carries an article describing the women workers as wearing 'a peculiar style of dress, consisting of a short frock and apron, tight to the neck . . . red worsted stockings and lace-up boots heavy with hobnails that would pull the legs off some of the ploughmen of the Midland Counties. The bonnet or hat, for it is difficult to discern to which of the classes this head dress belongs, is bedecked with beads, brooches, and feathers'. *Courtesy of Amgueddfa Cymru / National Museum Wales.*

Figure 18

This is one of the photographs taken by William Edmund Jones (see also Figure 11) in the coal mines around Pontypool in the early decades of the twentieth century. Taken about 1905, a miner is 'holing' the coal at the Plas y Coed level. 'Holing' meant cutting out a strip along the base of the seam to ease the compression before removing the rest of the coal above. These photographs are remarkable because of their technical quality and because they depict with such detail and clarity the working conditions at that time. Their importance is enhanced by the fact that W. E. Jones knew most of the people he caught on his glass plate negatives and slides and was able to supply detailed information about them. For instance, the man in this photograph 'was exactly the same age as my father. My father and him had a fight up here one day . . . about the place and what drams they were having'. A 'place' was the actual section of the coalface allocated to each man. It was common practise for sections of the coalfaces to be allocated to a miner and his 'butty'. The ease with which the coal could be extracted and transported determined how much money could be earned, so the need for a good 'place' was paramount. *Courtesy of the Roger Worsley Archive.*

Figure 19

The massive coal opencast workings at Ffos y Fran to the east of Merthyr Tydfil photographed in June 2009. It is part of a large-scale programme of land reclamation with the by-product of the production of some five million tonnes of good quality steam coal, most of which is, and will be, used for electricity power generation. Work began in 2007 and is due to be completed in 2024. It is one of the largest continuous excavations of it kind in Britain and permission for the project was only granted in the face of sustained opposition by local people and environmental groups. The photograph shows the nature of the upper coal measures of the south Wales coalfield consisting of narrow compressed seams of high quality coal interspaced with rock strata. *Photograph: Richard Keen.*

The Trefil Rail Road was constructed in 1793 to carry limestone from the Trefil Quarries to the ironworks at Beaufort (established 1780) and Ebbw Vale (established 1790). The quarries continued to supply limestone to the Ebbw Vale works throughout the nineteenth and well into the twentieth centuries. In 1908, the Trefil Rail Road was converted into a narrow gauge railway on which two locomotives and hopper wagons brought limestone to the furnaces.[38]

The Bryn Oer Tramroad was constructed between September 1814 and April 1815 to connect the Bryn Oer coal patches and Trefil quarries with the Brecknock and Abergavenny Canal at Talybont on Usk. On the western side of the tramroad on the northern outskirts of Trefil stands a D-shaped mound, aligned east to west and measuring some 15 by 10 metres across and 3 metres high. It was constructed as a surveying point during the construction of the tramroad.[39]

Figure 20

Remains of crushing and grading plant foundations photographed at the Trefil Limestone Quarries in June 2009. The limestone deposits at Trefil were extensively worked after the opening of the Trefil Tramroad in 1793 linking with the Beaufort and Ebbw Vale Ironworks. The Brinore Tramroad that operated between 1815 and 1865 linked the quarries to the Tredegar Ironworks and the Monmouthshire and Brecon canal at Talybont. Sections of the tramroads have been opened as footpaths. *Photograph: Richard Keen.*

Cefn Coed y Cymmer north of Merthyr Tydfil owed its origins as a community of quarry workers and the Gurnos Quarry nearby that served the Cyfarthfa Ironworks is now an SSSI. The tramroad that linked the quarry with the works crosses the river just below the confluence of the Taff Fawr and Taff Fechan via Pontycafnau ('the bridge of troughs'). There is debate about the actual date of the bridge but it is probably either 1792 or 1793.[40] This is the earliest cast iron railway bridge in Wales and is appropriately named as, in addition to carrying an L-shaped plateway, it also carried two watercourses. One, of cast and wrought iron, is still extant and suspended below the plateway. The other was constructed of timber and was carried at a high level above the bridge.

This is a remarkable survivor and of great engineering significance, marking a transitional point in bridge construction in the area. Throughout the construction of the original bridge only wood working joints have been employed including dovetails and ball and socket fixings. The A-frame construction is perfectly adapted to the use of cast iron thrusting the compressive pressure downwards to be supported

Figure 21

A rare photograph showing a horse-drawn plateway still in operation on the tramroad between limestone quarries at Penderyn and Hirwaun. Flangeless wheels run on the L-shaped rails. This method of transportation was widespread across the Heads of the Valleys where it is estimated some one hundred and fifty miles of plateway were in use in the pre standard gauge railway period. Steam power and later diesel was used on the line after 1904. The line was closed in 1984. *Courtesy of Amgueddfa Cymru / National Museum Wales.*

by the substantial masonry abutments.[41] The use of the timber patterns allowed for the production of exact copies of the bridge elsewhere in the Cyfarthfa works.

The limestone workings on the Blorenge above Blaenafon are unusual because of the presence of a shaft cut into the living rock that housed a water balance lift that raised stone from the lower workings to the level of Hill's tramroad.[42] Its feeder reservoir and watercourse leading from Keeper's Pond are still clearly visible on the landscape.

Limestone is still being quarried along the Heads of the Valleys for hardcore, infill material and for the cement industry but on a greatly reduced scale.

The basic manufacture of iron in vertical furnaces remains the same today as in the last quarter of the eighteenth century. Layers of limestone, iron and coke are fed into the furnaces at their tops and smelted by raising the temperature to approximately 1900 degrees centigrade at the base. The heat rising up

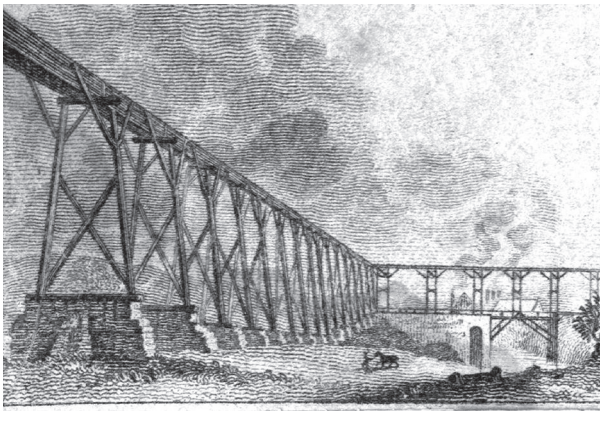
Figure 22

This illustration, copied from a 35mm slide taken in 1978, shows Pontycafnau, (the bridge of troughs) which is located just below the confluence of the Taff Fawr and Taff Fechan, near the remains of the iron furnaces at Cyfarthfa in Merthyr Tydfil. The bridge dates from 1793. It can be claimed that this is the first cast iron bridge built to carry railed transport. The bridge is significant because of its early date and its construction techniques. In the original structure, only woodworking joints have been used relating to the skills and training of its designer Watkin George who was the Chief Engineer at the Cyfarthfa Works at the time. It is the perfect example of cast iron working in compression with the weight and stresses being transferred via its substantial A-frame into the masonry abutments. It was an important link in the tramroad that ran from the Gurnos limestone quarries to the Cyfarthfa ironworks. Below the actual bridge surface is one of the two water troughs that gave the bridge its name. The lower trough carried water from the lake (which is itself fed by an extended and well-engineered water course tapping the Taff Fechan about 1.5 miles north) in Cyfarthfa Castle park. *Photograph: Richard Keen.*

through the furnace liquefies the iron that percolates through the layers of limestone—that acts as a flux—gathering at the lowest point in the furnace in layers of molten iron topped by a layer of molten slag. The slag is tapped off before the molten iron. The difference between the eighteenth century and today is, of course, the scale, capacity, output and technology of iron manufacture.

The product of the iron furnace was pig iron[43] which by reheating and refining was converted into high-quality wrought iron. In the eighteenth century this was carried out by using water-powered tilt hammers later to be supplemented by rolling mills that could produce a wide range of finished products

Figures 23–25



A timber watercourse was supported on and high above the surface of Pontycafnau, shown on the right of the illustration, both of which carried water to the ironworks. The illustration (top) appears on banknotes issued by the Crawshay Company who commissioned Penry Williams in *c*. 1819 to produce views of the works. The notes were issued to help alleviate the short supply of money at the time.

A short distance north of the bridge is an extensive furnace-slag waste tip running alongside the river. The size of some of the trucks used to dump the semi molten slag can be gauged from the dumped blocks (middle).

Immediately adjacent to the bridge is the former hydro-electric generation power house owned by the Merthyr Tydfil Electric Traction & Lighting Company that opened in 1929 and operated until 1955 (bottom). A similar building and replicated cast iron bridge were located a short distance downstream. Only the bridge abutments and the foundations of the weir and generation building remain at the lower site.

Top: *Courtesy of Cyfarthfa Castle Museum & Art Gallery, Merthyr Tydfil.* Middle and bottom: *Photographs: Richard Keen.*

Figure 26

Although the ironworks at Blaenafon was one of the first in south Wales to be dependent solely on steam power, water was vitally important in supplying energy to its ancillary industries including the quarries and a forge. This oblique aerial photograph shows, with great clarity and detail, the watercourses and reservoirs on the Blorenge above Blaenafon. Pwll Ddu quarry in the foreground was served by a water balance lift set into a shaft cut out of the rock (its reservoir is clearly visible along with its feeder that was, in turn, supplied 'Keeper's' pond in the middle distance). Also shown are the routes of the horse-drawn tramroads that linked the quarry with the ironworks (through a long tunnel) and with the forge at Garn-Ddyrys (where another dry reservoir is visible) and ultimately, via a superbly engineered and constructed incline, with the canal basin at Llanfoist. The area around Pwll Ddu is an important part of the World Heritage Landscape.

Figure 27

Side elevation of the bank of iron furnaces at Cyfarthfa in Merthyr Tydfil photographed in June 2009. These are all that remain of what was one of the most important iron-making sites in Britain. Established by 1765, the works came under the control of the Crawshay family in 1783 and for the next fifty years or so was the dominant force along the Heads of the Valleys far outstripping its competitors. It was the combination of entrepreneurial drive, good business practice (at least in the early stages) and location that were the keys to its success. With favourable mineral leases, plentiful supplies of water and close proximity to the raw materials Cyfarthfa was well placed. With the construction of the Glamorganshire canal reaching virtually into the works the major challenge of transportation was eased considerably. The casting houses, rolling mills, puddling furnaces, coke ovens, blowing engines and all the associated buildings and infrastructure required to manufacture iron on a large scale have long since been removed. The furnaces therefore, are very important survivals. In common with what became loosely known as the 'Welsh Method' the furnaces were built against a natural slope that was quarried to provide a vertical face so that the raw materials could be gathered and charged from above. The furnaces were actually built as freestanding structures with the tapping arches (where the molten iron and slag were released) on the left and three blowing chambers (where air was pumped in, via the tuyères ports, at the base of the furnace to raise the temperature) on the other sides. The smaller bricked arch is one of the tuyère ports. The elegant high arch provides access between the furnaces and the rock face through which the air blast mains were passed, and the decorative circular opening provided light and ventilation to a stairway and ancillary chambers. The furnaces were conserved and repaired some years ago but the amount of vegetation visible on the masonry faces demonstrates the need for constant maintenance. *Photograph: Richard Keen.*

including rail and sheets. Further technological advances included the introduction of the puddling furnace.[44] All these technological advances necessitated the construction of large buildings to accommodate the machinery and equipment necessary to add value to the basic product of pig iron. Besides, there were the coking ovens,[45] brickworks, raw materials storage areas,[46] engineering workshops and the other buildings housing the equipment and skills necessary to keep a large-scale integrated ironworks in operation.

Although south-east Wales is well blessed with preserved iron furnaces some complete with casting houses and blowing engine houses there are few examples of secondary iron-working sites. One of the best is Garnddyrys part of the World Heritage Landscape at Blaenafon. Opened in 1817, alongside the route of Thomas Hill's tramroad that linked the ironworks with the Brecknock and Abergavenny canal at Llanfoist, its water-powered hammers and rolling mills were in operation until a new forge was constructed at the appropriately named Forge Side closer to Blaenafon in the 1860s. Forge Side became an integrated works in its own right with iron furnaces, puddling furnaces, forges and mills that were producing up to 500 tons of finished products every week. Alongside, workers' housing in the form of five terraces were imaginatively named 'A', 'B', 'C', 'D' and 'E' rows.[47]

Hill's tramroad, complete with its 2,400 metre long tunnel—the tunnel entrances are still visible—and a spectacular incline dropping sharply down to the canal basin at Llanfoist, exemplifies the importance of the horse-drawn tramroads to the northern outcrop. Most were constructed to serve the industrial canals because the topography precluded the evolution of a linked network of navigable waterways. It can be claimed that the construction of the canals and the tram roads in south Wales from the 1790s onwards were fundamental to the expansion of industry. The main routes were the Glamorganshire Canal from Cardiff to Merthyr Tydfil (opened 1794) with a branch running up the Aberdare Valley (opened 1812), the Monmouthshire Canal from Newport with a branch running up to Crumlin (opened 1799),[48] and the main line to Pontymoile in Pontypool (opened 1799) where it joined with the Brecknock and Abergavenny Canal that linked with Brecon (opened 1812).

Ironmasters and speculators invested in canal building as the narrow boats carrying payloads of up to twenty-five tons transformed bulk transportation. The opening of the Glamorganshire Canal was an event of some significance: 'The canal from Cardiff to Merthir-Tidvil is completed, and a fleet of canal boats have arrived at Cardiff laden with the produce of the iron-works there, to the great joy of the whole town'.[49]

Little remains of the Glamorganshire Canal in the uplands with the exception of a short but dry section alongside Joseph Parry's cottage in Merthyr Tydfil and dry sections near Abercanaid. There is another section to the rear of the site of the Brown Lennox Chain works in Pontypridd. Little remains of the Aberdare Canal as much of its route was taken for road-building.

The Brecknock and Abergavenny Canal is one of the best preserved in Britain and passing largely through the Brecon Beacons National Park it is rich in archaeological evidence including Goytre Wharf[50] and the complex at Llanfoist. This canal is superbly engineered following the contours and along its length there are only six locks, one of which is alongside the Brynich aqueduct.

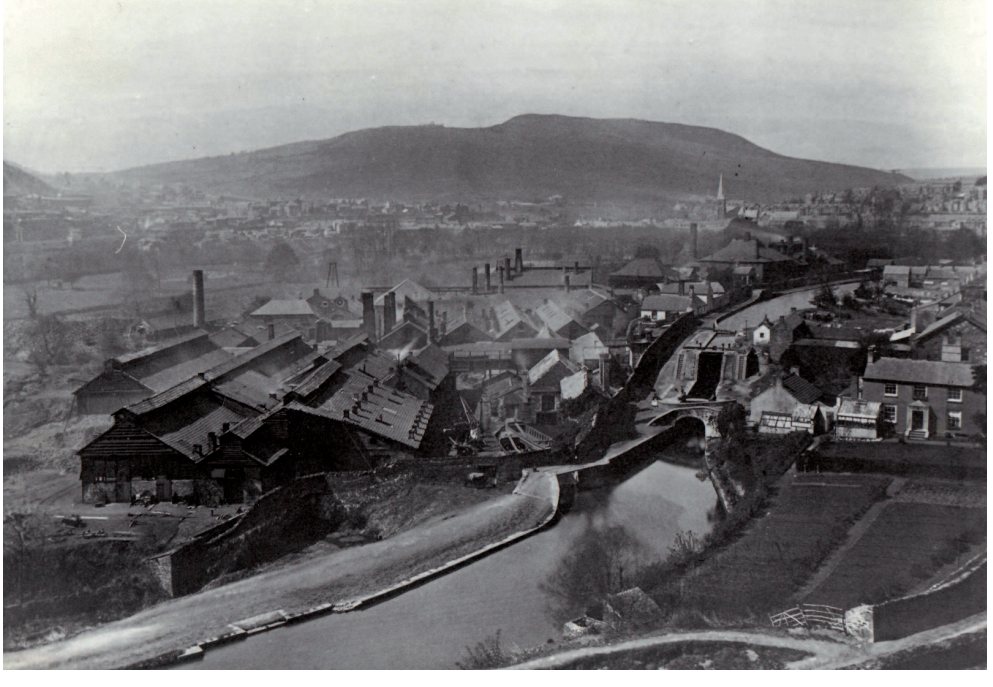
The canal Acts of Parliament made provision for the construction of tramroads and the promoters were quick to take advantage with the result that a network of L-shaped and bars rails mounted on stone sleeper blocks were built to link the industrial processes together and to the canals themselves. The engineering was often of a high standard required to negotiate the difficult topography. In the Rhymney and Sirhowy valleys, independent tramroads linked directly to Newport.

It was along the Merthyr Tramroad opened in 1802, more familiarly known as the Penydarren Tramroad, that ran the first steam locomotive in the world. On 22 February 1804 the Penydarren Works engineer, Richard Trevithick wrote, 'yesterday we proceeded on our journey with the engine; we carry'd ten tons of Iron, five wagons, and 70 men riding on them the whole of the journey. Its about 9 miles which

we perform'd in 4 hours and 5 mints, but we had to cut down some trees and remove some Large rocks out of the road'.[51] The tramroad ran from the works to a canal basin on the Glamorganshire Canal and is accessible along most of its route passing through a tunnel, crossing high arched stone bridges and carried on embankments high above the river. In many places rows of stone sleeper blocks can be seen.

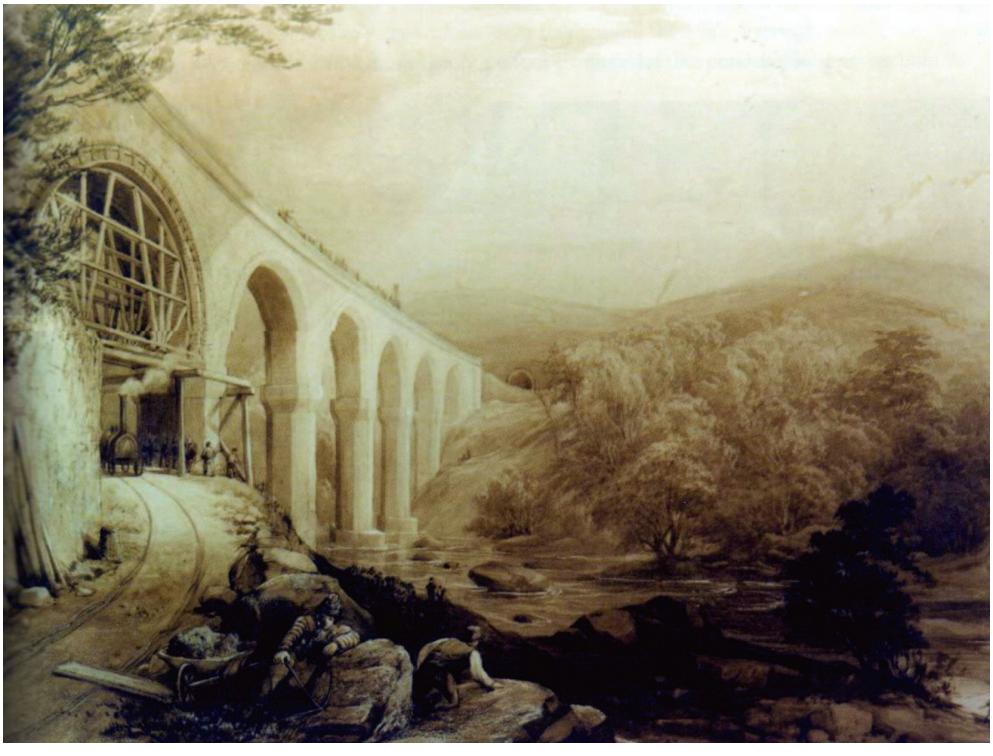
Many of the tramroad routes are open and provide easy, well-engineered access into the upland landscape. Along their lengths can be found limekilns, bridges, cuttings, quarries and mines. Over the past two decades they have become increasing well-used by walkers, a purpose that has improved their preservation and conservation prospects.

Figure 28



The Glamorganshire Canal at Nightingale's Bush to the rear of the Brown Lennox Chain Works in Pontypridd, early twentieth century. The canal, fully opened between Merthyr Tydfil and the sea lock in Cardiff by 1798, was fundamental in accelerating the development of the iron industry. The arrival of narrow boats that could carry payloads of some twenty-five tons was revolutionary compared to the few hundredweights formerly carried by teams of packhorses. In 1830 over two hundred thousand tons of coal and iron products were carried, increasing to nearly six hundred thousand tons by 1851. The Brown Lennox Works, more familiarly known as 'The Chainworks' were opened in 1816 supplying wrought iron chains for maritime use. The iconic photograph of I. K. Brunel shows him standing in front of a 'curtain' of chains made for his *Great Eastern* at the Brown Lennox Works. Canal boats can be seen in a private dock a short distance below the locks. Water was drawn from the canal to drive machinery in the works. *Courtesy of Amgueddfa Cymru / National Museum Wales.*

Figure 29



Attributed to Penry Williams, this wash drawing *c*. 1841 shows the recently constructed Quaker's Yard viaduct spanning the river Taff and the Penydarren Tramroad. The railway viaduct is so new that the scaffolding centring is still in position. The Taff Vale Railway was designed by I. K. Brunel and fully opened to Merthyr Tydfil by 1842. The Penydarren Tramroad was opened in 1802 running for over nine miles from the Penydarren Ironworks to a canal basin on the Glamorganshire Canal at Abercycnon. The tramroad was proposed and financed by some of the ironmasters in Merthyr Tydfil under the terms of the original canal act. It was along this length of tramroad that the first steam locomotive, designed and built by the famous engineer Richard Trevithick, ran on rails on 21 February 1804. *Courtesy of the Ironbridge Gorge Museum Trust, Elton Collection.*

Technological advances in iron manufacture and the advent of steel-making along the Heads of the Valleys heralded changes to the industrial landscapes as works became more integrated producing finished products on single sites. Ebbw Vale epitomises this change as the company acquired the Victoria Ironworks by 1838 and began to introduce steel-making after initial experiments in 1845–55. Under the leadership of Abraham Darby who became the manager in 1861 the works entered the steel age. The company put into blast one of the first Bessemer steel plants in Britain by 1868 and by the same year was reorganised to become the Ebbw Vale, Steel, Iron, and Coal Company with capital of £2,383,000.[52]

Figure 30

The steelworks at Ebbw Vale once occupied (virtually) the whole of the valley floor and this view looking south shows the intense concentration of industrial activity in a very limited space. The main town is to the right climbing up the western slopes, with the site of the early ironworks to the bottom left and the main steel producing plant in the centre. It was the opening of a hot strip mill in the interwar years to ease the massive unemployment in the area that gave Ebbw Vale a much longer life than the other iron and steel making locations along the Heads of the Valleys. That the works were revived after their closure in 1929 was due largely to the efforts of Sir William Firth, Chairman of the Richard Thomas Company. Between 1936 and 1938 the works were remodelled with many of the earlier processes being swept away for the construction of the continuous strip mill built to compete with the successful USA mills. Little now remains in situ at Ebbw Vale with the exception of the works offices that will house the Gwent Record Office scheduled to open in October 2011, and the furnace retaining walls nearby. What does remain, of course, are the buildings and street patterns of the town that include the Literary and Scientific Institute opened in 1853 and the company funded Christ Church completed in 1861. *Courtesy of Amgueddfa Cymru / National Museum*.

The history of steel-making was greatly influenced by the work of two Blaenafon-based chemists, Percy Gilchrist and his cousin Sidney Gilchrist Thomas. Bessemer's new furnaces could not cope with the high phosphorus content of the south Wales iron ores but it was the experiments conducted by Sidney Gilchrist Thomas in producing linings for Bessemer furnaces that would absorb phosphorus that enabled the local ores to be used. This breakthrough was to have a profound effect on steel manufacture throughout the world and the steel magnate, Andrew Carnegie, paid $250,000 for the rights to use the Gilchrist Thomas process in the United States of America.[53]

The Dowlais Ironworks were also very quick off the mark and in 1856 they took out the first licence to use Bessemer's patent and quickly installed converters. This saw the beginning of the end of the puddling process across the northern outcrop and by 1865 the Dowlais Works were rolling steel rails. As the redoubtable Lady Charlotte Guest, widow of Sir John Guest of the Dowlais works, stated, it 'must

Figure 31

Experiments in steel making began at Ebbw Vale in 1854 and by 1868 the first Bessemer Converter was operating. In 1898 there were two Open Hearth furnaces working and the works provided employment for about three thousand people. The works closed in 1929 but were reopened in 1938 with the first Hot Strip Mill outside the USA. During the 1940s and 1950s steel making increased until increasing costs and competition saw the decline begin in 1965 when the output of the Open Hearth Shop was reduced. At approximately 10.30 am on Friday 19 May 1978 'A' furnace was tapped for the last time. This image, copied from a 35mm slide, captures the moment when large-scale steel manufacture came to its conclusion along the northern outcrop. *Courtesy of Amgueddfa Cymru / National Museum Wales.*

revolutionize completely our present system of iron making'.[54] To meet the demand for steel, non-phosphorus ores were imported from northern Spain also bringing immigrants seeking employment. A row of terraced houses in Dowlais, Alphonso Row, is reputedly so named as a consequence of this influx of people.

Steel-making was introduced in most of the larger works but, with the exception of Ebbw Vale, the decades after the end of the First World War saw their decline and closure as the area was plunged in to a prolonged depression that did not really ease until the Second World War. The local iron ore deposits were either worked out or found to be less suitable and therefore the costs of transportation from the coast added extra financial burdens. By 1888 work began on the construction of an integrated works at East Moors in Cardiff and within four years part of the Dowlais operation had been moved there. Even the great Cyfarthfa Works, a name synonymous with iron manufacture for over 150 years, closed in 1910.

It was only through a combination of government intervention and the drive, energy and commitment of Sir William Firth of the Richard Thomas Company that steel manufacture was reborn in Ebbw Vale after 1935. The works were vitally important to the economy of the area but competition from other producers and increasing costs provided constant challenges.

The works closed in July 2002 and where once the floor of the valley was crammed with the paraphernalia of iron and steel manufacture, today all that remains are the former works offices[55] and the furnace retaining walls. The site has been completely cleared and earmarked for other uses.

THE BUILT ENVIRONMENT

What remains in the industrialised valleys are the street layouts and late nineteenth- and early twentieth-century terraced housing. The evolution of the built environment was haphazard to say the least with housing often spreading out from the ironworks in a completely unplanned manner restricted only by the topography and the needs of industrial expansion. Merthyr Tydfil to this day retains its distinct districts directly related to the individual ironworks. As the clusters of housing around a particular works increased in size so they intermingled with the neighbouring communities creating the larger conurbation. Physically, the town may present a single entity yet culturally the boundaries of each particular area prevail.

It was the close confines of the upper reaches of Ebbw Fawr that dictated the development of the town of Ebbw Vale. The Beaufort ironworks established in 1778[56] followed the pattern of other works close to the northern outcrop. In 1790[57] the Ebbw Vale ironworks were established lower down the valley on a narrow site alongside Afon Ebbw. As the works expanded north and south so the housing was pushed further northwards and up the slopes of the hillsides. In 1919 a journalist from *The Times* saw the town as:

> one of the strangest landscapes in these islands. . . . There are two mountains facing one another, and on the skirts of the nearest hangs the town which is named after the valley, with its ironworks below. Across the hollow are terraces of white cottages ruled on the mountainside as with a ruler, and the brown mountain stretches up behind. . . . But how insignificant it all looks on the shoulders of the mountains: there you feel that you could forget the pits, the furnaces, and the heat of the hammers, and lose yourself above.[58]

The narrow confines of the steep-sided Clydach Gorge almost defied all but the most tenacious of builders. Small clusters of terraced houses clinging precariously to the side of the valley were built to

Figure 32

The Ranks, Abercarn from a 35mm slide taken in August 1973. This was complex of four rows completed for a local colliery by 1850. The houses were simple in plan with two rooms up and down. They were quite advanced in terms of public health in the mid nineteenth century but by the time this photograph was taken the lower of the rows had already been demolished and the others followed quickly. The small lean-to extensions were mainly used for coal storage and an appropriate place to hang the galvanised bath tub. *Photograph: Richard Keen.*

serve the local ironworks, quarries and mines. This is an important area in which to gain an understanding of the scattered, somewhat isolated, nature of early industrial development as the valley never developed into a larger conurbation.

Not all housing developments were haphazard. The centre of Tredegar, taking its name from the grand house near Newport the home of the Morgan family who owned land at the head of the Sirhowy Valley, is unusual when compared with its counterparts along the northern outcrop. There is a definite feeling of

formality in the town centre with the focus placed upon its famous clock tower dated 1858 (although it was not completed until the following year). From the clock tower the roads run in four directions and each one had its own point of perspective—a chapel, a theatre, iron furnaces and parkland. Bedwellty House and park, once the home of the ironmaster, is undergoing conservation, repair and refurbishment.[59] The development of the upper reaches of the Sirhowy Valley began with housing built close to the ironworks,[60] followed by Beaufort and Tredegar then spreading down the valley as coal mining increased in the second half of the nineteenth century. The remote communities of Troedyrhiw and the, appropriately named, Bedwellty Pits remain as examples of small-scale, isolated industrial development.

Figure 33

The workingmen's institute along with the Nonconformist chapel probably represent the two most important pillars of south Wales industrialised society in the first half of the twentieth century. Within the institutes could be found extensive libraries, a wide selection of daily newspapers, educational classes and a range of leisure activities including the ubiquitous snooker and billiards rooms. The Llanhilleth Institute is both physically and culturally important in the local community. Between the World Wars, the cultural significance of the institute in society began to outweigh that of the chapel. The double storey extension on the façade at Llanhilleth was built to house cinema projectors. This is a copy from a 35mm slide taken in August 1975. *Photograph: Richard Keen.*

The majority of housing development across the Heads of the Valleys was mainly speculative in nature with limited company housing and a few examples of self-terminating building societies. Many of the houses were built on very short leaseholds sometimes as little as twenty-one years. The overriding character of the early building was the use of locally available building materials with limestone along the northern outcrop intermingling with Pennant stone into the coal measures. The increase in the number of local brickworks and the improvements in transportation saw an increasing use of standard sized bricks for chimneys, door and window openings.

There were exceptions and one of the best preserved examples of company housing is Bute Town[61] at the head of the Rhymney Valley. The houses were built between 1825 and 1830 to serve the local ironworks and are distinctly Palladian in appearance with two-storey houses flanking three storey central 'barrack' blocks for single men, and a schoolroom.

Elsewhere, in the iron towns development was at best unplanned and at worst chaotic as often the demand for accommodation vastly outstripped supply, with the concomitant overcrowding and inevitable disease. There was little provision of fresh water or for the disposal of sewage and street paving or lighting were unknown in some places until the first quarter of the twentieth century.

The dominant features of the coal mining valley communities are the lines of two-storey terraces punctuated by the chapels of varying denomination rising above them. An archetypal example is Marine Street in Cwm, south of Ebbw Vale. Built for the workforce of Marine Colliery in the late nineteenth century it is one of the longest and straightest lengths of terraced housing in south Wales.

The Nonconformist communities were quick to respond the industrialisation and often the sinking of a pit was rapidly followed by the opening of a chapel. As the second half of the nineteenth century progressed, so the chapel architecture became increasingly flamboyant. The Anglican Church was slower to respond to the needs of the population and with a few exceptions[62] churches did not become widespread within the actual industrial landscapes until the last decades of the century. The hill-top parish church[63] continued in use, albeit that its rural community had often become subsumed by industry. Sadly many of the places of chapel worship have been abandoned, demolished or changed use.

This applies to other physical manifestations in the cultural landscape as over the past three or four decades many of the workingmen's institutes have disappeared. Fortunately some have survived and two outstanding ones remain at Llanhilleth and Blaenafon.[64] Along with chapels, the institutes exemplified the self-help nature of the industrialised society as both were usually locally financed and sustained.

Comparisons are often made between the lifestyles of the workforce and those of the ironmasters and coal owners and their families. This is clearly evident in Merthyr Tydfil where the castellated Cyfarthfa Castle[65] overlooks the site of the Cyfarthfa Ironworks and workers' housing. Designed by Richard Lugar and costing £30,000 it was completed in 1825.[66]

Historic buildings in Merthyr Tydfil have had a chequered history and some are certainly at risk. Those that remain are important reminders of the status of the town between the 1880s and the First World War. Both the former Town Hall (1897) and the dominant YMCA (1911) are currently abandoned and in disrepair and a number of the chapels have been closed and are empty. Fortunately, the very fine Dowlais Stables (1820) survive and have been converted into housing.

Merthyr Tydfil deserves a special mention because of its fascinating and sometimes tormented history. So much of the human experience of the industrialisation in south Wales can be deduced from its landscape.

Given the sustained criticism of conditions in the town from the mid nineteenth century onwards it may not be surprising that very few examples of early housing exist as they were swept away during clearance schemes. Williamstown and Chapel Row, Georgetown are among the best remaining examples. Number four Chapel Row was the birthplace of the composer Dr Joseph Parry and has been refurnished in the style of the 1840s.

Figure 34

Cyfarthfa Castle, Merthyr Tydfil, photographed in September 2010. Designed by Richard Lugar the castle was completed as the Crawshay family home by 1825. It occupies a dominant position overlooking the site of the Cyfarthfa Ironworks and part of the town. The eastern section of the building houses the Cyfarthfa Castle Museum and Art Galley where the history of the town and surrounding area is told. The County Borough of Merthyr Tydfil was created in 1908 and by the following year they had purchased the building and one hundred and fifty eight acres of grounds for £22,000 from W. T. Crawshay. By 13 January 1913 part of the building had been converted and opened as the first free secondary education school in Wales. It has been used as a school continuously since then. The parkland was also opened to the public in the same year. A main feature of the landscaped grounds is a large lake that was both ornamental and practical in that it acted as a header pond for the ironworks. Both the castle and the grounds continue to be of great significance to the local community and are very well used. When William Crawshay II put forward his proposals for the construction of the castle it became the subject of a bitter dispute between himself and his father. The latter complaining that it was a waste of money that could be better spent on increasing output from the works. The budget for the castle was limited to £30,000. The building itself covers almost an acre and there are fifteen towers and along with the stables and outhouses once had seventy-two rooms. The parkland was renowned for its landscaping and production of home-grown fruits including pineapples and grapes. Probably the best known occupant of Cyfarthfa Castle was Robert Thompson Crawshay (1817–79) who is buried in Vaynor Churchyard under a slab of stone weighing ten tons and bearing the inscription 'God Forgive Me'. *Photograph: Richard Keen.*

Figure 35

Taken by Robert Thompson Crawshay from the forecourt of Cyfarthfa Castle, this image demonstrates the close physical relationship between the ironmaster's house and the actual works. In the foreground is the lake that was both ornamental and practical as it acted as a feeder to the ironworks. The twin gatehouses were demolished sometime in the 1950s. Pandy Farm, complete with haystacks, is partly hidden behind the trees. The lack of smoke, steam and general activity may indicate that the photograph was taken sometime between 1874 and 1879 when the works were closed initially due to a strike, followed by an extended lock-out. The bank of furnaces (still extant) can be seen on the far right. Immediately in front of these can be seen the casting houses. Then, covering the flat area either side of the river are the rolling mills, machine shops, engine house and all the other buildings necessary to manufacture iron on a large scale. With the exception of the actual furnaces all the other buildings have been removed. The works were established in 1765 and benefited from a very favourable lease of over four thousand acres. During the first half of the nineteenth century they were one of the most important works in Britain although, in common with other ironworks, were to experience much more difficult times from the last quarter of the century as competition and lack of diversification saw iron and steel manufacture decline along the Heads of the Valleys. Except for a brief revival during the First World War the works had effectively closed by 1910. *Courtesy of Merthyr Tydfil County Borough Council.*

There are many references to the social conditions that prevailed. *The Morning Chronicle* in April 1850[67] reported on Pont Storehouse in Merthyr Tydfil:

> The houses are mere huts of stone – low, confined, ill lighted, and unventilated; they are built without pretension to regularity and form a maze of courts and tortuous lanes, hardly passable in many places, for house refuse, rubbish and filth. In some parts they are considerably below the level of the road, and the descent is by ladders. . . . Thieves, prostitutes, vagrants, the idle, the reckless and the dissolute, here live in miserable companionship.

Figure 36

Living conditions in some of the towns could be appalling and there are many reports and references to small, overcrowded houses and the lack of any kind of planning, adequate sewage disposal and fresh water supplies. Photographed in Georgetown, Merthyr Tydfil shortly before their demolition in 1976 are these examples of 'court' housing where dwellings have been built in the limited spaces between two terraces. One of the courts can be just seen through the passageway. The 'Good Words' Commissioner wrote in his article *Toiling and Moiling* published in 1869 that some of the houses in the town were 'satirically built on a rubbish heap: but the streets are narrow and winding, dark and dirty. A great many of the houses are mere cottages, with slovenly rough-walled gardens raised above the road, or sunk below the road; and some of them in the side lanes poke their noses, so to speak, into one another's faces as intrusively as the hovel as any London court'. Georgetown was named after the younger son of William Crawshay II. *Photograph: Richard Keen.*

The social and political history of the northern outcrop can be interpreted through some of its buildings and landscapes and an important example is Round House Farm at Nantyglo. There can be little doubt that this site is one of the most important of its kind in Britain. Archaeological recording work[68] undertaken by the Clwyd-Powys Archaeological Trust has shed more light on the evolution of the complex that consists of two defended circular towers (one is more or less complete although in poor condition, the other partly demolished), a much-altered farm house and a number of farm buildings including one range with cast iron floor support pillars and cast and wrought iron roofing trusses.[69] This was both a defensive complex dating from post 1813 doubtlessly built as a response to the turbulence of the times and as the home farm for the nearby Nantyglo House and providing stabling for the ironworks and local coal levels.[70]

In terms of twentieth-century social and political landscape statements the massive Gurnos housing estate in Merthyr Tydfil is among the most potent. Built from the 1950s onwards it is now reputed to be one of the largest housing estates in Europe. The site was chosen because it was one of the few areas within the borough that had not been previously worked for industrial purposes.

The open hill-tops and countryside could provide a welcome respite from the intensity of industry and life in the valleys and have long been used for leisure activities. The Waun Fair held on open land above Dowlais was once famous for its horse sales and Waun y Pound[71] between Tredegar and Ebbw Vale was an important meeting point between the Sirhowy and Ebbw valleys. The past two decades has seen the increasing recognition of the upland ridges for walking and hiking and a number of routes have been designated.

Set on top of the mountain above Tredegar is Cefn Golau ('the ridge of light')—a perhaps ironic name as here can be found a melancholy reminder of the social conditions that prevailed in the nineteenth-century northern outcrop towns. In common with other parts of Britain the iron towns were swept by cholera in the nineteenth century. The outbreak in 1849 was especially virulent. Described as the poor man's disease[72] it was prevalent in places where poor sanitation and polluted water supplies prevailed. Once the disease struck and took hold a painful demise could happen within a short time. One of the gravestones at Cefn Golau recording the death on 18 August 1849 of Thomas James, a Roll Turner of Tredegar, aged 20 years bears a telling verse.[73] The burial area has recently been fenced, providing some protection although many of the gravestones are now in a very poor condition.

Given the conditions in the iron making communities it is not surprising that cholera should have had such a potent effect. Dr Samuel Holland described a typical scene in Merthyr Tydfil in 1853:

> I can hardly expect credence for such facts as the following yet it is perfectly free from exaggeration. I saw a young woman filling her pitcher from a little stream of water gushing from a cinder heap the surface of which was so thickly studded with alvine deposits that it was difficult to pass without treading on them, in some of which I saw intestinal worms, and the rain then falling was washing the feculant matter into the water which the girl was filling into her pitcher, no doubt for domestic use.[74]

Harnessing of water sources was vital for the function of the industries and the towns, and there is plenty of evidence across the area of a long history of pond, reservoirs and water supply systems. An assessment of the Ebbw Vale Drainage System[75] identified eight reservoirs in a small area to the north of the town. The construction, from the mid nineteenth century onwards, of the Taff Fawr and Taff Fechan reservoirs and their pipe work linkages were enormously beneficial in offsetting the public health problems of Merthyr Tydfil. Their importance continues and they have become significant landscape and leisure features along with their surrounding conifer plantations that were planted to exclude livestock and tree leaf pollution in the water catchments.

Figure 37

The cholera burial ground at Cefn Golau above Tredegar is a poignant reminder of social conditions that existed in the iron towns of south Wales in the nineteenth century. Most of the burials took place during August and September 1849. Many of the grave-marker inscriptions are in both English and Welsh, an indication of the dual use of the two languages in the locality at the time. The remote location was chosen because of the deep concern about the possible transmission of the disease. A circular was issued stating that all graveyards should be 'closed against those who died from cholera'. Such was the stigma associated with the disease that some of the burials took place at night. Burial regulations elsewhere noted that 'Those who died of this disease should be buried as soon as possible, wrapped in cotton or linen cloth saturated with pitch, or coal tar, and be carried to the grave by the fewest possible number of persons. The funeral service to be performed in the open air'. Another reason perhaps why the mountain top above Tredegar was selected. *Photograph: Richard Keen.*

Born out of the need for self-sufficiency in timber production after the First World War large blocks of the upland zones were planted with conifers; largely spruce, larch and pine. This has had a material visual effect on the landscape and large areas of once open countryside have been restricted to public access. However, the Forestry Commission has been proactive in providing access to many woodland areas including the opening of Cwmcarn Forest Drive in 1972. This was one of the first of its kind and has proved very popular. With the opening of mountain bike trail it now attracts some 100,000 visitors each year.

Figure 38

One of the most potent images of iron-making along the Heads of The Valleys, the view of the Nantyglo Ironworks *c.* 1830 is a powerful representation of the both the physical and psychological impact of industrialisation. Little remains (with the exception of a few houses) of the structures and buildings shown in the painting. However, the illustration is a powerful reminder of the conflict between man and nature and in this instance, the battle at that time had been won. In this remarkable painting, the sun is almost obliterated by pall of smoke and fumes turning day into virtual night and the lonely figures seem to be waiting for a dreadful event to take place. In the minds of some contemporary commentators, it already had. *Courtesy of Amgueddfa Cymru / National Museum of Wales.*

We are particularly fortunate that the area has attracted the attention of visitors over the past 250 years and their written and visual images have provided a body of information on the landscape and cultural changes. The responses of the artists to industrialisation produced powerful images that were to influence perceptions of the area for generations. Some of the paintings show all too clearly the impact of industrialisation. One of the most famous depicts the Nantyglo Ironworks about 1830 showing a landscape where the battle between nature and industry was under way. Smoke and fume almost obliterate the sun and the once clear river is little more than an open sewer.

The psychological impact of the industrialisation process in south-east Wales and our inherited responses to it and its aftermath has affected the way the historic landscape has been treated in the second half of the twentieth century. From a time when the remains were simply abandoned and the area provided

rich pickings for exploration, to a period when former industrial buildings and landscapes were swept away under the zealous bulldozer blade.

It was a privilege to have had the opportunity to visit so many places and speak to people who had first-hand experience of industry. The times spent with former miners and steelworkers and their families who so vividly recalled their 'industrial' lives were memorable and precious.

Reflecting on the past forty years there has been a remarkable change in attitude toward the remains of industrialisation. It is fair to say that there were times when the slightest whisper of preservation was received with both official and private hostility, including a meeting in Blaenafon in the early 1970s when the demolition and reclamation of the ironworks site was actively discussed. There were other occasions when the descriptions 'an enemy of progress' or the 'preserver of symbols of working class subjection' were also applied.

So much was lost during that period, some rightly so as the sites and landscapes were required for other more socially and economic viable uses. However, there were occasions when the fight to retain some important places was lost due to ignorance and a lack of concern—the Dunlop Semtex factory at Brynmawr was one of the extreme examples and there are still places that require attention. But slowly over the intervening decades the work of enthusiastic groups and individuals began to be noticed, especially when the outcomes of their commitment and enthusiasm began to seen as having potential economic benefit. It was also helped, I think, by a combination of dogged perseverance along with a sustained commitment towards raising public awareness of the importance of industrialisation as reflecting the history of the greater part of the population of Wales over the past two hundred and fifty years. Placing those physical manifestations within their local and wider cultural landscapes has been crucial.

On a personal note it was gratifying and exciting in the mid 1980s when my proposal to put forward the area in and around Blaenafon as a potential World Heritage Landscape was met so positively and enthusiastically by the then Chief Executive and some of the elected members of Torfaen County Borough Council. A moment, perhaps, when industrial heritage came of age.

Today our industrial landscapes have earned conservation status and standards of protection that seemed impossible to achieve in the 1960s and 1970s. Perhaps the present understanding is only fitting as, arguably, the process of industrialisation had the most profound effect on the society of Wales. This is especially true of the Heads of the Valleys.

ACKNOWLEDGEMENTS

My thanks to everyone who has been so helpful in the production of this article including Peter Wakelin, Toby Driver, Frances Foster and Penny Icke at the RCAHMW; Robert Prothero Jones, Carolyn Cheadle, Bethan Jones, Meinwen Ruddock-Jones and Kay Kays at National Museum Wales; Brian Davies, Pontypridd Town Museum, John Powell, Ironbridge Gorge Museum Trust; Angela John; Scott Reid, Cyfarthfa Castle Museum & Art Gallery, Merthyr Tydfil, and finally Frances Lynch Llewelyn.

NOTES

1. Alexander Cordell, *Rape of the Fair Country. A Novel* (London: Victor Gollancz, 1959).
2. Gwyn A. Williams, *The Merthyr Rising* (London: Croom Helm, 1978), 16.
3. D. Morgan Rees, *Mines, Mills And Furnaces* (London, 1968), 74–6.

4. The Act was specifically designed to assist areas of high unemployment—South Wales, Scotland, North East and North West England—by providing investment funds for new projects. The Ebbw Vale steelworks is another example.
5. The demolition of the complex in 2001 (with the exception of the Boiler House that still stands but in a dilapidated condition) that was described by many as an architectural and industrial relations masterpiece has been regarded as one of the greatest losses to the twentieth-century built heritage of Wales.
6. Under the creative guidance of Paul Matt, the 'Brynmawr Experiment' began producing simply-made furniture, providing employment for twelve untrained men and school leavers. The factory operated until 1940. The Brynmawr Museum run by the Brynmawr and District Museum Society has a good collection of the furniture.
7. One of the notable exceptions was the Sirhowy Railway opened in 1805 linking Tredegar to the quay at Pilgwenlly, Newport. Originally horse-drawn, in 1829 the Tredegar Iron Company began using steam locomotion on the line. The line was converted to standard gauge starting in 1863 and became the Sirhowy Railway Company in 1865.
8. Another of the engineering masterpieces of the Newport, Hereford and Abergavenny Railway was the massive Crumlin viaduct. Built of cast and wrought iron and completed in 1857 it was 1,700 feet long and 200 feet high. The wrought iron was supplied by the Blaenafon Works. It was demolished in 1966 although the substantial stone abutments remain.
9. Pontypridd bridge was finally constructed by a local stonemason, William Edwards, in 1755 after three failed attempts. For some seventy-five years it was the longest stone span in Europe. There are many contemporary visual and written descriptions of the bridge. Another fine example of a high-arch stone bridge remains at Pontygwaith north of Quaker's Yard. A bridge was recorded here in the 1540s but the present structure dates from 1811. A short distance away is the site of a charcoal burning iron furnace.
10. G. A. Phillips, 'Mid Glamorgan Inter Valley Roads Scheme', paper presented to the South Wales Division of the Institution of Municipal and County Engineers, Cardiff, 9 July 1927, p. 4.
11. A number of Country Parks have been created on former industrial sites and are now important in the cultural life of the communities. Examples are the Dare Valley Country Park and Bryn Bach north of Tredegar. The making of such places has required massive and large-scale landscape reformation. Sultan the Pit Pony is an example. A 200 metre long sculpture at Penallta Parc near Bargoed created out of colliery waste is now celebrated as being one of the most recorded 'hits' on Google Earth. The creation of public parks within the townships is not new. In the 1920s and 1930s a number of parks and leisure facilities were created by both local and other volunteers. Among the most notable were the facilites provided at Brynmawr by a group of international volunteers.
12. F. J. North, *Coal and the Coalfields in Wales* (Cardiff: National Museum of Wales, 1931), 173.
13. G. Humphrys (ed.), *Geographical Excursions from Swansea. Volume 2: Human Landscapes* (Swansea: Department of Geography, University of Wales Swansea, 1991), 121.
14. J. Gross, *Merthyr Tydfil: A Valley Community* (Cowbridge: The Merthyr Teachers Centre Group and D. Brown & Sons, 1981), 394.
15. Francis D. Klingender, *Art and the Industrial Revolution* (London: Paladin, 1975), 116.
16. Richard Keen, 'Horrid and curious: art and early industrialisation in Wales', *Apollo Magazine* (London, 1993), 240–3.
17. Richard Hayman, *Working Iron in Merthyr Tydfil* (Merthyr Tydfil, n.d.), 3.
18. Quoted by Paul Jenkins, *'Twenty by Fourteen'. A history of the south Wales Tinplate Industry, 1700–1961* (Llandysul: Gomer, 1995), 24.

19. D. Morgan Rees, *Mines, Mills and Furnaces* (London: HMSO, 1969), 54–5.
20. T. S. Aston, *Iron and Steel in the Industrial Revolution* (Manchester: Manchester University Press, 1963, 3rd edn), 22.
21. Roofed structures immediately alongside and usually connected to the furnace towers where the raw materials were stored and weighed before being tipped (or charged) into the open tops of the furnaces.
22. It is likely that the term is derived from Old French for pipe or it may also be of Germanic origin. With the introduction of hot blast furnaces, the tuyères were water-cooled and very good examples can be seen at the Cyfarthfa and Blaenafon ironworks.
23. These include those in their original locations at Bigsweir and Chepstow bridges; Brutes' Row, Blaenafon; Pontycafnau, Merthyr Tydfil; Robertstown, Aberdare; Trehearne Terrace, Maesteg.
24. See www.blaenau-gwent.gov.uk/leisure/8027.asp
25. Information on the Clydach Gorge has been largely derived from John van Laun's, *The Clydach Gorge* (Brecon Beacons National Park, 2008, 3rd edn). This excellent booklet is superbly illustrated by Michael Blackmore.
26. Pen-fford-goch, to the north of Blaenafon, a Scheduled Ancient Monument covering some 40 hectares is now probably the best example of a preserved area of land where evidence of coal and iron mining covering a period of over one hundred and fifty years is clearly visible. The hushing and scouring method of mining was largely abandoned in the locality after 1817.
27. These included Llywellyn & Cubitt in Pentre, Rhondda, and Uskside Engineering in Newport.
28. Cambrian Archaeological Association, 'Programme Notes 156th Summer Meeting' (2009), 23.
29. J. H. Morris and L. J. Williams, *The South Wales Coal Industry, 1841–1875* (Cardiff: University of Wales Press, 1958), 19.
30. Ray Lawrence, *The South Wales Coalfield Directory* 2 vols (Blackwood, 1998), 57.
31. Ibid. 68.
32. The Cynon Valley Museum and Art Gallery are housed in a former wagon repair shop that was built on the site of the Gadlys Ironworks casting houses. To the rear is a bank of four furnaces. The works were opened in 1827 and operated for the next forty-nine years. A blowing engine house of 1857 has been converted into offices.
33. For information on buildings in Merthyr Tydfil see John Newman's, *The Buildings of Wales: Glamorgan* (Penguin Books/University of Wales Press, 1995), 434–8.
34. Malcolm J. Fisk, *Housing in the Rhondda 1800–1940* (Cardiff: Merton Priory Press, 1996), 8.
35. E. D. Lewis, *The Rhondda Valleys* (London: Pheonix House, 1963), 228–42.
36. William Harries, Bargoed, interviewed by Richard Keen in April 1970 when he was ninety-one years of age.
37. *Blaenavon Industrial Landscape: Nomination Document of inclusion in the World Heritage List* (Torfaen County Borough Council, Cadw: Welsh Historic Monuments, RCAHMW, 1999).
38. Arthur Gray Jones, *A History of Ebbw Vale* (Risca, 1971), 185.
39. See www.blaenau-gwent.gov.uk/leisure/8027.asp
40. W. L. Davies, *Bridges of Merthyr Tydfil* (Glamorgan Record Office and Merthyr Tydfil Heritage Trust, 1992), 85.
41. Cambrian Archaeological Association, 'Programme Notes 156th Summer Meeting' (2009), 8.
42. Described in greater detail in Cambrian Archaeological Association, 'Programme Notes 156th Summer Meeting' (2009), 14.

43. So-called because the molten iron flowing from the furnace was conducted into a central trough in the casting floor then conducted into smaller side troughs similar to a line of piglets lined against the sow.
44. The process was patented by Henry Cort in 1784 whereby iron could be heated for reworking without coming into direct contact with coal thus preventing sulphur from contaminating the iron. This was highly skilled work and puddlers were considered to be among the elite of the workforce.
45. Two rows of 'beehive' coking ovens have been preserved at Tondu Ironworks near Bridgend close to a bank of calcining kilns.
46. Recent excavation and clearance work (August 2009) at Blaenafon Ironworks has revealed the final charges of limestone and coke adjacent to the calcining kilns located above the furnaces.
47. Op. cit. (note 37), 40.
48. A series of fourteen locks were built near Rogerstone. These have been preserved and opened to visitors.
49. Charles Hadfield, *Canals Of South Wales and the Border* (Cardiff: University of Wales Press, 1960), 94.
50. Described in greater detail in Cambrian Archaeological Association, 'Programme Notes 156th Summer Meeting' (2009), 5.
51. Stuart Owen-Jones, *The Penydarren Locomotive* (Cardiff: National Museum of Wales, Cardiff, 1981), 9.
52. Jones op. cit. (note 38), 83.
53. A plaque at the Blaenafon Ironworks commemorates this achievement and Carnegie wrote that 'These two young men, Thomas and Gilchrist of Blaenavon, did more for Britain's greatness than all the Kings and Queens put together. Moses struck the rock and brought forth water. They struck the useless phosphoric ore and transformed it into steel'.
54. A. V. John and R. Guest, *Lady Charlotte Guest: An Extraordinary Life* (Stroud: Tempus Publishing, 2007), 195.
55. Newman op. cit. (note 33), 223. The offices will house a family history and visitor centre and the Gwent Record Office will eventually be accommodated as well.
56. Jones op. cit. (note 38), 37.
57. Ibid., 41.
58. Quoted in ibid., 9.
59. In Bedwellty Park is a testament to the skills of a local mid nineteenth-century coal miner. A single block of coal weighing 16 tons that was excavated and destined for the 1851 exhibition in the Crystal Palace. It never got there as it proved too large to transport by railway.
60. The Sirhowy Ironworks are preserved and consist of the remains of an impressive charging bank and the bases of several furnaces. The works were established in 1778, iron making ceased on site in 1883.
61. Jeremy Lowe, *Welsh Industrial Workers Housing 1775–1875* (Cardiff: National Museum of Wales, 1985), 40. There are other examples of early housing including Forge Row at Cwmafon below Blaenafon built in 1804 and the terrace of houses from Rhyd y Car now preserved in the National History Museum at St Fagan's. Industrial housing at Stack Square at the Blaenafon Ironworks dating from as early as 1778 have been refurnished along with a recreated Truck Shop.
62. An example is Christ Church, Ebbw Vale. Built for the Ebbw Vale Company in 1861 its position on a steep hillside and its size and scale can be interpreted as a reaction against the intensive chapel development. A generalisation perhaps but nonconformity tended to predominate in the

work force and their families with the owners and middling classes attending the Anglican Church.

63. St Sannan's Church, Bedwellty is a good example. See Madeline Gray, Cambrian Archaeological Association, 'Programme Notes 156th Summer Meeting' (2009), 17.
64. The Llanhilleth Colliery Workmen's Institute dating from about 1900 with it highly decorative façade dominates the surrounding environment. The Blaenafon Workmen's Institute is equally, if not more, dominating. It was completed in 1894. Both are good examples of the community confidence of the time and both are continuing to function successfully serving their local communities.
65. See Cambrian Archaeological Association, 'Programme Notes 156th Summer Meeting' (2009), 9.
66. Ibid.
67. Quoted in Harold Carter and Sandra Wheatley's, *Merthyr Tydfil in 1851* (Cardiff: University of Wales Press, 1982), 30.
68. Nigel Jones, 'Round House Farm'*, Archaeology in Wales* 45 (2005), 188.
69. Of particular interest are early examples of hand cut roofing slates on the main barn.
70. Tram road stone sleeper blocks are visible in places in the farmyard and a now shallow depression close to the main entrance was reputed to be used as a pond (nicknamed the 'Greasy Foot Pond') for washing clay and other dirt from pit horses.
71. At Waun y Pound is a memorial to Aneurin Bevan MP (1897–1960) widely recognised as being the founder of the National Health Service. It was also the location of a pitched battle between workers from the Ebbw Vale Works and striking coal miners during the 1893 Haulier's Strike.
72. R. J. Morris, *Cholera 1832* (London: Croom Helm, 1976), 95–128.
73. 'One night and day I bore great pain, To try for cure was all in vain, But God knew what for was best, Did ease my pain and give me rest'.
74. Quoted in Ieuan Gwynedd Jones, 'Health and sanitary engineering in mid nineteenth century Merthyr Tydfil', *Journal of the South East Wales Industrial Archaeology Society,* 2, no. 2. (April 1976).
75. Neil Oakley and S. R. Mayes, 'Ebbw Vale/Glyn Ebwy drainage system'*, Archaeology in Wales* 45 (2005), 188–90.