

A survey of the charcoal-fuelled ironworking industries of Carmarthenshire and Pembrokeshire

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SUMMARY: A project carried out in 2001 recorded the most important surviving remains of charcoal-fuelled blast furnaces and forges in Carmarthenshire and Pembrokeshire, and reviewed the documentary evidence relating to them. The earliest sites date to the end of the 16th and the early 17th century. The furnaces at Ponthenri (Carmarthenshire) and Blackpool (Pembrokeshire) and the forges at Llandyfan (Carmarthenshire) were surveyed. One furnace site (either Ponthenri or Pontiets) may retain below-ground evidence for experiments in coke smelting by Hugh Grundy in 1620, giving it considerable national importance. These monuments are little known; attention is drawn to their steadily deteriorating condition.

INTRODUCTION

The early post-medieval charcoal-fuelled ironworking industries of Carmarthenshire and Pembrokeshire in south-west Wales have left significant, although rather scant, archaeological remains and documentary records. These provide information regarding the development of the industry and the impact it had on the landscape. Standing remains of the earliest recorded post-medieval ironworking sites, where production began in the late 16th and early 17th centuries, survive in both counties. In Carmarthenshire iron production later developed into one of the area's bedrock industries; in Pembrokeshire, however, it had almost died out by the late 19th century. In 2001 a survey,¹ grant-aided by Cadw: Welsh Historic Monuments, was carried out to record the surviving sites of charcoal-fuelled ironworking and to identify new ones. A key aspect of the study was the production of topographic and photographic surveys of three of the best-preserved sites: the furnace at Ponthenri, where production started at the end of the 16th century, and the 17th- and 18th-century forges at Llandyfan. A survey of the

Blackpool Furnace, carried out in 1996,² is also presented, and the paper discusses the furnace site of Furneis Pontiets. New information about the condition of the surviving remains has allowed recommendations to be made regarding further investigation and the future management of these important sites.

Several gazetteers of charcoal-fuelled blast furnace sites in Britain³ and studies of individual local sites⁴ had been published before the survey was carried out; they identified thirteen early post-medieval furnaces or forges in the two counties (Table 1; Fig. 1). Where possible, all these were researched by further documentary study (not all had surviving records) and by site visits, during which the extent and condition of surviving features were assessed. Some (Whitland, Cwmbran Forge, and the possible early furnace on the site of Alexander Raby's Furnace, Llanelli)⁵ are no longer traceable on the ground. Information about the other sites and a discussion of the resourcing of the industry may be obtained from the original survey report.⁶ The known sites, with their national grid references and status, are shown in Table 1.

TABLE 1

Sites of charcoal-fuelled ironworking in Carmarthenshire and Pembrokeshire. (Sites are in Carmarthenshire unless stated otherwise.)

SITE NAME	NGR	STATUS (SAM = Scheduled Ancient Monument)
<i>Furnace sites</i>		
Ponthenri	SN 4741 0917	SAM Carms. 227
Raby's Furnace	SN 5039 0151	SAM Carms. 219
Blackpool (Pembs.)	SN 0656 1449	SAM Pembs. 484
Carmarthen	SN 4208 2063	Grade II Listed Building
Fwrneis Pontiets	SN 4785 0860	
Whitland	SN 208 181	Precise site lost
<i>Forge sites</i>		
Whitland	SN 208 181	Precise site lost
Llandyfan Old Forge	SN 6590 1694	SAM Carms. 223
Llandyfan New Forge	SN 6563 1682	SAM Carms. 223
Cwmdwyfran	SN 4100 2546	
Blackpool Forge (Pembs.)	SN 0615 1435	
Kidwelly	SN 40 05	Site lost
Cwmbran	SN 70 25	Site lost

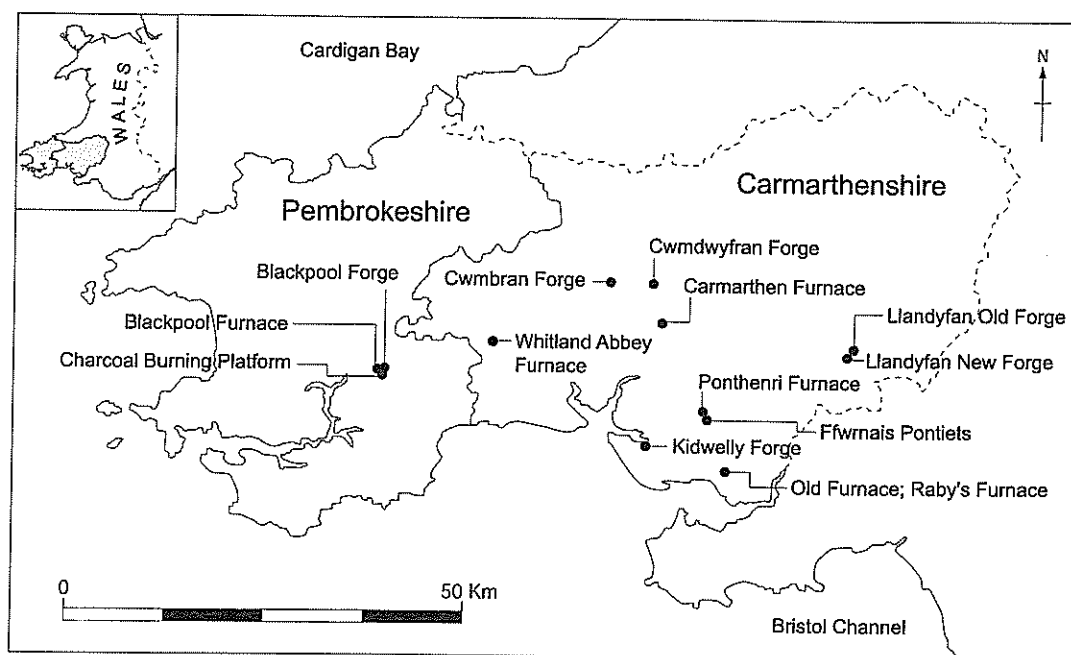


FIG. 1

Location map showing sites mentioned in the text (drawn by Hubert Wilson).

HISTORICAL BACKGROUND

The new technology of the charcoal-fuelled blast furnace had been developed on the Continent by the mid-15th century⁷ and by the time the first furnace of this type was built in Britain at Newbridge, Sussex, in 1496, there were specialist workers operating this new technology in many parts of north-west Europe. Some of them migrated to Britain, bringing their skills with them. The introduction of the new techniques had a significant impact in Carmarthenshire and Pembrokeshire, where there had been no previous recorded ironworking tradition. Immigrant craftsmen may have established the first furnaces in Carmarthenshire, where the earliest works were set up, during the late 16th or very early 17th century. In Pembrokeshire the earliest known site, Blackpool Furnace, was established in 1635 by George Mynne, an ironmaster who already had extensive ironworking interests in the Wealden district of East Sussex and Kent, and in the Forest of Dean, before moving to the county. In the following year Mynne also constructed the furnace and forge at Whitland, Carmarthenshire, whose site is now lost.⁸ Forges were later constructed at Kidwelly and Llandyfan (the Old Forge), both in Carmarthenshire, during the early to mid-17th century. These are the key sites in the history and development of the industry in the region.

The industry developed steadily during the 17th and early 18th century, until the widespread use of coke for fuel and steam power allowed the industry to move away from the rural locations that the early works required. This led to the centralization of the industry in the hands of fewer but larger companies, and ultimately allowed the development during the later 18th and 19th centuries of the significant steel and tinplate industries at Carmarthen and Llanelli. The industry in Pembrokeshire never flourished and Mynne's furnace at Blackpool and the later Blackpool Forge are the only two sites in the county associated with the charcoal-fuelled iron industry.

THE SURVEYS

BLACKPOOL FURNACE

Location

Blackpool Furnace is in Canaston Wood, Pembrokeshire, nowadays owned by the Forest Enterprise. Its coniferous plantation was clear-felled in the early 1990s; naturally regenerating forest is now encroaching on the site again.

History

A charcoal-fuelled blast furnace was erected at Canaston Wood in 1635 by George Mynne. In the lease for the furnace, Mynne was granted the right to take timber and cordwood for the works from nearby woods.⁹ A similar grant was made over a century later, when a lease of 1760 for the nearby Blackpool Forge, 0.4km west of the furnace, confirmed on the new owner, Robert Morgan of Carmarthen, 'the right to cut timber in Canaston Wood within four miles of the forge'.¹⁰ The site of a possible charcoal-burning platform has been identified at SN 0666 1390, on the steep wooded bank of a small stream some 0.9km south-east of the furnace, well within the four-mile [7km] limit from the forge stipulated in the lease. Ore for the furnace was available locally, but the locations of the ore pits are unknown.

It is not clear at present how long the furnace or its associated forge operated, but they seem to have been abandoned by the time that Blackpool Forge was constructed in the 18th century. Blackpool Forge operated until a lack of cordwood in Canaston Wood forced its closure in the early 19th century.¹¹

The site (Fig. 2)

The survey carried out in 1996 revealed a series of low earthworks and terraces that are the only visible remains. The terrace sits above a small stream which forms the eastern edge of the site. In 1996 some of the earthworks of the furnace structures were low but relatively free from vegetation, and it was possible to trace the outline of what appear to have been the furnace and the blowing and casting houses. Although these were difficult to locate, owing to self-regenerating woodland, the line of a leat was traceable for some distance and the tailrace was visible through the wooded area to the north-west.

The leat, wheel pit and tailrace (Fig. 2)

The leat entered the site from the south. It brought water from a nearby stream somewhere near the modern bridging point on the track to Eagle Lodge.¹² The leat is visible as a slight hollow, c. 1m wide in places; it is generally hard to follow beyond the southern edge of the furnace site. It approaches the furnace from the south-east and appears to curve west, before turning to run north along the west wall of the furnace.

Slight earthworks surrounding the southern end of a rectangular hollow surveyed in 1996 appear to be the remains of the pit for the bellows wheel. The tailrace is visible 2m north of the

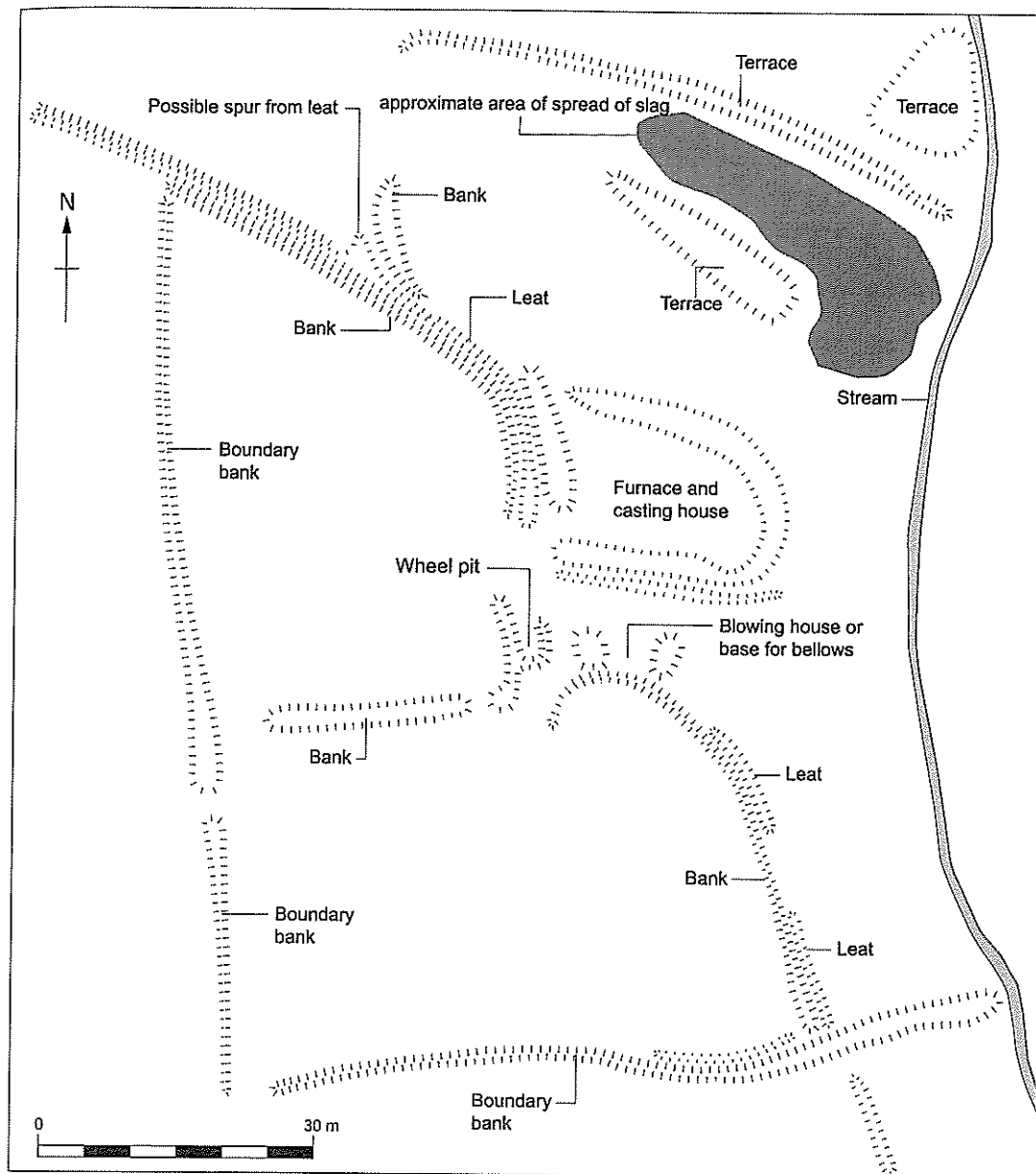


FIG. 2

The survey of Blackpool Furnace carried out in 1996 (drawn by Hubert Wilson).

hollow, which may in fact be the point at which the race leaves the north end of the wheel pit. From here the tailrace survives as a well-defined hollow, c. 1m wide, running north-west from the furnace and through the wooded area beyond it. It has been noted running towards Blackpool Farm, 0.5km to the south-east of Blackpool Mill,¹³ which

may have been the site of a finery forge built by Mynne to process the iron from the furnace.

The furnace (Fig. 2)

The probable position of the furnace is indicated by the line of the leat and tailrace and the possible

wheel pit. Assuming that the identification of the hollow as a wheel pit is correct, it is possible to speculate on the layout of the furnace. Two low banks c. 3m long, 2m east of and parallel to the possible wheel pit, may be the wall lines of the blowing house, or even the base for the bellows. The furnace would therefore have been to the north of this area, probably in the south-west corner of a sub-rectangular area defined by another low bank. Part of this area may also have formed the casting house.

Other features (Fig. 2)

Mounds and terraces containing large amounts of characteristic green glassy slag lie to the north-east of the furnace; several field boundaries were also recorded in 1996.

PONTHENRI FURNACE AND FURNEIS PONTIETS

Location (Fig. 3)

The remains of the furnace stand in a wooded area on a modified terrace on the west bank of the Gwendraeth Fawr River. The terrace is defined on its north side by a low bank that leads to a plateau extending for several hundred metres, roughly parallel to the river. It was this terracing that made the site suitable for the construction of the furnace, which was built into the base of the bank.

History

The history of the Ponthenri Furnace is complex. The documentary evidence indicates that there were at least two phases of furnaces in the Ponthenri area (see below), and there are three possible furnace sites. It is not known with any certainty which phase the surveyed furnace represents, although a late 17th-century date seems plausible.

An Elizabethan date for the foundation of the original Ponthenri Furnace is indicated by a survey of the Duchy of Lancaster Lordships, carried out in 1609, which recorded that charcoal had been obtained from woodland for a furnace at nearby Wenallt, 'aboute twentye yeares laste paste . . .',¹⁴ that is, around 1590. The first contemporary record of activity at Ponthenri Furnace was around 1611, when Hugh Grundy, ironmaster, obtained charcoal from one Lewis Morgan of nearby Forest. During that year Grundy purchased 200 cords of wood from Morgan.¹⁵ In 1620 Grundy was awarded a patent by the Crown for 'charking earth fuel', a process that was attributed to Grundy¹⁶ and presumably developed at

Ponthenri. If the site of Grundy's early 17th-century furnace could be located positively, it may contain below-ground remains of his experiments in coke-smelting, making the site of considerable national importance.

The furnace was closed around 1629, following a dispute between Grundy and Walter Vaughan over a piece of land called *yr Rhace* (the race), which was crossed by the leat carrying water to the furnace. The judgement went in favour of Vaughan and the leat was 'turned out'.¹⁷ It is not clear when production started again, but the furnace may have produced cannon balls during the Civil War.¹⁸ The furnace eventually passed to Hugh Grundy's granddaughter, Lucy, who married Anthony Morgan. It is uncertain whether members of the Morgan family operated the furnace themselves, but in 1696 Thomas Morgan and his mother Elizabeth leased it to Thomas Chetle, and a lease of 99 years was also secured for the watercourse across *yr Rhace*.¹⁹ This is the first mention of the Chetle family in the Carmarthenshire iron industry; they eventually expanded their interests to include the forges at Llandyfan, Whitland and Kidwelly.

It was around this time that a new furnace is thought to have been built at Ponthenri, close to the site of the original furnace.²⁰ However, it is not clear from the published sources where the evidence for this rebuilding came from, nor what form the evidence takes. Evans²¹ mentions the possibility that an earlier furnace may have stood some 50m upstream of the present site, which appears to post-date a leasing of the watercourse in 1696. Examination of the area during our survey revealed a possible leat (perhaps the one mentioned crossing *yr Rhace* in the 17th century), whose course corresponds to one shown on the Llangendeirne parish tithe map of 1846. Large amounts of slag were also found, although these could easily have been transported and dumped from the later furnace site.

In 1717 a furnace, referred to as Kidwelly but in fact probably Ponthenri Furnace, was producing 100 tons of pig iron per year. In 1729 Peter Chetle sold all his Carmarthenshire iron interests to Lewis Hughes of Carmarthen.²² By 1747 the furnace had come into the possession of Robert Morgan, who opened a further furnace at Carmarthen in the same year.²³ There is no record of when production ceased at Ponthenri, but Morgan was supplying pig iron from 'Kidwelly', again probably Ponthenri, to forges in Stour as late as 1693.²⁴

Another furnace site named Furneis Pontiets has been identified about 1km away; it may have been part of the Ponthenri story.²⁵ This site is

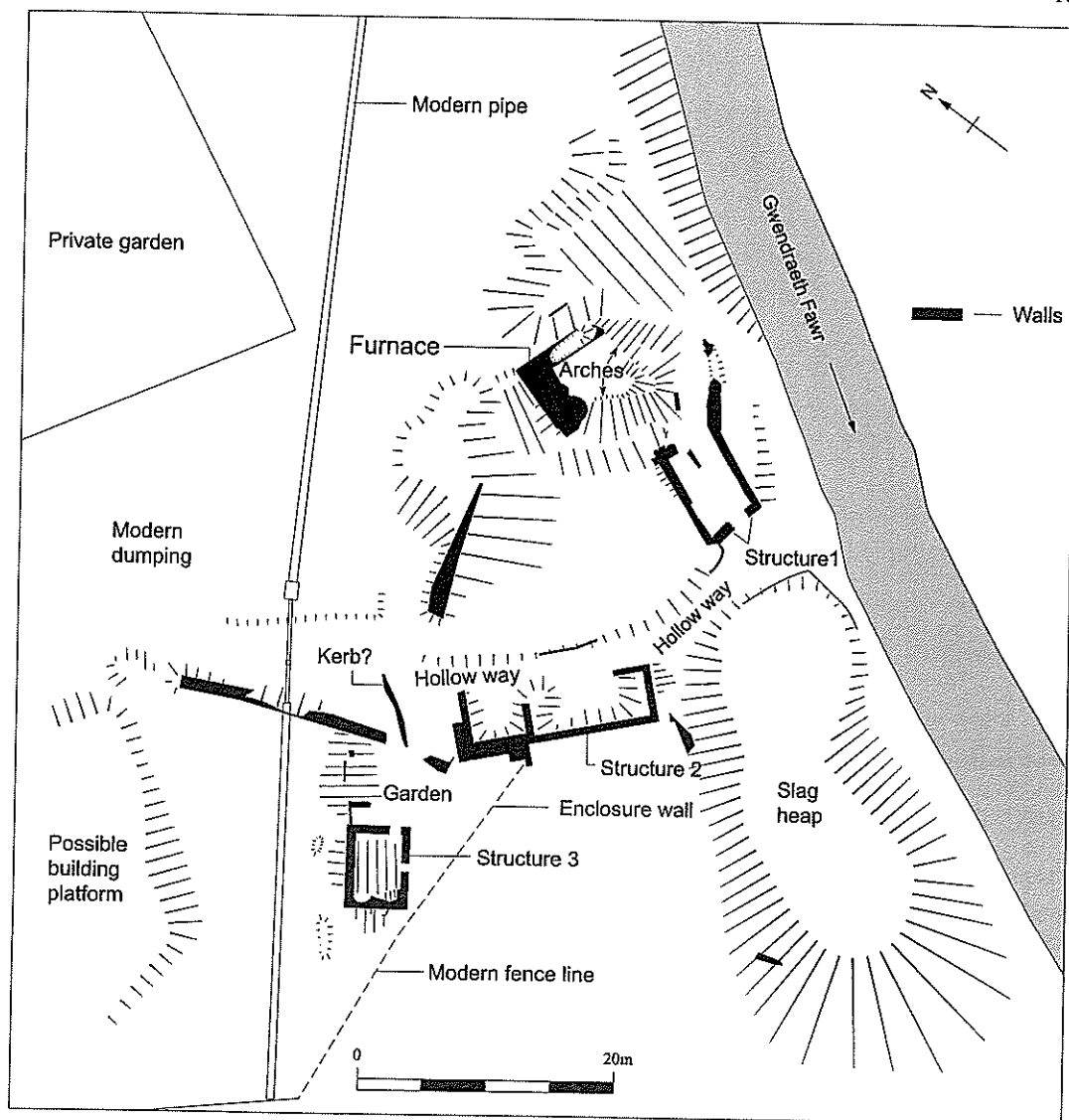


FIG. 3

The survey of Ponthenri Furnace conducted in 2001 (drawn by Hubert Wilson).

centred on the remains of a farmhouse near Ynys Hafren which still retains the name Hen Ffwrness (Old Furnace). The former presence of a furnace here is also indicated by field names recorded on a map dated 1761, which include 'Old Furnace Yard' and 'l'lain yr Hen Furnace' (Old Furnace Strip).²⁶ A local history published in 1905²⁷ referred to a smelting house close to Hen Ffwrness. Slag deposits from smelting operations mark the site today, although there are no standing remains of the furnace or any associated structure.

No references contemporary with the operation of an ironworks on this site have been found. It has been claimed that the furnace lay to the south-east of the farmhouse whose remains are visible today.²⁸ Stones are said to have been taken from the furnace during the late 19th century,²⁹ but no buildings other than the farmhouse are shown in this area on early Ordnance Survey maps, or on the Llangendeirne parish tithe map of 1846.

It is not clear at present what relationship, if any, this furnace had with the operations at

Ponthenri. In 1697, the year after Chetle leased Ponthenri, an agreement was reached between the Morgan and Vaughan families which guaranteed the continuation of the water supply over land called *yr Rhace* for 99 years. This suggests that they had no need to build a furnace on a new site some distance away. Furneis Pontiets may therefore be the site of the earlier furnace, a possibility reinforced by the map evidence, which indicates that it had already been abandoned for some time by the 1760s. It is also known that Ponthenri pig iron was being sent to the Stour forges as late as 1763.³⁰ However, Hugh Grundy's dispute of 1629 concerning his leat crossing *yr Rhace* cannot refer to the Furneis Pontiets site. Could this site have been an interim furnace, built by Grundy to solve his difficulties with Walter Vaughan, and replaced by the surviving furnace in the later 17th century? Another possibility is that Furneis Pontiets was not associated with the Ponthenri works, but was an undocumented independent enterprise. More work is needed to resolve these uncertainties.

THE SITES

PONTHENRI FURNACE (Fig. 3)

Substantial remains of the furnace and other buildings survive but there is no clear evidence for the water supply.

The furnace (Figs 3-4)

A large portion of the furnace survives; it is built of coursed rubble in lime mortar. Its south-west corner stands to a height of c. 3m above present ground level (Fig. 4), and it is likely that the fallen masonry around it is at least 1m deep. The ground level around the furnace now rises to the point where the north-west side of one of the arches springs from the outer face of the furnace wall. The position of a segmental arch is visible in the west wall; the arch has collapsed and fallen masonry including stone voussoirs now fills its space. There was a second arch in the south wall, but this too has collapsed and is obscured by fallen masonry. These two arches are likely to have been the blowing and casting arch.

The higher ground to the north and north-west of the furnace does not appear to have been cut through by a watercourse and there is no obvious tailrace feeding back into the river. The references to the 17th-century leat crossing *yr Rhace* are too vague to pinpoint the water supply; they may not even refer to this site (see above). The lack of any clear evidence for the source of the water supply makes it difficult to understand the

operation of the furnace: for example it is not clear which arch was which. This is crucial information in understanding the layout of the site and the operation of the furnace. The requirements for operating a blast furnace are well known; principal among them was a waterwheel to operate the bellows, set on the outside wall of the blowing house, parallel to the bellows. The blowing house at Ponthenri must have been on either the south or east side of the furnace, so there are two likely locations for the wheel. If the blowing house was on the south-east side, the wheel would have been on its north-east wall. If the blowing house was on the south-west side, the wheel would probably have been on its north-west wall; otherwise it is difficult to see how the casting house could have fitted between the furnace, the headrace and the river. Fairly small-scale excavation in front of either arch of the furnace could supply the answer to this crucial question.

It is reasonable to suppose that the high ground to the north of the furnace would have been the site of the charging ramp. No upstanding evidence of this is visible, but buried remains of it may survive.

Structure 1 (Fig. 3)

This measures c. 11 × 6m and lies to the south of the furnace. Three sides of the building survive. The two ends may have been open: there appears to be an opening in the south-west wall, now blocked by fallen masonry, whilst that on the south-east side flares outwards at its north-east end and originally extended as an outer wall along the east and north sides of the furnace. Two short lengths of wall, partially visible beneath the collapsed masonry of the furnace, may run parallel to this flared section, but it is impossible to be certain whether they are *in situ*. There is an opening in the north-west wall with at least one step down into the interior.

Structure 2 (Fig. 3)

The remains of a building measuring 16 × 5m lie to the south-west of Structure 1. Its walls consist of dressed stone blocks bonded with lime mortar. One of its long sides stands beside a hollow way, described below. Blocked openings in the south-east and south-west walls seem to have been doorways and the lower part of a window with flared reveals. The remains now appear to consist of two rooms; however, the Ordnance Survey 1st edition map of 1880 shows that it was then a three-celled building. The dividing wall between the south-eastern rooms may have been removed after



FIG. 4

The surviving north-western corner of Ponthenri Furnace.

1880, or is now concealed by fallen masonry. The function of this building is unknown; a store and/or workers' housing are possibilities.

Structure 3 (Fig 3)

This rectangular building measuring $6.5 \times 5\text{m}$ is constructed from squared blocks, bonded with lime mortar containing charcoal fragments. The presence of charcoal suggests that it was built after the furnace had begun production. The north-east gable stands almost to its full height of c. 4m, with a central window indicating the presence of an upper floor towards the gable top, but the uppermost 1m of the opposing south-west gable collapsed in bad weather during our survey. The side walls are also ruined. The south-east wall appears to have been the house front, with a probable doorway approached by at least one step. That to the north-west was evidently the back, cut into the bank at the edge of the river terrace.

The interior of the building has a rounded west corner which retains some plaster. The curve of the wall continues into the side of a rectangular

feature occupying the south corner of the room. This retains a wooden lintel above an opening in its east side, but the area is obscured by tree growth and fallen masonry. Outside the building, part of a small rectangular extension and a low stone structure which may have been an oven, subsequently blocked, are also visible.

The building stood within an enclosure. The boundary wall which flanked the main entrance track or hollow way into the site still stands; other enclosing walls shown on the Ordnance Survey 1:2500 map of 1915 are now lost. The building was probably a house; its separation from the rest of the site suggests that it may have been the manager's with a small garden plot. It may also have functioned as the works office.

The hollow way or trackway (Fig. 3)

A well-defined hollow way or trackway runs through the site. It leads from the farm to the north-west, but part of its course approaching the site is infilled by modern dumping and levelling. Lengths of wall flanking the track are visible on

each side. The track varies in width from about 5m at its north-west end, where it enters the site, to c. 3m where it runs alongside Structure 2, before widening to its original width as it approaches Structure 1.

The slag heap

The main spoil heap, composed of green glassy slag typical of smelting using limestone as a flux, is located to the south-west of the site. It measures c. 40 × 18 × 3.5m high; at a rough estimate this amounts to c. 2,500 tonnes of slag. A retaining wall supports the north-east end. Another short length of wall at the south-west end of the spoil heap is probably part of a later field boundary. Not surprisingly, a large amount of slag is also spread over most of the site and on the higher ground to the north of the furnace.

Other features

To the north of Structure 3 there is a well-defined platform with a large amount of tumbled masonry along its west and south sides. A building was shown here on the Llangendeirne tithe map of 1841. It is not clear if it was associated with the furnace, possibly being an ore and charcoal store, or whether it was a later agricultural building.

FURNEIS PONTIETS

The site stands on the wooded slopes of the narrow valley of the Afon Hafren. No above-ground remains can definitely be attributed to the furnace, but several old watercourses and terraces are visible in the vicinity. Previous small-scale investigation revealed several leats leading from the Afon Hafren towards Hen Ffwrness and deposits of 'iron slag incorporating charcoal'.³¹ The remains of a possible dam were also recorded on the Afon Hafren, although this could be related to later coalmining or brickmaking, which were also carried out in the area. Several lumps of green glassy slag, typical of slag from a smelting furnace using limestone as a flux, were recovered during a recent visit to the site; they had been incorporated into the enclosure bank of Hen Ffwrness farmhouse.

LLANDYFAN OLD FORGE

Location

Llandyfan Old Forge sits on a low terrace beside the Afon Loughor in the upper reaches of the Loughor valley in south-east Carmarthenshire. The site covers a total area of 0.9ha of unimproved pasture and woodland.

History

The foundation date of the forge is unknown. The earliest known reference to it is in a rental of the Golden Grove estate dated November 1669, which records 'a parcel of land bought of Sir Henry Vaughan adjoyneinge the forge'.³² An entry in the same rental also names one of the estate tenants, John Stephens, a 'hamerman' employed at the forge.³³ It is possible that the forge was intended as an outlet for pig iron produced at a nearby furnace which had been abandoned by 1756.³⁴ The site of the furnace is not known, but surviving correspondence indicates that it was on or close to the forge.³⁵ A second ironworking site shown on Emmanuel Bowen's 1729 map of South Wales may refer to the Llandyfan furnace, or to another furnace which is thought to have operated in the area during the later 17th or early 18th century.³⁶ However, inaccuracies in the positioning of the works on Bowen's map — they were shown on the wrong side of the River Loughor — demand cautious use of this evidence.

The forge was built on land owned by Sir Henry Vaughan of Derwydd, but there is no evidence to suggest that he ever operated the forge himself. It is more likely that he leased out the land and encouraged the construction of the forge, and possibly the now-lost furnace, as a way of securing timber sales from his extensive woodland holdings. Likewise, the Vaughans of Golden Grove probably acquired the forge from their relatives at Derwydd as an outlet for their timber, which would also account for their interest in the Kidwelly forge in the same period.³⁷ The burgeoning charcoal-fuelled ironworking industry was an important consumer of timber from the extensive woodlands of many, if not most, of the estates in Carmarthenshire and Pembrokeshire. As well as the Golden Grove estate, Llandyfan Forge also acquired charcoal from the Dynevor and Edwinsford estates.

Records for the early working of the forge are few and confined to estate rentals and lease agreements, allowing a chronology of tenancy but not a proper assessment of the operation of the forge. A map of the site drawn in 1789 also survives (Fig. 5). The earliest known lessee of the forge was William Davies, who also held the lease of Kidwelly forge in the later 17th century.³⁸ By 1702 the lease on the forge had been reassigned to William Spencer of Carmarthen, who obtained it for fifteen years at a rent of £33. An inventory drawn up at that time listed amongst other things 'The Iron and all Geers for the Chaffery and finery Bellows & and every Materiall, old Bellows Nayles wth'.³⁹

The rent that Spencer was paying was considerably less than the £60 paid by the previous

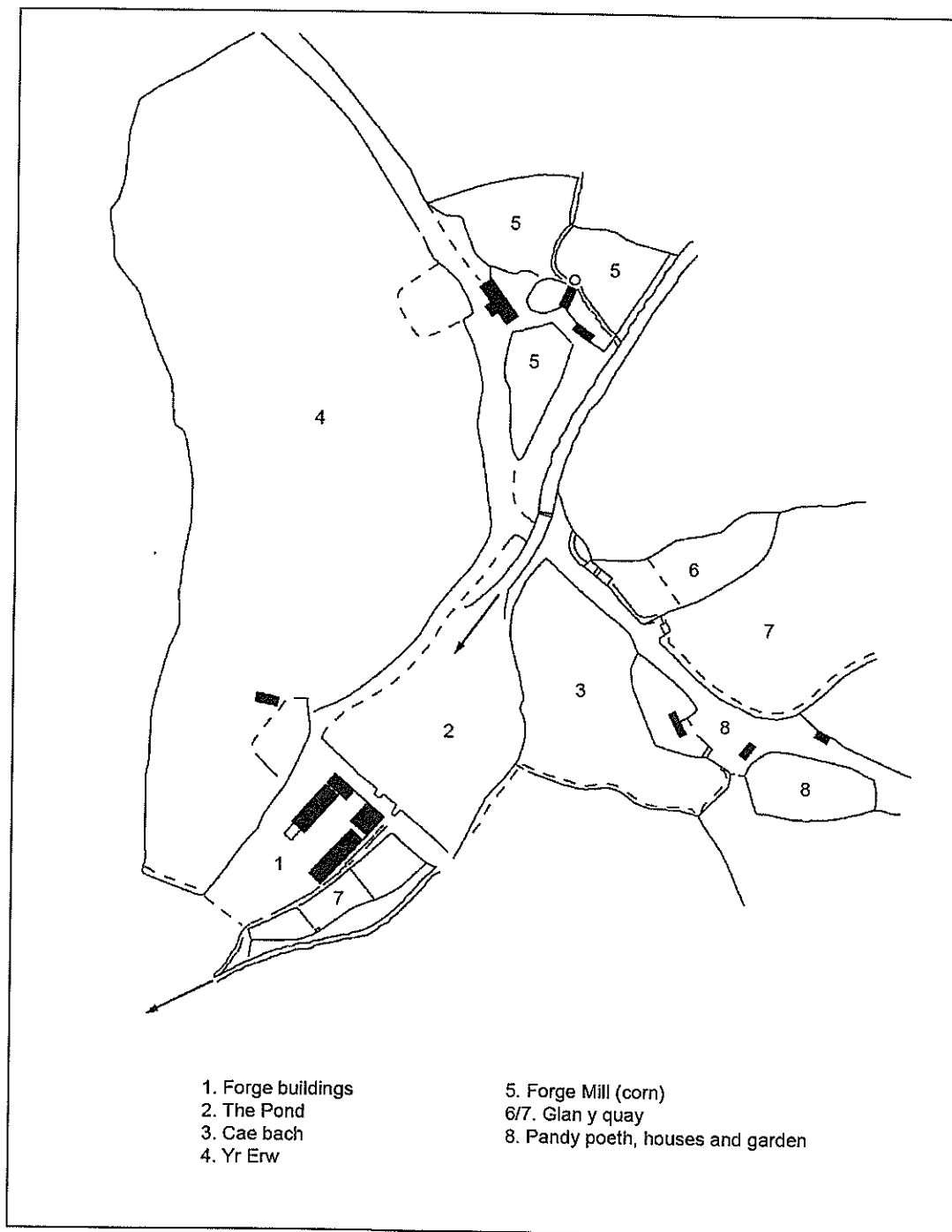


FIG. 5

The survey drawing of Llandyfan Old Forge dated 1789 (drawn by Hubert Wilson).

tenant. Spencer was also granted £30 for the repair of the forge,⁴⁰ which was evidently in some disrepair. Spencer did not see out his fifteen-year lease and by 1712 the forge was leased by Thomas Chetle, whose son Peter took responsibility for running it. By this time Peter Chetle was also controlling operations at the furnace at Ponthenri, which his family had leased from Thomas Morgan and his mother in 1696.⁴¹ Peter Chetle did not renew his lease of Llandyfan when it expired in 1715.

Two local landowners took up the option on the forge at an annual rate of £22 10s — less than the £33 paid by the Chetles.⁴² A list of forges and furnaces operating in Wales and England in 1717 records that Llandyfan was then producing 20 tons of iron per year, well below its estimated potential of 100 tons. The reduced rent and low annual output probably reflect the declining state of the early 18th-century Carmarthenshire iron industry; a further and more serious slump occurred in the 1730s, when the forge was forced to close.⁴³

The forge was in a ruinous state by 1739 and, despite some repairs to the roof, further extensive repairs were still required when it was leased to Thomas Popkins of Forest, Swansea, in that year.⁴⁴ Popkins leased the forge at a rent of £22 10s, although for the first year the rent was charged at the nominal figure of 12s to allow him to effect the repairs. He operated the forge until at least 1750, by which time it was producing 100 tons per year. By 1752 the lease, at the same rent, had been assigned to Thomas Price of Cwrt-rhyd-hir near Neath.⁴⁵ An upturn in the iron industry during the middle of the 18th century is reflected in the increased annual rent of £42 charged when Price renewed his lease in 1757.

Price held Llandyfan until 1777, when a local partnership operated the forge at an increased rent of £50. The partnership, between a Llandeilo shopkeeper, John Griffiths, and William Roderick, had been dissolved by 1790, leaving Roderick in sole control of the forge. This was a crucial period in the history of the Llandyfan Forges, for it was around the later 1780s that the New Forge appears to have been built on land leased by Roderick. It is possible that he constructed the New Forge on land he already leased in an attempt to circumvent another increase in the rent for the Old Forge, which by 1798 had increased to £70.

From 1800 onwards the Old Forge was leased by John Morgan and Company of Carmarthen.⁴⁶ This effectively completed the monopoly of the Carmarthenshire ironworking industry by Morgan's iron and tinplate business, a situation that the Golden Grove estate had fought against during the 1750s in an effort to protect the price of timber and cordwood. Morgan was the last

operator at the Old Forge; a serious flood around 1807 led to its final closure. In this period Llandyfan processed pig iron from the Clydach and Ynyscedwyn furnaces near Swansea. The Ynyscedwyn Furnace operated from around 1711 until the later 19th century.⁴⁷

The site (Figs 6–8)

Substantial remains survive on the site, with many identifiable structures. The most prominent is the massive dam that divides the site in two, with the pond to the north-east and the forge buildings to the south-west. Other remains survive in various states of collapse. The forge building retains some standing walls, whilst the rest of the structures can be traced in outline as vegetation-covered mounds and banks. The large amount of masonry strewn across the site, from the demolition and collapse of the forge buildings, has made the identification of some building remains difficult.

Some areas are becoming increasingly boggy; up to 0.2–0.3m of waterlogged, organic soil has developed across the central section of the site. The area containing the forge buildings is heavily wooded, with mature trees growing on most of the structures. Many of the trees have been coppiced, indicating past woodland management, but the site is now abandoned and its condition is deteriorating.

The pond

The area marked simply as 'pond' on the 1789 plan, which lies upstream from the dam, is a grass field with several large wet hollows along its south side (Fig. 5). A large bank (Fig. 6, no. 1), c. 30 × 15 × 2m high, presumably built to retain the water in the pond, runs along part of the south side of the field, separated from the dam by a narrow wet hollow which was probably an overflow channel.

On the 1789 plan the River Loughor is shown flowing straight into the top of the field, but there is no sign today of how the water filled the pond. It is possible that construction of the new bridge at the east end of the pond field has removed evidence of any former sluices or channels. Water from the pond also fed the New Forge, some 300m to the south-west, via an open roadside channel, which has gradually been filled in over the last 20–30 years.

The dam

The dam appears to survive to its original size, c. 64 × 7 × 4.5m high. It was constructed as an

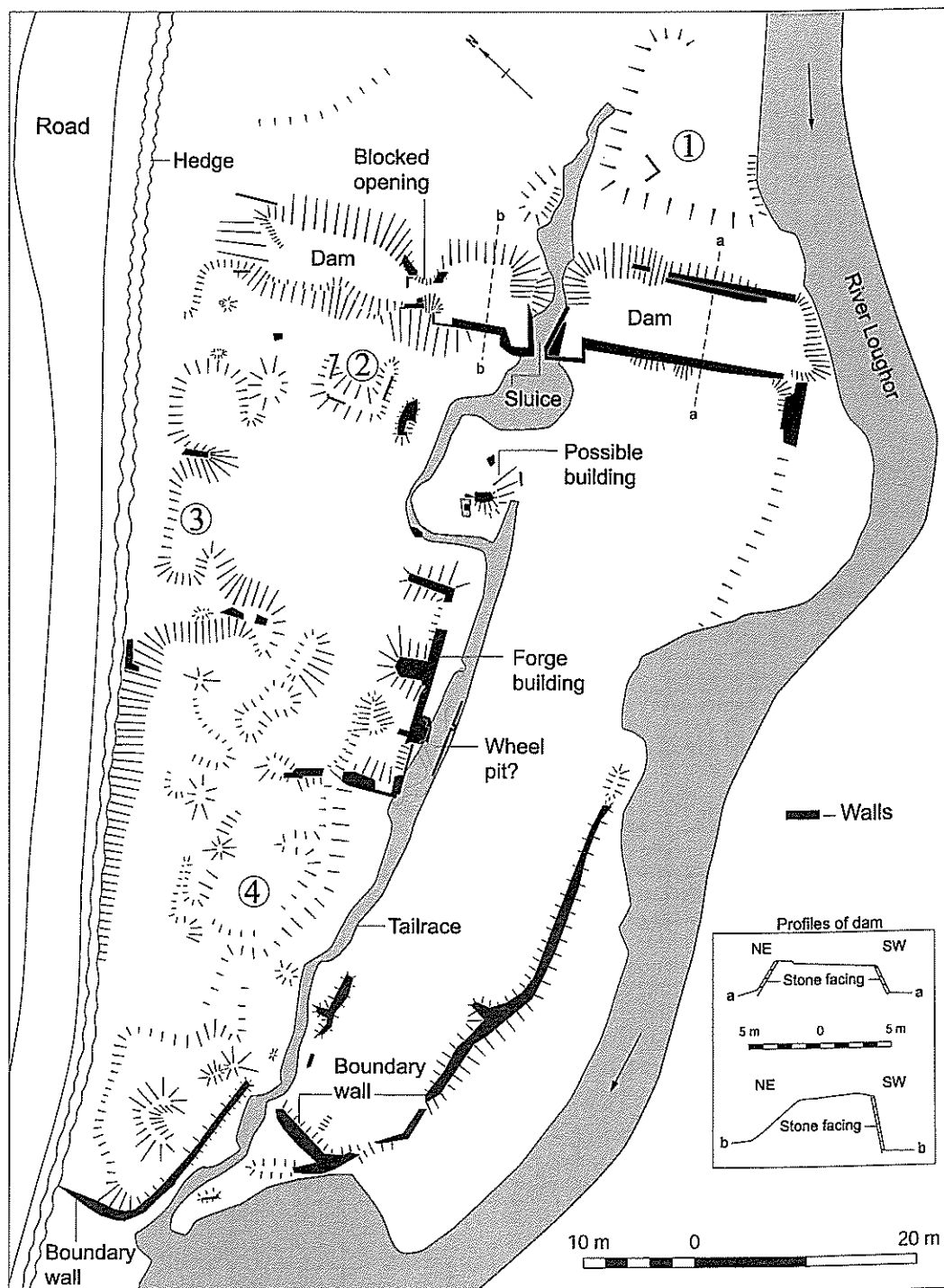


FIG. 6

The survey of Llandyfan Old Forge carried out in 2001 (drawn by Hubert Wilson).

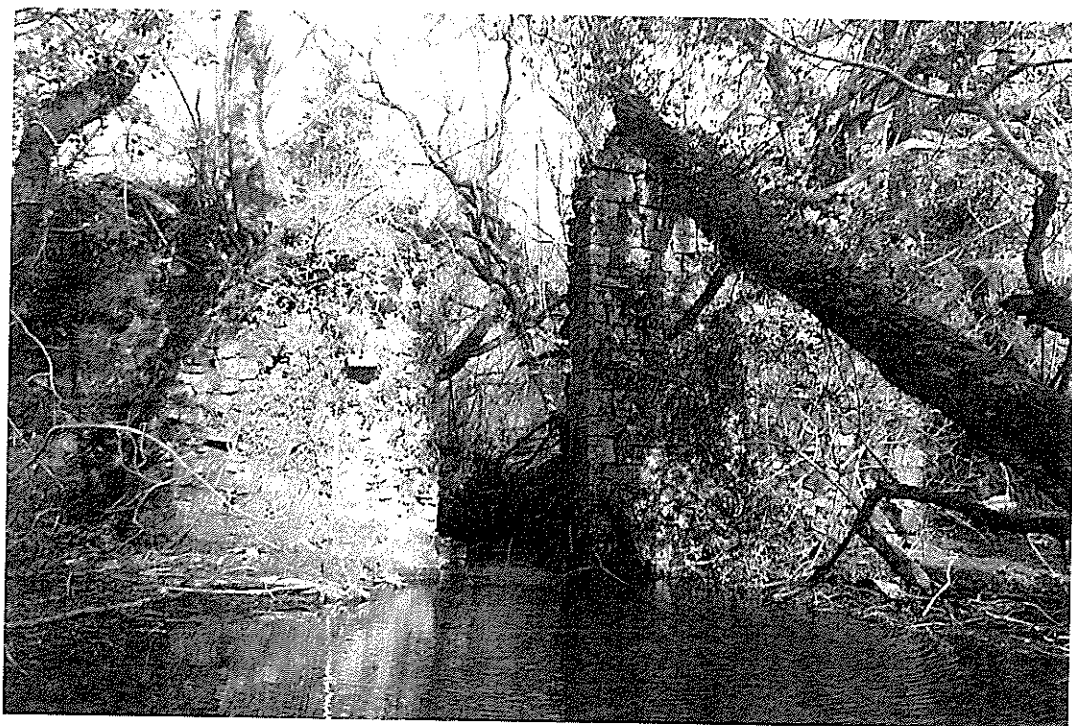


FIG. 7

The sluice gate in the impressive 17th-century dam at Llandyfan Old Forge.

earth and rubble bank faced on both sides with substantial walls, with a 10–15 degree slope on each side. It was first shown on the 1789 plan of the forge (Fig. 5) as a massive structure with two rectangular notches in the side facing the pond; the notches correspond to two openings still visible in the dam. One is a stone-lined sluice which feeds the leat to the forge. The other is now blocked; its original form and function are unclear. The 1789 plan shows neither notch extending through the width of the dam, suggesting that some form of walkway, presumably of timber, covered them in the past.

The sluice, which divides the dam in two (Fig. 7), is funnel-shaped, tapering from c. 3m wide at the upper end to 1.5m wide at the lower end. The sluice projects 1.0–1.5m from the lower face of the dam. The projection on the north-west side has a rounded north-west corner, whilst that to the south-east is much larger and rectangular.

A step is visible just above the present water level in both the angled walls of the sluice; it stops at the point at which the walls straighten and become parallel. Neither of the angled walls above the steps appears to have been faced in the same

way as the sluice exit projections or the dam faces. However, there has been some collapse and tree damage to the sluice walls which may have removed the facings.

There is a blocked opening 10m north-west of the sluice. Tree growth and the collapse of the dam faces at this point make it difficult to be certain of the original form of the opening, but the pond side does flare out, suggesting a funnel shape similar to the open sluice. In the south-west side of the opening is a projection, again similar to the open sluice, which appears to butt the face of the dam. The opening is blocked by a large amount of masonry and debris — much more than could possibly have collapsed from the dam, indicating deliberate blocking of what was probably a second sluice, but when and why this was carried out is unclear.

The amount of material required for the core of the dam can be estimated roughly as about 2,000 tonnes, excluding the significant tonnage of stone required for the facings. Since there is no sign of quarry pits for the dam in the vicinity, it seems to have been formed from material imported from elsewhere. Quarries on the hills to the north and north-west may have been a source.



FIG. 8

Remains of the forge building at Llandyfan Old Forge.

The water channel

Water still flows freely along the channel draining from the pond, past the forge and into the River Loughor, 40m downstream from the forge. For most of its length it is still confined to its original course, although an obstruction just below the dam has caused the water to pond and form a new channel, which loops north for a short distance before returning to its original course. The channel is *c.* 1m wide for most of its length, although obstructions and erosion have reduced or widened it in places. On the 1789 plan a wall is shown running along the south side of the channel; a short length of wall recorded towards the south-west end of the site may be a remnant of this.

The forge building (Fig. 8)

The best-preserved building is the forge, which now measures 20 × 8m; its original size is unknown. It is constructed from roughly squared blocks bonded with a grey mortar. The best-preserved section is the south-west corner, which survives to a height of 2.5m. A short length of wall

exposed in the side of the watercourse, 10m to the east of the forge, may originally have been part of the forge. A straight section of wall is visible below the water level in the leat, running alongside the south wall; this may be the south side of a wheel pit. A stone projection which extends from the south wall of the forge slightly into the water channel may be a support for a penstock for a wheel to the south-west.

The building is divided into three rooms by the remains of two cross-walls. Two of the rooms are of roughly equal size, *c.* 4 × 4m, whilst the third and easternmost room is slightly larger, *c.* 6 × 4m. No internal fixtures or fittings were noted, but the vegetation cover and collapsed walling may obscure such detail, so the functions of the rooms are uncertain. Comparison with similar forges elsewhere, however, suggests that its layout conforms to a common pattern in which the central room contained the hearth, whilst the outer rooms housed the bellows and hammer.⁴⁸ This design required two waterwheels, one for each of the outer rooms, powering the bellows and hammer. Excavation would be required to establish the room functions.

The forge building is shown on the 1789 plan, and on the Ordnance Survey maps of 1891 and 1907. On the 1789 plan, it is linked to the dam by a large square building, of which no definite remains are visible.

Other structures

Remnants of a stone structure (Fig. 6:2), built against the dam just below the blocked opening, were also recorded. The walls of its west end are clearly defined stony banks, but the rest of the building seems to have been robbed. It is shown on the Ordnance Survey maps of 1891 and 1907, but not on the 1789 plan.

A series of low banks (Fig. 6:3), some with visible walling, appear to form part of a further building or range of buildings. Another low bank may link this building to the north-eastern end of the dam. The 1789 plan shows a rectangular building here, extending from the end of the dam nearby. It also shows a small open, walled enclosure on the south-east end of the building; a surviving dog-legged section of wall may be the corner of that enclosure. This range of buildings is not shown on the Ordnance Survey map of 1891. Although the functions of this building are uncertain, they probably included charcoal and ore stores, a site office and possibly workers' accommodation.

Another series of low banks, one with exposed masonry, appears to define the remains of a further building extending south-west from the forge (Fig. 6:4). The banks seem to represent its east, south and west walls, with an internal cross-wall dividing it into two rooms. No building is shown in this location on any of the maps of the site.

Other features

A number of mounds and hollows are also present, particularly along the northern edge of the site. Their origin is unknown, but they may result from the demolition and collapse of buildings and subsequent removal of reusable materials. Repeated road widening during the last 20–30 years has created a bank forming a terrace along the northern side of the site. This has buried and possibly protected some of the remains of the northernmost buildings.

LLANDYFAN NEW FORGE

Location

The New Forge lies on a flat terrace at the base of Carreg y Dwfan, beside an unclassified road. The

site was chosen with care to allow the creation of a large pond to the north of the forge, which was used to power at least two waterwheels. Remains of two tailraces which empty into the River Loughor have been identified to the south of the road, c. 230m south-west of the Old Forge.

History

A founding date for the New Forge during the later 1780s has been argued convincingly by Evans,⁴⁹ using rentals and lease agreements. He also noted that some of the water supplied to the New Forge was taken from the pond of the Old Forge, implying either sole ownership or occupancy, or extremely good relations between the operators of the two forges. During the 1780s and most of the 1790s William Roderick leased the land on which the New Forge was constructed whilst operating the Old Forge.⁵⁰

A plan of the site dating from 1793 (Fig. 9) shows two separate ranges of buildings at right-angles to one another, with the large triangular pond to the north. The western range is shown beside the tailrace, over which a waterwheel is shown. The range immediately below the dam appears to have consisted of a row of buildings with open enclosures in front of them. This range probably included stores and workers' housing.

The New Forge remained in Roderick's hands until its closure upon his bankruptcy in 1808.⁵¹ It may be no coincidence that this occurred at about the time that the Old Forge, operated by John Morgan and Company, was closed after severe flooding undermined its buildings. The link between the water supplies may have resulted in the New Forge being at least partially cut off — perhaps when the Old Forge was flooded, or slightly later in the aftermath of the flood, when the Old Forge was closed and the site no longer maintained. Another possibility is that the forge was also a victim of Roderick's bankruptcy.

Whatever the cause, the forge and surrounding land were put up for auction in 1808.⁵² The forge was sold for £70 to Peter DuBuisson of the nearby Glynhir Estate, who was supposedly acting on behalf of Lord Dynevor. DuBuisson, however, appears not to have transferred the property to Lord Dynevor and it is possible that he resumed production at the forge to supply iron to his own Glynhir knife works. The knife works are thought to have continued in production until the end of the Napoleonic Wars in 1815⁵³ and it is likely that DuBuisson would have wanted to maintain the easily accessible supply of local iron. The works were closed by the 1830s and from the early 1840s

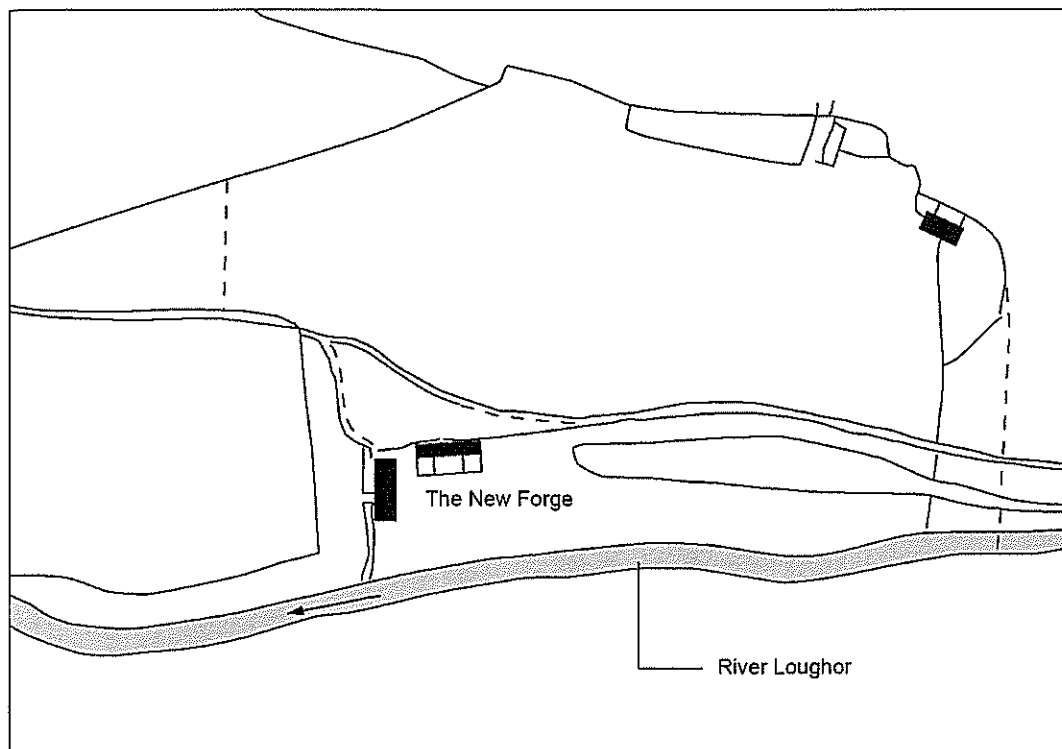


FIG. 9

The 1793 survey drawing of Llandyfan New Forge (drawn by Hubert Wilson).

the forge was converted into a woollen mill, which operated into the 20th century.

The site (Fig. 10)

The substantial remains of the woollen mill buildings survive in places up to c. 6m high. The pond and the buildings are becoming overgrown and a vast amount of rubble within the buildings masks all internal details. Fallen masonry has partially blocked the leat along the western side of the buildings, although water from the pond still finds its way out through the leat and into the River Loughor.

The pond and its water supply

The pond occupies a triangular area to the north of the buildings. It was formed by constructing a large earth dam against the base of the slope of Carreg-y-Dwfan. The south bank had been faced with a stone wall, which also formed the back wall of a range of buildings (Fig. 10, Rooms 1–5). The pond was supplied by two leats, one fed directly

from the River Loughor near Llandyfan Bridge, the other linked to the pond at the Old Forge. The leats fed into the north-east corner of the pond; a stone structure c. 20m east of the forge buildings may have been part of the original sluice. Road widening over the last 20–30 years has filled in the leats. A length of stone revetment along the southern bank of the pond may have been inserted to block an old leat leading to a second and disused wheel pit (see below).

The wheel pit and tailrace

The overshot waterwheel for the forge was fed from the south-west corner of the pond through a narrow channel, presumably via a wooden launder which is lost. A sluice originally controlled the flow of water from the pond into the channel; the stonework of the sluice survives. A stone revetment forms the rear wall of the dam and the front of the wheel pit, which is positioned beside the forge. A straight-faced section of wall stands at ground level on the south-west side of the wheel pit/tailrace wheel, whose width was 1.75m.

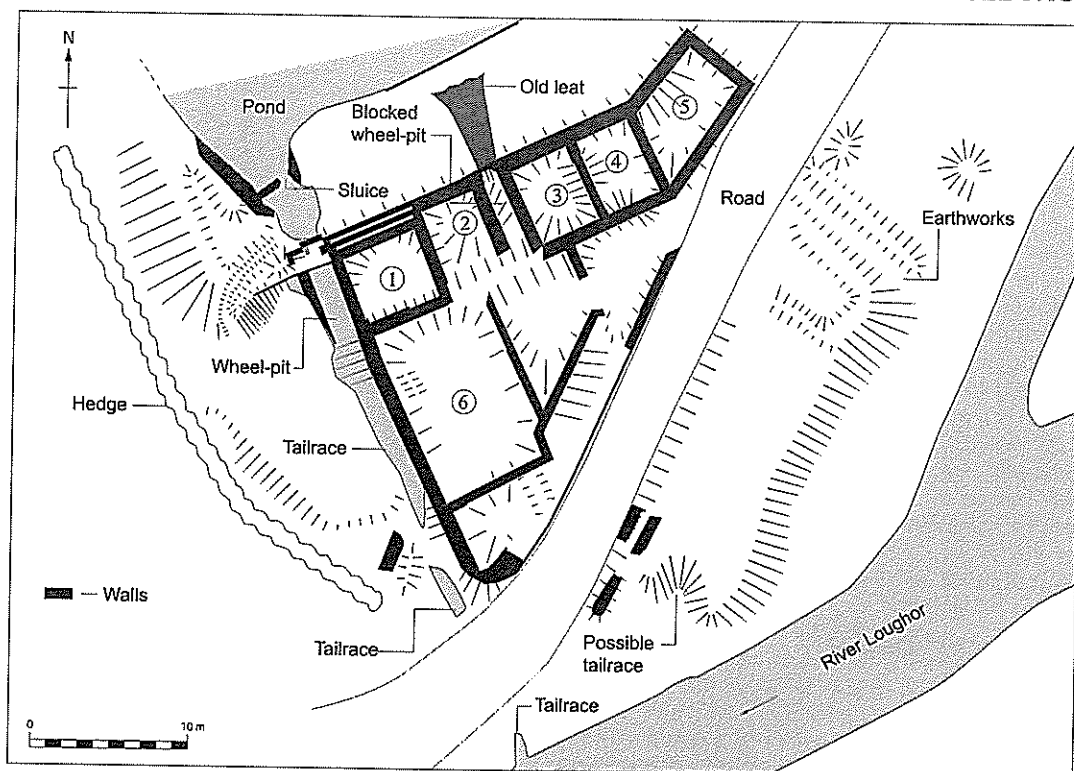


FIG. 10

The survey of Llandyfan New Forge conducted in 2001 (drawn by Hubert Wilson).

Fallen masonry and erosion have reduced the width of the tailrace as it runs alongside the forge. At one point it disappears underground, reappearing 2–3m to the south, some 1m lower than its previous height. From here it passes under the road and empties into the River Loughor. The drop in height is difficult to explain without excavation, but the point at which it disappears may be the end of a wheel pit.

The blocked wheel pit and tailrace

A break in the wall at the back of the dam, 15m from the south-west end, has apparently been blocked by the dumping of stone rubble. Below the break, in the interior of the building, is a narrow channel between Rooms 2 and 3, measuring 8 × 1.5m. There is a muddy depression leading from the southern edge of the pond towards the break in the wall and, even though no direct relationship between them was established, it seems that the depression represents the infilled remains of a leat leading to a waterwheel that stood in the

channel. An irregular and partially overgrown linear hollow in the bank on the opposite side of the road may be the end of the tailrace.

This group of features evidently represents the remains of a second wheel pit and its water supply, but its date is uncertain. Clearly it was not associated with its final early 20th-century phase and according to the 1793 plan not its earliest phase. The most likely explanation is perhaps that it was a short-lived adaptation dating from the conversion of the forge into a woollen mill in the early 1840s.

The forge buildings

The 1793 plan of the forge shows a building at the rear of the dam where the remains of Rooms 1–4 now stand. It is difficult to be certain how much of the fabric visible today is from the forge and how much dates from the later woollen mill. As it is unlikely that the forge buildings were completely demolished prior to the construction of the woollen mill, some of the fabric — perhaps a

substantial proportion — may belong to the original forge buildings. Collapsed masonry and vegetation obscure most of the internal detail, making understanding of the interior difficult.

Room 1, beside the wheel-pit, is the most complete. It measures c. 5 × 5m internally and survives to a height of up to c. 6m. A ledge c. 2.5m above the present ground level appears to mark a floor for an upper room. Since no internal fixtures or fittings are visible, it was not possible to determine its function or internal layout. A large opening with a flattened stone arch in the south-west wall may have been a loading door for the upper room of the woollen mill, although it is located above the waterwheel. There is a blocked arched or round opening towards the base of the wall, which may have been for the axle shaft leading from the waterwheel; the bottom of the opening is obscured by fallen masonry. Other openings in the west wall, some of which had been blocked either partially or completely, probably date from the alteration of the buildings from forge to woollen mill.

The lack of surviving masonry in the southern half of the building (Room 6) suggests that the later operations were at its northern end; this may signify a shift in the direction of the industrial processes carried out on the site. On the 1793 plan the forge is shown aligned north-west-south-east and separated from the other building. However, it seems that when the site was converted to a woollen mill, the buildings may have been linked and the processes of the woollen mill may have been concentrated in Rooms 1-4, possibly extending later into Room 5.

The woollen mill building

This building (Rooms 3-5) was originally separated from the forge by a fairly wide gap, and more recently by a blocked wheel pit. It may be the building shown on the 1793 map, in front of which are shown three small enclosures. These may once have been a row of three workers' cottages, each with a small garden plot.

Room 5 was a later addition to the north-east end of the building, laid out on a different alignment respecting the line of the adjacent road. It has been reported that there was a chimney on the north wall of this room, but this is no longer visible.⁵⁴ Without excavation it is not possible to determine the function of Room 5, or to assign it to a particular phase.

Other features

Several other features which appear to be associated with the site were recorded between the road and the River Loughor. They consist of a low

vegetation-covered linear bank that includes some apparently *in situ* stone walls, and one linear and two small sub-circular hollows. The linear bank measures 10 × 8m; it forms a narrow, open-ended hollow. This feature, of unknown function, appears almost in its present form on the Ordnance Survey map of 1906. The linear hollow runs parallel to the north-east side of the possible building and the two may be associated. There is nothing to indicate the former function of these hollows; they may not be connected with the forge or woollen mill.

CONCLUSIONS

This project has provided an opportunity to carry out for the first time topographical surveys of some of the earliest surviving and potentially most important sites associated with the charcoal-fuelled ironworking industry in south-west Wales. It is possible that Hugh Grundy was conducting experiments in coke smelting in the early 17th century at Ponthenri or nearby. If so, and if his early furnace could be located with certainty, below-ground evidence for his experiments may survive, making the site of considerable importance. However, it is not at present clear which of the Ponthenri sites Grundy was operating; more work is required at Ponthenri and Furneis Pontiets to unravel their complex phasing and relationships. Likewise further work is required at Llandyfan to understand fully the chronology of production and the changes that occurred at the Old Forge, and the significant alterations at the New Forge during its conversion to a woollen mill.

The overall condition of the surviving sites is poor; they are all suffering on-going degradation, largely through tree growth and neglect. The surviving evidence is a rare and fragile resource that, in the case of Ponthenri, may contain information that has significance that stretches far beyond south-west Wales.

ACKNOWLEDGEMENTS

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NOTES

- ¹ Page & Wilson 2001.
- ² The survey was undertaken on behalf of the Forest Enterprise to determine the extent of the furnace remains for inclusion in their Forest Management Plan for Canaston Wood.
- ³ Schubert 1957; Riden 1987.
- ⁴ Evans 1967; 1973; 1975.
- ⁵ The well-preserved blast furnace that survives today dates from 1793–1802, but it is thought that operations began on the site during the 1750s.
- ⁶ Page & Wilson 2001.
- ⁷ Crossley 1981, 37.
- ⁸ Evans 1967, 23.
- ⁹ Rees 1968, 311.
- ¹⁰ Rees 1968, 311.
- ¹¹ Howell 1987, 322; Thorne & Howell 1987, 368–9.
- ¹² Cloughton 2005.
- ¹³ Cloughton 2005.
- ¹⁴ A local tradition, first voiced in an early 20th-century poem, assigns the founding of the Ponthenri furnace to a Swedish ironmaster ('*Haiarnvr o Sveden*') in the reign of Elizabeth I (1558–1603). This is unsubstantiated and the founder and foundation date of the furnace are unknown. The poem states that the Swede constructed a furnace, a smelting house, a water wheel and two bellows, as well as establishing an ore mine. It concludes that the furnace supplied cannon balls for the war against Spain and that the Swedish ironmaster was successful enough to build a mansion house. There is no way of testing the validity of any of the poem's claims. Rees 1953, 207.
- ¹⁵ Rees 1968, 231.
- ¹⁶ Evans 1967, 31; Riden 1987, 5.
- ¹⁷ Evans 1967, 31.
- ¹⁸ Evans 1967, 24.
- ¹⁹ Evans 1967, 32; Riden 1987, 5.
- ²⁰ Evans 1967, 30; Riden 1987, 5.
- ²¹ Evans 1967, 30.
- ²² Evans 1967, 39.
- ²³ Evans 1938, 136.
- ²⁴ Riden 1993, 29. Riden identifies Kidwelly with Ponthenri.
- ²⁵ Evans 1979, 16; Riden 1987, 6.
- ²⁶ CRO Stepney mapbook, 1761.
- ²⁷ Thomas 1905.
- ²⁸ Thomas 1905.
- ²⁹ Thomas 1905.
- ³⁰ Riden 1993, 29.
- ³¹ Evans 1979, 16.
- ³² Evans 1973, 136.
- ³³ Evans 1973, 136.
- ³⁴ CRO Cawdor 5570.
- ³⁵ Evans 1973, 146.
- ³⁶ Evans 1973, 146.
- ³⁷ Evans 1967, 34–5.

³⁸ Evans 1973, 137.

³⁹ Evans 1973, 148.

⁴⁰ Evans 1973, 137.

⁴¹ Evans 1967, 32.

⁴² Evans 1973, 138.

⁴³ Evans 1973, 138.

⁴⁴ Evans 1973, 139.

⁴⁵ Evans 1973, 139.

⁴⁶ Evans 1973, 142.

⁴⁷ Roberts 1983, 32.

⁴⁸ Bowden 2001, 73–6.

⁴⁹ Evans 1973, 146.

⁵⁰ Evans 1973, 146.

⁵¹ Evans 1973, 147.

⁵² Evans 1973, 147.

⁵³ Evans 1973, 147.

⁵⁴ Information from the Cadw site visit forms (visit made in 1986).

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ABBREVIATIONS

CRO Carmarthenshire Record Office.

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