CPAT Report No 1144

Medieval and Early Post-Medieval Industry in East and North-East Wales

The Scheduling Enhancement Programme

THE CLWYD-POWYS ARCHAEOLOGICAL TRUST

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The Scheduling Enhancement Programme

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April 2012

Report for Cadw

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Contents

Medieval and Early Post-Medieval Industry

Background

This report on medieval and early industry falls within a third phase of scheduling enhancement undertaken by the four regional trusts in Wales since the mid-1990s. The first phase began in 1995 when two pan-Wales projects were started, one looking at historic churches, the other on the heritage of the Welsh coast. Other pan-Wales projects followed, the results being used for increasing the schedule of protected ancient monuments, for increasing the coverage and quality of the four regional Sites and Monuments Records, and for more academic outputs. When we summed up the situation in the spring of 2010 in *The Archaeologist* published by the Institute for Archaeologists Ken Murphy of the Dyfed Archaeological Trust and the writer estimated that over 26,000 sites (or assets as we should perhaps call them) had been visited and more than a thousand new schedulings made.

In the second quarter of 2007/8, Cadw requested a scoping study of sites and assets recorded in the regional Historic Environment Records (the HER being the successor term to the SMR) that might still need assessment to complete the scheduling enhancement programme for prehistoric and Roman sites in the region, taking the study from the earliest times through to around 400 AD. Such a study was required to inform thinking on priorities for scheduling enhancement in the two years up to April 2010 which at that time was the projected date timetabled for the implementation of the proposals in the Heritage Reform White Paper.

Though the White Paper was ultimately shelved, the completion of the prehistoric and Roman studies went ahead, and between September 2008 and March 2010 a series of scheduling enhancement projects (SEPs) were conducted. Reports were submitted covering both themes (e.g. caves, mines and quarries, burnt mounds, Roman settlements) and geographical areas where multiple site types were in evidence (e.g. Vale of Clwyd, Elan Valley, Black Mountains etc). The submission of the final report in March 2010 effectively marked the end of the second phase.

In the summer of 2010 a scoping study was conducted by each of the Welsh trusts to examine the range of medieval and early post-medieval (pre-1750) site types that might warrant further assessment with a view to enhancing the schedule of designated sites. Independent of this Cadw had also assessed the types of material evidence relating to the period and developed a list of themes that might usefully be progressed. As an introduction to the period, a monastic and ecclesiastical project was completed during the later part of 2010/11, with the intention of further topics being tackled in 2011/12.

The Project

The project on industry commenced in the third quarter of 2011/12, but with a staggered work programme across the different trusts. The desk-top assessment utilising the HER and other resources was completed during the year, a limited amount of fieldwork was conducted and this report was completed in April 2012. Work on mills and milling, treated as a separate project though clearly with strong links to industry, also commenced in 2011/12, but fieldwork is timetabled to continue in 2012/13.

The present report considers the desk-top assessment and provides details of industrial sites and features where there has been a substantive addition to the information held in the HER as a result of either that desk-top work or subsequent fieldwork. This will act as

a statement on the current state of knowledge of the topics under consideration and provide data for the enhancement of the regional HER. A second report, prepared solely for internal use by Cadw, provides a set of recommendations about potential scheduling targets in the region.

The Scoping Study

In the 2010 scoping study the theme of industry was assessed in the following terms:

> Medieval and early post-medieval industry can be broken down into a number of subject areas, though inevitably there is some overlap and cross-cutting. It is also perhaps a theme with greater regional diversity, for particularly within the range of mining types there are obvious differences between north-east and central Wales on the one hand and the north-west on the other. One relevant study already completed has been the Metal Mines project across the region which was completed in 1993 with the award-winning CBA Research Report in the following year. CPAT has been advocating a rural industries project since 2006. It is anticipated, too, that the forthcoming Research Agenda Framework paper on the industrial age could contribute to the thinking on this theme.
>
> Mining includes *lead mining, copper mines, mines, coal mining* and *salt works* of which there are relatively few. Mining was studied during the metal mines study, but as we found during the prehistoric and Roman SEP on mines and quarries (CPAT Report 1033; March 2010) exploitation phases pre-dating the 18th century were not assessed comprehensively, so it is anticipated that there may some further assessment to be undertaken on this subject. Coal mining has not previously been considered in any assessment, and pre-1750 activity in Flintshire and Denbighshire will be relevant in this context.
>
> Iron working includes *bell pits, bloomeries, ironworks* and iron ore extraction in general. Medieval examples in the HER are few in number with only a small number of citations, which tends to suggest that the HER may be deficient in this field, and could requirement enhancement, subject to the availability of easily accessible sources.
>
> Pottery production includes *potteries, pottery kilns* and *tile kilns*. Again only very small numbers of sites appear in the HER and apart from record verification, it is unlikely that there will be much scope for enhancing the dataset.
>
> Milling includes *mills, corn mills, fulling mills* and *smelt mills.* It is unclear how up to date the HER is in its coverage of mills. Around 12% of the HER records for ordinary mills are classed as medieval, and for mills generally there appear to be 11 listed structures and one scheduled site, a very small number, and all of these are classed as post-medieval in date. Associated features such as *mill leat* and *mill pond* are currently less easy to isolate in the HER, because of the ambivalence of site-typing. There are only 4 mill leats and 46 mill ponds in the record, clearly a gross under-estimate of the actual situation. With an active mill society in Wales producing its own journal and newsletter, a well-attested staff interest within the Royal Commission, as well as individual workers in several counties, there is more potential for expanding the HER coverage than in many subject areas.
>
> Field industry covers *lime kilns* and *quarries*, and could also cover *charcoal burning* though most of the recorded remains are probably post-1750, and distinguishing

those of an earlier age may be virtually impossible. Four lime kilns and 54 quarries have been attributed to the medieval period, but it is reasonably certain that in the case of the latter, if not the former, medieval and early post-medieval attributions are likely to come from association (as in the case with Cwmhir Abbey where the stone quarry for the abbey has been recognised on the slopes above it) or from early maps that showed the quarries. Little evidence of quarries yielding specific types of stone has yet been identified, as for instance millstone quarries. There is some potential here for assessing readily accessible sources of information.

Non-specific types include *furnace, kilns, ports and quays,* and *spoil heaps*. This heterogeneous group requires some attention, though coastal ports on the north Welsh coast have already been covered reasonably thoroughly in the north-east Wales ports and harbour project which was completed in 2007. Inland ports, wharves and quays have not yet been assessed but might be expected on the courses of major rivers.

Site type	Cadw theme	Outcomes	Work input	Project
Mining	Industrial	HER/SE	Medium	Industrial
Iron working	Industrial	HER/SE	Low	Industrial
Pottery production	Industrial	SE	Very Low	Industrial
Mills	Industrial	HER/SE	High	Industrial
Field industry	Industrial	HER/SE	Medium	Industrial
Non-specific industrial remains		HER/SE	Medium	Industrial

It is evident that certain industries are entirely omitted from the above commentary and listing because no relevant sites or features have made it onto the HER.

Medieval and post-medieval industries fall into three distinct classes in considering their physical remains. There are the extractive industries – stone, coal, metals, clay, peat – where the nature of the process involving the removal of the raw material from the ground is such that particular landform features will be created but there is also a likelihood that the physical remnants such as the working face, the trial hole, or the pit will be erased by succeeding phases of activity of a similar nature. Therefore the chances of medieval or early post-medieval remains surviving may be relatively poorly. Secondly, there are the processing industries which in a developed form will normally have required buildings or other substantial facilities. A third group covers industries where the raw material comes from a system other than extraction. Thus the woodworking industry, the leather and woollen industries, and charcoal manufacture all depend on the exploitation of organic materials.

Methodology

It was clear well before the start of the project that comprehending industry in the centuries through to 1750 would pose considerably more of a challenge than say medieval ecclesiastical sites or even mills. For both of the latter the subject matter is generally well-known and often well-researched, even if the archaeological evidence is poorly recorded. Industry is by contrast not a homogeneous topic, but one which

exhibits considerable variety, both in application and remains. Above all, however, it is one where past research has been very uneven and sporadic, where sources are more diffuse or obscure, and one where more often than not, specialists have tended to veer towards more recent times when the material evidence is so much more impressive. This project cannot rectify the deficiencies in previous research, but it can demonstrate where lacunae in our knowledge exist.

The approach adopted during the present project has been to assess the subject matter on an industry-by-industry basis, examining readily available printed texts and reports for data which is significant and relevant to eastern Wales, then moving to less obvious sources including some for other parts of Wales and England for comparative purposes. Where it was viable, catalogues of the holdings of the record offices in north-east Wales were also consulted for further references to early sites and the maps and manuscripts of both Flintshire and Denbighshire have been exceptionally informative. The Historic Environment Record (HER) and Coflein (the on-line search engine of the RCAHMW) have both been consulted and the paper files of the National Monuments Record were also examined for two of the five counties, though without much positive outcome.

Charcoal Burning

Background

Charcoal burning can be classed as an industry, albeit the operations were generally on what we might term a localised rather than an industrial scale. The product of the industry – lump charcoal – would have been necessary for the blast furnaces of the 17th and 18th century, and perhaps for earlier forms of iron smelting prior to those centuries. This is conventionally perceived as the most significant industrial use of charcoal up to the advent of the Industrial Revolution, yet lead processing also needs to be taken into account, and there were other applications for charcoal, amongst them domestic heating and gunpowder manufacture, though these appear to have been minor by comparison. Charcoal is seen as a better fuel than wood, as it has a higher energy yield and burns longer.

In the medieval period, and probably later, charcoal making was viewed as an itinerant occupation, yet we should probably not underestimate its significance. It is reported that in Edward I's demesne woods in the Forest of Dean in 1282 no less than nine hundred charcoal burners were operating. When in 1284 the burgesses of Flint were granted all the necessities for mining and smelting lead ore from the wood and underwood in the woods of the Northop areas as far as Ewloe, charcoal would have been one of the important products. The need for charcoal in the iron industry of the Wrexham-Ruabon area no doubt placed a significant demand on local timber stocks in the period before coal became the preferred fuel used in smelting. Even after coal came into widespread use, there was still a demand for charcoal in finery forges, used to make workable iron from cast iron.

Even the most local of records can provide an insight into the practices. For instance, the Erddig (Denbs) accounts record a payment to Edward Bennion for ten days burning charcoal in November 1721 (Flintshire Record Office/E/361), and this entry may well be typical of many. Yet it seems likely that charcoal burning was one of those industries or crafts which generally went unrecorded.

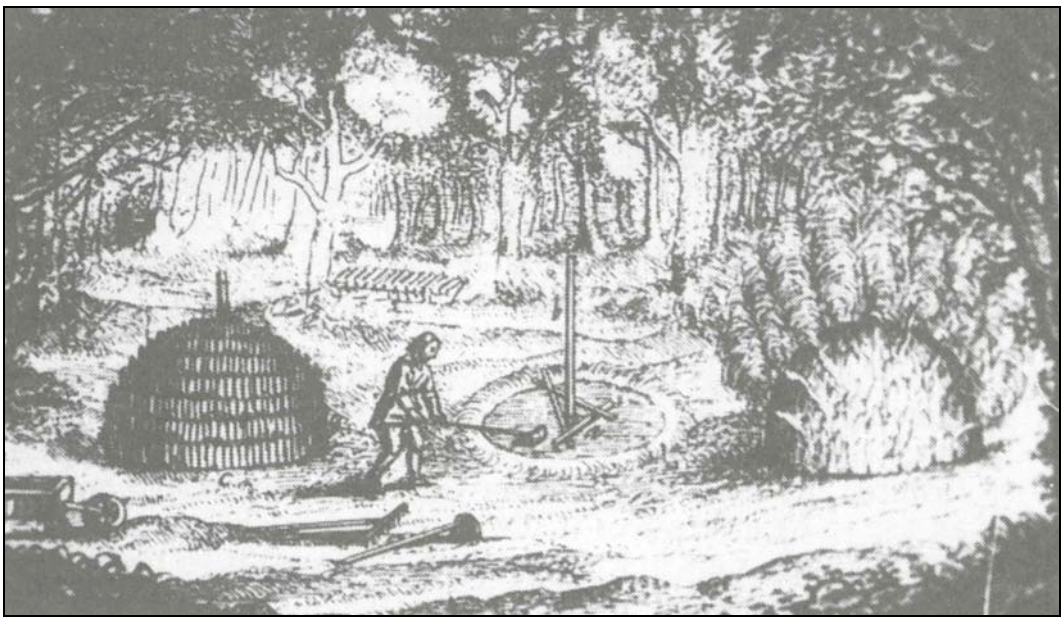

Fig 1: John Evelyn's image in *Sylva* (1664) shows the stages in building a charcoal kiln

The best background history on the subject, at least for Wales, is by William Linnard (2000) who deals with the outline history and describes also the nature of charcoal-burning sites, though the emphasis is focused very much on the south of the country. The best brief description of the subject written by an archaeologist, is that by Bowden (2000).

Sites and the HER

The features that distinguish the presence of the industry in an archaeological sense are the platforms that were created for the kilns or bonfires, which in places go under the name of 'pitsteads', though it may be the north of England where this term is particularly prevalent. These originated as circular levelled areas or depressions in the ground large enough to take the amount of timber being converted to charcoal by constructing a 'kiln'. A central vertical shaft or vent was created around which timber was stacked, and the mound then covered in leaves and soil (Fig 1). Only one such platform has been excavated in Wales in recent years as far as can be ascertained, that one at Llanelen on Gower. The other feature associated with the industry are the small and often circular (though not invariably) earthworks signifying the charcoal burners' huts.

There is a local belief that Coedpoeth to the west of Wrexham takes its name from the fact that the area, once covered in beech and oak, was a centre for the production of charcoal, hence the English translation 'hot' or 'burnt wood'. The earliest form of the Welsh place-name appears in 1391. However, the most recent authoritative report on Welsh place-names considers it more likely that the name was acquired when the woodland cover was burnt off to facilitate mining.

Fig 2: A charcoal platform from Wrekin (CPAT 1884-015)

Where there was an appreciable demand for the product, charcoal-burning platforms ought to be commonplace. Thus in a survey of The Wrekin in Shropshire in 2005, CPAT

identified 126 platforms on the hill (Fig 2), perhaps not surprisingly in view of its proximity to the industrial centre around Coalbrookdale.

But apart from giving us as fieldworkers a much clearer appreciation of how the remnants of the industry might present themselves, the Wrekin is hardly relevant here. Indeed blast furnaces are generally not common in east and north-east Wales, though there was a notable concentration of furnaces in the Wrexham-Ruabon district, and the region as a whole seems to be surrounded by areas where iron manufacture was practiced. Thus the Dyfi Furnace between Machynlleth and Aberystwyth – and in Cadw's guardianship – was built about 1755 and used charcoal, but is just outside the region, in Ceredigion; and above the Mawddach estuary, west of Dolgellau is Coed y Brenin recognised for its iron smelting sites, the one at Llwyn Du of the later 14th century being excavated by Peter Crew.

For the Ruabon furnace and its forge at Pont y Blew, Edwards (1960, 32) notes that there are records of timber (normally described as cordwood) being taken from a number of woods in the locality to make charcoal, including Black Park and New Park on the Chirk Castle estate. Both of these parks or at least their locations in the landscape can still be identified in the landscape, but to the best of our knowledge there has never been any systematic fieldwork here that could have led to the recognition of relevant remains.

Linnard links charcoal burning to metal ore smelting in western Breconshire (both iron and lead) and Montgomeryshire. While it would generally be anticipated that charcoal production was located close to the industry that it was fuelling, this was evidently not always the case. It was of course easier to transport the charcoal than the wood that produced it. Linnard refers to Dolobran forge near Meifod (Monts) where charcoal was transported by pack animal from 25 miles away, perhaps from the Llandinam area, which is said to have supplied the forge with charcoal in the late 17th and early 18th centuries, though no surviving evidence of this industry has so far been recorded in that locality. On the other hand, Oliver Rackham has claimed that charcoal was too fragile to be transported far, While it is difficult to subscribe to Rackham's contention that 'fuel-using industries lived near woods because ores and finished products were easier to transport than charcoal' (1990, 84), there is one conclusion that derives from the two conflicting statements, above, the one very general, the other a specific example: it is that medieval and later workers would have done whatever was practically and economically feasible.

In regard to Dolobran Forge, there are a number of references to wood and charcoal supplies in the diary of John Kelsall, the clerk from 1719 to 1729, which are repeated by Davies (1940, 45-64). Places mentioned as supplying wood or charcoal include Llyssun, near Llanerfyl, the Hill (possibly Bryn Farm ?), Tregynon, and 'Evan Morgan's wood, beyond Pont ys cowrhyd' (Pontysgawrhyd near Trefnanney). There is an interesting reference in March 1721, which states 'Went this day beyond Llanvair (Caereinion) at ye finishing of the charcoaling', implying that charcoal was being made where the trees had been cut. This seems to relate to Llyssun, something confirmed in June of the same year when he states 'I was at Llyssyn Park to see the (char)colliers'.

It is as much the small-scale of the operations and the ephemeral nature of the remains that are likely to be encountered in primarily rural regions that has inhibited the recognition of charcoal-burning sites in mid-Wales, and it is probably not surprising that very few platforms have been recorded in the past. The HER has 25 individual records of 'charcoal burners site' as a type, from 14 locations. The largest group, of five, is recorded from Park Wood, near Talgarth, and indeed four other groups are also located

to Breconshire, the most interesting of which are the Gelli Rhyd charcoal mounds (26797) in the Vale of Grwyney which reportedly supplied the blast furnaces in Blaenavon and Glangrwyney, and the Neuadd charcoal burning site in Llangynidr (48512) where at least 14 relatively small platforms were thought to have provided fuel for the many lime kilns along the Brecon and Monmouth canal. Further north in Glantwymyn at least nine were found on wooded slopes above the River Dovey at Mathafarn (48748), possibly related to the iron forge that was apparently still in evidence near the house in the 19th century.

In all there are probably little more than 60 recorded charcoal-burning platforms (variously referred to as mounds, hearths, platforms or charcoal burning sites, though never as kilns) across the whole of east and north-east Wales, and the majority of these have come from Tir Gofal field visits in the early 2000s. Compare this figure with the numbers encountered on The Wrekin (above) and it is all too evident that the site type is grossly under-represented in the HER, and that the examples that are recorded can hardly be paraded as typical examples nor that the 'sites' in their entirety, regardless of the density of platforms, are good examples of their kind.

Sources

Bowden 2000; Crew 2001; Davies 1940; Kelley 1986; Kissock and Wright 2001; Linnard 2000; Newman 2001, 116; Rackham 1990; Silvester 2005; Steane 1985.

Clay Industries

The use of clay during the medieval and early post-medieval periods, though frequently barely mentioned in major works dealing with the industrial history of Wales (e.g. Rees 1968; Dodd 1971), was nevertheless of some significance despite the scarcity of visible archaeological remains. Four main clay industries are represented in mid and north-east Wales can be identified - brickmaking, roof and floor tile manufacture, tobacco pipe manufacture, and potting.

Unfired clay was also widely used in for a number of other domestic and industrial purposes that are not considered here. These include its use in flooring, the walling of timber-framed buildings and possibly cob-built buildings in parts of the region up until about the 17th and early 18th centuries, its for caulking water containers or ponds.

Local clays are also likely to have been used for refractory processes, for the production of crucibles, furnaces and moulds, but their history prior to 1750 appears to be poorly documented.

Brickmaking

Background

The earliest recorded use of brick in the region dates to about the middle of the 16th century though its use was uncommon until the emergence of a brickmaking industry at various local centres in mid and north-east Wales in about the 1760s. Prior to this, its use was largely for the construction of fashionable, Dutch-influenced gentry houses, though during the course of the course of the 18th century it was also becoming more commonly used as brick noggin, infilling the panels of lesser timber- framed buildings and also for the construction of chimney stacks in half-timbered houses and it also soon became used for industrial structures such as forges and mining shafts.

The earliest use of brick in Wales is thought to have been that by Sir Richard Clough in the construction of Plas Clough, Denbigh, in 1567 and at Bach-y-graig, Tremeirchion *c.*1567-69 (Hubbard 1986, 93; Smith 1988, 265n), which were reputedly built with imported Dutch bricks supplemented by bricks produced locally by brickmakers brought over from Holland (Conolly 2003, 16). Despite these early beginnings, brick appears to have only rarely been used as a building material in the counties of north Wales prior to 1750, probably due to the abundance of good building stone and the existence of an already well-established stone quarrying industry. Late 17th and early 18th-century records exist, however, for brickmaking at Old Hall, Wrexham (1680), Penley Forge or Cross Mill (1720), Erddig Hall near Wrexham (1721-22) and Nantclimbers, near Overton (Edwards 1987, 50, 58; Connolly 2003, 16).

In mid Wales, the use of brick before 1750 was largely confined to Montgomeryshire (Haslam 1979, 169-70), where the earliest dated example is the now vanished New Building at Montgomery Castle, built for the Herberts in the Middle Ward in 1622-25 (Haslam 1979, 169-70), destroyed in 1649, which had walls of brick and timber. This included the use of ornamented bricks (Knight 1994, 183-5) and possibly also roofing tiles (Knight 1990-91, 22), whose production was probably based on the brickmaking traditions and skills in the adjacent county of Shropshire, where the industry is known to have originated before 1540 (Mercer and Stamper 1989; Knight 1994, 185). Other pre-1750 brick houses in Montgomeryshire include the now-demolished house of the Blayneys at Tregynon (1636?), Vaynor Park, Berriew, (*c.*1650), Llandrinio Hall (*c.*1670),

Criggion Hall (*c.*1675), Maesmawr Hall (1689-92). Other early use of brick in Montgomeryshire included the farmhouses at Abernaint, Llanfyllin and Haughton Grange, Llandrinio (both of *c.*1700) as well as some ecclesiastical use, as in the case of Dolobran Quaker Chapel, Pontrobert (1700) and Llanfyllin Church (*c.*1706-10?) (Haslam 1979, 169-70). Early brickmaking in Radnorshire is less well attested, but is represented at the storeyed gentry house at Pilleth Court, built in the latter part of the 16th century (Haslam 1979, 267; Suggett 2005, 144).

Pre-industrial brickmaking in mid and north-east Wales was normally undertaken by the larger and more progressive estates, and appears to have been temporary and short-lived, and undertaken for a specific building project. Bricks were generally produced where suitable deposits of clay and fuel were locally available in order to reduce costs and to exploit the resources available on a particular estate. Coal was often used for firing where this was readily available, at least from the early 18th century, though brushwood and timber is also likely to have been widely used (cf Davey and Roseff 2007, 19-20). At an early date brickmaking was probably carried out as a part-time occupation of labourers or estate workers under the supervision of professional or semi-professional brickmakers (cf Whitehead 1981).

The former existence of clay pits are known from field names such as 'Cae Bricks', 'Brick Kiln field' or 'Brickfield' which appear on Tithe and estate maps, but these are often not closely dated and generally without surviving visible remains. The location of clay sources is also sometimes recorded in estate accounts, as in the case of the record of payment for 'Riseing Clay' at Coed y Gline, Wrexham (17049), recorded in the Erddig accounts in 1722 (Edwards 1987, 58).

So far, no pre-1750 brick kilns have been identified within the region, but surviving remains are likely to be similar to the excavated remains of the late 18th- or early 19th-century kiln brickmaking sites at Great Brimmon near Newtown and at Four Crosses, both in northern Powys (Jones 2009; Jones and Grant 2011, 4-7). These were clamp kilns, with no permanent superstructure, represented by intensely scorched subsoil associated with brick waste. The kiln bases at these sites were either circular and between about 5 by 8 metres or rectangular and up to about 7 metres by 18 metres across, with the position of linear flues between the original brick stacks evident in the pattern of burning. The kilns were evidently dismantled after use and have left no surface trace but would show up in geophysical survey. In the case of the Four Crosses kilns, the clay used for brickmaking had been dug from shallow irregular pits between 5-50 metres across immediately next to the kiln bases, but no traces of working areas for the moulding of bricks were identified (Jones and Grant 2011, 4-7).

Despite the temporary nature of pre-industrial kilns, brick production even for a single building project was sometimes carried out on a substantial scale, however. The account books for Erddig Hall record the manufacture of 74,250 bricks in April 1721 and 600,000 bricks in February 1722, used building extensions to the property (Edwards 1987, 58; Connolly 2003, 16).

Surviving remains

The only certain surviving remains of the brickmaking industry in the region are some of its products which exist either as archaeological finds or in standing buildings. As is commonly the case elsewhere, no undeveloped brickyards, certain kilns, workshops, claypits or other infrastructure of the industry dating to before 1750 are known, with the

possible exception of several brickyards on the Maes-Mynan estate, Caerwys, shown on Thomas Badeslade's map of 1742 (see Gazetteer).

Management recommendations
None

Significance
The identification of early brickmaking sites in the region would make a contribution to our currently poor understanding of the its scale, distribution, chronology and cultural significance in the region.

Research strategies
Further fieldwork, finds analysis, documentary and cartographic research is needed to find out more about the history of brickmaking in the region.

Gazetteer
120443 Maes-Mynan, Brick Yard, Caerwys, Flintshire
Brickyard shown on Thomas Badeslade's 1742 map of Maes-Mynan estate. Structures are still visible both on the first OS map in the 1870s and modern OS maps.

120447 *Maes-Mynan, Croes Wean, Brick Yard*
Brickyard shown on Thomas Badeslade's 1742 map of Maes-Mynan estate. By the time of the first OS map in the 1870s the landscape shows change with no brickyard visible. By the modern OS map this has changed drastically.

Roof And Floor Tile Manufacture

Background
The history of roof and floor tile manufacture in mid and north-east Wales is generally poorly documented. Like brickmaking, the industry was based upon the local availability of sources of clay and fuel which, depending upon availability, would have been either coal and timber.

A large proportion of the floor tiles that appeared on high status ecclesiastical and secular sites in Wales between the 13th and 15th centuries appear to have been imported from production centres in adjacent areas of the English Midlands, though local production is known or suspected from the distribution of products within mid and north-east Wales (Lewis 1999, 12).

A medieval kiln at Denbigh is one of the very few known examples in Wales. This late 14th-century kiln (102021) was partially excavated during the digging of drains and foundations for building on the south side of Middle Lane in 1938, and is now assumed to be destroyed or built over (Newstead 1938; Lewis 1999, 234-5). It was a substantial tile-built structure about 3.5 by 3m across with arched flues. Associated finds included roof-tile wasters and a single glazed waster floor tile. The kiln is assumed to have supplied high status sites in Denbigh (such as Denbigh Castle, Denbigh Friary, and St Hilary's Chapel) where tiles have been found, and possibly further afield in north Wales (Lewis 1999, 91, Group 52).

Two possible tile kilns are thought to have existed at Basingwerk, Greenfield. The first lay about 200m to the south-west of the abbey (102388; Davies 1949, under Holywell; Lewis 1999, 228), noted by Pennant in the 18th century as having been found during the construction of metalworks. The second is a site 300m to the north-west of the abbey (102390), said to have been destroyed during housing construction. This produced roofing tile wasters, said to be identical to those used for roofing the abbey (Davies 1953) and also possibly producing 15th-century floor tiles (Lewis 1999, 93, Group 53, and 228).

Another possible centre of production of floor tiles in the upper Severn valley is suggested by the distribution of a further group of tiles whose distribution centres on Strata Marcella, north of Welshpool (Lewis 1999, 87-8, Group 51), for which no kiln sites have so far been identified.

Roofing tiles appear to have been amongst the latest products of the medieval pottery kiln at Ewloe, Buckley Common, identified from finds scatters. These included glazed ridge-crest tiles and decorative roof finials, probably of 15th century date (Harrison and Davey 1977, 94-5, 98-9) whose fabrics are often similar to those of locally produced pottery (Papazian and Campbell 1992, 78-9).

A further possible centre of production of late 13th- to early 14th-century roof furniture in the Montgomery/Welshpool has been suggested by the distribution of pottery and tile of Powys Siltstone type (Papazian and Campbell 1992, 71-3), though no kiln sites have so far been identified.

Little is known about the production of tiles in mid and north-east Wales in the early post-medieval period. It is likely that these products were being used for a wider range of domestic and industrial uses than in the medieval period, including those for hearths and ovens in addition to roofing and flooring. As noted above, the local production of roofing tiles in an early 17th-century context may be represented at Montgomery Castle (Knight 1990-91, 22),

Surviving remains

The only known site where buried structural remains may survive is the Ewloe Pottery Kiln (44492) which is known from surface finds.

Management recommendations

Consider further field assessment and potential scheduling in the case of the Ewloe site.

Significance

Little is know about the dating and production of roof and floor tile in mid and north-east Wales during the medieval and early post-medieval period. The identification of well dated tile kiln groups is of intrinsic importance and would have potential significance to dating the archaeological contexts in which the products are found.

Research strategies

Further fieldwork and finds medieval and early post-medieval roof and floor tile making in mid and north-east Wales.

Gazetteer

44492 Buckley Potteries, Ewloe Pottery Kiln

Site of medieval pottery kiln, identified from finds scatters, evidently producing 15th-century glazed ridge tiles and roof finials in addition to a range of 14th-century pottery

types (see also below) (Harrison and Davey 1977, 94-5, 98-9, Davey and Longworth 2001, 63).

Tobacco Pipe Manufacture

Background

Eight named manufactures of clay tobacco pipes have so far been identified in the Buckley area in the period *c.*1650-1750, based upon parish records or the products themselves, which are sometimes stamped with the names or initials of manufacturers. The industry was evidently being carried out by a small number of family businesses (Bentley *et al* 1979, 15; Cropper 1906), as an adjunct to the contemporary pottery industry at Buckley (see below). The industry was based upon local supplies of coal and clay, the latter in this instance being pockets of white-firing fire clays within the Carboniferous Limestone bedrock (Davey and Longworth 2001, 63). The use of similar moulds to contemporary manufacturers of clay tobacco pipes in Broseley, Shropshire suggests personal contact between the two areas (Bentley et al 1979, 20; Davey and Longworth 2001, 66). Like Buckley pottery, the main area of distribution was north Wales, Isle of Man and Ireland. The absence of Buckley clay pipes in Chester probably indicates the operation of marketing monopolies within the city during this period (Bentley *et al* 1979, 20).

Surviving remains

The only certain surviving remains of the industry are its products. As is commonly the case elsewhere, no surviving kilns or workshops associated with the industry at Buckley have been identified though significant quantities of clay pipe fragments found at Pinfold Lane 1 (57689) and Brookhill (101670) have suggested kiln sites where they may have been produced in the period 1650-1750 (Bentley *et al* 1979, 15). Firmer evidence has been forthcoming from the Brookhill site which has produced probable wasters (Higgins 1983; Higgins 2006; Davey and Longworth 2001, 66).

Management recommendations

None

Significance

The Buckley area appears to the only or one of only a small number in Wales where clay tobacco pipes were manufactured in the period before 1750 (cf Oswald 1975). As well as the intrinsic interest of this industry, as in the case of Buckley potteries, the identification of well dated kiln groups would have potential significance to dating the archaeological contexts in which the products are found.

Research strategies

Further fieldwork, finds analysis, documentary and research is needed to establish workshops and kiln sites and their chronology, and socio-economic history of pipemaking at Buckley.

Gazetteer

None

Potting

Background

The predominantly Welsh areas of Wales demonstrate little use of ceramics in domestic contexts until as late as the 16th century, even on relatively high-status sites, until the early post-medieval period its use being very largely confined to areas strongly influenced by Anglo-Norman, Henrician and Edwardian settlement (cf. Papazian and Campbell 1992, 81). Though the reasons for this are likely to be complex, its presence or absence on sites of the medieval and early post-medieval periods provides a significant cultural and economic indicator throughout Wales during the medieval period.

These cultural and economic factors have also influenced the distribution of centres of production in mid and north-east Wales – a sizeable proportion of the pottery found on sites of the medieval and early post-medieval periods in the region having probably been imported from potteries in adjacent areas of the English Midlands and further afield. Some local production is known or suspected, however, based upon a number of disparate sources of evidence: ceramic fabric analyses and their distribution; a limited number of known kiln sites; place-name and documentary evidence. Like the manufacture of brick and tile, potting was based upon the suitable local sources of clay and fuel which, depending upon availability, would have either coal and timber.

Medieval wares produced in Wales generally had a local distribution. Four generalized production centres have been suggested in mid and north-east Wales based upon an analysis of pottery fabrics and kiln products (Papazian and Campbell 1992, 40; cf Courtney and Jones 1988).

A short-lived production centre in second half of 13th century existed in Rhuddlan, producing jugs, cooking pots, bowls, curfew in a fabric known as 'Rhuddlan ware', whose products were distributed to sites along the north and north-west coast of Wales (Papazian and Campbell 1992, 72, 74). A single kiln site is known (see below).

A production centre at Ewloe in the late 13th to 16th centuries is known which made jugs, bowls, lids or platters and roof furniture in a fabric known as 'Ewloe ware'. Kilns distributed within the area covered by the northern Welsh counties. (Harrison and Davey 1977; Papazian and Campbell 1992). The approximate location of one of possibly a number of kiln sites is known (see below).

The distribution of pottery in a 'Cheshire Plain fabric' suggests production in the region between Chester and Wrexham, late 13th to 14th century, jugs, bowls, cooking pots and baking trays predominant distribution in northern Welsh counties (Papazian and Campbell 1992, 55). No kiln sites have yet been identified.

A production centre possibly in the Montgomery/Welshpool area is suggested by the distribution in the Welsh borders of late 13th to early 14th century, cooking pots, jars, tripod pitchers, glazed jugs, baking trays, bowls, roof furniture in what has been termed a 'Powys Siltstone-tempered fabric' (Papazian and Campbell 1992, 71-3). No kiln sites have yet been identified.

From the 15th century onwards pottery production within mid and north-east Wales appears to have been largely restricted to the Buckley area, which continued to produce a wide range of ceramics up to the early 20th century (Davey and Longworth 2001, 62). From the 16th century the products of this industry were marketed fairly widely and have been found in the north Welsh counties, Cheshire, Lancashire, Liverpool, the Isle of Man, Ireland and the Americas.

As noted above, medieval kiln sites are known at Rhuddlan and Ewloe (see further details in Gazetteer). The Rhuddlan kiln, which is assumed to be no longer extant, was short-lived and probably associated with the Henrician settlement, probably in the period 1241-63. In its second phase its form belongs to Musty's type 2a medieval kilns, consisting of a firing chamber joined by arched flues to two opposed stoke-pits, which was a common type for professional pottery production at this period. The kiln appears to have been operated by potters brought in from Cheshire, produced jugs, cooking pots, bowls and curfews (fire covers) (122249; Miles 1971-2; Miles 1977; Quinnell et al 1994, 52-56; Owen 1994; 193-98).

A possibly extant kiln site of 14th- to 15th-century date at Ewloe is suggested by a concentrated scatter of medieval pottery including wasters recovered during field-walking in 1975 (44492; Harrison and Davey 1977; Davey and Longworth 2001, 63). Other possible medieval kiln sites are suggested by medieval pottery found at a number of other post-medieval kiln sites in the area, some of which have now been lost to development, such as Ewloe Green (103755). Products of the medieval potting industry at Ewloe appear to have included jugs, jars, bowls, cisterns, bottles, lids or platters and roof furniture (also noted in a previous section). The origins of the industry in the late 13th century is suggested by the occurrence of the surname 'Potter' and related forms as early as 1292, and evidence of clay digging as is indicated by the field-name 'Pottersfield' in 1435-36 (Messham 1989).

During second half of the 17th century a flourishing cottage-based potting industry had emerged in the Buckley area (101664). These formed encroachments on the Buckley common and were based upon the local availability of sources of clay, opencast coal, and nearby sources of lead for glazes (Davey 1975a; 1975b; 1976; Davey and Longworth 2001; Longworth 2005). A map of *c*. 1750 of the lands of Robert Davies shows encroachments on the edge of the mountain common and small complexes characteristic of small family-based pottery including house, outbuildings and kilns. By the 1780s at least 14 potters or families of potters were evidently at work in the area (Pennant 1784, 91), and would no doubt have given rise to reasonably well-established infrastructure industries providing materials, fuel and transport.

Coal was obtained locally from outcrops of the Coal Measures which occur in seams which run across the district from Ewloe in the north to Padeswood in the south. Clay was available in a variety of sources including the buff- and red-coloured clays found in the Coal Measures, surface deposits of red glacial boulder clay, and white-firing clays which occur in pockets in the Carboniferous Limestone underlying the Coal Measures. Lead sulphide used in the production of glazes occurs as mineralization deposits in joints and faults in the solid geology (Wedd and King 1924, 61; Davey and Longworth 2001, 63).

Brookhill pottery, Buckley (101670) is the earliest post-medieval kiln site so far known in the Buckley area. Partial excavations in 1975 revealed structural remains and finds including later 17th to mid 18th-century pottery, clay pipes and kiln furniture, dated to the period *c*.1640-1720 (Amery and Davey 1979). Parts of the kiln and ancillary structures may possibly still be extant.

A total of about 19 kiln sites are now known in the Buckley area, some of which remained in production until the 19th century (Davey and Longworth 2001, fig. 2). Being a family-based industry, earlier kilns and workshops appear to have often been superseded by ones of later date. The difficulty of being certain whether evidence of

earlier kilns, workshops and associated domestic structures might survive below later potteries is illustrated a number of sites, including Cotterel's pottery, Pinfold Lane 1, and Willow's Pottery. Excavations at Cottrell's Pottery, Buckley (101671) in 1972-72 and 1984 (McNeil 1984) have shown that it was in operation in c. 1690-1720 and ceased production by the 19th century, two beehive kilns of the updraft type, with 8 flues, belonging probably to a later period of production. A narrow trench excavated at Pinfold Lane 1, Buckley (101679), in 1975 revealed layer of coal ash and clinker and pits full of kiln waters including black-glazed wares and flanged bowls probably dating to the period 1650-80. An adjacent derelict single-storey stone cowshed seems likely to be a potter's cottage, and irregularities in the pasture to the north may represent other pottery structures (Davey 1976, 28). The full-scale excavation of a later pottery at the Willow's Pottery, Buckley (103720), in 2000 revealed a pit containing wasters of black-glazed bowls and spouted pipkin also suggesting earlier manufacture on the site in the late 17th and early 18th century (Earthworks 2000; Dodd 2003, 248). A small circular hearth with an archaeomagnetic date of between 1660-1690 associated with structural remains had initially been thought to represent an earlier kiln but is now thought more likely to represent a domestic structure (Dodd, pers. comm.). Associated structures included foundations of workshops, drying floors, storage rooms and accommodation, small pits (or 'blunger') used for kneading clay and for mixing glazes, from which liquids were channelled to shallow settling ponds (Earthworks 2000, 3).

A wide variety of glazed wares as well as tobacco pipes (see above) were produced by the Buckley kilns in the period before 1750. The earliest wares include slip-decorated thrown bowls, with both sgraffito and trailing techniques, porringers, figurines, and large tripod cooking vessels, many of the 17th- and 18th-century products being of high quality and on a par with contemporary Staffordshire products. By 1700 press-moulded wares were being produced and after about 1720 the yellow slip is abandoned and simpler designs in black, brown and orange slip were applied. Later wares include mottled-ware tankards and bowls, slipware dishes and black and brown-glazed cups and storage vessels (cf Davey and Longworth 2001, 64; Longworth 2005; Gruffydd 1980). The products of the Buckley kilns were traded widely in mid and north Wales, Cheshire, Lancashire, Isle of Man, Ireland and the Americas.

The existence of other smaller-scale centres of pottery production in the period before 1750 outside the Buckley area are occasionally suggested by documentary evidence tied to a particular locality. Examples include a reference to the potter Stephen Samuel of Penny-Clawdd, Chirk in 1655 (13340) and a reference to the pottery David Roberts who had a works at 'Place yr Abbot', Ruabon in 1707 (Edwards 1987, 80).

Significance
As well as the intrinsic interest of this industry, the identification of well dated kiln groups would have potential significance to understanding the marketing strategies of different production centres, their cultural context within the marcher lordships, dating the archaeological contexts in which the products are found.

Surviving remains
Further fieldwork and documentary research in the Buckley area is needed to clarify what evidence of kilns, workshops or associated domestic structures dating to before the middle of the 18th century might still survive.

Management recommendations

Consideration should be given to scheduling or otherwise protecting the sites of kiln, workshops and domestic structures associated with the pottery industry, particularly in the Buckley area.

Research strategies

Medieval and early post-medieval kiln sites and workshops in mid and north-east Wales have an intrinsic importance in terms of social, economic and technological history and cultural affiliations, and also have an importance in for dating purposes throughout the region in which their products were traded.

Gazetteer

122249 Rhuddlan, Ysgol-y-Castell medieval pottery kiln

A short-lived kiln of the second half of 13th century which produced jugs, cooking pots, bowls and curfews (fire covers) was excavated just inside the Norman defences of the town in 1973 in advance of development work at Ysgol-y-Castell at Rhuddlan, which is assumed to be no longer extant. Excavation of the kiln showed that it was of three different phases of construction, in its second phase having a firing chamber joined by arched flues to two opposed stoke-pits, which was a common type for professional pottery production at this period. The unlined firing chamber was up to 2.4m across and 0.35m deep whose back-fill included wasters and kiln props. The kiln superstructure, which would probably have been a low clay dome, did not survive. (Miles 1971-2; Miles 1977; Quinnell et al 1994, 52-56; Owen 1994, 193-98).

44492 Buckley Potteries, Ewloe Pottery Kiln

Site of a medieval pottery kiln identified from a dense and reasonably concentrated finds scatter discovered in 1975 (938 sherds), of which about 20% are definite pottery or tile wasters (Harrison and Davey 1977; Davey and Longworth 2001, 63).

101670 Buckley Potteries, Brookhill Pottery

Site of Brookhill pottery, the earliest post-medieval pottery kiln identified in the Buckley area. Excavations by Bentley in 1975 revealed structural remains and finds including later 17th to mid- 18th-century pottery, clay pipes and kiln furniture. The earliest post-medieval site in Buckley (c. 1640-1720) dated by tobacco pipes. The earliest wares include slip-decorated thrown bowls, with both sgraffito and trailing techniques, porringers with press-moulded handles, a female figurine and large tripod cooking vessels. Later wares include mottled-ware tankards and bowls, slipware dishes and black and brown-glazed cups and storage vessels (Amery and Davey 1979; Davey and Longworth 2001, 62-72). The current status of the site is uncertain, having been said to be 'now occupied by a derelict house' in 1976 (Davey 1976, 18).

101671 Buckley Potteries, Cottrell's Pottery

Excavated, partially excavated in 1972-73 and in 1984 (McNeil 1984). The site has produced kiln furniture and pottery of *c*. 1690-1720, the pottery having ceased production by the 19th century. Two beehive kilns of the updraft type, with 8 flues were identified during excavation. It was described in 1976 as 'now farmland' (Davey 1976, 18) but is assumed that the site has been developed.

101679 Buckley Potteries, Pinfold Lane Pottery site 1

In 1975 a narrow trench revealed layer of coal ash and clinker and pits full of kiln waters including black-glazed wares and flanged bowls probably dating to the period 1650-80. An adjacent derelict single-storey stone cowshed seems likely to be a potter's cottage,

and irregularities in the pasture to the north may represent other pottery structures (Davey 1976, 28).

103755 Buckley Potteries, Ewloe Green Pottery, medieval phase
Excavations in 1986 (event record PRN 38251) following anomalies detected by geophysical survey produced large quantities of pottery of 13th-19th-century date but failed to locate any kiln structures (Weetman 1986). The site may have been lost beneath housing development.

Sources

Amery and Davey 1979; Bentley and Harrison 1973; Blockley 1999; Bentley, Davey and Harrison 1979, 1980; Connolly 2003; Courtney and Jones 1988; Cropper 1906; Davey and Roseff 2007; Davey, P J, 1974a, 1974b, 1975a, 1975b, 1976, 1977; Davey and Longworth 2001; Davies 1953; Dodd 1971; Dodd 2003; Earthworks 2000; Edwards 1987; Gruffydd 1980; Harrison and Davey 1977; Higgins 1983, 2006; Jones 2009; Jones and Grant 2011; Knight 1990-91, 1994; Lewis 1999; Longworth 1999, 2004, 2005; Mercer and Stamper 1989; Messham 1956, 1989; McNeil 1984; Miles 1971-72, 1977; Musty 1974; Newstead 1938; Oswald 1975; Owen 1994; Papazian and Campbell 1992; Pennant 1784; Quinnell, Blockley and Berridge 1994; Rees 1968; Smith 1988; Suggett 2005; Wedd and King 1924; Weetman 1986; Whitehead 1981.

Coal Mining

Background

Coal reserves are found in two main localities within the study area. In north Wales the coalfield extends from near Oswestry north-westwards to Point of Ayr, the most northerly tip of mainland Wales, while in the extreme south, a small part of the major south Wales coalfield occurs around the head of the Swansea valley. The coal from the two areas is markedly different in its nature and potential uses, which has implications for its exploitation in historic times. There is also a third, much smaller area of coal-bearing rock at Coedway in the eastern extremity of the old county of Montgomeryshire, this forming an isolated outlier of the Shrewsbury coalfield.

North-east Wales

Historical evidence is plentiful for the north Wales coalfield, and coal was mined in Flintshire from at least the 13th century, just as it was in other counties where the coal measures rose close to the surface. Traditionally, its emergence has been attributed to the needs of the Cistercian monks at Basingwerk, though how much reliance we should place on this surmise is perhaps open to question. What is certainly clear is that land on at least one of their manors – Holywell – was being exploited during the 14th and 15th centuries.

Edward I's castle building programme required coal to fire the lime kilns used in the production of mortar and large amounts were being mined and shipped: 2428 tons went to Anglesey for instance in 1295, at which time a fleet of thirty boats were based at *Holstan*, between Basingwerk and Bagillt, to carry coal and stone to Beaumaris (Hatcher, 1993, 131), while further west coal was being mined at Mostyn in 1294. Then there is a couplet from the poet Iolo Goch describing the bishop's palace at St Asaph in the 14th century which states that: 'I would have a peat fire, or [one of] wood; there's no silent sea-coal there'; but the bishop did claim the right to mine both coal and lead on his estate at Faenol which was only a couple of miles to the west (Rees 1968, 35). And the burgesses of Holt in 1412 had the right to take coal from the wastes of Coedpoeth and Brymbo.

Around Ewloe there was a small but important portion of the north-east Wales coalfield where, as Rees puts it (1968, 35), the coal lay in a belt from Ewloe Green to Buckley, around half a mile wide, and up to six feet deep in places, with it surfacing in some of the outcrops along the belt. This source was worked from at least as early as 1312. Neaverson (1953-4, 16) also recounts evidence of mining in this area and suggests that the earliest workings in this district were to be found in a rectangle measuring 2km north-north-east/south-south-west by 1km centred at SJ 290 660, where coal is found close to the surface. Perhaps significantly, this encompasses the site of a group of coal-rich shaft mounds (19557) mentioned in the 'Iron Making and Forging' chapter of this report and seemingly of early date. Further south, Hatcher (1993, 132) refers to mining on what seems to be a domestic scale in the neighbourhoods of Brymbo and Coedpoeth in the 15th and 16th centuries, also commenting on John Norden's survey of 1620, which mentions six mines on the Grosvenor family's land at Brymbo Common (Hatcher 1993, 134; Rees 1968, 71).

The growing number of references to Flintshire coal mining as the centuries pass have been assiduously collected by Ken Lloyd Gruffydd. These demonstrate that coal was being mined on a considerable scale during the later Middle Ages and into the 16th century, but that exploitable coal deposits (i.e. close to the surface) were found in only a few locations and that demand was variable, high in the peak building era of the later

13th century, lower when building was limited, and coal was used only as a fuel and then not by everyone.

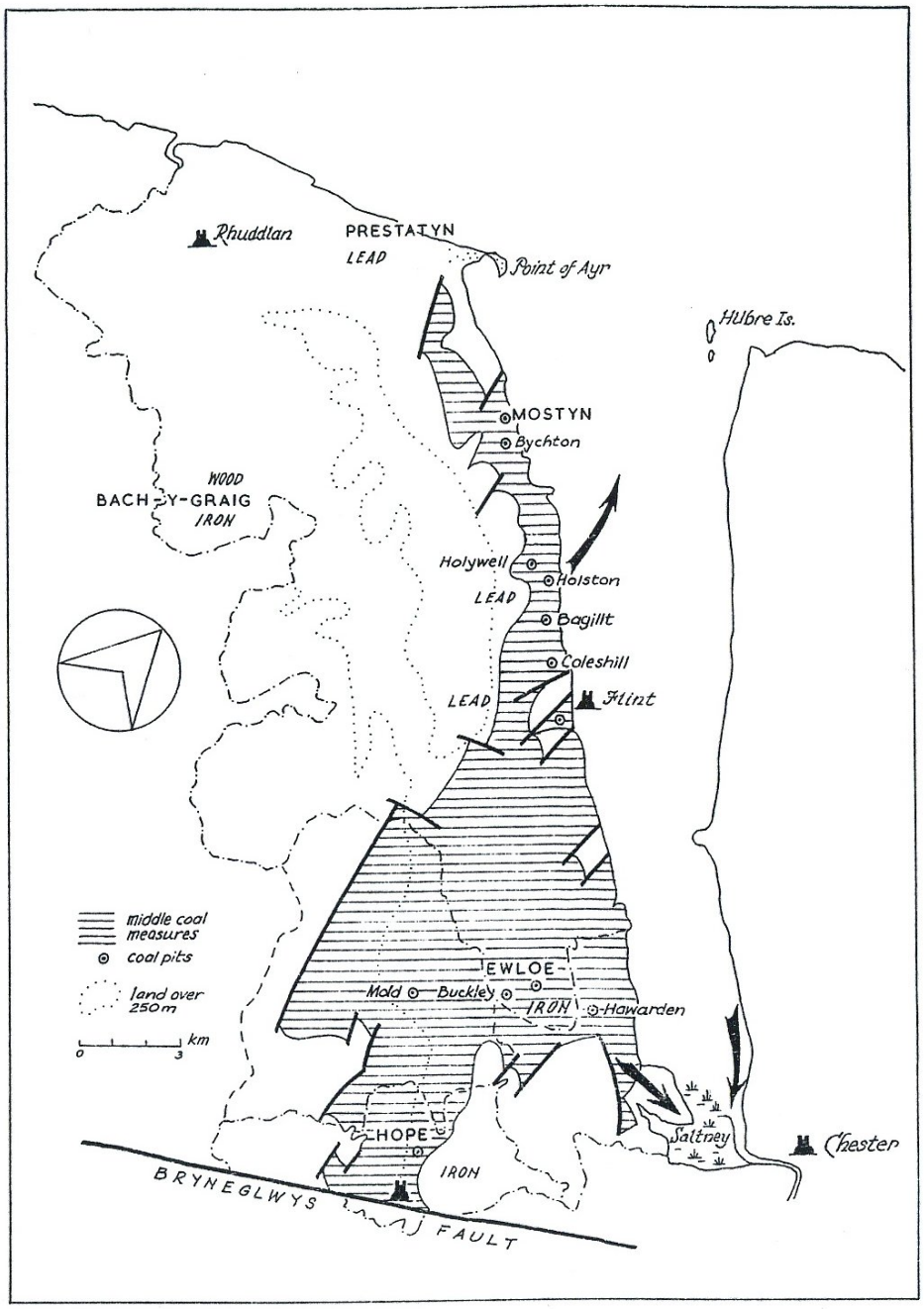

Fig 3: Flintshire and its coalfield showing medieval coal pits. Illustration taken from K.L. Gruffydd 1981-2.

In Denbighshire, coal was being worked before 1620 in the town fields of Chirk at Penclawdd, and at Bryn Kinallt (Rees 1968, 75). For the end of the 17th century, the returns for north-east Wales from Edward Lhuyd's local correspondents which are to be found in his *Parochialia* were analysed by Trefor Owen to illustrate the different fuel dependencies in various parishes. Coal, not surprisingly, featured heavily but not exclusively in the North Wales coalfield, a good example being Llanarmon-yn-Iâl, where coal from Brymbo was used (Lhwyd 1909-11, 158).

The scale of coal mining certainly expanded in the 16th and 17th centuries and the documentation became fuller, with the larger landowners increasingly exploiting their grounds. The colliery at Mostyn was described in *c.*1677 as lying in a large parcel of woodland, the older pits on the high ground above the 15m contour, compared to the ones of *c.*1638 on the sea shore above the high water mark; the mine as a whole seems to date to at least the 16th century. But again the references are largely documentary and existing commentaries have paid little attention to pinpointing the coal pits in the landscape. The accounts for the Erddig estate near Wrexham are particularly illuminating for that locality in the early 18th century, noting nine pits on 'castle hill' (perhaps Gardden, 4km to the south-west of Erddig) in 1718, although Edwards (1961, 73) also notes that coal and ironstone were raised from the Gardden for the furnaces at Bersham and Ruabon in the 1720s. The estate was employing colliers and 'sinkers' (of shafts) in the 1720s at Bryn yr Owen, perhaps at the later colliery site or at SJ 3027 4745; an 'engine' is also mentioned there (Flintshire Record Office D/E/361-4), presumably referring to a horse whim. Then, too, the HER carries a record of a coal mine at Black Park, Chirk in *c.*1620 (13341); there is no precision on its location other than the name attribution which covers quite a large area of the parish but it is almost certain that it relates to the site of the Black Park Colliery (119824); Edwards (1960, 43) also records that coal was obtained for use in forging from the 'New Great Gutter' at Black Park in 1665. Later in the century, in 1677, Andrew Yarranton is said to have shown the coal pits of Aston on his map of the Dee Estuary (37870). Formerly these had been given the NGR of SJ 31000 67999 but it is now acknowledged that this was much too specific.

In north-east Wales, coal was utilised in the lead-smelting process only after 1680 and a breakthrough date was 1704 when the London Lead Company established a reverbatory furnace near Bagillt. As a firing agent in the pottery industry, it was employed at Buckley in the early 17th century, and in copper smelting it seems to have been successfully employed only in the later 18th century. Although coal was largely a regional fuel, both in its extraction and use, up to this study's cut off date of 1750, Pennant (1988, 133) comments that it was exported from north-east Wales to Ireland in the decades around 1700, but that the trade was subsequently affected by the rise of the collieries of Whitehaven in north-west England.

Central Wales

Much of central Wales was remote from any of the coalfields, and it was only the arrival of the canals towards the end of the 18th century that facilitated the distribution of coal, and even then its use was often dictated by need rather than preference. Nevertheless, there were sporadic attempts to identify coal deposits, though without much obvious success. The most recent seems to have been at Presteigne in 1912-4. The late David Bick recorded several places where attempts to find coal had failed: at Llanwrtyd Wells in Breconshire (undated); at Tynycoed near Llandrindod Wells, Radnorshire, at Llwyn Madoc, Radnorshire (in 1816), at Rhiwgoch near Llandrindod Wells (undated) and at Weythel Common, near New Radnor in Radnorshire (in 1805) and an earlier attempt in Presteigne (early 19th century). Bick was able to identify shafts or adits at several locations. There was also an abortive coal mine (6250) cut into the foot of the prominent hill known as Moel Pentyrch to the west of Llanerfyl (Monts). It was apparently started at the beginning of the 19th century, was then abandoned and was re-started in 1871. Its single shaft about 30 yards deep may be represented by one of the 'wells' (49112 or 72639) at Tan-y-foel farm. Any trials that took palce before 1750 appear to have gone unrecorded, presumably because of their lack of success.

In the northern part of Powys there was a small colliery at Coedway on the very edge of Montgomeryshire. The site is undated but was worked as an outlier of the Shrewsbury coalfield, which was being exploited from at least the 1720s. Although it is said that the seam ran from the Breidden Hills into Shropshire, Coedway appears to be the only place where coal was actively sought.

South Wales

In south Wales, the small part of the coalfield which enters the study area lies near the head of the Swansea valley around Ystradgynlais and there seems to have been little or no activity there in the centuries preceding 1800 as the coal was unsuitable for contemporary industries. Although the deposits there outcrop on a fairly steep hillside and are easily worked, they are of anthracite, which was only widely exploited in the 19th century when it became feasible to use it in the iron-making process (see the relevant section of this report). Prior to that, the main mining activity in these deposits was for the interbedded clay ironstone. The earliest known leases for coal extraction in the district (National Library of Wales ref ABL 6/1) relate to the Palleg Estate, north-west of Ystradgynlais, and date to the last years of the 18th century. The first colliery to be established seems to have been Lefel-Fawr, which was started around 1800 (RCAHMW NPRN 33371).

Sites and The HER

The HER contains 95 records where the Type1 field contains the word 'coal'. In 83 instances this is combined with 'mine', in four with 'shaft' and in five with 'pit', the three remaining citations being a 'coal and oil works' and two 'sheds'. Around twenty-five of the mines have references sufficiently precise to suggest that the mines were either initiated subsequent to 1800, or were depicted on maps as working at that time. Undoubtedly though, the number of post-1800 coal mines is very much higher for many records display no chronology whatsoever.

Gruffydd has pointed out that the methods of extraction in the Middle Ages were fairly primitive, involving quarrying, surface trenching along exposed seams, and bell pits. These were satisfactory as long as surface outcrops remained but as these became exhausted, alternative methods needed to be found. It has been suggested that by the early decades of the 16th century colliers were driving levels into sloping terrain, and in the second half of the century vertical shafts were introduced into Flintshire.

Gruffydd was able to plot eleven coal pits where medieval extraction occurred, all of the locations being based solely on documentary sources alone, both along the Dee estuary and in the area around Ewloe. If there are any surviving remains of medieval and early post-medieval vintage, they had not been identified. For the period between 1650 and 1737 he could map twenty-four, but again there is no attempt to pinpoint them with any precision.

John Ogilby's maps of the road network, produced in the 1670s, provide some clues and one definite location of a coal mine in that period. He depicts a group of 'cole pitts' on the north-east Wales coast, about 2.5 miles north-west of Flint, a location which coincides with that of the later Bettisfield Colliery and was possibly the site referred to in an agreement regarding waterworks related to pumping engines in 1626 (Flintshire Record Office D/GW/B/557). These were reasonably close to Whelston, formerly known as *Holstan*, a township in Holywell from where 524 tons of 'sea-coal' was sent to Conway Castle in 1286 (Colvin 1963, 349; and see above). Other coal workings are

suggested on Ogilby's maps where side-roads are shown with an appended note reading 'to ye colepitts'. Three sites have been identified in this manner, two in the Wrexham-Ruabon area around SJ 290 436 and SJ 298 473, the latter probably that at Bryn yr Owen (mentioned above) which was working between 1716 and 1736 (Flintshire Record Office D/E/361-364, 547), and another at Ffrwd (SJ 305 552) near Gwersyllt. Dodd (1951, 18) refers to mid-17th-century workings and an 'engine' (probably meaning a horse-gin) at Black Park near Chirk, under the control of the Myddleton family. All of these sites appear to have either been worked at a later date and subsequently built over, or landscaped, so it is unlikely that any recognisable traces of early working will have survived.

A source not previously utilised is Thomas Badeslade's map of the mountain lands in the hundred of Bromfield and Yale prepared for Sir Robert Grosvenor in 1740 (Flintshire Record Office D/GR/1680). Reasonably accurately surveyed, it depicts twenty-four localities where there were 'old coal pits' and another twelve where there were coal works 'in use', all in the Brymbo-Coedpoeth area. Virtually none of these was previously recorded in the HER; a gazetteer of sites revealed by the map is appended at the end of this section. A sample of the sites were visited as part of this project, but no surface evidence was recognised at any of the locations.

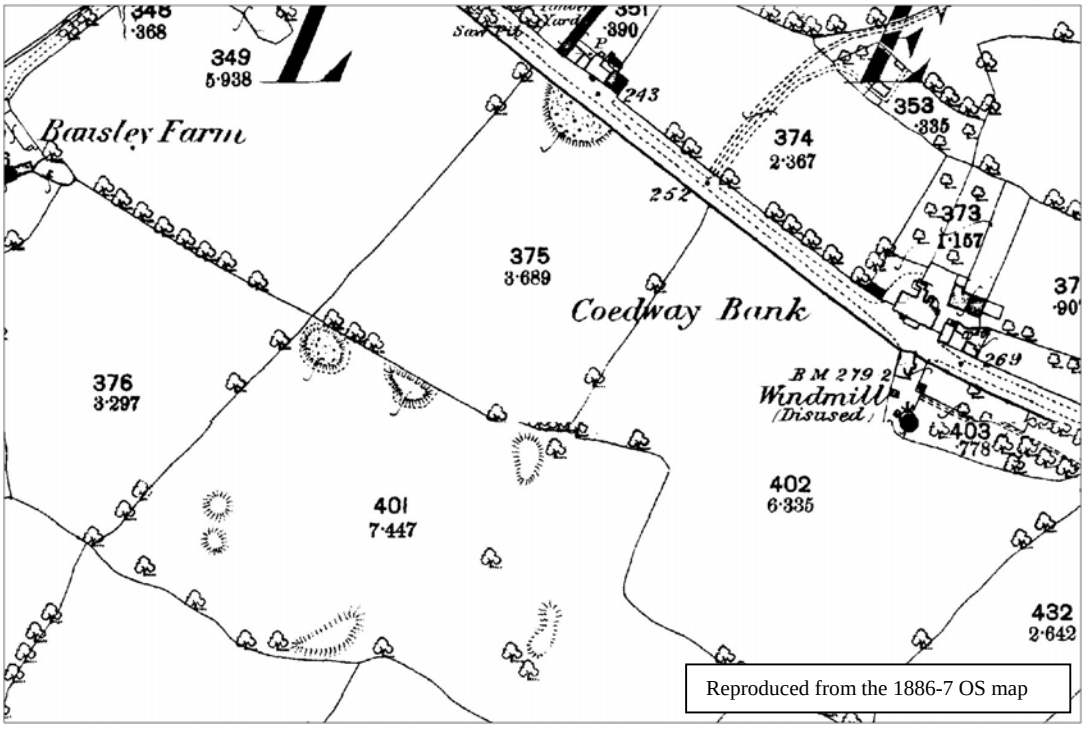

Fig. 4 Earthworks at the site of Coedway coal mine, as depicted on the 1st edition OS mapping of the 1880s and still extant

At Coedway (122206: SJ 3359 1483), the only colliery in northern Powys, mounds from the workings can still be seen. They are recorded as overlying possible strip cultivation remains in the National Monument Record (NPRN 400817, accessed via Coflein), but had not previously been recorded in the HER. The mine was fairly small in scale, and the earthworks in their current form are depicted on the 1st edition Ordnance Survey mapping of the 1880s, but without explanation, implying that it had been abandoned for some time (Fig 4). A symbol denoting abandoned coal workings is located here on a

plan in Pocock and Whitehead (1935,68). The Shrewsbury coalfield, of which this was an outlying part, was exploited from at least the 1720s (Tomlins nd).

Gazetteer of coal mining features in the Brymbo-Coedpoeth area on Badeslade 1740

PRN 121540 Bellan Farm shaft I SJ3070454678
'Old coal works' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680). This or PRN 121541 may be the shaft recorded under PRN 104321, nearby, as Pendwll Colliery.

PRN 121541 Bellan Farm shaft II SJ3069754655
'Old coal works' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680). This or PRN 121540 may be the shaft recorded under PRN 104321, nearby, as Pendwll Colliery.

PRN 121542 'The Old Wagon' coal mine SJ2982254507
Old coal pit called 'The Old Wagon' depicted and named on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121543 Summer Hill coal shaft I SJ3082054191
'Coal work now in use' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680). No longer extant, probably built over.

PRN 121544 Summer Hill coal shaft II SJ3083754142
'Coal work now in use' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680). Not visible.

PRN 121545 Summer Hill coal shaft III SJ3083954126
'Coal work now in use' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680). Not visible.

PRN 121546 Gwersyllt Hill coal shaft I SJ3106253190
'Coal work now in use' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680). No longer extant, probably built over.

PRN 121547 Gwersyllt Hill coal shaft II SJ3106653170
'Coal work now in use' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680). No longer extant, probably built over.

PRN 121548 Gwersyllt Hill coal shaft III SJ3104453169
'Coal work now in use' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680). No longer extant, probably built over.

PRN 121549 Gwersyllt Hill coal shaft IV SJ3099653173
'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121550 Gwersyllt Hill coal shaft V SJ3102853087
'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121551 Gwersyllt Hill coal shaft VI SJ3110153021

'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121552 Gwersyllt Hill coal shaft VII SJ3109153011
'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121553 Mr Hill's coal pits, Cefn Road SJ3000753187
Coal shafts, presumably in use at the time, depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121554 Brymbo Steelworks, coal shaft SJ2948153405
'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121555 Sir Robert Grosvenor's coal pits, New Road, shaft I SJ2988853539
Coal shaft, presumably in use at the time, depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121556 Sir Robert Grosvenor's coal pits , New Road, shaft II SJ2985753557
Coal shaft, presumably in use at the time, depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121557 Sir Robert Grosvenor's coal pits, New Road, shaft III SJ2982653568
Coal shaft, presumably in use at the time, depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121558 Queen's Road coal shaft I SJ2982353702
'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121559 Queen's Road coal shaft II SJ2981253727
'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121560 Queen's Road coal shaft III SJ2979053770
'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121561 Brynmally Park coal shaft I SJ2978653885
'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121562 Brynmally Park coal shaft II SJ2978053909
'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121563 Church View coal shaft SJ2935154160
'Coal work now in use' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121564 Pleasant Lane coal shaft SJ2942754087

'Shaft sunk by Sir Robert Grosvenor in 1739' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121565 Nant Farm coal shaft I SJ2934153986
'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121566 Nant Farm coal shaft II SJ2832050604
'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121567 Coedpoeth Cemetery coal shaft I SJ2817251170
'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121568 Coedpoeth Cemetery coal shaft II SJ2814351217
'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121569 Coedpoeth Cemetery coal shaft III SJ2811351244
'Old coal pit' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121570 Coedpoeth Cemetery coal shaft IV SJ2805751209
'Old coal works' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121571 Coedpoeth Cemetery coal shaft V SJ2807451179
'Old coal works' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121572 Coedpoeth Cemetery coal shaft VI SJ2809251155
'Old coal works' depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680).

PRN 121573 Bryn Tegla coal and iron shaft I SJ2796951989
'Old coal iron' (shaft) depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680). No longer extant.

PRN 121574 Bryn Tegla coal and iron shaft II SJ2795752003
'Old coal iron' (shaft) depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680). No longer extant.

PRN 122213 Bryn Tegla coal and iron shaft III SJ2798751975
'Old coal iron' (shaft) depicted on Badeslade's map of 1740 (Flintshire Record Office D/GR/1680). No longer extant.

Gazetteer of other coal mining features revealed by this study

PRN 122206 Coedway Coal mine SJ3359614836
Coedway was the only colliery in northern Powys. Mounds from the workings can still be seen, and they are recorded as overlying possible strip cultivation evidence in the RCAHMWs National Monument Record (NPRN 400817). The mine was fairly small in

scale, and the earthworks in their current form are depicted on the 1st edition Ordnance Survey mapping of the 1880s without explanation, thereby implying that it had been abandoned for some time. A symbol denoting abandoned coal workings is located here on a plan in Pocock and Whitehead (1935, 68). The Shrewsbury coalfield, of which this was an outlying part, was exploited from at least the 1720s (Tomlins nd).

PRN 103981 Bettisfield Colliery SJ2147776021
Although the colliery is of relatively recent date, there are records of activity in the immediate area which go back to at least the 13th century. Ogilby's maps of the road network in the 1670s depict a group of 'cole pitts' in this location and it was possibly the site referred to in an agreement regarding waterworks related to pumping engines in 1626 (Flintshire Record Office D/GW/B/557). It is also close to Whelston, formerly known as 'Holstan', a township in Holywell from where 524 tons of 'sea-coal' was sent to Conway Castle in 1286 (Colvin, 349). In 1295, 2428 tons were sent to Anglesey, at which time a fleet of thirty boats were based at 'Holstan', to carry coal and stone to Beaumaris (Hatcher, 131).

PRN 104346 Bryn yr Owen Colliery SJ29994725
The Erddig estate, near Wrexham, was employing colliers and 'sinkers' (of shafts) in the 1720s at Bryn yr Owen, which was worked between 1716 and 1736. This might have been at the later colliery site (NGR given above), or perhaps at SJ 3027 4745. An 'engine' is also mentioned here in the estate accounts (Flintshire Record Office D/E/361-4), presumably referring to a horse whim.

PRN 122231 Gardden coal pits SJ29574507
The accounts for the Erddig estate, near Wrexham, are particularly illuminating for that locality in the early 18th century, noting nine pits on 'castle hill' (perhaps Gardden, 4km to the south-west of Erddig) in 1718, although Edwards (1961, 73) notes that coal and ironstone were raised from the Gardden for the furnaces at Bersham and Ruabon in the 1720s. The first edition shows at least two collieries (Gardden Pit and Gardden Lodge Colliery) on and around the hill and a large number of old coal shafts; some of which may be those exploited in the early 18th century.

Sources

British Geological Survey 2002; Bick 1991; Colvin 1963; Dodd 1933; Dodd 1951; Owen 1969; Gruffydd 1981-2; Gruffydd 2010; Hatcher 1993; Ogilby 1675; Pocock and Whitehead 1935; Tomlins nd

Copper mining

Background

Although *c*opper mining is widespread in neighbouring districts, evidence from the study area is sparse, so much so that Grenter and Williams in the *Archaeology of Clwyd* (1991) felt able to assert that copper was not mined in what was then Clwyd. And the situation is no different in central Wales, at least for period before 1750. A number of copper processing sites are known from the 19th century, at Bagillt, Greenfield and Mostyn along the north-east Wales coast, but these were processing copper sourced from outside the study area. Copper therefore seems to have played little part in the industry of the study area for the medieval and post-medieval periods.

Sites and The HER

In the north-east the HER has a single record for an old copper mine (89920) at Springhill, near St Winefride's Well, Holywell, but the workings are undated and have not been precisely located. The mine was recorded in the former Flintshire SMR as being in a field called 'Caer Odyn ' (kiln field), where the only recognisable evidence of activity observed during a visit was apparently ridge and furrow cultivation.

In central Wales, copper mining is recorded in the HER around Llyn Glaslyn (SN 827 941), near Dylife, in the 19th century, but the chalcopyrite deposits here do not appear to have been worked in the medieval or post-medieval periods. Activity is likely, however, at Llanymynech, where malachite and azurite mineralisation is evident. This is best displayed on a map of 'Llanymynech Rock in Carreg Hova' (National Library of Wales Chirk Castle V 7390), dated 1753, on which a number of 'old copper mines' are depicted. While the age of these workings has not yet been determined, and one or more could easily be of Iron Age or Roman date, the map still illustrates that copper deposits were known to exist on the hill in the 1750s.

The only other copper mines in the HER which have some record or suggestion of post-medieval working are the Nantyricket (8476) and Geufron (8479) mines, the latter apparently sending ore to the River Dyfi by pack horse in the 18th century. It is claimed that the former has a post-medieval phase, though on what basis is not known. Some copper mineralisation has also been recognised by one of the writers (RH) in early stopes at the Craig Rhiwarth mine (8430), Llangynog, which was apparently begun in the 17th century. It is not known if this was exploited as it occurs in conjunction with the lead minerals for which the locality is better known.

Physical remains

The HER references are mentioned above, but there are other sites which were utilised and for which there are likely to be extant remains. There are references to copper mining in the area near Dyserth in the late 17th century, contradicting Grenter and Williams, most notably in a diary covering the period 1684-1697 of Roger Whitley, an owner of land in the parish. This includes entries on July 4th and 5th 1688, which recount a visit to his lead and copper mines and mention a stock of copper ore at his warehouse in Dyserth. These are almost certainly the mines recorded by Neaverson (1953-4, 12), who mentions copper pyrites (chalcopyrite) in some old trenches above Dyserth, probably those to the south of Graig Fawr at SJ 0603 8017, which seem to represent workings started in 1303, then revived in the 1630s; this reference, probably mistakenly, has been appended to the description of the Talargoch lead mine (17814) in the HER. Copper mining here appears to be confirmed by Lhuyd, who noted 'copper mines at

Karreg Failon' in the 1690s, activity which can be placed in the landscape by reference to the nearby Dyserth Castle (102059), which he terms 'Castell Ffailon' (Llwyd 1909-1911, I, 52-3). Rees (1968, II, 477n) refers to copper mines and works at Dyserth, which were being developed by 1709 and a little later, in 1720, he (1968, II, 479n) refers to a lease of copper mines in Meiriadog.

Copper mining also seems to have been carried out on Gop Hill, located 3km to the east of Dyserth at about NGR SJ 085 803. A series of letters regarding mining and other subjects from John Key to Joshua Edisbury at Erddig (Flintshire Record Office D/E/724) include one of April 1694, which accounts for work done in 1693-4 at Gop and includes costs for gunpowder, candles, 'one loade of timber to ye new pitts', 'for dressing, …., sending ye ½ ton of copper oare to Chester'. It also refers to four trial mines, of which two found lead ore, and some copper works, although these are probably the workings mentioned by Lhuyd (1909-11, 60) later in the 1690s, as producing some copper whose extraction was not economical.

Gazetteer of new sites revealed by the study

PRN 122223 Carreg Failon copper mine SJ 0603 8017

Copper mines to the north of Dyserth Castle, possibly first started at the beginning of the 14th century, revived in the 1630s and worked until at least the beginning of the 18th century. Rees (1968, II, 515-6) notes that the London Lead Company had extended its interest to the mine by 1736 and was mining lead, copper and calamine there, probably up to the 1780s. The area has seen a large amount of mining activity, in the form of small to medium-sized open cuts and small pits, and these are probably the workings at which Neaverson (1953-4, 12) recorded copper pyrites (chalcopyrite) in some old trenches.

PRN 122224 Gop Hill copper trials SJ 085 803

A series of what amounted to trial workings on or near Gop Hill, from which some copper and lead ore was raised in the 1690s. These were proved to be uneconomical by the end of the decade. A partially rubble-filled hole was seen alongside a footpath at SJ 08925 80150, some 1.2m long and 0.5m wide, but of unknown depth. This may be natural but was the only likely feature seen within the Gop Hill forestry plantation when it was visited; it was surrounded by shallow limestone workings.

Sources

Grenter and Williams 1991; Lhwyd 1909-11; Neaverson 1953-4; Rees 1968 II; Roger Whitley's Diary, covering the period 1684-1697.

Glass-making

No evidence of glass-making has been identified in the study area. The Historic Environment Record and the National Monuments Record were both checked for relevant entries by searching for glass under the 'type' and 'name ' fields, but without any result, and the internet was checked unsuccessfully for any useful website. There are a number of associated industries producing material used in the glass-manufacturing industry, such as manganese for decolourising glass. Deposits of this mineral were exploited in Gwynedd, outside the study area; and its period of use was probably post-1750.

Iron Making and Forging

Background

The main type of iron-making site (and the process that it represented) through much of the period under consideration in this study was the *bloomery*. This provided a means of forming iron by heating iron ore with charcoal in a small cylindrical furnace, aided by a draught. The process provided a *bloom,* which contained a mixture of iron and slag; the slag was then removed by repeated hammering which created workable iron. The *bloom* was produced at relatively low temperatures to prevent the formation of molten iron which led in turn to the formation of *cast iron*, a material that was not suitable for the manufacturing techniques available in the medieval period. The *bloomery* has a history stretching back at least as far as the Roman period, so the identification of authentic medieval iron-making sites is somewhat problematic unless associated datable material is uncovered, or there is residual charcoal that can be dated.

The bloomery was gradually replaced by a larger-scale version in which the draught was provided by water power, and this was in turn supplanted by the *blast furnace* in which iron ore and charcoal (later coke) were heated in a strong air current with a limestone flux to produce molten iron that was then cast into iron *pigs*. The air current required by the later methods was provided by a water-powered bellows, necessitating a ready supply of water, so the siting of the works was of considerable importance. With the advent of the blast furnace, the production of wrought iron became an indirect process, as the iron *pigs* were too brittle to be formed into iron objects by the blacksmith. A further process was introduced, entailing the use of the *finery forge,* which was used to produce malleable bar iron. Water power and charcoal were pre-requisites in the process, but there was no particular need for the forge to be in close proximity to the sources of ore as the cast iron pigs could be transported.

In addition to the sites where iron was being made and worked, the sources of the ore need to be considered. These are more varied than is the case for other minerals, as iron is a plentiful constituent of the earth's crust and percolation of iron minerals from local rocks can result in the deposition of a layer of hydrated oxide in areas of waterlogged ground. This so-called 'bog ore' was evidently in sufficient quantity in some areas to provide the raw material for bloomery sites, but once more industrialised processes (such as the blast furnace) came into operation, larger-scale mineral deposits were required.

In south Wales large-scale iron deposits could be found as clay ironstone in the coal measures, characteristically occurring as thin seams and bands of nodules. Deposits of this type are found in the extreme southern part of our study area, only around the head of the Swansea valley, near Ystradgynlais. This coincides with a reference to a site at Glyntawe (Brecs) in 1325, providing four loads of smelted iron annually to the lord of Brecon (Rees 1968, 39). Further north there seem too to have been mines in the districts of Penbuellt and Inan in the lordship of Builth – but what may have been a going concern in 1334 was evidently in decline in 1347 when few workers were recorded, and the scale of activity is unknown.

Ironstone was also originally worked by the simple expedient of picking nodules out of the beds of streams, which led to the realisation that water could be used to wash away the softer surrounding deposits leaving the ironstone, by a method locally known as *scouring* but elsewhere is often termed *hushing*. This activity leaves characteristic evidence in the local topography, including the dams where water was ponded-up, and the channels created by its sudden release down a hillside. Much later workings of this

type are known near Blaenavon in Monmouthshire, where Lowe and Lawler (1980, 78) note that this method was in use in about 1750. After the initial phase of working, the ironstone was recovered by quarry-type workings as well as the driving of adits and underground mining, perhaps often centred on places where the ore had already been found by *scouring*.

Ironstone is also present in the coal measures of north Wales and this was exploited in the areas around Wrexham and Ewloe (with a reference in 1303) in the medieval period. In Domesday Book (1086), an iron mine is attributed to the manor of Rhuddlan. Rees speculated that it was at Bodfari (1968, 30), although this mine is only known to have been exploited in the 19th century. Rather the reference is almost certainly to Marian Ffrith and Moel Hiraddug (see below), which were probably both in the manor. The iron deposits at the two localities may have formed as replacements in the limestone beds there and it seems that these are the only places in the study area where this type of deposit was being exploited prior to the 19th century. Similar deposits in the Forest of Dean were being mined at least as far back as the Roman period.

References in the early post-medieval era seem to be just as sporadic. On their Chirk estate the Myddeltons had an iron forge at Pont y Blew in the 1630s, and a furnace there was leased out in 1653. North (1962, 91) notes an, unfortunately undated, occurrence at Ponciau, 2.5km NW of Ruabon where shallow 'bell pits' (possibly 101145) were sunk through a coal seam to obtain the ironstone, the coal 'being then of no value for the ironworks'. Another source which highlights this is Badeslade's map of 1740 (Flintshire Record Office D/GR/1680), on which are depicted a group of three shafts (121573, 121574 and 122213) called 'old coal iron', just to the north of Coedpoeth (see the gazetteer in the *Coal* section of this report), implying that they had produced both minerals and had already gone out of use by the mid-18th century.

The HER and physical remains

Very few early iron production sites have been identified in the study area, and it might be reasonable to assume that at least in part this is due to a lack of the specialised input that is the hallmark of work by Peter Crew and Katherine Smith (1995) in the north-west of Wales. Bloomery sites may once have been scattered throughout the landscape, but there are only six confirmed examples in the study area. Two (6115 and 17562) lie on the edge of the Beacons Reservoir in the upper reaches of the Taf Fawr valley near Storey Arms, but are undated and normally submerged. Three other bloomeries are situated within a short distance of the village of Trefeglwys in south-western Montgomeryshire: one (13387) lies near Cwmbernant, 3km to the south-west of the village, and another (1782) is near Cilhaul, almost 2km to the west-south-west. The latter may have been the source of slag waste (16616) used in the levelling out of the site of Ty-mawr, a late medieval house dated by dendrochronology to 1510.

The only probable bloomery site known in north Wales is at Rose Cottage, near Hope (97989), about 1km east of Caergwrle Castle and it might even be that this is one of the 'forges for making iron in the Forest of Rustuy' (Yr Estyn), mentioned in the Black Prince's register for 1351 (Neaverson 1953-4, 17); if so, other similar sites would be present nearby. The bloomery was visible as turf-covered circular feature with a depressed centre that was 2m in diameter, set in a private garden that has been heavily landscaped and levelled. Documentary references also make it clear that there must have been other bloomeries, particularly around Ewloe further to the north-west, where Ewloe Wood produced iron-ore, and in other parts of the north Wales coalfield. Overall,

it is inconceivable that the few bloomery sites recorded in the HER represent anywhere near the total resource.

Another area in which the existing record is markedly deficient is in the recording of potential iron-mining sites. Three were included in the gazetteer of mines in north-east Wales in Jones *et al* (2004), at Bodfari (102769), Nant Uchaf (18138), near Abergele and Marian Ffrith (18118), near Cwm, where all are attributed a 19th-century date. This is not correct in the case of Marian Ffrith, as Pennant (1991, II, 8), writing in the second half of the 18th century, mentions long trenches in the locality from which he believed iron ore had been dug and to which he ascribed an earlier medieval date, demonstrating their perceived antiquity at that time. He also noted (1991, 14) that Hugh d'Avranches, Earl of Chester from 1071 to 1101, enjoyed a portion of the mines of iron ore found in Rhuddlan manor, which then included Marian Ffrith; it probably also included Moel Hiraddug, where early iron mining has been recognised in the past.

Documentary records confirm that medieval and post-medieval iron mining was being carried out in other parts of north Wales, particularly near Wrexham and Ewloe. North (1962, 31) notes that iron from the mines at Ewloe was used in building the castle at Flint in the time of Edward I. There is an existing HER record for iron pits (103795) at Ewloe, but no extant workings are known at that location. The only evidence which might be relevant was found in close proximity to the A494-A55 junction, some 1km south-west of Ewloe, where a series of small coal-rich shaft mounds (19557) may represent workings similar to those noted at Ponciau. It is known that ironstone nodules were found here in conjunction with the coal deposits and these beds seem to have been worked from at least the early 14th century (Neaverson, 1953-4, 16-7). Three shafts depicted on Badeslade's map of 1740, from which coal and iron was obtained to the north of Coedpoeth, have already been mentioned and are detailed in the relevant gazetteer for the *Coal* section of this report.

Methods indicative of earlier working are also apparent near Ystradgynlais where evidence of hushing (locally termed scouring) is depicted on later maps. The only record in the HER (38564) lies just over 1km to the east-north-east of the town, but the location has been subsumed within a forestry plantation and the traces obscured. A group of bell pits (38565), potentially of 18th-century date, were recognised on aerial photographs some 1.2km to the east-north-east, although these have since been removed by opencast coal extraction. The RCAHMW archive also has a reference to a hushing pond with a scouring channel (NPRN 291881) on Mynydd Llangatwg at SO 19269 13817; this was presumably used to search for ironstone, though whether it was successful is unknown.

The locations for the large scale manufacture of iron in the post-medieval period are recorded by Schubert (1957) and Riden (1993); the gazetteer that follows of pre-1750 blast furnaces and forges in the study area is largely taken from these sources, with some additions from the regional Historic Environment Record and the National Monument Record. The lack of a grid reference against a particular record means that the HER location should be taken as either correct or based on the best available evidence.

Gazetteer of Sites

PRN 5303 Ynyscedwyn ironworks, Ystradgynlais As in HER

The National Monument Record description of the site suggests that it was occupied by a single charcoal furnace, built in 1612, probably on the basis of Lewis' (1849) reference to the site under Ystradgynlais parish, which states "…the opinion of their antiquity has

been confirmed by the discovery of an old pig of iron in a cinder-bank in 1795, on which was the date 1612". The HER, however, states that it was built in 1696 and Schubert ascribes an even later date, given by an iron plate bearing the date '1711', found when digging a foundation for a new furnace in 1870. The above-ground structures that survive date from the 19th century, but it gained its place in the annals of British industry when the works were acquired by George Crane in 1823; in the 1830s Crane and David Thomas applied Neilson's hot-blast method which allowed the local anthracite to be used successfully for iron smelting for the first time. This resulted in no fewer than thirty-six iron furnaces being built in the anthracite coalfield (RCAHMW archive via Coflein). It is interesting to note that late 18th-century and early 19th-century mining leases in the Ystradgynlais district mention both coal and stone, the latter no doubt the iron-producing clay ironstone mentioned earlier.

PRN 5693 Brecon furnace As in HER
There are some fragmentary remains of the ironworks site which was apparently built in 1720, as a dated lintel was found there, but was probably disused by the end of the 18th century. It allegedly provided iron for the forge (6201) at Pipton by Aberllynfi which the HER records as operating from the 1670s to 1790. The source of the ore used is not known but the head of the Swansea valley, around Ystradgynlais, is probably the nearest locality in which suitable material could be found.

PRN 6486 Dolobran forge As in HER
The forge was built in 1719 by Charles Lloyd of Dolobran and operated until 1808. Davies (1940, 45-64) repeats the relevant section of the diary of John Kelsall, the clerk of the forge from 1719 to 1729, which reveals many interesting details regarding the day-to-day activities. Further details of the surviving buildings at the site are contained in the HER record.

PRN 13084 Pool Quay forge As in HER
Davies (1940, 35-40) records that the forge was probably built in about 1674, to take advantage of this being the highest navigable point on the River Severn. He also says that it was used for both forging and lead smelting, though this was presumably in different buildings, something which explains why both coal and charcoal were used here, the coal being suitable only for lead smelting in a reverbatory furnace, while the forge would have used charcoal. The main source of power was the great weir (64531) on the River Severn. From the early 19th century up to 1881, the site was apparently used to grind barytes for paint making (Davies 1940, 36).

PRN 18118 Marian Ffrith, near Cwm Location as HER
The mining evidence here is alleged to be of 19th-century date in the HER, but this is not correct as Pennant (1991, II, 8), writing in the second half of the 18th century, mentions long trenches in the locality from which he believed iron ore had been dug and to which he ascribed an early medieval date, demonstrating their antiquity at that time. He also noted (1991, 14) that Hugh d'Avranches, Earl of Chester from 1071 to 1101, enjoyed a portion of the mines of iron ore found in Rhuddlan manor, which then included Marian Ffrith. It seems likely that the iron mines on Moel Hiraddug also fell within the manor. Unlike Moel Hiraddug, where much of the evidence remains relatively undisturbed, most of the mining traces on Marian Ffrith have been obliterated by land improvement. There is a partially filled-in openworking at SJ 0718 7798 that seems to be the only survivor of the features seen by Pennant.

PRN 26809 Glangrwyney Forge/Furnace As in HER

The HER record notes a former blast furnace possibly located in the beer garden of the Bell Inn seen by CPAT in July 1995. The placename "Forge House" nearby was thought to imply that this was a water-powered forge rather than a blast furnace; it is undated.

PRN 38682 Pont y Blew, Ruabon As in HER
Schubert suggests that a blast furnace and forge were in operation here, although the HER has no real mention of the former, and that it was working from 1634 under the control of the Myddleton's of Chirk Castle. Edwards (1960, 29) has the rather more coherent argument that it was set up as a forge to work iron produced at the Ruabon furnace, as both were on the Eyton Estate and the 1634 agreement for the setting up of the Ruabon furnace specifically mentions the need to construct a 'forge or hammerworks for the furthering and finishing of the said ironwork'. Perhaps a furnace was built during the 1661-2 rebuilding phase, as one was apparently still working here in the 1730s, perhaps later. The name of the site testifies to the use of bellows. Gruffydd (2010) claims that coal was successfully introduced into iron forging at Pont-y-Blew as early as 1679.

PRN 101243 Bersham Ironworks, Wrexham As in HER
Schubert (1957, 368) notes there was evidence of activity here in 1649, making it one of the earliest blast furnaces, although Riden (1993) gives its date of construction as 1670; it was probably rebuilt around 1717 by Charles Lloyd of Dolobran, Montgomeryshire. The works produced pig iron for local forges, but it is also interesting that Lloyd of Dolobran ran a forge (6486) distant from the sources of iron, at his home near Meifod, which was in operation from at least 1697 (Levy, 1988, 98-9). Bersham started to produce cast iron goods from the early 1730's when owned by John Hawkins (RCAHMW archive via Coflein), but it gained its reputation for being the first place at which cast iron was bored to produce cannon and cylinders for steam engines, from the activities there of John Wilkinson, whose father took over the works in the 1750s. The site was subject to a series of archaeological excavations in the late 20th century and there are significant surviving structural remains, although most are probably post-1750 in date.

PRN 102789 Ponciau furnace, Rhosllanerchrugog As in HER
The remains of a charcoal furnace recorded in the HER, its date of construction is not known but it was depicted on a map forming part of a lease of 1850. It seems the attribution to charcoal use is incorrect as Edwards (1961, 76) states that it was started by Thomas Jones in 1807, in the coke era.

PRN 102790 Pant charcoal furnace, Penycae As in HER
The HER records the demolished remains of a charcoal furnace on the site of the brickworks at Pant, near Penycae. No further information is available regarding the nature or date of the site.

PRN 102797 Plas Isa furnace, Penycae As in HER
Remains of a charcoal furnace at Plas Issa (Rees 1968, 243). No further information is available regarding the nature or date of the site.

PRN 102798 Plas Madoc furnace, Wrexham SJ 2877 4361
Little remains of the site of this furnace, first recorded in the late 1670s (Edwards 1960, 53) and listed as operational in 1717. Edwards (1960, 31) notes that it was involved in casting hammers and anvils for forges in the late 17th century. It continued in use beyond 1750, probably to the mid-19th century.

PRN 102866 Abenbury forge, Wrexham As in HER

A forge apparently built in 1726 according to the HER, but Dodd (1951, 24) notes that this replaced an earlier one. Edwards (1961, 75) is inconclusive saying that it was set up or rebuilt at that time, but does also note a mortgage of a 'smithie or forge' by Thomas ap Richard ap Richard of Abinburye' in 1615. It seems to have continued in use beyond 1750.

PRN 119875 Bodfari forge As in HER
A forge created by the conversion of a water corn mill in 1698. There is a record of payments for coal 'for the Forge House and Chafery' here in 1706-7 (Edwards 1960, 42).

PRN 121526 Greenfield Forge SJ 189 767
A 1743 indenture (Flintshire Record Office D/MT/233) mentions a forge and buildings at Greenfield "for the working of iron, the charcoal house there", although it has not been possible to identify its exact location. There is a possibility that the site was later used by either the Greenfield or Bryn Celyn iron foundries.

PRN 122207 Ruabon Furnace SJ 329 453
The Ruabon Furnace mentioned by Edwards (1960, 25) was constructed in the mid 1630s and is mentioned in an agreement of 1634. Its location has not been ascertained, but Edwards considered Gyfelia (SJ 329 453) a possibility (from 'gefail', meaning smithy) and there is also a 'Cinders' placename at SJ 324 437, although neither of these seems to have a sufficient water supply; the record may relate to one of the other furnaces near the town. Ironstone was apparently obtained from Ruabon (Edwards 1960, 32) and there are records of wood being taken from a number of woods in the locality, including Black Park and New Park on the Chirk Castle estate. It apparently supplied iron to the forge at Pont y Blew. Records relating to the furnace are scanty for the 18th century; it was apparently last mentioned in 1763.

PRN 122210 Llanarmon-yn-Ial Forge SJ 191 543
Edwards (1961, 53-4) notes that there was a forge in Bodidris township of Llanarmon-yn-Ial, which is mentioned in the *c.*1670 Hearth Tax. It has not been accurately located.

PRN 122225 Parc Mathrafal Old Forge SJ 133 108
Davies (1940, 40) notes that the forge was used between 1651 and 1780, and states that the ruins of the mill on the River Banwy could still be traced (in 1940); water was apparently taken from a pool on the river called Llyn y Felin Hairn (Iron Mill Lake). The forge was also apparently used to smelt a small amount of silver ore in 1665-6 (Rees 1968, II, 480). It may be that the forge represents a conversion of Trefedrid Mill (37406), near Upper Hall, which appears in records dated 1596 and 1609. But there is another placename on the Vyrnwy, where a corn mill called 'Old Forge Mill' is depicted on the south side of the river, upstream of Dolobran Forge, at NGR SJ 1157 1179.

PRN 122226 Mynydd Llangatwg hush SO 1926 1381
The RCAHMW archive has a reference to a hushing pond with a scouring channel (NPRN 291881) on Mynydd Llangatwg; this was presumably used to search for ironstone, but it is unknown whether any ore was ever found.

PRN 122227 Mathafarn Forge SH 8071 0449
A forge apparently stood in a field called 'Cae Forge', near Mathafarn in the valley of the Afon Dyfi. The RCAHMW record of the placename, as recounted by Davies (1940, 64) mentions some large beams in the barn that might have been taken from the site, also that parts of the forge walls were standing within living memory (in 1910). The site is not recorded in the HER or, strangely, the NMR, but there is an interesting HER record

of a charcoal production site (48748) in a formerly wooded area about 900m to the north-east which could be associated.

Sources

Crossley 1990; Dodd 1951; Edwards 1960; Edwards 1961; Gruffydd 2010; Levy 1988; Lewis 1849; Lowe and Lawler 1980; Morgan Rees 1975; North 1962; Pennant 1990; Rees 1968; Riden 1993; Schubert 1957; Smith 1995

Lead Mining

Background

A general assessment of the metal-mining remains in the region has already been completed (Jones *et al*, 2004) and it provides the background to the present study, so its overall themes will not be repeated here. Medieval and post-medieval lead mining was considered in the earlier study, but attention understandably focussed on the widespread and intensive workings of the 19th century.

The search for lead was one of the major industries during the period, only limited by the distribution of suitable ores and the technology available for their retrieval. The main mineral source is galena (lead sulphide) which yields about 80% of the metal (Lewis, 1967, 22), and can be found throughout the limestone districts which spread from the north Wales coast as far south as Llanymynech. The ore also occurs, though in much more isolated fashion, in the earlier rocks of central Wales.

These ores have been exploited since at least Roman times, to judge from a range of material found at the main mine sites. The ease of casting and the malleability of lead meant that it was used for a variety of purposes, as diverse as water pipes and statuary. In the medieval period, one of the main uses for the metal was in the construction and repair of roofs for castles, abbeys and manor houses, and mention of this is made in an enquiry of 1312 relating to the mines of Engelfield (part of Flintshire), the source also revealing its use in the salt pans of Cheshire (Lewis, 1967, 30).

At most mine sites, it is difficult to be establish whether any of the physical traces represent evidence surviving from the medieval era, as the mines have been worked in subsequent centuries and the intensive nature of this later exploitation is likely to have erased or covered the remains of early working. Generally, then, it is the documentary sources that confirm a particular mine had a medieval phase. Llanymynech Hill, located through its proximity to Carreghofa Castle, was primarily a source of lead, but also reputedly sent silver to the mint at Shrewsbury in the late 12th century (Rees 1968, 31). Vale Royal Abbey in Cheshire was given the issues of the lead mines of Englefield by Edward I in 1283 (Neaverson 1953-4, 13), and more specifically the mining area of Halkyn is first mentioned in 1357. Although the scale of medieval working was relatively small in comparison to 19th-century activity, it was nevertheless sufficiently important in parts of Denbighshire and Flintshire for the 'Laws and Customs of the Mine' to be recognised in the Black Prince's Registers from 1351 and 1352, respectively (Jones et al, 2004, 14). These formalised customary practice into a written code that could be invoked in the settlement of disputes and the regulation of the industry. Around Minera and Eryrys in Flintshire, the miners were organised in a guild in the last quarter of the 14th century, while the miners of Holywell working on the common above the town were an established community enjoying special liberties (Rees 1968, 40).

The post-medieval period saw a significant increase in mining activity at existing sites and the opening up of mines in previously unexploited areas such as north and western Montgomeryshire. Some of these became large concerns, such as Dylife, first mentioned in the records in the early 17th century (Lewis, 1967, 45). Others had a more chequered history, including the main north Montgomeryshire mines in the district around Llangynog, which seem to have flourished around the end of the 17th century. These mines could have been first exploited as far back as the Roman period, but the earliest documentary evidence of working is provided by a lease of 1656 covering the mining of lead ores in 'all the commons and waste grounds . . . within the several townships of Kanen Cloach [Cefn-côch] and Rhiwarth in the Manor of Mochnant' - which

encompassed the areas of the what were to become important mines at Craig-y-mwyn and Cwm Orog. Further south in Radnorshire and Brecknock, a few isolated mines are known from the end of the period but they were relatively unproductive.

In north Wales, Rees (1968, II, 477-481) references a large number of documentary sources to various mine sites: some may only represent leases to search for minerals, the mining adventurers never finding any suitable ores, and many are not located, other than to a township, manor or district.

Sites and the HER

In north Wales, evidence of old working on the slopes of Graig Fawr hill, near Prestatyn, is mentioned by Pennant (1991, II, 7), writing in the second half of the 18th century, and this is still evident in the modern landscape. A letter relating to the terms of employment of miners at nearby Dyserth also survives from 1650 (Flintshire Record Office D/HE/254) and there are references to both lead and copper mining there in the 1680s and 1690s in Roger Whitley's Diary 1684-1697 (Bodleian Library, MS Eng Hist c 711; http://www.british-history.ac.uk/source.aspx?pubid=121); The writer mentions miners from Derbyshire who were working at the site. These references msut be separated from those referring to another lead mine, at Talargoch by Meliden (17814), working in the 1690s.

Halkyn Mountain, near Holywell in Flintshire seems to retain significant evidence of medieval or early post-medieval mining. Rows of pits mark the lines of mineral veins, and openworkings comprise narrow strips of land along the mineral vein quarried away to form linear gullies (see Jones *et al*, 2004, fig 83). It is known that lead was being raised in this district in the mid-14th century (Lewis, 1967, 35) and this presumably continued in the following century, although in 1509 the mines of Vaynol and Holywell were idle because nobody wished to rent them (Lewis, 1967, 36). There are accounts of the quantities of lead ore being raised on Halkyn Mountain in the 1660s (Flintshire Record Office D/E/722), and although the location of the mines are not obvious from this source, it is clear that there was a marked increase in mining activity at the time. Ogilby's maps of the road network around Holywell confirm the presence of lead mines to the west-south-west of the town in the 1670s.

Workings with a similar morphology to Halkyn Mountain are found at Eisteddfod in the Minera district (Jones *et al*, 2004, figs 99 and 100), where there is also evidence of 'hushing', a technique used in lead mining from Roman times which utilised water released from artificial reservoirs to wash away overburden and reveal mineral veins. Another feature, which can generally be taken to signify post-medieval working is the 'horse-whim', where a horizontal wheel turned by horse-power was used to raise and lower buckets in a shaft; the flat circular areas where these were sited next to shafts are easily distinguished on the ground and from the air (see plate on following page).

Another area, thought to have perhaps been worked since Roman times is the Nant-y-Ffrith valley, near Ffrith, where a number of potentially early workings have been recognised. There is a reference to workings here in a letter of the early 1690s (Flintshire Record Office/E/517), and the most likely mine (121527) is depicted as 'Nant y Ffrith lead works' on a map of 1740 (Flintshire Record Office/GR/1680) at SJ 2660 5397. Similar letters (D/E/724) from John Key of Holywell to Joshua Edisbury at Erddig in 1693-4 regarding mining trial works at Gop (121528), probably around SJ 0802 8038, include costs for gunpowder, candles, "one loade of timber to ye new pitts, for dressing, …., sending ye ½ ton of copper oare to Chester". They also refer to four places examined

of which two identified lead ore, one of the latter possibly the 'old shaft' (121529) depicted on the 1st edition OS map at SJ 0866 8048.

Fig 5: A horse whim (122219) next to the collapsed shaft which it served on the London Lead Company's 'Old Rake' workings at Halkyn (CPAT 3432-0004)

The Halkyn Mountain district demands additional attention as it was within the sphere of the London Lead (or Quaker) Company from the late 17th century, and they were responsible for the introduction of more advanced methods of extraction such as the erection of a Newcomen steam engine at nearby Trelogan (102786) in 1731 (Lewis, 1967, 131); the mine itself had opened around 1694. They bought at least four more engines for use in local mines at the same time. A 'Mapp of Halkin Mountain and of the other Mountains or Wast Comon Ground in the two hundreds of Rhuddlan and Coleshill in the County of Flint in Wales', surveyed in 1738 by Thomas Badeslade, provides an invaluable view of mining activities in the area covering Halkyn Mountain, and extends as far south as Loggerheads, near Mold. In the south, four 'rakes' are depicted in Llanferres parish, as well as 'the great lead work on Mold Mountain', at Pant-y-buarth, and an 'old lead works' at Pantymwyn; documents relating to these mines date back to at least 1673 (Flintshire Record Office/G/3277). Further north, the part showing Halkyn Mountain, as far as Pen y Ball, has about twenty-four linear workings depicted, as well as what appear to be isolated groups of shafts. Some of the linear workings are named and were evidently in use at the time, such as those described as 'Gadlas Company's Work', a reference to the London Lead Company's use of the smelting site at Gadlys, between Halkyn and Bagillt. Other mapped details include a number of 'Whimsey' (Horse-whim) sites and smithies, and even a timber yard near the London Lead Company's 'Old Rake' working, which implies the use of wooden supports in that locality, and possibly also the construction of machinery such as horse whims, one of which was present in the immediate vicinity (Fig 5).

Owing to the potential interest of the features depicted on Badeslade's map, a digital version was registered against the modern mapping with the aid of the first edition

Ordnance Survey maps. This generated locations for the various mapped elements of the early 18th-century mining landscape, to an approximate accuracy of the order of 30m. Most mines are depicted on the map as linear workings, although the actual workings themselves are likely to have comprised a series of shafts along the mineral vein. Bearing this in mind, the total length of the veins mined in the Halkyn district at the time the map was made comes to nearly 10km. Unfortunately, all the horse whims recorded on the map seem, on the evidence of our fieldwork, to have been removed by later quarrying. The features recorded from the map have been given new PRNs and are listed in the gazetteer below. The lines of selected workings were visited and a number of new horse whims were identified which appeared to be related to 18th-century activity; all bar one of these new discoveries were of the same diameter, which implies some standardisation in manufacture. These new sites have been added to the gazetteer at the end of this section relating to the 1738 map.

A few additional lead workings were recorded on a further map produced by Badeslade for Sir Robert Grosvenor in 1740, in the area of Brymbo and Coedpoeth near Wrexham (Flintshire Record Office/GR/1680). These are recorded in the gazetteer of Badeslade map discoveries below, and their positions have been referenced to OS grid in a similar fashion to that used for the 1738 with a similar level of accuracy anticipated.

En passant, the Grosvenor papers also include a sizeable number of early 18th-century leases of land with old lead mines or grounds suspected of being mineral-rich, from Llanarmon-yn-Iâl in the south to Halkyn in the north. Many of the leases are accompanied by maps showing shafts, huts, buddle pools and the like. These could be a valuable source of geographical information on the lead mining industry immediately prior to the Industrial Revolution, but their analysis lies outside the remit of this project.

In addition to the actual extraction of the ore, most later mine sites have nearby areas where the ore was processed to reduce the amount of rock for smelting. Evidence of 19th-century processing is normally readily apparent as the use of circular buddles leaves characteristic physical evidence and waste material. Processing at early sites is likely to have been less complex, involving breaking the rock by hand and simple sorting to obtain ore, a task that is rather more difficult to identify.

Smelting of the ore to obtain lead is dealt with separately in the following section.

Gazetteer of lead mining features recorded on Badeslade's maps of 1738 and 1740

PRN 121491 Pen y forddnewyed SJ 1768 7434
Linear arrangement of mine workings on Holywell Common, some 0.54km in overall length. Main alignment runs NNE/SSW, with a dog-leg to the NE at its SSW end. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121492 ?Brin Sannen lode SJ 1810 7426
Linear arrangement of mine workings on Holywell Common, some 0.31km NNE/SSW. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121493 Wain Rake SJ 1856 7401
Linear arrangement of mine workings on Holywell Common, measuring 0.24km NE/SW. Depicted on Badeslade's map of 1738 (Flintshire Record Office D/G/3277).

PRN 121494 Pen y pylla SJ 1909 7433

Linear arrangement of mine workings, some 0.20km long (WNW/ESE). Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121495 Old Rake SJ 1915 7331
Linear arrangement of mine workings exhibiting a slight curve, measuring 0.19km WNW/ESE. Depicted on Badeslade's map of 1738 (Flintshire Record Office/ G/3277).

PRN 121496 Sir Richard Grosvenor's Work SJ 1888 7347
Short section of mine workings, some 0.06km in overall length. The eastern part is aligned E/W, and at its W end a further part runs NW. It includes horse whim PRN 121497. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121497 Whimsey SJ 1887 7347
A horse whim on the line of the mine workings known as 'Sir Richard Grosvenor's Work'. Site probably quarried away. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121498 Pen y bryn SJ 1858 7352
Linear arrangement of mine workings, measuring 0.34km E/W. The alignment is now partially within the Bryn Mawr quarry and this part has either been removed or covered with spoil. Depicted on Badeslade's map of 1738 (Flintshire Record Office /G/3277).

PRN 121499 Pant y puda (pydew) SJ 1818 7350
Dog-leg arrangement of mine workings, some 0.45km in overall length. The workings run both to the E and the S from the given NGR. The S part is now in improved pasture. Depicted on Badeslade's map of 1738 (Flintshire Record Office /G/3277).

PRN 121500 Unknown SJ 1828 7329
Linear arrangement of mine workings, measuring 0.20km NE/SW. Largely within improved pasture. Depicted on Badeslade's map of 1738 (Flintshire Record Office /G/3277).

PRN 121501 Unknown SJ 1805 7298
Dog-leg arrangement of mine workings, some 0.45km in overall length. It runs both E and SW from the given NGR and is now entirely within improved pasture. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121502 Silver Rake SJ 1833 7296
Linear arrangement of mine workings, measuring 0.22km E/W. Entirely within improved pasture. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121503 Unknown SJ 1847 7300
Dog-leg arrangement of mine workings, some 0.34km in overall length. It runs both E and SE from the given NGR and is partly within improved pasture. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121504 Unknown SJ 1874 7295
Linear arrangement of mine working, measuring 0.13km NW/SE. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121505 Unknown SJ 1871 7284

Dog-leg arrangement of mine workings running both SE and SW from the given NGR. Overall length is 0.46km. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121506 Unknown SJ 1958 7230
Short line of mine workings, measuring 0.16km ENE/WSW. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121507 Rawleigh's Rake (also Pant y Billins) - Gadlys Co SJ 1913 7219
Extensive linear alignment of mine workings extending for about 1.59km WNW/ESE. Worked by the London Lead Co. Two associated horse whims (PRNs 121509 and 121 510) are also depicted. The central section may have been removed by later quarrying. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121508 Brinenew SJ 1781 7220
Linear arrangement of mine workings, displaying a curved course measuring 0.50km E/W. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121509 Whimsey SJ 1919 7219
A horse whim depicted on the line of Rawleigh's Rake, and therefore presumably used by the London Lead Co. Lost to quarrying. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121510 Whimsey SJ 1907 7220
A horse whim depicted on the line of Rawleigh's Rake, and therefore presumably used by the London Lead Co. Lost to quarrying. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121511 Dogpitt Rake SJ 1923 7144
A broadly linear arrangement of mine workings, extending for 0.45km on an approximate E/W alignment. Depicted as an 'Old work called Dogpitt Rake'. Modern AP sources suggest it was intensively worked and survives largely intact. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121512 Timber Yard SJ 1985 7137
A square enclosure named as a timber yard. Presumably used to store wood for use in the London Lead Co's workings as it lies next to the Old Rake, which was in their possession. Modern AP sources appear to show an earthwork of similar appearance to the map depiction at this location. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

Fig 6: The early open cut (77742) on the line of the 'Old Rake' (121513)
(CPAT 3432-0005)

PRN 121513 Old Rake (Gadlys Co) SJ 1996 7133
A dog-leg arrangement of mine workings, extending for a short distance to the ESE and a longer distance to the WSW from the given NGR. The overall length is 0.82km. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277). There is an interesting open cut (77742), about 5m deep, running from SJ 1944 7124 to SJ 1929 7124, which is suggestive of early working (Fig 6).

PRN 121514 Cheyne's Rake SJ 1913 7151
A curved line of mine working running both ENE and WNW from the given NGR. The total length was 0.60km, but the W end has been lost to quarrying. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121515 New Rake (Mr Pigot's work) SJ 2034 7086
Dog-leg arrangement of mine workings, running both E and SW from the given NGR. Overall length of 0.33km. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121516 Windy Gapp (Sir Robert Grosvenor's work) SJ 2024 7056
Dog-leg arrangement of mine workings, running both ENE and WNW from the given NGR. Overall length of 0.64km. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121517 Smithy SJ 2037 7056
Smithy depicted just to the S of the 'Windy Gapp' mine workings and no doubt related. Modern AP sources suggest it has been converted to or replaced by a dwelling. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121518 Whimsey SJ 1999 7063
Horse whim depicted at the W end of the 'Windy Gapp' mine workings. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121519 Unknown SJ 1976 7019
Linear arrangement of mine workings, running on an E/W alignment for 0.12km. Entirely removed by quarrying. Depicted on Badeslade's map of 1738 (Flintshire Record Office D/G/3277).

PRN 121520 Lord [??'s] work SJ 2079 7002
Short section of mine workings, measuring 0.06km WNW/ESE. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121521 Old works SJ 2047 6928
Linear arrangement of mine workings, running on a NNW/SSE alignment for 0.14km. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121522 Unknown (Gadlys Co) SJ 2002 6970
Linear arrangement of mine workings, running on an ENE/WSW alignment for 0.15km. In the possession of the London Lead Co. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121523 Mr Pigot's works SJ 1898 7089
Area of shafts now within the vilage of Rhes-y-cae. Presumably levelled. Depicted on Badeslade's map of 1738 (Flintshire Record OfficeG/3277).

PRN 121524 Bryn y Catch (Sir R Grosvenor) SJ 2067 7054
Linear arrangement of mine workings, running on an E/W alignment for 0.14km. Largely within Halkyn village. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 121525 Smithy SJ 1965 7204
Smithy near Pant y Billins, presumably operated by the London Lead Co as it is in close proximity to their Rawleigh's Rake workings (PRN 121507). The site is still occupied but it is unknown whether there are any remains of the smithy. Depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277), but the site is occupied by a modern house and industrial site and there is no surviving evidence of the smithy.

PRN 121527 Nant y Frith lead works SJ 2660 5397
This is the approximate centre of an area described as above on the 1740 map (Flintshire Record Office/GR/1680).

PRN 121530 Boundary Shaft lead works, Minera SJ 2628 5170
A group of about five shafts is depicted here on the map (Flintshire Record Office/GR/1680), apparently owned or run by 'Mr Robinson of Chester'.

PRN 121531 Minera: Old lead works SJ 2719 5101
A line of about seven shafts along the course of a lead vein is depicted here on the map (Flintshire Record Office/GR/1680).

PRN 121532 Bryn Eithin lead shafts SJ 2470 5267
There appear to be two shafts depicted on the 1740 map (Flintshire Record Office/GR/1680) at this location.

PRN 121533 Bryn Eithin: Old lead works SJ 2488 5262
A line of what seem to be shafts are depicted along the course of a vein at this location on the 1740 map (Flintshire Record Office/GR/1680).

PRN 121534 Eglwyseg Mine lead shafts SJ 2376 4768
Shafts are depicted in the approximate location of the Eglwyseg Mine on the 1740 map (Flintshire Record Office/GR/1680).

Other lead mining sites recorded during the project

PRN 121528 Gop Hill lead trials SJ 085 803
A series of what amounted to trial workings on or near Gop Hill, from which some copper and lead ore was raised in the 1690s. These were proved to be uneconomical by the end of the decade. A partially rubble-filled hole was seen alongside a footpath at SJ 08925 80150, some 1.2m long and 0.5m wide, but of unknown depth. This may be natural but was the only likely feature seen within the Gop Hill forestry plantation when it was visited; it was surrounded by shallow limestone workings.

PRN 121529 Gop mine shaft SJ 0866 8048
Possibly one of the trials mentioned under PRN 121528, where an 'old shaft' is depicted on the 1st edition OS map.

PRN 122214 Mount Villas Horse whim SJ 2011 6985
A horse whim about 14m in diameter, possibly related to a nearby working (PRN 121522) depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277). The whim adjoins a mound in which a stone-lined shaft is still visible.

PRN 122215 Billins Horse whim SJ 1946 7215
A horse whim, 14m in diameter, defined by an external bank 1m wide and 0.3m high. Central hollow, 2m in diameter and 0.3m deep, around which the drum would have pivoted. The associated (collapsed) shaft is on its north-north-west side. Associated with Rawleigh's Rake (Pant y Billins) depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277).

PRN 122216 Pant y pydew horse whim SJ 1840 7344
A horse whim about 14m in diameter, part of the 'Pant y puda' rake (PRN 121499) depicted on Badeslade's map of 1738 (Flintshire Record Office D/G/3277). The whim has a central hollow and adjoins a mound in which a stone-lined shaft is still visible.

PRN 122217 Dogpit Rake horse whim SJ 1954 7141
A horse whim about 14m in diameter, near the eastern end of the 'Dogpitt Rake' (PRN 121511) depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277). The whim has a central hollow 1m in diameter and adjoins a mound in which a collapsed shaft is visible.

PRN 122218 Chwarel Las horse whim SJ 1967 7139
A horse whim about 14m in diameter, with a large collapsed shaft immediately to its north-west.

PRN 122219 Old Rake horse whim SJ 1981 7133
A horse whim about 14m in diameter, on the course of the 'Old Rake (Gadlys Co)' (PRN 121513) depicted on Badeslade's map of 1738 (Flintshire Record Office/G/3277). The

whim has a central hollow and there are the remains of an encircling wall on the north and west. It adjoins a collapsed shaft to the south. There may be a processing site at this location as a couple of small reservoirs with leats can be seen. It lies close to the site of the London Lead Company timber yard (121512).

PRN 122241 Clegyr lead mine, near Gwyddelwern SJ 043 477
An unlocated lead mine noted by Rees (1968, II, 480) as having been worked in the 1670s. The only industrial activity known in the locality is a quarry (67459).

Sources

Adams, 1991; Jones et al 2004; Lewis 1967; Lewis 2000; Neaverson 1953-4; Ogilby 1675; Rees 1968 II; Roger Whitley's Diary 1684-1697; Williams 1985; Willimas 1988.

Lead Smelting

Background

The smelting of lead ore to obtain the metal was an unpleasant process, mainly owing to the release of noxious gases that could poisoned both the surrounding land and the stock that grazed on it. This is well demonstrated by a 1743 indenture relating to an iron forge at Greenfield (Flintshire Record Office D/MT/233), which specifically excludes the "smelting of lead ore, copper ore or slags or refining the same or any of them or making red lead or any other metal that is sulphurous so as to be poisonous or hurtfull to man or beast and grinding of corn". The use of charcoal in the smelting process was also responsible for denuding lead mining areas and their surroundings of woodland, so much so that mining was often halted for a lack of wood. Leland (Smith, 1964, 123), writing in the 1530s relates a typical situation at Cwmystwyth mine in Ceredigion, where "Ther hath beene in times paste a greate mine digging for leade…. summe menne suppose that it sesid (ceased), bycawse the wood is sore wastith".

The earliest form of smelting was the 'bole furnace', generally positioned in a windy location close to the mine and comprising a hollow containing the fire (fuelled by wood) into which ore was fed, with lead running out and solidifying as it cooled. Evidence of this method is known in the Halkyn Mountain area, where characteristic slag has been observed (M Walters: pers comm). The name of the hilltop called 'Pen y Ball' (Bole), less than 1km west of Holywell, also identifies this as an area of early smelting, its name going back at least as far as the 1738 Badeslade map of the area. The name 'Waen-y-Balls' on Flint Mountain is also significant, while smelting operations presumably of this type were noted at a mine in the Forest of Ewloe in 1340 (Lewis, 1967, 31). Neaverson (1953-4, 5) mentions smelting at Vaynol (near Dyserth ?) and Halkyn in the 1350s.

Bole-smelting probably lasted into the early part of the post-medieval period, but increasing extraction in the early years of the 17th century and improvements in technology led to the general adoption of the smelt mill, using methods similar to the blast furnace that was being brought into service for iron smelting. The fuel used was charcoal and the blast was provided by the operation of a water-powered bellows. Waterwheels are mentioned in regard to the Mostyn's smelter in 1684 (Lewis, 1967, 65) and it is perhaps significant that the stream just to the west of Mostyn Hall is called 'Nant Felin-blwm' or 'Leadmill stream'; it may well be that the smelter was at Garth Mill (25063), also known as 'Mostyn Mill', which had been converted into a flour mill by the time of the first edition OS map. There were a number of other smelters serving the mines of north-east Wales, particularly on Deeside, where one at Flint is noted by Lhuyd at the end of the 17th century (Lhwyd 1909-11, 86). There was another inland near Mold, a district of which is still known as 'Leadmill', and this derivation is confirmed by Ogilby's map showing the national road network in the 1670s, which depicts and names a 'Led furnace' (101690; Fig 7) in this spot. References to lead smelting in Dyserth in 1693 are contained in a series of letters regarding mining matters from John Key to Joshua Edisbury at Erddig (Flintshire Record Office/E/724), but this does not currently have an identified site recorded in the HER, though it may have been somewhere near Dyserth Castle.

Unfortunately, the increase in smelting capacity with the new methods exacerbated the wood shortage problems, something also highlighted by John Key's letters where a recurring theme is the shortage of timber. This was only solved by the introduction of a new type of smelter using the coal-fired reverberatory furnace at the end of the 17th century. The most notable example of this type in the study area was the London Lead

Company's smelter (PRN 100340) at Gadlys, built in 1703-4. The widespread availability of coal from the north Wales coalfield led to a rapid change to the new methods and Lewis (1967, 128) notes that in 1703 three smelters of the old type in the Mold area were forced to stop dealing with lead and became corn mills. One of these may have been Loggerheads Mill (PRN 25917).

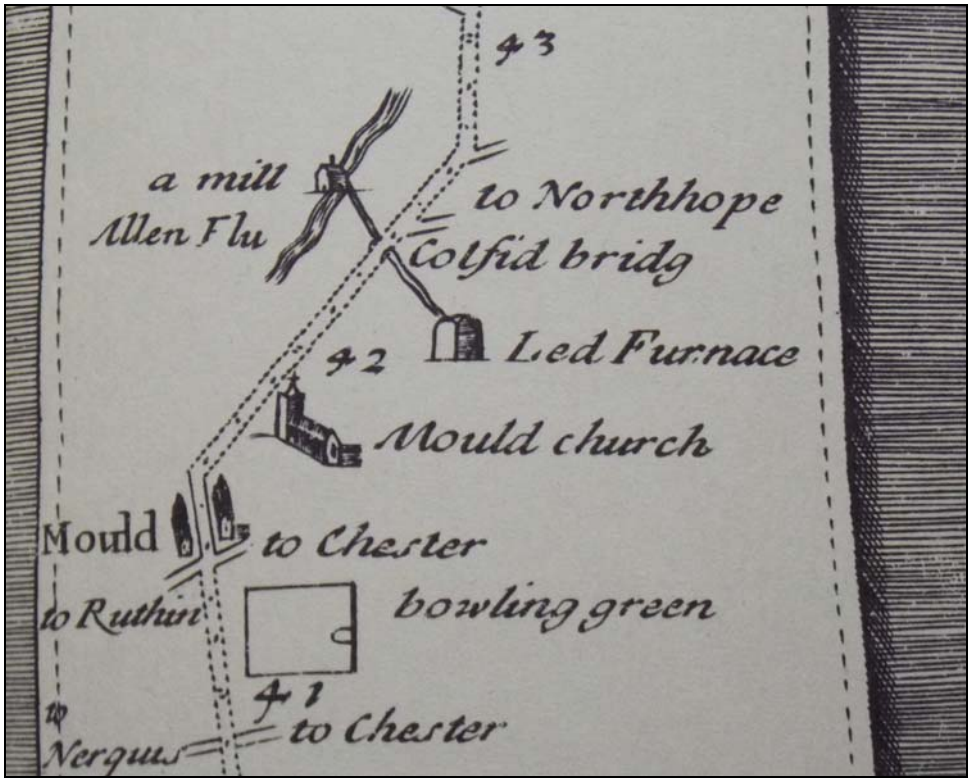

Fig. 7: Ogilby's map of Mold in the 1670s, showing the lead smelter (101690)

Lewis (1967, 141) records a number of the later type smelters in north-east Wales, including that at Gadlys, and one known as the Lower Works, Bagillt (possibly 37874), thought to have been converted from a blast furnace that operated in the late 17th century. Others included the Bagillt Upper Works (104019), built in 1727; Llanerch-y-mor, Mostyn (102395), working in at least the 1720s and depicted on a map of 1740; the Cockram Smelting Mill somewhere in Coleshill, working in the 1730s; and another on the Holywell Stream, probably at Greenfield, that ceased operation before 1733. The HER also records a smelting site (104014) at Flint, apparently dating from the early 18th century. Reverberatory smelters continued to be built in the 1750s and later, such as that at Pentrobin, Hawarden (103805), although these fall outside the strict definition of this study's period of interest. A site seemingly not previously recorded was noted during this study; it is depicted and named as 'New Smelting House' on a Mostyn Estate map (Flintshire Record Office/NT/M/135), dated to 1743. The position given equates to NGR SJ 1660 7982, the location being confirmed by the name 'Slaghearth' given to what appear to be a row of cottages on the 1st edition OS 1:2500 map of 1872.

Smelting activity in mid-Wales seems to have been localised in the north Montgomeryshire district, where at least two smelting sites are known from the early 18th century. The evidence from the available sources suggests the earliest (18319) was in the valley of Cwm Glan-hafon, near Llangynog (Jones *et al*, 2004, 27), and served both the Llangynog mines and Craig y Mwyn, above Llanrhaeadr-ym-Mochnant. There is

some confusion as to its age and type with some sources suggesting it was of the blast furnace type, and therefore potentially earlier, while others cite the name 'Cubil' as suggesting it was of the reverberatory type. At any event, it had been replaced, probably by the beginning of the 18th century, by a new smelter (43123) built near Pool Quay at the upper limit of navigation on the River Severn, some 3km from Welshpool. The Pool Quay smelter had easy access to coal from the river, but lead ore had to be transported a considerable distance from the mines, and it eventually closed in 1762. Interestingly, Williams (1985, 73) mentions that both coal and charcoal-fired furnaces were in use at Pool Quay, but this may have nothing to do with lead smelting as there was an iron forge (13084) close by. A reference to a possible smelting site, defined by the placename 'Dol y Felin Blwm' (Lead Mill meadow) is mentioned by Rees (1968, II, 481n), but the HER record (55) implies that this was of Roman origin.

Gazetteer of new information

PRN 25063 Garth Mill, also known as 'Mostyn Mill' As in HER
Waterwheels are mentioned in regard to the Mostyn's smelter in 1684 (Lewis, 1967, 65) and it is perhaps significant that the stream just to the west of Mostyn Hall is called 'Nant Felin-blwm' or 'Leadmill stream'. It may well be that the smelter was at this site, which became a flour mill by the time of the first edition OS map.

PRN 122232 Mostyn: New Smelting House SJ 1660 7982
A site seemingly not previously recorded noted during the study. It is depicted and named as 'New Smelting House' on a Mostyn Estate map (Flintshire Record Office NT/M/135), dated to 1743. The position given equates to the given NGR, the location being confirmed by the name 'Slaghearth' given to what appear to be a row of cottages on the 1st edition OS 1:2500 map of 1872. The site is now levelled, but there may be some sub-surface remains.

PRN 122233 Cockram Lead Smelting Mill SJ 225 713
The site is recorded as lying somewhere in Coleshill, and working in the 1730s. It has not been located, but may have been somewhere near Coed y Cra.

PRN 122234 Greenfield Lead Smelting Mill SJ 190 770
A lead smelting mill at Greenfield, that was built alongside the Holywell Brook before 1590. Rees (II, 448-9) states that it had been erected on common ground in Greenfield, formerly belonging to Basingwerk Abbey, and that it was attacked and destroyed by local residents soon after, on the grounds that it was polluting water supplies. The 1743 indenture mentioned at the beginning of this chapter may be an oblique reference to the results of this dispute. Lewis (1969) says only that it ceased operation before 1733. It has not been definitively located.

Sources

Jones et al 2004; Lewis 1967; Lewis 2000; Neaverson 1953-4; Ogilby 1675; Rees 1968; Williams 1985.

Leather

Introduction

Leather manufacture is of course a manufacturing trade, the workers including tanners, curriers and tawyers, the last of these working with deer, horse and sheep skins. The three essential materials for manufacture were hide, water and oak bark. And the products were numerous including shoes, saddles, bottles, sheaths and belts, gloves and purses. As John Steane has put it: 'the importance of leather to medieval society can only be understood when it is remembered that there was no rubber, no plastic, no cardboard. The toughness and waterproof qualities of leather made it a suitable material for use in containers, covering and clothing'.

In archaeological terms the most obvious survival of the industry would be the tannery, manifested by the numerous pits that were needed for soaking hides. The currier's workshop would leave few archaeological traces for, as Cherry has noted, all the work was done above ground.

Background

Leather-working was practiced in prehistory and tanneries go back well into the medieval period, continuing into the modern era. Most tanneries that have been investigated are in urban areas and the focus on towns is of no surprise because it was there that animals were usually marketed and slaughtered. While water was a prerequisite this does not mean that a tannery would invariably be sited by a river. The Maes-glas area of Machynlleth was a focus for tanning from the 17th century. The most famous in this region is the later 18th-century tannery at Rhaeadr which was moved to St Fagans Museum in 1982, and reminds us that by the time we reach the 18th century, if not before, we are more likely to be dealing with standing buildings than with purely archaeological sites. There is some evidence, too, that even villages might have had a resident tanner, certainly after the Reformation and perhaps before. Monasteries might also have tanneries, particularly those whose economy was heavily reliant on cattle. Williams indicates that Tintern Abbey had one which was mentioned in the ecclesiastical Taxation of 1291 and which was documented as failing to meet all the needs of its monastic community in 1388.

The evidence though can be indirect. Thus Brecon Cathedral has its chapel for the 'corvizers' [shoemakers] guild, and St John's church in the town likewise had a guild chapel. And Bowen points out that in the 1664 rental for Brecon, the tanners, corvizers and glovers were the three most frequently mentioned occupations within the town. The craftsmen were concentrated in Ship Street Ward which was formerly Sheep Street. Bowen also saw Builth Wells as an important focus for the leather working industry, but mentioned too a small 'rural' tannery at Defynnog.

Associated with the industry was the oak bark used in the tanning process, and this had to be ground down. In the Middle Ages it is possible that this was done in a bark mill, although this has yet to be attested archaeologically.

Sites and The HER

The HER has records of two tanneries in Breconshire, four in Radnorshire, four in Montgomeryshire, five tanneries in Flintshire, and one in Denbighshire. Of these the

Dingle Tannery site (103437) at Holywell revealed vats when it was developed, although no date is provided as to when it was functioning.

Coflein records two tanneries in Breconshire, two in Radnorshire, three in Montgomeryshire, four in Denbighshire and none in Flintshire. One of the Radnorshire examples at Presteigne is attributed a medieval date though it is not clear as to the reason.

Field and place-names, particularly Tanhouse but with other variants as John Field makes clear, are assumed to indicate where tanning was practiced. Thus there is a Tanhouse meadow in Guilsfield (Monts; 64697) and the Tan house in Overton (Flints; 37118)

It is evident from the sparse figures given above that few tanneries have yet been recorded in the major archaeological records that have been compiled for Wales, and most of those that do appear are 19th- or even 20th-century in date, at least in the site remnants that are visible, if not in their date of origin. Almost all, then, fall outside the remit of this study, but even if they were relevant it would be difficult to identify typical or exceptional examples and determine whether any one was a legitimate candidate for statutory protection.

Sources

Bond 2004, 352; Bowen 2000, 135; Cherry 1991; Field 1972; Steane 1985, 247

Papermaking

Background

It seems to be generally accepted that the first papermaker in the United Kingdom was a citizen of London named John Tate whose papermill in Hertfordshire was operating in 1488, but it was not until the second half of the 17th century as far as is presently known that papermaking commenced in Wales with the first papermill operating at Glyn Parc near Wrexham on the Clywedog in 1658. Other mills came into existence over the next century both in Flintshire and Denbighshire, but also elsewhere as with Llangenny in Breconshire and reflecting the wider use of printing in Wales in the 18th century and the appearance of the first Welsh newspaper in 1735. Generally knowledge of these early mills is sparse, and not one can be pinpointed with any certainty in the period up to 1750. Early mills were located in river valleys where there were supplies of clean water, but the papermaking process required plentiful linen rags, so a location near a town or village was necessary to generate a supply.

Sites and the HER

There are 14 entries in the HER for papermills. Most are for mills that were established or at least were first documented after 1750. Only three of the pre-1750s are to be found in the HER, and not surprisingly that source adds little detail to Davies' exhaustive work (see below). The exception may be Presteigne, but here there can be no certainty that the papermill of 1761 and the Grove House mill are one and the same.

Gazetteer

A. E. Davies has recently published what will probably be the definitive work on the history of Welsh papermaking for the foreseeable future. This lists mills that are documented in the period up to 1750 as follows:

PRN 15998 Presteigne paper mill AS in HER
Sited on the River Lugg. The paper maker from there was buried in 1761. There is apparently a Papermill Close in Presteigne. The HER, citing G.W. Ridyard, claims that there was evidence for a paper mill in 1776 and it was also mentioned in the sale of Grove House in 1846. Despite this Ridyard could only speculate that the mill was between the house and the river, and no precise location can be established.

PRN 17014 Pentre Felin As in HER
Recorded near Wrexham in 1663. Not located, but see Esclusham, below.

PRN 17015 Glyn Parc As in HER
Probably located in the Gresford area near Wrexham in 1658. Not located.

PRN 122242 Esclusham paper mill SJ 355 490
A. H. Dodd claimed a paper mill after the Restoration on right hand side of Clywedog, opposite a large house known as Laurel Grove. It was burnt down in 1897. Powell tentatively equated this with the Llwynon Mill, and placed it at the spot now occupied by the Llwynon flour mill within the hamlet of Pentrevelin Newydd at the given NGR.

PRN 122243 Greenfield paper mill SJ 190 770

An indenture of 1743 (Flintshire Record Office/MT/233) refers to a parcel of land formerly called "The Hemp Yard" which was demised to George Scott, papermaker. It also refers to the "old papermill". Not located, precisely.

PRN 122244 Halghton in Hanmer paper mill SJ 415 435
Recorded in 1680. Edward Wilkinson probably worked the Upper Mill there, but there were three more paper makers named for the area, so it is possible that there could have been two mills; Davies places the second on the Emral Brook. Neither can be located.

PRN 122245 Llandinam paper mill SO 025 885
Where a paper-maker had his will proved in 1693/4. Not located.

PRN 122246 Hanmer paper mill SJ 454 397
Recorded in 1728 and known as Upper Mill in 1816. It is not clear how, if at all, this relates to Halghton above. Not located.

PRN 122247 Llangenny lower paper mill SO 241 172
Llangenny paper mill was recorded in 1737. Whether it was this or the upper paper mill (122248) is not clear. Both were in operation by the 19th century

PRN 122248 Llangenny upper paper mill SO 239 178
Llangenny paper mill was recorded in 1737. Whether it was this or the lower paper mill (122247) is not clear. Both were in operation by the 19th century

In the second half of the 18th century others are documented – at Holywell in 1767, Caerwys in 1786 and Worthenbury in 1790. Some of these could of course have been in existence rather longer than the first documentary record.

Sources
Powell 1985; Davies 2010

Peat Cutting

Background

The digging of peat, primarily for fuel, has a long history stretching back into the Middle Ages, perhaps not surprising in view of the fact that over 7% of the surface of Wales is covered by it. References seem to be reasonably plentiful from the 14th century onwards with some earlier. In this region the burgesses of Holt (Denbs) in 1391 claimed the right to dig fuel of turves and coals at Coedpoeth and Brymbo, in 1573 complaints were made that the queen's lessee had prevented peat being cut on Radnor Forest, and in the 17th century local people around Mynydd Illtud on the northern side of the Brecon Beacons and some five miles from Brecon itself dug for peat in Traeth-mawr and Traeth-bach and annually carried away over 10,000 loads of excellent fuel.

Peat could be found and extracted widely from the hills and mountains, less commonly from the infrequent lowland mires and deposits along the north coast. The best known and most thoroughly researched lowland mires are the interlinked Fenn's, Whixall, Bettisfield and Cadney Mosses that straddle the border of England and Wales in Wrexham Maelor, the closest town being Whitchurch (Shropshire). The earliest reference to peat being cut there is in 1572, when rights of turbary were attached to a tenement known as the Hall Closes. There is also a reference to a turbary or 'moss-pit' in an indenture of 1684 (Flintshire Record Office: KY/583) for 'Wyen Wenn' farmhouse (42963) in Hanmer, about 5km to the west-north-west of Fenn's Moss. Turbary was both a concept, the cutting of peat and/or turf, and a physical entity, the place where the cutting took place. In the 16th century peat cutting was largely a subsistence industry, with peat being dug for home consumption, but certainly by 1652, and probably before, there was already a market for turves well beyond the mosses and the manorial court was finding it impossible to prevent this commercial exploitation. This continued until the enclosure of Fenn's and Bettisfield Mosses in 1777 (and Whixall Moss first in 1710 and later in 1823) extinguished common rights and allowed local landowners greater control over the removal of peat.

It is doubtful whether any of the physical remains now visible on the mosses are of a vintage pre-dating 1750. Almost all of the existing landscape features are much more recent and this includes the peat processing works built in the early 1930s which because of its rarity – the last surviving example in mainland Britain – was scheduled by Cadw in 1991.

The coastal peats along the Dee Estuary are extensive, but are generally buried beneath marine silts, though they do come to the surface in the vicinity of Prestatyn. Nevertheless they were both valued and exploited, as a petition to the Black Prince from the bishop of St Asaph in 1348 regarding two acres of turbary at Gronant, west of Prestatyn, makes clear. It comes as no surprise that no physical evidence of early peat extraction has ever been identified in that area. Elsewhere there were more localised deposits that were exploited, as at Llanfyllin (Monts) where at an unspecified time during the post-medieval period a large turbary lay on the north-west side of the town, supplying the needs of the townspeople. Later it was converted into a meadow.

The use of upland peat was considerably more commonplace but generally less frequently alluded to. Many of the hills where peat formed will have functioned as turbaries, certainly in the 18th and 19th centuries, some in earlier centuries, a few perhaps even more recently. The earliest documentary evidence to peat digging in the Mynydd Hiraethog area appears in the Survey of the Honour of Denbigh compiled in 1334 which

records the rights of turbary held by the tenants of a number of vills, including one recorded as being on the common waste at Gwytherin, for which tenants gave 12d for the licence to dig turves.

Aerial photography of the enclosed uplands, particularly that taken in the late 1940s by the RAF, is extremely useful in identifying former turbaries and on occasions as on Trannon Moor (39909) in southern Montgomeryshire these can be so extensive as to suggest that peat was being removed on a heroic scale, almost commercial rather than subsistence, though it should be stressed that there is no documentary evidence to confirm that this was the case. Fieldwork too can identify the regular linear scars of peat cutting and indeed has been (or should have been) a consistent element in the discoveries made during the many surveys promoted by the Royal Commission's Uplands Initiative. It is, though very uncommon to encounter peat cuttings on the ground that cannot be recognised on one or other of the sets of vertical aerial photographs that are readily available.

That said, the chances of being able to isolate and then recognise at ground level peat cuttings from the era before 1750 are very slim. Maps compiled for the official parliamentary enclosures of the 19th century frequently record those blocks of land designated as public turbaries, but such maps for an earlier century are rare, and this is generally not the type of information that was recorded during estate surveys, though there may be the occasional exception. The earliest cartographic evidence that we have is provided by John Ogilby's maps of the road network compiled in the 1670s, where, uniquely for the study area, a side-road from the route leading south-south-west of Maerdy, near Corwen, has an appended note 'to ye peatwork'. This perhaps related to a turbary on the hill called Pen y Cerrig-serth (SH 975 430), although none has yet been recorded there, and that it is mentioned by Ogilby implies a rather more concerted effort to cut and collect peat. About 50 years later, a turbary (80311) is shown on an estate map of 1723 on Bryn-glas above Machynlleth and the location coincides reasonably well with some vague earthworks that could be the relict traces of peat cutting. There is though no information as to when peat extraction terminated there. It is difficult then to determine the location of 18th-century and earlier turbaries and virtually impossible to recognise any physical traces that might survive from the earlier part of that century.

Sites and the HER

The HER contains 141 records where the Type field contains the word 'peat', in conjunction with the Period field showing 'post-medieval' (with the one 'medieval' exception being a record originating with the Royal Commission. Of these, 45 entries are associated with 'cutting', 42 with 'stack' and 49 with 'stand'. Other more occasional uses include 'mound' and 'processing works'. With the exception of Bryn-glas (80311) already noted above, none appears to refer to peat-cutting that could pre-date 1750.

Sources

Bell 2007; Berry *et al* 1996; Hankinson *et al* 1998; Leah *et al* 1998; Ogilby 1675; Owen 1969; Owen 1990

Rope Making

Background

The making of rope is a diverse topic that extends well back into prehistory, but probably became industrialised only at a late date. No attempt will be made here to provide a comprehensive history; rather it is rather proposed to highlight the relatively few traces of the industry during the period in question, and there is no intention to deal with the smaller scale production of thinner cord as this would have been made in domestic contexts, given access to sufficient suitable fibres. However, it should be noted that evidence of the cultivation of hemp as a crop was recently revealed in a palaeoenvironmental study in the Mynydd Hiraethog uplands, carried out as part of the RCAHMW's uplands survey programme (Grant, n.d.). The suggestion of this work was that local conditions were favourable for the production and preparation of hemp fibre, which could then have been used in rope making.

As long as they have sufficient tensile strength, various materials can be twisted or woven together to form manageable ropes; mention, for instance, is made in the Welsh Laws of ropes of hair and elm-bark (Richards 1954, 93-94). By the medieval period, the main fibre used was hemp, produced from the cannabis plant. It suffered from the typical problem of all natural fibres, limited lifespan owing to the weakening of the fibres by rotting. One of the main uses of this type of rope was as rigging in sailing ships, where the constant damp accelerated the rotting process, so ropes were protected by a coating of tar before they were used, giving a possible origin for the term 'Jack Tar', used to describe seamen.

Throughout the period of this study the making of rope was carried out in a mechanically-assisted 'ropewalk', which was a long strip of ground, usually covered, where the strands that went to form the rope were laid out and then twisted together. The mechanism employed in making rope in this manner is summarised by Fronzaglia (2006, 2), who describes the machine, called a rope jack, which consisted of three hooks connected mechanically by a gear or chain at one end of the ropewalk, and a swivel, capable of spinning freely, at the other. The three hooks were spun together to put twist in the strands attached to them. When the strands had enough twist, the rope was formed (laid) by allowing the swivel to spin freely. He also notes that this method of rope-making was used throughout the Middle Ages in Europe. In earlier periods, the work would have been done in an essentially similar manner, but by hand and with simple tools. Towards the end of the 18th century, machines began to be introduced in which rope was formed from a large number of small diameter threads in a single process, but this lies outside the scope of this study.

Steel (1794, 53-76) suggested that a ropewalk should have an overall length of 400 yards (365m), and a detailed discussion of the use of rope and the methods of production in relation to seafaring at the end of the 18th century can be found in his work. Some of this may be relevant to earlier periods. The locations where the various processes may have been carried out are generally not known, but it seems logical that larger ropes, in particular, would have been produced in close proximity to the place where it was to be used (*i.e.* near the sea), to minimise the costs of transport.

Sites and the HER

Only three ropewalks are recorded in the HER. The origin of one at Holywell (89924) is uncertain, but may be referred to in deeds of the late 18th century (Flintshire Record Office D/BC/61-76). The other two are on the coastal plain between Flint and Greenfield, at Bagillt (37755) and Bettisfield (34296). The site at Bagillt is mentioned in a lease of 1818 (Flintshire Record Office D/KK/353) and depicted on a manuscript plan of 1824 (Flintshire Record Office D/DM/131/5 (e)) and appears to have still been in operation at the time of the first edition Ordnance Survey mapping in the 1870s. This was some 270m long, whereas the Bettisfield example seems to have been shorter, but is only really defined by the name 'The Walk' on the first edition Ordnance Survey mapping. The known lengths suggest that neither was producing rope for the Navy, given that Steel mentions that a pre-requisite for marine use was the facility to produce a minimum rope length of just over 290m (160 fathoms).

Thus no pre-1750 ropewalks have been claimed in east and north-east Wales, and more generally, other than the assumed and localised use of hemp fibre for rope making on Mynydd Hiraethog we have no evidence for rope-making in the medieval and early post-medieval eras.

Sources

Fronzaglia 2006; Grant n.d. (2007); Richards 1954; Steel, 1794

Salt Works

Background

The manufacture of salt, a natural product primarily used for preservation of meat and fish, was of vital importance in a period that lacked modern methods of food refrigeration. The salt production industry in Cheshire dates back to at least the Iron Age (Twigg, n.d.), and the Roman settlement of *Salinae* (Middlewich) was a production centre, something implied by its name, which is echoed by the modern term 'saline'. The modern name of the town incorporates the suffix *wich*, sometimes spelt *wyche*, an Old English term that often denotes the presence of salt works in the Cheshire salt district. Whether production extended into north-eastern Wales at this time is uncertain, but probably unlikely.

Two main sources of salt were exploited in the study area in later centuries. It was extracted from sea water on the north-east Wales coast and saline solutions were extracted from flooded 'brine pits' dug into the rock salt deposits on the Cheshire/Wrexham border. In both locations the liquids would have been placed in pans where the water could be evaporated by the application of heat, causing salt to be precipitated. Prior to the 17th century, the pans would have been made of lead, and wood fires would have been employed, but the increasing use of coal from that time on, coupled with the low melting point of lead, meant that iron pans were adopted in their place.

Sites and the HER

The salt-producing area in the eastern part of Wrexham Borough extends across the border into Cheshire and is centred on two villages with *wych* in their names, Higher Wych (in Cheshire) and Lower Wych (in Wrexham Borough), positioned on the banks of the Wych Brook which here acts as the national border. They were formerly known as Higher and Lower Dirtwich, and in the earlier part of the medieval period as 'Fulewic'. The earliest references to 'Fulewic' are between 1096 and 1101, when it was a part of the barony of Malpas, and Pratt (Flintshire Record Office NC/216) notes that a brine pit, established in 1527 at Higher Wych, formed part of the endowment of Malpas Grammar School. Exploitation during the medieval period is indicated by the salt pit or (*salinae*) valued at 24s recorded in the Domesday survey of 1086 as an appurtenance of the manor of Burwardestone, and this is possibly the same one as that at *Wiche* in Iscoyd which was noted in the possessions of Haughmond Abbey in 1291.

Both Higher and Lower Wych were the site of a number of salt works, and Pennant (1991, I, 225), writing at the end of the 18th century, mentions brine springs and a salt works at the Wyches. Pratt refers to three brine pits at Upper Wych that ceased working in 1830 and 1840, and two at Lower Wych, which ceased working in 1856. He records too that one of the brine pits consisted of a shaft 450ft deep, into which a small stream of brine flowed at a depth of 60ft.

Two artificial brine pits are recorded at Lower Wych in the HER. Lower Wych brine pit and waterwheel (101915) should be located at SJ 4862 4439, rather than its position in the centre of the settlement given in the HER, and comprises the filled-in brine pit together with a second pit for a waterwheel used to pump the saline solution to the salt works on the Cheshire bank of the Wych Brook. The salt works belonged to Lord Kenyon in 1838 according to the Tithe survey but are known to have closed in 1856 (Twigg, nd). Higher up the Wych Brook, there is another brine pit (101916) at SJ 4885 4416, which Twigg considers to be no later than the end of the 18th century in date owing to the lack of both

visible structural remains and archive information. Records relating to salt works in Higher Dirtwich date to 1725 (Cheshire Archives DCH/D/372) and 1750 (Cheshire Archives DCH/C/631), but these are just over the border in Cheshire. Twigg, however, notes a brine spring nearby at SJ 497 435, on the Welsh side of the border, which is unrecorded in the HER. It may be the site of another salt works but lacks documentary evidence. The importance of the area in the late medieval period is confirmed by the 1611 *Inquisition Post Mortem* of Randle Brereton of Malpas (Cheshire Archives DCH/C/805), which apparently refers to 10 brine pits or salt houses at Higher and Lower Dirtwich (Twigg, n.d.). Sadly none of these has been identified.

On the north-east Wales coast salt was extracted from sea water in a few places but the scale of the industry and the distribution of its products is not known. Confirmed sites include one at Mostyn (37741) and another at Flint (37740). The latter is recorded on 'Morfa Avon Lwyven' by Lhwyd at the end of the 17th century (Lhwyd 1909-11, 86). It was subsumed beneath the Flint lead smelting works, according to Pennant writing at the end of the 18th century (1988, 281), and then by various industrial developments in the 19th and 20th centuries; the area has since been redeveloped. The site at Mostyn is first recorded in a deed relating to a salt pit there, dated 1591 (Flintshire Record Office D/MT/47).

Salt needs to be stored in controlled conditions to ensure that it does not absorb water from the atmosphere and a salthouse is mentioned at Mostyn in a conveyance of 1621 (Flintshire Record Office D/MT/519); it is named as such and depicted as a substantial building on a map of 1743 (Flintshire Record Office NT/M/135), although it is unknown whether there are any surviving remains.

As far as is known, the only salt warehouse (32379) which remains intact in the study area dates to the 1820s or 1830s and is thus outside the remit of this study. It is situated at the Pentreheylin Wharf on the Montgomeryshire canal, next to the Vyrnwy Aqueduct.

Gazetteer of new information

Flint Saltworks PRN 37740 As in HER
The site is recorded on 'Morfa Avon Lwyven' by Lhwyd at the end of the 17th century (Lhwyd 1909-11, 86). It was subsumed beneath the Flint lead smelting works, as suggested by Pennant (1988, 281), writing at the end of the 18th century, and then by various industrial developments in the 19th and 20th centuries; the area has since been redeveloped.

Mostyn Saltworks PRN 37741 As in HER
The site at Mostyn is first recorded in a deed relating to a salt pit there, dated 1591 (Flintshire Record Office D/MT/47). Salt needs to be kept in controlled conditions to ensure that it does not absorb water from the atmosphere and a salthouse is mentioned at Mostyn in a conveyance of 1621 (Flintshire Record Office D/MT/519); it is named as such and depicted as a substantial building on a map of 1743 (Flintshire Record Office NT/M/135), although it is unknown whether there are any surviving remains.

Lower Wych brine pit and waterwheel PRN 101915 SJ 4862 4439
The site is incorrectly located in the HER, the revised location is included here.

Lower Wych brine pit PRN 101916 SJ 4885 4416
Twigg considers this site to be no later in date than the end of the 18th century, owing to the lack of both visible structural remains and archive information.

Upper Wych brine spring PRN 122235 SJ 497 435
Twigg notes a brine spring at the given location which is unrecorded in the HER; it may be the site of another salt works but is not documented.

Sources
Twigg, n.d.; Pennant, 1990; Pratt (Flintshire Record Office NC/216)

Stone Quarrying (Freestone and other building stone)

Background

The immense scale of the subject is revealed by the fact that the HER has records for more than 2,700 quarries of various types, although very few if any are securely dated. Map evidence may indicate a date at which a quarry was open, but cannot provide a guide to when quarrying started or finished. The problem of dating though is significant, and the most useful approach is normally to start with the buildings that represented the ultimate destination of the quarried stone. Useful reference works regarding the use of stone in buildings of medieval and post-medieval date include Smith's *Houses of the Welsh Countryside* and Thurlby's *Romanesque Architecture and Sculpture in Wales*, but while these deal in great depth with architectural styles and the methods of building, little effort is made to discuss the origin of the materials used. The situation is rather better in Pevsner's Buildings in Wales series, in which the geology of the districts is discussed to varying degrees, with Hubbard's *Clwyd* (1986) being an improvement on Haslam's *Powys* (1979).

The use of stone for building is rather more restricted than might be thought in the period under study, for the earliest domestic buildings in the study area are more commonly of timber construction. This has often been attributed to the lack of suitable building stone in contrast to the availability of plentiful timber supplies (see Haslam 1979, 30 and Hubbard 1986, 89); but it is likely too that the extraction of better quality stone, its transport, and the employment of skilled masons to work with it would have been a source of considerable expense, even in areas where suitable material was available, and this may well have limited its exploitation to higher status building projects. While the rubblestone that made up a large part of the walling could have been found relatively near to the site, larger projects normally required the use of *freestone,* which could be readily shaped and carved to provide fine architectural detail. By way of example, Carboniferous sandstone known as 'Cefn Rock', extensively quarried from outcrops at Cefn-mawr and Broughton, near Wrexham, from medieval times (Ashurst and Dimes, 1998, 71) and used in the parish churches of Wrexham and Ruabon. An early lease of stone quarries in Ruabon, dated 1626, may relate to this rock type (Denbighshire Record Office: DD/WY/941).

The higher status buildings in which good quality building stone was used were primarily castles, churches and gentry houses. However, the likely distance between the quarry and the building site potentially creates difficulties in linking the two. It may only be resolved by a geological specialist closely examining and correlating the characteristics of both the bedrock at the quarry and the stones incorporated into the building, the latter datable by architectural style or documentary evidence. The best published example of this methodology in action is still the work of E. Neaverson (1953-4) in north-east Wales, who carried out detailed analyses of the building stone in a number of the medieval buildings of the area and then compared it with extant quarry sites. Hubbard (1986) similarly considered the locations of quarries in his work detailing the historic buildings of Denbighshire and Flintshire, probably utilising the work of Neaverson. The British Geological Survey (BGS) is now undertaking a considerable amount of relevant work in this field (for which see Lott and Barclay 2005), though most of their research is not available in an easily accessible form.

Sites and the HER

The message derived from Neaverson's writings is that it was generally local stone sources that were exploited, and it was only in exceptional circumstances that materials were brought in from a considerable distance. Thus the BGS list Machynlleth and Montgomery as places where local building materials – both for roofing materials and block stone as they term it – were used; Montgomery castle displays local Silurian sandstone. Roofing slates were quarried near Nantglyn (Denbs) for local use; Kinnerton sandstone was quarried locally for Rhuddlan Castle; locally available coarse shale and slate is assumed to have been used at Valle Crucis Abbey, so that 'fetching the quantities of rock required for the construction of the abbey would have needed minimum effort', as Crane (2005) put it, and in addition Cefn y Fedw sandstone was used for decorative work and again in a later re-building phase. But it is this last example which focuses the archaeological issue. Crane was able to pinpoint several sandstone quarries on top of Eglwyseg around 4km from the abbey, but apart from pointing out that they were old, he was reluctant to argue that these were the ones operating in the Middle Ages. And he goes on to note that there is another quarry producing similar stone near Trevor which is 7km away but on much more level ground making the transport of stone much easier. In most of the reports that have been published on standing buildings, the quarries that were worked are not identified, though it is not clear whether this is a result of ignorance or because of a lack of interest in the topic on the part of the writer.

Fig 8: Shrewsbury sandstone used in Meifod church, Powys. © R J Silvester

Little geological sourcing has been done in this regard in Powys, where much of the stone is not necessarily suitable for the construction of higher status buildings. It is usually the historic churches that provide the best evidence. Freestone was a rare commodity and in some regions it had to be imported from across the English border in order that it could be used for window and door dressings, columns and other architectural detailing. Thus in the Norman period, churches such as Llandrinio, Llanfechain and Meifod (Fig 8) had their window and door arches carved from red sandstone, freestone that came from the quarries at Shrewsbury (J. Davies, Welsh Stone Forum: pers. comm.). Further south the same use was fulfilled by tufa at Presteigne and

perhaps Cefnllys, the material coming from the Black Mountains region, though probably in the Herefordshire portion. For the rubblestone which made up much of the material from which a medieval church was fashioned, the builders resorted to local sources. But as yet only a few of these have been recognised. Presteigne church has a late Saxon phase (the only church in Wales which can claim to have surviving pre-Conquest fabric) and this incorporates Llandovery sandstone identified in woodland above the Hindwell Brook about 1.2km to the south of the church (and just in Herefordshire). Old Radnor church was almost certainly built from stone derived from the quarries that lie on the same hillside only a short distance away to the north, while Llanbadarn-y-garreg (Rads) has, so it is claimed, boulders derived from the nearby river. But the best example is from the southern part of the region where some of the stone for Cwmhir Abbey (Rads) probably came from the quarry workings now known as Fowler's Cave (214). The overriding trend for the churches in this area of east Wales is thus assumed to revolve around the exploitation of local sources of stone where these could be accessed, and presumably if this held true for the churches it would also hold for any houses that were built of stone in the immediate vicinity. Such local quarries are perhaps unlikely to have been of any great size.

More extensive may have been the quarries in the south of the region where the red sandstones in the Devonian rocks were widely used. Ashurst and Dines (1988, 63) noted a stone known as 'Racephas Stone', quarried from near Hay-on-Wye, that was used for tiles and building stone. The area known as Chwarel Ddu below Hay Bluff may have been the source of this stone as it is occupied by a large number of sandstone quarries that potentially belong to the earlier part of the post-medieval period. It is known that quarries were exploiting this stone in Aberllynfi parish at Coed y Polyn (probably 78527) and in Gwernyfed Park (80610) in the late 17th century, where Lhwyd (1909-11, II, 30) asserts that 'tyles and table stones were dug[d]'. The latter lies within the former Deer Park and is of interest as it has already been identified as a sandstone quarry, known to have been depicted on an estate map of 1796. Tangentially, the Coed Polyn reference seems to have given rise to a false record (526) in the HER, where the tiles and table stones were taken to mean that Roman ceramics had been found; none has been revealed by subsequent work and the position of the reference in the text fits with it being a note regarding the natural resources of the parish. These are just isolated examples of what must have been a widespread activity, as there are significant numbers of dispersed quarries of unknown date in the old red sandstone rocks of the Brecon Beacons and adjoining hills. While it is presumed that these were largely for building stone, some of the beds were sufficiently fissile for use as roofing tiles, as evidenced by the above source, and examples of this type of roof can still be seen in parts of Radnorshire and Breconshire. In Montgomeryshire, there is a reference by Lhuyd in the late 17th century to the excavation of 'tile stones' in the parish of Trefeglwys, who specified the location of the quarries; these are detailed in the gazetteer (122228-122230). Stone roofing tiles were probably displaced as the main roofing material in these areas, perhaps along with thatch elsewhere, as the north Wales slate industry developed in the 19th century. Improved methods of transport made slate widely available and the resulting reduction in the weight of the roofing materials, would have made the material attractive as a cost-saving roofing solution.

In addition to the stone itself, buildings required mortar, which was made using lime formed by burning limestone to create the active ingredient *quicklime*. Burning was often carried out in close proximity to a suitable quarry to minimise costs of transport and it is common to find small quarries with a single limekiln close by. Lime burning, and therefore quarrying, had a further and arguably more significant use; to provide lime for spreading on fields to improve the fertility of acidic soils. This was a significant element

of agriculture and its use is mentioned in a number of pre-1750 works, including Fitzherbert's 1523 *Boke of Husbandry* (Skeat, 1882) and Tull's 1731 *The Horse Hoeing Husbandry* (Brachfeld and Choate, 2007).

Limestone quarries could have a dual role, as they were also commonly utilised to provide stone used in the bulk of the walling of higher status buildings in the limestone districts of North Wales. It may well be that the same quarry provided both types of raw material. An early example of lime use is noted by Hallam (1988, 441) where lime bought at 'Holstan', located on the coast between Basingwerk and Bagillt, was brought to Flint Castle in 1302-3 to repair the walls. The reference comes from the Chamberlain's accounts for 1302-3, recounted in Jones (1913), and a further piece of information refers to payments 'for the wages of one mason making round stones and repairing other defects of the masonry within the said castle (Rhuddlan), and for 15 quarters of lime bought and used within the said castle for the aforesaid works, and for the carriage of stones for the masonry work from Holstan to Rothelan by water'. It is evident from a number of sources that the name Holstan had become 'Whelston', a township in the parish of Holywell, by the late 19th century. A series of what appear to be underground quarries are depicted within the township around NGR SJ 1930 7564 and it is possible, though by no means certain, that this was the source of the stone. Neaverson mentions a buff sandstone used in the upper parts of the towers at Rhuddlan, but does not offer a source.

Lime burning was carried out in other parts of north-east Wales, where suitable rocks were available, as in the area around Hope where the activity is recorded in a mortgage of lime quarries in the manor, dated 1662-3 (Flintshire Record Office D/G/2706-7). Pennant (1991, I, 436), writing in the late 18th century, mentions an 'abundance of limestone burnt into lime on Caergwrle Hill'.

Limestone also forms a thin belt to the north of the coal measures in south Wales and large deposits are present in the upper Swansea valley. Late 18th-century activity is known in the area from places like Cribarth, a hill near Craig-y-Nos, but much of the quarrying in earlier times took place in remote upland locations and seems to have gone largely unrecorded. Further work is needed to identify early sites. There was some extraction of the silica-rich Millstone Grit rocks that are found in close conjunction with the limestone, but it may be that much of this was exploited in a later period, as the most common use of the material was for the production of furnace linings in the 19th century.

There is a reference to the extraction of limestone in Glasbury parish given by Lhuyd (1909-11, II, 31) writing in the late 17th century, who notes that 'Lime stones are dug somewt plentifull in this parish'. As, however, there is no Carboniferous limestone in the parish; the reference is explained by the presence of a thin band of lime-rich stone in the Old Red Sandstone rocks of the upper section of the Vale of Ewyas, the result of a marine transgression in Devonian times. A number of lime kilns, identified by fieldwork in the 1990s, lie on the course of this band of stone and it is therefore likely that these, and the small quarries adjacent to most of them, could date to at least the late 17th century.

Gazetteer

Much of the following gazetteer has been derived from the work of E. Neaverson, who considered the sources of stone for buildings in north-east Wales by comparing the composition of stone at quarries with that used in buildings which are readily datable by

architectural style. He also recounts evidence from original sources and this has been expanded by the consultation of other readily available secondary sources. For other areas the situation is less clear but a few examples are recorded in the HER or secondary sources and are included here. Hubbard also considers stone sources, but it appears that some of this has come from the work of Neaverson. A small number of the quarries were depicted on Badeslade's map of 1740 (see section on *Coal Mining*)

PRN 15420 Rhewl quarry, which must be Craig-y-ddywart As in HER
This limestone quarry is said to be an important source for the medieval churches of the region.

PRN 19085 Bryn Iorcyn quarry, near Caergwrle As in HER
A Carboniferous sandstone quarry near the house was used as the source of stone when it was built in the 17th century. There is also some evidence for the production of mill stones there, an activity first recorded in the locality in about 1350 (see also the section on *Millstone quarries*).

PRN 19086 Caergwrle Castle quarry SJ 3070 5714
The Cefn-y-fedw Sandstone used in building the castle was obtained from the south side of the hill on which it stands. The existing record in the HER incorrectly locates this to the north of the castle, so a revised NGR is appended. There is also a reference to the production of millstones here.

PRNs 35616 and 35617 Chwarel Ddu limekilns I and II As in HER
These limekilns are likely to be associated with the reference to the extraction of limestone in Glasbury parish given by Lhuyd (1909-11, II, 31) writing in the late 17th century, who notes that 'Lime stones are dug somewᵗ plentifull in this parish'. The kilns probably utilised a nearby band of lime-rich stone in Old Red Sandstone rocks, which was the result of a marine transgression in Devonian times; it is the only lime-rich stone found within the parish. These are two of a number of limekilns, identified by fieldwork in the 1990s, which lie near the course of this band of stone and it is therefore likely that these collectively date to at least the late 17th century.

PRN 37840 Moor quarry, Greenfield As in HER
This is thought to be the site quarried in the 12th and 13th centuries to provide stone for Basingwerk Abbey. It may also may have been used in 15th century for Holywell church and the well-chapel of St Winefride.

PRN 78527 Coed y Polyn quarry, Aberllynfi As in HER
This quarry is only known as a disused site from the 1st edition OS map of the late 19th century, but it is almost certainly the site in 'Coed Bollyn' where Lhuyd (1909-11, II, 30) asserts that 'tyles and table stones were dugᵈ' in the late 17th century, meaning sandstone roof tiles and larger slabs. The reference seems to have given rise to a false record (526) in the HER, where 'tiles and table stones' were taken to mean that Roman ceramics had been found; none has been revealed by subsequent work and the position of the reference in the Lhuyd's text fits with it being a note regarding the natural resources of the parish.

PRN 80610 Gwernyfed Park quarry, Aberllynfi As in HER
The quarry lies within the former Deer Park and has already been identified as a sandstone quarry, known to have been depicted on an estate map of 1796. This is almost certainly the site, where Lhuyd (1909-11, II, 30) asserts that 'tyles and table stones were

dug[d'] in the late 17th century.

PRN 93330 Valle Crucis abbey quarry As in HER
Silurian mudstone from a location just to the W of the abbey was apparently used as the main building stone where decorative work was not required.

PRN 102059 Dyserth Castle quarry As in HER
Limestone was dug from the site for use in the castle walls. Any surface evidence has almost certainly been lost to later quarrying activity.

PRN 103514 Cwm quarry As in HER
This limestone quarry may have supplied stone for the church, although Neaverson suggests that the stone came from the main quarry on Moel Hiraddug.

PRN 121535 Bwlchgwyn limestone quarry SJ 2564 5339
Limestone quarry depicted on Badeslade's map of 1740. Nothing visible on the 1st edition OS map and now wooded.

PRN 121536 Plas Gwyn Mountain quarry SJ 2619 5260
'Limestone' (quarry) depicted on Badeslade's map of 1740. The 1st edition OS map shows that it was subsequently extended to the north-west. Now disused and overgrown, but it is *c*.5m deep in places. Rock faces are visible which imply that the stone quarried was actually a lime-rich sandstone.

PRN 121537 Gwynfryn limestone quarry SJ 2565 5253
'Limestone' (quarry) depicted on Badeslade's map of 1740. The 1st edition OS map appears to show a pond or pit. Levelled and now occupied by a playground.

PRN 121538 Minera limestone quarry SJ 2566 5232
'Quarry of limestone' depicted on Badeslade's map of 1740 on the outskirts of Brymbo. Nothing is visible here on the 1st edition OS map, but there are grassed-over quarry workings and an undoubtedly associated limekiln with a stone facing around its stokehole (on the north-north-east) at SJ 2566 5237 (Fig 9).

PRN 121539 Brymbo stone quarry SJ 2934 5398
A stone quarry depicted on Badeslade's map of 1740 on the outskirts of Brymbo. Nothing visible on the 1st edition OS map. Now built over.

PRN 121575 Abergele quarry I SH 9357 7726
A limestone quarry situated on the ridge south of the town apparently supplied stone for the church in the 15th century. This is one of three possible sites, but the evidence of medieval extraction has allegedly been destroyed by later work.

PRN 121576 Caerwys quarry I SJ 1252 7269
One of two limestone quarries on the outskirts of the settlement, both of which are depicted on the 1st edition OS map. This site probably corresponds with Neaverson's note that stone quarried on the margins of the town was used in the medieval church (Neaverson, 1953-4, 12).

PRN 121577 Denbigh Castle quarry SJ 0515 6578
The main stone used in the castle and town walls is apparently limestone taken from the rock on which these structures stand.

Fig 9: One of the quarries (121538) depicted on Badeslade's map of 1740 on the outskirts of Brymbo, seen on the ridge in the middle ground (CPAT 3432-0013)

PRN 121578 Dyserth quarry SJ 056 793
Limestone from near the village was probably carried by water traffic to Rhuddlan castle, but the extraction site has not been identified.

PRN 121579 Graig quarry, Denbigh SJ 0522 6675
The quarry was used from at least the 13th century and limestone from there is found in a number of buildings, including Leicester's church and the tower of St Hilary's in the town, and also the parish church and Bodfari Church. Later quarrying may have obscured the early workings.

PRN 121580 Gwaunysgor quarries SJ 074 810
There are a series of quarries in the village, one or more of which may have supplied limestone for the medieval church. Possible sites exist at SJ 0746 8098, SJ 0745 8102, and SJ 0737 8107, none of which were previously recorded in the HER.

PRN 121581 Hafod y Calch quarry SJ 0545 4287
An area of limestone quarrying about 2km west-south-west of Corwen. Neaverson asserts that this is definitely of medieval origin, the stone having been used to provide lime for Carndochan Castle, 22km to the south-west, for which this was the nearest source of supply.

PRN 121582 Henllan quarry SJ 0197 6819
A limestone quarry, which supplied stone for the church, probably near the given NGR, but nothing has been recorded there.

PRN 121583 Llanfair Dyffryn Clwyd quarry SJ 1247 5520
The quarry may have provided stone used in the church, so potentially it is 14th or 15th-

century in date. This may be the site recorded by Lhuyd (1909-11, 150) in the late 17th century as 'Quarrel Garreg las yn y mynydh: a good flagging stone'. A limekiln (58294) is recorded within the quarry.

PRN 121584 Llanrhaeadr Dyffryn Clwyd quarry SJ 0770 6320
The limestone from here was possibly used for the village church.

PRN 121585 Moel Hiraddug main quarry SJ 0611 7900
A limestone quarry considered to date to the medieval period, possibly the source for the stone of Rhuddlan Castle and the nearby church. It was perhaps also used at Cwm church.

PRN 121586 Moel Hiraddug quarry II SJ 0612 7821
One of two small quarries depicted on the OS 1st edition map, either of which has been suggested as the likely source for the earthy limestone used in the arch of the south porch at Cwm church.

PRN 121587 Newmarket (Trelawnyd) quarries SJ 0885 7999
The church is built from stone found on the south slopes of Gop Hill. There are a series of quarries there, of which the most likely is at the given NGR. All or any could have been the source of stone used.

PRN 121589 Segrwyd quarry, Denbigh SJ 0441 6445
Limestone was burnt for lime here in 1334.

PRN 121590 Cefn Meiriadog SJ 0375 7131
The well-known 'Elwy Stone', a purple Carboniferous sandstone, was quarried on the banks of the River Elwy just above Pont yr Allt Goch, 2 miles south-south-west of St Asaph. The lower courses of Rhuddlan Castle used this stone, and this is possibly associated with a payment to the canon of St Asaph purchasing stone for Rhuddlan in 1278 (Neaverson 1953-4, 5). The stone was also used in St Asaph Cathedral and the 'Red Tower' of Denbigh Castle, which may be early 14th-century in date.

PRN 122187 Cefn-mawr quarries, Ruabon SJ 2801 4245
Carboniferous sandstone quarries at Cefn-mawr were apparently the source of stone for the 13th-century church at Ruabon. Some of the dressed stone at Valley Crucis was also probably sourced from Cefn-mawr. There are a number of possible quarries centred at the given NGR.

PRN 122188 Pont Lawnt quarry, Denbigh SJ 0427 6508
Greenish sandstone, probably from near Pont Lawnt, was used in the gatehouse at Denbigh Castle, its flanking towers and the Goblin Tower.

PRN 122189 Ewloe Castle quarries SJ 2902 6765
Carboniferous sandstone from the moat was used in the building of the castle, with other stone probably from a quarry at the given NGR. The latter is the most likely source of the reddish sandstone used in the windows and door jambs of the castle.

PRN 122190 Flint Castle quarry SJ 2470 7334
Sandstone from the site of the building was apparently used at Flint Castle, but Taylor (1986, 19) says that 10,000 stones were obtained for the works from a quarry near Shotwick.

PRN 122191 Gwespyr area quarries SJ 109 830

Talacre stone came from this area, but the exact site not known. The largest quarry on 1st edition OS map was at SJ 1095 8309, and was apparently used in Denbigh Friary; the E part of St Asaph Cathedral; Rhuddlan Castle; for the windows in Gwaunysgor church; and as floor paving in St Asaph cathedral in the early 18th century (Neaverson 1945, 221). Similar stone was apparently used at St Winefride's Well. It should be borne in mind that this material may be similar to sandstone in the township of Whelston in Holywell, rather nearer to St Winefride's Well.

PRN 122192 Bilberry Wood quarries, Hawarden SJ 3134 6493

A group of quarries identified by Neaverson as the source of sandstone used in Hawarden Castle towards the end of the 13th century.

PRN 122193 Pentre Broughton quarries SJ 3077 5308

Neaverson (1953-4, 18) states that the "Cefn Stone has been quarried in the neighbourhood of Broughton and this is probably the source of stone used for the churches of Wrexham and Gresford in the 15th century". The location given is central to a group of quarries at this locality.

PRN 122194 Whelston quarries, Holywell SJ 1930 7564?

Fig 10: The platformed area at SJ 1933 7552 (CPAT 3432-0011)

Sandstone from the township was used at a number of large building projects in the medieval period and records of 1302-3 refer to 'the carriage of stones for the masonry work (at Rhuddlan Castle) from Holstan to Rothelan by water'. Holstan can be identified as the 19th century township of Whelston, but the location of the quarries in the township has not been conclusively determined. Neaverson mentions buff sandstone used in the upper parts of the towers at Rhuddlan and the eastern part of St Asaph Cathedral, but does not give a source, other than comparing it to Talacre stone from Gwespyr. It is also possible that stone from these quarries was used at St Winefride's Well, nearby.

A series of partly abandoned surface and underground quarries which fall within the upper part of Whelston township are depicted on the 1st edition OS mapping in the wooded valley of Coed Llwybr-y-bi around SJ 1930 7564, and may be the source of this material. The local rock seems to be a poor quality shale, but it appears unlikely that this would have been the stone being quarried. Unfortunately, all entrances to the underground workings are blocked and the stone type is therefore not readily apparent; a large platformed area at SJ 1933 7552 may have been a working/dressing area for the material.

PRN 122195 Bryn Polin Bach quarry I, St Asaph SJ 0505 7335

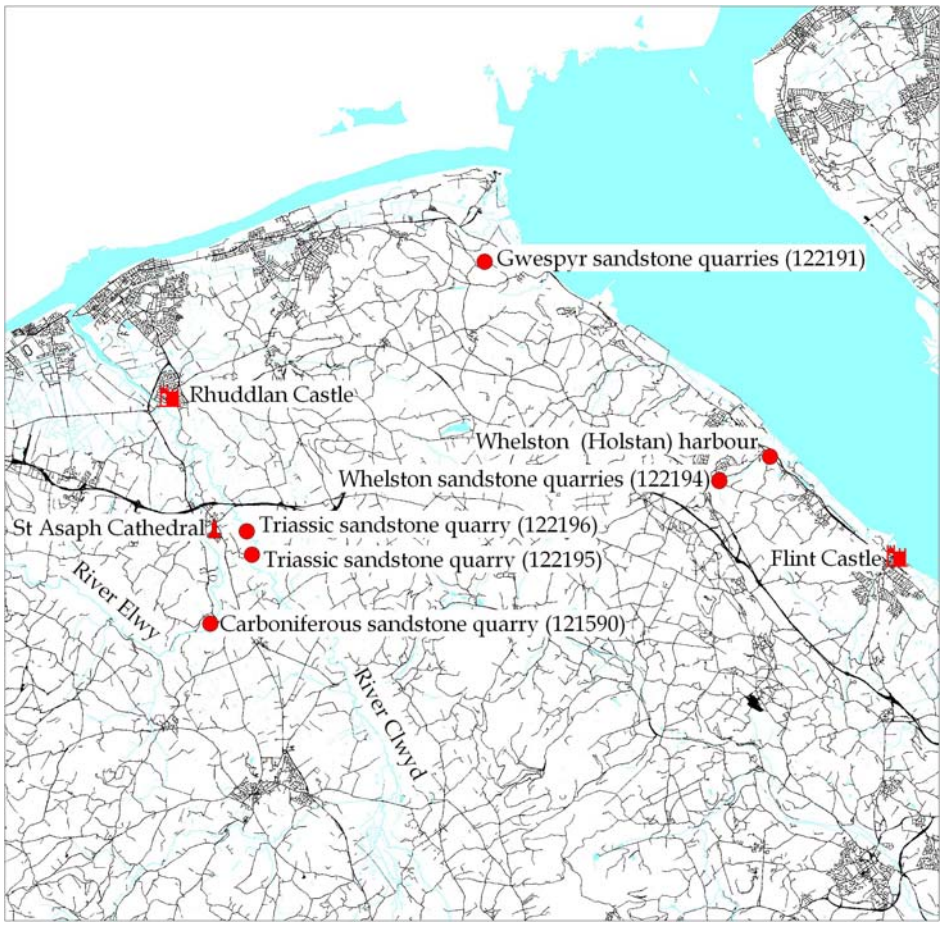

Fig. 11: Quarries of probable medieval date which may have supplied stone used in St Asaph Cathedral and Rhuddlan Castle

New Red Sandstone was possibly taken from the banks of the river Clwyd for use in St Asaph Cathedral. This is one of two localities mentioned by Neaverson, the other being recorded as PRN 122196. This type of stone is probably that referred to as 'red stone' in an agreement of 1380 between the bishop and his tenants (Neaverson, 1945, 222).

PRN 122196 Bryn Polin Bach quarry II, St Asaph SJ 0476 7405

New Red Sandstone was possibly taken from the banks of the river Clwyd for use in St Asaph Cathedral, and though there is some doubt regarding the rock type here, it seems probable that it is a correct attribution. This is one of two localities mentioned by

Neaverson, the other being PRN 122195, and covers a relatively large area. A field nearby is called 'Dol y garreg' (101574), 'stone meadow'.

PRN 122197 Hirwaen quarries SJ 1418 6133
Quarries are evident here on the 1st edition OS mapping and may have been the source of sandstone used in churches at Llandyrnog, Llangwyfan, Llangynhafal, and Llanrhaeadr Dyffryn Clwyd. The quarries are therefore possibly of 14th or 15th-century date.

PRN 122198 Holt Castle quarry SJ 4109 5378
Red-coloured Bunter sandstone was quarried from around the site of the castle for use in its walls in the 13th century. The same material was used in the 15th century for the churches at Holt and Farndon.

PRN 122199 Llanfwrog quarry SJ 1112 5780
A possible source of stone for St Mwrog's church, so therefore it is potentially 13th to 16th-century in date.

PRN 122200 Ruthin castle quarry SJ 1228 5804
New Red Sandstone from the immediate area of the castle was apparently used in its construction in the mid-13th century.

PRN 122201 Castell Dinas Bran quarry, Llangollen SJ 2230 4304
Silurian mudstone from the site was apparently used in building the castle.

PRN 122202 Corndon Hill quarry SO 3014 9629 ?
Stone roofing tiles quarried from the hill were apparently used in the 15th century (Haslam 1969, 31).

PRN 122203 Caerwys quarry II SJ 1304 7273
This site could have provided stone for the medieval church, but its location is more likely to correspond with the quarry that provided stone used around the millpond (300m to the east-north-east) in 1351-2 (Neaverson 1953-4, 12).

PRN 122204 Dolforwyn Castle quarry SO 1519 9502
At least some of the poor quality Silurian shale used to construct the castle was probably excavated from the site.

PRN 122205 Powis Castle quarry SJ 2159 0646
The variable reddish-purple to grey sandstone of which the castle is built apparently came from the site of the castle itself.

PRN 122212 Garthgynan quarry SJ 1424 5542
A quarry for 'red gritty freestone (a very excellent firestone for Ovens), by Garth Gynan house' was reported by Lhuyd in the late 17th century (Lhuyd 1909-11, 150). It has not been accurately located, but probably lies in the woodland just to the north of the farm. Given its location, it seems this exploited an outcrop of the Permian/Triassic sandstone that occupies the floor of the Vale of Clwyd.

PRN 122220 Ty Shores quarry, Glasbury SO 2618 3144
An area of quarrying associated with a limekiln (35834). This is likely to be associated with the reference to the extraction of limestone in Glasbury parish given by Lhuyd (1909-11, II, 31) writing in the late 17th century, who notes that 'Lime stones are dug

somewt plentifull in this parish'. The thin band of lime-rich stone which the quarry exploited lies in Old Red Sandstone rocks and is the result of a marine transgression in Devonian times; it is the only lime-rich stone found within the parish. There are a number of similar sites, where the limekilns were identified by fieldwork in the 1990s, which lie near the course of this band of stone and it is therefore likely that these collectively date to at least the late 17th century.

PRN 122221 Cwm Brychen quarry II SO 2575 3208
An area of quarrying associated with a limekiln (35828). This is likely to be associated with the reference to the extraction of limestone in Glasbury parish given by Lhwyd (1909-11, II, 31) writing in the late 17th century, who notes that 'Lime stones are dug somewt plentifull in this parish'. The thin band of lime-rich stone which the quarry exploited lies in Old Red Sandstone rocks and is the result of a marine transgression in Devonian times; it is the only lime-rich stone found within the parish. There are a number of similar sites, where the limekilns were identified by fieldwork in the 1990s, which lie near the course of this band of stone and it is therefore likely that these collectively date to at least the late 17th century.

PRN 122222 Cwm Brychen quarry I SO 2597 3284
An area of quarrying associated with a limekiln (35821). This is likely to be associated with the reference to the extraction of limestone in Glasbury parish given by Lhwyd (1909-11, II, 31) writing in the late 17th century, who notes that 'Lime stones are dug somewt plentifull in this parish'. The thin band of lime-rich stone which the quarry exploited lies in Old Red Sandstone rocks and is the result of a marine transgression in Devonian times; it is the only lime-rich stone found within the parish. There are a number of similar sites, where the limekilns were identified by fieldwork in the 1990s, which lie near the course of this band of stone and it is therefore likely that these collectively date to at least the late 17th century.

PRN 122228 Allt y Glyn quarry, Trefeglwys SN 952 912
A quarry for stone roof tiles was recorded here by Lhuyd (1909-11, III, 42). Its precise location has not been identified, but is probably within a few hundred metres of the given location.

PRN 122229 Bryn Cerrigog quarry, Trefeglwys SN 9402 9226
Quarry for stone roof tiles recorded by Lhuyd (1909-11, III, 42). Almost certainly the one on Bryn Crugog which is visible on modern vertical aerial photographs.

PRN 122230 Maesmor quarry, Trefeglwys SN 918 929
A quarry for stone roof tiles was recorded here by Lhuyd (1909-11, III, 42). The area is now partially afforested and its precise location has not been identified, but is probably within a few hundred metres of the given location.

PRN 122236 Montgomery Castle quarry SO 2215 9674
The Welsh Stone Forum newsletter (No 6) from March 2009 includes a comment on page 16 that the quarry which supplied most of the stone for the castle formed the ditch which is crossed on entering the castle (from the south).

PRN 122237 Abergele quarry II SH 9380 7658
A limestone quarry situated on the ridge south of the town apparently supplied stone for the church in the 15th century. This is one of three possible sites, but the evidence has allegedly been destroyed by later work.

PRN 122238 Abergele quarry III SH 9411 7641
A limestone quarry situated on the ridge south of the town apparently supplied stone for the church in the 15th century. This is one of three possible sites, but the evidence has allegedly been destroyed by later work.

PRN 122239 Moel Hiraddug quarry III SJ 06041 78502
One of two small quarries depicted on the OS 1st edition map, either of which has been suggested as the likely source for the earthy limestone used in the arch of the south porch at Cwm church.

Sources

Ashurst and Dimes, 1998; Brachfeld and Choate 2007; Crane 2005; Davies 2005, and also John Davies: pers. comm.; Hallam 1988; Hubbard 1986; Lhwyd 1909-11; Lott and Barclay 2005; Neaverson 1945; Neaverson 1953-4; Skeat 1882; Taylor 1986

Slate Quarrying

Background

Slate is a metamorphic rock capable of being split into relatively thin sheets. The material varies widely in its quality, some areas producing thin slates which can be used in roofing, others a thicker product which is generally known as 'slab'. Richards (1991, 10) suggests that Welsh slate was quarried from at least Roman times, with the years between then and the last quarter of the 18th century being ones in which it was used mainly (if at all) for local building purposes, where available. There is, however, correspondence regarding slates shipped from the Foryd (the artificial channel between Rhuddlan Castle and the sea at Rhyl) between 1754 and 1758 (Denbighshire Record Office PD/47/1/34), which demonstrates a more commercial approach, although the origin of the slate referred to is not known. The growth in transport links in subsequent years allowed the material to be moved over longer distances at reasonable cost and it came to dominate the market for roofing material over large areas of the country in the 19th century. For the period up to 1750, therefore, slate was largely a locally sourced building material, used for both flooring (as slab) and roofing. In some areas, fissile shales and sandstones which produced thicker roof tiles were used; these are not strictly slates and are therefore mentioned in the section on Stone Quarrying.

The morphology of a quarry (see Richards 1991, 10-14 for a detailed discussion) generally depended on its location and the way in which the workable beds of slate were aligned to the topography. The most common and easily worked was the hillside quarry, worked in a series of levels where the rock outcropped on or near the surface. In some cases the slate beds were developed vertically and this led to the excavation of a 'pit' working. Both types might eventually become underground workings if the workable slate extended sufficiently far for this to be cost-effective.

The following commentary has been compiled by district, at least for those areas which were operating before 1750, and demonstrates limited use of slate up to the end of the period of study. Those areas where early working has not been recognised by previous writers are ignored. In terms of the potential for recognition of early sites, it is most likely that the extractive nature of the industry will have led to the removal of evidence for early working, as those sites for which early records are available were used more intensively in later periods. Any small-scale early workings which may survive are generally not possible to date accurately by examination of the working methods, as the only real advance in techniques came with the introduction of powered drills towards the end of the 19th century.

Sites and the HER

Llangollen

The Llangollen district formed a distinct region of the slate industry in north-east Wales and though small by contrast with the scale of the industry in north-west Wales, it was significant locally. Quarrying began in the 17th century, though the most intensive period of working came in the 19th and the earlier 20th centuries, following in the wake firstly of the canal and secondly the railway which transformed a predominantly local industry into one exporting outside the region to the Wrexham area and the English Midlands. The slate was of variable quality, with some quarries producing material which had very poor resistance to weathering.

A number of groupings of quarries can be distinguished. One group of large quarries lay

around the fringes of Llantysilio Mountain and the Horseshoe Pass in the Maesyrychen and Llantysilio Mountain historic landscape character areas at Oernant, Moel-y-faen, Clogau (Berwyn), Craig y Glan, Cymmo and Rhiw Goch, The original workings at Oernant (17026) lie in the conifer plantation below the Horseshoe Pass where there is an early hillside working, mainly used for the production of slate slabs but including some roofing slate, and this is said to have been in operation in the late 17th century by Lhuyd (1909-1911, I, 124), who recorded 'a very good slate at Oernant in maes yr ychen (in Llantysilio parish) whence they are taken to ye neighbouring counties'.

Corwen and West Berwyn

A number of quarries developed on the south side of the River Dee near Corwen, and there are documents relating to Moel Fferna quarry (105054), which demonstrate that it was in use by the second half of the 18th century (Flintshire Record Office/NT/170). Further west, on the slopes of the Berwyn Mountains near Llandrillo, there are some small workings including a pit working at Cwm Tywyll (19590) which Richards (1991, 148) considered to be early, potentially dating to 1706; there is a stack of slates here, abandoned before they could be removed from the site for use.

The only site not already recorded in the HER, which may belong to the relevant period in this district, is the Penarth Quarry (SJ 107 424) noted by Richards (1991, 206-7) as having been expanded in the 1860s but possessing some open workings which 'are undoubtedly much older'.

Glyn Ceiriog

Richards records a number of quarries in the upper reaches of Glyn Ceiriog, of which the most substantial was the Cambrian Quarry (17032). This site has been incorrectly recorded in the HER and its location should be SJ 1895 3794, Edwards (1985, 115) notes a reference in the churchwarden's accounts of Chirk parish church for 1675, which refers to a payment for quarrying 3000 slates 'from ye Glyn Quarry'. It is almost certainly this site, as it is the nearest to Glyn Ceiriog, only 1km distant.

Llangynog

The early history of slate production here is poorly documented, although there are suggestions that the quarries (15200) on Craig Rhiwarth above the village may be early in date. Richards (1991, 199) states that Craig Rhiwarth was opened before 1760, possibly as early as the 16th century, and this may come from Leland's comment in the 1530s that the houses in Oswestry, the nearest large town, were slated (Edwards, 1985, 94). Local quarries were producing stone flags for flooring by at least the early 18th century, replacing earlier earthen floors. Slate quarrying in the Llangynog district was already thriving by the later 18th century, taking up the lull in the metal mining industry. In the 1770s slates were exported by road and then by river to Shrewsbury.

Elan Valley and West Brecknock

Richards records a small number of quarries working the area between the Elan Valley and Llanafan Fawr. These seem to have been used for local purposes, but no information regarding their origin was given by Richards.

Gazetteer of new information

PRN 17026 Oernant

This lies in the conifer plantation below the Horseshoe Pass where there is an early

hillside working, mainly used for the production of slate slabs but including some roofing slate, and this is said to have been in operation in the late 17th century by Lhuyd (1909-1911, I, 124), who recorded 'a very good slate at Oernant in maes yr ychen (in Llantysilio parish) whence they are taken to ye neighbouring counties'.

PRN 17032 Cambrian Quarry, Glyn Ceiriog SJ 1895 3794
This site has been incorrectly located in the HER and is given its revised position is given here. Edwards (1985, 115) notes a reference in the churchwarden's accounts of Chirk parish church for 1675, which refers to a payment for quarrying 3000 slates 'from ye Glyn Quarry'. It is almost certainly this site, as it is the nearest to Glyn Ceiriog, only 1km distant.

PRN 19590 Cwm Tywyll quarry As in HER
This is one of a number of small workings on the slopes of the Berwyn Mountains near Llandrillo. Richards (1991, 148) considered the pit working here to be early, potentially dating to 1706; there is a stack of slates here, abandoned before they could be removed from the site for use.

PRN 105054 Moel Fferna quarry As in HER
Documents relating to the quarry demonstrate that it was in use by the second half of the 18th century (Flintshire Record Office NT/170).

PRN 122240 Penarth Quarry SJ 107 424
This quarry could belong to the pre-1750 period; it is the noted by Richards (1991, 206-7) as having been expanded in the 1860s but possessing some open workings which 'are undoubtedly much older'.

Sources
Edwards 1985; Richards 1991.

Millstone quarrying

Background

Certain regions of the United Kingdom have become renowned for the provision of millstones over the centuries. Putting aside the fact that both French millstones and German lava millstones were imported into Britain in the Middle Ages, native millstones were garnered mainly from the millstone grit of the Pennines and the Derbyshire Peak District, and from Penselwood in Somerset. In Wales it was the sandstone conglomerate of the lower Wye valley below Monmouth that provided millstones for large areas of south Wales and southern England, and there were much smaller quarries on Anglesey. East and north-east Wales does not feature much in the general literature about millstones, but there is some evidence, albeit sparse.

Sites and the HER

Neaverson (1953-4, 17) pointed out that Caergwrle Castle stands on an outcrop of pale pebbly sandstone (Cefn y Fedw Sandstone), and that this had been quarried on the south side of the hill, not only to provide stone for the castle itself but also for millstones. Manley and Jones state this sandstone is the equivalent of the millstone grit of northern England. This has been reinforced by observations by Brian Malaws of the RCAHMW who has noted that at Caergwrle there is a millstone not completely severed from the parent rock and another lying further down the hill; these may be the two 'almost complete stones on the west hillside, one close to the south tower' referred to by Manley and Jones. Leland in the 1530s wrote of castle hill 'where be digged good millstones of a blew girth'. Apparently, though the stone was cherty in appearance, it was favouring in the grinding of barley.

Broadening out the discussion, Neaverson noted that the Flintshire Ministers' Accounts for 1349-50 referred to the source of such material as the 'forest of Rosty' which has been equated with Yr Estyn, just to the east of Caergwrle, a township in the parish of Hope.

A precise location for another quarry is given by Neaverson near to Bryn Iorcyn on the eastern side of Hope Mountain. The house of that name was built of the stone in the early 17th century, and millstones were still to be seen in the quarry there in the 1940s. This exploitation seems to go back to at least the 1620s for Star Chamber Proceedings in 1622 and again in 1626 listed a dispute between the tenant of Caergwrle castle hill whose monopoly of millstone quarrying was being threatened by the owner of Bryn Iorcyn.

Two millstones are also built into the south wall of Hope church, an ecclesiastical site which CPAT has been involved with in the recent past (Fig 12).

There is also the possibility of a third millstone quarry, this one in Mold parish, though it is later in date, its lease being advertised in 1776, and no other information seems to be available (Ward 1990, 25).

On the southern boundary of the region Elwyn Bowen has claimed that there was millstone working in the Brecon Beacons at Pontsticill, not far from Merthyr Tydfil and at Ystradfellte, the stones being used for coarse grinding for fodder and the like. The evidence for the former is slight: the outcrops at Pontsticill are comparable with rocks being exploited elsewhere in Wales, a locally termed 'Roman wheel' is (or was) a millstone, and local mills have stones of similar appearance. At Ystradfellte, no millstones are claimed but the stone is of the right type and a gully is claimed which could have facilitated the removal of millstones on sleds. Bowen has argued that the

shaping was done at the quarry, but the final dressing elsewhere.

Fig 12: the south wall of Hope Church nr Wrexham exhibiting the secondary use of a millstone. © R J Silvester

Finally Ward posited a millstone quarry at Cwmbychan, located in the hills immediately to the south of Machynlleth. The evidence is a single document of 1322 referring to the manufacture of eight millstones at *Cumbarkan* and purchased at Troy in Glamorgan. It is difficult to give much credence to this location.

Gazetteer

PRN 19085 Bryn Iorcyn quarry SJ 2990 5676

Ward records the quarry along the bluff, partly wooded, above Bryn Iorcyn. One broken stone in the quarry, three others near complete in the grounds of the house. Ward (1990, 24) claims that records for the quarry go back to the 13th century, and that the large size of the surviving stones supports an early date. A Tir Gofal farm visit in 2001 failed to detect any evidence of millstone production. LiDAR data points to small quarries at SJ 2992 5690, but also a much more extensive area of quarrying some 200m to the west at SJ 2973 5692.

PRN 19087 Ystradfellte millstone quarry SN 924144; 922125; SO 915145

Broken millstones and a deep gully that could have been used by sledges removing millstones from the quarry site are claimed by Bowen. The quarry itself is mentioned but no details are provided. It is not feasible from aerial photographs and Ordnance Survey mapping to determine the location of the quarry, other than to note that it lay to the south of Plas-y-daren farm.

PRN 122208 Caergwrle millstone quarry SJ 30675713

Millstone still attached to the living rock noted by B Malaws of RCAHMW in 2000. Another lower down the slope. There are general references to the south side of the hill being quarried. This is confirmed not by large-scale Ordnance Survey maps but by LIDAR which reveals significant quarry-like scarping below the south edge of the hilltop (at SJ 3072 5715) and also some smaller, more discrete quarries on the east side of the hill (at for instance SJ 3077 5720).

PRN 122209 Pontsticill millstone quarry SO 082 111; SO 1070 105 [sic]
The available evidence is too imprecise to pinpoint the outcrops or quarries that Bowen believed were being exploited, and the issue cannot be resolved because of the two differing grid references that are given in different sources. For the purposes of the HER, the first of the two has been selected.

Sources
Bowen 2000; Jones *et al* 2001; Manley 1994; Neaverson 1953-4; Richards 1969; Ward 1990

Woodland Industry

Introduction

Julian Munby has written: 'The use of timber and wood was so widespread in the medieval period that we might justifiably think of it as an age of timber, despite the obvious importance of masonry and the widespread use of iron. For timber, quite apart from its use in roofs and walls, bridges and wharves, was the major component of vehicles and vessels, and in the machinery of agriculture, industry and war'.

From a different perspective and probably with a veneer of exaggeration, a petition to the king in the early 14th century emphasised that for the men of Hopedale and Kinnerton in Flintshire 'the greater part of their sustenance is derived from the woods'.

Together these explain why the industries that utilised the natural products from woods and forests need to considered in this report.

Growing

Wood was carefully managed as a resource, and timber was felled as the occasion required. The key industries through the centuries were timber for building and for shipbuilding, for mining (or pitwood as Linnard has termed it), for charcoal burning, and bark for tanning.

The classic form, certainly in the Middle Age and beyond, was coppicing with standards whereby standards (or full-size trees), usually oak, were left to mature over long periods while undergrowth was cut on a regular cycle. Timber was even imported, primarily from the Baltic regions of northern Europe from the 13th and 14th centuries.

The best example of management that the writers have encountered is an account from about 1545 of the age structure and valuation of 60 acres of coppice with standards and coppice in the forest of Coyd Kyrye ap heren (the forest of Ceri), of which fifteen blocks of two acres each carried coppice of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 16, 18 and 20 years growth; and there were ten acres of coppice ten years old, and a further 20 acres of coppice twenty years old both with sixty-year old oak standards.

In medieval and Tudor times tree planting was rare, it became a gentleman's hobby in the 17th century, but became more prevalent with the popularity of parklands amongst the aristocracy and gentry. At the same time the demand for timber continued to increase. This was not just for the well-heralded requirements of shipbuilding, a focus which Rackham thinks is misleading (1990, 94) but for tanning and even for fuel. Nevertheless, the examples quoted by Linnard (2000, 98) are linked to the navy, perhaps because of the surviving documentation. And one of Montgomeryshire's landmarks – Rodney's Pillar on the Breidden – commemorates the admiral responsible for the defeat of a French fleet in 1782, and was erected by the local gentry to demonstrate their appreciation for Rodney who had advocated the use of Powysland oaks in ship building.

Regardless of the nature of the demand, it is clear that there was a heightened awareness amongst estate owners that their woodlands were sources of revenue, and this finds tangible form in the surveys that were being prepared from the mid-18th century, and in the accounts of the great estates.

Finally, we might note in passing that the forest (or wood) of Rusty (= Hopedale, Flints) was the scene of one of the first forestry experiments in Britain in 1351 when a part of the wood was cut down to ground level, and another part not so far, in order to see which part grew best. This area was known for its iron production, which may have been one factor in attempting to optimise growth.

The HER and Archaeology

Though the exploitation of trees and woodland was commonplace in medieval and later centuries, the tangible evidence of both the woods themselves, other than surviving trees within them, and the industries that exploited them, are sparse.

There are 38 woods recorded in the HER, many, on the evidence of the written statement, because they have been recognised as being managed in the past. It might be inferred, however, from what has been written above, and by the general testimony of experts such as Rackham and Linnard that many woodlands were managed in some way in the past, and that in many parishes unmanaged woodlands would have been in the minority. Some sort of perspective can be offered by comparing the figure of 38 which is outnumbered by the 41 woods shown on William Rees' map of 14th-century south Wales (as calculated by Rackham). Admittedly this map shows the whole of the southern half of the country, but it also presumably reveals only those woodlands that can actually be attested from the written records of the time.

Amongst the 38 are a sizeable number of reserved woods recorded by Berry in north-east Wales (that is woods that were tied to the castles and their boroughs, presumably for their exclusive use), in what is one of the very few studies to touch on the subject of woodlands. One of the most intriguing woods in the region, not recorded on the HER despite a short piece on it by Berry in about 1993, is Common Wood at Holt (SJ 3853) which was used by the burgesses of the medieval borough, and succumbed to enclosure only in 1848 when it was divided into 64 allotments. Hardly a candidate for designation, it should nevertheless be recorded in the HER.

In physical terms medieval and later woodlands leave relatively few physical traces. The trees themselves, depending on the period under discussion might still in some cases remain, veteran trees likewise in wood pasture, as Fleming has recently discussed in Powys, and coppices too may survive though where a coppice is still in evidence one suspects that in general terms it will have been used in relatively recent times. Woods were often enclosed by a boundary, usually a bank and ditch. Rackham claims that many Welsh woods have wood banks around them, a statement that he does not substantiate, and elsewhere in all-embracing fashion states that 'nearly all woods more than 100 years old have some kind of earthwork around the edge' (1990, 86; 114). While we may wonder whether there is at least a touch of the hyperbolic in Rackham's contention and suspect that the practice of enclosing a wood has become less prevalent in more recent centuries, proving that a bank has medieval or even Tudor origins could be a fruitless task. Not that this has much relevance to the present enquiry: despite Rackham's observation, the HER has only two wood banks recorded, both from woods at Eriviatt Hall in Llansannan (Denbs) located during a Tir Gofal assessment in 2000. Coflein is no better with just one, at Coed Lan Fraith in Rhaiadr (Rads). Observations from colleagues involved in woodland visits in recent years implies that enclosing banks are rarely encountered.

Other features of woods include internal banks, tracks and holloways. and rides. The last of these are thought by Rackham to have become a feature of woodlands only after

the Middle Ages, the first may well exist in some Welsh woodlands, yet seem rarely to have been recorded. But then as Rackham notes: archaeologists tend to avoid woods (2006, 187).

Processing

Trees were felled and the bark and branches then removed, much of it sold on for use in tanning and for making charcoal and firewood. Larger timbers might be sawn with two men using a saw-pit, an invention it seems of the 14th century. Otherwise it might be carted directly to a building site or framing yard, or taken to a sawmill the technology of which was first introduced in the 17th century.

Gazetteer

PRN 122211 Common Wood, Holt SJ 3839 5345

The common wood for the borough of Hold, reduced in size in 1628, and converted to allotments in 1848. It is still divided into multiple strips today.

Sources

Berry c.1993; Linnard 2000; Munby 1991; Rackham 1990; Rackham 2006; Smith 1988; Williams 1976

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