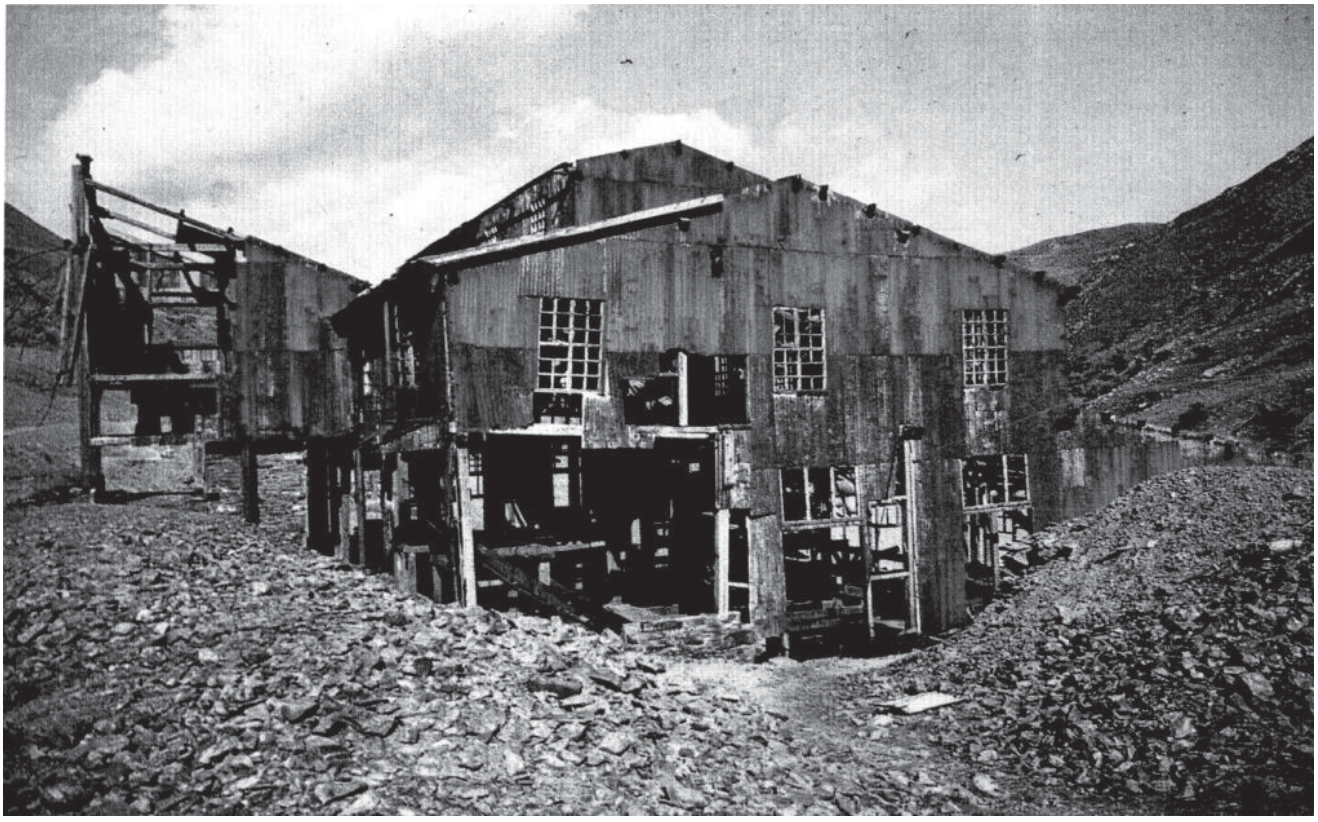
CBA RESEARCH REPORT

No 79

WELSH INDUSTRIAL HERITAGE: a review

edited by
C Stephen Briggs



1992

In Memoriam

Douglas Hague, David Morgan Rees,

a n d

W Gerwyn Thomas

The Welsh industrial heritage: a review

based upon the proceedings of a joint Cadw/CBA conference held in Cardiff, 5 December 1986

edited by C Stephen Briggs

CBA Research Report 79

Published 1992 by the Council for British Archaeology
112 Kennington Road, London SE11 6RE

British Library Cataloguing in Publication Data

Welsh industrial heritage. — (CBA Research Reports ISSN 0141–7819; v. 79)
I. Briggs, C. S. (C. Stephen) II, Series
609.429

ISBN 1 872414 13 3

Printed by Derry & Son Ltd, Nottingham

Foreword

Industrial Archaeology in Wales was the theme of the third *Welsh Archaeological Conference* held in December 1986 under the auspices of Cadw and the Council for British Archaeology at the National Museum of Wales in Cardiff. It has taken over four years to publish the papers presented then: but the delay has not been wholly disadvantageous. Collections of contributions to conferences are often unsatisfactory, even as records of the 'state of the art' at the time of their delivery: but here Dr Stephen Briggs has filled out what would have been a partial picture by including additional contributions so as to present a wider and deeper view than could have been offered on that one day. The articles naturally vary in scope and treatment, but they are all significant in their different ways.

Industrial archaeology as a specific branch of study had become recognised nationally at the very end of the 1950s. Certain enthusiastic individual proponents, amongst whom the names of Michael Rix, Rex Wailes, E R R Green, and Douglas Hague deserve to be especially mentioned, found a champion in Professor W F Grimes, then President of the Council for British Archaeology. Grimes was a 'mainstream' archaeologist of high reputation gained by his excavations of prehistoric, Romano-British, and medieval sites, and his standing and breadth of view enabled a definition of industrial archaeology to be agreed and officially accepted. Though Grimes had no personal concern with the archaeology of industry, he examined its possibilities and found them good and acceptable. There was some danger that the study might by too close definition have been limited to the so-called 'Industrial Revolution'. Some of us who served under Grimes on the steering group saw the danger, and it was averted by his influence. But it was a near thing, and this volume shows how serious that limitation would have been. Welsh industrial archaeology is the study of men and women at work, and their equipment and way of life (outside agriculture and seafaring, already provided for), throughout the whole of the discoverable history of Wales.

It is an undercurrent in the papers presented and now printed, that Wales nearly left things too late. After sporadic beginnings duly noted in Chapter 1, it was not until the 1980s that efforts were coordinated, workers in the field began to exchange experiences in fruitful discussions, and ideas of a coherent and rigorous approach began to be formed and discussed. At the conference in 1986 I could not help feeling that what was being done was rather opportunistic and fragmentary: perhaps it had to be so, but it seemed to me that some greater urgency needed to be felt and expressed. Now, three and a half years later, it can be seen that more coherent views are emerging, with principles and guidelines proposed for the future.

I hope that this collection of papers will be read, not only for what they put on the record, but even more for the implications they convey. And I hope that everyone who buys (or borrows) the book for the sake of an article on a particular subject will not put it away without reading, at the very least, Stephen Briggs's programme for the future of industrial archaeology in Wales, spelt out in Chapter 27. Wales has lost too much of the physical evidence of its industrial formative years. May the efforts now going ahead ensure that later generations than ours can see and understand evidence of some of the most significant productions of that astonishing era, and of the ensuing years too!

Michael Robbins,
President of the Society of Antiquaries of London
27th May 1990

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Abbreviations and conventions used in text

AIA	Association for Industrial Archaeology
Cadw	Welsh Historical Monuments
CBA	Council for British Archaeology
CBA2	CBA Group 2 (Wales & the Marches)
CEGB	Central Electricity Generating Board
CP	Community Programme
HBMC(E)	Historic Buildings and monuments Commission for England
LBC	Listed Building Consent
MSC	Manpower Services Commission (temporary government unemployment relief scheme 1985–8)
NP, NPA	National Park, National Park Authority
NMR(W)	National Monuments Record (Wales)
NMRS	Northern Mines Research Society (Sheffield)
NMW	National Museum of Wales
NT	National Trust
PCP	Pembrokeshire Coastal Path
OS	Ordnance Survey
RCHM(E)	Royal Commission on Historical Monuments (England)
RCAHM(W); (S)	Royal Commission on Ancient Monuments (Wales); (Scotland)
SSSI	Site of Special Scientific Importance
WDA	Welsh Development Agency

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Editor's Preface

This volume contains (with one omission — a paper on the development of Swansea's docklands), the papers presented at the *Third Cadw Archaeology Conference,* an event held in the National Museum of Wales, Cardiff, on Friday 5th December 1986, which was chaired by Dr Michael Robbins. The steering committee included Dr C J Arnold (CBA2), R Avent (Cadw), Dr C S Briggs (CBA2), Dr H Cleere (CBA), S R Hughes (RCAHM(W)) and M Messenger (AIA). Contributions were invited on that occasion in order to shed light upon the current state of industrial archaeology. Additional papers were commissioned after the event in order to help provide a fuller, more balanced picture which might assist in formulating future national policy on preservation, survey and education, for presentation to the Secretary of State.

Editorial obstacles have included *inter alia* the non-appearance of some promised contributions and the loss of a computer disc. Thanks are due to Mrs L Jones, MS S Jones and Mrs A Collis for typing, and to Mr P Smith for allowing some of this to be done at RCAHM(W). Illustrations (Figs 1, 24, 27, 28, 32–41) are either original artwork or were redrawn on commission by Mr G A Ward from drafts submitted by the contributors. Gratitude must be expressed to CBA2 for releasing funds collected by the late Douglas Hague whilst its Industrial Archaeology Secretary, to pay for these graphics. National Monuments Record photographs were variously taken and printed by Fleur James and Iain Wright. Individual acknowledgement for other illustrations is given in the text.

The editor wishes to record his thanks to Miss Pippa Langhorn, sometime administrative assistant at the CBA, for her sterling efforts in organising the conference, Dr Julie Gardiner, Dr Henry Cleere, Professor Barry Cunliffe, and the CBA Publications Committee for their encouragement to publish such a full record of it.

Editorial note: Welsh Placenames

Although the orthography of placenames is consistent within each contribution, some have favoured Anglicised forms (for example, Blaenavon, Caernarvon), others, the Welsh equivalent (Blaenafon, Caernarfon). Both forms are used in the index.

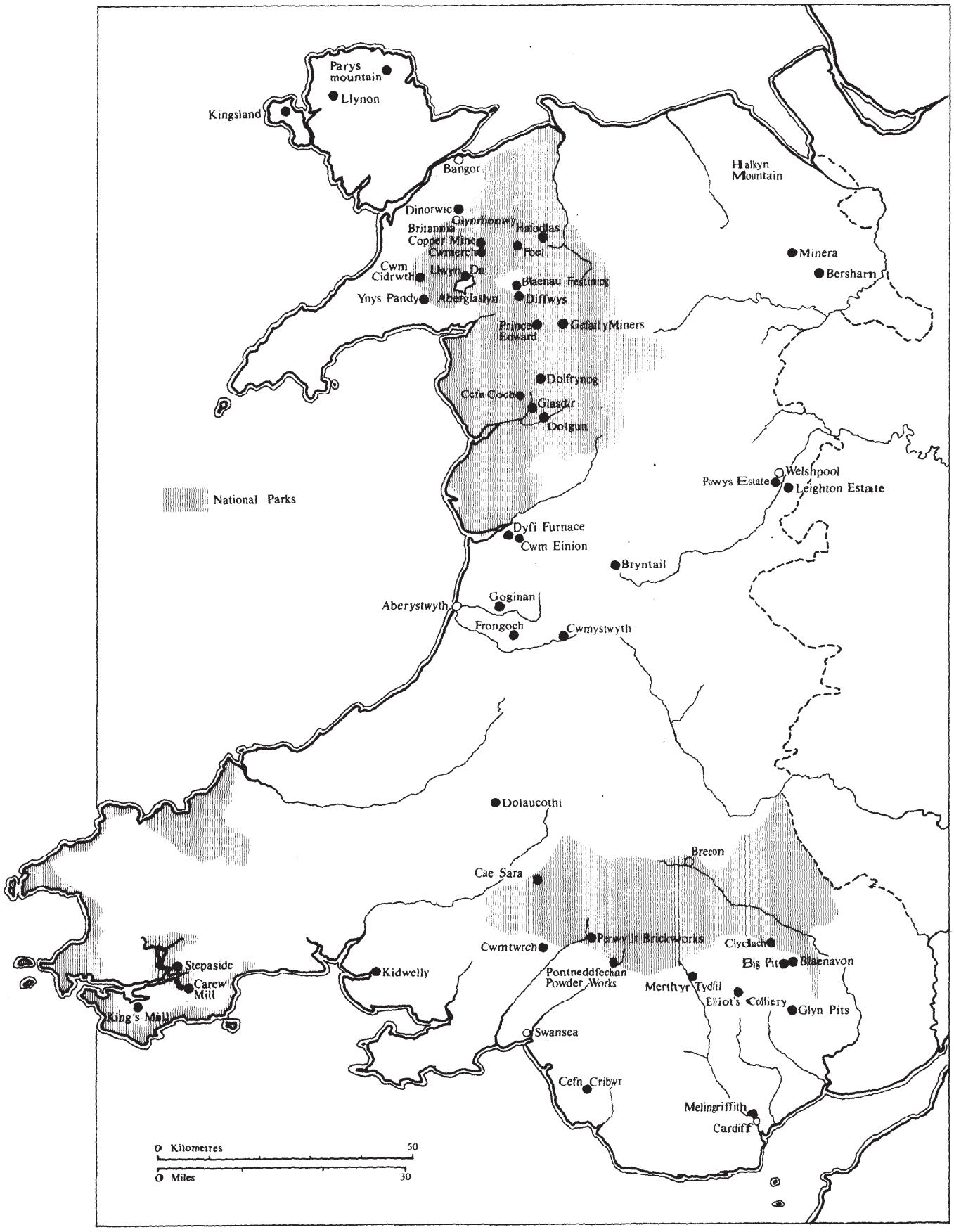

Figure 1 Distribution map showing main sites discussed in text

1 The growth of industrial archaeology in Wales

by C Stephen Briggs

Introduction

It would be impossible to embark upon any account of industrial archaeology in Wales without first paying tribute to those who introduced and fought for what it has come to represent. Whereas its earlier progenitors were researching historians like Professor A H Dodd, Sir William Rees and the polymath Dr F J North, when industrial archaeology came to Wales in the early 1960s its frontline activists were Douglas Hague at RCAHM(W) and Dr David Morgan ('Mog') Rees, assisted by his colleague Dr W Gerwyn Thomas at the National Museum of Wales. They were supported by enthusiastic, loyal amateurs, who, also conscious of post-War industrial development and dereliction, often ably assisted the crusades to record, conserve, preserve and educate. A brief history of their individual contributions seems in order. This must be undertaken part-anecdotally, and partly from more accessible manuscripts and printed papers.

Further to this history, a brief account will be given of the situation obtaining at the time of the 1986 Cadw–CBA Archaeological Conference which gave rise to this Review.

Industry at the National Museum of Wales

When David Morgan Rees came to the new Department of Industry at the National Museum in 1959, the seeds of interest had been growing for almost twenty years, having been sown by Dr F J North, Keeper of Geology. Although in this subject area North is best remembered for his important contribution to the study of early mines (North 1962), as early as 1940 he had considered acquiring working parts from Glyn Pits. Sadly, Wartime restrictions seem to have prevented the venture's success. However, the matter of rescuing Cornish beam engines from Glyn Pits continued to exercise him, and in 1950 he mooted the possibility of establishing a National Museum of the Coal Mining Industry (Nat Ind Mar Mus MSS, W G Thomas letters; F J North to G E Aeron-Thomas 18 x 1950; G E Aeron-Thomas to F J North 19 x 50). Unfortunately, at that time, it was not yet 'possible for the Museum to implement its Charter to the extent of establishing a Department of Early Industries in Wales', so the Museum was unable to collect anything so large as these engines, and activity had to remain limited to photographic record and displaying models (F J North to A Tate 18 x 1950). Although attention was further drawn to the surviving Cornish beam engine at Glyn Pits in 1964 by Gerwyn Thomas *(Archaeology in Wales* 4 (1964), 25, no 65), in 1966 by David Bick *(J Ind Archaeol,* **6,** (1969), 417), and by Morgan Rees in 1975 (107–8), proper recording conservation activity there was not prompted until the later 1980s.

David Morgan Rees

Greater opportunity did eventually arise, however, and in 1959 David Morgan Rees became Assistant Keeper-in-charge in a new Department of Industry at the National Museum. By that time Dr North had become honorary keeper and there were two other members of staff (Bassett 1984, 280). Morgan Rees' background amply suited his future calling; he began life as HM Inspector of Factories in 1939, afterwards becoming an Area Education and Training Officer with the British Iron and Steel Federation for south Wales and Monmouthshire (John 1956).

Once at the Museum, he spent some twenty years laying the foundation stones upon which institutionalised industrial archaeology in Wales was to be based (Bassett 1978). At first this was through the Department of Industry at the Cathays site (John 1956; 1958). But as that proved unsuitable for long-term accommodation of the old machinery so essential to its role, after some years of parking important cast-iron frames and other such pieces between the Museum building and University College, proposals were made in 1970 to establish a home elsewhere sufficiently large to house them (Anon 1970a; b). The site was chosen in Butetown docks. Mog lived to witness its opening in 1977.

His long-term contribution to the subject was two-fold: to encourage both the responsible preservation and the recording of sites. Both objectives took him well beyond collecting representative relics of the industrial past for the Museum in Cardiff. To achieve these objectives, articles were written for local and national learned journals drawing attention to surviving features, explaining their importance to history and technology, and urging their proper study (Rees 1964; 1965a; 1966; 1968). He was, for example, closely connected with the establishment of the

Llechwedd Slate Museum at Dinorwic, Llanberis (Rees 1975b). Nomination to the Ancient Monuments Board came in 1966 — he was the first member with particular responsibility for industrial archaeology — and with this came the opportunity to influence more directly the cause of site preservation. Besides the first Scheduled industrial monuments, it was under his guidance that Bryntail mine was brought into Guardianship (Rees 1977b).

An important, readable and well-illustrated overview of his subject, the *Industrial Archaeology of Wales* (1975) contained in its Gazetteer (pp 233–73), a list of key sites felt worthy of investigation and preservation. Whilst definitions of 'site' are open to different interpretation, it covered over 500 specific locations of industrial installation. In 1973 he became a Council Member of the Newcomen Society and the following year the first industrial archaeologist to serve as Commissioner on RCAHM(W), a position from which he was able to encourage Stephen Hughes' continuation of the Swansea Canal surveys only just begun by Douglas Hague.

As the first industrial archaeologist Commissioner and Ancient Monuments Board member, Morgan Rees' was often the only voice to be heard on his wide-ranging subject; yet despite this, remarkable achievements were made by way of raising levels of consciousness within officialdom and he also left a most useful legacy of printed papers in the journal literature, which succeeded in stimulating and maintaining an interest at the more local level (see Knight, this volume, Chapter 3).

Dr W Gerwyn Thomas

In 1963 Morgan Rees was joined at the Museum by Dr W Gerwyn Thomas as Assistant Keeper. Like Morgan Rees, Gerwyn Thomas had worked in industry, though his particular calling was almost exclusively coal. After graduating as a mining engineer from University College Cardiff in 1946, he worked first as apprentice in that trade, gained his Colliery Manager's Certificate, being appointed Assistant Manager at a colliery near Ammanford, before becoming lecturer at the National Coal Board Divisional Mining and Machinery Instruction Centre at Pengam in Gwent in 1949. This was portent to a lectureship in related subjects at Birmingham University in 1952, and in his gaining a PhD in 1961 on the incendivity of frictional sparks.

His wide experience of coalmining in Wales enabled him to plan exhibitions, collect items and develop the mining gallery which to this day is one of the most popular in the museum.

However, Dr Thomas' most important role was in helping organise amateur support for industrial archaeology in south Wales. Soon after joining the department, he organised the first course on this subject for the Extra-Mural Department at University College, Cardiff, and as a direct result the South East Wales Industrial Archaeology Society was formed in March 1965. For the first three years he was its secretary. Close links were maintained with the University by his acting as honorary lecturer in two other Departments: Archaeology and Mineral Exploitation. In addition he also lectured to local and national societies throughout Wales.

Outside the Museum Dr Thomas was responsible for the *in situ* preservation of several coal mining sites on the South Wales Coalfield. He devoted a great deal of time to advising and helping students, visitors and local authorities, on the history of coal mining.

Among the most memorable exhibits acquired by him for the Museum was the *Sea Alarm* — the last coal-fired steam tug in the Bristol Channel. In later years he was partly responsible for the establishment of Big Pit Museum, and indeed his last publication was a booklet entitled simply *Big Pit.* Almost all his published historical works were on coal mining (for example 1969a; 1969b; 1974; 1977) and at the time of his death in November 1981 (not long after retirement), he was collating the results of a long-term study of coal mining in Wales which remains unpublished.

Douglas Hague and the Royal Commission on Ancient Monuments

Douglas Hague was well acquainted with David Morgan Rees, and though of quite different temperaments, they cooperated, sometimes closely, in an effort to raise an interest in the industrial past.

Douglas came of a Midland manufacturing family and trained as an architect at Birmingham Art School. As a conscientious objector, he spent the War years working on the land in Pembrokeshire, having been unable to gain acceptance in the merchant fleet which had been his first choice. The War over, Douglas began work for RCAHM(W) in January 1948, and he remained there his entire working life until retirement in April 1981. Employed as an Investigator of Ancient Monuments, he came to help expedite the three *Inventories* of Caernarvonshire (1956–63) (Houlder 1990). At the time of his appointment the Commission had previously only undertaken surveys of monuments dating from prior to the Industrial Revolution, like Anglesey windmills, roads, bridges, and ferries. Douglas himself began systematic work upon the Swansea Canal in 1973, an ambitious task brought to completion by Stephen Hughes. During his work for the Commission, Douglas regularly commented upon intentions to demolish listed buildings, appearing, often colourfully, at public inquiries not only as the Commission's spokesman, but also variously

representing the Ancient Monuments Society, the Victorian Society, and the Association for Industrial Archaeology, as well as the CBA.

Douglas Hague's interests were wide-ranging. During the 1950s, with a grant from the Leverhulme Foundation, he began to pursue Dark Age saints through the excavation of their accredited monasteries, only to find later, medieval, monastic institutions in evidence. Through these discoveries came an expertise in medieval pottery and its production and with both went an interest in castles (Hague 1971). Outside the Commission he also took an interest in recording the Cardiganshire lead mines and in writing architectural articles for *Country Life*. He will probably be best remembered for his advocacy of the technological and historical importance of lighthouses (Hague 1972a; 1975; 1976; 1979a), and, jointly with Mrs Rosemary Christie, then his partner, he authored the only archaeological work on that subject (Hague and Christie 1976).

Industrial archaeology in CBA Group 2 (Wales)

Douglas achieved most as evangelist to his calling through the CBA. In the same year as the establishment of a Department of Industry at the National Museum (1959), the CBA inaugurated a survey in industrial remains. Under the chairmanship of Professor William Rees, a working party was established to oversee the survey in south Wales (Anon 1962). Douglas became founder Industrial Archaeology Secretary of CBA Group 2 (Wales), after its inception in 1964 — an office *sui generis* both to man and group. At that time his sights were set on establishing communications with a wide range of enthusiasts by circulating an annual news sheet (1964–70). In this connection he was responsible for locally disseminating and collecting standard CBA site descriptive record cards which had been distributed nationally and which appear to have been designed ultimately to help the Inspectorate in their national Scheduling policy *(J Ind Archaeol,* **5,** (1968), 201).

The first newsletter chronicled 'valuable work done by small groups and several individuals', including a small society in Swansea; Monmouthshire County Planning Office was the first to undertake a systematic survey; Bryngolwg County Secondary School, Miskin, Mountain Ash, had filled in twenty-two record cards, mainly dealing with mines. The first conference on Industrial Archaeology in south Wales was held in the National Museum on October 17th (Hague 1964; Rees 1965b). Earlier that year Douglas circulated lists of useful reference books and of almost 150 sites covered by CBA record cards.

This circulation and infilling of record cards was undertaken on a national basis, the intention being to produce a National Record of Industrial Monuments capable of reference within a proper monuments preservation strategy. Although the National Buildings (later, Monuments) Record in London was early repository to these raw data, there seems to have been no contemporary realisation in government circles of the need to properly resource or implement this urgent task of recording and preserving. Indeed, it is sad to relate that 'the co-ordination of this material into a National Record .. was left vague' (Buchanan 1967, 358).

By 1965 the number of sites listed had more than doubled to 312 *(J Ind Archaeol,* **3,** (1966), 239). New interest groups were being founded at Merthyr Tydfil and in south-east Wales (Hague 1965). Sadly, however, the 'teaching profession ... [displayed] almost total apathy .. towards this subject', an apathy generally shared by ... 'colleges and the University'. Douglas assiduously made three copies each of the record cards 'to prevent research from being done twice' ... indeed ... 'fieldworkers [were] asked to consult it before venturing on to new ground' *(J Ind Archaeol,* **3,** (1966), 224).

Four hundred and two sites had been recorded on cards by 1966, and the cyclostyled broadsheet was beginning to convey a strong sense of urgency to its readers. Douglas had 'nothing to report' on preservation, and lamented how 'buildings and structures of an era when Britain really did lead the world, disappear daily'. He also hinted that insufficient official time was being allocated his professional endeavours at saving or recording early industrial features (Hague 1966). Only about ninety cards were added in 1967 *(J Ind Archaeol,* **4,** (1967), 281).

By 1968–9, the flow of incoming record cards had slowed down to a trickle, but the Forestry Commission had been persuaded to notify impending demolitions, and industrial archaeology enjoyed a fruitful relationship with Swansea District Council (Hague 1968–9). At this time the *Newsletter* was being described as 'virtually a one-man effort by its editor' *(J Ind Archaeol,* **6,** (1969), 319). It is unclear why the totals of incoming record cards fell to sixteen in 1969 and four in 1970 or indeed why the recording scheme eventually petered out (further national and county figures are given in *J Ind Archaeol,* **3,** (1966) 239; **5** (1968), 412; **6** (1969), 412; **7** (1970), 468).

Of greatest importance during this period, however, was the 1966 decision by the Minister of Public Buildings and Works to accept Industrial Monuments for Scheduling under the Ancient Monuments Acts, or in appropriate cases to take them into care. Dr Michael Apted was able to report the taking into Guardianship of Bryntail Lead Mine; 28 industrial monuments had been recommended for Scheduling (Hague 1968–9). It will be recalled that Morgan Rees came to the Ancient Monuments Board at that time to oversee this new venture.

Douglas was involved in numerous campaigns to save particular buildings or features. These

included railways (Hague 1977a; 1977b), Maesteg Enginehouse, the ill-fated Merthyr Triangle, an important and early group of workers' housing which was lost after two hard-fought Public Inquiries (Lowe and Gross 1980); the Severn Pumping Engines at Sudbrook *(J Ind Archaeol,* **5,** (1968), 96), and the demolition of Merthyr Tydfil Iron Bridge. He played a prime role in saving the Conway Bridge and ensured its acquisition by the National Trust *(J Ind Archaeol,* **3,** (1966), 309; Hague 1972b) and lamented the passing of the Crumlin Viaduct, demolished in 1966 *(J Ind Archaeol,* **3,** (1966), 67; Anon 1965).

As he neared retirement, by 1979 Douglas believed that officialdom lacked more than the most general interest in important architectural monuments landmarking the Industrial Revolution, arguing that ugliness ought not to be used as an excuse to demolish important buildings (Hague 1979b) and in a scathing article entitled *A catalogue of failure,* which appeared in *The Western Mail,* he indicted the Historic Buildings Council for neglect (Hague 1979c).

Douglas continued his interests and campaigns throughout retirement, in 1987 becoming Vice-President of the Association for Industrial Archaeology in recognition of his contribution to the study. He maintained support for these many interests and societies until his death after a long illness, in September 1990.

Amateur archaeology in Wales

The existence of several vigorous, conserving, preserving and recording groups involved in industrial archaeology has already been touched upon. And whereas it may have been felt that insufficient national resources were being put to these activities by the employment of professional archaeologists, a great deal was accomplished by local history interest groups.

Industrial archaeology came to local history studies in south Wales in 1963. In June of that year Mr Rex Wailes was invited to give a public lecture on the subject by members of University College, Swansea, an event which led to the formation of the Swansea Industrial Archaeology Group. They held seven group meetings and compiled over sixty record cards of the region over the next two years (Morris 1964), then, following the first Conference in Cardiff, the South West Wales Industrial Archaeology Group was formed (Coggins 1970). As already noted, the South East Wales Group was established the following year (1964). The momentum of this growing interest was given a great fillip in October 1964, by a well-organised and well-attended conference in the NMW at which Rex Wailes again spoke. This meeting was felt to have marked 'an important step forward in the exchange of information and the stimulation of further action' (Rees 1965b, 244).

The two main regional interest groups, together with Cynon Valley Industrial Archaeological Society (1967), the Oxford House Industrial Archaeology Group (1971), Merthyr Tydfil Historical Society (formed to 'preserve the past, protect the present and propogate the future' in 1973), Port Talbot Historical Society, the Neath Antiquarian Society, and an East Carmarthen Group (mainly based on the Carmarthenshire Antiquarian Society) took an effective grip upon industrial archaeology throughout most of south Wales. Groups have also been active in north Wales at Llandudno, Porthmadog, and in the form of well-known Railway Preservation Societies (Campbell 1977) like Ffestiniog (Jarvis 1965), for some years. An Industrial Archaeology Group was formally constituted by Pembrokeshire County Museum in late 1970, and questionnaires were sent to all Women's Institute branches as part of its initial survey *(J Ind Archaeol,* **8** (1971), 424–5). Later interest was maintained through the presentation of short articles of both documentary and archaeological interest in the Newsletter published by the Friends of Pembrokeshire Museums.

Accessible accounts of the early activities of some of these local groups appeared in the *Journal of Industrial Archaeology* **(8,** (1972), 204; **10,** (1973), 446). Only through the concern of the Industrial Steam Preservation Group, based outside Wales, was the Dorothea Cornish Engine drawn to more general attention *(J Ind Archaeol,* **6** (1969), 205–6).

Although there are still important amateur groups working in Wales, the advancement of industrial archaeology on a professional basis seems to have witnessed a regrettable decline in the contribution afforded by amateurs (though see Palmer, this volume, Chapter 8 for a more up-to-date account of successful, thriving amateur groups).

The success currently enjoyed by Welsh industrial archaeology is owed not only to the cumulative works of the three men whose careers we have briefly celebrated here, during a pioneering quarter century, but also to many others, whose behind the scenes efforts make them less readily identifiable. It seems worth reflecting that the path has not always been easy, and that in the study, preservation and publication of the industrial past, much has been achieved through individual endeavour, often in isolation, both at the national and the local level.

Industrial archaeology in Wales since 1981

When the writer took over from Douglas Hague as CBA2 Industrial Archaeology Secretary in 1983, he wanted to continue earlier efforts and maintain a constructive dialogue by recommending more comprehensive and integrated procedures for

staffing and funding in the subject area. In 1984 when the CBA produced a working paper (EXEC/27/84) on industrial archaeology, for submission to HBMC(E), the opportunity was taken to draft a comparable paper of recommendations for submission to Cadw for Wales. It seems worth reflecting upon the suggestions made at that time for recording, preservation and protection, and for amateur archaeology.

> **Recording:** The complete absence of any full-time staff dealing exclusively with industrial buildings under threat in Wales was lamented. This was despite the large amount of redevelopment taking place in decaying industrial urban areas. Emergency recording had been undertaken by staff at the National Museum and by the Torfaen Museum Trust and although amateur groups were also doing Stirling work in this field, concern was to be expressed at the lack of coordination in these several activities. The suggestion was made that staff at the four archaeological trusts might usefully be involved in future survey.
>
> **Preservation and protection:** Levels of protection afforded monuments of industrial and technological interest seemed less stringent than those which applied to prehistoric sites. There was a need for close consultation to produce a priority list of sites for protection, restoration and interpretation. The absence from the Ancient Monuments Board of an industrial archaeologist demanded urgent consideration.

These observations followed concerns expressed locally and nationally over the years. For example as early as 1965 Caerphilly Urban District Council had called for a campaign to save industrial relics. At a meeting of the Council on 23 February Dr C R K Blundell had explained that Wales held a very special place on a world scale; he pointed out that 'this magnificent story ... continued ... up to the present'. Llanwern steelworks and Trawsfynydd Power Station were examples *(Western Mail,* 24 February 1965).

> **Amateur archaeology:** As industrial archaeology enjoyed considerable popularity among the public at large, and there was also an important active amateur component, this energy might usefully be channelled into recording projects. It could also be more effectively exploited through well-presented tourist developments.

Overall, an important departure was suggested in the form of a forum 'which might encompass the national interest by drawing together those at present involved in recording, and helping to formulate future policy for the most economic deployment of manpower, co-operatively if necessary'. It was concluded that industrial archaeology did not enjoy the same status as other branches of archaeology in Wales, and recognition of its potential had been slow at both local and central government levels. Cadw, then newly-established, was invoked to 'recognise the truly international importance of some of the sites, by offering greater protection and by insisting upon minimum levels of recording'; also '... realising this worth through affording high standards of display and of publication.'

Realisation of several of these pleas was met over the next three years. In 1986, Richard Keen was appointed to the Ancient Monuments Board and a steering committee was set up with the intention of devoting the Cadw Archaeological Conference of that year to the problems of industrial archaeology. At that conference the establishment of the hoped-for Industrial Archaeology Panel was announced. An account of its achievements is fittingly presented here (Hughes, this volume, Chapter 26).

Acknowledgments

Thanks are due to Mary Corin, Joan and the late Douglas Hague, Dr Stuart Owen-Jones, John Kenyon, and Dr W (Bill) Jones for their assistance in the production of this Introduction. All opinions and errors of fact remain the writer's responsibility.

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Section I: Protection

2 Problems of protection

by Richard Keen

Kenneth Hudson notes in the third edition of *Industrial Archaeology: a new introduction,* how, over thirty years ago, Michael Rix first juxtaposed the words 'industrial' and 'archaeology' in an article in the *Amateur Historian* (Hudson 1976, 15). Hudson mused that this had produced 'an impossible mongrel, the ugly offspring of two parents who should never have been allowed to breed'.

Hudson traced the history of new terminology further back than Rix, and alluded to an article by Isaac Fletcher of 1878 on 'The archaeology of the West Cumberland coal trade' published in the *Transactions of the Cumberland and Westmorland Antiquarian and Archaeological Society,* and observed that, already in 1851, the Great Exhibition included material relating to technological developments in the early days of the Industrial Revolution. It is possible to go back even further, to 1858, when T J Taylor also wrote on 'The archaeology of the coal trade' in the *Proceedings of the Royal Archaeological Institute, at Newcastle* in 1858 *(J Ind Archaeol* **2** (1965), 49–50). The Newcomen Society was founded in 1920 and its annual transactions soon provided a major source of information on its chosen topic — the history of engineering.

The Great Exhibition of 1851 had led to the founding of a national Science Museum in London, around 1857. Scientific instruments joined natural history in 1874, and 1884 saw the addition of machinery formed by the Commissioners of Patents. Other major engineering and machine collections were added and in 1909 the Science Museum proper was separated from its cohabitants in South Kensington, to house its five main groups of material; (1) industrial machinery and manufactures; (2) power production; (3) civil engineering and land transport; air and water transport; (4) physics; and (5) chemistry. The Railway Museum at York, founded by the London and North Eastern Railway, and the Newcastle Museum of Science and Engineering followed in 1928 and 1934 respectively.

The work of Isaac Fletcher and of those early museum curators was of course, like today, based upon historical research with recourse to the great variety of documentation that is available. Maps, drawings and photographs are just as important as sites and buildings. Even though a vast amount of documentation was generated during the Industrial Revolution, this has a limited value, so it is vital that some studies of that period are archaeological. In some areas of history, only fieldwork can supply the answers to outstanding questions. It is not uncommon for a manufacturer who may have started in a small building with limited machinery to have expanded and diversified to such an extent that only an architectural and archaeological study of his original workplace can illustrate these developments. Similarly, as the work practices of craftsmen-engineers were seldom documented, artefacts are again necessary to elucidate our understanding of them.

To return to Hudson on Michael Rix: Rix stated that industrial monuments should include steam engines and locomotives that made possible the provision of power, the first metal-framed buildings, cast iron aqueducts and bridges, and the pioneering attempts at railways, locks, and canals. By 1962 the Inspectorate of Ancient Monuments defined an industrial monument as any building or other fixed structure, especially of the Industrial Revolution, which either alone or associated with primary plant equipment illustrated the beginning and development of industrial and technical processes, including means of communication (Hudson 1976). The CBA accepted a slightly modified version.

It may be fair to say that in the early days, enthusiasm for industrial history was directed mainly at industrial buildings and machines, especially steam locomotives. Through railway preservation, many were drawn into other aspects of the subject.

In the late 1950s and early 1960s there was a rather astonishing growth in interest shown towards the remnants of our earlier industrial history. The time was just right in some ways. As new processes were introduced and pre-War machinery was being replaced, money became available for urban redevelopment. Small groups of diverse individuals began to generate interest in the subject, letters appeared in the press, books and articles were published, and many of that minority interest undertook crusades to save and preserve. As Kenneth Hudson (1976) said, 'These evangelists gradually learned patience in countering accusations that they were sentimental fanatics and enemies of progress'.

Doubtless, this evangelism helped spread industrial archaeological societies into many parts

of Britain. During the mid '60s several were created in Wales (Briggs, this volume, Chapter 1). The subject had (and still has) a lot to offer, allowing the free use of many talents. In fact its very lifeblood draws upon the talents of this wide range of disciplines — the engineer, geographer, economist and architect. At that time in the '60s, amateur commitment was essential. Even now, full-time industrial archaeologists are few and far between. We are, of course, indebted to these 'sentimental fanatics' and these 'enemies of progress' because without their efforts, in what state would we find archaeology in Wales today? They have increased awareness and enabled us to become more assertive in protection of the monuments of an important period in history. It has not been an easy path and neither will it be, because there are many problems to be confronted when trying to apply protection.

Local opinion must always be taken into consideration. The reaction of a local councillor in a south Wales valley, confronted with a proposal to preserve industrial features in the area, was 'I don't want a load of outsiders gawping through my windows'. This was an understandable reaction, and a problem not only presented by preservation of our recent past. Perhaps there was more to be read into that statement, though, Was it only concern about increased visitor pressure, or was it also a reaction against the preservation of artefacts representing a period of oppression and hardship?

Clearly it is important to develop an historical perspective. What one person sees as a depressing jumble of decaying buildings and slag tips another may see as the physical manifestation of a great period of history.

Can we allow history to be dictated in this way? Has the gradual change in attitude of the past few years arisen as a consequence of distance separating us from the items that are representative of the period? These points were further illuminated during a meeting at the steam winding engine house of a colliery in Pontypridd. The engineman was, to say the least, angry that the machine he saw as 'a symbol of Welsh subjection' was to be preserved. His reaction was that it should be demolished to eradicate a period of repression. When it was pointed out to him that if such a criterion were used for all monuments it might be argued that Caerphilly Castle should also be demolished as it was an even more powerful symbol of Welsh subjection, his response was: 'oh no, that's history'. Alas, we never discovered when, within his perception, history began and ended.

Throughout the past few decades of growth in industrial archaeology both these attitudes have been encountered in greater or lesser forms from various bodies and individuals. Even today industrial archaeology is seen by some as something of a joke, something to be used as a form of entertainment. Recently it was suggested that a waterwheel used to pump drinking water to a house should be removed from its original location to a point closer to the Visitor Centre so it could be something to 'attract the visitors' attention'. This attitude is rather depressing as it shows lack of understanding for both the waterwheel and its potential visitor audience. It would be unethical to divorce the waterwheel from its original environment without good cause.

It is important that questions are asked about our desire to preserve; what kind of statement is being made and does it add to our understanding of the period? We can, of course, take the soft option every time and say it is too big, and therefore too expensive, to preserve *in situ, so* remove only a representative part to the museum, having first made an adequate record of it. In many instances this option is acceptable, indeed vital. We must also respect industrial archaeology because it deserves consideration in the same ways as other period interests. It is easy to be a minimalist and avoid the problem but it is often very difficult to preserve, as the decision to do so may present almost insurmountable problems of funding, provision of appropriately skilled personnel and future funding of the site.

Further considerations must be borne in mind, since any kind of preservation presents change, for example, change in the types of materials used in preservation, and careful thought and great care must be exercised, as all too easily we can produce an *in situ* replica. Some students of technology decry the use of new materials, but what is the alternative — a pile of crumbling masonry or pieces of rusting machinery?

What should we preserve? Should it be just the iron furnace, the pit headframe and winding engine, the coal hoist, *or* slate quarry workshop? Are the individual sites, large or small, truly representative of technological or social history? Are we perhaps constrained by the semantics of industrial archaeology and should we be changing its emphases? Perhaps the term 'archaeology of industrialisation' may prove better, allowing a flexibility of opportunity to pay tribute to that essential element of the industrialisation process, labour. Labour may be considered in all its forms: not only the iron master or quarry owner, not only the great engineer or architect, but also the mass of people whose efforts changed the face of Britain. Alongside the workplaces were their dwellings, places of recreation, education, and religion. There were whole landscapes of industrialisation.

This is not to advocate the total preservation of Wales into a great industrial archaeology theme park. However there are now too many inconsistencies of site representation and some aspects are suffering from overkill whereas others are scarcely represented. Now that the subject has come of age it is time to take an objective look at Welsh industrial archaeological preservation to find out what the past three decades has taught us. One of the strengths of the discipline has been the

widespread interaction among its participants. This must continue so that we understand the problems and share in the failures and successes of preservation throughout the Principality.

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3 Problems of scheduling; the role of Cadw

by Jeremy Knight

Introduction

David Morgan Rees had an almost evangelical enthusiasm for his calling, and this, combined with certain of his published works (Rees 1964; 1969 and 1975), did more than anything else to create a solid foundation for the subject (Briggs, this volume, Chapter 1). The years before, when some of us were first exploring for ourselves the industrial sites of Wales, were an exciting time. One could still walk across the Iron Bridge at Merthyr (SO 038 072), since demolished, ostensibly as a flood hazard and 'a place of assignations', or because it spoilt the view of the new fire station; Merthyr and Blaenavon still retained many of their late eighteenth–early nineteenth century buildings and workers' housing. Of Blaenavon's Shepherd Square, the Ranks, and Victoria Row, only Stack Square

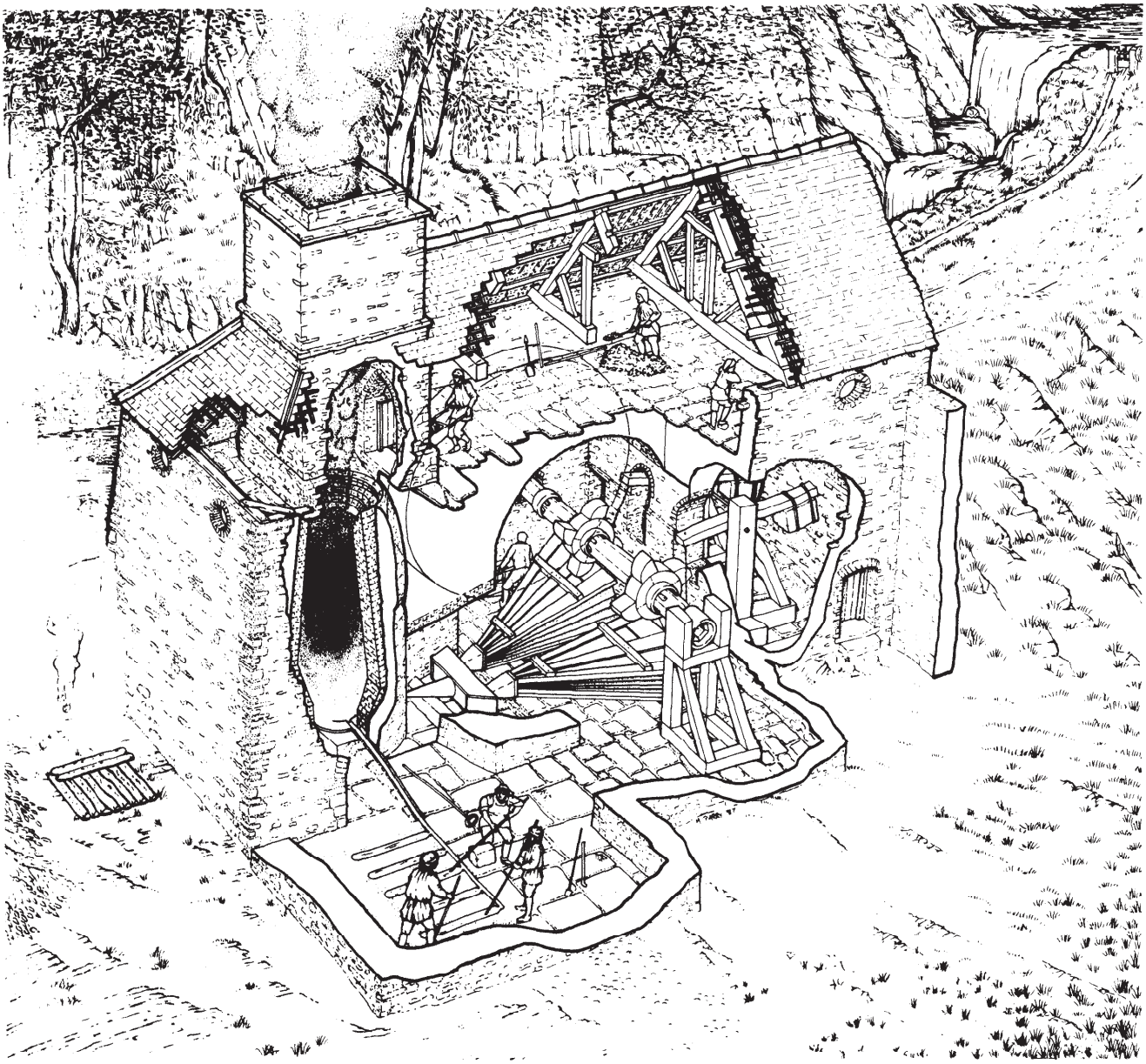

Figure 2 Dyfi Furnace: section drawing, from Cadw Guide *(Rees 1987) (Crown copyright reserved)*

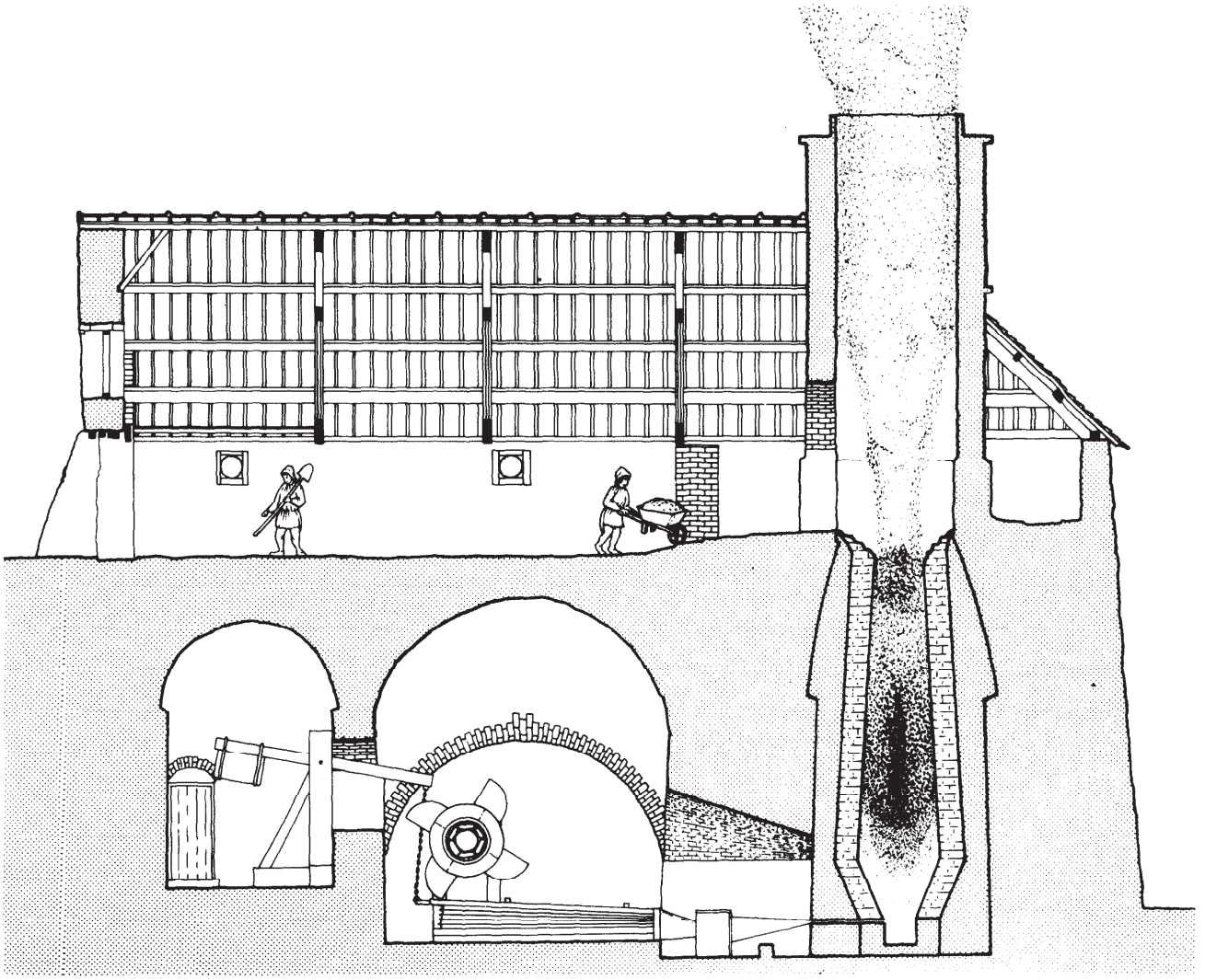

Figure 3 Dyfi Furnace: cutaway drawing by Medwin Parry, from Cadw Guide *(Rees 1987) (Crown copyright reserved)*

and Forge Row, Cwmavon now remain. Thankfully, good photographic records and descriptions of most were made by Jeremy Lowe (see Lowe, this volume, Chapter 10, for references). Sad losses also include the Cwmbyrgwm water balance (SO 252 032) and the gunmetal bearings from the nineteenth century beam engines at Glyn Pits (SO ST 265 998).

Though much is taken, much remains. Tennyson's words are apt here, and David Morgan Rees would have been gladdened by what has happened on a number of Guardianship sites.

The Aims of Cadw

Cadw came into being in 1984. The new heritage body incorporates the Inspectorate of Ancient Monuments, Ancient Monuments and Historic Buildings administration, and others concerned with the management and presentation of monuments. The Inspectorate's role of protection involves both Scheduling under the 19'79 Act and the Listing of Historic Buildings. This contribution concerns only the former. At present there are roughly 2500 sites protected by Schedule, of which approximately 100 may be described as of interest to industrial archaeology (Strachan, this volume, Chapter 28).

This brings us to some of the particular problems of protecting industrial monuments by Scheduling. Hillforts and barrows tend to stay put unless ploughed or heavily planted. The purpose of Scheduling is to prevent damage of that sort. But the neglected stonework of industrial buildings will deteriorate and collapse unless treated. Trees grow from masonry, ivy feeds on the mortar, and scrap metal thieves or children pull things apart. Sites become dangerous, or are perceived as such and it may become difficult to see a mine like Frongoch Mine, Cardiganshire (SN 723 745), as a thing of beauty, in the way that one might a prehistoric earthwork or a medieval abbey. Yet the

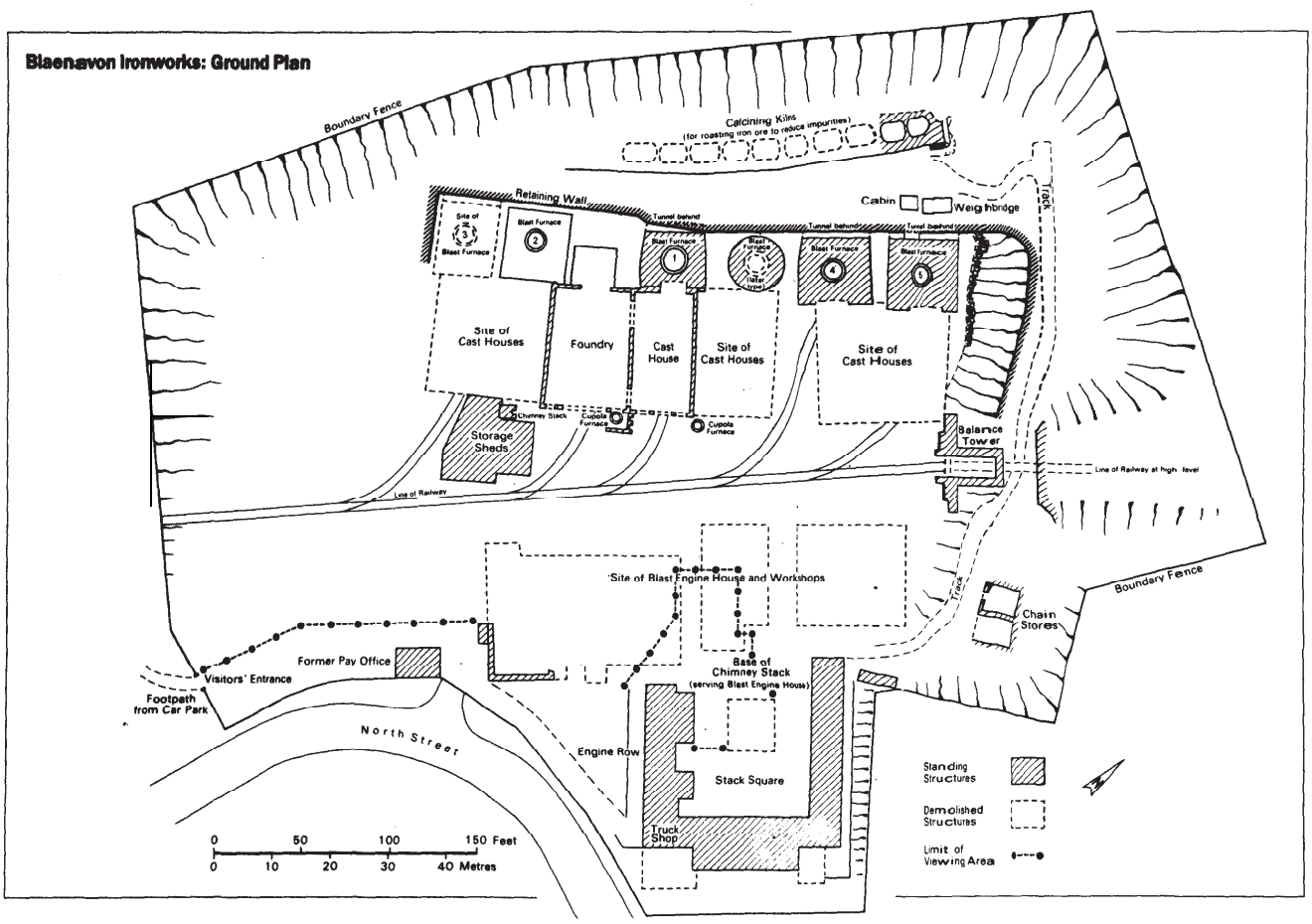

Figure 4 Blaenavon Ironworks: ground plan, from Cadw Guide *(Knight 1989) (Crown copyright reserved)*

conservation of sites is an extremely expensive and labour-intensive business – even more so than excavation. Scheduling, though it protects a site against many dangers, does not mean that resources can always be found for restoration or repair.

Among the many sites now Scheduled are Porth Wen brickworks on Anglesey, lead and copper mines in Snowdonia and mid-Wales, limekilns and Stepaside Ironworks in Pembrokeshire, Bersham Ironworks (Grenter and Williams, this volume, Chapter 19), the fine staircase of fourteen locks on the Monmouthshire canal, Brynich aqueduct, Breconshire, and blast furnaces like Coity, Coed Ithel or Woolpitch Wood, and nineteenth century giants like Cyfarthfa (Pearson, this volume, Chapter 22).

Guardianship sites

The first industrial monument taken into guardianship in Wales was Clywedog (Bryntail) lead mine in Montgomeryshire, which lies in the shadow of the eponymous dam (Rees 1977). Not far distant is Dyfi Furnace, an eighteenth century charcoal furnace built in 1775 by Ralph Vernon of Warmingham, Cheshire, and some of the ubiquitous Kendal family (Rees 1987; Figs 2 and 3). Here David Morgan Rees addressed the Cambrians the year before he died, and it has now been conserved together with its fine waterwheel by Ivor Tanner and his brothers from Montgomery under the supervision of my colleague Dr Sian Rees.

Big Pit (Davies, this volume, Chapter 21) and Blaenavon Ironworks (Knight 1989; Fig 4), are part of seven square miles (18 km²) of industrial landscape, a network of mines, levels, patches, and tramways which has been at least part-recorded (Lowe and Lawlor 1980). Publication of the survey of pre-industrial settlement by Martin Lawlor here is awaited with interest, as it clearly demonstrates how industrial archaeology, like other forms of archaeology, has moved beyond the study of individual buildings or sites to the study of landscapes and complexes.

Blaenavon has been described as 'a large. if grubby jewel in Cadw's crown', Here both major heavy industries of south Wales – iron and coal – are represented on either side of the valley. The old town around North Street, now largely gone, has

become a *locus classicus* for the study of nineteenth century workers' housing. The ironworks is the finest surviving example in Britain and it is arguable as to whether or not Neath or Cyfarthfa has better furnaces. Blaenavon preserves the whole complex (except the engine house), with calcining kilns, blast furnaces, cast house, James Ashwell's splendid water balance of 1839, cupola furnaces, and workers' housing. The whole site played a central role in the development of the British iron and steel industry, for it was one of the first generation of steam-blown coke-fired multiple furnaces, built as batteries rather than singly, and the Gilchrist-Thomas (or Thomas Gilchrist) experiments gave the key to those twin Pandora's boxes of the twentieth century, the American and German steel industries. Recording this rich site has been undertaken in great detail, with the result that much information on the earlier local population is now card indexed.

Elsewhere, in partnership with the National Museum of Wales (NMW), Cadw has taken into care the Elliott Colliery engine house at New Tredegar (SO 147 027), which the local authority is now planning to take over as the core of an industrial museum.

Scheduled sites with Cadw restoration input

It is now possible to see changes in many parts of Wales, from the Greenfield Valley to Bersham, from the work of the Torfaen Museum Trust at Pontypool to that of the Heritage Trust at Merthyr. This has come about through encouraging and enlightened changes in public attitude.

Having restored the Ynysfach furnaces, the Merthyr Trust is going on bravely to tackle the Cyfarthfa furnaces themselves (Pearson, this volume, Chapter 22). And to go from one of the largest furnaces to one of the smallest, following negotiations with the local authority, a group known as Y Cefn Gwrwdd hopes to take over Cefn Cribwr ironworks between Pyle and Bridgend (SO 232 834). As well as at Dyfi and Bersham, meticulous excavations have been undertaken of blast furnace sites at Clydach, near Abergavenny (SO 232 138; Wilson 1988), and in Snowdonia. These have demonstrated the difficulty of applying conventional archaeological techniques to industrial sites. Attitudes, not least among local authorities, are changing. In this context it is worth rcording the glee of one farmer somewhere in south Wales, who had a particularly large and magnificent Second World War pillbox literally at the bottom of his garden. He received by the same post two letters from the local authority, one asking him to demolish it as an eyesore, the other telling him that it had been designated as a county treasure!

Conclusion

Cadw continues to undertake its Statutory duties, preserving and maintaining monuments in Guardianship. It undertakes to present them in 'as imaginative, interesting and attractive a manner as possible with a view to promoting a greater interest in, and understanding of, how that built heritage has contributed to, and will continue to influence, the lives of as wide a spectrum of people as possible' (Carr 1986, 25). Perhaps the best preserver of heritage monuments is that public awareness, and not least among the heritage monuments are Wales' early industrial sites.

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4 Industrial archaeology and the National Parks

General Introduction

**Based upon information provided by J Bowers, P Crew, C Ledbury, M Williams, and G Yeomans.*

National Parks first came into existence in Britain as a result of the *National Parks and Access to the Countryside Act* of 1949. The Snowdonia NP was created in 1951, the Pembrokeshire Coast NP in 1952, and the Brecon Beacons NP in 1957. The 1949 *Act* placed a Statutory duty on all National Park Authorities (NPAs) to protect natural beauty and provide recreational opportunities for the public. Later, under the provisions of the *Local Government Act* of 1972, each NPA is required to publish a National Park Plan, reviewable at intervals of no less than five years. In this document each Authority sets out its objectives, explaining intended management policies and the ways these are to be implemented.

From 1st April 1990, the archaeologist formerly employed by Snowdonia NPA as a lecturer at Plas Tan y Bwlch Study Centre took on a full-time role in the Snowdonia NPA. The postholder vets planning applications, agricultural and forestry developments, and is responsible for the Authority's heritage conservation projects. Planning applications are also routinely submitted for comment to the Gwynedd Archaeological Trust, and projects arising therefrom are usuaily of a 'rescue' nature. Since 1988, the Brecon Beacons NPA has employed an area warden whose time is divided equally between wardening duties and archaeology. Although the work is part-educational and involves some recording, during 1990 the demands upon this post also became more planning-oriented. This will become a full-time archaeological post in 1992. The Pembrokeshire Coast NPA employed a full-time archaeologist from 1986 to 1989, but the post is currently vacant. Here the former postholder was employed almost exclusively upon excavation and conservation work at one site — Carew Castle, with minimal involvement in other aspects of the Park's work. No immediate replacement is planned for this post, and the financial resources are to be temporarily redeployed to pay for writing up past excavations at Carew before readvertising in late 1991 or 1992.

At the time of writing (1991) therefore, only one of the Welsh National Parks has an archaeologist in full-time employment solely concerned with the planning, management and conservation of ancient monuments. It seems worth commenting that, among the several strands of aesthetic upon which the National Parks ethic is built, it is rare to find positive assessments of landscape value based upon the industrial, built-up, man-made environment. However, the notion of managing larger areas of industrial heritage landscapes in the way that was originally conceived for the Ironbridge Gorge (Rix 1964), is a challenge which might yet usefully be taken up both inside and outside Wales' established National Parks.

Snowdonia National Park

by Peter Crew and Merfyn Williams

Introduction

In the present review of the Snowdonia NP Policy, a comprehensive statement of policy *(Historic Landscapes and the Archaeological Heritage, Conservation Policies Section 14)* reflects an increasing awareness and involvement within the NPA in archaeological matters. This awareness and involvement are also indicated by the fact that the NPA now has an Archaeological Officer and a growing budget allocated for archaeological records, management, and conservation.

Section 14 outlines the scope of historic landscapes and the archaeological heritage, the way in which they are managed under the *Ancient Monumenis and Archaeological Areas Act* 1979, and the way in which their management should be integrated with the activities of the NPA. In Section 14 the descriptive and policy statements all implicitly or specifically include industrial archaeology.

Section 15 of *Conservation Policies* deals with abandoned mines and quarries and recognises the

need for consultation to take note of industrial archaeology interests.

Snowdonia National Park involvement in industrial archaeology

The Snowdonia NP has a long-standing involvement with industrial archaeology as it was recognised over ten years ago that the needs of industrial archaeology were not being fully met through the conventional channels. The initiative for this stemmed from the work of two officers with specific interests in industrial archaeology and much subsequent activity has been as a result of projects carried out through the NP Study Centre at Plas Tan y Bwlch, which has provided an essential academic background. The majority of the projects on slate quarries have been carried out in conjunction with Dr M J T Lewis of Hull University. All the projects have benefitted from the involvement of a large number of people with a wide range of expertise, essential for the adequate understanding and interpretation of industrial sites.

Whereas conventional archaeological sites may be essentially stable and rarely in need of maintenance, a crucial factor with industrial archaeological sites is that they frequently have standing structures, and sometimes machinery, still in a state of decay. The underlying aim of Snowdonia NP activity has been the recording and conservation of the more fragile industrial archaeology sites, to ensure that as much as possible survives both as archaeological and educational recourses. Because of this a large proportion of the Snowdonia NP archaeological budget has been spent on this aim.

Surveys of sites have been carried out for a number of reasons, but primarily where there were features of particular fragility and information was likely to be lost through accelerating decay. Some sites have been surveyed prior to clearance by the WDA and, more recently, to provide information and advise them on features of industrial archaeological interest worthy of consolidation. Long-term projects, on slate quarries in the Blaenau Ffestiniog area and on iron-working sites in Coed y Brenin, have been undertaken to provide comprehensive information on a particular industry. Some surveys have been carried out as a first stage of the consolidation of a site.

A number of consolidation projects have been carried out, both small and large scale, and the Snowdonia NP and its specialist contractors have now developed some expertise in this field. The degree to which these sites are subsequently interpreted is dependent on a variety of factors, such as their potential appeal to non-specialist visitors, their fragility, and their accessibility. Access and management agreements have been entered into with some landowners and, where possible and desirable, sites have been purchased by the Snowdonia NP. In some cases it is not intended to provide any interpretation material at all, in the majority of cases the interpretation will be low key, and in a few particularly suitable cases a full range of interpretive facilities will be provided.

A substantial archive of survey and excavation data is now held at Plas Tan y Bwlch. Some of this has already been published as indicated below. Publication, in a variety of formats, is regarded as a priority both to make the information more easily available to other workers in the field and as a means of increasing general awareness of the value of industrial archaeology, both as an academic discipline and as an educational resource.

The brief details listed below will give some idea of the range of work carried out by the Snowdonia NP over the past ten years. It is not expected that the level of activity will decrease over the next decade.

Appendix 4.1

Copper Mines

Dolfrwynog Copper Turf Works (SH 745 253) Survey and excavation. Part of this project was carried out using labour from the British Trust for Conservation Volunteers. Consolidation works planned for 1988 and undertaken in 1989, to be followed by interpretation material.

Britannia Copper Mine (SH 629 545) Consolidation of main mill building.

Cwm Erch Copper Mine (SH 635 530) Clearance and survey, including a detailed record of the wide range of surviving machinery. Consolidation work is planned for this site but the logistical problems are horrendous.

Cwm Ciprwth Copper Mine (SH 527 477) There is an access agreement with the landowner. Consolidation work is in hand. The first phase which includes reconstruction work on the water-wheel, pumping shaft and balance bob, partly funded by the WDA.

Glasdir Copper Mine (SH 736 224) A general survey of this site has been carried out with some excavation on the site of the smelter. Over the next few years, in a joint Forestry Commission/NPA project this site will be cleared of trees, surveyed in detail and consolidated. The site will be provided with a network of footpaths and interpretation material, linking it with other industrial archaeology features in the vicinity.

Gefail y Miners (SH 807 395) Survey of site prior to afforestation.

Llwyn Du/Cwm Bychan (SH 606 484) Survey of sites, including various unique features, due to rapid deterioration. Consolidation work has subsequently been carried out at Cwm Bychan by the National trust, the owners of the site.

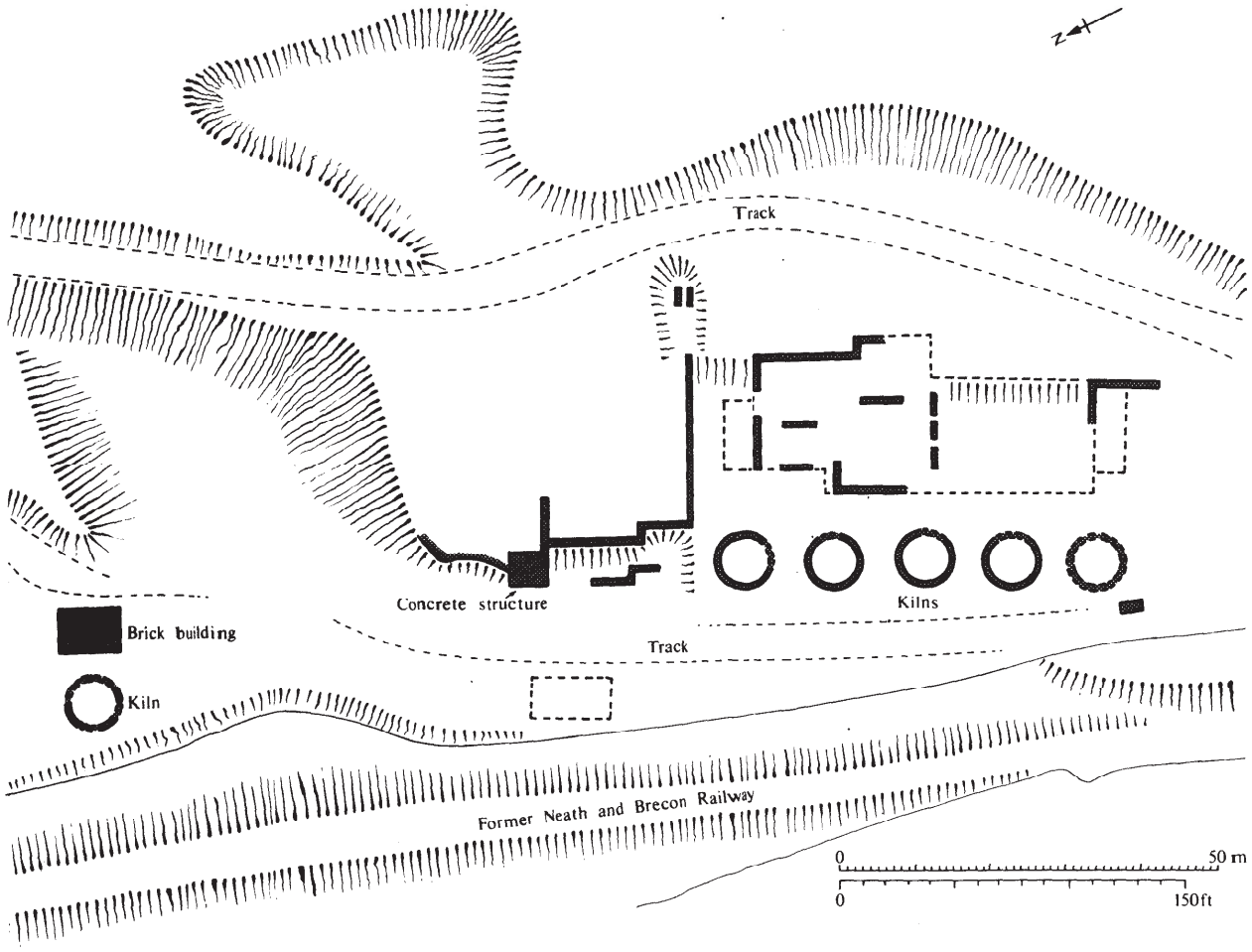

Figure 5 Penwyllt silica works, based on a survey in the Brecon Beacons National Park Office

Gold mines

Cefn Coch and Berth Llwyd Gold Mines (SH 718 233) Survey and partial excavation. The first phase of consolidation work has been carried out by the Snowdonia NP on behalf of the National Trust who own the site and have incorporated in into a trail.

Prince Edward Gold Mine (SH 743 385) Clearance, partial excavation and detailed survey.

Iron-working sites

Dolgun Blast Furnace (SH 751 187) Continuing programme of clearance, survey, excavation and consolidation. Access agreement with landowner. Preparation of interpretation material in hand,

Dol y Clochydd Blast Furnace (SH 734 221) Continuing programme of clearance, survey, excavation and consolidation. This site will eventually be incorporated into an industrial archaeology trail (see Glasdir, above).

Coed y Brenin Bloomery Sites (SH 72 27) Survey to identify extent of sites prior to felling of first rotation crop by the Forestry Commission.

Slate quarries

Ynysypandy Slate Mill (SH 549 433) Purchased by the NPA in 1981 and now fully consolidated, with grant aid from Cadw. Open to the public, with low-key interpretation boards and a pamphlet.

Diffwys Slate Quarry (SH 713 462) Detailed survey and some excavation.

Foel and Chwarel Rhos (SH 717 555) Detailed survey and some excavation.

Hafod Las Quarry (SH 778 560) Clearance work and detailed survey, prior to consolidation works to be carried out 1988–9. This quarry will soon be in the ownership of the NPA.

Slate quarries, surveys

Pant Mawr, Fron Boeth, Wrysgan, Conglog, Moelwyn, Maenofferen, Cwt y Bugail, Blaen y Cwm, Rhiw Bach.

Brecon Beacons National Park

by Chris Ledbury and C Stephen Briggs

Introduction

The Brecon Beacons NP covers something over half of Breconshire (Powys), together with parts of Carmarthenshire (Dyfed), Monmouthshire (Gwent), and Glamorgan (Mid-Glamorgan). And whilst for the greater part the living landscape is now based upon a rural economy, there survive historically important industrial areas, particularly upon its southern fringes (eg Barber 1985). In 1976, a pamphlet commissioned by the Authority usefully listed some eighty-six sites or groups of sites of interest to industrial archaeology (van Laun 1976). Descriptions of these and of many others are kept at the NP office.

The most widespread early industrial features are stone quarries and limekilns. There has been quarrying for roof-tiles, building, road, silica, lime, and iron stones, as well as small-scale copper and lead mining and coal extraction. Limekilns are widespread, and some of the densest known distributions survive around Ystradfellte. Although extremely numerous, few of these are protected in any way, and no proper survey has been undertaken on a county-wide scale.

Brecon itself was the terminus of both a railway and a canal, although the Brecon–Hay Tramway lies mainly outside the Park. The Brecknock and Abergavenny Canal (Stevens 1974) follows the Usk east-west through the eastern park of the Park. Though maintenance has proved costly, it is a valuable landscape feature still of some importance to the local economy on account of its tourist potential. Here the Park sees its role as one of preserving the fabric and atmosphere of the waterway by encouraging only limited development, as agreed in the Canal Development Plan (Anon 1982). The British Waterways Board is funding a full archaeological survey of the canal by RCAHM(W), in advance of its development. Complex tramroads linked this waterway with stone quarries on the hills to its south, and these have recently been the subject of a thorough survey (Rattenbury 1980).

Limited linear earthworks and several interesting upstanding buildings survive from the Brecon Forest Tramroad, which ran north–south through the Forest Fawr in the west (Reynolds 1981). Using management agreements, it has been possible to redesignate some parts of this route as permitted paths on the Cnewr Estate. A comprehensive survey of this extensive complex has been published (Hughes *1991).*

Aims

The draft National Park Plan (1986) sets out in Chapter 17 the National Park Authority's policies for the conservation of historical features and describes in some detail what can be achieved by the Authority. The whole of that chapter is relevant but the section dealing specifically with industrial archaeology is as follows:

This has been a neglected branch of archaeology in the Park, despite the importance of some of the remains. None of the Statutory bodies are specifically responsible for their recording or protection. A few sites have been Scheduled as Ancient Monuments but there is a relative lack of information and of expert advice available to the NPA compared with that for other ancient monuments or historic buildings. One hundred and seventy-eight features have currently been identified, some being important sites in the history of the industrial revolution in South Wales, including the Monmouthshire and Brecon Canal.

The NPA will pay special attention to increasing its knowledge and protection of industrial archaeological sites, and urge Statutory bodies to give them more consideration.

There are extra opportunities to protect some such features as they may fall within the classification of derelict land, thus enabling the NPA to apply to the Welsh Development Agency for grand aid in respect of them. Expensive repair work to structures, in conjunction with other landscape or safety improvements, may thus be carried out, as at Henllys Vale colliery, which was funded with the benefit of 100% grant.

Methods

Methods for conserving sites include the use of management agreements, other agencies' grant aid and expertise, and the NPA's own grant and work force. The latter has only been used so far for small features such as limekilns. Education can also help to conserve sites. A warden devoting 50% of his time to archaeology was appointed to the Authority in 1988. In 1979 the Park Authority produced the much acclaimed booklet *The Clydach Gorge* which required a second edition (van Laun 1979; 1989), and also runs an annual course on industrial archaeology at its study centre at Danywenallt.

Current work

Current work is concentrated on four sites. At Henllys Vale Colliery (SN 762 137; see Powell, this volume, Chapter 12, and Fig 27), major restoration of limekilns and a 30m chimney stack was completed in 1986. Work on minor features such as the leat, screen wall, and wheelpit is in progress using an environmental improvement grant from

the WDA. A similar grant is available for work at Penwyllt Brickworks (SN 855 153; Fig 5), but work has not commenced since the site was very badly vandalised in 1988. The remains of Cae Sara Lead Mine (SN 753 275) including an engine house, the ore dressing buildings, and wheelpit are in a dangerous condition and much overgrown (Hall 1971, 32–5). Here, limited restoration has been undertaken. More was planned but, unless offered Statutory Protection, the site is unlikely to attract the necessary financial support from the WDA (see Briggs, this volume, Chapter 27).

Finally, during 1986 a steering group was formed to guide an ambitious project at Pontneddfechan Gunpowder Works and Craig y Ddinas Silica Mines (SN 913 082). The group includes rep- resentatives of the Forestry Commission, Neath Development Partnership, Brecknock Borough Council and the NPA. The site is extensive and conservation will require a major capital and labour input. Over sixty features of interest have been identified including the remains of powder grinding mills, turbine, pump and pellet houses, waterwheels, aqueducts, tramways, and chimney stacks. A project manager was appointed during 1987 who will, with expert help, prepare a detailed work programme *(cf* Pritchard *et al* 1985). The Authority has now purchased this site and a management plan has been drawn up (Anon 1990).

Pembrokeshire Coast National Park

by C Stephen Briggs, S Gerrard, and C Kirkbride

The Pembrokeshire Coast National Park is Britain's smallest but contains within its 225 square miles (58,000 hectares) a rich diversity of archaeological monuments and landscapes which contribute to the unique character of the area. A somewhat inadequate reflection of this resource is provided by the Scheduling of some 200 Ancient Monuments,

Kennedy (1973) has drawn attention to the coincidence of charcoal-burning, water-power, and a labour force in the genesis of organised industry in Pembrokeshire, as elsewhere. There are several grist mills, of which the best surviving example is Blackpool Mill (SN 060 145; Dashwood 1970), originally an iron forge and furnace site, now open to the public. Out of the domestic agricultural economy grew an important woollen industry (Jenkins 1966), as well as commercial production of cattle, grain, pelts, and boats. Three working woollen mills survive in the county; Tregwynt (OS SM 895 349), Wallis (SN 014 258), and Middle Mill, Solva (SM 807 259), although the location of Wallis falls outside the Park.

From this dominant agricultural base the Industrial Revolution brought with it the production of lime (Davies 1989; Edwards 1963), clay, iron, and stone. Coalmining, an activity dating from medieval times (Edwards 1963, 10), continued to be of particular importance, high quality anthracite being produced from a large number of pits. The limestone trade also left numerous monuments, both quarries and kilns, of considerable interest to archaeology (Moore-Colyer, this volume, Chapter 5). More unusual industries included papermaking and it is noteworthy that the ruins of an important paper mill, built in the Classical style, survive at Prendergast (SM 808 247; Kennedy 1986).

National Park Authority involvement in industrial archaeology

Of the four post-medieval industrial sites currently Scheduled as Ancient Monuments in the Park (1989), the Authority owns the freehold on Porthgain harbour, limekiln, and brickworks (SM 814 325) and, since 1984, has a 99–year lease on Carew (French) Tidal Mill (SN 043 038); Anon 1972). It is also represented on the Stepaside Industrial Heritage Project Steering Committee which was established in 1982 to plan and develop a major new visitor attraction based on the substantial remains of the former Grove Colliery and Stepaside Ironworks (SN 140 072). The Authority also owns a medieval quarry and has undertaken restoration of Porthclais Harbour (Yeomans 1986, 69–70).

Projects involving industrial archaeology

In recent years, although the Authority has been involved in a limited programme of consolidation and interpretation at several individual sites, completed work is concentrated mainly at Carew and Porthgain.

At Carew tidal Mill a major management, restoration, and interpretative programme was undertaken in 1984 and the first phase completed in readiness for the 1985 season. Rehabilitation work here involved the conversion of the northern annexe as a visitor reception area; a viewing

gallery bearing upon one of two unrestored waterwheels; and a film theatre equipped with automatic slide and tape programmes with stereo sound. Inside the mill, visitors are guided through its three storeys and attic by a series of push-button activated talking points situated on each floor. These explain the main milling machinery and processes.

Restoration work at Porthgain (SM 814 325) presents very different problems. Within this area is grouped a significant survival of multi-functional manufacturing installations including limekilns, slate, granite, roadstone quarries, and brickworks. Dangerous masonry has been stabilised. There is a variety of associated harbour and railway structures and a proposed major rehabilitation and interpretation scheme will commence in 1991.

There is a more modest sized site at Freshwater West (SM 885 994). On a hillside outside the settlement stands a well-known reconstructed seaweed gatherers' hut accompanied by an interpretative panel.

Besides these better-known projects there is a handful of sites where ongoing consolidation is being, or has been, undertaken and at some of which it is intended to erect interpretative display boards. These sites include Aberfelin Mill (SM 834 324); Manorbier Grist Mill (SS 062 977) and Lime Kiln (SS 069 977); and Saundersfoot Incline Winding House (SN 131 048).

In addition, an information centre has been established at Kilgetty (SN 123 071) where a display of nineteenth century industrial archaeology in the Saundersfoot area is exhibited (Price 1982; Stickings 1976).

Conclusion

The National Park's industrial heritage is a largely untapped educational, visitor, and research resource and the Authority is working towards realising this potential by actively involving itself in site care and management. Unfortunately, up to the present time, heritage research has generally been piecemeal and monument orientated, so old industrial sites have not been systematically examined.

The Park Authority employed a full-time archaeologist from 1987–9, a departure which heralded increased activity in this field, particularly in respect of site interpretation and availability of information, both prerequisites to increasing public enjoyment, awareness, and understanding of the heritage.

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5 Coastal limekilns in south-west Wales and their conservation

by Richard Moore-Colyer

Although the agricultural economy of the western counties of Wales has been predominantly pastoral since late medieval times, the bulk of farms grew a small acreage of arable crops for the sustenance of both household and farm livestock. A combination of high rainfall, inadequate drainage, and acidic parent rock tended towards soils of above average acidity and thereby sub-optimal conditions for growing most cereal and root crops. Thus, while oats were relatively tolerant of acidity, successful crop production as a whole could only be achieved where some means of increasing pH were effected. Burnt and slaked lime had been used for this purpose in England since the sixteenth century and in the more anglicised areas of south-east Wales it was in widespread use by the latter years of the following century. Besides reducing acidity, lime had the effect of increasing the 'workability' of heavy soils, of enhancing the availability of certain plant nutrients, and, by promoting earthworm activity, of increasing the rate of incorporation of soil organic matter. So effective was this simple product that it became a major force in transforming intractable acid soils into relatively productive ones and thereby performed signal service in the sustaining of whole agricultural communities.

From the late eighteenth century, lime, either solely or intermixed with sea sand, seaweed, farmyard manure, or kindred organic materials, became increasingly the predominant 'fertiliser' in the western counties of the Principality, retaining this predominance until the arrival of relatively cheap 'artificials' in the closing decades of the following century. As demand from agriculture increased, so expanded the trade in limestone and culm between the Carboniferous Limestone regions of south Pembrokeshire and the lime-deficient parishes of north Pembrokeshire and Cardiganshire. Concurrently the on-farm 'sod kilns' were abandoned and farmers resorted for their supplies of burnt lime to the coastal kilns which mushroomed in considerable numbers from the 1750s onwards and played a major role in the local development of agriculture for a century or more.

The logistics and economics of the limestone trade have been described elsewhere in some detail including the role of lime on the farm, the extent of its use, and the operation of the coastal limekilns (Moore-Colyer 1988; 1990). A typescript of kiln descriptions, details of access and a photographic record of extant limekilns between Aberystwyth and Haverfordwest has been deposited at the NMR(W). The present brief contribution attempts to highlight the importance of conserving at least some of the remaining kilns along this coastline.

In his account of the circular 'draw kilns' of the Sussex coast, which operated more or less continuously throughout the limeburning season to yield some 300 bushels of lime each day, Young (1813 *passim)* described the typical larger coastal limekin common in the late eighteenth century. In essence this was little more than a deep bowl of stone dropping to a small opening called the 'kiln eye', approached from the outside by a tall, arched entrance chamber, generally termed the 'drawing arch' (Fig 6.6). Fuel and limestone (broken with picks to a diameter of 6 to 8 inches (15–20 cm), or the size of a man's hand) were loaded into the bowl or 'charge chamber' from the top, the burnt lime eventually being drawn out of the kiln eye with purpose-made shovels. In the larger and more sophisticated kilns (especially those being constructed in the mid nineteenth century), the charge chamber was lined with firebricks, its lower parts being supported with iron strapping sometimes visible above the kiln eye in existing remains. Such kilns were capable of burning for several years until they were eventually closed down for relining. These remained, in their essentials, the dominant form of limekiln in Britain until the development of the rotary kiln in the 1890s into which raw materials were loaded in the form of a wet slurry (Aldsworth 1979).

Whereas the kiln described by Young had a chamber capacity approaching 1200 bushels, the majority of the coastal kilns in south-west Wales were considerably smaller and usually non-continuous, with few containing any sort of chamber lining. Burning generally lasted 24–48 hours, depending upon kiln design and windspeed. Although there were several large 'draw kilns' operating in Haverfordwest towards the end of the nineteenth Century, the coastal kilns in Cardiganshire and north Pembrokeshire were principally of the simple 'pot kiln' type requiring some 7–10 cwt (0.35–0.5 tonnes) of culm to yield one ton(ne) of lime. In these the charge was allowed to burn out completely before the lime was removed. Variation between these kilns was limited to shape, the presence or absence of any form of ornamentation of the external stonework structure and the mode of construction of the drawing arches, the majority of which appear to have been corbelled

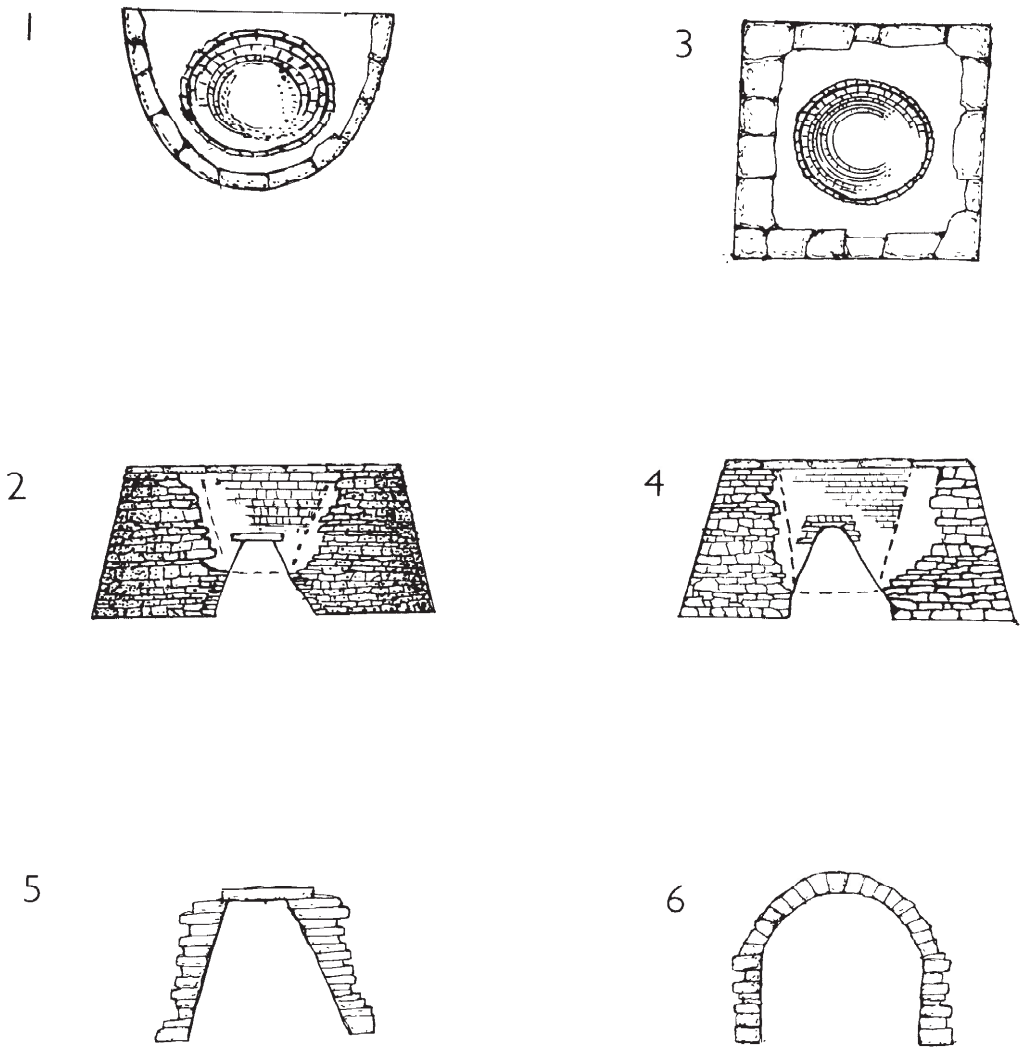

Figure 6 The typology of limekilns: 1–2) plan and section of three-quarter circular kiln. Most examples of this type abut onto solid stone walls, though they may (like Mwnt) abut onto an earthern bank; 34) plan and section of rectangular kiln type (eg Llanrhystud, Old Castle); 5) 'triangular' drawing arch (eg Aberbach, Aberfforest, Porthgain); 6) rounded type (eg Cwmtudu, Llangrannog, Williamston Pill). Not to scale but limekilns stand up to c *6 m high and* c *6 x 4 m in section. (Illus. C Stephen Briggs)*

with a rounded or roughly-pointed external arch (Fig 6.5; 6.6). Throughout England and Wales there existed a considerable variety of drawing arch types. While this may have been linked to local building traditions, it more probably reflected the nature of the fuel being used in the kiln since the shape of the drawing arch would to a large extent control the draught entering the charge. Prior to the availability of sensing instruments, the lime burner needed to exercise considerable skill and judgment in controlling draught and chamber temperature according to both the nature of the limestone and the fuel with which the kiln was charged. Air distribution had to be carefully maintained to prevent overburning and yet to achieve a kiln temperature sufficiently high to expel carbon dioxide from the rock — a difficult task given the variable windspeeds prevailing along the coasts of west Wales. The marked contrast between the drawing arches of the canalside limekilns of the Upper Swansea valley, which decrease in width towards their mouths, and

those of the Cardiganshire and Pembrokeshire coasts, which are widely splayed outwards, emphasises the extent to which kiln structure reflected location and fuel type. Thus the anthracite used in south Wales tended to burn more fiercely than the low-grade culm loaded into the Cardiganshire kilns, thereby requiring a restricted draught to prevent overburning. Conversely culm usually needed a more liberal air supply which would be permitted by outwardly-splayed drawing arches wherein temporary baffles could be constructed if windspeeds were excessive or wind direction inappropriate (Hughes 1981, 101–2).

If, as is frequently alleged, the folk culture of west Wales was nurtured and sustained on the farm, it might be argued that a readily available source of those off-farm inputs necessary to ensure the success of husbandry would play an important role in the maintenance of cultural activity. On the basis of this argument, the limekiln and its product might perhaps be accorded a significance beyond mere considerations of husbandry. This apart, the limekiln was a warm and rather friendly place. On a cool evening in the lime burning season, it might attract all manner of people to its precincts so, like the smithy and pub, becoming a focal point for the local community. In the light of these considerations and the fact that the coastal trade in limestone and culm was an important element in the economy of the area — many of the vessels engaged in the trade being share-owned by farmers — it is surprising that few attempts have been made to conserve some of the remaining kilns or to develop a selection of them as interpretation sites. With the exception of those currently on National Trust managed sites and a few on private land, many of the surviving coastal kilns are under attack from elemental decay, coastal erosion, the accretion of adventitious structures, conversion, and, of course, vandalism. Given the prevailing climate of public opinion, and the increasing availability of resources for conservation, the time may be ripe for those concerned with the preservation of cultural heritage to focus the same degree of attention on these humble structures as is currently accorded to castles, furnaces, and follies.

The list of limekilns which appears below was compiled during 1986 and 1987 and summarises the typescript list mentioned above. Whereas references to some of the kilns in the list indicate lime burning on a particular site in the late seventeenth century if not earlier, the bulk of the remaining kilns appear to be of late eighteenth or early nineteenth century origin, having been constructed at a time of increasing agricultural prosperity. Others, notably the kiln at Old Castle, built of well-dressed stone as opposed to the usual stone and rubble, and Llangrannog (datable to 1887) incorporate safety ramparts around their outer circumferences. This may be a feature of later construction. Apart from the Old Castle and Llanrhystud rectangular kilns, the Aberystwyth, Caerbwdi and Neyland square kilns (cf Figs 6.3; 6.4), and circular structures at, for example, Newgale and Millhaven, most kilns of the 'three-quarter circular' type were constructed with their backs to the solid stone wall (cf Figs 6.1; 6.2). As a general rule single kilns were built, although from time to time they appear as complexes of four or five (eg Llanryhstud, Solva) or as linked pairs, (eg Dale, Slade, Porthclais). Coastal kilns were equipped with a pair of drawing arches which were either rounded (Cwmtudu, Morfa Bychan, St Brides, Williamston Pill) or roughly triangular with their apices capped with a single flat stone (Mwnt, Aberfforest, Aberbach, Porthgain). Exceptions are the kiln at Mwnt with its single drawing arch, and the pair of kilns at Aberystwyth and the complex at Llanrhystud, both of which have a trio of drawing arches. The kilns surveyed varied relatively little in size with chamber diameters averaging 3 m at the upper opening with drawing arches rarely exceeding 3 m in height and 2.3 m in width. Excepting the larger rectangular structures, the circular and three-quarter circular kilns averaged 3.75 m in height.

Appendix 5.1: List of Limekilns between Haverfordwest and Aberystwyth

The general condition of the kilns below is assessed on a 'scale' ranging from *Good* to *Ruinous:*
Good: Structure complete; chamber open or only partially infilled; no overgrowth; some recent restoration.
Fair: Structure complete; chamber infilled; some overgrowth; capable of restoration.
Poor: Chamber infilled or collapsed; one or more of the drawing arches in dereliction; extensive overgrowth; presence of 'extraneous' structures; restoration difficult.
Ruinous: Remains limited to rubble; both drawing arches and chamber collapsed; restoration impossible.
Although the following summary list is limited to brief entries, some expansion is provided in the case of two sets of kilns by way of indicating the scope of the documentary material which has survived for some sites. Local historians might care to investigate further some of the remaining kilns and kiln sites and to carry out detailed structural surveys. Asterisked sites are of particular interest.

1 **ABERYSTWYTH (Trefechan)* SN 582 812: Two surviving kilns with rounded drawing arches and silica brick linings; *condition:* fair; *access:* public.

2 **LLANRHYSTUD* (Craiglas) SN 521 687: [Sources: OS 1st ed, 25-inch (1887); Tithe Map (Llansantffraid), 1843].

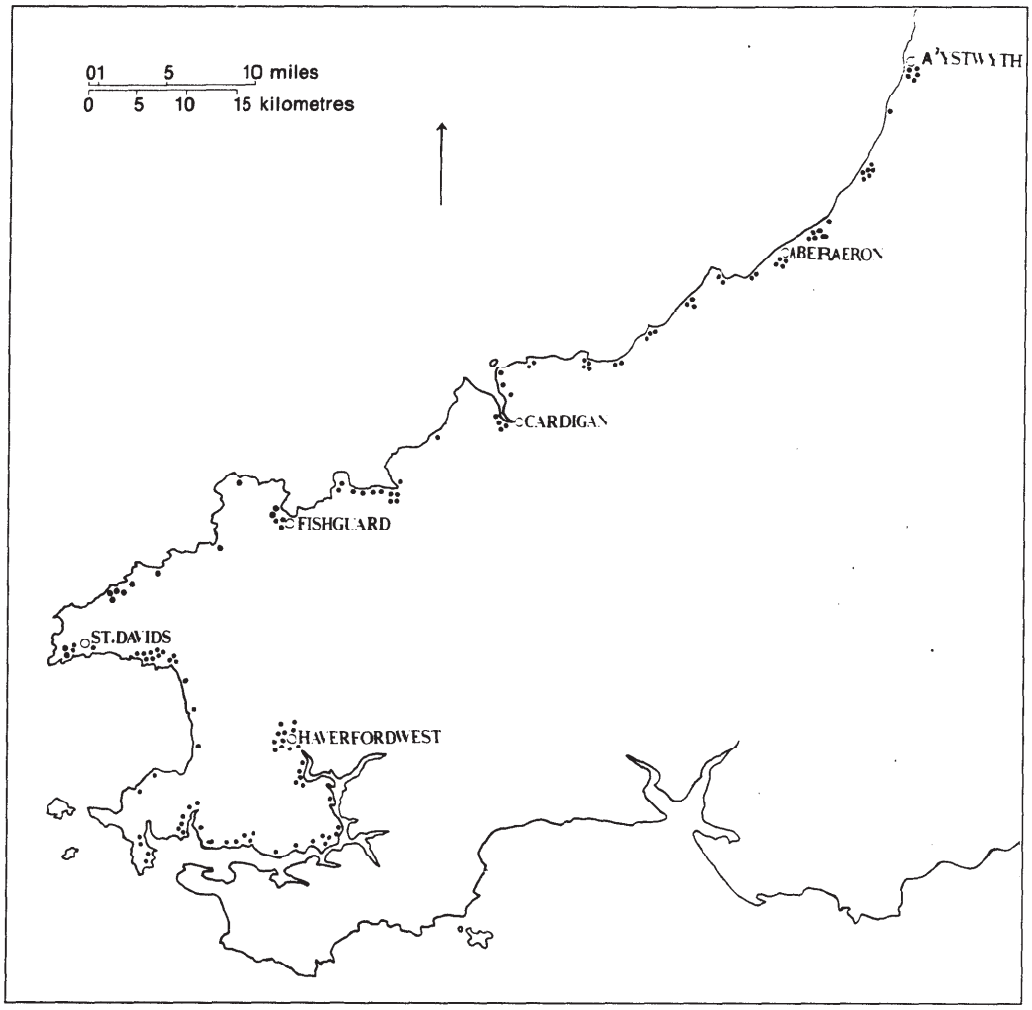

Figure 7 Distribution of limekilns in SW Dyfed. Each dot represents known examples of single kilns

	Diam (m)	Chamber diam (m)	Drawing arch height (m)	Drawing arch width (m)
Kiln I (north)	4.30x6.00	3.00	2.70	2.10
Kiln II	4.50x6.00	3.00	2.30	1.80

Four rectangular, stone and rubble-built kilns. The most northerly, probably older, seem to have been built as a linked pair. Each kiln has three pointed drawing arches, capped with flat stones. The chamber of Kiln I is virtually infilled and that of Kiln II overgrown. The north wall of Kiln I and the west wall of Kiln II have been substantially buttressed. The 'eyes' of Kiln II are capped with a course of brickwork supported by a heavy iron band. Kilns III and IV (the two most southerly) are of similar proportions, the collapsed chamber of Kiln IV revealing its full depth of some 3.50 m and the several iron bands used as supports around the full circumferences. Kiln III, heavily buttressed on its south and west walls, reveals brickwork above the north and south 'eyes', the most westerly 'eye' having been closed off with stone. All appear to have been limewashed. Immediately to the north, a section of rubble and mortar walling in the low cliff together with a spread of vitrified material and burnt lime waste on the beach suggest the remains of further kilns. Indeed, an 1850 plan of the site delineates six kilns whereas a further plan, ten years earlier, shows only two (NLW MS PA 8097).

Notes: In 1796 two limekilns at Aberstrincell/ Craiglas were granted by James Lloyd of Mabws by way of a lease for two lives to William Davies of Alltwyd Ganol who also operated as a ship builder in a yard close to the site, this having disappeared as a result of coastal erosion (NLW MS Alltwyd 40). By 1824, when the kilns were in the occupation of Evan Morgans at a yearly rental of £12 12s 0d, they had been sold by the Mabws estate to the

widow Jane Hughes who subsequently leased them to David Morgan of Alltwyd (1814–1882) (Dyfed Record Office MS D/LP/643). A man of some enterprise, Morgan rebuilt the appurtenances of Alltwyd which had previously been destroyed by fire, extensively improved the farmlands by drainage, and built several further limekilns at Craiglas. Manuscript material in the possession of Mrs C Griffiths of Pentremawr, Llanrhystud, a descendant of David Morgan, testifies to a constant traffic of limecarts and as many as thirteen ships at a time waiting to discharge their cargoes of limestone and culm (Dyfed Record Office DB/4/67; Jenkins 1976, 152). The various remains of wooden groynes on the shoreline were probably associated with importing lime to this set of kilns. *Condition:* fair; *access:* via public beach.

3 *MORFA BYCHAN* SN 565 775: Rubble-built kiln with two rounded drawing arches. *Condition:* poor/ruinous; *access:* via beach.

4 *MORFA MAWR:* SN 506 608: Apart from stones on the cliff edge and vitrified material on beach no structural features remain. *Condition:* ruinous; *access:* via beach.

5 *ABERARTH* SN 478 629: Of the five kilns located on the Henfynw Tithe Map (1841) all have succumbed to coastal erosion.

6 *ABERAERON* SN 466 629: The bases of kilns at west end of Heol yr Odyn; lime weighing house nearby.

7 *NEWQUAY; (Ceibach)* SN 415 599: Two sets of paired kilns; rubble built; triangular drawing arches; rapidly eroding. *Condition:* ruinous; *access:* via beach.

8 **LLANGRANNOG* SN 309 541: Single 'three-quarter circle' kiln of partially-dressed stone; rounded drawing arches. *Condition:* fair; *access* via roadside.

9 **CWMTUDU* SN 355 577: 'Three-quarter circle' kiln; rounded drawing arches; partially restored; interiors obscured by temporary buildings. *Condition:* good to fair, the whole recently repointed; *access:* via beach.

10 *TRESAITH* SN 278 518: One kiln beneath mound close to public lavatories, second in Llys yr Odyn. *Condition:* ruinous; *access* private.

11 *ABERPORTH* SN 260 517: Of the six kilns originally at Aberporth no remains survive.

12 *MWNT* SN 194 518: Single kiln remaining. 'Three-quarter circle' type; triangular drawing arch. *Condition:* good; *access:* public on National Trust site.

13 *CRAIG Y GWBERT* SN 159 502: Circular kiln, rubble built; two pointed drawing arches. *Condition:* fair; *access:* private or via beach.

14 **CARDIGAN, (Old Castle)* SN 165 463: Rectangular kiln, well-dressed stone; two pointed drawing arches, ramparts present. *Condition:* good; *access:* public via riverside or private on Old Castle Farm.

15 *PWLLGWAELOD* SN 006 398: 'Three-quarter circular' kiln; rounded drawing arches; brick course above eyes. *Condition:* good; *access:* public via roadside.

16 **ABERFFOREST* SN 025 396: 'Three-quarter circular' kiln; pointed drawing arches. *Condition:* fair; *access:* Public via Pembs Coastal Path (PCP) or by road courtesy of Aberfforest Marine Ltd.

17-18 **NEWPORT:* (1) Parrog Beach; pair of kilns; infilled and overlain by other buildings; (2) SN 062 397: on north bank of Nyfer estuary; large kiln with rounded drawing arches. *Condition:* fair; *access:* public (PCP).

10 *CEIBWR BAY* SN 109 458: Pointed drawing arch and chamber of single kiln. *Condition:* fair; *access:* public (PCP).

20 *FISHGUARD TO GOODWICK:* (1) Slade; pair of circular kilns with infilled chambers forming part of private garden; access to upper parts private. (2) Of the numerous other kilns recorded in documents the only extant remains appear to be behind Janie's Gents' Hairdresser's on Goodwick Main Street.

21 **ABERBACH* SM 884 352: 'Three-quarter circular' kiln; pointed drawing arches; open chamber; roofless rectangular structure nearby. *Condition:* fair; *access:* public (PCP).

22 *PORTSYCHAN* SM 905 407: No surviving remains.

23 **ABERCASTLE* SM 852 338: 'Three-quarter circular' kiln; pointed drawing arches; open chamber. *Condition:* fair; *access:* public via beach.

24 *TREVINE* SM 832 334: No surviving remains.

25 *PORTHGAIN* SM 814 326: 'Three-quarter circular' kiln; pointed drawing arches; chamber infilled forming corner of private garden. *Condition:* fair; *access:* public via roadside, chamber private.

26 *ABEREIDDI* SM 797 312: Of the two limekilns originally here the remains of both are in ruinous condition.

*27-29 *PORTHCLAIS* SM 742 233: (1) South bank of River Alun, no surviving remains; (2) Pair of 'three-quarter circular' kilns with pointed arches on west side of harbour; recently well restored; (3) Pair of *ditto* on east side of harbour; one restored the second ruinous. *Access:* to all via PCP.

*30 **CAERBWDI* SM 767 245: Square stone and rubble kiln with two drawing arches; ruined rectangular structure nearby; *condition* good; *access* via PCP.

31 **SOLVA* SM 804 242: [Sources: OS 1st Ed, 25–inch (1887); Tithe Maps (Whitchurch & St Elvis), 1838]. According to Warburton (1944), of the twelve limekilns originally operating at Solva, eight remained in 1944, of which one was in use around 1900. The five kilns on the Gribin side of the harbour, mentioned by Warburton and regularly featuring in tourist

literature are still extant at low tide. A further kiln, of the 'three-quarter circular' type, located behind the Harbour House Hotel now forms part of a chalet conversion and caravan site, while the remaining member of a pair by Solva Bridge, of the same type, is largely ruinous and incorporated into a private garden. All the other Solva kilns mentioned by Warburton and delineated on the map sources have now disappeared.

Notes: Solva had long been an important centre for the lime trade before the railway assisted its decline. Limestone was shipped into the village for repairs to St David's Cathedral in 1384 and subsequently kilns in the town burned lime from West Williamston quarries using culm from Lawrenny, Hook and Norton, some of which was probably stored in one of the nine warehouses in Lower Solva (Green 1923, 84-5). From 1800:

> The lower town.... would not be very unpleasant or very irregular were it not for two limekilns placed in the centre of the western row and rather too forward in it, whose hot vapours and the dust and noise of carting incident to them, made them very offensive .... yet those friends of agriculture, though in this instance nuisances, from having existed prior to the thought of any homes, will be able to maintain their ground and it would be difficult perhaps to prevail upon the owners to destroy them. (quoted by Warburton 1944, 84–5).

In 1771 George Phillips of Haverfordwest leased (for three lives at a rental of £14 14s 6d) to John Grifflths of Solva Mill, a limekiln at Whitchurch together with the upper limekiln at Solva Harbour, 'with free liberty of laying down limestone and culm' (NLW Morgan Richardson MS 224). William Reynolds, who was probably one of the three Solva lime burners in Pigot's Directory of 1844, is mentioned as occupying a limekiln in Solva (NLW Morgan Richardson MS 367).

32 *DINAS FACH* SM 826 232, SM 827 231: Not visited.

33 **NEWGALE* SM 851 217: Circular kiln; pointed drawing arches; infiled chambers. *Condition:* good; *access:* public via roadside.

34 *NOLTON HAVEN* SM 859 186: Remains of circular kiln incorporated as external abutment to north wall of Mariner's Inn. *Condition:* ruinous; *access:* private.

35 *BROADHAVEN* SM 861 140: No surviving remains.

36 *MILL HAVEN* SM 817 123: Circular kiln with collapsed chamber; ruined rectangular buildings nearby. *Condition:* ruinous; *access:* public via PCP.

37 **ST BRIDES* SM 802 109: 'Three-quarter circular' kiln; chamber infilled; rounded drawing arches. *Condition:* good; *access:* public via PCP

38–40 **DALE:* (38) *Watwick Bay* SM 817 040: no surviving remains (39) *Castle Beach* SM 820 050: circular kiln; pointed drawing arches. *Condition:* ruinous; *access:* via PCP (40) *Dale* SM 808 067: pair of linked three-quarter circle kilns; pointed drawing arches. *Condition:* good to fair; *access:* public by roadside.

41–44 * *SANDY HAVEN PILL:* Of six kilns identified from map sources, the remnants of four are extant. (41) SM 862 088: single pointed drawing arch; rest ruinous; *access:* public. (42) SM 857 087: ruined chamber with restored pointed drawing arch; access private, courtesy of Sandy Hill Baptist Chapel. (43) SM 856 074: round circular kiln at Pill end of lane linking Herbrandston and Sandy Haven Pill; *access:* public via road. (44) SM 853 074: circular kiln with weighbridge and weighing machine by Bartlett's of Bristol. Currently being restored under the auspices of the local District Council. *Access:* via public road.

45 *GELLISWICK BAY* SM 885 056: No surviving remains.

46 **MILFORD HAVEN* SM 903 072: (a) Ruined circular kiln on public footpath from Priory Hill to Milford Haven; (b) *Ditto* on opposite side of the Pill on private property.

47 SM 941 061: 'Three-quarter circular' kiln with intact pointed drawing arches on waterside near Black Bridge. *Condition:* good to fair; *access:* public.

48–50 *NEYLAND (LLANSTADWELL TO HAZEL-BEACH): (48)* SM 947 048, SM 954 050: no surviving remains. (49) SM 938 043 (West Point): no surviving remains though ruined walling on beachside may represent part of a rectangular kiln, (50) SM 959 052: square kiln partially reconstructed to form a roadside feature next to the bus shelter at the juction of Church Road and Church Way.

51–52 *WESTFIELD PILL:* (51) SM 962 073: ruinous remains of kiln at head of the Pill to the west side of the ford. (52) SM 963 072: ruinous bases of two circular kilns to the west of the ford.

53–54 *WILLIAMSTON PILL: (53)* SN 002 054: base of circular kiln; condition ruinous; access private. (54) SN 002 062: circular kiln with rounded drawing arches of which one is obscured by a boathouse forming an abutment to the kiln. *Condition:* fair; *access:* public.

55 *BLACKTAR POINT* SM 999 094: No remains.

56–60 *WESTERN CLEDDAU:* By the mid-19th century at least seven limekilns were operating on the Western Cleddau to the east and north of Lower Freystrop. (56) SM 967 122: hollow circle of kiln base on riverside edge of NT woodland. *Access:* public footpath. (57) SM 969 129: 'Three-quarter circular' kiln; rounded drawing arches in woodland by riverside.

Condition: fair/poor; *access:* public footpath. (58) SM 967 128; similar with associated enclosures and ruined buildings. *Condition:* fair/poor; access: public footpath. (59) SM 967 127; 50 m south of (3); circular kiln completely ruinous. *Access:* public footpath. (60) SM 967 139; in woodlands south-east of Haroldston St Issell's Church; 'three-quarter circular' kiln with single intact drawing arch; iron banding around collapsed chamber base. *Condition:* ruinous; *access:* private.

Haverfordwest

Of the numerous and well-documented limekilns in Haverfordwest and Prendergast all have succumbed to urban development. A small section of what appears to have been a circular structure close to the public footpath on the right hand side of Crow Hill Road as it leads north from the town *may* represent the remains of a kiln (SM 952 161).

Appendix 5.2 Conservation of coastal limekilns

Of the kilns listed above, those adjudged worthy of Scheduling/conservation are asterisked. The sites comprise individual kilns, linked pairs and complexes giving a total of thirty kilns in all, this representing 19% of the total operating in the mid nineteenth century and some 43% of those whose remains, in various stages of dilapidation, are currently traceable. Since there appears to be little purpose in attempting to restore structures in an advanced state of decay, only those in good to fair condition are identified and, bearing in mind considerations of accessibility, selected sites are representative of the range of kiln types flourishing on the coastline of Georgian and Victorian Wales.

Individual kilns

Aberystwyth (Trefechan); Llangrannog; Cwmtudu; Mwnt: Cardigan (Old Castle); Pwllgwaelod; Aberforrest; Newport; Aberbach; Abercastle; Caerbwdi; Newgale; St Brides; Sandyhaven Pill; Milford Haven.

Linked pairs

Porthclais; Dale.

Kiln complexes

Llanrhystud (Craiglas); Solva.

In compiling this grouping, concern has been less with uniformity of distribution along the coastline than with representivity of type and locations with respect to public popularity; hence the bias towards 'beauty spots' and popular beaches. Whereas some of the kilns selected have already been partially or fully restored (eg Cwmtudu, Porthclais, Sandyhaven Pill), the remainder require varying degrees of attention. In some cases kiln chambers are either completely infilled (eg St Brides, Llangrannog, Mwnt) or supporting a flourishing growth of bushes (eg Old Castle), while in others chambers merely require clearing of rubble and modern rubbish (eg Abercastle, Newgale). Some sites, with kilns otherwise in good order, are overgrown with a morass of blackthorn, ivy and bracken (eg Caerbwdi, Aberbach, Milford Haven) or encumbered with adventitious buildings (eg Cwmtudu). Overall, the kilns identified above require relatively minor attention. Although some rebuilding of the northern corner of the large kiln on the Nyfer estuary at Newport may be necessary (once the ivy and blackthorn overgrowth is cleared), structural work to most kilns is likely to be limited to stonework pointing and occasional buttressing.

An interpretation site?

It now seems reasonable that efforts be directed towards developing at least one accessible site as an interpretation centre. The Llanrhystud Craiglas) kiln complex would be almost perfect for this purpose. It is well documented, accessible and in a state of reasonable repair. Plans and drawings in the NLW also document a culm yard, tavern and offices, the ruins of which, like the walled access lane, are overgrown. Adjacent timber groynes on the beach were probably used by ships discharging their cargoes of limestone and culm. Conservation measures could easily be effected and would yield an educational and tourist facility of great value, possible even including reuse for burning limestone. The conservation of a selection of coastal limekilns and the identification of one or more interpretation sites will contribute significantly to our appreciation of the true nature of the economy and conditions of life in rural Wales in the 1800s.

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6 Slate quarries: problems of survey, conservation and preservation

by Anthony Parkinson

The slate-quarrying industry was one of the most important extractive industries in Wales in the nineteenth century, and by far the most important single industry in north-west Wales. Like all extractive industries it presents great problems of recording and conservation.

The first problem is to establish the number of sites and their relative importance. No complete tabulation of known quarry sites (from documentary sources or fieldwork) has yet been published: however. the 'Snowdonia Database' (being compiled at Oriel Eryri) has listed over eighty quarries in Snowdonia alone, varying in size from 1 ha to over 300 ha. It is instructive to note that a published account of the industry *(Practical Magazine* 1873, 280, 401) named no fewer than nineteen quarries in the Llanberis area (of which nine made up the huge Dinorwic complex (SH 59 60) and eighteen in the Nantlle area (SH 50 53): some were already out of use. Of the total number, relatively few are of more than passing interest to industrial history: only the larger and longer-lived quarries developed transport systems or established permanent dressing mills, and few of these survive in anything like a complete state. Anything reusable would he removed after the quarry closed, leaving only masonry and holes. The importance of the surviving remains therefore depends on the interpretation of their technological and historical significance. Thus Abercwmeiddaw Quarry (Corris SH 74 09) is important because of the holes left by a tunnel-boring machine; Vivian ((SH 5855 6022) and Dinorwic Quarries are significant because their incline-systems are more or less intact; and Penyrorsedd Quarry (OS SH 500 540) is of paramount importance because it still has its aerial ropeways.

Recording and conservation present greater problems. The sheer size of the quarries is daunting: recording can rarely be more than selective examination of individual structures. A survey of Allt-ddu Quarry (Llanberis SH 5910 6105) by the National Monuments Record produced photographs and measured drawings of over sixty separate features, ranging from single cottages to enormous mills and extensive incline-systems (Figs 8, 9): dating these accurately so as to produce a reasonable developmental history of the quarry has proved very difficult.

Conservation is just as difficult. There is an innate tension between the wish to conserve a very important part of the history of north-west Wales, and the equally valid wish to 'tidy-up' derelict and potentially dangerous sites, often in areas of outstanding natural beauty. There is also a limit to the number of sites which can be turned into tourist attractions. Already open to the public are examples of both major types of quarry, the Merioneth underground workings and the Snowdonia 'terraced' workings, and it is not easy to see many more being developed since possible sites are too close to existing sites to avoid direct competition. Scheduling as Ancient Monuments is also-difficult. Ideally one would suggest protecting

Figure 8 Allt-ddu, Llanberis: dressing mill (Photo: NMR(W), Crown copyright reserved)

Figure 9 Allt-ddu, Llanberis: powder house (Photo: NMR(W). Crown copyright reserved)

Figure 10 Glynrhonwy, Llanberis: tramway entrance (Photo: NMR(W), Crown copyright reserved)

Figure 11 Glynrhonwy, Llanberis: tramway tunnel (Photo: NMR(W), Crown copyright reserved)

the whole area of a quarry and its attendant structures, hut without the appropriate powers in the 1979 *Archaeological Areas Act* this might be difficult. As it is, a few structures in a few quarries are Scheduled, without reference to their wider context.

A recent example of these problems is the question of what to do about Glynrhonwy Quarries, a complex south of Llanberis (SH 5636 6052). This group of quarries was in operation until the 1920s, and part was subsequently used first as a military explosives store and then as a CEGB depot. From 1983 onwards there have been various proposals to reclaim part of the site, perhaps for leisure activities, but so far this has come to nothing. Equally fruitless were proposals to reopen part of the site as a working quarry. The complex is very extensive and very ruinous, although (as with many such sites) preservation is better in the parts furthest away from major roads. There are remains of cottages, dressing mills, inclines, and winding houses, but no machinery, Non-intensive recording has been carried out by the NMR(W) in the form of a photographic survey (Figs 10, 11) and descriptive notes covering over eighty separate features, but hardly any measured survey has been undertaken. Most of the features and sites noted can be paralleled elsewhere: a notable exception is a steam-powered dressing mill. If the site is to be landscaped, further recording should be undertaken.

At the present one would hesitate to recommend large-scale conservation measures, partly because of the poor preservation of the site (compared to the nearby Vivian and Dinorwic Quarries), and partly because its vast size would make it difficult to 'interpret' for visitors. Equally one would wish to impose archaeological constraints on possible reclamation and development for alternative use, since some of the features (such as the inclines) could possibly be retained and incorporated.

Some of these problems have been successfully addressed by the Snowdonia NPA by the acquisition of Ynyspandy Slate Mill and Hafod Las Quarry (Crew and Williams, this volume, Chapter 4).

Without more information about surviving sites one cannot adequately assess the importance or rarity of the different features in an individual quarry. A careful (albeit non-intensive) survey of all surviving quarries should be undertaken as an essential first stage. Only then can a realistic sample of the best examples be put forward for protection from a position of knowledge. Otherwise it is possible that reclamation work will leave only the least important examples for eventual protection as the last survivors.

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7 The conservation of non-ferrous mines

by C Stephen Briggs

Introduction

For environmental planners, old metalliferous mines constitute health and safety hazards from pollution, erosion, structural collapse, and also because of their magnetic attraction for rubbish. But they conjure up quite another picture to the historically-minded tourist, and, in Wales, no doubt stimulated to a greater degree by David Bick's popular accounts (1974–8), and to a lesser, by those of F J North (1962) and W J Lewis (1966), visitors annually flock to the remoter parts of the Principality in search of them.

Wales' importance in the history of metal mining is not in doubt. And although recent claims of Bronze Age origins for the mines are probably misguided (see Briggs, this volume, Chapter 14), there is a strong likelihood that at least the Romans may have trenched or systematically worked the lead-rich Carboniferous hills and gravels of Clwyd (Briggs 1988; Webster 1952–3). Whatever these possibilities, there are so far no convincing excavation records of Roman, medieval, or even of seventeenth century mining ventures. Besides this historical potential, several important technical advances in ore processing are known to have been developed in Wales. In the search for remoteness of antiquity, it is possible to forget the need to plan investigations giving both overall historical perspective and also preserving details of unique technological achievement. Perhaps the very visual impact and massive scale of eighteenth and nineteenth century mining has so far precluded serious study and assessment of conservation needs. However, the recent appearance of several site-specific studies may play an important role in changing attitudes within 'public archaeology'.

One of the purposes of this paper is to look at how far such studies are affecting mine conservation policies and, indeed, to ask if mines are afforded the same heritage value, as, for example, hillforts or medieval moats.

Some mine conservation schemes undertaken in the National Parks have already been noted (Crew and Williams, this volume, Chapter 4; Ledbury and Briggs, this volume, Chapter 4; Vernon 1989). Among those to be considered here are two large-scale projects of contrasting character, both in lead extraction areas, at Minera, and Halkyn (Clwyd). Another reclamation programme is currently planned for the metalliferous mines of north Dyfed. The archaeological implications of all these programmes are clearly of interest, since they must pose questions not only of historical record, survey and conservation, but also those of public access, and the degree and integrity of visitor interpretation provision.

At the outset it seems important to ask how far the sponsors of reclamation schemes regard prior archaeological investigation to be desirable or necessary. Whose responsibility is it to make archaeological assessments? Should the standards of investigation now demanded by prehistoric archaeology also be adopted for all mining sites, whatever their perceived histories? How might the adoption of such exacting investigation techniques affect the development of commercial enterprises run as visitor and educational centres? Should 'state archaeology' be more closely involved at all stages of site research, evaluation and presentation?

Halkyn Mountain

During the existence of the MSC schemes, Clwyd County Council undertook a WDA-funded operation to cap dangerous lead-mining shafts. Contemporary survey for geological mapping provided an unusually full picture of their distribution which illustrates uncontrolled, mostly nineteenth century, patterns of shaft exploitation (Campbell and Hains 1988, 23–9; figs 5a, 5b and 6; here Fig 13).

One of the survey's major concerns was to locate areas of undermining for reasons of safety and future planning. 'Areas of mining' were found to be 'mostly restricted to narrow, relatively thin veins and joints which tend to occur in conjugate sets. As these veins can, in many instances, be well defined by the linear chains of shafts and shallow trial pits, displaying the veins themselves provides a good guide to the undermined areas'. Several thousand shafts and adits were located. These proved impossible to depict in their totality (Campbell and Hains 1988, 24). Mapping was undertaken under the categories: capped shafts (not necessarily filled); uncapped shafts and deep pits (not necessarily open at the surface), and probable trial pits and shallow shafts. Distinction between the latter two types was considered a largely subjective exercise, since surface collapse had sealed off many deep shafts which in appearance were indistinguishable from shallow trials. Surface indications were found to be of assistance, since the larger the volume of spoil, the greater the likelihood of its having been a deep shaft. Unfortunately, owing to the 'increasingly common practice to attempt land restoration in areas of

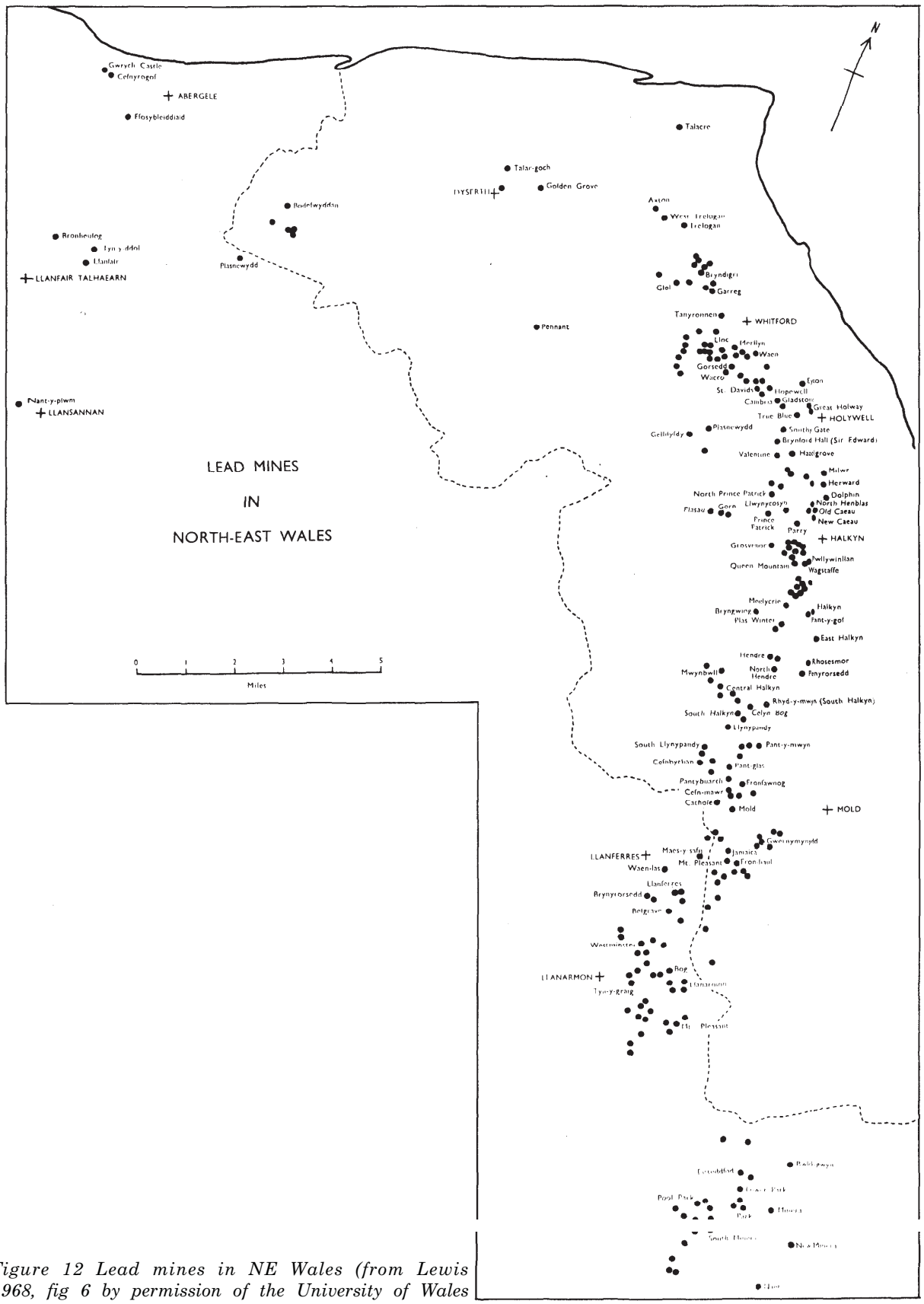


Figure 12 Lead mines in NE Wales (from Lewis 1968, fig 6 by permission of the University of Wales Press)

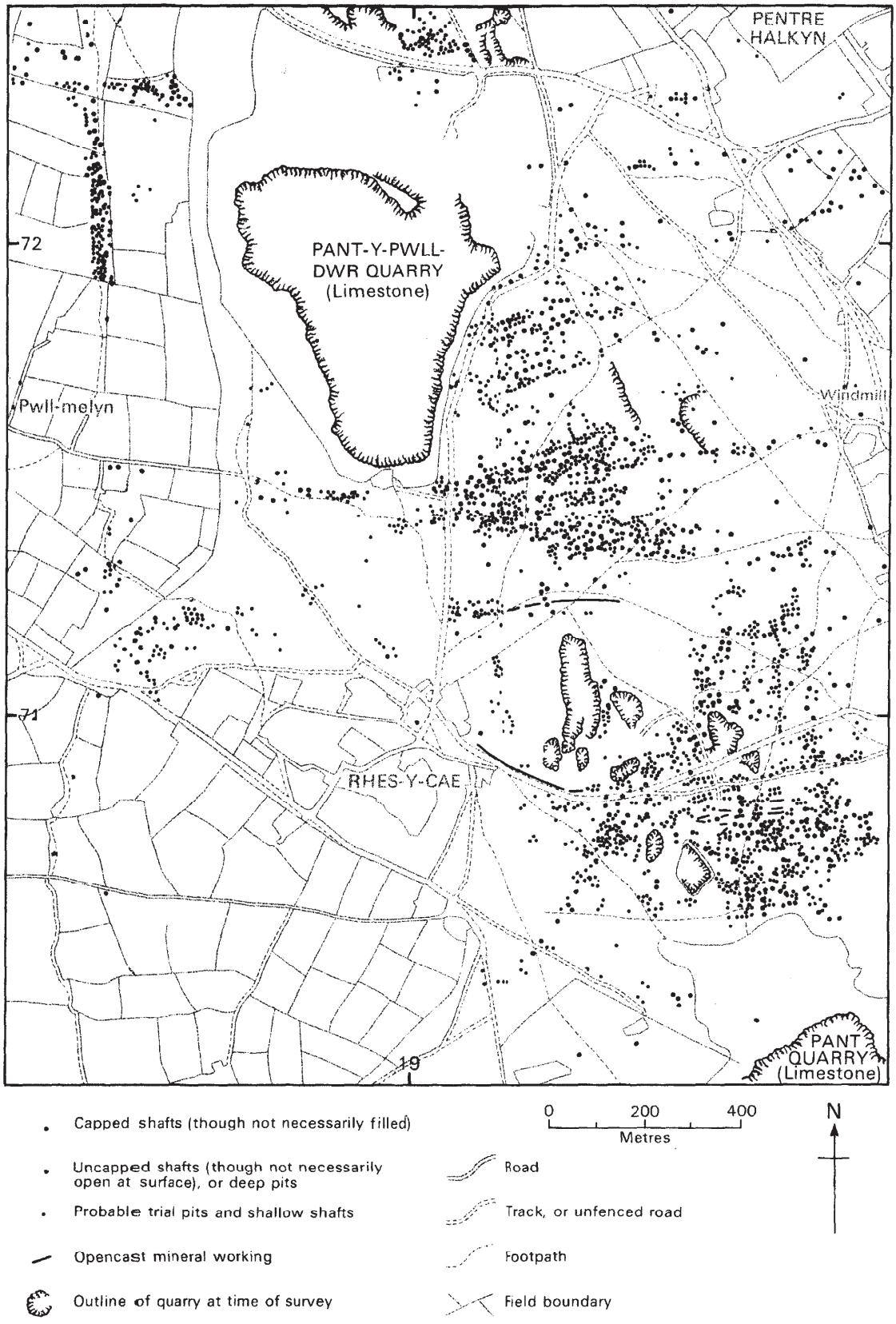


Figure 13 Detailed map of the distribution of shafts and trial pits on Halkyn Mountain. The area between Pant and Pant-y-pwll-dwr. Scale 10,560 (reproduced with permission from Campbell and Hains 1988, fig 5a; British Geological Survey, Crown copyright reserved)

previous lead mining, by bulldozing flat the made ground...in some areas the number and density of shafts will remain unknown' (Campbell and Hains 1988, 29).

The study concludes, perhaps fortunately for industrial archaeology, that the nature of mineralisation at Halkyn renders unlikely its future large-scale exploitation. Nevertheless, the prospect of widespread land restoration throughout an area known to have provided lead-ore since Roman times (Webster 1952–3), is daunting. Besides detailed records of shafts archived by the British Geological Survey, further systematic site visiting is needed for historical and archaeological record purposes. Observations and photographs might usefully be taken at a range of shaft-types, and soil disturbances and spoil-heaps need thorough examination in case they have archaeological potential.

It is unfortunate that the Halkyn reclamation project was not undertaken cooperatively with archaeologists. Even minimal survey might have helped more clearly establish the nature of eighteenth–nineteenth century working practices upon this particular terrain (cf Moissenet 1857; Thorburn 1986). Future fieldwork could still provide clues as to the whereabouts of earlier workings, or even of pre-Industrial settlement or burial sites.

Reclamation at the Minera Mining area, Clwyd

To the west of Wrexham, along the north-north-west–south-south-east margin of the Esclusham Hills, along the Clywedog Valley, survive extensive remains of lead mining activities, mainly of the eighteenth–nineteenth centuries. The site, known as Minera, occupies a strip of land about 1.5 miles (2 km) in length. Here, a diversity of minerals has been intensively worked, apparently in post-medieval times. Its products have included lead, zinc, limestone and silica, the value of the lead alone amounting to about £60 million at current prices.

In May 1986, under growing public pressure to clean up the area, Wrexham Maelor Borough Council appointed Richards Moorehead and Laing Ltd of Ruthin to 'assist with environmental and landscape matters in the design of the reclamation scheme' (Richards Moorehead and Laing 1987a). It was a useful departure involving close cooperation with both the curator of the Bersham Industrial Museum and local historians. Through cooperative effort it was quickly established that historical features on the site were more extensive than originally imagined, and it was therefore decided to explore its archaeological potential more fully by appointing a consultant industrial archaeologist. This appointment, held by Mr David Bick, was funded by the WDA.

In his account of the area, Mr Bick outlined its history, suggesting the survival of workings as early as the Roman period at the north end of the site, and identifying several important features, such as the Cornish enginehouses (Bick 1989, 86, 88). One of the most important messages contained in Bick's submission, was his insistence that due to the potential burial of many important features beneath spoil or undergrowth, great caution should be exercised in any future reclamation. Subsequent excavation showed this advice to be well-founded, as a complete eighteenth century farmstead was later discovered below one of the waste tips. This clearly illustrates the need to undertake all such clearances with the greatest sensitivity to archaeological features.

The Consultancy felt Minera possessed great potential, and recommended that at least part of the site be developed as an open-air museum, a project which since its adoption in 1987, has been partly funded by the Countryside Commission.

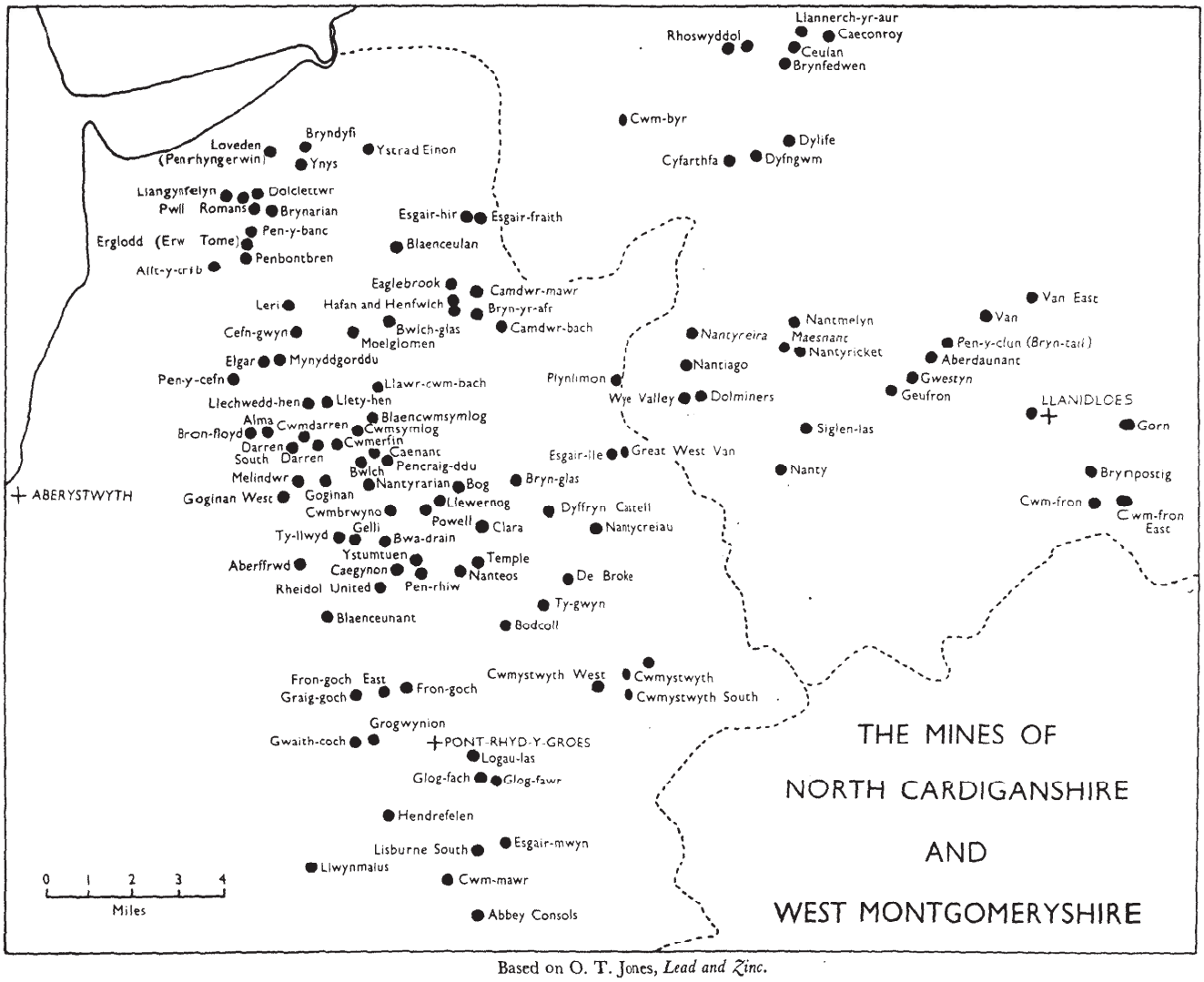
By way of contrast to the Halkyn project, and indeed differing from many other industrial reclamation projects, Minera is clearly an industrial archaeology success story. Here, considerable research was undertaken before environmental assessments were made and although the survey was limited to surface features, it resulted in the discovery and description of important relics which might otherwise have fallen to the bulldozer. This project obviously benefitted from enlightened Council policies and from determined efforts on the part of the County Council Conservation Officer, Bersham Museum staff and the Consulting Archaeologist.

The Cambrian Mines Project

In 1988 Dyfed County Council, also funded by the WDA, engaged Messrs Clouston and Partners to undertake a survey of derelict metal mines in Dyfed. Cloustons' brief was the broad appraisal of *Physical, Environmental and Pollution Hazards,* and of *Development Potential.* The firm was asked 'to identify and draft proposals (including estimates) for the specific development and after-use of a limited number of sites where it was considered opportunities would exist for ... development' (Clouston and Partners 1988).

Fifteen major mining areas were outlined: Cwmerfin-Bwlch; Frongoch-Wemyss-Graiggoch; Cwmrheidol-Tynyfron-Rheidol United-Ystumtuen; Cwmsymlog; Castell; Cwm Ystwyth; Grogwynion; Nantymwyn; Level Fawr-Glogfach-Glogfawr; Esgairhir and Esgairfraith; Llwernog; Ystrad Einion; Dolaucothi; Bronfloyd and Llancynfelin (for grid references and further details see Bick and Williams this volume, Chapter 28; Fig 14).

Greatest concern is expressed for real or potential pollution hazards at Cwmerfin-Bwlch, the Cwmrheidol group, Grogwynion, Nantymwyn, and the Level Fawr Group. Llwernog and Dolaucothi



Based on O. T. Jones, *Lead and Zinc.*

Figure 14 Lead mines in Cardiganshire and W Montgomeryshire (from Lewis 1968, fig 2. Reproduced by permission of the University of Wales Press)

are noted as having museum and visitor-centre status; the Frongoch-Wemyss area is considered to possess remains of 'outstanding ... engine houses and other structures' (Bick *et al* 1986; Bick 1989, 86, nos 23–5); there is a fine engine house at Nantymwyn (Hall 1971, 51–9, Rees 1975, 131–2, Rees 1977, pl 35); an underground water wheel at Ystrad Einion (Hughes 1980; see Stephen Hughes, this volume, Chapter 9, Fig 15); well preserved surface remains at Bronfloyd (Bick 1976, 26–9), and Llancynfelin has an outstanding example of chimney (Bick 1976, 42–3; 1989, 86, no 21). Only Esgairhir and Esgairfraith are said to be of 'great historic interest', presumably owing to the quality of the account presented by Palmer (1983; Bick 1976, 53–61), after exploratory excavation and exhaustive research. Curiously, the report attaches little or no value to the industrial archaeology or history at Cwmerfin-Bwlch (Bick 1976, 10–15, 38–42), the Cwmrheidol-Ystumtuen group, Castell (Bick 1975, 10–11), Grogwynion (Bick 1974, 17–18; Thorburn 1988), and Nantymwyn, despite the presence of a fine engine house at the latter, and although Pritchard (1985) has demonstrated the Rheidol United group to have considerable historical interest. As four of these 'historically uninteresting' areas are also among those considered to possess real or potential pollution hazards, concern must be expressed at the possibility that they may be *in* imminent danger of being cleared away without full survey and record.

More positively, the report highlights derelict mines with tourist potential; Frongoch, Castell, Cwm Ystwyth, Nantymwyn, Llwernog, Ystrad Einion, Dolaucothi and Bronfloyd. It also recommends that Llwernog be developed further and that that a 'country drive' be established, including thirty-three tourist attractions of which fourteen could be disused metal mines. Obviously such an enterprise requires car-parking provision, picnic sites, signposting and interpretative facilities.

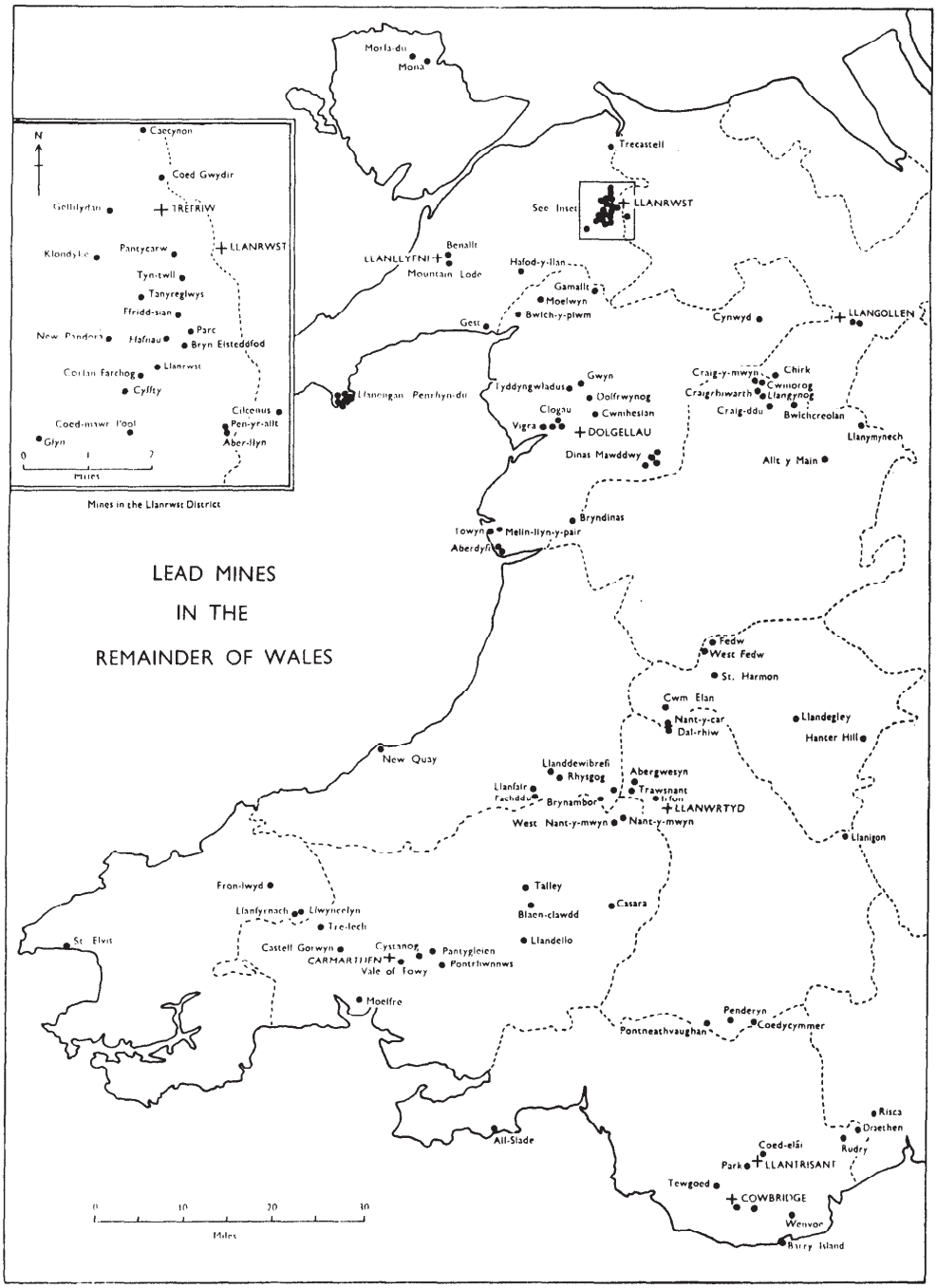


Figure 15 Lead mines in Wales (from Lewis 1968, fig 10, by permission of the University of Wales Press)

Specific recommendations are made for Statutory Protection of the surviving features at Frongoch-Wemyss, Cwmsymlog, Cwm Ystwyth, Esgairhir and Bronfloyd as Ancient Monuments. Costs estimated at around £6.3 million are submitted for executing the environmental work and responsibility for its implementation would involve both the WDA and Dyfed County Council. Well over 95% of the capital estimate is attributable to land reclamation. Greatest among hazards necessitating this reclamation is obviously pollution. But other priorities include making safe up to sixty-five sites where uncapped shafts, adits, and/or open levels are located close to footpaths or highways. The need for urgent survey of the most important buildings and structures on the major sites is recognised, and it is also urged that consultations be undertaken to fulfil1 the intention of Statutorily Protecting them. Particular concern is expressed that due regard be paid *inter alia,* to nature conservation and industrial archaeological interests throughout future undertakings.

What, then, are the long-term implications of this report for industrial archaeology?

Of 200–300 known mid-Wales mining sites (Fig 14; Foster-Smith 1979), at the moment not more than a handful enjoy Statutory Protection (see Strachan, this volume, Chapter 28); parts of Bryndyfi, Darren, Ystrad Einion, Copa Hill (Cwm Ystwyth) and Frongoch. Upstanding mine buildings are now rapidly diminishing in numbers, so in this respect the report's recommendations are most welcome. But evaluation and protection must now go ahead quickly. Already the ore-processing shed at Cwm Ystwyth (see front cover; Rees 1965, pls V.2, V.3; Hughes 1981), has been dismantled for scaled-down re-erection at Llwernog Mining Museum during summer 1989 using WDA finances. It is to be lamented that such an important topographical and historical landmark should have been removed from its context, rather than offered *in situ* protection and restoration.

Clouston's recommendations fall short in one important respect: they include no insistence on full archaeological survey prior to development, and no suggestion as to how future heritage evaluation might be resourced. Since the report's analysis clearly demonstrates its objective to be providing suitably 'cleaned-up' and touristically 'visitable' sites, it has to be protested that the 'cleaning-up' might well sweep away important buried features. Upstanding remains are only part of the story, so those sites under consideration for protection comprise but a small proportion of the known archaeological potential. Only full and exhaustive historical research and systematic field survey (with occasional trial excavation) might establish which mines and processing areas (if any) still preserve stratified deposits demonstrating, for example, pre-Monastic extraction, Cistercian exploitation, or the works of the Mines Royal. Thorburn (1987) has recently shown the value of systematic fieldwork, by finding the isolated and small, presumably early, primitive ore-processing floor at Nant Silo (SN 653 836). Obviously, without in-depth documentary study, neither the origins of this nor the sites at which more recent technological developments took place, are likely to be ascertained. In this respect it is noteworthy that although the proposed land reclamation budget is large, no monies appear to be earmarked for archaeological survey or historical research.

Difficulties have already been experienced in land-clearance proposals without prior archaeological consultation or survey. Owing to a lack of Statutory Protection at Goginan lead mine (Ceredigion), proposals to landscape it were undertaken in 1988 (Richards, Moorehead and Laing 1987b), largely without regard for the archaeological potential of buried features at a historically important site, the origins of which go back to at least the seventeenth century (Hughes 1988).

And although Ceredigion District Council has commissioned further archaeological studies of certain important mines on the central and northern parts of the orefield (Richards Moorehead and Laing 1990), it is unclear how far the mines' histories may be taken into account when considering future planning applications for permission to develop, to landscape, or to infill.

Commercial mining museums

Dolaucothi is arguably the longest-established metal mining museum in Wales, its National Trust visitor facility dating from about 1972 (Clough and Briggs, this volume, Chapter 20). Since then, two others have come into existence; the Lead-Silver Mine at Llwernog, The Mid-Wales Mining Museum Ltd (SN 733 809) in 1974, and Sygun Copper Mine (SH 606 486) which was acquired and established as a visitor centre in the mid 1980s. Neither site enjoys Statutory Protection.

Llwernog's known history began in the 1740s, but its main floruit of activity was during the 1860s and '70s. Although at the time it opened as a museum, probably not the best preserved, most historic or comprehensive collection of processing features, the site occupies a prime position on the A44 between Aberystwyth and Newtown. For the fifteen years after its opening, restorations and working features gave the impression of a frontier industrial settlement, set in a wilderness of dumps and abandoned workings. More recent development, however, has seen the erection of brick and wooden entrance buildings not entirely in keeping with either the period or spirit of mine exploitation.

Equipped with video display, the centre is geared to educational visits from school parties, most groups apparently coming from outside mid-Wales. About a dozen fact-sheets are available *(Llwernog Mines Pamphlets);* these are of variable interest, but are readable and modestly priced.

Considerable effort has been expended upon authentic restoration, and numerous relics have been imported from abandoned mines elsewhere in north Cardiganshire. These include a waterwheel and the scaled-down ore-dressing shed from Cwmystwyth (front cover).

Restoration has been made possible during the past ten years, through tenure of MSC/CP funded schemes administered by Ceredigion District Council. Further expansion for tourism now appears likely under the recommendations of the Dyfed County Council Plan outlined above. Over the years, developments at the mine have involved considerable ground disturbances for building, excavation for the location of ancient features like leets and adits, and for normal service installations.

Unlike Llwernog, which has always enjoyed local authority support, permission to open Sygun was only granted on appeal after a Planning Inquiry,

since the Snowdonia NPA had refused planning permission on the grounds of highway access, and *inter alia* due to a belief that the area's tourist heritage potential was already well served by the Llechwedd Slate Mining Museum at Llanberis. Like Llwernog, Sygun is also easy of visitor access, lying in Nant Gwynant, on the main road to Cape1 Curig, just outside Beddgelert. The site has considerable interest to the history of mining technology, as one of the earliest installations at which Elmore's patent ore separation process was developed during the late 1890s (Bick 1987). Remains of the ore separation tanks survive, forming an important component of the site. Formerly overgrown processing floors and a wheel pit lying immediately adjacent to the river have now been cleared out and consolidated for display; part of the workings have been made accessible through a safe underground walk. There is also a water-powered half-scale stamp battery in working order. The car-parking facility covers old mining dumps.

Discussion

First, the importance and nature of the sites must be considered. Great numbers of mines are involved in the three projects outlined above. And, whereas at Minera caution was urged against development without archaeological investigation, the consultants were in this case dealing with a local authority particularly sympathetic to environmental and historical interests. At present, local and county authorities are not obliged to act upon enlightened recommendations of this type, and had the commissioning agent been a commercial developer, it is quite possible that the mine's unprotected features might still have been covered or damaged, as they no doubt will be over about one-third the area of historic mining upon Parys Mountain (Briggs, this volume, Chapter 14).

In recent years whereas most local authorities have awoken to their environmental responsibilities in respect of derelict industrial sites, perhaps overzeal for cleanliness has caused many to be swept away without record. Would 'public archaeology' knowingly allow unmonitored 'cleaning-up' or covering of landscape elements at hillforts, early field-systems or around the stratified levels of a medieval town? It seems unlikely. There are those who may feel the comparison between mines and these sites to be invalid. But is it? Like many classes of antiquity, there is a limited number of old mining sites. Also in common with other specific classes of monument, by and large, their periods of exploitation were also limited. Like medieval settlements, some mines enjoyed great longevity; also like medieval settlements, only limited documentary sources survive, in some cases explaining how they came into existence, or detailing production outputs.

Minimal excavation and fieldwork has shown surviving documentation for some mines to be quite misleading in any case. Surface indications alone are insufficient for evaluation. Owing to the nature of nineteenth century mining speculation, claims about advanced innovation in adit-driving or processing were not infrequently made to help attract share capital. Some claims now appear highly improbable when surviving features are examined, for example at Rheidol United (Pritchard 1985). Excavation has also revealed differences between documented nineteenth century claims and the features actually discovered at Esgair Hir (Palmer 1983).

Many old metal mines have therefore a great deal in common with other types of abandoned site; often little is known of their origins, their longevity, or the working methods employed there. Indeed, in some instances, the type of metal mined in antiquity may even be in question. At Dolaucothi, for example, unpublished nineteenth century records seem to suggest the mine was tenanted for silver and copper exploitation, not for gold, as was later the case (Dolaucothi papers, NLW, E Plunkett-Dillon, pers comm).

Through the eyes of one coming to industrial archaeology from studies of earlier periods, it appears that when compared to older monument types, mines are at present inadequately protected, so that many important sites could still be reclaimed quite without archaeological consultation. Indeed, it is only through the strong personal commitment of their owners (and other enthusiasts) that some of the surviving visitable mines have been rescued and restored as visitor attractions. And it is no criticism of them that earth-moving can be and has been undertaken in the vicinity of historic features there without close archaeological scrutiny.

There is a clear need for the adoption of particular criteria in the evaluation of industrial sites for conservation and preservation. Although ideally, this evaluation should pay due regard to present condition, dates, type and scale of layout, potential vulnerability to damage, and numbers of existing examples, thought must also be given to documented histories and to their potential value in the wider history of technology. Conservation policy should also be based upon rapid archaeological survey of the whole sample and in-depth survey of a representative group of mines, possibly even with selective excavation.

The Welsh Industrial Archaeology Panel has begun making recommendations for Statutory Protection. Respecting the mines, although it may now seriously consider a policy which selects a representative sample of sites, so that individual industrial processes are each preserved, there are cases involving whole industrial landscapes, where the existing legislation appears inadequate for effective preservation. Such cases might profitably be given Area Protection, which is now urgently

needed, particularly for this type of site. Another possibility would be for the introduction of Landscape Conservation Orders, the promised introduction of which has recently been delayed; or simply to use existing planning legislation by creating Conservation Areas.

There is certainly some urgency for a more imaginative approach by local planning authorities, which needs to go beyond those controls which normally offered and carrying minimal constraints on development.

The Panel might consider going a step further. At present (money permitting), the opportunity exists to select a handful of the most impressive, historic, or apparently ancient sites for future generations to enjoy and to study. It must be asked, if the State can own and maintain several massive medieval castles which belong to a period and to activities remote from the present, why should it not do the same for industrial monuments, much closer in time, and much more relevant to present-day economic and social values? At present in Wales, the State owns only Bryntail lead-mine (Bick 1977, 35–8). Serious thought might also be given to taking into care Frongoch for its unusual collection of engine houses and as the birthplace of the Lisburne Buddle; among gold mines, Gwynfynydd (SH 737 282 and 736 275) or Clogau (SH 670 200) *(Archaeology in Wales* 6 (1966) 29), neither of which is even Scheduled at present.

Finally, it is clearly desirable that future land reclamation developments like those proposed for N Dyfed be preceded by detailed archaeological fieldwork and survey by National Archaeological Survey and National Monuments Record staff. It would be unfortunate if further extensive mining tracts were to be redeveloped quite without any State archaeological presence, and, since the main resourcing agency for such work is the WDA, it would seem reasonable to hope that it might fund or part-fund a liaison archaeologist to help coordinate the necessary research, survey and conservation work. Without a clearer mandate from State Archaeology, there is at present some danger that 'conservation' work in north Dyfed and elsewhere could actually sweep away a significant proportion of its as yet poorly researched, under-protected, historical and archaeological heritage potential.

Acknowledgments

The writer thanks Stephen Greuter for helpful discussion of preservation priorities; Drs S D G Campbell and B Hains of the British Geological Survey; Mr N Ward of Richards, Moorehead and Laing; and Mr John Llewelyn of Dyfed County Council, for kindly providing information upon the main sites discussed in this review. Thanks are also due to Mr James Thorburn.

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Section II: Recording

8 Problems of Recording

by Marilyn Palmer

The value and nature of the Welsh industrial landscape

One of the major problems in recording the industrial heritage of Wales is its very richness. Metalliferous mining took place in most of the Welsh counties: coal was extensively exploited in the south, while other areas witnessed a great demand for stone and slate. Because of the difficulties of transport throughout much of Wales, fuel could not easily be taken to industrial sites, many of which, therefore, remained waterpowered well into the nineteenth or even twentieth centuries. Equally, the decline of metalliferous mining in face of competition from larger deposits overseas and the lack of subsequent development in Wales, except in the south and parts of the Denbighshire coast, has resulted in a relict industrial landscape unique in the British Isles. So much survives in a relatively compact area, a fact which has been exploited by the Welsh Tourist Board in their excellent publication, *A glimpse of* the *past* (Anon n d). This covers much more than the well known 'Little trains of Wales' and includes tours through the Rhymney and Rhondda Valleys, an industrial trail through the Lower Swansea Valley and car trails to visit gold, lead and silver mines. It would be interesting to compare visitor figures to, say, Harlech and Dolbadarn castles with those of the North Wales Quarrying Museum in Llanberis or the Llwernog Silver-Lead Mine at Ponterwyd. Many visitors to Wales are as interested in its industrial heritage as in its more remote past. So many visitors to Wales come to walk and to enjoy scenery: it is difficult to walk anywhere in Wales without coming across relics of industrial activity, and many have been turned into trails and boards erected to explain the sites, which add greatly to the understanding of the Welsh landscape.

Threat to Welsh industrial archaeology

For how much longer, however, is the visitor to Wales, or the student of the industrial past, going to be able to enjoy the Welsh industrial landscape? Inevitably, development threatens many sites and if the Welsh economy is to thrive, relics of the past will have to disappear. Many industrial sites have not the aesthetic appeal of vernacular housing or castle architecture, and a case cannot be made out for the preservation of the entire industrial past of the Principality. What should be done, however, is to record these sites which, attractive or not, are as much a part of the past as Offa's Dyke or Caernarvon.

What are the threats?

(a) **The Welsh Development Agency,** which wishes to clear and utilise derelict land which is usually where mining sites survive. The Agency has clearly done some very useful work in parts of Wales, but because of the lack of a body such as the Scottish Industrial Archaeology Panel in the past there have been no means of ascertaining interest in specific sites on land which they might, rightly, be thinking of clearing for development.

(b) **The Forestry Commission,** which has already covered large areas of land and is still active. Industrial archaeologists have enjoyed good relations with the Commission — they allowed the writer to work on the sites of Esgair Hir and Esgair Fraith in Cardiganshire for two seasons. However, owing to poor communications between archaeologist and forester, a road was driven through the lead dressing floor. Much had already been recorded, and was later published by the Northern Mines Research Society as *The richest in all Wales* (Palmer 1983) — the incident serves to make the point about the urgency of recording in much of upland Wales. In 1988 after many years' delicate negotiations a Liaison Committee for Archaeology and Forestry was established in Wales, and it is hoped that this will tackle problems of industrial archaeology with vigour equal to that given to prehistory.

(c) **Lack of first edition 25-inch Maps.** The need for recording in these areas is made more essential by the fact that first edition 25-inch maps, dating from the 1870s and 1880s when so much industrial activity was in full swing, were not published for so-called waste areas, usually above the 1000 ft (300 m) contour, which includes many metalliferous sites.

What has been done

(a) **Statutory recording bodies.** The Welsh Royal Commission has a good record in the industrial archaeology field, having appointed a Commissioner with an industrial brief from the early 1970s, first the late David Morgan

Rees, then the late Professor Gordon Tucker, and latterly Dr Geraint Jenkins. The personal interest of members of staff has helped, particularly the late Douglas Hague, Tony Parkinson, and Stephen Hughes. Some of their work has been published, for example Stephen Hughes' monograph on the Montgomeryshire Canal and, more recently, a joint publication between the RCAHM(W) and the Northern Mines Research Society on the important Frongoch lead mine in Cardiganshire (Bick *et al* 1986). But the professional staff have other tasks to do and cannot cover the entire field of industrial archaeology nor, with present staffing levels, undertake the historical research necessary to support building and site surveys.

Cadw is involved in listing industrial buildings. At the time of the 1986 conference Jeremy Knight, one of their five inspectors, had special responsibility for industrial sites, a major responsibility when the extent and importance of Welsh industrial archaeology is realised. In September 1990 it was joined by Peter Wakelin, who initially has specific responsibility for the Valleys.

(b) **Local societies.** The writer has recently carried out a survey of all societies affiliated to the Association for Industrial Archaeology to ascertain the kinds of recording and survey work they were doing. In England, a great deal is done by amateurs, some of it to a very high standard. The terrain of Wales probably militates against active county Industrial Archaeological Societies, although some good work has been done by the South-West Wales Industrial Archaeology Society and by the Oxford House Society at Risca. The former has produced some well-presented industrial trails in conjunction with Swansea City Council and undertook major rescue and restoration work at Scott's Pit, Llansamlet. The latter worked on the restoration of the Melingriffith Water Pump on the outskirts of Cardiff, and were awarded the Dorothea Award for restoration by the Association of Industrial Archaeology for their work there (Williams, this volume, Chapter 24). In the mid 1970s they excavated the Rudry Furnace, dating from 1829–1833. This had only a short working life but had rail connections to the Rhymney Tramroad. Unfortunately, they had to backfill before the work was really completed, but this was done very carefully to preserve the archaeological integrity of the site.

In 1986 a group was set up in mid-Wales, the Ceredigion Mines Group, to encourage and assist the preservation and consolidation of buildings, machinery and other features, above and below ground, associated with mine sites and mining in Cardiganshire. Such a group is badly needed but could, as well as attempting to preserve sites, take a leaf out of the book of the Peak District Mines Historical Society in England, who are recording all surface detail of mining activity on the White Peak of Derbyshire, using standard symbols: the information obtained is kept in 250 folders each covering two grid squares and also containing a 25–inch map of the area covered.

(c) **Field groups.** The writer's work in Wales has concentrated on the Cardiganshire lead mines. It is perhaps significant that several lecturers who teach practical industrial archaeology in England bring students to Wales to carry out survey work! This is partly because so much needs to be done and, particularly when working with adult students, it is important that they should feel they are doing something worthwhile which is not just an exercise. Secondly, it is important that those learning industrial archaeology in the lowlands of England should have some experience of the uplands. Dr Michael Lewis has carried out extensive work with adult students from the University of Hull, on the slate quarries of north Wales. His group produced what should be regarded as a model industrial archaeology monograph, *Rhosydd Slate Quarry* (1976), notable for its detailed recording work as well as for its historical research. His work on the north Wales slate industry continues through courses run at Plas Tan-y-Bwlch, the Snowdonia National Park Study Centre at Maentwrog. The writer's work with adult students has been centred on recording the remains, and carrying out some excavations, on the sites of Blaenceulan, Temple, Bron Floyd, Bryn Dyfi, and Ystrad Einion in Cardiganshire. The problems for all groups of this kind is finding the necessary time to consolidate and publish the work, a problem shared by many others including the staff of the Royal Commission who are heavily engaged in rescue surveys and do not therefore always have the time to follow up the sites they record in detail. The Cardiganshire lead mining recording has been written up in the form of an article on *The comparative archaeology of tin and lead dressing,* published by the Peak District Mines Historical Society (Palmer and Neaverson 1989).

The writer has continued work on recording industrial archaeology in Wales with a research team by recording the unique colliery site of Glyn Pits near Pontypool in south Wales, where an 1845 beam pumping and winding engine and a vertical winding engine of uncertain date remain *in situ.* A detailed report was sent to Cadw in 1989 and the work was awarded the Association for Industrial Archaeology's annual Fieldwork and Recording Award for Initiative in 1990 (Palmer and Neaverson 1990). Yet the site, a Scheduled

Ancient Monument, has been allowed to continue to decay, despite enthusiastic statements by both Cadw and the local planning authorities which have not been followed up by any practical action. It is therefore necessary to record not only sites threatened by afforestation or development but also those sites which have been Statutorily Protected since the latter is no guarantee of survival.

Other survey work is done on an annual basis by staff from RCAHM(W) for the Institute of Industrial Archaeology in Ironbridge, which has resulted in some very useful recording work.

(d) **Individual research.** There are many enthusiastic students of Welsh industrial history and archaeology, particularly its mining heritage, who have contributed to the recording process. Notable among these is David Bick, whose volumes on the Cardiganshire and Montgomeryshire lead mines Bick, 1974–8) recorded the surface remains on numerous sites in considerable detail: his gazetteers include lists of pumping and winding engine houses, crusher houses, dressing plant, etc. He also included extracts from first edition Ordnance Survey maps which enable the reader to interpret the sites. A similar approach has been adopted by J Bennett and R W Vernon in their planned seven part series on the mines of the Gwydyr Forest area of the Snowdonia National Park (Bennett and Vernon 1989). Their first volume on the Llanrwst mine contains a careful drawing of the pumping and winding engine, while their second volume on the Hafna mines include a detailed pull-out plan of the layout of the dressing floors. It is heartening to see such meticulous attention being paid to the recording of surface remains.

The future

Although, therefore, in-depth recording work has been carried out in Wales, it has been on a piecemeal basis with no overall plan or policy. This is what Wales so desperately needs. The writer would, therefore, make four major recommendations:

(a) **The need for thematic surveys of the whole Principality.** The rather disjointed survey work which has been carried out, either by amateurs or professionals, does not enable generalisation to be made about the Welsh industrial heritage. In Scotland, the Scottish Industrial Archaeology Survey has completed thematic surveys of, for example, windmills, watermills, and the heavy ceramic industry, etc, throughout the whole of Scotland, including the islands. This has enabled the significance of individual sites to be appreciated and has also enabled the recorders to understand the development of the particular industry being recorded. Graham Douglas has, for example, been able to produce a sheet illustrating the development and regional differences of Scottish water mills. This work has proved invaluable in determining priorities for listing and scheduling. Such surveys, badly needed in Wales, have been presented to the Industrial Archaeology Panel since 1988 (Bick 1989).

(b) **Research.** It is impossible to produce adequate records of the industrial heritage without paying some heed to documentary research. This is, after all, what industrial archaeology is all about — the ability to relate fieldwork to documentary evidence because of the comparatively late date of what is being studied; but adequate research takes time, The Esgair Hir survey involved long periods in the North Library of the British Museum as well as in the NLW. In his work on the Yorkshire Textiles Mills survey, Colum Giles of RCHM(E) has had the help of a researcher who provides historical details about mills to be visited before sites are recorded, and so enables the recorders to look for specific features of interest. The staff of RCAHM(W) need similar research support.

c) **Publication.** The surveys carries out by the Royal Commission and other public bodies are deposited in the NMR(W) which is a valuable archive. However, it is not perhaps enough to create an archive of recording work; it is also necessary to publish some of it to create public awareness. RCHM(E) has recently done this in conjunction with the West Yorkshire Metropolitan County Council by producing the two excellent volumes on rural housing (Giles 1986) and workers' housing in West Yorkshire (Caffyn 1986): the Scottish Commission has published Geoffrey Hay's and Geoffrey Stell's important *Monuments of industry* (1986), which reveals the industrial recording work carried out in Scotland. The Welsh Commission has produced the book on Frongoch in conjunction with the Northern Mines Research Society as mentioned earlier. More recently, a second edition of Stephen Hughes' *The archaeology of the Montgomeryshire Canal* has been published and he, in conjunction with Paul Reynolds of the South West Wales Industrial Archaeology Society, has produced *A guide to the industrial archaeology of the Swansea region* (1989). The latter was produced in preparation for the conference of the Association for Industrial Archaeology in Swansea in 1988 but will appeal to all interested in the industrial heritage of south Wales. Since publication takes time, it is probably best not done by those who have

expertise in field recording, since their skills are badly needed in rescue surveys, but they do need the support of photographers and graphics staff if their recording work is to see the light of day beyond deposition in a public archive.

(d) **Welsh Industrial Archaeology Panel.** At the time of the Cadw/CBA conference, it had already been recommended that some forum for exchange between the professional and the amateur was badly needed, so that each would know what the other was doing and could dovetail their work and avoid duplication: there was also a need to assess priorities (Briggs, this volume, Chapter 1). The Scottish Industrial Archaeology Panel, which had last met in 1982, in 1986 decided to convene on a twice-yearly basis with the brief that it should act as 'an informal and wide-ranging forum for the exchange and coordination of information relating to industrial sites, artifacts and records', not as policy-making or management body. This kind of informal exchange was also badly needed in Wales: industrial archaeologists working in Wales could often only find out what others were doing by accident, or at conferences. The establishment of a Welsh Panel (Hughes this volume, Chapter 26) is therefore much to be welcomed.

Three major areas of action are therefore needed to tackle the vast problem of recording Welsh industrial archaeology,

1 The statutory recording and listing agencies should recognise the value of the Welsh industrial heritage for what it is, of equal value with the more remote archaeological and historical heritage of Wales. I would go so far as to say that nowhere else in the British Isles is there such a concentration of instructive industrial landscapes within a relatively compact area as in Wales.

2 The staff of public recording bodies such as the RCAHM(W) should have both the necessary field and back-up staff to enable thorough thematic surveys as well as rescue surveys to be carried out, and the results to be readily available through publication as well as deposition in public repositories.

3 A Welsh Industrial Archaeology Panel should be established to enable the exchange of information to take place between the amateur and the professional working on the Welsh industrial heritage, and it should meet on a regular basis.

It is hoped that these recommendations meet that approval of those in a position to best help implement them.

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9 Industrial archaeology and the Royal Commission on Ancient and Historical Monuments in Wales

by Stephen Hughes

Established in 1908, the Commission first concerned itself in post-medieval industrial archaeology with sections on windmills, roads, harbours, and ferries in its *Inventory of Ancient Monuments in Anglesey* (1937; third impression 1968).

A much more substantial and continuous commitment to industrial archaeology came about after the Commission assumed responsibility for the NMR(W) in 1964. Some 3600 industrial archaeological sites, classified by type, have since been indexed as part of a record that holds details of over 30,000 Welsh sites of all periods. The Welsh Commission, unlike its counterparts in England and Scotland, has always had a sophisticated indexing records system open to the public. It is possible, for example, to locate watermills, canals, railways, japanning works, foundries, and forging or smelting works throughout Wales, without having to make an intensive search through all the records of one locality. In recent years submission for the computerisation of this vast archive has been made in order to allow this record to keep abreast with its newly computerised counterparts elsewhere and these should come to fruition in 1990–91. Extensive accessions to the Record from other sources include industrial archaeologists' survey books, estate and planning drawings, and important photographic collections on a wide range of industrial subjects. A selection of stereoscopic views of the vanished Crumlin Viaduct (Fig 16) in Gwent is amongst the treasures from the Howarth-Loomes Collection now in the Record. Any further gifts of such industrial sources material would be most gratefully welcomed and acknowledged. It is also intended that books on 'Lost industries of Wales' should be published to make available to a wider audience a sample of the irreplaceable material held in the NMR(W).

In the early 1960s an attempt was made to begin the recording of the more important and/or endangered industrial archaeological sites of Wales. Sites where survey and recording has taken place fairly recently include: Frongoch (published as a joint monograph with the Northern Mines Research Society (NMRS) (Bick *et al* 1986)), Cwmsymlog, Cwm Ystwyth, and Cwm Einion (Fig 17); Ceredigion lead mines; Gwynfynydd Gold Mine in Merioneth; Morlais, Carmarthen, Abergorky, Felindre, and Scott's Pit Collieries, Glamorgan; Allt-du, Glynrhonwy, Dinorwic, Penrhyn and Pen-yr-Orsedd Slate Quarries (Caernarfon; see Parkinson, this volume, Chapter 6); Forest Tinplate Works, West Glamorgan; Bersham (Wrexham Maelor; see Grenter and Williams, this volume, Chapter 19), Cyfarthfa and Ynyscedwyn Ironworks, Glamorgan; the Leighton and Powys Estate Industrial Farming Complexes, Montgomery; Holyhead Station and the Ferry Workshops, Anglesey; Cardiff Tubal Cain Foundry, South Glamorgan, Clydach-on-Tawe, West Glamorgan, and the Aberystwyth Foundries, Ceredigion; Llynon, Anglesey, and Sully windmills, South Glamorgan; Haverfordwest Castlemartin Watermill (Fig 18), Abattoir and Churn Works, Preseli; and amongst many others, workers' housing and chapels at Dowlais, Georgetown, Abercanaid Square, and the Pentrebach Triangle at Merthyr Tydfil, Mid-Glamorgan. The latter two were recorded in response to listed building consent to demolish.

A major problem is that very few industrial monuments are Listed or Scheduled so that we are much more dependent, than is the case in more established archaeological disciplines, on our own primary fieldwork to locate industrial monuments before they collapse irretrievably into ruin or are merely bulldozed away. This is why the Welsh Commission began to host the Industrial Archaeology Panel for Wales; so that workers in this vast field could get together and help identify those monuments worthy of preservation and/or recording.

Even then the logistics of large-scale recording with present resources is a difficult one. The poor upland soils of Wales could not support a large population prior to the industrial period. The nineteenth century economic boom led to the growth of new communities all over Wales with their mines, factories, houses, and chapels. This forms by far the greatest part of the built heritage of Wales. The many surviving remains of the late eighteenth and early nineteenth century industrialisation in Wales antedate similar monuments outside the British Isles and are consequently of international significance.

Given present staffing levels, the Welsh Commission can only record a sample of the

Figure 16 Crumlin Viaduct (now demolished) during construction. Archive photo in NMR(W), Howarth-Loomes Collection

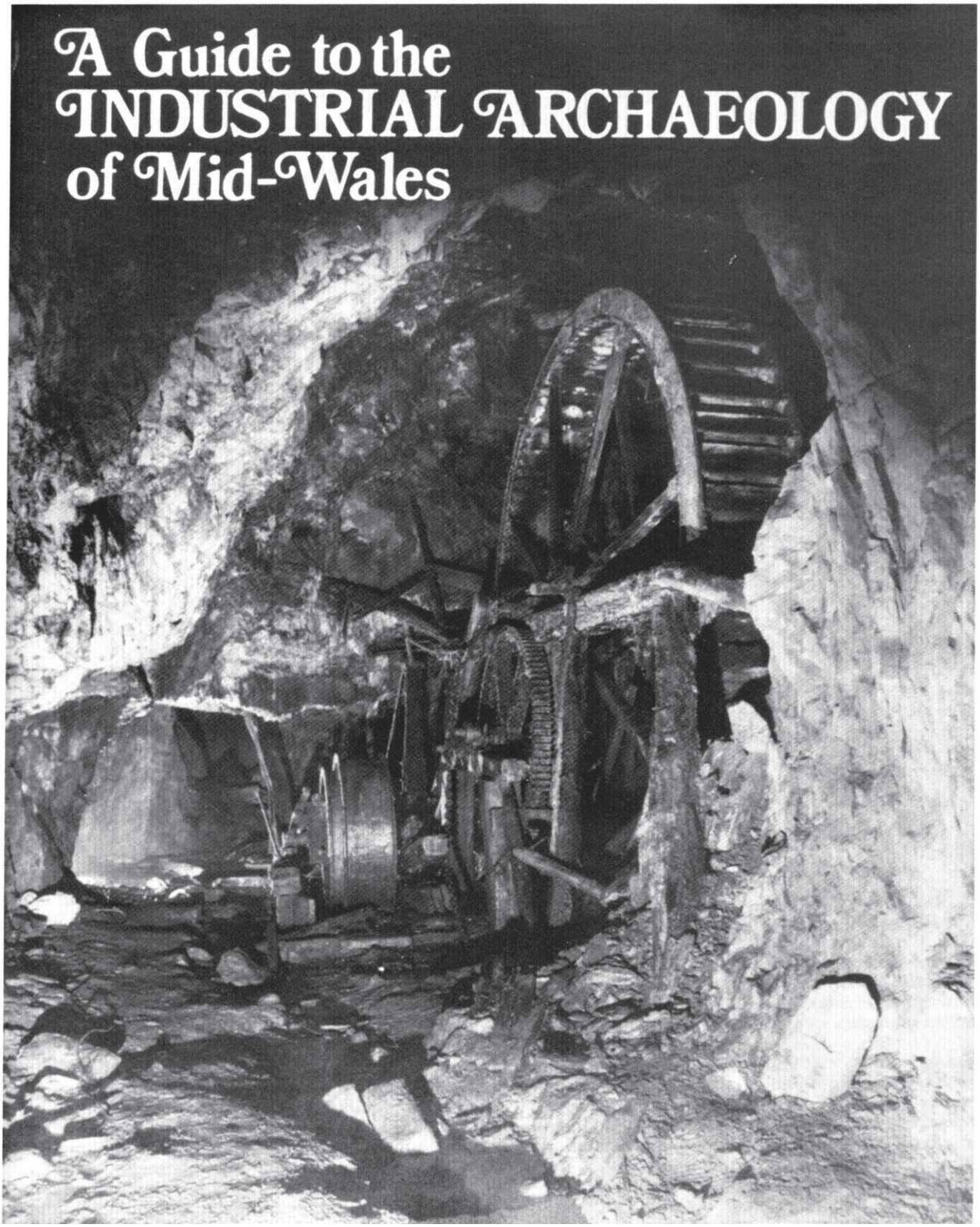

Figure 17 Cwm Einion lead mine waterwheel: record photo taken during RCAHM(W) survey (Crown copyright reserved)

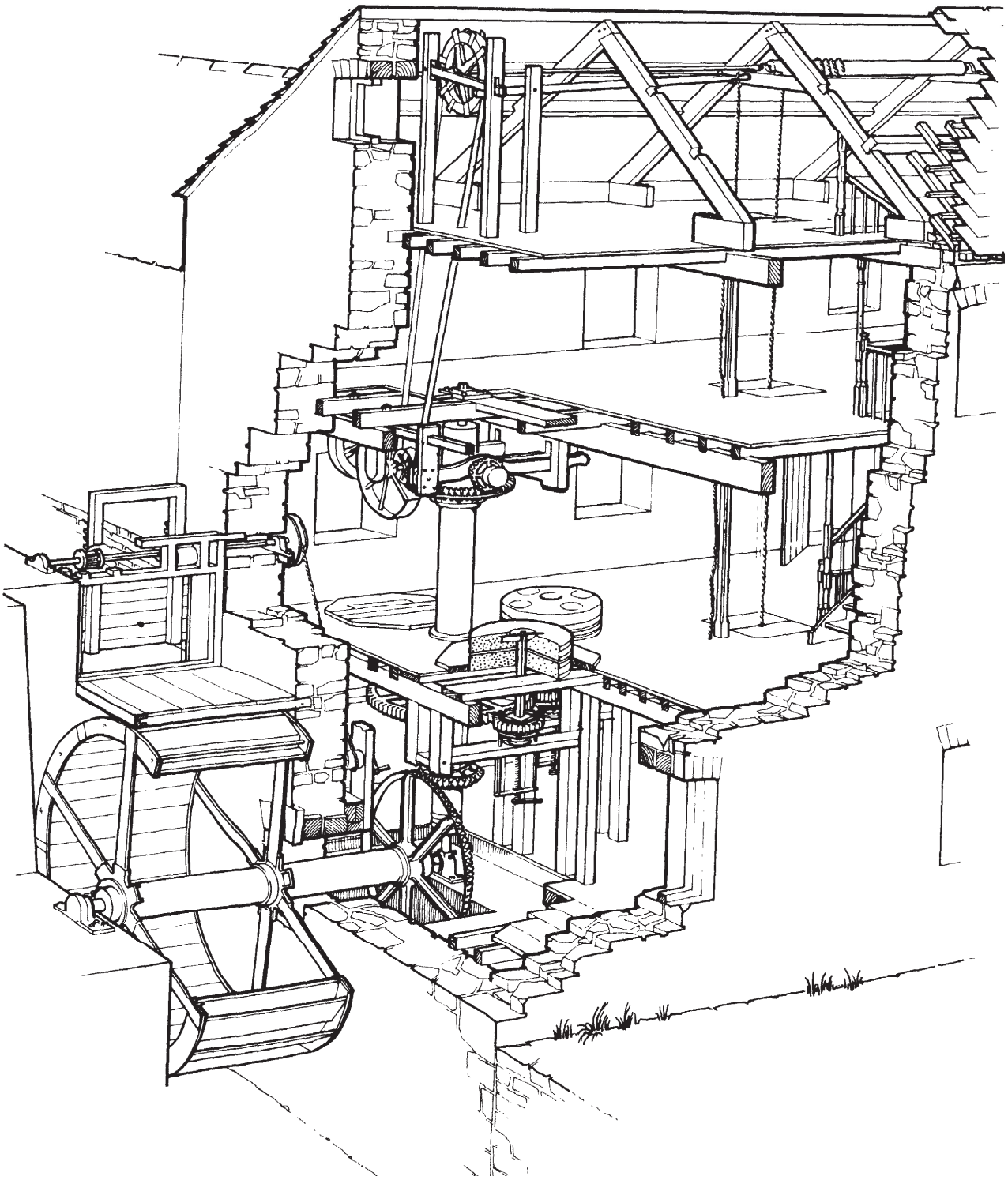

Figure 18 King's Mill, Castlemartin Army Tank Range, S Pembrokeshire: surveyed by RCAHM(W) as part of its programme of recording endangered buildings

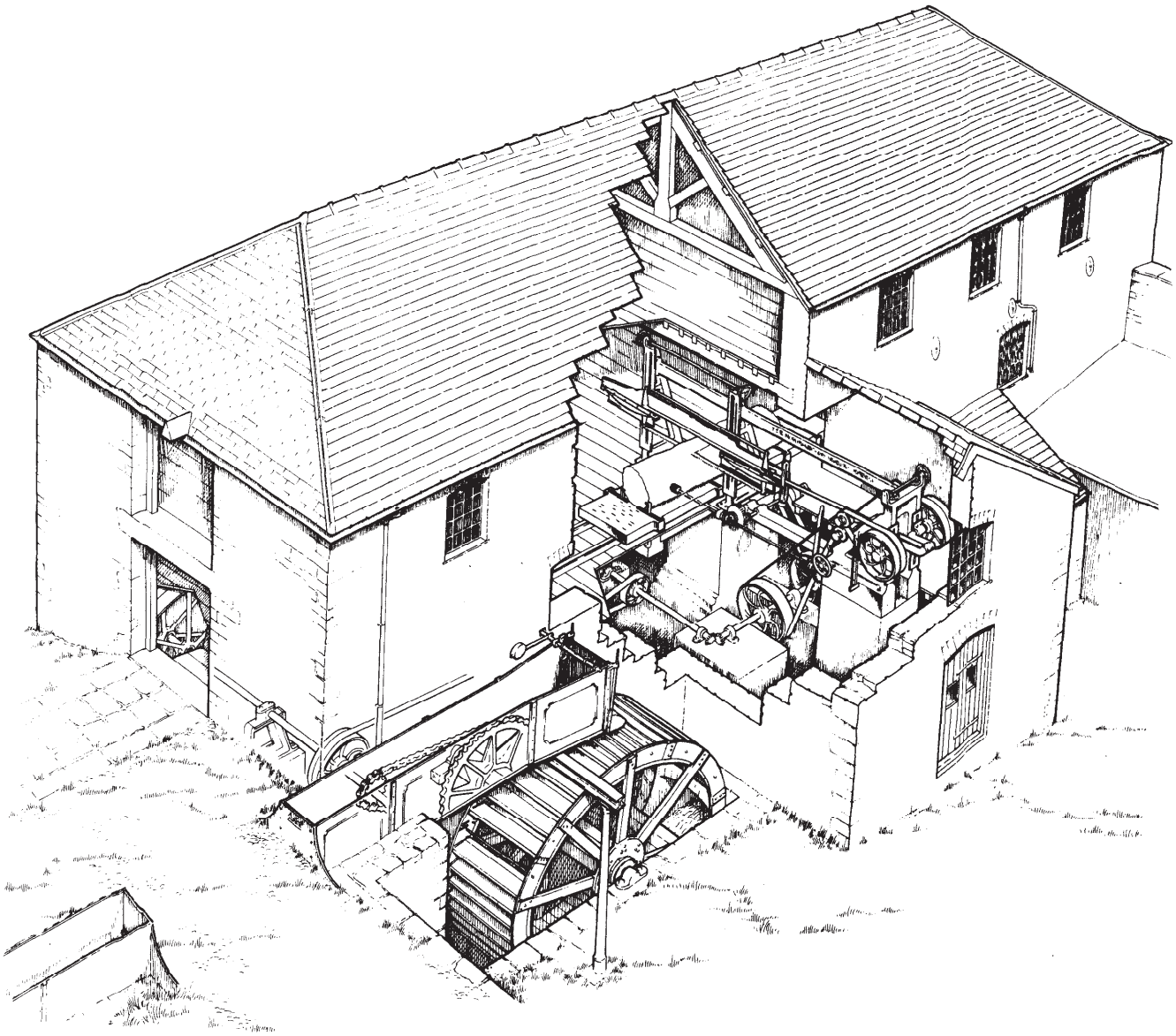

Figure 19 Powis Estate Sawmill, near Welshpool, Powys: a surviving miniature 'time capsule', recorded as part of an industrial archaeological training course run by the Commission, which the public may attend at a nominal fee

monuments of this period. Consequently, guidelines for those who wish to help in the task of making records of our unique and fast disappearing industrial heritage have been drawn up (Hughes *et al* 1985). At the 1981 CBA conference on 'The crisis in industrial recording', the Welsh Commission was the only organisation able to provide an answer to criticisms that none of the professional bodies were willing to train amateurs in the surveying and recording of industrial sites, The surveying course it was then setting up with the Ironbridge Institute of Industrial Archaeology has since provided training for students in industrial recording during each successive autumn. The availability of a number of personnel in training means that much more ambitious recording of large, complicated and important sites can be undertaken than would otherwise be the case. The finished ink drawings of a large number of sites have subsequently been lodged with the NMR(W).

Many of the earliest and most important industrial sites are in south Wales and often only fragmentary remains survive in an area of narrow, heavily populated and rapidly-changing valleys. In slower-moving and sparsely-populated rural mid-Wales there survive, by contrast, a whole range of 'time-capsule' sites – later in date than their south Wales prototypes but often with all their machinery intact, The complete recording of such interesting installations is also often beyond

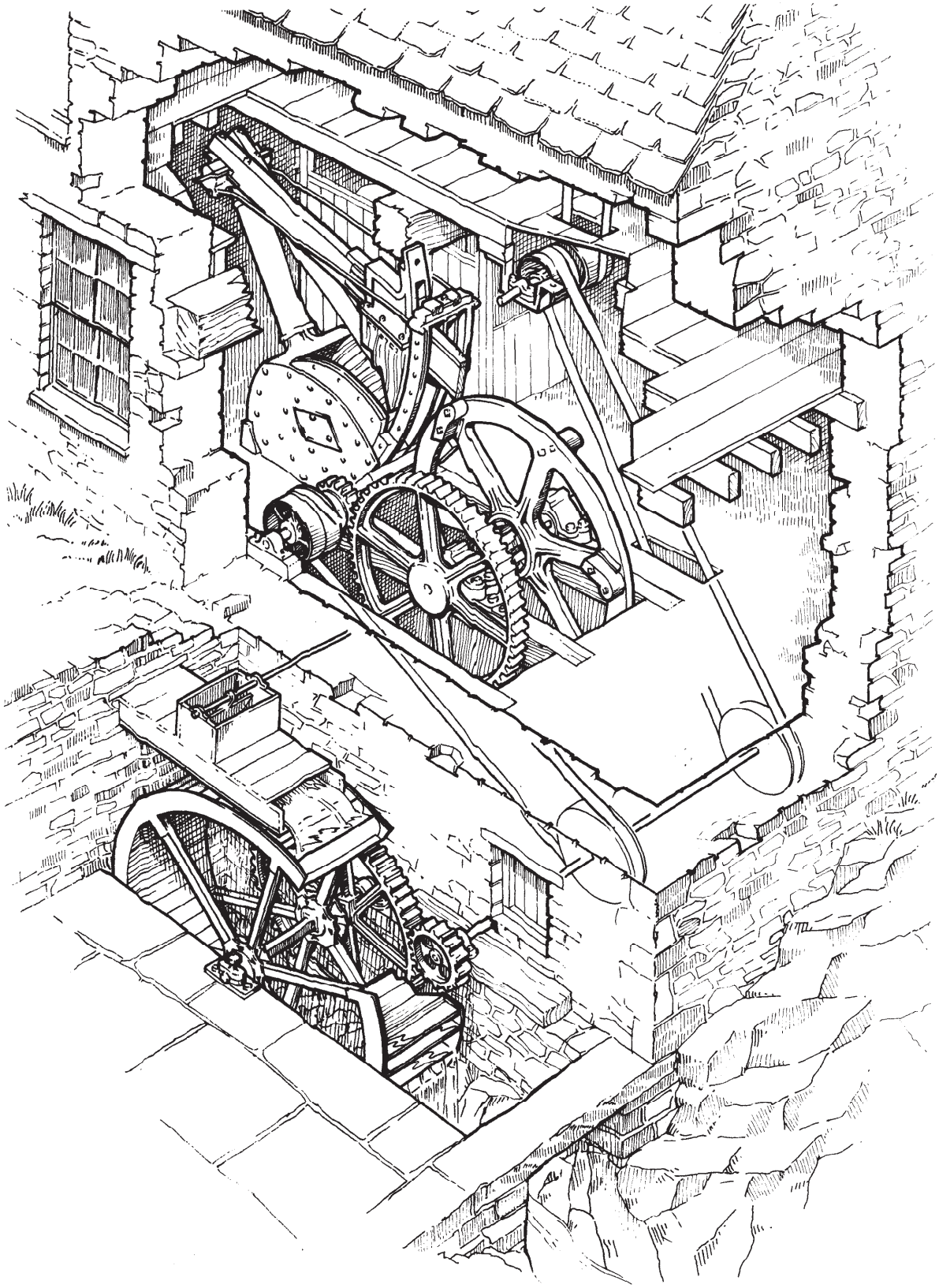

Figure 20 Moelwyn Mill, near Blaenau Ffestiniog, Merioneth: a survey commissioned from RCAHM(W) by Gwynedd Co Council

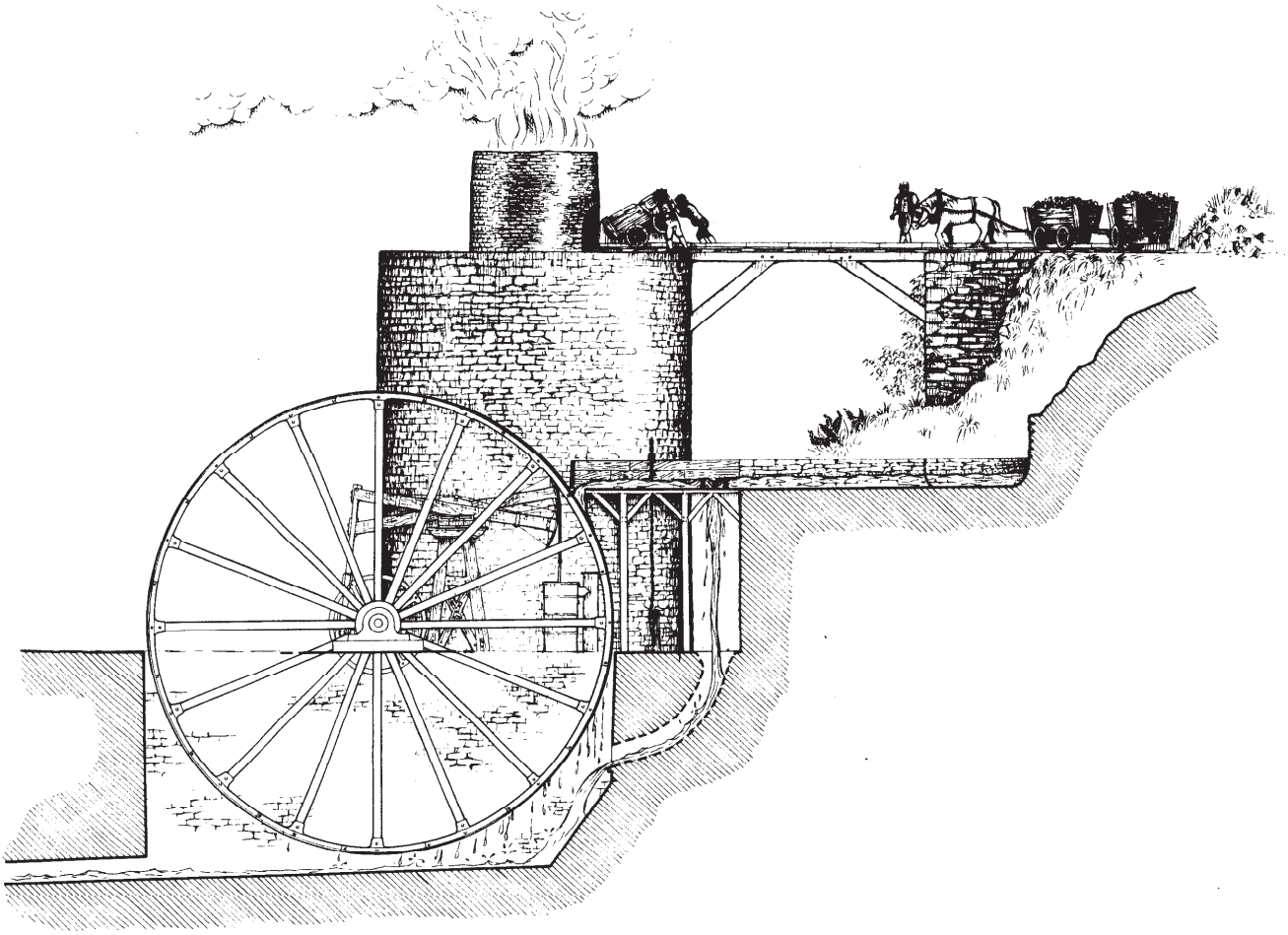

Figure 21 Abercrâf Ironworks: reconstruction. The site is one of 48 water-powered installations on the Swansea Canal. Dimensions of the wheel (38 ft [c 12 m] in diameter, by 8ft [c 2.6 m] wide) were revealed by wear marks detected within the wheelpit

the resources of the Commission. However, the Powis Estate Sawmill near Welshpool (Fig 19) has been intensively surveyed by students on the autumn recording course, and one recent student is surveying the Ceulan Woollen-mill at Talybont, near Aberystwyth, highlighted as the site most worthy of further recording during a Commission survey of watermills in Ceredigion (see below). Another student project has been to transcribe all industrial references in the 400 or more early nineteenth century tours of Wales on to cards ready for incorporation in to the NMR(W). An MSC team working on the Montgomeryshire Canal was also trained to survey during autumn courses and has gone on to record some of the more interesting monuments along that waterway. An MSC team working in the Swansea Valley also recorded some of the disappearing early industrial heritage, complementing to a degree the Commission's work in this area of primary industrialisation.

Another facet of the Commission's industrial recording work is undertaken by the National Archaeological Survey for Wales, formed in 1984 as part of a new obligation to supply the Ordnance Survey with archaeological information. Detailed work has involved recording a previously unrealised density of limekilns near Ystradfellte in Breconshire, where some 240 kilns were recorded in and around one field! By contrast, distribution maps in a recent review of limekilns research show similar numbers for each county (for example, see Moore-Colyer, this volume, Chapter 5). Pillow mounds and other structures forming some of the vast nineteenth century rabbit farms have also been recorded. These were established in the western Brecon Beacons in the mid nineteenth century in order to make use of the newly enclosed land in supplying the needs of the population of industrial south Wales.

Industrial archaeology is such a broad subject that the differences between recording limestone quarrying, blast furnaces, textile factories, and suspension bridges are as great as the differences of knowledge recognised as being required for recording prehistoric hillforts, medieval churches, and seventeenth century timber-framed houses in more orthodox archaeology. Thus, one of the best uses of resources available for recording, is

thematic studies of single industries. In-depth knowledge of one industry enables logical priorities for detailed recording and preservation to be established. Such studies have been carried out for lighthouses in Wales (Hague 1979); fulling-mills in Merioneth (Fig 20; Parkinson 1984) and water-mills in Ceredigion (Parkinson 1985a). The priority for the latter two studies was established by local need. Work is now proceeding intermittently on the recording of mills throughout Wales (cf Nash, this volume, Chapter 25).

The Commission's most detailed work to date has been undertaken on the extensive canals and related early railways, housing, kilns and works. This study was instigated by the large-scale redevelopment of the south Wales canals as routes for new roads. The work yielded surprising and valuable historical results.

As a result, the extent of known early railways connected to these waterways has been quadrupled to the length of some 1300 miles. This era saw the transformation of the short mineral railway (which had been in Britain since the seventeenth century) into fully-fledged modern lines developed after 1830. The building of such a large early industrial infrastructure created a pool of innovative experience. For instance the archaeological evidence now suggests that the first known iron rails came into use in Swansea (Wales' first heavily industrialised area) in 1779 and not as generally accepted in Sheffield, in 1787; the first railway tunnel on a surface line has been said to date from the 1790s — however, one was built at Swansea between 1760 and 1768; underground canals are said to have been developed with the first modern British Canal at Worsley (near Manchester) in 1759, yet there is independent evidence for several such features in south-west Wales from the 1740s; Telford's great aqueduct of Pont-cysyllte is supposed to have been based on an earlier prototype at Longdon-upon-Tern but it is now possible to provide evidence that this was based on a generally unknown iron aqueduct of 1793 surviving at Merthyr Tydfil. This was the first such structure in the world, probably designed by Watkin George, as a railway bridge (Hughes 1989). Most railway history books say that the first iron railway bridge was George Stephenson's Gaunless Bridge of 1825. However, it has been possible to find evidence for a whole group of iron railway bridges built in south Wales prior to that date (Hague and Hughes 1982).

This detailed work in industrial archaeology, with the necessary historical study of associated contemporary documents and maps, illuminates a previously unknown class of brilliant and intuitive Welsh engineers and their pioneering works. Their genius was not only funelled into developing the contemporary transport system. The recent plotting of early railways and water courses at the end of the Llansamlet Canal, Swansea, revealed an intersection of such features at a site where a colliery developed by 1782 ought to have been sited. Here, in a group of derelict buildings by the M4, it was possible to locate a former engine house whose features suggested a date contemporary with the adjacent canal. There was general consternation in industrial archaeological circles, for this building had housed a rotary (winding) engine and not a pumping-engine and James Watt is not supposed to have developed successful rotary motion until the following year. However, recourse to the Boulton and Watt papers revealed that at least one other Welsh engineering genius had been carrying out similar and successful innovation on adjacent collieries between 1763 and 1783. The evidence is contained in a letter of 1783 from G Watson (at Swansea) to James Watt's partner Matthew Boulton. It describes the death of Mr Powell, 'a wonderful prodigy of nature' who had arrived at the Swansea Collieries in 1763 'a young man and common blacksmith'. The 1783 he had built and put into successful operation several rotary steam-engines. His employer, John Morris, said that, 'he had only to perceive to comprehend, and from comprehending to execute'. Watkin George had a similar artisan background — he entered the Cyfarthfa Works a carpenter and left what were then the largest ironworks in the world a full partner and rich man.

It has also been possible to find more extant engineering works of the great William Edwards, himself also originally an artisan — a stone-mason.

The engineers of many other previously unrecorded structures remain anonymous For example, the White Rock Canal Tunnel in Swansea for long passed unnoticed by the writers of the standard canal histories of south Wales; the Bont Fawr at Pontrhydyfen, (one of the largest masonry aqueducts in the United Kingdom) also survived unrecognised and at Sennybridge one of the earliest railway warehouses in Wales (1834) has recently been 'discovered'.

However, these significant industrial structures are unlikely to survive until publicity is afforded by adequate publication of these discoveries or before the completion of programmed 'Listing schemes'. Joint visits have therefore been made with Ancient Monuments Investigators and Historic Buildings Inspectors from Cadw in order to effectively carry out the Commission's Warrant 'to specify those [monuments and constructions] which seem most worthy of preservation'. It is hoped that the Industrial Archaeological Panel will provide this effective liaison between fieldworkers in the rich but fast diminishing field of Welsh industrial archaeology. It has also been possible to establish a sound liaison with local authorities and have conservation areas established around important sites that could not be Listed or Scheduled. In addition the White Rock Tunnel has been conserved by Swansea City Council as the centrepiece for an industrial archaeology park, and earlier plans by both the City Council and West Glamorgan County

Council have been appropriately changed. Lectures and exhibitions prepared during the course of the project have helped new local canal amenity groups to develop, and ensure the future of the newly protected waterways.

Archaeology, in such thematic and structured studies, has revealed facts unsuspected by historians. The canals of Wales functioned not only as providers of transport but also attracted many industries to the Valleys by providing a water-power source. However, only half a percent of the waterways' income came from this service. In fact no less than forty-eight such installations existed on the Swansea Canal alone (Hughes 1979–80b; Fig 21). This important aspect of the canals and associated railways recording project has already been published and it is hoped that the rest will follow fairly soon. The various industrial archaeological works already published by the Commission staff are listed below. The next extensive thematic study may be on the ironworks of Wales: a class of large, historically important monuments now largely threatened by ruination or clearance. An emergency colliery recording programme has also been undertaken.

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10 Recording nineteenth century workers' housing: a case study

by Jeremy Lowe

Introduction

The theme of this paper is that late eighteenth and nineteenth century housing, up to the period of bye-law control, can be regarded as a form of archaeological data. In *Fieldwork in local history* (1967) Professor Hoskins summed up what he then saw as the main possibilities and problems of a programme to record workers' housing. 'Houses', he wrote, 'speak their own testimony of the past - if only we can construe it', but 'with the almost total clearance of slums in our towns, we have lost information about house types and housing conditions which can never be recovered'.

These few words highlight the three main problems of recording houses; first the problem of data destruction, both by demolition and modernisation of houses; second, the problem of utility or interpretation — what enlightenment can be gained from the facts recorded. Hoskins specifically links house types with housing conditions but, while recording house types is a matter of field observation and classification, by what indices does one record 'housing conditions'? Third, we observe Hoskins' caution, for, though demolitions have lost us archaeological information, it is possible that many of the most relevant data may still be deducible from the documentary sources in which the nineteenth century is so rich.

The distribution of industrial house types

The writer and David Anderson began fieldwork on the housing of the iron industry in the Heads of Valleys district in 1970. Though this was five years before the publication of *Houses of the Welsh countryside* (Smith 1975), several extensive surveys of Welsh rural vernacular housing were already available. However, records of industrial houses were relatively few, and we started work, under the pressure of a widespread campaign of house demolition, in almost total ignorance of what we would find. Within days of starting, we were struck by the variety of house types, some partly vernacular, some fully industrial in character. We took up without question an assumption that each type would have its geographical distribution — like a vernacular house type. Spurred on by the example of Peter Smith's work for the Royal Commission, we thought we might be able to record such a distribution of industrial types. David Glyn Jones' splendid campaign in Snowdonia in January 1972, by showing types very different from those in south Wales, strengthened these expectations (Jones 1972).

In fact there had been early signs of difficulty in finding a geographical basis for such type distributions. We soon found some isolated non-conforming types, such as 10–18 Long Row, Pentrebach, and the interlocking plan houses on Varteg Hill, both of which we discovered could only be paralleled in Shropshire. Then we recognised 'company standard houses' such as the Blaenafon House, of which thirty survived out of an original total of 160 confined to the area around one works. We focused on this Blaenafon type and its distribution for a long time, trying to trace its evolution from local prototypes. There was, however, no convincing geographical link between the company standard houses in Blaenafon and the scattered possible prototypes, like Poplar Cottages, Merthyr Tydfil.

With hindsight, it is possible to see that the identification in 1973 of the 'catslide outshot' type should have provided a different perspective. Apart from a few scattered occurrences, the distribution of the catslide outshot type was clear. It was found in quantity only around works owned or managed by the Crawshay family or their servants. We could find no local prototype. From its largest concentration around the Cyfarthfa and Ynysfach works (exemplified by the Rhydycar houses, six of which have been re-erected at St Fagans) the type spread to Nantyglo, jumping over the intervening iron-working towns. Such a distribution may now be recognised as managerial — a concept introduced to housing history by Dr Lance Smith (1976) — rather than geographical. When in 1811, William Crawshay sent Matthew Wayne to manage the Nantyglo works for Joseph Bailey, Wayne took his employer's house type with him. The same rationale accounted for catslide outshot houses at Rhymney (for Ben Hall), Hirwaun and Treforest.

The idea of a managerial distribution of types (Fig 22) identified by such variables as size, standard of construction, and amenities like ventilation) requires a different approach to data collection. In the early 1970s the writer spent some time using punched cards for a 'Manchester' types survey, using external, superficial indicators to decide the types. The survey was very much guided by vernacular architecture studies, but the parallel

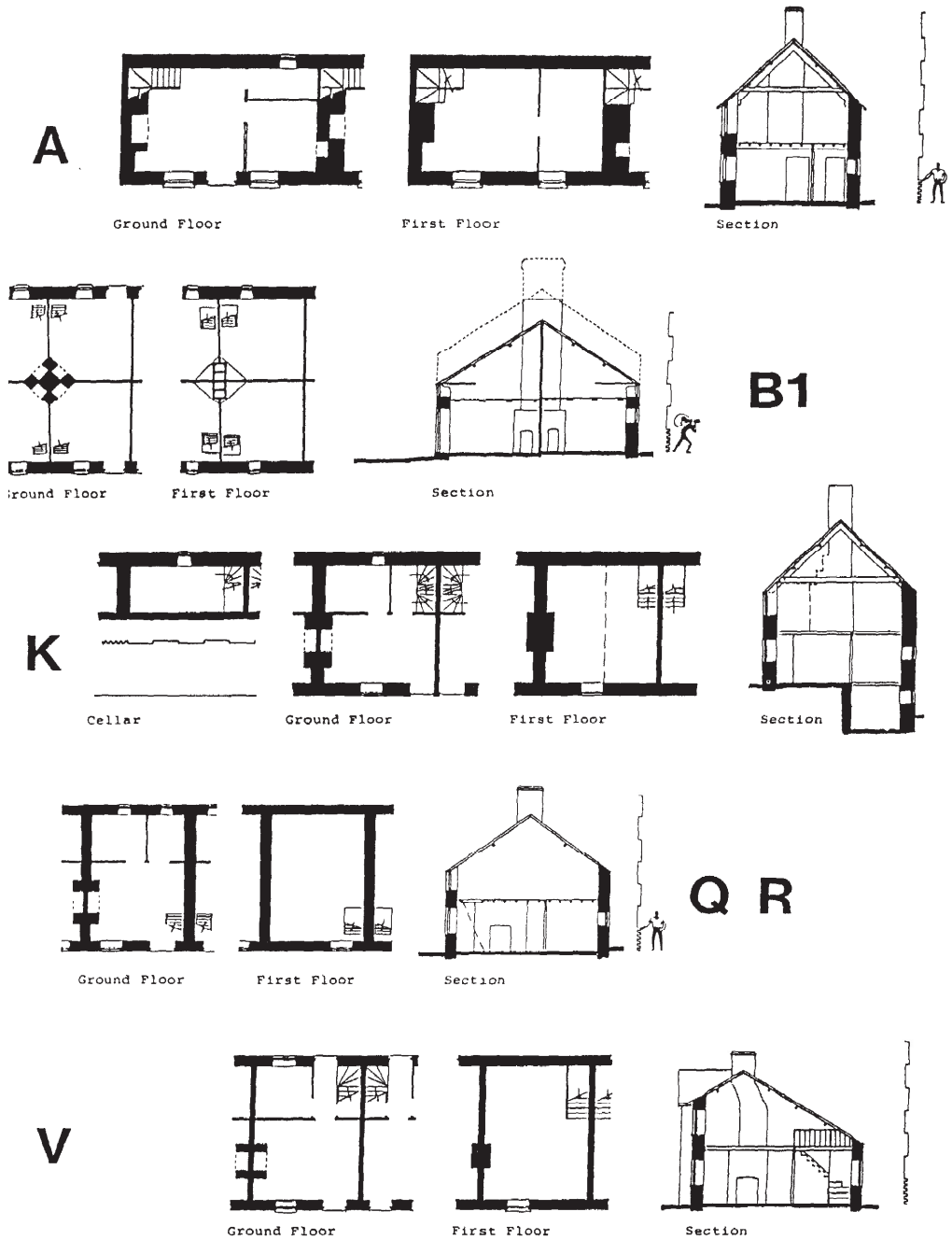

Figure 22 A managerial range of house types. Houses built in quantity between 1789 and 1839 for the iron works at Blaenafon, Gwent, showing some variations in design as circumstances changed and the housing stock increased.
A: Skilled mens' houses of 1789 at Stack Square (floor area 44-57 sq m)
B1: Iron miners' houses of 1789 at Bunker's Hill (floor area 20 sq m)
K: Furnace workers' houses of c 1808 at Shepherd Square, leased to the works by an outside entrepreneur (C H Leigh) (floor area 43 sq m)
QR: Colliers' houses of c 1820-5 on several sites, a 'company standard' design (floor area 39 sq m)
V: Colliers' houses of 1837 at Victoria Row, with a 'composed' facade expressing 'company image' (floor area 43 sq m)

was wrong. The choice of type for a vernacular house is likely to be based on a customary practice broadly reflecting geographically distributed cultural factors. An industrial house type is the result of managerial decisions with no particular geographical fixity. Thus, taking a well-known example, the Triangle, Merthyr Tydfil was built between 1839 and 1843–44 as part of Anthony Hill's development of a new Pentrebach rolling mill. Detailed surveys before its demolition in 1977 showed that it was built sequentially over some time, with at least one long pause in building during which the supply of bricks was changed (Lowe and Gross 1980). The house type is the four-room double-front, very common in the mid years of the nineteenth century in many south Wales localities. But the significance of its choice by Anthony Hill has to be assessed mainly by reference to the standards of the other houses that were available to house his workforce at the time he decided to build.

In these terms the Triangle houses were built to above average standards of space, durability, and finish. These standards were kept up throughout the building period which was one of great managerial uncertainty. The year 1839 when the new mill and houses were begun had seen a distinct upturn in the price of bar iron, but thereafter the price fell steadily to a historic low level in 1844. Also in 1839 there was intense Chartist activity in Merthyr Tydfil. The Triangle can only be adequately evaluated in this context.

A superficial determination of house type thus takes one only a short way towards understanding the Triangle in the context of industrial history. A record of the construction breaks that were visible in the back walls of each row is as necessary as the type classification of the front,

Housing conditions

It is also the case that unravelling the building history of the Triangle could not have been done without reference to Dr Beechey's work on the 1841 and 1851 censuses (unpublished). David Anderson did much work in the early 1970s on these two censuses, and this helped focus our attention on housing conditions. Much writing on housing seems to assume that there is an entity called a 'household' which generally approximates to some kind of norm. Perhaps in early nineteenth century farmhouses there was some sort of balance so that the larger the occupiers' family, the smaller would be the number of resident servants, but this correlation of occupancy and size is not to be observed in humbler homes.

Working-class occupiers could not easily adjust their household sizes. If their households became overlarge they could not add accommodation, nor board out some of the supernumerary members. Consider the New Ranks at Blaenafon (demolished 1969–1972): two rows each of twenty houses of a uniform three-room type (Lowe 1985a). Physically they are adequately described by an exterior photograph, a site plan, and a scaled survey drawing and could be replicated from these data. However, inside those simple exteriors there was an astonishing variety of household size and composition. In 1841 five houses were occupied by only an adult couple, four of these couples having also one child. At the other extreme were two houses with thirteen occupants, both these households including lodgers. One was a boarding house with six or seven lodgers; another sheltered two families, of three and six persons, *and* their three lodgers. If one wishes to evaluate housing standards, one is plainly dealing therefore with matters more complicated than a physical building type and a figure for mean, or median, household size.

Having attempted to give extra meaning to Hoskins' twin concepts of 'house types and housing conditions', we can move on to consider the present *desiderata* for recording houses. In Wales the recording of types is still important, but less urgent. We still need to collect some house types in rural areas, especially those associated with cottage industry, but in general, apart from some gaps in mid century housing types and possibly in types occurring only in some neglected localities, the basic knowledge of types now exists. The two booklets on *Welsh industrial* and *Welsh country workers' housing* give a fair general idea of the range of sizes and types in Welsh workers' houses (Lowe 1985a; 1985b). As a comparison with them Ms Caffyn's excellent *West Yorkshire houses 1750–1920* is apparently more comprehensive, but it provides only fifteen measured sections (12% of 117 examples dated prior to 1880) and forty measured plans (32%) (Caffyn 1986). The two Welsh booklets record sixty-seven sections (74%) and seventy-four plans (82%) out of a total of ninety examples (Lowe 1985a; 1985b).

Reconstruction of housing stock

The next stage of recording is to move beyond types to the compilation of descriptions of what we may call housing stock'. This can be defined as all the houses under one managerial control at a stated time (such as the 500 or so houses at the Blaenafon ironworks in 1841), or in one managerial context (such as the 376 houses in 1841 in the Penygloddfa district of Newtown, where wool spinning and weaving were the dominant occupations). A 'stock' will be varied, containing houses of different ages, types and standards of construction. It provides the context against which new additions can be evaluated. To do this it is worth recording every trace of field evidence. The houses next to Tilsley's Factory in Bryn Street, Penygloddfa, were demolished before 1960, but their shadow outline remained in 1980 on the gable wall of the factory. Simply by counting and measuring brick courses

and brick lengths it was possible to draw up an accurate cross-section of a building destroyed twenty-five years earlier.

At Blaenafon, eleven different house types (plus one small miscellaneous class) can be identified in the iron company's 1841 housing stock (Lowe 1982). One-third of this stock still survived in 1970 providing the opportunity for an archaeological record of six house types. From public health records, maps and photographs detailed information was available about two more house types and another third of the 1841 stock. Fragmentary data exist for all but a scattered thirty of the remaining houses and from this data (mainly the Tithe Plan and first edition 1:2500 OS map) it is possible to identity three more house types. In total, there is analysable data for 93% of the stock. For Penygloddfa, where the census data is particularly good, the corresponding figure is 89%.

Of course these particular reconstructions depend upon field surveys made some time ago. Subsequent destruction of houses would make a good stock reconstruction at Blaenafon next to impossible now. There has been less destruction in Penygloddfa; the survey of this stock is now being prepared for publication.

No effort has been made in this paper to assess the potential of other areas in Wales, although Snowdonia seems a possibility. Surprising survivals still come to light elsewhere in Britain. Professor Beresford (1971) identified 1787 as the year when the first back-to-backs were built in Leeds, but he did not locate a single surviving eighteenth century example of back-to-back housing. Lucy Caffyn, fifteen years later, has found and illustrated several examples in her West Yorkshire inventory, including a well-preserved block near Huddersfield with a 1790 datestone. She notes that survivals of early back-to-backs are especially common in Pudsey, about 6 miles (9.7 km) from the centre of Leeds (Caffyn 1986). A systematic field check of the OS 1:500 1880s maps covering twenty-six Welsh towns would be an informative step in assessing survivals in the Principality.

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11 The National Trust Archaeological Survey: industrial sites at Aberglaslyn

by John Latham

The National Trust began its programme of property assessment in north Wales in 1983. The aim was to provide land agents with sufficient knowledge for them to preserve, within reason, all identified sites by whatever means available. It was apparent that vast areas contained many sites, none of which were protected by law. The Ysbyty Estate for example, (10,500 ha), has only a single Scheduled Ancient Monument, this being a packhorse bridge. From the archaeologist's viewpoint, vast areas with no record, and changing perspectives on precisely what constitutes an archaeological site, would be suficient motivation, given resources, to proceed with fieldwork. However, for the tenants, pressure for land improvement was the main factor that prompted the initial phase of assessment and a scheme was devised between the Trust and the Honorary Archaeological Adviser for north Wales, Frances Lynch. The survey was intended for the Trust's Ysbyty Estate, but a pilot study at Dolmelynllyn, a small estate six miles north of Dolgellau, (Fig 23, inset) was produced first. The programme has gone through a number of stages of reappraisal and now encompasses the whole of Wales. There is also a programme of assessment and survey in the Trust's other fourteen regions in England and Northern Ireland. These have essentially two phases: Phase I being an initial assessment, and Phase II, a detailed survey. About one-third of the Trust's properties in Wales have so far been completed as part of the Phase I assessment. The Aberglaslyn Estate and covenant were the subject of fieldwork during 1987. Ultimately with a more complete overview of the Trust's archaeological holdings, Phase II of the project can begin with more detailed surveys of selected sites and areas.

At Aberglaslyn, in the former county of Caernarfon, the area of the National Trust property and covenant extends for some distance on both sides of the Aberglaslyn Pass between Nantmor and Beddgelert, the pass itself forming a deep rift between the two halves (Fig 23). The initial acquisition was made by the Trust in 1935 and the property has been added to since that date. A large and significant area consisting of most of the east flank of Moel Hebog is not owned but is partially protected by a covenant. Almost all the area east of the Glaslyn is a treeless and deeply indented landscape with many rocky outcrops. At its south-west extremity it is near sea level but rises to an altitude of 380 m at the eastern edge. To the west the property is partly wooded, the southern part being coniferous plantation, and the northern being native oak woodland with a considerable area of steep rocky hillside between. Above the belt of owned land is the area of the covenant. This land rises to an altitude of 792 m with few level breaks to the summit of Moel Hebog.

Many of the more intensively worked industrial remains, including the copper mines at Llwyndu, Cwm Bychan, Bryn Du and Bryn y Felin are named on the map. The Sygun Mine, which is adjacent to the property, has recently been reopened as a tourist attraction (Briggs, this volume, Chapter 7). Most of these sites have been noted and recorded to varying degrees since the late eighteenth century, though contemporary accounts, of which the following is a typical example, are almost invariably tempered with some scepticism as to the viability of such enterprises:

> Copper ore has been discovered in different places between Bethcelert [sic] church and Pont Aberglaslyn. And although some spirited experiments have been made on it, nevertheless it has been found blended and mixed with other matters in so great a proportion, that the expense [sic] of separating it exceed the profit, and the work was discontinued (Williams 1802, 48).

During the nineteenth century the unsuccessful nature of much of the copper mining in the area resulted in useful records that can be related to surviving features; this account of the Bryn y Felin mine is one:

> The adit was said to be driving east towards a junction of lodes, and Captain Matthew Francis reported upon the prospects. By July 1861 the engine shaft had been sunk 5 fathoms under adit, but before the close of the year there arose 'insuperable difficulties to the company carrying out the intention expressed', of which lack of ore was no doubt the greatest. Following an application for a dissolution, the venture vanished into obscurity *(Mining J* 1861, 184, 213, 229, 286, 449; quoted in Bick 1982, 51).

Whereas most of the mines were the scene of many closures and reopenings, the apparently

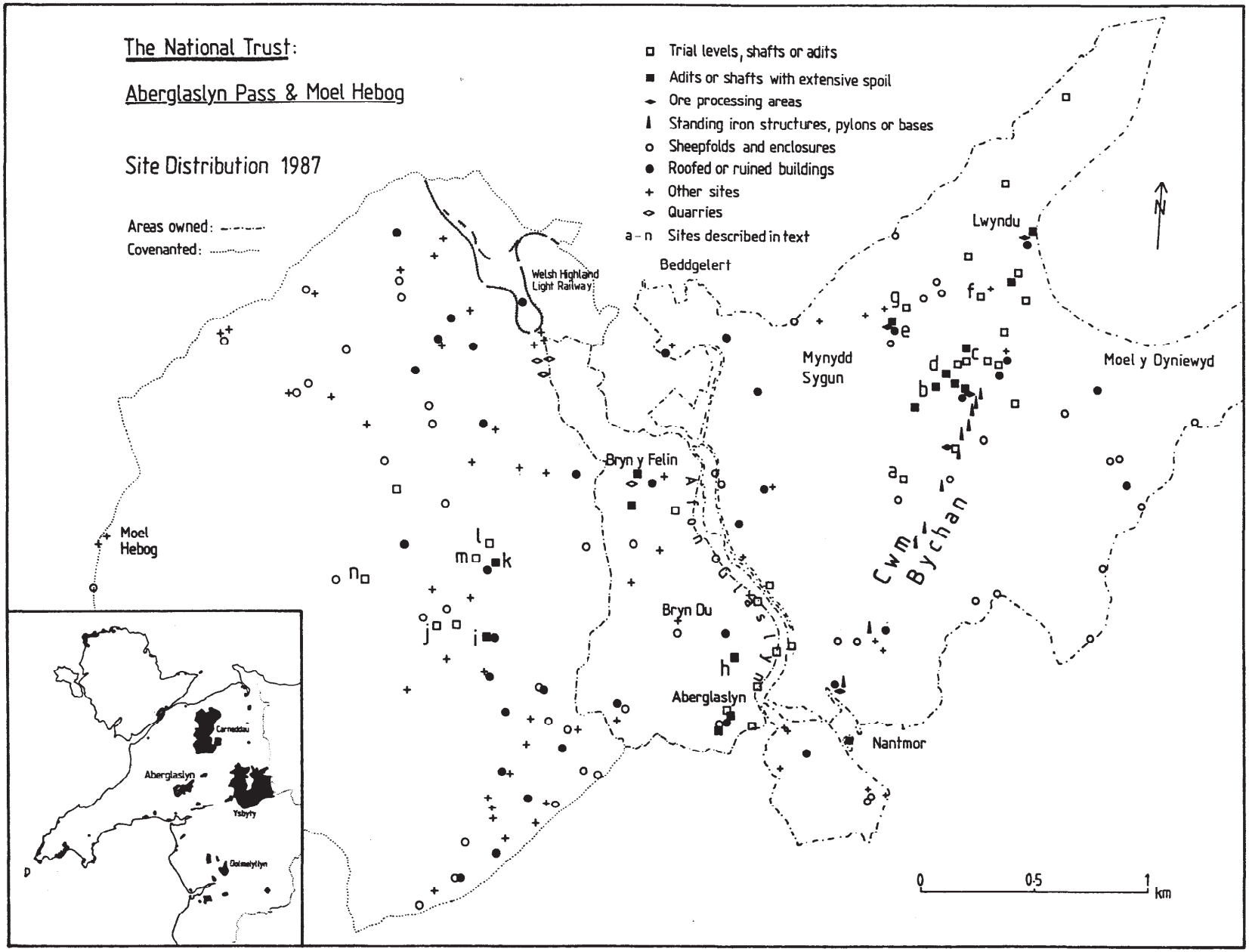

Figure 23 The Aberglaslyn Estate, showing industrial sites (source: J Latham)

successful venture at Llwyndu was intensive and short-lived. It was actually illustrated by Robert Byers who was acting manager of the Llwyndu Mining Company in 1836. Sketches (in the NLW) show sections of the mine-workings as they were in 1842 shortly before their demise. They were never reopened and have survived virtually intact. However, this mine is sornething of an exception. The evidence tends to indicate mines verging on the insolvent, due either to the poor quality ores or to problems with transportation from site. The latter became a particular difficulty following the building of the tidal barrier at Porthmadog in the early years of the nineteenth century and the consequent silting up of the Glaslyn. The pattern during the nineteenth century was one of sporadic reopenings, reflecting market forces, local extraction being very dependent on a high national price of copper in order to be viable.

Mining activity at Aberglaslyn had all but ceased by the beginning of the twentieth century. As mentioned above, transport of ore from the Aberglaslyn area was a problem. How the possible advent of a railway influenced the decision to invest heavily in Cwm Bychan mine is not known. Part of the Welsh Highland Light Railway track crosses the northern part of the covenanted area and continues on the east bank of the Glaslyn via a tunnel to emerge at Nantmor. None of the route is owned by the Trust, but its connection with the transport of ore from Cwm Bychan with the ore processing plant near Pont Aberglaslyn, where a proper halt was contemplated, is of interest. This halt may only have been a gravelled stopping area (Boyd 1972, 57). Dogged by misfortune, the enterprise was unsuccessful. The cableway was apparently ill-conceived and eyewitness accounts relate that the ore-filled buckets hit the ground when the machinery was in use (Neale, pers comm). The remains of this cableway are a notable feature of Cwm Bychan. Four pylons out of a possible eleven and the terminal station survive, and these have been partially consolidated and repaired. The ore-processing site, including the concrete foundations for machinery, two circular buddles and the cable tensioner cage (recently rescued from the stream bed), also partially survives.

Before the production of a Sites and Monuments Record (SMR) map by the National Trust, no detailed site distribution seems to have existed in published form. The map reproduced here is adapted from that SMR map, and indicates something of the density and spread of new sites. The most notable feature indicated by fieldwork is the extent of former industrial activity beyond the named areas of extraction. Much of this mining activity in the form of 'trials' consists of little more than an excavation a metre or two deep and a heap of partially processed ore. These trenches could well have been excavated either as part of a concerted programme of prospecting for new and better sources of ore either by individual miners, or by groups of miners in their spare time, or during protracted periods of unemployment. Some of these outlying trials were quite considerable undertakings, consisting of deep shafts or adits. There are also one or two possible slate trials within the covenanted areas. A representative sample of these sites is included below. It should be stated that many of these are not new discoveries. Some are shown and often currently located on large scale OS maps up to the most recent editions; others are mentioned in a variety of sources, but are not named on maps. Nonetheless, as an exercise in focusing attention on a discrete area, the Trust's survey has produced a comprehensive record of industrial activity. Something considerably more detailed would be even more rewarding.

Appendix 11.1

The following examples of sites are taken from Latham and Plunkett-Dillon 1988.

1 *Level* (SH 6005 4717) 200 m above OD.
A small trial working consisting of a hole 2.5 x 1 m x 5 m deep. To its immediate west is an area of spoil about 5 m in diameter.

2 *Trial levels* (SH 6019 4758) 230 m above OD.
An area with a water-filled pit, presumably once deep, 1.5 m in diameter; to the south and west are one or two small scatters of spoil, the one at the south of the site being approached via a deep natural gully.

3 *Trial level* (SH 6035 4768) 220 m above OD.
A quarried area (adjacent to a crag) consisting of a kind of cutting or gully, presumably following a lode running north-south about 9 m, and a very short adit no more than 2 m deep cut into the crag at the south end. An area of associated spoil exists to the immediate east of the site.

4 *Level* (SH 6029 4768) 230 m above OD.
One of a large number of similar sites now consisting of a water-filled pit or shaft, to the east of which is an area of spoil. A quarried runnel or corridor survives at the south-west of the pit. The whole site is contained within a rectangle approximately 35 x 10 m.

5 *Area of mining activity* (SH 6001 4789) 260 m above OD.
This area of obvious mining activity is situated at an isolated spot at the head of a small valley. Several features are in evidence. Starting from the north end of the site is a deep shaft, beside a crag and in a wide cleft, which is drained by a shallow cutting. The depth of the shaft has not been determined. Immediately to the west is an area of spoil and an excavated rockface — loosely demarcated by a low curving bank containing some stone. The spoil heaps appear to contain some burnt stone and galena. At the south of the site are the remains of a kind of

shelter, built against sloping ground and consisting of walls forming three sides of a rectangle.

6 *Trial level* (SH 6040 4880) 250 m above OD.
A small but neatly worked trial level. It consists of a narrow area of quarried rockface, wedge-shaped in plan — the wide base being excavated down to form a pit about 1 m deep. The quarried vertical face cut into the hillside has at least one borehole and the marks of cutting tools cut it. Dimensions overall are about 2 m wide at the base, narrowing to 0.75 m by 5 m long. Just beside the excavated area to the east is a heap of spoil.

7 *Small trial level* (SH 6006 4796) 250 m above OD.
A short excavation 2.5 m long in a crag with maximum depth at rear of 2.5 m, where there is some oxidised or distinctly red ore; a spoilheap lies to one side. The pit is about 1 m wide at its mouth. Presumably a chance find which proved unworkable.

8 *Mine shafts* (SH 5934 4647) 130 m above OD.
An area with several water-filled stopes on a steep open hillside. The three visible holes appear to follow a vein or lode which is oriented south-west–north-east and continue for a distance of about 40 m, but further holes could well exist beyond the searched area nearby to the southwest within a dense plantation. Some spoil exists below the central opening. The slot-like stopes are each about 1 m wide and respectively 2 m, 8 m, and 8 m long.

9 *Adit and spoil* (SH 5822 4653) 260 m above OD.
A short adit cut into a low crag fronted by an area of spoil. The entrance to the adit is 2.5 m square and the adit is about 15 m deep. The spoil area is about 15 m in diameter.

10 *Level* (SH 5799 4658) 290 m above OD.
A site consisting of an extensive excavated area cut 8 m into the steep hillside exposing the underlying strata to a depth of 3 m with a width of 3 m. In front of this cutting the resultant spoil has been formed into a fairly level-topped heap about 18 m by 12 m.

11 *Quarry* (SH 5826 4685) 280 m above OD.
The site is marked on the 1:10,000 scale OS map as 'Tip (dis)' and 'Quarry (dis)'. It is quite a large working but nonetheless probably only a trial prospect, possibly for slate. It consists of a rock-cut pit about 12 m deep and 8 x 6 m at the base. This pit is approached by a rock-cut gully 23 m long and 1.5 m wide starting from a kind of rough terrace. Spoil surrounds the gully, its approach, and to both sides west, and continues below the site (north) for about 30 m, where it is formed into two level terraces each 10–12 m wide, one above the other.

12 *Quarry* (SH 5824 4694) 260 m above OD.
A site marked on the 1:10,000 scale OS map as 'Tip (dis)' and 'Level (dis)'. In fact it is more or less one continuous site consisting of an area excavated into the hillside about 38 m long and 15 m wide overall with a maximum depth of 4–5 m. The sides are gently graded and there is no exposed rock. This excavation opens out below to the north into a grass-grown spoil heap about 35 x 30 m.

13 *Quarry* (SH 5818 4688) 280 m above OD.
A fairly small but significant trial in the Bwlch Golau area. It consists of a cutting into the slope about 17 m long and up to 4 m wide with a maximum depth of 1.5 m. The cutting is now grass-grown, the sides presumably having slumped. At the north end the cutting opens out onto a spoil heap about 12 m long and 10 m wide with some exposed waste, though most of the site is grass-grown.

14 *Level* (SH 5768 4678) 360 m above OD.
An isolated level on steep hillside at a point where the ground begins to rise more sharply. It consists of an adit of unknown length, the entrance to which is partly blocked. This is approached by a gully revetted on its east side, about 1 m long and 2.5 m wide. In the revetment wall is a small recess perhaps intended to protect items from the weather. The gully opens out onto a spoil heap 10 m in diameter.

Acknowledgements

I am indebted to my colleague Dr Emma Plunkett Dillon for assistance with fieldwork as well as to Peter Crew of the Snowdonia National Park; also to the National Trust warden, Richard Neale for information concerning the Cwm Bychan aerial cableway.

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12 Industrial archaeology of Cwm Twrch

by Dilys Powell

Introduction

Cwm Twrch and its tributary streams dissect the south slope of the Black Mountains, and form some distance from the extreme south-west boundary between the counties of Brecknock and Carmarthen. The area's post-medieval history reflects mixing of the rural, Black Mountains population, with people from the industrialised valleys, of which the area now arguably forms a socio-economic component.

As part of the Brecon Beacons National Park, today the upper part of the valley (the main subject of this study) enjoy some measure of environmental protection. The landscape has, nevertheless, suffered severely from pressures of afforestation and recent opencast coal exploitation, economic forces which remain threats to this industrial heritage landscape.

The study which follows was undertaken as part of a countryside management course at the Normal College, Bangor, in 1984, and comprises investigations of both historical sources (part 1), and a field survey of the industrial archaeology (part 2).

Part 1: Historical

Limestone quarrying

In south Wales, lime was originally used for agricultural purposes (Moore-Colyer, this volume, Chapter 5). In Cwm Twrch, farmers collected lime after the harvest. They would take their donkeys or ponies to outcropping coal seams on the valley sides of the Lower Twrch, then carry the coal across the moorland to Blaen Llynfell, where it was used to burn limestone which outcrops there. This was then brought down in panniers and spread onto the enclosed land (Owen et al 1935, 18).

By the nineteenth century, improved farming methods had increased the demand for lime which resulted in building small stone kilns which are now commonly found in areas close to limestone outcrops. The main lime burning centres, such as Llandybie, were generally easily accessible and supplied lime to a wide area.

The Henllys site in Cwm Twrch, with its bank of five kilns, is unusual in that it is relatively remote and inaccessible from the agriculturally dominated areas of rural Carmarthenshire. The development of lime burning on such a large scale at Henllys is the result of an expanding iron industry along the northern rim of the coalfield during the nineteenth century. Limestone from Henllys was also taken to the ironworks at Ynyscedwyn where it was used as a flux in the furnaces.

Limestone quarries were opened on the Black Mountains in 1883 at Blaen Llynfell by John Hay, then the overseer at the Cwmllynfell works. Scores of workmen lived in tents near the quarry during the week, returning home down the valley at weekends. Quarrying was restricted to the summer months, as the men were unable to endure the harsh conditions during the bleak winter months (Owen 1912).

Lime was originally carried down to the kilns on horses with panniers. In 1884, an incline was constructed by John Hay for the kilns below Gelliau Farm to the mountain ridge. A steam engine at the top of the incline lowered the full trucks and pulled up the empty ones. From the top of the incline, a tramline still contours the hillside to the Blaen Llynfell quarries along which the waggons would have been pulled by horses (Owen 1912; Owen et *al,* 1935).

Silica sand workings

Rottenstone and silica sand occur as a result of faulting to the east of the limestone outcrop. This was in great demand at the Landore (Glandwr) works, where it was used for polishing metals (Owen 1912). Later, a silica brickworks was established at Brynhenllys, owned by the Tir Bach Brickworks Company, Ystalyfera (Owen 1912). Before the tramroad was built, men and girls would collect the soft sandstones in baskets from near Ffrydiau Twrch. These were carried on horseback, the gatherers being paid one shilling per journey, three times a day. After 1884, the silica sand was carried down on the incline to the limekilns, and then on the tramroad to the brickworks at Brynhenllys (Owen 1912).

Coal mining

As was the case with limestone quarrying, coal mining began on a small scale, dictated by local needs. It was used for lime burning and as a domestic fuel. It was relatively easy to extract small amounts of coal from the seams outcropping on the valley sides using a method known as 'patchio' (Owen 1912).

Mining in its strictest sense did not begin until the late eighteenth century, when a number of local businessmen started to investigate the outcrops

and drive levels into the hillside along the line of the two to three underlying seams. The first pit in the area was sunk by Christopher James and R C Aubrey at Cwmllynfell. Here the coal was raised by a water balance system which overbalanced an empty cage at the top while drawing a full cage to the surface (Owen et *al* 1935). As the Llynfell did not contain sufficient water to operate the balance system during the summer months, a channel known as 'feeder Jams' was constructed to carry water from the Twrch near Ffrydiau (Thomas 1970, 72). However, mining remained small-scale until 1838. Before that time it had not been possible to use anthracite in the iron industry, but in 1838, George Crane and David Thomas of the Ynyscedwyn works adapted the hot blast process, enabling anthracite to be used in the blast furnace. This greatly increased the local demand for coal and led to an expansion in both the number and scale of the collieries in the valley.

Brynhenllys

Brynhenllys Colliery was opened in 1792 under the management of five local Welsh businessmen: Enoch Owen Powell, Thomas Powell, Richard Lewis, his son Hywel Lewis and Levi Rees (Thomas 1970, 72; Anon 1901). Locally it was known as Gwaith y Powelliaid. In its heyday 300 workers were employed there extracting 120 tons a day (Evans 1820). After the closure of the Ynyscedwyn Iron Works in 1877 the coal was mainly exported through the port of Swansea.

Operations at Lower Brynhenllys Colliery (SN 756 123) were powered by three waterwheels, turned by water from leats. The uppermost feeder was tapped from just below the weir, opposite Upper Brynhenllys Colliery. By taking the water supply from higher up the valley, a fall of 10-20 feet (3-6 m) could be obtained, giving sufficient power to rotate the large wooden waterwheels. These in turn operated the winding engine, screening machinery and the beam pump which drained the mine (Thomas 1970, 75).

Nothing remains of either the waterwheels or their associated machinery. The leat can, however, be traced from the weir, following a course roughly parallel to the tramroad. This feeder also turned the wheel which operated the machinery at the silica brickworks. These were situated just above Lower Brynhenllys Colliery, to the south of the present road bridge.

Upper Brynhenllys

On a raised bank, close to the weir, lie the remains of the surface buildings and machinery of Upper Brynhenllys Colliery, which was opened in order to save on haulage from the extremities of the lower colliery (Evans 1890).

This colliery also operated on water power until its closure at the turn of the century. The line of the leat can still be followed, being indicated by a line of iron stakes which once held the wooden trough in position. The waterwheel drove the winding engine which brought the coal to the surface from the main slant and also the pump which drove water out of the mine.

Henllys

Originally, coal at Henllys was extracted almost exclusively for use in the limekilns under the auspices of the Black Mountain Silica Sand, Lime, Brick and Colliery Co Ltd, owned by John Hay. However, production of lime ceased in the late 1880s, as a result of the migration of the iron industry towards the coast, since local iron ore resources had been exhausted and the industry became dependent on imported supplies.

After a period of inactivity, the concern was sold in 1898 to the Black Mountain Anthracite Co, which opened Henllys Vale Colliery, near the end of John Hay's incline. Unlike earlier pits, power to haul coal to the surface was provided by a coal-fired steam engine. The engine house chimney still stands. It seems likely that at least in the initial stages of development water power was used to drive coal-sorting screens.

There then followed a period of prosperity, the work force rising to 141 in 1904. However, the profitability of the company soon declined so rapidly that it was offered for auction in 1906. The sale included the colliery, silica and limestone quarries, mineral rights over 492.5 acres (c 200 ha), buildings, fixed and loose plant, machinery, railway sidings, stocks, stores and effects. Bids did not reach a realistic level, and the concern was withdrawn from the auction at £ 5,500.

The colliery lay idle for a while, then was restarted by a new company, the New Henllys Anthracite Co Ltd, to be worked until the First World War, which effectively withdrew the labour force, and forced the mine to remain idle for the duration of hostilities. In the event, it proved impractical to recommence operations after the War and the mine was finally abandoned in 1918.

Part 2: Industrial archaeology: a survey of existing structures at Cwm Twrch (Fig 24)

Henllys

The best preserved relics are found at Henllys.

Limekilns (SN 7627 1378). Limekilns are arguably the most important feature of the site, being unique in their state of preservation and their remote location, away from major transport routes. It consists of five enormous rubble-choked kilns which are structurally sound. The bank of

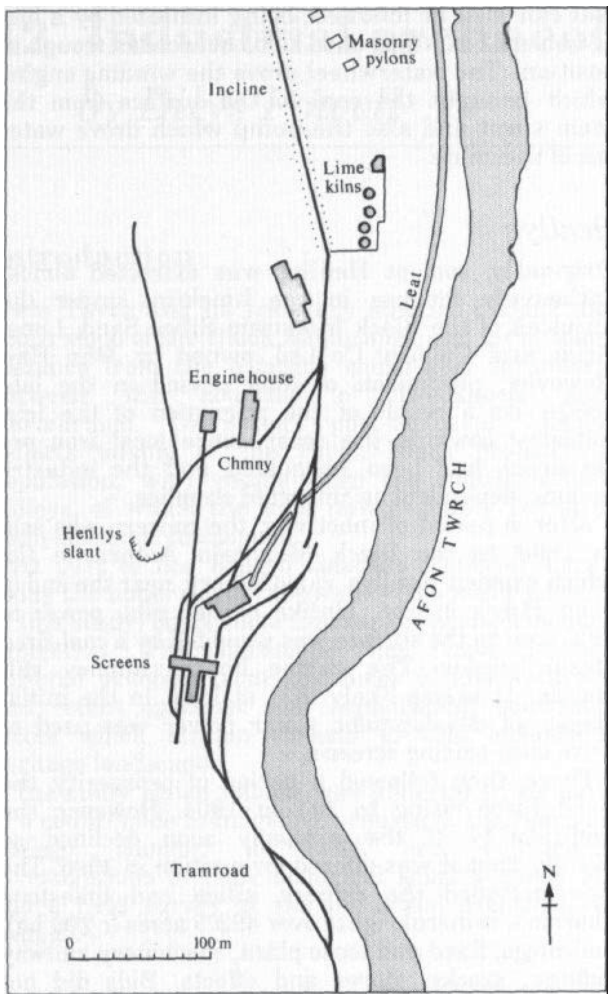

Figure 24 Henllys Colliery 1905: leats and tramroads of Lower Cwm Twrch (from OS 25-inch plan)

kilns was built into a steep slope, probably partly artificial, for top-loading.

The kilns appear to have been constructed in two phases. The northern three kilns (one of which has been blocked off) have tall, stone-faced arches, the passages having been extended by the addition of a second facing wall. Their interior is also of stone. The later kilns are better preserved and retain their inner brick walls and tapping arches. The circular kilns have a brick lining above square bases.

Chimney (SN 7624 1378). The chimney is circular and of red brick, rising to some 30.5 m above its octagonal base and capped by a now incomplete ornamental corbell. There is an archway on the southern side of the base. Dart of which has now collapsed. the chimney lining has deteriorated and loose yellowish bricks lie inside on a basal fill of coal, dust, and ash.

The purpose of the chimney is not clear from structural evidence as the surrounding buildings were demolished sometime in the 1950s. The suggestion has been forwarded that it acted as a ventilation shaft for underground workings, despite the conflicting evidence of coal and ash found at the base. However, local people say that the chimney was once attached to an engine house. Some sources suggest that this steam engine worked the incline, but this is unlikely as the remains of an engine house and small brick chimney are to be found at the top of the incline. Old maps (OS 25-inch 1905) show that the engine must have been used for hauling coal to the surface from Henllys Slant. The impressive size of the chimney is the result of its location within the confines of a narrow valley. It had to be constructed sufficiently tall to allow the smoke to escape.

Masonry Pylons (SN 7623 1383). Beyond the kilns are the remains of three or four stone-built towers which may have carried an aqueduct, As it is not possible to follow the line taken by the associated leat, their purpose is not yet clear.

henllys Slant (SN 7617 1364). The stone-lined entrance to Henllys Slant is still visible, partially hidden by debris, which has fallen from above.

Screening wall (SN 7619 1361). The entrance to the colliery is dominated by a large flat area surrounded by 'the imposing screen wall. After being hauled up the slant by steam engine, coal was taken to the top of the screen wall by truck and then poured down the chute onto conveyor belts. After sorting, it was loaded into trucks and taken down the valley on the tramline.

The screens were operated by water power, at least in the initial stages of development. Water was taken from a weir at (SN 7632 1388), via a stone-lined leat, to a wheelpit at the eastern end of the screening wall. A shallow depression marks the former channel, which returned the water back to the river.

Brynhenllys

Little of interest is now visible at Upper Brynhenllys. Even the course of the leat which fed the large wooden water wheel is not readily discernible, being marked at best by a line of iron pegs, which once held the wooden trough in place.

The most notable feature of the valley below Henllys is the leat which was tapped just below the weir, I near the remains of Upper Brynhenllys Colliery. It has a rough concrete retaining wall, emphasising just how recently water had to be relied upon as a source of power. The regulating weir lies a short distance downstream. From this water level built up on the river it would overflow into! the leat, the course of which can still be followed downstream for a considerable distance.

The leat is bridged about 300 m from its source by a masonry structure, vertical on its upstream side, but with supporting buttresses on the downstream side. Between each pair of buttresses is a wooden lintel, approximately one foot (0.3 m)

off the ground, below which the water would have been channelled. Its function is not yet clearly understood.

Some 50 m north of the road-bridge, the route of the leat becomes indistinct. Originally, the water split into two channels here. One branch was conduited under the tramline and then followed it down to Lower Brynhenllys Colliery; the other was taken by aqueduct some 20 m to the brickworks. Any remains of the aqueduct system still surviving *in situ,* will now be buried below the spoil.

Brynhenllys Tramroad

In addition to the tramroad built to carry silica sand down from the Black Mountain quarries to the brickworks, a second tramroad was built at a higher level, to transport coal from Upper Brynhenllys Colliery. Although the two tramroads are parallel for much of their course to the county road from Upper Brynhenllys, the gradient on the upper tramroad is less. In places the side of the higher track is held in place by railway sleepers and iron stakes, but elsewhere the height differential is so great that a retaining wall had to be built.

Within the wall is an interesting feature which has proved to be totally inexplicable. An oven-like structure, some 0.75 m wide going back about 2 m, has been built into the retaining wall. The sides and roof are well constructed in stone but there is no back as such, the tramline infill being visible. There are small openings on either side which appear to have no connection to the central cavity.

Conclusion

It has been found possible to greatly enhance the outcome of a local area study of a neglected derelict industrial landscape through routine historical research. Furthermore, systematic attempts to correlate fieldwork observations with both manuscript and published sources have resulted in clear explanations of the functions of otherwise potentially inexplicable features on the ground, giving some idea of the area's economic activity in its heyday.

Today the landscape of Cwm Torch is under great pressure from proposals to work opencast coal seams. Although the intended area of opencasting lies to the east of most features described here, this investigation illustrates that a valley such as this, still endowed with recognisable abandoned plant, could be extremely vulnerable to future economic activity. Should further applications for open cast development be forthcoming in Cwm Twrch, this historically interesting industrial landscape, currently unprotected by Statute, will require careful monitoring if the industrial community of south Wales is not to lose further important heritage sites.

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Section III: Economic development and the industrial heritage

13 Industrial archaeology and the role of the Welsh Development Agency

by Gwyn Griffiths

The Welsh Development Agency having been found guilty of unspecified crimes against archaeological sites, it is intended to present sufficient evidence to earn at least a retrial, and to demonstrate the policy towards, and expenditure upon, sites with archaeological significance.

One of the Statutory duties of the WDA is to improve the Welsh environment. To this end, it deploys (1986) a budget of £13 million in grant aid support to local authorities, private individuals and companies, and voluntary bodies. The Agency has approximately 650 projects in its current programme. Although the Agency gives high priority to the reclamation of land for development it is very aware of the importance of supporting projects related to heritage and tourism.

In assessing the level of grant support to projects containing items of archaeological significance, grand aid is limited to works of preservation, not restoration. The division between these two is inevitably somewhat grey. The following illustrated description of projects in which the Agency has an involvement is not intended as a defence of the Agency's role, but an outline of the contribution the Agency can make to archaeology.

1 Sites reused for public amenity

Penarth Dock (ST 1772 1872)
The imposing masonry structure will be retained as a working marina.

Port Dinorwic Harbour (SH 524 677)
Restoration and dredging of the tidal harbour will ensure its retention as a marina.

Blast engine house, Dowlais (SO 169 077)
Refurbishment of this large building of 1785-6 will result in it being used as a warehouse by the adjoining chocolate factory (Pearson, this volume, Chapter 22).

Dowlais stables (SO 072 *078)*
This imposing but poorly founded facade has been made good, and a Housing Association is negotiating to build within that facade (Pearson, this volume, Chapter 22).

2 Sites with scope for amenity rescue

Greenfield Valley, Holywell (SJ 1876 1977)
Much of the £0.75 million expenditure on this site was spent making safe the dams of the lakes within the site. The site, which is of considerable industrial significance, has fine walks, fishing, and birdlife.

Trefor Harbour, Lleyn
The jetty and harbour wall, repaired following the demolition of a concrete hopper, enhance a pleasant tourist spot.

Llanrwst Mine
Works at this site have been limited to dealing with metalliferous waste and clearing out the making safe buildings, a wheel pit and chimney (Williams and Bick, this volume, Chapter 29).

Bangor Pier
MSC labour and funding from a wide range of bodies has brought this pier close to a completely restored state. Its future care and maintenance could however pose a major burden upon its owners.

3 Actively promoted 'commercial' monuments

Big Pit, Blaenavon
This colliery, being shallow and free-draining, was an ideal candidate to be opened up to the public (Davies, this volume, Chapter 21).

The Monmouthshire and Brecon Canal
This canal is obviously historically significant and actively used for leisure purposes. The WDA gave £0.5 million grant aid towards major repairs (Ledbury and Briggs, this volume, Chapter 4).

Lewis Merthyr Colliery
This site is designated as the Rhondda Heritage Centre (see pp 142-3). The WDA are funding the building preservation, safety and reclamation works.

Dolaucothi goldmines
Equipment at Halkyn has been rescued with Agency grant aid and installed at the Dolaucothi Goldmine which is in the custodianship of the National Trust (Clough and Briggs, this volume, Chapter 20).

4 Dormant monuments

Cwm Ystwyth Lead Mine
Work on this site is likely to be limited to pollution control and making safe or preserving relics (cf Briggs, this volume, Chapters 7 and 27).

Cyfarthfa Furnaces (SO 038 070) *and 'A' Frame Bridge* (SO 038 072)
This magnificent set of six eighteenth century iron furnaces and a cast iron bridge are within the Pontycafnau Reclamation site and their preserv-

ation will be grant-aided (Pearson, this volume, Chapter 22).

Henllys Vale Colliery (SN 762 137)
A limekiln, wheel pit, leat and chimney are the more obvious relics in this reclaimed site. The site is managed by the Beacons National Park (Ledbury and Briggs, this volume, Chapter 4; Powell, this volume, Chapter 12).

Cymmer Viaduct (SS 857 961)
Although this structure has not been Listed, local council members have fulfilled their wish to retain it as a monument by removing the decking, but leaving the trusses on the masonry pillars.

Ynyscedwyn Tinplate Works (SN 782 094)
The arches and chimney retained on the site were never completed and so constitute an industrial folly. They were cleaned down and pointed with WDA grant aid.

Breakwater Quarry, Holyhead
Difficult to restore but an interesting silica brickworks in a beautiful setting.

Cwmblacs Merthyr
A contract is being let to put a portal on the remnants of a tunnel on Richard Trevithick's railway (ST 085 950 to SO 056 069), as part of an overall reclamation scheme (Pearson, this volume, Chapter 22).

5 Sites complementing existing monuments

Flint Castle
Courtaulds vacated the adjoining Castle Works site and the reclamation of that site will include work on the filled-in castle moat and surrounding area,

Greenfield Valley
Wat's Dyke runs alongside this site and Saint Winifred's Well and Basingwerk Abbey adjoin the site. The clearing of the dereliction has opened up the whole area. Reclamation expenditure included the employment of an archaeologist for three years.

Dolwyddelan Castle
The reclamation of the nearby slate waste, in conjunction with a road improvement, will provide much improved parking and access to the Castle.

If the WDA errs, it errs on the side of retention rather than demolition. This approach preserves options. Demolition does not.

Conclusion

It is crucially important that the wide range of professional disciplines that affect industrial archaeology keep in contact with each other on a regular basis. The absence of any sizeable local authority representation at the Conference must be seen as a mistake. Despite the Melingriffith problem there are many officers in local authorities who are keen, sympathetic and enthusiastic, and are in positions to have a major beneficial effect.

We should avoid professional insularity. It leads to destructive alienation. People from other disciplines often have great interest in and knowledge of our professions. Although a Civil Engineer, the writer has a deep interest in archaeology, nurtured as it was by a childhood at Pipton Farm, Breconshire at a time when the base of its early horse engine was still visible, static machinery was powered by a 1909 Hornsby oil engine, and an ancient barrow on the farm was being excavated by one of today's delegates.

In conclusion, communication is all important. The Agency has contributed much, but if mistakes are made it must be partly the fault of archeologists, because they are not telling the WDA what could be done differently.

Editorial note and postcript

Since the above was written, the WDA has involved itself more closely with industrial archaeology, through sending delegates to the Industrial Archaeology Panel, and through routinely cooperating in the design and execution of its projects (Hughes, this volume, Chapter 26).

14 Site preservation and mineral development at Parys Mountain, Anglesey

by C Stephen Briggs

The importance of Parys Mountain

Parys Mountain (centred upon SH 40 90) is believed to have been worked in Roman times, or even earlier. 'Ancient workings' are marked upon the earliest eighteenth century plan of 1764 (Reynolds 1764) and excavations were undertaken to ascertain their age and technology following interest generated during the 1930s. No artefacts were found other than undatable 'grooved mauls' (Davies 1939), and a Roman dating for the very earliest activity is inferred only from local discoveries of inscribed copper bun ingots (Davies 1937). More recent excavations have produced no further culturally diagnostic artefacts. However, radiocarbon dated charcoal from the site is Bronze Age (Timberlake 1988; 1989). Misgivings have been expressed by the writer about uncritical acceptance of the dates alone (Briggs 1988), since peat and timber were a commonplace and important fuel resource outside coal-bearing areas from at least as early as the medieval period (Owen 1969).

Copper mining began on an industrial scale soon after 1760, although it is clear that the ore body had been tried before that date (Harris 1964, 18-21). Two distinct developments were involved. Owing to differences of ownership, the western side of the hill became Parys Mine, the eastern, Mona Mine. Although there are several metalliferous ore types, copper sulphide formed the staple of the industry, and unique surviving features testify to the unusual processing methods.

At first, mines were driven by vertical shaft operated from above by horse gins, some of which are clearly indicated on the earliest maps. Soon, however, many of these smaller adits coalesced into larger and smaller massive opencasts. These features attracted tourists and artists to view and describe the remarkable spectacle, one of the man-made wonders of the new, industrial, world (Cockshutt 1960). The continued expansion of this opencast until the 1820s, or later, consumed many earlier processing features and office buildings. The geological importance of features revealed by these unique quarries was recognised in August 1987, when the Nature Conservancy Council designated parts of the Great (western) Opencast a Site of Special Scientific Interest on account of its important geological sections (Anon 1988).

After mining, the metal was recovered in two ways. Raw sulphide ores were roasted for weeks or even months, within ovens either *in situ,* at Amlwch, or at one of the destination smelter ports like Swansea or Garston. Sulphur for the gunpowder trade was sublimed in this way, and the Parys Mine itself possessed a 'Sulphur Yard', the confines of which are no longer easily ascertained. The smelter still standing at Dyffryn Adda (not marked on Fig 27), probably took roasted ores. It is possible that smelting was also undertaken near the spot where large bun slags are dumped on the south-east side of the site (SH 4492 9054).

Besides taking copper direct from the ore, itself a labour-intensive job, an alternative method for metal recovery was to pass the copper-rich water emanating from the hill through tanks containing scrap iron. From this iron, rich deposits of about 50% copper metal could be scraped, making a very valuable, easily smelted product. From depictions shown on the 1786 survey of Cerrig y Bleiddin Mountain (Anon 1786), it is clear that precipitation tanks for this process were then already in use at Mona Mine. Most of those very early tanks no longer exist, unless buried beneath later tips. But some tanks survive at Cerrig Goch on the south of the hill on sites of this early period.

A number of small tanks seem to have been established sporadically on various parts of the mountain before the 1815 (Hughes 1815 [here Figs 25; 26]) and 1818 (Anon 1818) maps were produced. But by that time those waters lying upon the southern side of the hill seem to have been taken into joint use by both mining companies, forming tanks and reservoirs along an east-west alignment about 500 m long. These tanks appear to have fallen out of use during the later nineteenth century, though sporadic precipitation seems to have been carried out at Dyfryn Adda until the 1950s.

Various interesting upstanding buildings remain. A windmill of 1878 now punctuates the skyline. This is a Listed Building. An engine house survives on the north-east side of the hill (Bick 1989, 86,88). Less well preserved, though equally deserving of attention is the Mona Mine Yard (marked on the 1786 Survey: Anon 1786), its walls upstanding to about 2 m in places, seemingly along the exact lines of the original plan. Like a number of other important parts of the early plant, the Vitriol Works shown in 1818 (Anon 1818) are no longer to be found. A detailed ground survey to establish further details of early plant and processing should be undertaken by archaeological agencies.

The later history of mining at Parys

Mining at Parys ceased in 1917. Modern exploration began in 1955 after which time a succession of companies drilled with the aim of delineating economic quantities of 'Bluestone Ore' — a combination of lead, zinc, and copper. Although this ore was found, neither quantity nor quality were considered sufficient to justify economic exploitation. However, initiatives taken by the Anglesey Mining Company after acquisition of mineral rights in 1984 demonstrated the ore reserves to be as great as 4.5 million tonnes.

Proposals and effects of mineral extraction at Parys Mountain: summary of proposals

As a result of its detailed reconnaissance, in May 1986 the Anglesey Mining Co Ltd, a subsidiary of the Imperial Metals Corporation of Vancouver, Canada, submitted to Gwynedd County Council as Mineral Planning Authority an application for planning permission to develop a mining and milling complex to extract and process metalliferous ores and to dispose of waste rock and slurry at Parys Mountain. At the time of the application the only Statutorily Protected feature on the mountain was the windmill. During the course of discussions and consultations the Planning Authority began increasingly to appreciate the historic importance of the site, and steps were taken to seek advice as to the relative importance of surviving mining and processing features, in order to minimise future potential damage to this unusual environment..

At an early stage Gwynedd County Council consulted among others the 'Welsh Mining Society, the Museum of Welsh Archaeology *[sic]* and Cadw'. 'Areas of Special Scientific Interest (SSSIs) and Ancient Monuments etc 'would be highlighted' on maps accompanying the application (Anglesey Mining Company 1985).

Following detailed negotiations during the following eighteen months, agreements were reached culminating in a statement of intent in December 1986 by Gwynedd County Council that they would grant outline planning permission subject to conditions and subject to negotiation of an agreement, under Section 52 of the Planning Act 1971. Negotiations were concluded and a resolution to grant planning permission passed in January 1988 (Gwynedd Co Council 1987).

The application, which put an end to years of speculation as to whether successive trial borehole studies had indicated reserves of sufficient quality and quantity to support viable commercial exploitation, covers an area of about 87 ha (215 acres), and contains the following elements:

(i) the sinking of a shaft, approximately 560 m (1840 ft,) deep on the upper western slopes of the mountain (SH 4338 9029);
(ii) the construction of processing plant and ancillary works (SH 4360 9020);
(iii) the disposal of coarse waste rock and
(iv) the disposal of slurry derived from the flotation process.

Effects of proposed development upon early mining features

Surface disposal is required for 275,000 tonnes of mine development waste and 27,500 tonnes per annum of coarse waste on and around the mountain. An original proposal to use part of the Great Opencast for this purpose was deferred through negotiation with the Mineral Planning Authority. The Great Opencast was considered too unique a feature to be obliterated by such dumping. However, the transport costs of remote dumping of mineral waste could have proved prohibitive to development, so it, is now proposed to dump to the west of the Mountain, on selected areas where the material will also serve the purpose of forming screens to the shaft and and processing plant sites, some of which cover small early nineteenth century precipitation tanks of which other examples survive elsewhere upon Parys.

The area of the planning permission which includes the Great Opencast is to be cleaned up in an environmental improvement scheme required by planning conditions. The waters already in the Great Opencast will disappear when all the old workings are drained.

Tailings lagoons are an even greater problem, owing to their projected massive volume; 185,000 tonnes of slurry per annum. The only site large enough (19 ha; 48 acres) upon which these could possibly be accommodated is along the east-west valley on the south of the mountain. Sadly, here the lagoons will not only obliterate the sites of the earliest documented tanks and reservoirs, but will also completely cover most of the copper precipitation ponds probably established early in the Napoleonic Wars and shown in their present form on the plan of 1815 (Hughes 1815).

The construction of processing plant and ancillary buildings, access road and secondary ventilation shafts sited on an area in part occupied by copper precipitation ponds will cover the area in which the Parys Mine Office and Sulphur Yard stood and will obviate any possibility of access to the possibly buried roasting ovens associated with sulphur production.

Mine dewatering will be undertaken through controlled release at the Dyffryn Adda adit of water from the existing workings. The construction of access and haul routes between waste disposal sites and processing plant will need to be carefully monitored, as it is likely that g-round disturbance

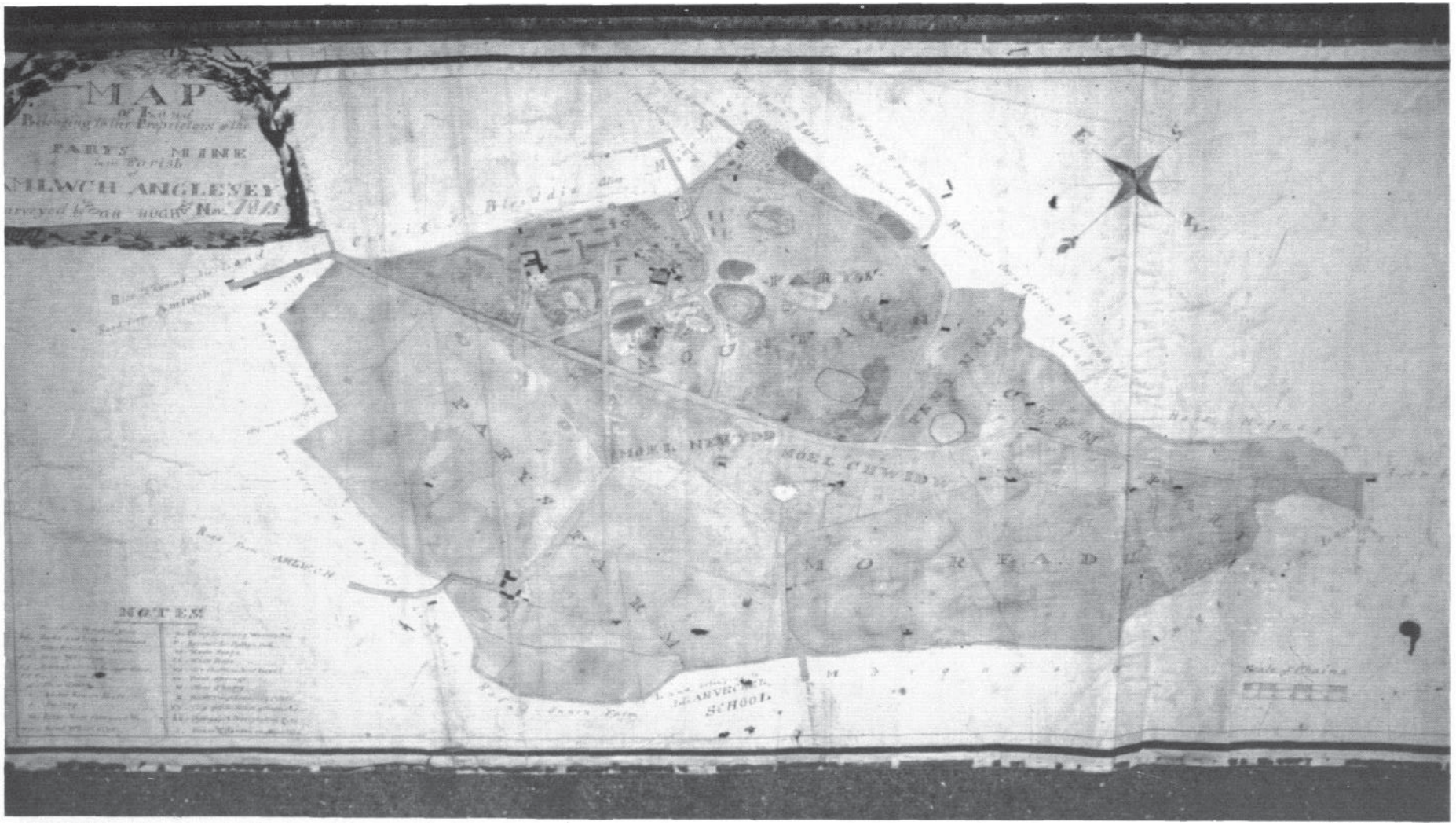

Figure 25 Parys Mountain: Hughes' survey of the Parys Mine, 1815 (plan on deposit in NMR(W)) (Photo C S Briggs)

Figure 26 Parys mountain: detail from Hughes' 1815 survey, showing Parys Mine Yard, a site which will be covered in future mineral exploitation (plan on deposit in NMR(W)) (photo: C S Briggs)

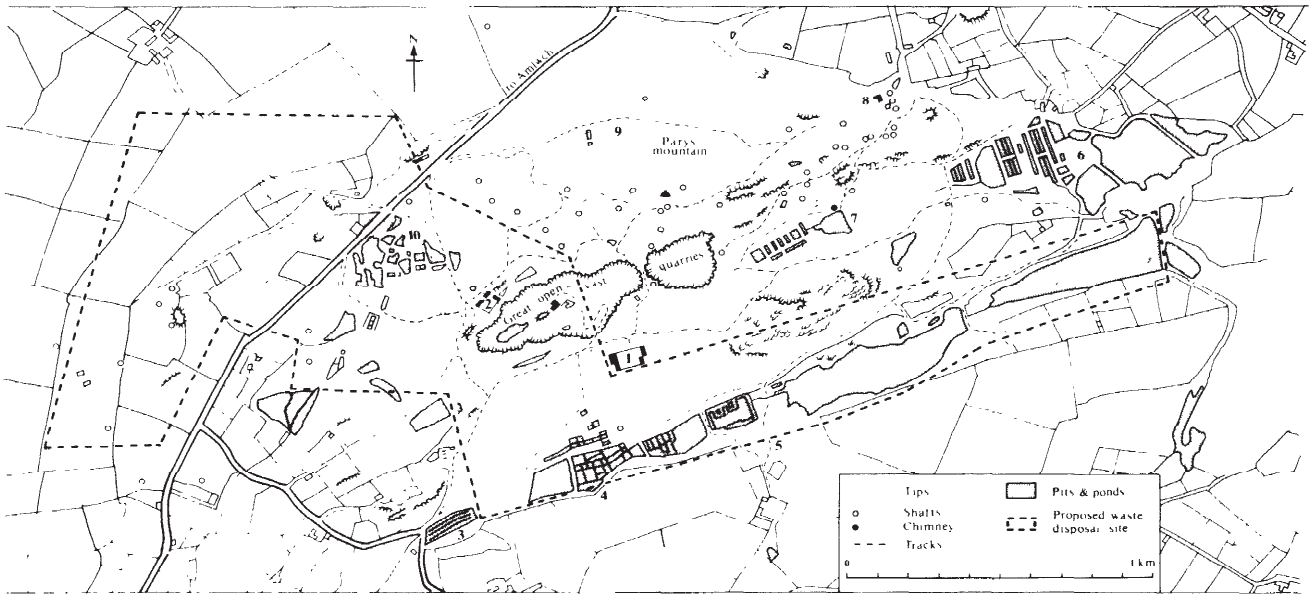

Figure 27 Plan of Parys Mountain showing main historical features and intended mineral development (from field survey blotted upon OS 1905 25-inch plan)

Key:
(bracketted numbers indicate order in Appendix 14.1)
The triangle indicates the site of the windmill (1878)
l (10) Mona Mine Yard
2 (11) Parys Mine Buildings
3 (1; xi) Tal y llyn (south of), precipitation pits (1815)
4 (1; xii) Dyffryn Coch precipitation pits (1786)
5 (6) Vitriol Works (lost) (1818)
6 (1: v) Hen Waith precipitation pits
7 (1; vi) Mona Mine precipitation pits (1786)
8 (5) Cornish engine house
9 (1) Site of 'ancient workings'
10 (1; iii) Parys (north-west) precipitation pits (1815)

almost anywhere on the mountain may reveal early cobbing floors, oven foundations, precipitation tanks or even smelting hearths.

In 1988 it was found possible to grant the developer planning permission on commercially acceptable terms, and as the world price of zinc rose, ensuring the future profitability of the project, work began upon clearing spoil from some parts of the mountain. As it has been found possible neither to mount a watching brief nor to undertake detailed rescue survey, it is clear that some undocumented features and others of considerable importance to the history of copper processing will be destroyed without record.

In order to safeguard the remaining historic features against encroachment from potential future development outside the area currently allotted to extractive and ancillary processes, detailed lists of surviving features and a research assessment of their dating and relative importance has been compiled at RCAHM(W), and this has been submitted to Cadw to assist consideration of implementing Statutory Protection under the Ancient Monuments Act (1979). A brief summary of this is appended and main features of interest are marked upon the site plan (Fig 27).

Conclusions

During negotiations for new mineral developments at Parys, it was the Planning Authority's concern to guide the applicant to develop areas in which environmental damage would cause the least effect. Parys Mountain is itself a massive and complex monument to industrial endeavour, its features almost entirely unprotected by Statute and of which no detailed archaeological survey existed at the time of the planning application. Conscious of its environmental and historical significance, Gwynedd County Council staff consulted widely within and even beyond their brief. But planning applications of such economic moment as this demand that a balance be struck between the practical and the ideal, and the Planning

Department could only negotiate on the strength of existing protection and upon the conservation case presented in responses from consultees.

Short of a permanent recession in the world price of zinc (which would slow down or defer future development), urgent detailed archaeological survey and a careful rescue excavation strategy remain the only tools left with which to examine the historical and technological secrets of this monument before those surface features affected by the planning application disappear for good.

One is left with a sense of regret that no national agency, broadly environmental or specifically archaeological in interest, either anticipated or adequately reacted to the need to record and protect Parys, thus affording it its due recognition as a site of international importance.

Acknowledgements

The writer gratefully acknowledges his indebtedness to Mr J L Gibbins of Gwynedd County Council for explaining the implications of the planning application at Parys itself; for providing most of the information upon which the second part of this contribution is based, and also for kindly commenting upon the draft text. Other comments or assistance with historical sources have been given by Mrs Mary Aris, Dr A P Bazley, Prof J R Harris and Miss P Round. Mr D Bick kindly drew the writer's attention to the smelter site.

Appendix 14.1: Early processing features at Parys Mountain

Sites affected by proposals of January 1988 marked by*:

1 Site of Oliver Davies's excavation on 'ancient workings'.

2 Precipitation pits (from N-S):
(i) Dyffryn Adda [SH 4385 91401; *(ii) North of Amlwch Road on land of Parys Farm [SH 4375 9060]; *(iii) Parys (North-west) [SH 4375 9035] 1815; (iv) Parys (North) [SH 4412 9070]; (v) Hen Waith [SH 4495 9060] 1818; (vi) Mona Mine [SH 4470 9050] 1786; (vii) Parys (West) [SH 438 904] 1815; (viii) Parys (South-west) [SH 4365 9025] 1815; *(ix) Great Opencast [SH 4410 9028] 1818; (x) Penrhyn (West of) [SH 4360 8985] 1815; (xi) Tal y llyn (South of) [SH 4335 8993] 1815; *(xii) Dyffryn Coch [SH 4415 8999] 1786; *(xiii) Parys and Mona (South) [SH 4381 8973 to 4455 9090], pond 1764, two ponds and ?present grid by 1815.

3 Lost precipitation pits: Mona Mine, [SH 4428 9020 and 444 903] 1786.

?*4 Windmill [SH 4320 9060 approx] 1878.

5 Enginehouse.

?*6 Vitriol Works [SH 4460 8992], 1818. Lost.

*7 Brimstone Yard [SH 4405 9045], 1815. Lost.

8 Great Opencast (East) [SH 443 903].

*9 Great Opencast (West) [SH 440 902] 1786 vestigial; 1815; 1818; 1905.

10 Mona Mine Yard [SH 4424 9015] 1786 New Yard.

?*11 Parys Mine Buildings [SH 4393 9023], 1815.

12 Mona Mine Reservoirs, 1786. Lost.

13 Smithy, 1786. Lost.

*14 Kilns [SH 441 901, 439 902 and other areas]. Possible that seven outlines shown on 1786 Mona plan north of New Yard are of kilns. Several marked on 1815 in two groups, and numerous appear in 1818 (Anon 1818). According to Harris (1964, 163-4) Champion introduced sulphur subliming at Parys Mine after 1778. The early kilns were oblong, the later, which improved upon the earlier, were tall and conical.

?*15 Furnaces. None yet positively identified though some may exist in area where bun-shaped cupola slags are dumped [SH 4492 9045]. There is a smelting cupola at Dyffryn Adda (SH 438 914).

?*16 Cobbing floors. There are a number of cobbing floors visible in the sections of early speilheaps. It is desirable that as many as possible of these be preserved, so that some may be excavated and an idea given of their size and nature.

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Anon, 1818 *A plan of the Parys Mountain showing the general disposition of the works belonging to the Copper Mines,* MS plan under varnish, restored and bearing the name J Taylor and Sons, London, photocopy with British Geological Survey, Llanfarian, Aberystwyth (D O Dee 1959, PP 299/DO, III)

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15 The industrial heritage: British Coal

by Ray Proctor

The development of the South Wales Coalfield has been crucially influenced by geology and topography. The coal seams tend to be heavily faulted and working conditions can be difficult. However, the variety of coals — anthracite, dry steam, coking coal — and the premium quality of the product have, when market demand has been strong, provided economic compensation for the difficulties. It was the discovery of steam coal in the Cynon and Rhondda Valleys in the 1850s and 1860s which led to the 'Klondyke' development of the coalfield. Previously, it had been an adjunct of the iron industry or, in the west, a cottage industry 'cropping' anthracite. Now, with a booming railway and marine market it started exponential growth. By 1913, the coalfield was producing 57 million tonnes per annum. Cardiff was the centre of the international coal trade. The Rhondda alone supported over fifty collieries. By 1921, the coalfield employed 280,000 people. One in every four Welshmen was a collier.

Topography was a major determinant of this development. In the eastern and central parts of the coalfield, the area was characterised by steeply-sided valleys. Before the discovery of steam coal, these valleys were sparsely populated. When industrialisation came, the limited areas of flat land in the valley bottom became a scarce resource. This flat land accommodated the head-gear and winding house and other surface facilities of the pit. A road and railway were also required. Spoil would be cast on the mountain side. To work the mines people needed to be imported, In the second half of the nineteenth century, south Wales was second only to the United States as an attractor of immigrants. In the era of 'frontier capitalism' the incomers were accommodated as near to their place of work as possible. Where flat land was available, the colliers' terraces were built in an early manifestation of ribbon development along the valley bottoms. Where industrial building and lines of communication had pre-empted the flat land, the houses were terraced along the valley sides.

In terms of output, the coalfield peaked in 1913. In terms of employment, the peak came in 1921. It is possible to argue that, strictly in volume terms, the coalfield has been in decline ever since. Recession, depression, and the rise of foreign coal industries impacted on the South Wales Coalfield between the wars. The industry was Nationalised in 1947. For a time, the decline in output was arrested and heavy investment was made in the mines. Productivity improved but, as the industry became more capital intensive, higher output no longer meant higher employment. In the wider economy, in the 1950s and 1960s, the consumer was turning away from coal. The UK was moving from a one-fuel (coal) to a four-fuel (coal, oil, natural gas, and nuclear) economy Coal was seen as expensive and inconvenient. Whole markets disappeared almost overnight. The coalfield experienced massive contraction in the 1960s. The 1970s brought some respite, as, in the aftermath of the Yom Kippur War, energy ceased to be a low-cost commodity and the importance of indigenous energy sources was made apparent. The coalfield attracted substantial capital investment but by the late 1970s the major competitor had ceased to be oil and had become imported coal. Twelve months after the 1984/85 strike, the coalfield consisted of sixteen collieries employing some 12,000 men.

British Coal has cooperated in attempts to preserve the industrial heritage. However, mining poses special problems in comparison with other industries. The major part of the productive process is underground and the environment has to be stringently controlled. The workings need to be pumped and ventilated, the strata constantly supported and shafts and equipment maintained to a high standard. The cost of maintaining such underground workings is considerable. In addition, much of the equipment from a closed mine can be transferred to productive work in an operating mine. In times of financial stringency, a major impediment exists to the donation of such 'artefacts' to museums and other institutions. Finally, in the context of south Wales, it is difficult to maintain surface installations intact when operations have ceased at a colliery. There is usually great pressure to free up the flat land for industrial development.

Within these pressures, British Coal has tried to be supportive of attempts to display the heritage. It has provided artefacts to many locations in south Wales, particularly Kidwelly, Afan Argoed and Big Pit, Blaenavon (Davies, this volume, Chapter 21). On an *ad hoc* basis, winding wheels and other artefacts have been provided to commemorate collieries in virtually every mining valley in south Wales. Where surface installations have been

maintained (Big Pit and Cefn Coed), major support has been provided. Again, the proposed Rhondda Heritage Centre has attracted support. Support has usually been in kind rather than in cash, because of the financial position of the industry, but in recent years British Coal (Enterprise) has provided financial support for, among others, both Big Pit and the Rhondda Heritage Centre.

Footnote

The above statement, written in 1987, does not take account of developments in recording abandoned collieries undertaken by the Welsh Industrial Archaeology Panel (Hughes, this volume, Chapter 26).

Bibliographical Note

In 1983, D Brown and Sons Limited, of Cowbridge, printed three studies on South Wales coalmining areas as part of a Coalfield series. Based upon both contemporary and archive photographs, the texts provided brief colliery histories with some technical detail. All were written by John Cornwell, viz: (1) *The Great Western and Lewis Merthyr Collieries;* (3) *Collieries of Western Gwent,* and (4), *Rhondda Collieries.* The third treated *Collieries of Kingswood and South Gloucestershire.* As most working mines described by Cornwell were abandoned within two or three years, these books form a remarkably valuable and prescient record.

Section IV Museums, education, and recreation

16 Problems of presentation

by Adrian Babbidge

Why do we preserve the tangible evidence of the past? Besides academic and aesthetic reasons, a paramount role is played by the psychological and emotional elements which link monuments of the past — and the people who created them — with our present-day society. They help generate a sense of identity and pride of place in the communities within which they are located, and strengthen cultural values. They have a special integrity deriving from their status as survivors of change and testaments of past experience. These psychological links, common to all ancient monuments, are especially well-presented by industrial archaeological sites. These are of the recent past, and have some characteristics common with today, so that the British public can relate to this particular period of history with ease.

Presentation of such monuments has to recognise these special characteristics. The three major components of presentation — use, interpretation, and management — should identify the real meaning of industry: the interface between technology and the people who created and used it. It is my intention during this paper to explore some of the problems posed by these three activities in terms of this interface.

Use is inevitably dictated by the nature of the property. A ruined blast furnace can only normally be treated as an ancient monument and conserved as such; a redundant steam engine is best preserved in a museum environment. Sometimes pieces of industrial archaeological equipment are treated as community memorials or even 'sculpture', yet often lack of maintenance or inappropriate landscaping degrade their meaning. What does the steam hammer in the municipal car park tell us? Or the railway locomotive in the park or the display of mining equipment in the school grounds? They may be justified on purely artistic or landscape values, but do they, as often claimed, really provide a link with the past?

Buildings present the greatest opportunities to bring the social and economic benefit of the industrial past to present-day communities, but often opportunities are allowed to slip by. Warehouses, engine houses, workshops and other industrial buildings, and community buildings such as workmens' institutes and chapels, reflecting the social background to traditional industries, often become redundant as a result of depopulation and changes in industry or fashion, yet internally have a potential flexibility of space which can be usefully deployed to modern use, sustaining an economic or social role in the community. Yet rarely are such opportunities taken up. Many usable buildings are lost, and others, capable of imaginative adaption and use, allowed to fall into disrepair and become derelict. The advantage of reuse has been proved time and time again by new occupiers who find in adapted premises a feeling of permanency and place within a community: they present an individuality evident to visitors and customers, who look upon such premises in a more positive way than they would a prefabricated industrial unit of limited architectural merit and apparent impermanence.

Similarly old housing can — and has been — adapted to meet the needs of the last quarter of the twentieth century. Many of these exercises have been successful in retaining their original features, particularly the feeling of tight-knit community generated by narrow pavements and absence of forecourts, and yards to the front and rear. One may legitimately ask whether the preservation of traditional dwellings can be justified if it involves the destruction of those features which marked the social characteristics of these earlier homes.

The interpretation of industrial archaeological properties present perhaps more profound and philosophical problems. The development of heritage tourism in recent years has been accompanied by a growing interest in the more recent past, and a number of industrial archaeological sites have become tourist honeypots. Indeed, many depend on visitor-generated income for their survival and development: a cynic would say this makes for an obligation on the part of their managers to give the public what it wants.

Of course, there is nothing wrong in giving the public what it wants, except that the public does not want very much, and a feeling of nostalgia is often satisfaction enough. Nostalgia is easily created on industrial archaeological sites, which unlike the remains of earlier ages were constructed in a period within the folk memory of the present-day population. The sites themselves may facilitate the generation of nostalgia. Their small-scale and semi-rural surroundings bear little resemblance to the dirty and smoky appearance which would have been all-present in the industrial past. The planning which goes into creating an environment capable of dealing with thousands of visitors tends not to be ordered untidiness of the past but a panorama which would not disgrace a twentieth century town planner. This attractiveness makes it difficult to appreciate the disadvantages and more unpleasant features of the past — death, disease, injury, industrial strife,

class conflict, and insanitary housing are relegated to the background, ignored or glossed over in favour of more appealing issues. Little of the misery is presented outside of introductory didactic exhibitions which may have less inherent appeal then the site itself.

Yet if we only identify what are perceived as negative aspects of the past — 'the bad old days syndrome' — we are likely to be equally untruthful in our interpretation. The demand for coal, and the rapid development of the south Wales valleys to fuel that need, led to the communities which grew around the collieries enjoying a standard of living which was a substantial improvement on what had gone before. Although there was industrial strife, disease and death were commonplace to all families, and there was some poverty and depression, between 1830 and 1914 most of the population experienced a dramatic rise in their living conditions. The demand for coal and the rapid expansion of collieries in south Wales to fuel that need enabled the colliers who worked there to enjoy a standard of life which would have astonished their ancestors. Workers found themselves able, for the first time, to buy their homes and furnish them comfortably. They had disposable income to fund visits to places of public entertainment, and to contribute to the community chest. They established, built and maintained their own places of worship; created libraries and recreational facilities in workmens' institutes; and founded medical societies to provide free treatment for subscribers. Opportunities for mass education existed for the first time; there was scope for self-improvement, and the trades union movement, and the Labour Party which grew out of it, presented scope for political action, and opportunities to participate in the government of the community. All reflect the financial, personal and cultural resources available until the First World War.

When we look at this past today we look at it from the viewpoint of the 1990s. Thus we consider eleven people living in a small cottage overcrowded, yet a century ago this would have been unexceptional. Even today, in some countries where the extended family is still commonplace, similar numbers of occupants in dwellings of the same size are not unusual even among professional classes. Similarly our attitudes to children have changed, as has our attitude to death. We have to accept that, although it may not seem a long time ago, and is within the memory of a couple of generations, our industrial past is culturally different from the society in which we live today. History is a dynamic, and fifty years hence attitudes to the 1990s will be as quaint as those generally held now to the early 1900s. The role of the interpreter is to recognise the nature of these changing attitudes, and to crystallise these so as to create a response from the audience which can identify these changes. Such interpretation will be most effective if it produces a historical mood comprising a convincing detailed physical environment, personal contact, and a high degree of user participation.

The most innovative approach to achieving this is through the American concept of 'living history'. The can be defined as the dramatic creation of history situations to show people's working lives and attitudes. Availability of a wider range of resources, materials, and good documentation make this technique especially suited to the industrial period. Trained demonstrators dressed in appropriate replica period costume carry out the daily routine of the role being created, and converse with visitors. This is done either in the first person ('this is how *we* live') or the third person ('this is how *they* lived'). At some American sites the role-play involves the demonstrator going to the extent of assuming personality characteristics, including reproducing period dialects and accents. Through carefully-researched induction of demonstrators, and thorough preparation for their role, there is little doubt that such performances can do much to convey the attitudes and characteristics of the period. Clearly though, the provision of such services to a high standard is an expensive item, and given the visitor numbers to most industrial monuments, such exercises are rarely financially viable. The key to success in this area of interpretation is high-quality training, and it is unfortunate that many of the 'living history' exercises undertaken in this country have been particularly poor examples of the type, seeking to reinforce stereotypes rather than explain the attitudes of past industrial societies. It is perhaps that these unfortunate examples have reinforced a traditional hostility from those involved in British heritage management who consider such activities to diminish the integrity of what is being preserved, and it is hard to see the technique being developed successfully without the resources and expertise of places like Old Sturbridge Village and Plimoth Plantation in the United States.

However, even if one rejects the 'living history' concept for economic or philosophical reasons, there is still scope for personalising history using the traditional media of exhibitions and publications. Most interpretation of industrial history is explained in terms of an overview; only rarely does it relate specifically to human experience as exemplified by the family or individual — the units with which the public can most easily identify.

In recent years much interpretation of the industrial past has made frequent use of the 'story board' concept. Rather than use traditional museum displays based on objects, displays concentrate on telling a story using artefacts along with graphics and other illustrative material to highlight the storyline. This approach has its critics, who consider the end-product to be 'a book on a wall', and argue that the same effect could be achieved more economically through a publication. In fact this criticism overlooks that the largest part

of the public do not read books, but can enjoy a well-presented exhibition — much of which is two dimensional — because it represents a different experience. It is not solitary, as is reading, and can engage several members of a group; it invariably involves travel and contact with other people, if only at the reception desk. It is perceived as a recreational activity and hence visitors for such exhibitions far outnumber the most popular books on related themes.

Improvements in communication technology have also produced media which can be effectively used in interpreting industrial history. The use of film and video to portray contemporary accounts of happenings, fashion and attitude is of great importance but tends to be under-used. A similar role of importance can be placed by oral material, especially in terms of publications. The technology of the past needs similar imagination in its interpretation. Generally the plant and equipment of the past survives divorced from its original context in museums or on-site: it is usually immobile, and lacks the smell and animation of its period in use.

Some items can be demonstrated but are not operated because, it is argued, to so do would result in deterioration of their fabric and the eventual destruction of the specimen. Yet we should recall that throughout its working life it was maintained, repaired and adapted, processes which often involved the replacement of components. In the case of railway locomotives, or similar machinery, during their operational existence they were probably subject to virtually complete rebuilds. What is important about such items are the skills and crafts which were put into their design, construction and maintenance, and perhaps those involved in the conservation of the technological past should put as much effort into sustaining this expertise — which is now slowly dying out. This need not be a purely sterile exercise involved only in the repair and maintenance of museum specimens, but could be integrated into training programmes and apprenticeships to stimulate the generation of engineering skills. Unlike other countries in the industrial world, engineering training in the UK tends not to be practically based: yet without appreciation of the skills which produced today's technology how can we expect to produce the skills and experience necessary to sustain a manufacturing base to our industry?

Management of the industrial archaeological heritage presents the last and perhaps most fundamental problem. As we have seen before, monuments of the industrial past are invariably identified with a landscape or townscape which needs to be seen in totality to understand the progress of industrialisation in an area. Yet in Britain preservation has been confined to individual sites rather than complete industrial environments. Similarly, this preservation has been reactive, rescuing material after the main decisions about the form of its enveloping environment have been taken. We have not adopted either the continental European concept of the ecomuseum or its American equivalent of the urban National Historic Park. In the United Kingdom our only response to the conservation of industrial environments has been through the Civic Amenities Act and its enabled Conservation Areas. Yet these are purely mechanisms for town planning control, and lack the depth of management in terms of design, recreational use and public service found in the ecomuseum or National Historic Park. What perhaps we should be seeking is an equivalent to the arrangements exercised by National Park Authorities in the UK, with not only power to maintain visual character, plan and control development and ensure the preservation of the environment, but to interpret and stimulate the recreational use of the locality by the general public. When this approach has been attempted on an informal basis in the past it has met with accusations of seeking to fossilise a community, and thereby hinder its social and economic development. The need — indeed the inevitability — of change must be accepted by all, yet no such change is totally isolated in time and space. Few developments obliterate a historic environment in total; rather change is part of a gradual evolution, and involvement by a heritage management agency in the planning of this change is likely to ensure that significant areas of development achieve the interpolation of the past environment with the new.

The benefits of the managed approach have been well proven elsewhere. It has helped in the regeneration of decayed inner city and urban areas. At Lowell in Massachusetts, several agencies — federal, state, city, and private — have, working to an organised and pre-agreed master plan, helped in the revitalisation of what was once the world's largest producer of textiles. In Pennsylvania the Museum of Anthracite, a fragmented operation spread throughout the Scranton-Wilkes Barre area, has included the conservation of a complete coalmining community at Beckley. In France, at Le Creusot-Montceau Les Mines, a pioneer ecomuseum has helped to stimulate a revival of a community in a decaying area of heavy industry. The only British development which bears any sort of comparison with these overseas examples is New Lanark, where a mix of public and independent agencies have rehabilitated Robert Owen's model town, providing thereby modern housing and community buildings, as well as industrial opportunities. This operation, like the best of those from overseas, shows a partnership by several public and semi-public bodies working to a well-defined master plan. Surely there are similar opportunities in Wales to rehabilitate communities in a way which reflects their heritage?

The end product would not only be able to maintain the essential features of the historic environment, but to stimulate a new confidence

from outside in terms of investment and heritage tourism. Only the most disinterested investor would wish to put money into a place without pride in itself. And although heritage tourism has been loudly trumpeted as a major factor in the revitalisation of the Valleys, worldwide experience shows that this type of tourism can only succeed when it is based on the wish of the local community to show off to the world. Without such community support for tourism, potential visitors are likely to have a fairly miserable time. Developments of the type indicated above, capitalising on the best of the community, is likely to be a strong antidote to the 'if it's here it can't be any good' syndrome which has derived from the mass emigration of the Depression and which has been one of the main sources for debilitation of the industrial Valleys over the past half century.

Conclusion

This paper has provided an opportunity to introduce a range of points relevant to the useful presentation of the Welsh industrial heritage. It is hoped that these and others might be explored in greater depth at a later date. However, it is sad to reflect that even though massive amounts of money continue to be spent on the more depressed areas of Wales, it seems unlikely that any sort of coordinated plan will emerge from within the Principality: as it is, it is already almost too late.

Footnote

This paper was written in the late Autumn of 1986. Changes in practice, attitude, and social fashion during the intervening five years would inevitably mean that a paper written on a similar theme today might have other priorities, or approach the issues discussed differently.

However, the need for co-ordinated action in the preservation and presentation of the industrial past would remain a pivotal issue. It is unlikely that there will be many new presentation projects, but schemes developed in the past, largely through government employment programmes, are vulnerable to decline or collapse. The case for creating effective networks of government, voluntary, and private concerns, remains as compelling as it was in 1986, but now with a brief to sustain what has been achieved — inadequate though it is — rather than to attempt anything new. The inheritance of Wales's industrial past has never been more at risk than it is now.

17 Industrial archaeology and the National Museum of Wales

by Geraint Jenkins

Within the last few years there has been a deliberate change of policy at the Welsh Industrial and Maritime Museum. It was originally conceived as a museum of industrial archaeology that set out to collect and display the relics of Wales's industrial past. In the galleries in Cathays Park and in a new purpose-built building in the heart of Cardiff's dockland, artefacts, many of them of considerable size, were held up to view like paintings in an art gallery with scant reference to their context and background, Of course it was very important in the days when a great deal of material was disappearing with the ever-increasing pace of deindustrialisation that the relics of industry were collected. But I believe that the presentation of those exhibits, interesting though they may be to a specialist engineer, is only a part of the work that we have to carry out.

The Welsh Industrial and Maritime Museum is not a science museum that happens to be located in Cardiff, and although the history and development of machinery and the technological processes may be an integral element in the museum's collections, the principal aim of the institution is to conserve and interpret that material which illustrates the character and personality of industrial and maritime communities in Wales. We have a duty to provide an insight into the heritage of a national group not only to provide knowledge but also to instil pride and inspiration in those people that visit the museum.

In other words the objects on view in an industrial museum can never be considered in isolation; they can never be held up or displayed like pieces of fine porcelain but they should contribute to a clearer understanding of the people that they represent; the history of a people and of communities that were concerned with making a living. We have a human as well as a technological story to tell and the Welsh Industrial and Maritime Museum should be, above all else, a living memorial to the generations of industrial workers and to the seamen that contributed so much to the heritage of the Principality. I believe therefore, that three dimensional objects should not be collected in isolation without reference to the geographical, economic, social, and cultural context of those objects.

As in all museum collecting, the preservation of material objects alone is not enough, for the objects concerned should contribute to a clearer understanding of a man's involvement in the industry, and the artefacts exhibited should be integrated into their proper systematic context to provide an insight into the many facets of economic and cultural life of an industrial community. It is not the function of a museum such as the Industrial and Maritime Museum to exhibit the beautiful, the unique, and the extraordinary out of context. Although those exhibits, like a picture in an art gallery, tell much about themselves, they tell us very little about anything else.

I believe that the concept of the Hall of Power, set up at the Welsh Industrial and Maritime Museum in 1977, was probably not the correct one, for the permanent exhibition gallery is bogged down with twenty-six engines of various types that once provided power for a variety of industrial undertakings. For example, like most other industrial museums, we have a beam engine turning merrily under steam power, or compressed air if it is not a special steam day. It may be enough just to say that this engine was built by Harveys of Hayle in 1851 and was installed at the waterworks in Cardiff in 1852, but the beam engine can be used as a peg to hang the story of the development of what became the principal port in the United Kingdom.

In 1801 Cardiff had experienced little of the effects of the Industrial Revolution; it was a small market town of about 1800 people with houses clustered around its castle. Cattle grazed on what was to become Cardiff Arms Park and the River Taff was particularly well-known as a salmon river. By 1850, as a result of the growth of the iron and coal industries, the population had grown to 50,000 and the development of the port led to overcrowding, squalor and disease. A community of less than 2000 people on the banks of the Taff with extensive open spaces around had no problems of water supply, drainage and sanitation, for the river provided an ample supply of reasonably pure water. Unfortunately that river became polluted, and the lack of drainage led to the contamination of the water supply with the result that typhoid and cholera were rampant. In 1849 the Cardiff Waterworks Company was formed and it embarked on a scheme to draw water from the river, filter it through a sand-bed and then pump it into a reservoir. The beam engine on view at the museum fulfilled this function.

Or take the example of the large, impressive, triple expansion engine once used for providing ventilation to the Crumlin Colliery. I am told that it

had an output of 500 hp, it is fitted with a Corliss valve gear, weighs fifteen tons and was capable of circulating 300,000 cubic feet *(c* 8500 cubic metres) of air per minute. What I am not told is how important a ventilating system was to a coal mine. What could happen without a proper system, as occurred at the Senghenydd Colliery Disaster in 1913? How did they ventilate a mine before the invention of an engine such as this? These are some of the questions I would like answered in a museum display.

Obviously in the collection of industrial material great care has to be taken in the choice and selection of specimens to be collected. It was my friend Niels Jannasch of the Museum of the Atlantic at Halifax, Nova Scotia, who said some time ago:

> We do live at the end of a long era, which developed slowly and in which traditions were kept much longer than is now possible. Suddenly our civilisation has been thrown into a turmoil by an unprecedented revolution in the technology. Hence a fantastic growth in the number of history museums because man does not want to lose his roots which provide so much stability. He wants to known about his past and he has also the incurable tendency to wax romantic. Imagine what the world, especially the western world would look like today if past generations had been as keen on collecting and preserving as we have been during the last twenty years. Perhaps one-fifth of our countries would by now be covered by museums, historic buildings, villages and towns, industries and historic harbours full of ships (Jannasch 1980, 189).

There is, I believe, a great danger in trying to preserve too much, and a museum that concerns itself with the collection of industrial artefacts and the preservation of industrial sites must proceed with great care and forethought. In Wales, for example, an attempt at preserving all kinds of industrial undertakings, industrial buildings, railway engines and steamships, beam engines and motor cars, is rapidly attaining the level of an epidemic, as if the past was the only flourishing future that we have. We now have at least a dozen corn mills preserved, with many more in the pipeline; there are at least six preserved slate quarries; twelve woollen mills and a spider's web of the Great Little Trains of Wales. The next growth point could be to preserve coal mines, for at any time it is proposed to close a coal mine, someone somewhere will have a plan for its preservation and its eventual opening to the general public, despite the almost insurmountable problems of safety and the huge costs of preserving such industrial monuments. I wonder if future generations will thank us for handing down to them so many preserved industrial sites and artefacts? Would it not be better to keep a selected few and we could turn to accurate plans, specifications, illustrations and histories of the remainder? It is difficult now and it will be even more difficult in the future for the curators of industrial museums to make the agonising decision of what to enshrine and preserve for posterity and what to let go to the scrap yard. Preservation of industrial material, much of it of considerable size, is both expensive and time-consuming, and its conservation may demand an expertise that may no longer exist.

To highlight these problems let me quote another museum growth point — the preservation of ships. The Welsh Industrial and Maritime Museum has four largish vessels and about a dozen boats in its collection and if the conservation of those relatively small item has proved so expensive and difficult, I find it very difficult indeed to justify the preservation of any large vessel. Obviously, preserved ships have a great appeal to the museum visitors, but preservation is not cheap or easy. If a museum authority had vast funds; if it were able to draw on a pool of expertise on the techniques of shipbuilding, mast and spar making, iron founding, and sail making; if it were able to obtain authentic raw materials, in the form of seasoned oak, cast iron, copper sheathing, etc, then selected vessels could be preserved. But ships, whether preserved in water or on dry land, demand endless attention and without a bottomless pocket and a very skilled extensive staff, preservations should not be contemplated. The same is true of so many other objects that represent our long and varied history as an industrial nation. There is no virtue whatsoever in a museum obtaining artefacts that are not properly conserved or restored.

I believe too, that in museum collections in Britain today, there has been a tendency to collect material, most of it dating from the late nineteenth and early twentieth centuries, that very often has nostalgic and romantic connotations. Is there a danger that we are becoming pedlars of nostalgia, the romance of the age of sail or the era of steam? Most collections in industrial museums today only represent a very short span in the history of man's industrial activity and it is necessary to collect material that will provide a balanced picture of man's activity throughout the ages, even bringing attention to recent developments in science and technology. As the nineteenth and twentieth centuries fade further into the past, the task of making museum visitors understand the whole history of man and industry will become even more complex. The dangers of becoming nothing more than purveyors of nostalgia will be with us for ever.

As far as museum exhibits are concerned, more and more obsolete material is readily available as factories and mines close down and as the process of deindustrialisation marches on at an ever-increasing pace. Nevertheless, very frequently the material offered to a museum by an industrial

company may not be the material a museum seeks and I am firmly of the opinion that the only way forward must be the drawing up of plan of priorities; the inventory of what is worthy of preservation and what is representative of the heritage that we wish to picture and interpret has to be drawn up. In other words for every field of activity one needs a blueprint for development, and that blueprint must be based on good academic research and a thorough understanding of each subject matter by those compiling the blueprint. The themes, the storyline that would provide an insight into the heritage and nature of an area are to be selected first, and thus, the curator is in a much better position to judge what is worthy of preservation and select the artefacts that are representative of the heritage that is being presented. For example, in establishing the Museum of the Welsh Woollen Industry at Drefach Felindre in rural Dyfed, the work started by carrying out a full-scale in-depth survey of the Welsh woollen industry. All the mills in Wales were visited and examples of their products were obtained. An attempt was made to obtain details of the location of the industry in the past and as a result of a press appeal, conversations with industrialists and with voluntary collectors, it became possible to locate nearly a thousand woollen mills in all parts of Wales. Most of them were visited and details were entered on a short questionnaire, either filled in by myself, factory owners or voluntary collectors. Every woollen mill was photographed and a large number were measured in detail. These ranged in type from a small owner-occupied, one-man business, to a large comprehensive mill employing hundreds of workers.

As a result of an intensive programme of fieldwork it became possible to decide where a major museum to represent the most important of Welsh industries, could be located. Undoubtedly, the whole life of a village such as Drefach Felindre was tied up with the processes of textile manufacture and while that industry flourished from 1860-1945, so too did a wide range of social, cultural and religious institutions.

In the interpretative exhibition in the museum, located in a part of a working mill, the unifying theme is that of wool. Within a mile of the museum, all the evolutionary stages of the development of the wool textile industry may be seen. There are about thirty disused mills and two that are still in full production. There are weirs across the streams that were concerned with water power, plantations of teazels, huge nonconformist chapels and extensive school buildings. They, together with a disused railway line and numerous weavers' cottages, are all associated with the golden era in the life of a village. It would have been relatively easy, at Drefach, to produce an historical museum that would reflect the dead forgotten past, but an attempt was made to bring the story of the Welsh woollen industry up to date by devoting a section of the exhibition space to the modern Welsh industry and its products; thus the museum acts as a shop window for the woollen manufacturer of contemporary Wales. In the same way the Museum of the Slate Industry at Llanberis, Gwynedd, another branch of the National Museum, is representative of that important industry and all its collections and displays are the result of close coordination between the museum on the one hand, and the local community, including the quarry owners, on the other.

I believe that in all industrial museums one has to search for authenticity and truth, and the picture that emerges in some cases may not always please those concerned with that particular industry. For example, when we visit the cosy, tourist-orientated slate quarries of Gwynedd, is the picture of the slate quarryman presented a truthful one? Were they all concerned with composing *englynion?* Were they all concerned with philosophical literary discussions in the *caban?* Were they all concerned with making slate fans in their leisure hours and did they all take rides along the network of narrow gauge railways? It was my colleague, Dr Dafydd Roberts who stated:

> The main pitfall in the preservation of the slate industry is to present a sanitised, innocuous industry and a happy community of men and masters who conformed to the most popular stereotype of the Welshman. Death and injury, insanitary houses and ill-health, trade unionism and hatred of anglicised masters are themes far too often ignored, or merely glossed over to hurry on to more desirable issues (Roberts 1987).

In the interpretation of any group there is a grave danger in clouding the unpalatable truth with an aura of romanticism and false tranquillity.

Let me finally return, then, to what we intend doing at the Welsh Industrial and Maritime Museum. The Industrial and Maritime Museum was opened in 1977 but since then we have had no new buildings of any sort, but we have attempted to solve our problems in two ways: by temporary exhibitions and by utilising existing buildings. In the first place the limited amount of exhibition space within the present building has been utilised for a large number of temporary exhibitions ranging from *The changing face of Cardiff's dockland* to *Civil engineering in Wales,* and from an evocative exhibition on the Rhondda, to a history of Welsh railways.

Recently, too, we opened a new Railway Gallery located in the old Bute Road Station just up the road from the main museum building. Here, in this Railway Gallery, you will see a large number of photographs, models, maps, documents and other railway material devoted to the history of railways in Wales. Particular attention is paid to the way in

which the coming of railways affected the life of Welsh people: the carriage of mail, the provision of fresh milk, of newspapers, and so on. In that Railway Gallery too, there is an exhibition of the history of the Taff Vale Railway itself, probably Wales's greatest railway company. And it is important that in a museum such as ours, concerned with the historical interpretation of Welsh industrial and maritime life, that we should utilise these sites that are of historic importance in various parts of Wales.

This we have already done at the Cambrian Mills, Drefach Felindre. We have done it at the Welsh Slate Museum at Gilfach Ddu, but we are also making an attempt in the heart of Cardiff's dockland to preserve buildings, for this area around the museum between the Bute West Dock and the Windsor Esplanade is an area of great historic importance. Here the Glamorganshire Canal, that brought prosperity to Cardiff, enters the sea. Here were located the shipbuilding yards where Cardiff's first steamships were built. Here, too, were the most important complex of graving docks in the whole of Wales and public houses (like the recently renovated Big Windsor Hotel) that were well-known to sailors in all parts of the world. These buildings still remain as fine examples of late nineteenth century architecture. In this area too were Frazer's Shipstores that the museum purchased some years ago and completely renovated in the heart of Bute Street to contain an interpretative exhibition relating to Cardiff ships and Cardiff shipowners.

In the future development of the museum, here in the heart of Tiger Bay, we are looking at the imaginative rejuvenation of an environment, a townscape that could be the most exciting in Britain. We envisage the development of a facility that could be different from anything else tried in the country and we in the capital of Wales could be innovators bringing in a completely new approach to the interpretation of maritime history and a dockland environment. The probability of a barrage from Penarth Head to the dock entrance of Cardiff and the revitalisation of Butetown presents us with an opportunity of development that we as an institution cannot possibly ignore.

Footnote

This paper, being the writer's Presidential Address, abbreviates a longer one, given to the Society for Folklife Studies at Bangor, September 1986, and which appeared *in extenso* in *Folklife,* **25** (1986-7), 5-17, as 'Interpreting the heritage of Wales'.

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18 The National Trust and industrial archaeology

by Richard Keen

In June 1982 a subject paper bearing the above title was presented to the Properties Committee of the National Trust. That it was written was an indication of the continuing and increasing awareness shown towards the subject within the National Trust. By 1940, when the first large house was acquired under the Country House scheme, there were already eight properties of an industrial archaeological nature in its care. Since then the Trust has continued to acquire industrial sites, though usually only where they form a part of some larger acquisition or 'provided that the highest possible standards — aesthetic, historical and financial — were observed' (Ridley 1964).

There is much of interest to industrial archaeologists associated with the large houses and their estates — watermills, lighting and heating units, pumps, etc, and many 'open space' properties bear witness to early industrial activity, for example, the metal mines on the Aberglaslyn Estate in the North Wales Region (Latham, this volume, Chapter 11). The number of instances where sites or installations have been acquired purely for their industrial archaeological value are limited. These include the lease of the Stratford Canal in 1960 (the freehold was purchased in 1964) and the Cornish Beam Engines in 1967. Even acceptance of the major industrial site of Aberdulais Falls in 1981 was influenced by its scenic setting (Hayman 1986; 1987).

The costs of preserving and maintaining industrial archaeological sites can be staggering, and the National Trust is naturally reluctant to over-commit itself, indeed whenever possible it seeks to work in conjunction with other bodies. The Quarry Bank Mill at Styal (Cheshire) and the Corn Mill at Dunster are examples whereby the Trust retains ownership, but others manage and raise funds to protect the sites.

In broad terms the Trust will continue to maintain the sites in its ownership but 'does not aim to hold a representative selection of industrial monuments' (Ridley 1964). However, it does acknowledge that certain regions, such as south Wales and the North-east, may, because of their history and concentration of industrial sites, place greater emphasis on industrial site acquisition.

Within the South Wales Region the Trust had expanded its activity in this field with the opening of Aberdulais Falls and the Dolaucothi Gold Mines near Pumsaint (Clough and Briggs, this volume, Chapter 20). Furthermore, it has recently acquired an area of coastline that includes the remains of a nineteenth century slate quarry at Abereiddy near St David's (SM 79 31). It is also working with the British Historic Buildings Trust and the Secondary Housing Association for Wales in attempting to preserve the essential, mainly external, character of industrial housing by the application of restrictive covenants.

Two of the large houses in the North Wales Region have important links with industrial history. Penrhyn Castle is a monument to a slate quarry owner (Marsden 1990), Erddig (Guide 1978) is rightly famous for its workshops, and Telford's Suspension Bridge at Conway (Hague 1972) must surely be one of the outstanding industrial monuments in Britain.

All industrial archaeological sites are, however, costly to maintain, and even where entry fees are charged, admissions alone are not sufficient to offset the costs. Conservation of 'open' sites therefore has to be met from other budgets. Sites that form part of larger properties can be problematic and require continual inspection especially quarries and ruined buildings with their all too obvious hazards. The Trust had every reason to be thankful for the plethora of MSC schemes that was directed towards specific projects.

In conclusion the National Trust is concerned about industrial archaeology but does not see itself as being in the forefront of providing protection. Rather it perceives its role as being the final resort and even then any proposed preservation scheme would have to meet its criteria of 'highest possible standards'.

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19 Bersham Ironworks

by Stephen Grenter and Ann Williams

Introduction

Bersham is situated two miles to the south-west of Wrexham within the Clywedog valley (OS SJ 307 492, Fig 28). The Clywedog river has been heavily exploited since the medieval period as a source of power with numerous water corn mills established along its length. This energy source, together with the easy availability of the necessary raw materials for iron production led to a furnace being built in the valley in the late-seventeenth century. Although initially on a small scale, fulfilling essentially local needs, by the early eighteenth century the works has expanded to become an important regional centre for iron production specialising in cast iron goods as opposed to wrought iron. The arrival of the Wilkinsons in 1753 coincided with escalating European conflicts. The ensuing large-scale armaments contracts led to the dramatic expansion of the ironworks which at its largest after 1795, employed, 'a great number of hands' (Aitken 1795, 399) and extended over a third of a mile.

History

Documentary evidence suggests that a blast furnace was established in the Bersham area sometime before 1670, possibly for the production of cannon. During the eighteenth century the ironworks was run by a number of ironmasters. From 1717, the works were in the hands of Charles Lloyd who established Bersham's links with Coalbrookdale. This link led in 1721 to Bersham furnace becoming the first blast furnace in Wales to use 'coakes for potting' *(John Kelsall Diaries* 1721).

Following Lloyd's bankruptcy in 1727, the Coalbrookdale connection continued when Abraham Darby's son-in-law, John Hawkins, acquired the Bersham works. An agreement between the two works, resulting in Bersham concentrating on pot founding, left Coalbrookdale free to produce Newcomen steam engines. This led to the expansion of the ironworks with an air furnace and moulding room being added in 1733 with money provided by the Coalbrookdale Company.

In 1753, the Cumbrian pot founder, Isaac Wilkinson, leased the works which were taken over by his sons John and William in 1763 as the New Bersham Company. The works then entered their most successful phase.

Although the New Bersham Company manufactured a variety of products, the two main branches were ordnance and engine production. Ordnance had been an important part of the firm's business since Isaac Wilkinson's time. In 1774 John

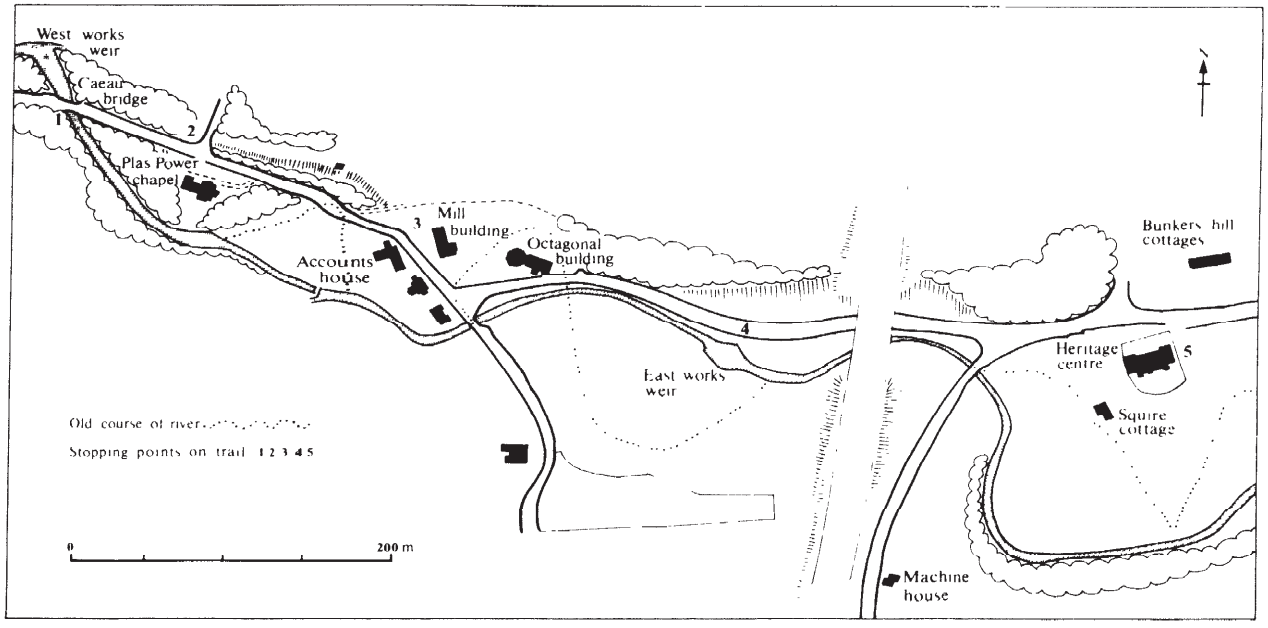

Figure 28 Plan of Bersham Heritage Trail, showing halting points along road

Figure 29 Bersham: octagonal building, attributed to Wilkinson c *1775. Probably intended as a cannon foundry (photo: S Grenter)*

Wilkinson patented his method of casting and boring cannon from the solid, which soon became a requirement of the Board of Ordnance. Wilkinson became a major manufacturer of cannon for the government, many being supplied for the American War of Independence.

From the cannon boring technique Wilkinson developed a method of boring cylinders for James Watt's new improved steam engine. From 1775 the production of engine components became increasingly important. After the end of the American War in 1783, ordnance production virtually ceased, allowing Wilkinson to concentrate on the engine branch of operation.

The increasing success of the works led to a drastic expansion to the south and east of the early eighteenth century site, now known as Mill Farm. By 1795, the ironworks consisted of cylinder and gun foundries, boring mills, the rolling mill where boilers were manufactured, Bersham old furnace, and joiners' and turners' shops (Boulton and Watt MSS box 20B 21, 28 August, 1795).

In 1793 John Wilkinson purchased the nearby Brymbo Hall estate where he established an ironworks which later became the Brymbo Steelworks (SJ 292 542). Brymbo had several advantages over the Bersham site and the decline of Bersham ensued. By the time of John's death in 1808, iron production at Bersham had ended.

Surviving buildings from Bersham Ironworks are now confined to a small area at the western end of the works, to the north of the River Clywedog at Mill Farm (Fig 28). The buildings at the eastern part of the works were demolished by Wilkinson himself in 1798, in order to escape the terms of his lease. Excavations on their site, in 1976, failed to reveal any remains of ironworks structures (McNeil Sale 1978). Buildings to the south of the Clywedog existed until the 1950s when they were demolished for house construction.

Surviving ironworks buildings include a Listed octagonal building, thought to have been a cannon foundry (Fig 29); a building later used as a corn mill, but originally built as a foundry (Fig 30); and a Listed farmhouse, the accounting house for the works.

Site conservation and preservation

In 1983, Clwyd County Council opened a Heritage Centre in Bersham, to interpret the industries of the Clywedog Valley and in particular the Bersham Ironworks. In 1988. the County Council acquired Mill Farm, the remaining part of Bersham

Figure 30 Bersham: late eighteenth century building erected as a foundry but converted into a corn mill in 1828 (photo: S Grenter)

Ironworks. A development programme has been initiated for the site, and documentary research into the history of the ironworks has been ongoing since the Heritage Centre was established. However, knowledge from documentary evidence of building functions is scarce. It has, therefore, been accepted that the development of the site will rely to a great extent on information forthcoming from archaeological excavation.

Excavations began on the site in 1987. To date they have revealed a well preserved foundry floor within the mill building, with a mould flask or 'drag' surviving *in situ* within a casting pit. Adjacent to the mill, a blast furnace together with associated air furnaces have been uncovered. Excavations on the Scheduled structure, previously thought to have been a blast furnace, have indicated its use as a limekiln, although a suggestion that it was originally built as an ironworking furnace cannot yet be ruled out (Fig 31). Excavations are continuing.

It is eventually hoped that Mill Farm will be opened as a museum of the eighteenth century iron industry. Surviving buildings allow the interpretation of many of the techniques of iron manufacture on site to be shown, from the production of iron, through the casting to the finishing of the items; many of these appear to date from the Wilkinson era, the period to be interpreted in displays.

Interpretation of the ironworks' site at present relies mainly on guided tours. During excavations, guided tours are available daily for schools and members of the public. In order to keep up to date with changes made to the site during archaeological excavations, and to study in depth the social history of the works, performance/workshops for schools by the Heritage Theatre Company are run at the beginning of each Summer term, using the surviving ironworks buildings and excavations as a stage. Schools are well catered for. A two-year MSC scheme based at the Heritage centre produced numerous resource materials for schools. With the appointment in 1987 of a County Museums Education Officer, the resource materials have been revised to provide for teachers and pupils at the Heritage Centre, on the Clywedog Trail, and in schools before and after visits (see Appendix 19.1 below).

The Bersham Ironworks project is as yet still only at an early stage. Robin Wade Pat Read Design Partnership has been appointed as museum consultant and a development plan produced. The first phase — which includes the restoration of the Mill Building — is due for completion in 1990/91. The second phase involves the completion of archaeological excavations, with restoration and interpretation of the remainder of the site. The third phase will be the development of a John Wilkinson Museum. The site will be opened in phases, the speed of development obviously depending on the availability of finance and the success of grant applications: funds have already been obtained from the Welsh Office and the Council of Museums in Wales.

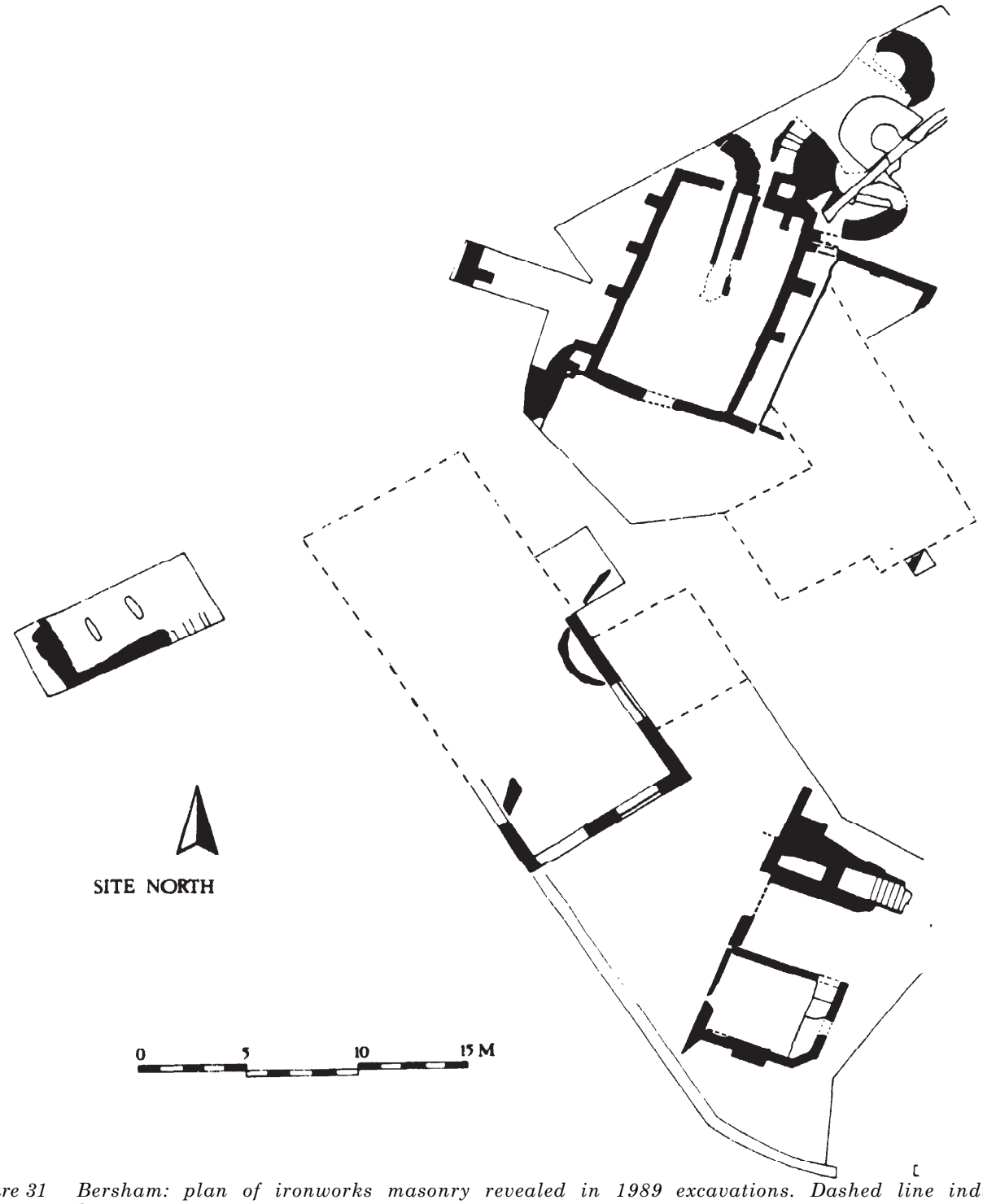

Figure 31 Bersham: plan of ironworks masonry revealed in 1989 excavations. Dashed line indicates post-ironworks structure

Appendix 19.1

The Bersham Industrial Heritage Centre produces the following educational resources:

The Clywedog Trail Teachers' notes, including suggested tasks for pupils:
1 Minera/City *Engine House section.*
2 Middle section above and below Nant Mill.
3 Bersham Village section.
Pupils answer sheets; *Minera-Bersham Trail.*
Loan materials: slide packs, rock and mineral specimens, etc.

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20 Dolaucothi Gold Mines

by Charlotte Clough and C Stephen Briggs

> These caverns are frequently visited in the summer season by numerous parties from the inn in the neighbouring village of Llanpumsaint, on the road leading from Llandovery to Lampeter. And all who have attentively examined them, speak with rapture of the novelty and beauty of the scene (Williams 1818).

The site

The site known as the Ogofau Gold Mines, Dolaucothi, is situated at SN 66 40, lying on the hillside to the east of the River Cothi, and comprises a complex of mining adits, underground tunnels and a large opencast, the original exploitation of which is popularly believed to date from Roman times (Lewis and Jones 1971).

History of acquisition and management

First described by passing tourists in the late eighteenth and early nineteenth centuries (for example Williams 1818), when it was unclear as to just what had been earlier mined there (Burnham n d, 16 *ff)* the site becomes more prominent in the later nineteenth century when exploitation began in earnest during 1871-2. Exploitation was then sporadic until 1938, when operations ceased (Annels and Burnham n d, 30-1).

The National Trust acquired the Dolaucothi Estate in 1943 from the Lloyd Johnes family (Methuen-Campbell n d), at a time when mines, ancient or modern, were not considered a particularly important asset. At the time of its acquisition, all worthwhile machinery and buildings on the property had been scrapped.

After earlier sporadic archaeological interest, the survey of Lewis and Jones attracted national if not international attention, with claims that the extensive leats and tanks were Roman in origin (Lewis and Jones 1971) and the mining complex linked to the neighbouring Roman fort on the other side of the river (Jones and Little 1973).

During the 1970s the site was landscaped as a caravan park and spoilheaps were flattened to create parking bays. In 1972 members of the

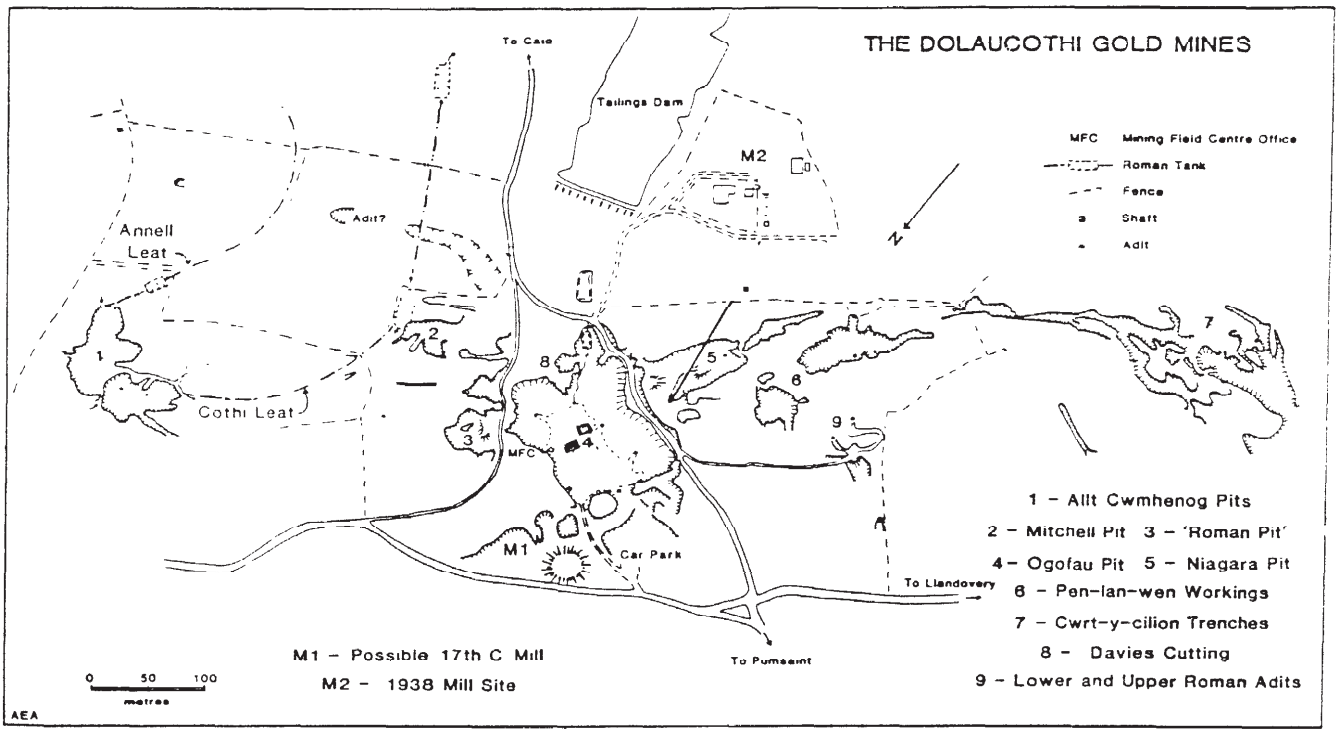

Figure 32 Dolaucothi gold mines: plan around general area of mine, showing main historic features. The visitor centre and pithead gear lie immediately to left and above the figure 4 *(drawing by A E Annels)*

Figure 33 Dolaucothi: recently-erected pit head gear taken from Olwyn Goch Lead mine, Clwyd

Department of Mineral Exploitation from University College, Cardiff, began investigations of the tailings pond and after several seasons' work a headquarters was established from which students were trained in basic mining techniques. This became, in effect, a mining field centre within an authentic setting. Thus the site's profile was raised with the result that visitor facilities had to be provided. A parallel interest by the Archaeology Unit at St David's University College, Lampeter, has led to a questioning of the leat's antiquity, and a suggestion that the technology of the watercourse and its tanks might more readily be accommodated within a medieval milieu (Austin and Burnham 1984).

By the early '80s, underground tours were being operated by Cardiff students during the summer season using the safer, more accessible adits. As the tours became more popular. the site attracted more than 9000 visitors over the thirteen week season in 1985, quite an achievement in view of the then low-key publicity.

The National Trust assumed management of tour operation during this period and commissioned a feasibility study (Brown 1984) to gauge the potential impact and success of commercial development. Some of the report's recommendations were taken in hand, the expansion of visitor facilities offering a natural progression from earlier more limited services. There was an important requirement to offer historical and technical interpretative facilities to complement these underground tours (Fig 32).

With renewed commitment to the provision of tourist services, a more aggressive marketing policy was embarked upon to encourage their exploitation to the full, and more importantly to ensure that the tours would become self-financing rather than dependent upon subsidy from National Trust interests elsewhere. The mine could not be maintained at this level of safety or of educational awareness without some form of independent income.

It is important to recognise the existence of two potentially conflicting paths which might be taken in opening up a site like this. One would be to mothball it, leaving it to be colonised by vegetation and to allow woodland or underground routes to

develop wherever interest took the visitor. The extreme alternative is to over-commercialise and devalue the historic and educational potential.

One clear objective adopted by the Trust at the mine has been to keep interpretation low key and unobtrusive, giving visitors the opportunity to explore, while still maintaining a strong element of personal discovery. The steady income has assisted the Trust in its maintenance of a conservation policy, preventing vandalism and closely controlling visitor erosion.

Nevertheless, the Trust recognises that landscape change is an organic process requiring constant respiration. And it must be argued that had nineteenth and twentieth century industrial development been arrested here, there would not now be any spectacular recent exploitation to visit and interpret. In the case of this site, its very uniqueness makes the site cry out for public access.

The National Trust has now acquired mining machinery and a pithead from the redundant Olwyn Goch lead mine, Clwyd. By re-erecting it in working order upon the site of the original Ogofau pithead, it is intended to fully recreate the atmosphere of a working mine of the 1930s (Fig 33).

Armed with authentic mining equipment at such an unusual site, it is clear that Edward Williams' sentiments will re-echo at Dolaucothi well into the future.

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21 Big Pit Mining Museum

by Brian Davies

The aims and objectives of the museum

Big Pit has now (1989) been open to the public for over seven years, and has received 700,000 visitors. Sufficient time has therefore elapsed to assess progress, and to identify some characteristics of this sort of 'independent' museum which merit careful consideration.

First it may be useful to explain the establishment of the museum. A Joint Steering Group was set up in September 1978 comprising officers of local authorities and other interested bodies. This led to the establishment of the Big Pit (Blaenavon) Trust, on which the bodies represented are: Gwent County Council, Torfaen Borough Council, British Coal, The National Museum of Wales, and Torfaen Museum Trust. In addition the Council of Museums in Wales and the Wales Tourist Board are involved in an advisory capacity. The objectives agreed by the Joint Steering Group and accepted by the Trust are as follows:

1 To present to visitors an authentic impression of the historical development of coal mining, the interpretive and other elements of site provision never being allowed to obtrude;
2 To ensure that, so far as is consistent with the above, visitors can enjoy a safe and pleasurable experience throughout the year, with adequate facilities for access, parking, visitor circulation and shelter, refreshment, toilets, and other appropriate needs;
3 To operate the enterprise, so far as is consistent with the above, on a viable financial basis, at least in terms of annual costs, including loan charges (or their equivalent, where the project is grant-aided); and
4 To programme development so as to secure the earliest opening of the museum at reasonable initial cost, and thereafter to extend facilities according to demand and availability of resources.

Financial arrangements

This article is not the place for a detailed analysis of the Museum's performance as a business. Suffice it to say that a modest surplus has been achieved during each of the last three years. When the labour-intensive nature of the enterprise is taken into account these results are definitely encouraging. Because visitors are taken underground the pit still has to comply with the requirements of HM Inspectorate of Mines and Quarries, particularly in respect of employing appropriately qualified mining personnel. The museum is open to the public all year round (with the exception of a short shutdown for maintenance in January or February), and employs over fifty people, of whom approximately two-thirds have regular work for nine months of the year or more. A profit-sharing scheme distributes one-third of annual profits to staff.

The reopening of the colliery as a museum involved greater expenditure than had initially been envisaged. The sources of funding for the period up to March 1985 were as follows:

Council of Museums in Wales	£27,555
European Regional Development Fund	£336,000
Gwent County Council	£150,000
National Coal Board	£23,000
National Heritage Memorial Fund	£26,989
Science Museum	£2086
Torfaen Borough Council	£123,750
Urban Aid	£226,082
Welsh Development Agency	£122,568
Wales Tourist Board	£300,000

The resulting achievements have been considerable. There are now two underground 'routes' open to the public, each just over a quarter of a mile long. On both routes visitors see roadways and underground buildings over 100 years old. Work on the surface has included extensive repair and some modification of the winding gear, opening to public view the blacksmiths' shop, fitting shop and sawmill, conversion of part of the pithead baths into exhibition areas, and provision of normal visitor facilities. Significant collections of artefacts and documents have been built up, including what may well be the best collection outside British Coal's archives of plans relating to any one colliery, and a rich archive of Blaenavon company and trade union records. Several temporary exhibitions are held each year, and a number of large exhibits have been acquired in preparation for future developments.

In many ways therefore, progress is satisfactory. An independent museum is standing on its own feet, and making a small surplus. There is an agreed programme of development for a three to five year period, which will tackle the remaining problems of long deferred maintenance on surface buildings, add new exhibitions, and greatly improve interpretation. An application for 50% funding of this programme is currently being

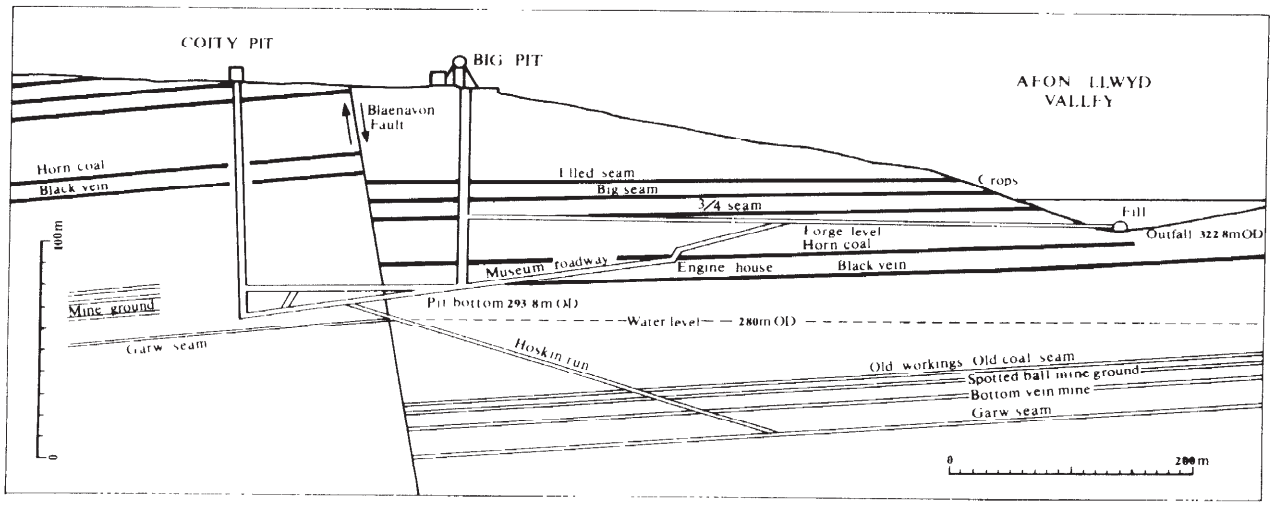

Figure 34 Big Pit: cross-section showing underground roadways open to the public

considered by European Regional Development Fund. In the meantime restoration work proceeds, a little slowly but steadily, using the museum's own financial and labour resources augmented by Council of Museums in Wales grants and the efforts of the Community Industry team.

The coal industry and museums

Nevertheless, taking a broader view there are a number of problems which need consideration.

Firstly, it must be said that the 'museum community' does not seem to fully appreciate that we are now witnessing an unprecedented contraction in what was our major industry in Wales. The number of remaining pits has more than halved since the strike of 1984-5, and this process seems certain to continue. The collieries which have closed mostly dated back to the last quarter of the nineteenth century, and they have not been comprehensively recorded by anyone. Neither has there been a systematic search for documentation. Some photographic work has been done, some records have been rescued by various bodies, and some artefacts have been taken into museum collections. But there has been little coordination, and there does not appear to be a prospect of a sufficiently coordinated effort to adequately record this last phase of the history of deep coal mining in Wales. There is an urgent necessity for museums concerned with coal mining to collaborate on this task, and for other bodies concerned with historical buildings and with documentary material to become more actively involved.

Secondly, this general problem has specific implications for Big Pit. Mining is by definition an activity that takes place underground, but investigation of mining sites is of necessity usually confined to recording surface features. Over the last seven years many tens of miles of underground roadways and perhaps hundreds of underground structures and machines, some well over a century old, have been buried without any record remaining other than that in the archives of British Coal (Fig 34). An equal amount may well be lost in the future. The preservation of the underground workings at Big Pit therefore assumes even greater importance. Here we have a representative sample of roadways and other structures of different periods, from the early nineteenth century onwards, showing all the main types of roof support — dressed stone, brick, timber, and steel. All these structures will need repair from time to time: some which have been disused for a number of years will need considerable work to make safe. It is at this point that the financial constraints within which an independent museum works may have far-reaching effects. This can best be explained by taking a few examples.

1 *Roadway repair.* The older roadways at the pit are lined either with stone or brick. This was typical of nineteenth century practice on main roadways which would be expected to remain open for the life of the mine. In these areas of the pit there is much fine work which is a tribute to the skill of the colliery stonemason and bricklayer. Inevitably there have been occasional roof falls over the years, and there are areas where there is so much distortion due to pressure of the strata above,. that reinforcement will be necessary to enable public access. The standard method of roof support now used involves steel arches or 'rings' set four feet apart with wooden 'flats' fitted between rather like g-uttering. This will, of course, completely hide from view the

original stone or brickwork, and make a roadway fully repaired in such a manner indistinguishable from one of much more recent date, except by its smaller dimensions. A few decades of such repair work would result in most of the roadways remaining at Bit Pit appearing to be of the same, relatively recent, date. This is obviously unacceptable for historical purposes. Nevertheless, it may become an economic necessity, as repairs using steel rings only involve about 20% of the cost of reconstructing stone or brickwork.

2 *The 'Elled Stables'.* On one of the visitor routes at the pit there is an underground stables. Another is within reach of the second route, but has not been used for at least forty years. It is older than the stables which is open to the public, and probably dates from around 1860. Part of the roof has collapsed, and a return roadway would have to be driven in order to open this area to the public. The main problem here would be the removal of rubbish from the collapsed roof and the new roadway. There is nowhere underground where this could be conveniently stowed, so there are only two alternatives. A 'pack' could be built in the stables large enough to contain all the rubbish. This would take up perhaps half of the total area of the stables. Alternatively, the rubbish could be wound to the surface, and the entire stables could be restored. The latter course of action is obviously preferable, but it is likely that it would cost about twice as much.

3 *The 'Three-Quarter Landing'.* Big Pit has a complicated history much of which has still to be investigated. The pit was sunk to its present depth in 1890, but it had been sunk to a shallower pit-bottom in the Threequarter Seam' in about 1860. This original pit-bottom is still accessible, and is linked with even earlier workings — Forge Level (*c* 1812), and the Coity Pits (*c* 1840). The roadways in this area are in substantially their original condition, unlike the roadways around the later pit-bottom; but they would require considerable repair before they could be opened to the public, and a 'landing' would have to be constructed in the shaft. No detailed estimates have been prepared for this work, but an educated guess, at present rates, could be at least £250,000.

Three examples by no means exhaust the possibilities. In addition to working coal Big Pit produced ironstone from 1880 to *c* 1897. It is, therefore, the last remaining accessible ironstone mine in the north crop of the coalfield and there are significant ironstone workings close enough to the shaft to be opened to the public. This possibility is surely deserving of consideration, as ironstone mining was a major industry in south Wales in the first half of the nineteenth century and is not yet interpreted in any museum.

Conclusion

The overall picture, therefore, is one of respectable achievement; but there are important possibilities, even requirements, which are beyond our grasp. An independent museum living largely on its own resources cannot present the history of mining in south Wales in as comprehensive and accurate a manner as is desirable, given the major consideration that Big Pit will be the only opportunity to preserve underground workings. The museum is now a success as a trading enterprise, but further development will depend heavily upon public funding. If underground conservation and restoration is to be carried out to the appropriate standards, which involve much more than simply making roadways safe, the resources generated by the museum's trading activities will need to be augmented. Perhaps the first step would be the recognition that underground structures can be considered as buildings of historical and architectural interest.

Postscript

Since this article was written the position at Big Pit has changed in some respects. The Trust now feels that it is not able to support a full-time curator. The scope of collecting policy has been narrowed substantially; and the documents, but not the plans, referred to above, have been transferred to Gwent County Archives, The 'Elled stables' has been opened to the public using the first method described. RCAHM(W) have made a photographic record of each colliery in Wales closed since 1988.

22 Merthyr Tydfil Heritage Trust

by Jane Pearson

Introduction

Merthyr Tydfil, located at the head of the Taff Valley, just 25 miles (40 km) north of Cardiff, is rich in surviving evidence of its eighteenth and nineteenth century industrial past. For a time the largest town in Wales, it was first the 'iron metropolis of the world', and then one of the major coal producing and exporting centres.

Some of the town's remains are of national and even world significance. For example, the Cyfarthfa Ironworks site (Fig 36), with Pontycafnau Bridge, is recognised as being of especial archaeological significance as one of the most important surviving groupings relating to early ironmaking history. Meanwhile, the Penydarren Tramroad running from Merthyr to Quaker's Yard, an important early tramroad, has a significant amount of evidence surviving over its entire length (Owen-Jones 1981). However, the record of conservation in Merthyr Tydfil has, until recently, been poor. Some failures in preservation have been dramatic — such as with the demolition of the Triangle housing and of the Squares at Abercanaid; and the future of some historic features hangs on a knife edge — such as the 1800 Iron Bridge formerly over the Taff at present stored in pieces.

The local authority, Merthyr Tydfil Borough Council, have published two consultative documents (Williams 1976; MTBC and MTHT 1983). Containing many practical and useful recommendations, these were noted by the full council — but not adopted as official policy, and the implementation of the particular recommendations, (such as the creation of Conservation Areas), has been limited.

Inspired by a visit to the successful Ironbridge Gorge Museum Trust in Shropshire, the Borough Council set up Merthyr Tydfil Heritage Trust in 1979 as a limited company with charitable status. The Trust's main objectives include:

> ... to secure the preservation, restoration, improvement enhancement and maintenance of buildings, features and objects of historical and industrial interest in the Borough of Merthyr Tydfil, including the promotion of conservation policies for districts, streets and individual buildings in Merthyr Tydfil.

The Trust is at present supported by Urban Aid grants through both the Borough and County Councils. The most ambitious project successfully concluded has been the rescue and restoration of Dowlais Stables, and plans are in hand for the development of the Ynysfach Enginehouse. Many smaller projects are also being carried out, including landscaping and environmental work as well as a programme of education through exhibitions, publications, and guided walks. This side of the Heritage Trust's work has been made possible through MSC Community Programme Schemes (which effectively ended in September 1988).

Dowlais Stables (Fig 35)

The facade of the former Dowlais Ironworks stables (SO 072 078) lies on a prominent site to the north of the former Dowlais Market Square where it originally dominated the skyline above the foundry. It was upgraded to Grade 2 in 1974 following its appearance on the Provisional Ministry of Housing and Local Government List of 1950 as a Grade 3 Listed Building. Built in 1820, it is the oldest surviving building in Dowlais, and along with the blast enginehouse (which dates from 1907), it is the last surviving Ironworks structure, originally intended to house the horses and ponies of Josiah John Guest's Dowlais Iron Company.

Of Pennant Sandstone, with lighter coloured ashlar limestone quoins set around the arches and windows, the classical Georgian facade is about 75 m long and 6.5 m deep. Its main features comprise a central arched section surmounted by a wooden cupola decorated with a large round metal clockface, flanked by symmetrical wings, each built on two floors, the first storey is reached by brick staircases set either side of the central arch. Both wings are fenestrated by nine openings per floor, those on the ground being square-headed, those above having a slightly arched appearance. The wings terminate in towers or pavilions set slightly lower in height than the central archway.

Terraced workers' housing stood to the sides and rear of the main building. Dating from the 1820s and 1830s this was known as the 'collar' block on account of the rounded corners of the terraces. The veterinary surgeon's operating rooms were in the outlying buildings around the back of the facade. The Stable Manager's House is the attractive Grade 2 Listed Building still to be found directly

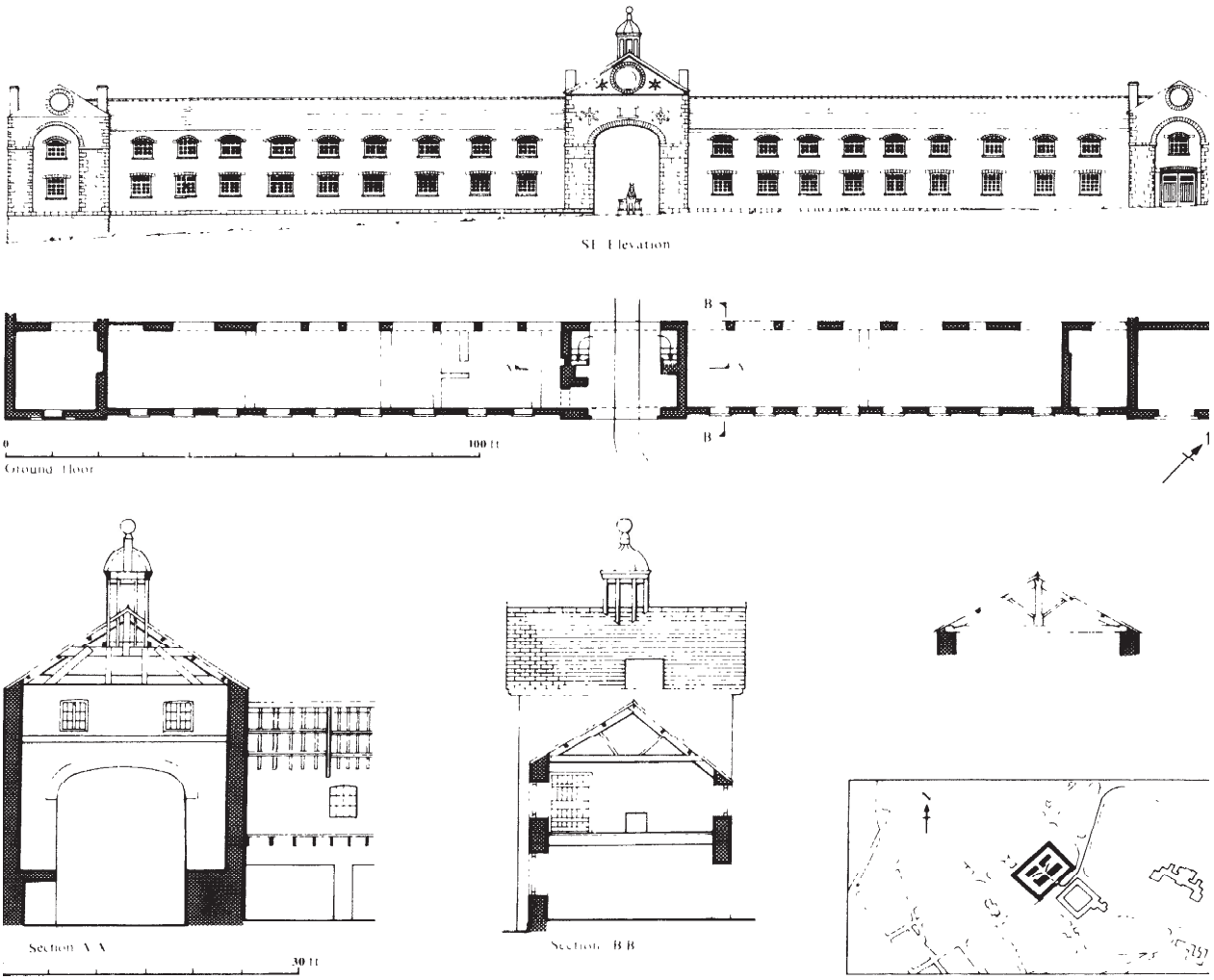

Figure 35 Plan and elevations of Dowlais Stables, Merthyr Tydfil. Inset: location plan

opposite the main archway and to the rear of the central courtyard. In front of the stables the covered Market Hall, for long the centre of commercial life in Dowlais, was built in 1844. It was demolished in 1971. The police station, the jail and the Dowlais Company Shop were situated nearby, but these have also been demolished, and for many years the Market Square lay derelict. It has now been reclaimed and landscaped as a small public park (see below).

Besides the main functions of sheltering animals and storing hay and fodder crops, the stables housed Dowlais Works School on the first floor. By 1855 this room had become too small, so it was then moved to a purpose-built central school. After the Merthyr Rising in 1831, troops were stationed at the stables and from time to time newly-arrived immigrant workers (particularly Irish) were housed there until permanent homes could be found for them. The Guest family also used its upper rooms for social functions, and an election ball was held here in 1835.

Destruction and reconstruction 1979-1986

During the first half of the twentieth century the Dowlais story is one of slow economic decline, a decline well reflected in the fortunes of the stables' fabric. For a long time these were used as storage, workshops and garages. In 1947 they were split up into smaller units and sold off by Guest, Keen and Nettlefold (GKN), then the holding company. Multiple occupancy resulted in neglect of the structure as a whole, and the stables were allowed to fall into a ruinous state.

From its very beginning in 1979, one of the prime considerations of Merthyr Tydfil Heritage Trust was the rescue and preservation of these stables.

By that time the building had reached an advanced state of disrepair, its roof leaking and walls bulging. The Trust therefore put proposals to Merthyr Borough Council as follows;

1 That the Council take urgent steps to acquire ownership of the stables.
2 That in due course the Council transfer the ownership to the Heritage Trust for £15,000.
3 That once the Heritage Trust had obtained ownership, they would carry out the necessary repairs to make safe the building and prevent further deterioration.
4 That the Heritage Trust should prepare plans for the conversion of the building for suitable after use approved by the Council and start a public fund-raising appeal. Possible uses considered by the Heritage Trust include a reference library for books, documents and maps related to Merthyr history, a museum of Merthyr's economic and industrial past, and also craft workshops.

The Borough Council accepted the proposals and prepared an application for a compulsory purchase order, submitted to the Welsh Office in May 1981. But even before it was processed at the Welsh Office, a part of the facade collapsed that December. In spite of protests *inter alia* from Royal Commission staff, Merthyr Tydfil Department of Technical Services then insisted upon demolishing a further section of the building in the interests of public safety.

At that stage the Heritage Trust appointed James and Nicholas, Consulting Engineers of Port Talbot to report on the state of the building. Their report was extremely pessimistic and expressed grave doubts as to whether in fact any part of it could be saved. In particular they recommended that important parts of the building, including the three pavilions, should be demolished. Despite this, however, the Trust persevered and began applying for funds for restoration.

A public inquiry into the application for a Compulsory Purchase Order was held in May 1982. The building's ownership was finally transferred to the Trust from the Borough in November 1982. By that time the Heritage Trust had received substantial grants from the Borough Council, the Welsh Development Agency and the Historic Buildings Council. These grants made it possible to start work on consolidation of the building. Scaffolding and timber supports were erected in December 1982; the roof, rear wall and ceiling, which could not be saved, were demolished in March 1983. A contract for grouting the main section of the facade, the west pavilion and the lower section of the central arch was awarded to Messrs Roger Bullivant Ltd and work begun in August 1983 was completed in March 1984. This contract included the erection of buttresses to support the western, rear, facade.

Work was resumed in June 1985 under the architectural supervision of Mr Andrew Thomas with Messrs Capps & Capps of Hay-on-Wye as contractors. The upper portion and roof of the central arch were restored, a new cupola constructed and the clock face repainted; the eastern pavilion was consolidated under a new roof. Extra buttresses were constructed, as the structure had been weakened by the demolition of the eastern facade. At this stage further fundraising became necessary. The fact that the stables building was Statutorily Listed gave its reconstruction the financial advantage of being zero-rated for VAT purposes.

Restoration: the final phase, August 1986–July 1987

At this point in the reconstruction, site preparation and the reclamation of building materials was carried out by an MSC Community Programme sponsored by the Heritage Trust. Modern building methods had to be employed in rebuilding. This work included casting concrete foundations, the insertion of a damp-proof course and reinforcing the interior facade with concrete blockwork. Here the string courses and window sills were carefully replaced and in general, undertaking the reproduction of original features, the traditional appearance of the rubble-coursed stonework was retained. Similarly, the north wall was consolidated and the gable rebuilt to roof profile in random rubblework. String courses were reset on the south wall and missing quoin and springer stones were replaced. Tower roofs were reslated in good quality secondhand Welsh slate with copings cut from Forest of Dean stone.

Afteruse

Invariably, expensive reconstruction and restoration of early buildings has to be balanced by reuse undertaken along lines determined at least partly by economic factors. Unless future use can be justified, it might cogently be argued that after a full record had been made, demolition or dereliction should be allowed to take its course.

In the case of Dowlais Stables, the final decision was based upon economic and practical considerations. Several options were examined and rejected; for example the possibility of museum, library or historical interpretation centre would have been uneconomic. In any case, historical use was pre-empted by the important Cyfarthfa Report (see below).

The conclusion was reached that residential use was the only option which was economically viable. Consequently, in May 1987 the stables were sold to Merthyr Tydfil Housing Association for £ 18,000 (less legal fees) and in April 1988, work was started on constructing sixteen flats behind the Stable facade. Obviously the design of the living

accommodation respects all architectural features of the restored building and through the Housing Association a planned programme of maintenance and repair is now assured.

Dowlais Market Square

As already noted, Dowlais Market Square, derelict since 1971, was also in need of rescue and restoration. During 1986 a scheme was put to the MSC by the Heritage Trust for reclamation and landscaping of this area.

The Community Design Service in Cardiff drew up plans for a public park which included a small carpark, footpaths, grassed areas, trees and shrubs, and a 'wild' play area. MSC accepted the scheme and a team of thirty labourers was taken on under the Community Programme Scheme in January 1987 for twelve months. During this period, the Dowlais Foundry closed down (British Steel Corporation, Ivor Works). Among the last castings to be made there were bollards cast especially for the Heritage Trust to place around Dowlais Market Square. A pergola was also cast and erected in the centre of the square over a flight of steps. This symbolises the heart of iron' so crucial to the history of Dowlais.

The Market Square reclamation scheme was completed in December 1987, and it was ceremonially returned to the care of Merthyr Tydfil District Council in April 1988. Landscaping the Market Square certainly enhanced the environment of the stables, providing a tidy, pleasant setting from which to appreciate the building. It also provides a welcome amenity for local people who, through the scheme, now appreciate much more the efforts of the Heritage Trust. It is felt important that attention is drawn to the site's significance to visitors and locals alike. In this respect, on-site interpretation is still needed and this is the Trust's next task.

Cyfarthfa Ironworks (Fig 36)

Once part of the greatest ironworks in the world, the remains of the huge Cyfarthfa furnaces now lie overgrown with vegetation and partially hidden behind an industrial estate (SO 038 069). The Ironworks is to the north-west of the town on a site bordered by the River Taff to the north, the Swansea Road to the south and the grounds of the Mormon Church to the east. Access can only be gained on foot at present, either from the small industrial estate off Brecon Road opposite Cyfarthfa Castle and thence across Pontycafnau Bridge; or along a footpath from the Swansea Road across the top of the furnaces.

The mineral rights of the 4000 acres (162 ha) of the Cyfarthfa estates were first leased to Anthony Bacon and William Brownrigg in 1765 for a term of ninety-nine years, at an annual rent of £100. The first furnace was built beside the River Taff in 1766 by Charles Wood, the son of a Wolverhampton ironmaster. It was located just downstream of the confluence of the two branches of the river Taff, the Fawr and the Fechan, in order to gain the maximum water power.

By 1786, when Richard Crawshay took over the lease after having managed the whole works for three years, the Cyfarthfa works consisted of a forge, a foundry, a furnace and a cannon-boring mill. There followed a great period of expansion, during which time the focus of the works moved from the river bank to its present site against the western natural hillside of the Taff valley. In 1787 Crawshay adopted Cort's new puddling process and changed fuels from charcoal to coke. These two factors helped to make Cyfarthfa the dominant iron company within Merthyr, and indeed, it soon grew to be the largest in the world. Between 1796 and 1803 three new blast furnaces were built, and seven were operative by 1814, when the Cyfarthfa Works were considered to be 'fully integrated', having a balanced number of furnaces, forges, puddling furnaces, and rolling mills.

The most impressive feature now on the site is the massive bank of seven furnaces dating from the late eighteenth to early nineteenth centuries. Originally free-standing (as shown in the numerous pictorial representations of Cyfarthfa Ironworks by such artists as Penry Williams), the intervening spaces were neatly infilled with stonework to form a long curving front wall with one massive arch where furnace no 6 once stood. This alteration took place during the 1880s modernisation, when cylindrical steel furnaces were built in front of the originals, which were then infilled with rubble and truncated to form the charging platforms for the new furnaces.

An awe-inspiring blast tunnel still runs behind the stone furnaces, above which are the remains of the rear walls of the calcining ovens and a railway arch. To the east of the furnaces stands the ruined enginehouse (which can be clearly seen more or less intact on the 1943 Welsh Office aerial photograph no 16042). Few traces remain above ground of the former huge complex of buildings with its casting and moulding sheds, forges, puddling furnaces and rolling mills, brickmakers' and carpenters' sheds, tramways, rail ways, and watercourses both at ground level and on elevated beds. Although the Works continued to produce iron and steel until 1910, and then again for a few years during the First World War, finally closing in 1919, some buildings were not demolished until after the Second World War. At that time little inclination was felt to save industrial structures which were often seen as symbols of social repression.

Pontycafnau Bridge

This cast iron tramroad bridge (SO 030 071) and aqueduct, built by Watkin George the principal

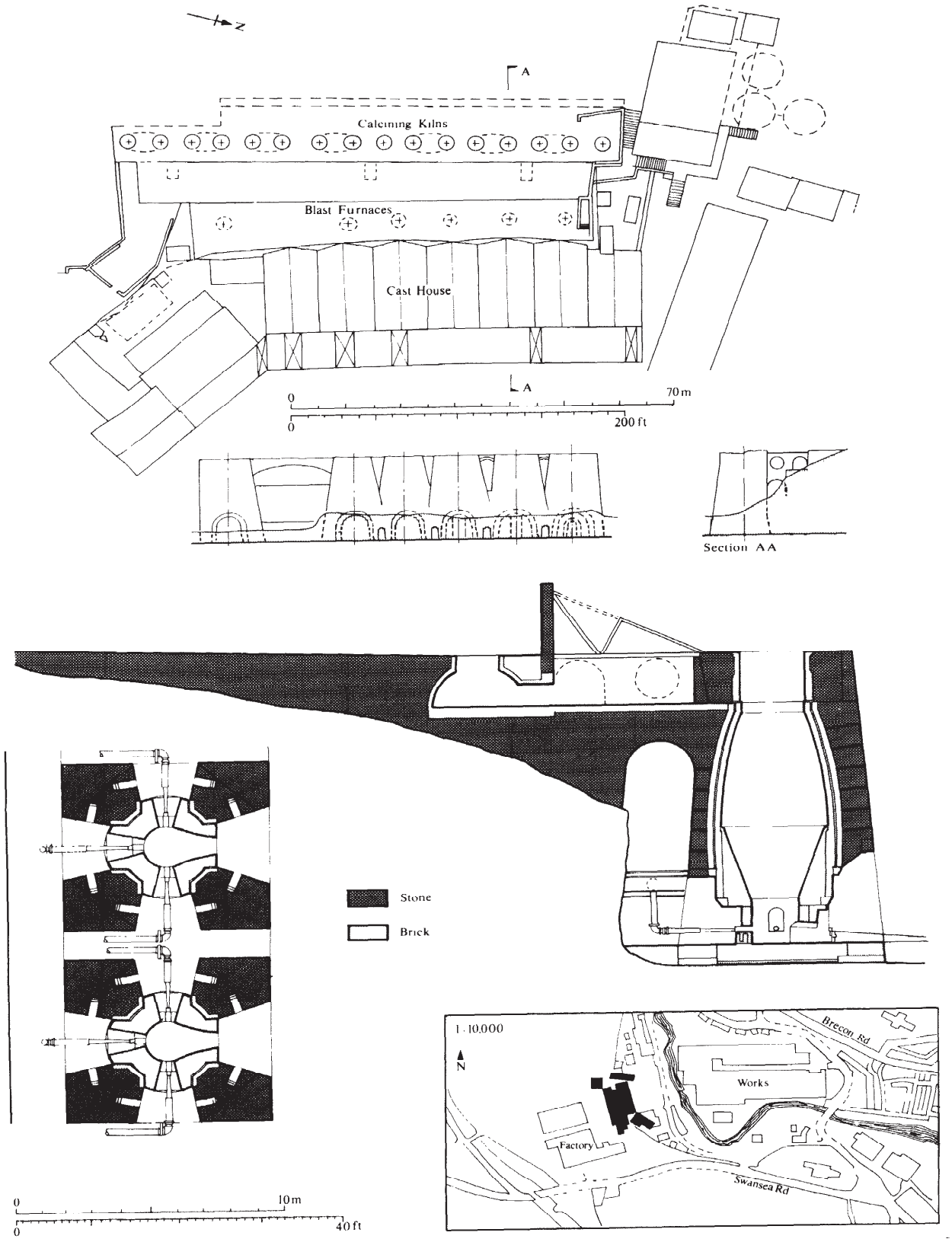

Figure 36 Plan of Cyfarthfa: conjectural plan and section by Richard S Dean, December 1984, adapted with assistance from RCAHM(W). Inset: location plan

engineer to Cyfarthfa Works, is of immense interest. It is thought to date from as early as 1794, though may possibly be later (Davies forthcoming). Owned by the Welsh Water Authority until March 1989 when it was transferred to Mid Glamorgan County Council, the bridge of troughs is both a Scheduled Ancient Monument and Grade 2 Listed Building.

An 'A' framed cast iron structure bolted together through woodworker-type joints, it carried the watercourse from the Cyfarthfa feeder pond to the works in a trough below the tramway bed which forms part of the Gurnos tramroad, itself a feature of considerable interest. At present the bridge is in a poor state of repair, its original clean, economically designed shape now spoiled by ugly rails and netting. Cyfarthfa's group value to industrial archaeology is now recognised and most of its component features are statutorily protected. However, statutory protection has not proven itself very helpful in securing their future preservation. Attention has already been drawn to the importance attached to the site by Merthyr Tydfil Borough in 1976 and 1983 (Williams 1976; MTBC and MTHT 1983); by Mid Glamorgan County Council (1985) and by Merthyr Heritage Trust (Keen 1982; Mander *et al* 1985).

Following such widespread recognition of this importance, an initiative has been started to develop and conserve those features of heritage interest by Mid Glamorgan County Council and Merthyr Tydfil Heritage Trust backed by WDA funding. However, the site is still vulnerable to the elements and to stone-robbing. The main problem is one of complex land ownership. Although the owner of the furnaces offered them as a gift to the Trust, complications arose over access and local authority involvement. At the time of writing, negotiations are proceeding. What is needed is a long term financial commitment by an appropriate authority, to properly protect and develop such an important heritage asset.

Merthyr Tydfil Heritage Trust already has draft plans for creating public access to the furnaces, and for interpreting the area to the large numbers of visitors which it would no doubt attract. Obviously the first consideration would be for safety and preservation of the entire structure, following the successful completion of which, the whole area could be carefully drawn together by lively interpretation systems. The site would also be linked to Cyfarthfa Castle Museum and to Ynysfach Enginehouse.

Ynysfach Enginehouse (Fig 37)

The Ynysfach Enginehouse (SO 045 060) lies behind Merthyr Tydfil Technical College just off the A 470 Cardiff to Brecon Road. It, too, is both a Grade 2 Listed Building, and a Scheduled Ancient Monument.

The Ynysfach Ironworks was a subsidiary to the Cyfarthfa Ironworks, opened by Richard Crawshay in 1801. It included coke ovens and calcining kilns and the two original furnaces designed by Watkin George. There was a beam blowing engine powered by a neighbouring coal-fired boiler. These were the first steam-powered Crawshay furnaces. In 1836 two additional furnaces and casting sheds were built alongside, with another enginehouse plus boilers and chimney at the other end of the row.

The main function of this subsidiary was to smelt iron for refining on the Cyfarthfa site. Coal and iron were originally mined close behind Ynysfach. As this source became exhausted, further supplies were sought elsewhere. A tramroad was constructed linking Ynysfach with the wharf on the Glamorganshire Canal at Chapel Row, and after 1841 there was a branch line from the Gethin Pits at Abercanaid and Glyndyrys Pit near Rhydycar. The Ynysfach Works were in operation until 1874 when R T Crawshay closed down the whole Cyfarthfa Works rather than meet Union demands. In 1879 investment was put into the main site for the modernisation of steel production, but Ynysfach remained only a standby ironworks.

The surviving remains consist of the earlier enginehouse (probably rebuilt during the 1830s) and four truncated blast furnaces infilled with retaining walls. The arches leading to the tapping points have been blocked but the furnaces have not collapsed. The four storey enginehouse itself is of sandstone with limestone quoins and semi-circular window arches — a style characteristic of all Crawshay buildings. Tramrails are still positioned in the blast passage behind the furnaces.

The site passed from Merthyr Borough Council's ownership in the 1970s to Mid Glamorgan County Council Education Department. It was leased to Merthyr Tydfil Heritage Trust for management as a 'heritage' site in 1986.

The discussion paper *Merthyr Tydfil; the future of its past* (Keen 1982) led in 1983 to the formation of a working party concerned with the Cyfarthfa Project, a project to develop the area identified in the paper as being of national and even international significance. It consists of representatives from many of the main industrial heritage development agencies dealing with economic regeneration and tourism in the Valleys area. In 1985 the working group commissioned a major study and feasibility report on Cyfarthfa (Wright *et al* 1985). Among the many recommendations put forward in this wide-ranging and thorough report, the Ynysfach Enginehouse was considered particularly well worth developing.

As the enginehouse was in County Council ownership it became the first part of the Cyfarthfa complex to be developed. With the full backing of the authority, funds were sought through land reclamation and urban aid schemes. A lease was drawn up to allow the Heritage Trust to develop the enginehouse and architects Jones Thomas

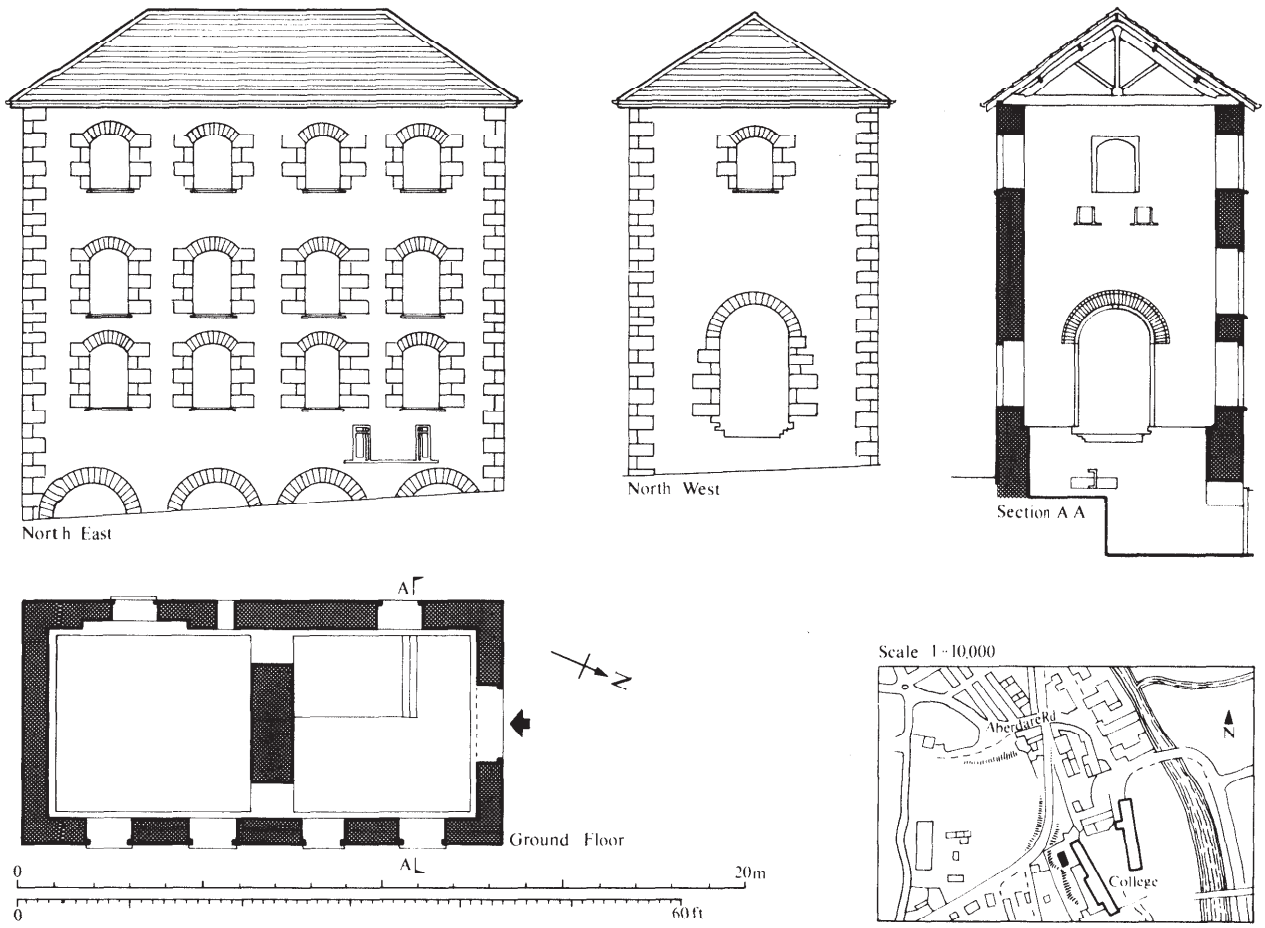

Figure 37 Plan and section of Ynysfach Enginehouse, based on a plan commissioned by the Merthyr Tydfil Heritage Trust from Jones Thomas Associates, Chartered architects, Builth Wells, December 1986. Inset: location plan

Associates were appointed in 1986 to prepare plans for its restoration and reuse as an interpretation centre and museum. Phase 1 was the restoration of the shell of the of the building, Phase 2, its conversion.

Phase 1: 1986–7 Cowlins of Cardiff were appointed contractors to restore stonework and replace the roof and window frames to as near as possible the original designs. Some clearing and landscaping was carried out by an MSC Community Programme team sponsored by the Heritage Trust. They also constructed a small visitors' carpark, access steps and a perimeter fence between the enginehouse and the Technical College property. Funds for this environmental work were also received from the Prince of Wales Committee.

Phase 2: 1988–89 This included the construction of three wooden floors linked by an iron staircase, and further landscaping and environmental works outside. Scheduled Ancient Monument consent was also given to carry out an exploratory excavation on the furnaces, and it is hoped to be able to include some on-site interpretation of these. The enginehouse is to be a centre for the interpretation of the history of the iron industry in Merthyr Tydfil from its earliest beginnings up to the final closure of the Dowlais Foundry in 1987. This course of action was taken because it was not possible to find a suitable engine to restore and house there, and the story of the Iron Metropolis of Merthyr is crucial to the Valleys and south Wales.

The original iron castings remain visible in the walls as part of the Scheduled Ancient Monument consent to the conversion and the plans are designed to be as sympathetic as possible to the original building. However, adaptation to a 'museum' setting is not always straightforward, for example because of conversion and display demands some of the window lights are blocked internally. Externally its appearance is little altered, although of course the original industrial context has gone. However, the advantage of interior changes is the creation of space for interpretation. Models, diagrams, photographs and audio-visual displays assist visitors to visualise the

relationship between Ynysfach Ironworks and enginehouse with the greater Cyfarthfa Ironworks, and to understand the role of the iron industry in Merthyr Tydfil during the Industrial Revolution.

The building was opened to the public in summer 1989.

Conclusion

The signs are encouraging for the conservation of the remaining industrial monuments in Merthyr Tydfil, but major financial commitments are needed urgently if a way forward is to be found and existing and detailed plans put into action.

The Heritage Trust, supported by its Friends' group, will continue to work closely with all interested parties towards the preservation and appropriate development of Merthyr's heritage.

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23 Kidwelly Tinplate Works

by Susan Moore

The site of the former tinplate works is located approximately 1½ miles (2 km) north of Kidwelly (SN 421 079) on the banks of the Gwendraeth Fach river. The 13 acre (5.3 ha) site today consists of four original buildings (the box room, assorting room, cold rolls, engine house, and mess room), a chimney stack and machinery (Figs 38, 39).

History

The site is of great historical importance for two reasons. Firstly, it is probably the site of the second tinworks established in Britain, and secondly, it is Britain's sole survivor of many works which once produced tinplate by hand.

The water-powered works was established in 1737 with steam power being introduced in the 1860s. Productivity improved greatly and the tinplate produced was of excellent quality. However, in 1941 the works closed as a result of restrictions of materials during the First World War and competition from the new mechanised strip mills (Kennett 1978, 26-9). The works was requisitioned for storage purposes during the Second World War, and in the late 1940s it was bought by J P Zammit & Co, scrap merchants. In 1970, the site was offered for sale and the possibility of preserving the works was discussed. However, in 1974 the firm went into liquidation and the receiver allowed a scrap merchant to start clearing the site.

Following pressure from local people, Llanelli Borough Council, with grant aid from the Science Museum and the British Steel Corporation, purchased the site with all remaining buildings and machinery. In 1980 volunteers began clearance work and the Kidwelly Heritage Centre and Tinplate Museum Trust was formed to develop and run the museum in 1982. Llanelli Borough Council became more actively involved in 1985 and the Museum is now jointly governed by the Trust and the Council through the Kidwelly Museum Committee. New features introduced to the Industrial Museum include a colliery steam winding engine and pit head gear, two steam and one diesel locomotives, a steam crane and a newspaper composition shop.

Aims

The main aim of the museum is to reconstruct as much as possible of the tinplate process and to interpret it to the visiting public. The secondary aim is to record, and in some cases to preserve, evidence of the area's other industries.

Three-quarters of the machinery of the tinplate process survive, some already under cover in original buildings, some under cover in new quarters, and some in the open air and requiring a building. The original appearance of existing features has been retained as far as possible. New structures will comprise replicas of the original buildings because of financial constraints. The hot rolling mill machinery has been housed, a building is being constructed over the cold rolls, and plans have been drawn up for a building to house the tinning line. To date, the machinery is only being cleaned and painted, but eventually the Trust will attempt to turn it in order to make it 'less static'.

None of the former tinworks enjoy Statutory Protection, and as there is no apparent threat to the buildings or machinery, it is felt that protection is not required at present.

Manpower

The museum is run by a curator/commercial manager employed by Llanelli Borough Council, which also employs two part-time sales assistants from Easter to September. Trust volunteers carry out maintenance of the museum and are responsible for various development projects, many of which have been assisted by Community Programme schemes.

Finances

Almost £2 million (including Community Programme Labour) has been spent on the museum to date (1988), £ 70,000 of which have been raised by the Trust.

Annual grants have been forthcoming from the Prince of Wales Committee, The Council of Museums in Wales, and in recent years, Kidwelly Town Council. Grants for various projects have been received from the Carnegie (UK) Trust, the Pilgrim Trust, the Julian Melchett Trust and Dyfed County Council, in addition to help in kind from various local businesses in the form of services and materials. Llanelli Borough Council sponsored the Community Programme schemes and provide the revenue budget which is offset by income from admission charges and sales profit.

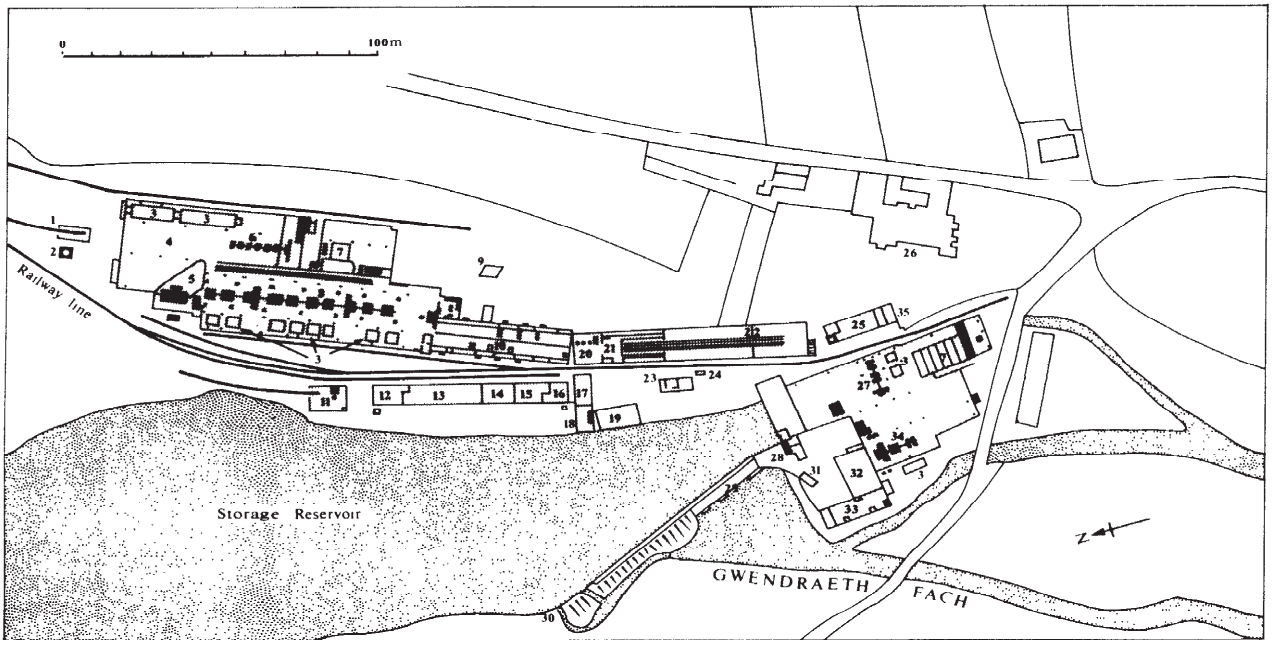

Figure 38 Kidwelly Tinplate Works in 1905

Key: 1) Loco shed; 2) chimney; 3) furnaces; 4) annealing room; 5) black pickling; 6) cold rolls; 7) boiler; 8) hot mill; 9) blow off; 10) tin house; 11) bar cutting room; 12) mason's shed; 13) box shed; 14) paper store; 15) bran room; 16) old electric room; 17) tinhouse smithy; 18) tin stores; 19) lower stores; 20) dusting room; 21) sorting room; 22) tin plate stores; 23) offices; 24) weigh bridge; 25) timber shed; 26) Felindre House; 27) old annealing mill; 28) watermill; 29) sluices; 30) weir; 31) toilet; 32) fitters' shop; 33) smith's shop; 34) mill; 35) coach house

Advice

Many organisations have been consulted and have been ready to offer advice. The Prince of Wales Committee, The Council of Museums in Wales, Dyfed Archaeological Trust, Dyfed County Council, Llanelli Borough Council, the Royal Commission on Ancient Monuments, National Trust (Aberdulais) and the National Museum of Wales have all been of great assistance.

Practical difficulties

In the early stages there were many problems, mainly due to lack of communication between the Trust and Community Programme Agency. These problems, diminished, then were superseded by that of an increasing dependence upon Community Programme schemes and the available manpower to carry out various tasks, before the termination of MSC in 1988.

Lack of manpower and money probably causes the greatest difficulty. The Trust does have a number of volunteers, but because they are volunteers, tasks cannot be carried out until they make themselves available. Volunteers cannot always be available and there are therefore times when work has to be paid for. As a registered charity, the Trust has the ability to attract funding from a wide range of sources, but there is so much competition for financial assistance that some projects do not proceed as well as they could; some projects do not proceed at all.

Education and recreation potential

A great deal has been achieved during the past years and there is no doubt that the museum has great potential for education and recreation.

Interpretation is, at present, at a basic level and explains what that features are and what went on there. Visitors guide themselves around the museum, following the route set out in the guide leaflet. In the future more detailed information, for example technical specifications and conditions of work, will be available, and it is hoped eventually to have 'workers' to explain their part in the process.

The museum has great potential with regard to school education, and with this in mind, a series of worksheets has been prepared for the seven to twelve year olds. These deal with the development

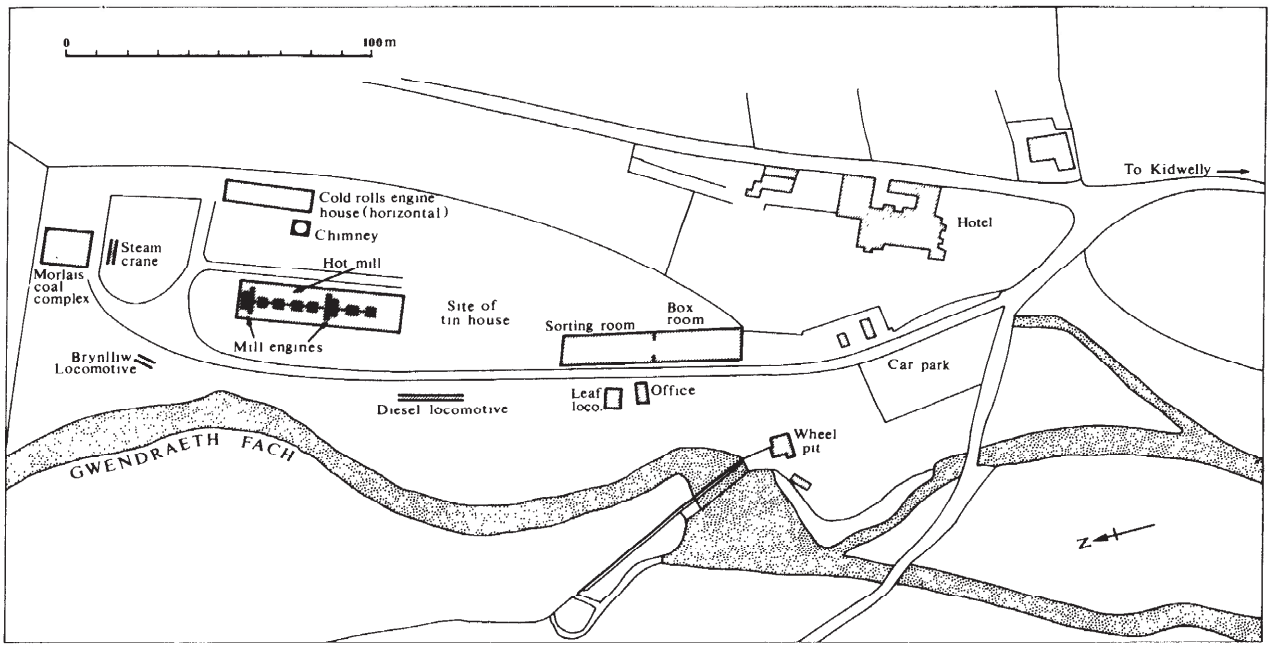

Figure 39 Kidwelly Tinplate Museum in 1987 showing surviving features and visitor facilities

of the tinplate and coal industries, and explain the nature of transport, the hydrophone, the wheel and numbers. These serve to focus youngsters' attention and make the tinplate process understandable. Older schoolchildren visit the museum as part of the syllabus for a wide range of subjects.

The museum is one of a series of attractions being promoted by Llanelli Borough Council which is developing the area for tourism. It is a growing attraction, both for tourists on holiday in the area and also for local people. Visitor figures are increasing annually, with about 5000 visiting during Easter to October 1987.

This ambitious project has grown well and with the determination and perseverance of those involved, its continued development is ensured.

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24 Meligriffith Water Pump

A joint restoration project by: Oxford House (Risca) Industrial Archaeology Society and the Inland Waterways Association (South Wales Section) in cooperation with the City of Cardiff

by Robin Williams

Location

The Pump is situated on the line of the Glamorgan Canal in the Parish of Whitchurch, Cardiff, 50 yd (80 m) south of Melingriffith Works, alongside the old Taff Feeder (OS ST 142 802; Fig 40).

History

The Glamorgan Canal (opened 1794) drew water from a feeder which also supplied the Melingriffith Works. A clause in the Glamorgan Canal Navigation Act required the Canal Company to protect the water supplies of local industries, but in the period 1794-1806, during dry weather, the canal took so much water out above the works to supply the Melingriffith Lock that the works frequently had to cease operation.

The ensuing legal battle between the Canal Company and the owners of the Works, Messrs Harford & Partridge, resulted in the Canal Company agreeing to take its water from the tail-race below the Works. However, this involved lifting the water 12 ft (4 m) into the Canal. To achieve this, the Canal Company paid Harford & Partridge £700 to set up a pumping engine, and agreed to contribute £90 per annum maintenance. Design and construction of the Pump was carried out by Messrs John Rennie and William Jessop, who, instead of building a steam-powered unit as originally specified, used the fast-flowing tail-race to power an undershot waterwheel.

The Pump (Fig 41) operated for a period of 135 years from 1807 until the Canal's closure in 1942, and was so solidly constructed of American oak and cast iron that it remained standing (albeit in a very fragile condition) until 1974, having defied the attempts of scrap merchants to dismantle it in the 1950s. The pump is a Scheduled Ancient Monument, and is situated in a Conservation Area.

In the absence of any interest by official bodies, the two societies commenced work in late 1974. In retrospect, the physical aspect of the restoration has proved less daunting than the seemingly interminable battles with bureaucracy and recalcitrant property owners, which have extended the project from an original estimate of five years, to thirteen years and still going.

The work has involved:

1 Complete clearance of the site, including removal of some 3000 tonnes of rubble from the tail-race, manual excavation of the immediate pump site, and erection of security fence.
2 Reconstruction of 75 yd (*c* 70 m) of wall supporting the waterwheel, and of the timber and cast iron dam which maintains a head of water.
3 Replacement of the 15 x 24 ft (*c* 5 x 8 m) in diameter wheel shaft (rotten timber replaced with a sectional rolled steel tube; we subsequently found evidence of a cast iron shaft which predated the timber one).
4 Reblading waterwheel (thirty blades, softwood, each 15 ft x 1 ft 10 in (*c* 5 x 0.3 m) on specially made oak supports.
5 Replacement of sluice frames and gates.
6 Building new 'A' frames. These have been made off-site by two retired carpenter members of OHIAS, and have involved mortice and tenon joints and halvings on 1 x 1 ft (*c* 0.3 x 0.3 m) oak, using timbers up to 1100 lb (500 kg) in weight.
7 Replacement of all steelwork supporting the pump cylinders, and reconstruction of spillway trough.
8 Refurbishment of driving chains.

New rocking beams 22 ft (7 m) long, 1 ft 4 in by 1 ft 2 in (0.4 x 0.35 m oak) have also been made.

Funding

Apart from funds raised privately (for example, sponsoring paddle-blades at £23 each), awards have been received from: The Lord Pontypridd Bequest; Landmark Trust; Architectural Heritage Year Award; Prince of Wales Committee and the Shell Industrial Archaeology Award (twice).

The project received a Prince of Wales Award in 1982, and won the 1987 Dorothea Award for Conservation.

Problems and frustrations

Virtually all problems have been concerned, directly or indirectly, with security of water supply. The leat itself flowed beneath the Melingriffith Works site, but in 1979, the then owners, who offered no cooperation at all, cut the supply by

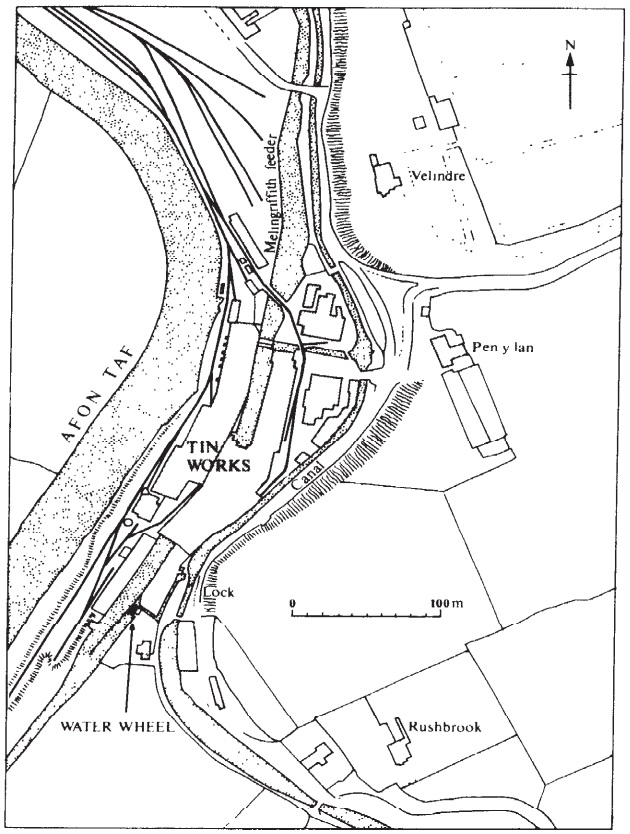

Figure 40 Melingriffith Pump: location plan in relation to later tinplate works, from OS 25-inch plan

diverting it into the River Taff upstream from the pump site. With no flow to flush it out, the leat became stagnant, and a sandbar built up at its exit into the Taff downstream. One hundred yards (30 m) downstream from the pump, a sewer had for many years been discharging, and this now created a sewage lagoon, which, when the river was in flood, backed its malodorous (and disease-ridden) contents up the leat into the pump area. Since that time it has been impossible to put work parties near water level.

The Welsh Water Authority was approached for assistance, both in restoring the water flow and getting rid of the sewage. The Authority's only reaction was to allege that an obstruction had been created on a main river which needed an abstraction licence. All responsibility for the sewage pollution was denied. By 1981, Cardiff Corporation declared the site a public health hazard, and eventually had to take legal proceedings against the Welsh Water Authority to force abatement of the sewage nuisance. As a result of this, a new sewer was built, discharging into the river well away from the leat.

At this point (1982), there was neither sewage nor water flow, and the clear, flowing stream created by 1976, then alive with fish, had turned into stinking swamp. By now, the Melingriffith Works had been demolished and the site sold to Wimpey for housing development, whilst on the site to the south of the pump, Barretts were doing the same. Many alternatives, none of which bore fruit, were discussed with a view to restoring the water flow. Worse was to follow. Cardiff Corporation suddenly realised that when the restoration was finished, they would have to take responsibility for the site, and that a stagnant mud-hole between two high-quality building sites was not acceptable.

The reaction of the two departments involved (Technical Services and Leisure Services) was to get out from under as fast as possible, and in Autumn 1986, reports were presented to the City's Policy Committee recommending that the pump be removed from the site to the Cardiff Industrial and Maritime Museum, and that the site itself be filled and levelled; this in spite of the fact that the Museum did not want it, did not have room for it, and did not have the necessary funds, The historical significance of the site was completely ignored, and Cardiff's dismal conservation record yet further enhanced.

This was the sorry state of affairs which prevailed at the time of the CBA/Cadw Conference on Industrial Archaeology in December 1986.

Postscript

In January 1987, the writer contacted the Leader of Cardiff City Council, and as a result was allowed to present this same paper, with all illustrations, to the City Policy Committee. This comprised the Lord Mayor and Chairman of all committees. At the end, the Lord Mayor stated that neither he nor the committee members had any idea of the amount of voluntary work which had been put into the project, and full support was promised.

As a direct result, the relevant Departments were instructed to present proposals to ensure that the Melingriffith Pump was preserved, on site, and in a suitable environment. There still remained the problem of finance to restore the water supply. At this point must be mentioned the untiring efforts over several years of friends and allies in Cardiff City Planning Department, who alone supported and fought for Melingriffith's interests. There have been a number of occasions on which the project was almost terminated by its own volunteers, and might well have done so without the support of Planning.

In February 1988, the WDA confirmed that it would assist financially, and the leat would be diverted north of the Works site, into a covered culvert running along the bank of the Taff, to discharge into the pump area, and guarantee a permanent flow of fresh water.

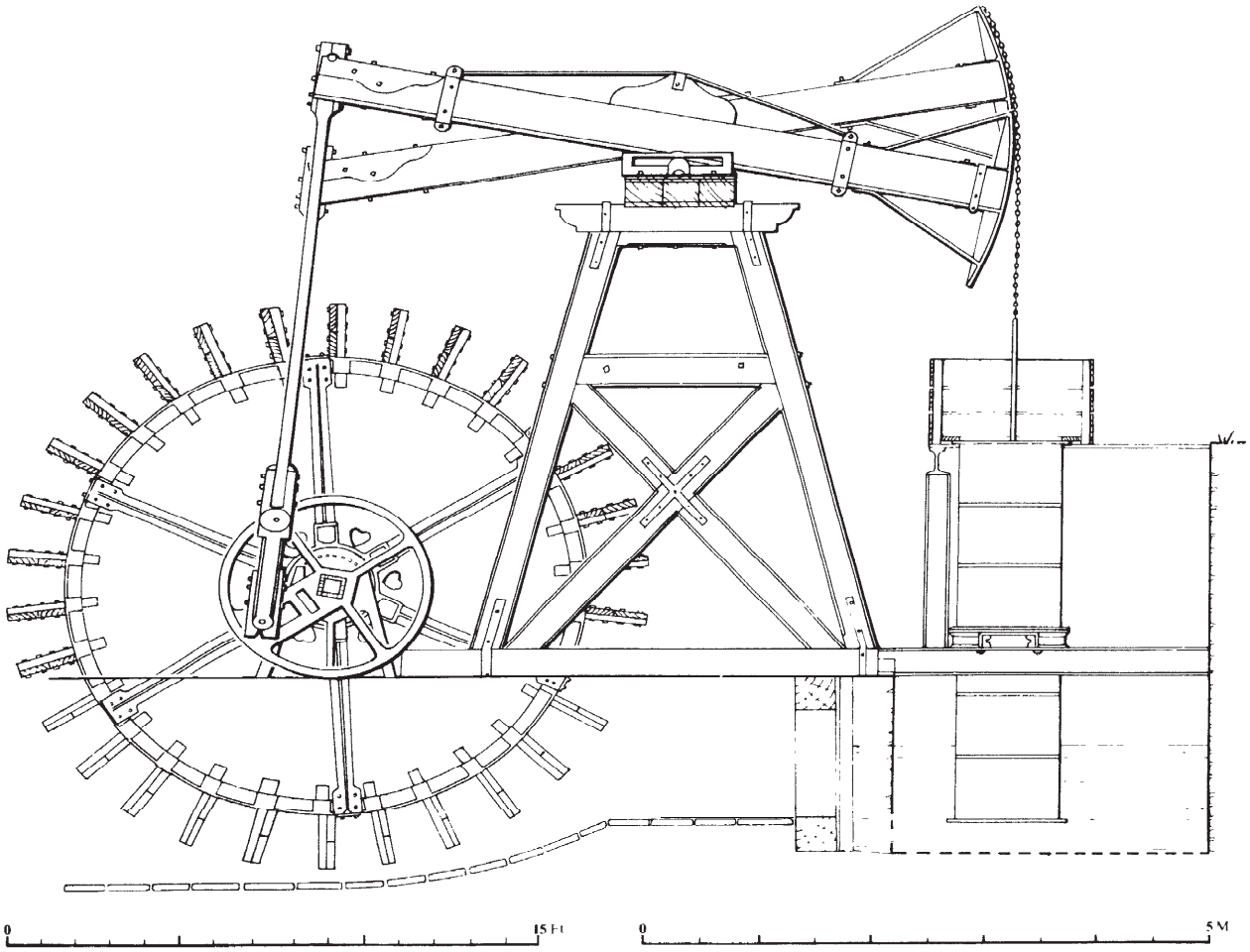

Figure 41 Melingriffith Pump: reconstruction of beam-engine and wheel

In October 1988, with the assistance of the Army Apprentice School, Chepstow, the pump 'A' frames were successfully installed, and following this, further funds were made available by the Prince of Wales Committee for purchase of the oak needed for the rocking beams. The extensive work required on these timbers was carried out by the Society's two carpenters (whose work has now been officially recognised by the Lord Mayor of Cardiff), with the assistance of Mayer and Cohen Ltd of Cross Keys, who provided both premises and invaluable help in this difficult work. Amongst other things, over 45 ft (14 m) of drilling took place through solid oak, using a special boring tool made for us by British Airways. The completed beams together weigh 2600 kilos.

Meanwhile, throughout the spring and summer of 1989, contractors for the WDA repaired Radyr Weir, and laid a culvert, controlled from a sluice chamber, to discharge water into the pump area. The leat was once again bulldozed through to the River Taff, the entire project costing in the order of £150,000.

In July 1989, once again assisted by the Army Apprentices' School, the rocking beams and connecting rods were craned into place, and to the world at large the pump seemed complete, although a considerable amount of detailed work still remained to be done on it. On October 15 1989, an historic event occurred. The new sluices at Radyr Weir were opened, and for the first time in over forty years, the leat was in full, uninterrupted flow past the Melingriffith Pump.

The situation today is a very far cry from the CBA/Cadw conference in December 1986, at which time we had virtually despaired of taking this project any further, and its great historical importance is now, thankfully, accepted in the quarters that matter.

Appendix 24.1 Technical specification of Melingriffith Pump (Fig 41)

1 General

An undershot paddle-wheel driving pistons in two cylinders through timber rocking beams and chain on timber tower.

2 Paddle-wheel

18 ft 6 in (5.64 m) by 12 ft 6 in (3.81 m) wide, mounted on a solid oak axle with cast iron spokes and rim, with thirty paddle blades, 22 in (0.56 m) deep.

3 Pump mechanism

Two cylinders of 2 ft 8 in (0.63 m) bore and 5 ft (1.52 m) stroke, each with a fixed set of flap-valves at bottom of piston stroke. Identical delivery valves set into each piston.

The valves are triangular weighted flaps of iron with leather hinges, mounted at 30° to horizontal.

Cast iron connecting rods 18 ft 5 in (5.13 m) long, 4 in by 5 in (0.10 x 0.13 m) section.

4 Tower and beams

Frame constructed of 1 x 1 ft (0.3 x 0.3) in American pickled oak, with iron reinforcement and strapping.

Two rocking beams, 22 ft (6.71 m) long, of oak 1 ft 4 in by 1 ft 2 in (0.41 x 0.36 m) with cast iron cappings.

Note: The ironwork is reputed to be the product of Neath Abbey Iron Works, but there is, as yet, no documentary evidence to support this.

5 Method of delivery

Water was lifted 12 ft (3.66 m) into a timber trough, the floor of which was 6 in (0.15 m) below the nominal level of the Canal, so that the pump was always primed.

6 Estimated performance

The pump has a theoretical total displacement of 4.9 ft (1.388 m) per cycle, with a maximum angular velocity of 0.94 ft (0.279 m) per second.

Section V: The reuse of industrial monuments and landscapes

25 Welsh corn mills — the past, present, ... and future?

by Gerallt D Nash

The handful of working mills surviving in Wales today represents but a small fraction of the corn mills that were once to be found in the Principality. Indeed, by the end of the nineteenth century virtually every river and stream could boast at least one waterwheel or turbine which powered a corn mill, a farm threshing machine or perhaps a saw mill.

The corn mill was the focal point of every community, for it represented the means of converting grain to flour, without which the population could not survive. Whosoever owned or controlled a mill therefore effectively controlled the population within that area. The mill was thus central to each community's well-being and economy. Today's mills are, by contrast, very much on the fringes of economic life and account for only a minute percentage of the country's milling capacity. They are survivals of a technology and a way of life that time has passed by.

As the last of the 'true' traditional mills closed down during the 1970s and '80s, so did the first of the new generation of restored mills begin to appear. In some cases, new owners took over mills that were still operating or that had only recently stopped. More often, however, such mills were already in a state of decay and neglect and had not worked for maybe a generation. The new millers are, by and large, a new 'breed', having no past experience of running a corn mill, whereas the previous millers tended to come from milling families, extending back over several generations. The 'new' millers are often able to employ skills and experience in fields such as engineering and marketing not readily available to their predecessors, and today this can mean the difference between a loss-making project and a profitable business.

Today's corn mills do, however, represent a valuable link with the past and it is hoped that the growing interest in low-energy technology will ensure their survival at least into the next century. Whether this will in fact be the case will depend as much on the implementation and enforcement of legislation designed to protect buildings as it will on the willingness of mill owners to expend much time, energy and capital in restoring, maintaining and operating their mills.

Corn mills, as opposed to hand-operated querns or saddle stones, were sufficiently well established to be mentioned in the old Welsh Laws as codified by Hywel Dda, briefly Ring of all Wales in the mid tenth century. These Laws contain what is believed to be the earliest known reference to milling 'soke', that is, the obligation placed upon tenants to grind their corn at a specific mill. The Doomsday Survey commissioned by William I in 1086 lists over 5600 such mills. At that time very little of modern-day Wales had come under his control and consequently, we have little idea as to how many water mills were actually in existence here at the end of the eleventh century. However, thereafter, with the progressive subjugation of the Welsh rulers by Norman armies, more and more evidence emerges for water-powered corn and fulling mills throughout the country, as well as some horse-powered mills.

Most early mills were built of timber, generally having wattled walls and thatched roofs. By way of contrast, the thirteenth century lord's mill at Rhuthun was substantially built of stone having a wooden waterwheel under an impressive arch, with slit lancet windows providing light into the milling room, Such a mill undoubtedly reflected the status of its owner.

The first windmills appeared in Wales during the thirteenth century, more than 100 years after their first appearance (and probable invention) in England. This is detailed in the study of medieval mills in England by Richard Holt (1988). The pattern of distribution of corn mills in Wales, once established, was to remain more or less the same for the next 500 years; though, of course, the mills built during the late eighteenth and nineteenth century reflected the technological advances in building techniques and millwrighting that had taken place since the Middle Ages, Later, as the power and influence of the manorial lords declined, private estate owners and individuals were able to erect and run their own mills so that rather than being merely a source of income for the lord of the manor, such mills became part of the mainstream of rural economic life.

By the nineteenth century virtually every river and stream boasted at least one water-powered mill, and as the century progressed, waterwheels, and later, Pelton wheels and turbines, became a feature of many farms where they were used to drive chaffing and threshing machines as well as small mills for animal feed. Corn mills of some description were to be found in or near every town, village and hamlet, though quite how many there were at this time is not known. Some detailed research has been carried out in about half of the

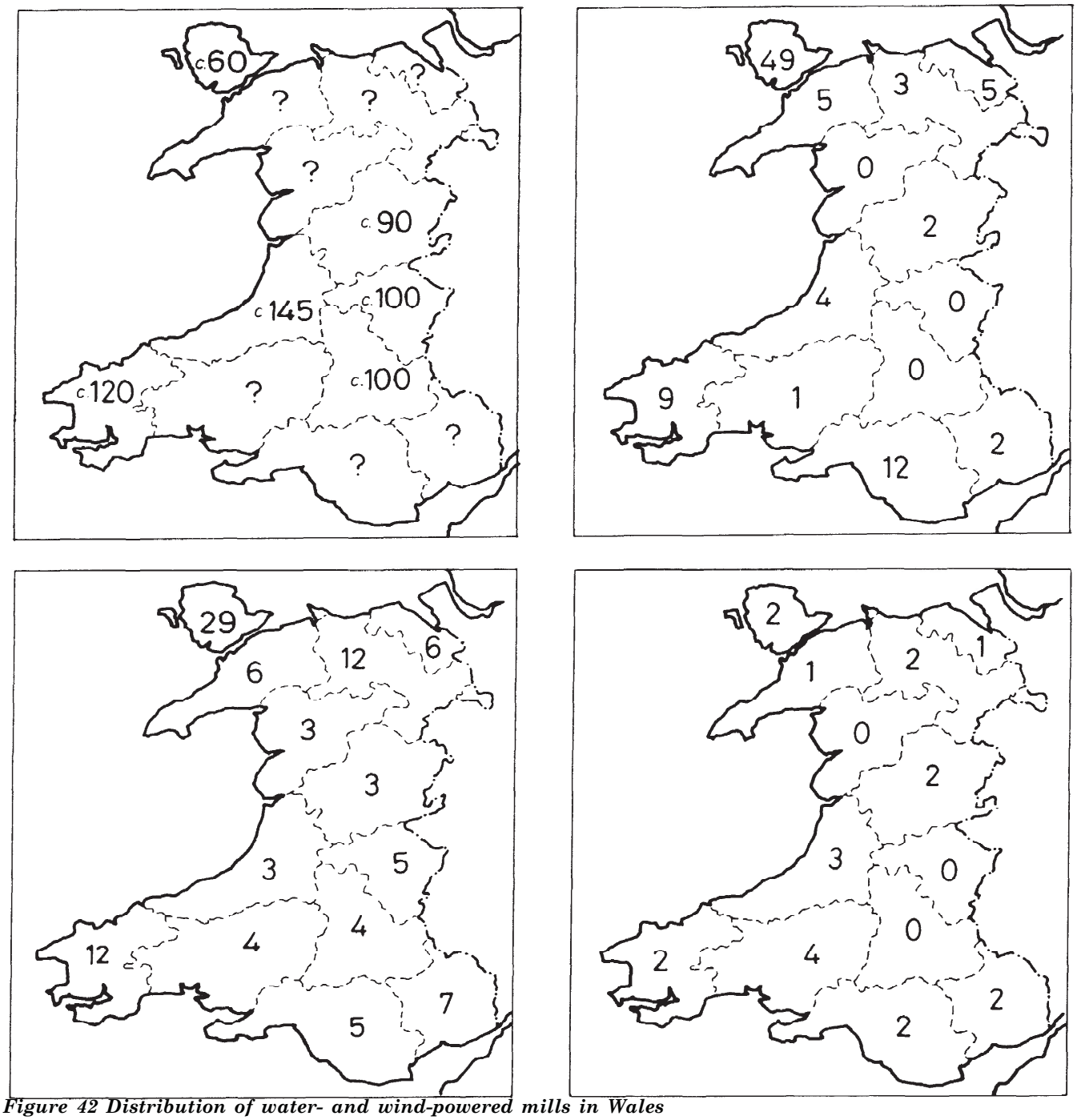

Figure 42 Distribution of water- and wind-powered mills in Wales

thirteen historic counties of Wales (Bowen 1987; Davidson unpubl; Jones 1968; Nash unpubl; Parkinson unpubl; Tucker 1989), but much work remains to be done if an accurate overall picture of the distribution of water-powered corn mills is to emerge. Figure 42, Map 1 shows those counties where fieldwork and documentary research has yielded information on the number of corn mills that were in operation by the first quarter of the nineteenth century. The figures shown within each county boundary represent the number of corn mills identified, but do not include water-powered woollen or fulling mills, industrial mills, pumps, or farm waterwheels. Thus it can be seen that counties such as Cardigan had in excess of 140 corn mills and Pembrokeshire, Breconshire and Radnorshire probably had more than 100 each. (Caernarfonshire and Carmarthenshire probably exceeded this figure). The six counties so far surveyed account for a total of 600+ water mills. The estimated total for the whole of Wales is therefore probably in the region of 1300-1500.

Less numerous, but no less important, were windmills and tide mills. These were generally built in areas where a reliable supply of water could not be depended upon. A total of ninety-two wind-powered corn mills were in operation in Wales during the nineteenth century, by far the largest concentration being on the Isle of Anglesey which had forty-nine mills. Figure 42, Map 2 shows the number of such mills recorded in each county during the nineteenth century, with the figures again not taking into account wind-powered industrial mills or water pumps, though some farm-based mills are included where they were also used for corn milling.

A total of ten tide mills existed around the Welsh coast, usually on tidal estuaries where the incoming tide could be trapped in an artificial lake or dam, the mill wheel being turned by the water released from this dam with the ebbing tide. Two examples were found on the Cleddau Estuary in Pembrokeshire at Carew (OS SN 0425 0375) and Pembroke (OS SM 9833 0163). Another two, at Port Dinorwic and Menai Bridge were sited on the banks of the Menai Straits in Gwynedd; but the largest cluster (six) was to be found around Holyhead in Anglesey (Minchinton 1977).

The year 1846 saw the repeal of the Corn Laws, legislation that had for decades kept the price of home-grown corn inflated at an artificially high level. The Corn Laws had served both to limit the importation of better quality grain from overseas, and had also encouraged farmers to grow corn crops, especially wheat and barley, even on land that was better suited to pastoral farming.

During the first half of the nineteenth century there was a marked upturn in the number of corn mills that were erected, modernised and extended in Wales. This was partly in response to the increased quantities of corn being grown, but also more particularly to the growing demand for flour from an expanding population both in the rural areas and increasingly in the developing industrial and urban centres. The repeal of the Corn Laws meant that much cheaper, better quality wheat could be imported from countries such as North America, Argentina, and even Russia and India. The effects were felt almost at once. The *Illustrated London News* of 14 November 1846 recorded that

> The supplies (of corn) so obtained (at Marseilles, France) are understood to be very great; they have had the effect already of lowering the price of grain, or at least checking its rise. In England and Ireland, the same effect has been produced by the large importations from America which are still on the increase.

One initial difficulty that had to be overcome with regard to imported wheat was the fact that most mills were located considerable distances from the ports where the grain was unloaded and this tended to buffer the effects of importation for a while. But within a matter of a decade or less, mills

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Key to Figure 42 (opposite):

Map 1: Water-powered corn mills in Wales, c *1750-1850*
Note: Insufficient data are available to give an estimate of the number of mills operating in Caernarfonshire, Denbighshire, Flintshire, Merioneth, Carmarthenshire, Glamorgan, and Monmouthshire.

Map 2: Wind-powered corn mills in Wales c *1750-1850*

Map 3: Statutorily Listed wind and water mills in Wales
Note: The Anglesey total includes 28 windmill towers. Windmill towers are also Listed in Caernarfonshire (3), Denbighshire (1), Flintshire (3), Glamorgan (2), Monmouthshire (1), and Pembrokeshire (2). The 59 Listed water mills represent less than 5% of the total number known to have been working in Wales during the nineteenth century.

Map 4: Mills known to have been working during the past 5 years
Note: The total of 21 working mills includes 12 mills restored during the past 15 years.

sprang up in and around the chief ports of Britain which enabled the grain to be milled, processed and bagged as soon as it was unloaded, enabling it to be marketed and distributed in a much more profitable and convenient form as flour.

Initially, these mills were wind or water-driven, using the traditional millstones; Liverpool, for instance, could boast upwards of twenty-five windmills (Bennett and Elton 1898), and at least eighteen corn tower mills stood at Hull (Gregory 1985, 22). The introduction of steam power enabled whole rows of millstones to be driven by a single engine, and in turn the stones were replaced by roller mills.

In 1854, a west country miller and flour merchant named Joel Spiller, in partnership with Samuel Brown, opened a steam-powered flour mill by the West Dock in Cardiff; in the following year, the firm of Kimberley & Co set up a mill at the Public Wharf Stores also on West Dock. Within a few years, scores of similar businesses had become established in the town, with others engaged primarily in importing grain. Thirty years later, Spiller's original mill had been replaced by three larger buildings of modern design, rollers now taking the place of millstones. Some 100,000 tons of wheat was milled annually, being imported from America, Russia, India, and Australia.

Against such competition, traditional mills had little choice but to close. The massive milling plants on Merseyside, to the north, and Cardiff, Barry and the Bristol Channel ports, to the south, dominated the economic base of the milling trade and completely undermined the viability of the wind and water mills that had served the country for 600 years and more. Those that did continue in use into the present century concentrated mostly on producing animal feeds for local farmers.

By about the year 1950 there were probably in the region of 100 to 150 working or workable mills left in Wales. Twenty years later, this number had dropped possibly by as much as 80%. The sudden realisation that working corn mills were on the verge of extinction in Wales was the catalyst needed to spur a few individuals into action to save some examples and to restore them to working order, By the late 1970s the decline had virtually been halted and more and more mills were being acquired for preservation.

The restoration works carried out at Felin Isaf, Glan Conwy (SH 8028 7494) and Melin Hywel, Llanddeusant, Anglesey (SH 3507 8447), both merited architectural awards in 1975, and the successful operation of Melin Pentrefoelas (SH 8736 5151) and later (and in particular) Felin Geri, near Newcastle Emlyn (SN 3005 4234), in producing stone-ground flour for the growing wholefood market, showed that traditional mills could be run on a profitable commercial basis. In 1970 Melin Bompren from New Quay in Dyfed was dismantled and reerected as a working exhibit at the Welsh Folk Museum, and by 1984 there was sufficient public interest in mills to justify the formation of a society dedicated to the study and preservation of Welsh mills, namely *Cymdeithas Melinau Cymru* — The Welsh Mills Society.

The 1980s saw a further increase in the number of mills brought back into production. In fact, in the three years between the formation of the Welsh Mills Group and the conference, no less than seven mills were restored, including the windmill at Llanddeusant, Anglesey (SH 3465 8523), and work on at least five more mills was either in progress or proposed.

On a more sobering note, however, several important mills descended the merit scale. The Grade II listed mill at St David's, Dyfed (SM 7446 2499), was converted to a dwelling in spite of the fact that it was virtually intact and had worked into the early 1980s. Felin Isaf, Glan Conwy, Clwyd, though fully restored using public funds, has not been operated on any sort of regular basis recently, if at all, by its new owner; and in August 1987 the Grade II windmill tower at Rhostrehwfa near Llangefni was demolished by the Isle of Anglesey Borough Council before receiving Listed Building Consent (LBC).

This brings us to the whole question of preservation and protection of mills. A building deemed to be of architectural or historical importance can be afforded Statutory Protection by being Listed. Listing a building is meant to ensure that no alterations can be made to the structure that would affect its character without the consent of the local planning authority, or on appeal, to the Secretary of State for Wales, or a person or authority charged by him to act on his behalf. There are currently ninety-nine Listed mills in Wales (Fig 43, Map 3), the vast majority being listed Grade II, that is 'buildings of special interest'. Two are categorised Grade II*, 'particularly important buildings', namely Melin Hywel, Anglesey (SH 3507 8447) and the questionable windmill tower at Garreg, Whitford in Clwyd (SJ 1336 7826). Of these Listed structures, fifty-nine are water mills and forty are windmills. All but two of the latter are empty towers, often ruined, or converted to dwellings. Only thirty of the water mills were described as substantially complete at the time of Listing: some have since been gutted and others have been converted to other uses. It is worth noting that many complete mills are not Listed at all and these include several working mills such as Felin Newydd, near Pumsaint, Dyfed (SN 6631 3849), and Skenfrith Mill, Gwent (SO 4574 2023).

There are other anomalies in the pattern of Listed mills. In Anglesey, just about every windmill ruin had been listed (a total of twenty-eight), whereas elsewhere in Wales selection appears to be piecemeal. For instance, the truncated windmill tower at Angle, Dyfed (SM 8668 0190) is Listed, but the tower at Dale (SM 7991 6533) just across Milford Haven which survives to its full height and

is protected by a cap of tarred felt, is not. Similarly, the two windmill towers that are Listed in Glamorgan, at Wick (SS 9258 7199) and Llantwit Major (SS 9614 6856), are both house conversions (though they were empty shells at the time of Listing), whereas the Hayes Farm windmill tower at Sully (ST 1410 6789) is unlisted even though most of its internal machinery and stones survive largely in tact.

Theoretically, the Listing covers everything included within the curtilage of the building in question and the removal or alteration of any fixture in such a way as to affect its character must first receive LBC. There appears to be some confusion in defining what exactly is protected in a Listed mill. Whereas one might expect this to comprise the building together with its associated machinery — the 'mill' proper — it would appear that some Authorities and individuals are reluctant to include any moving parts (machinery, millstones, gearing, etc) on the grounds that they are 'movable' and not 'fixtures' in the true sense. This possibly explains why so many mills have been turned into dwellings where the only restrictive clause in a planning approval appears to be that the character of the facade be preserved. Here we are faced with a conflict of interpretation. Does Listing a mill make it more attractive to the potential house converter, who might also be tempted by the possibility of grant aid towards the repair of the building fabric; and can such a course of action still constitute preservation? True the building may have been saved from further deterioration but by removing machinery it can be argued that it then ceases to be a mill. There has also been a lack of consistency amongst the Planning Authorities who have all too often supported applications to alter or convert Listed mills to other uses. The cases of St David's water mill and Rhostrehwfa windmill were noted earlier, and to these can be added the fine and virtually complete windmill tower at Kingsland, Anglesey (SH 2485 8107) which was granted LBC for conversion to a dwelling by the local council in 1975, a decision only partly redressed by that council's decision some years later to purchase and restore Llynon Windmill to working order.

Local Authorities are in a position to safeguard many such buildings and should take the initiative in identifying surviving mills (and other examples of industrial archaeology) and to seek some way of preserving them. This can be done either directly, by purchasing or leasing the structure in question, or by ensuring that all reasonable alternatives have been explored before allowing a mill to be converted to some other use. Indeed, Local Authorities are empowered under the Local Authorities (Historic Buildings) Act 1962, to make discretionary grants and loans for the repair of buildings of architectural or historical interest, irrespective of whether they are Listed. Similarly, a more flexible attitude from the Water Authorities regarding water charges might also ensure the survival and restoration of more mills.

Often it is the availability of grant aid which will swing the balance in favour of restoring a mill to working order rather than its retention as a static exhibit (museum) or conversion. The Wales Tourist Board is able to grant-aid projects if there is a resulting benefit to tourism. Similarly the WDA can provide grants and loans towards the reuse of redundant rural buildings, though this tends to be defined as the conversion of disused structures for other, generally light industrial or craft based uses. In other words, whereas it might be possible to obtain a grant from the WDA to convert a former barn to an electrical workshop or even a corn mill, such aid might not be forthcoming to return a corn mill to its original use! A lot obviously depends on how the WDA official in question interprets the application.

Where important buildings are neglected by their owners, Local Authorities should use their Statutory powers to issue a Repairs Notice under Town and Country Planning Acts of 1971 or 1986. It is encouraging to note that some Welsh county and district councils are now actively promoting the presevation and restoration of a few mills in the their respective areas. Clwyd County Council is currently responsible for the maintenance and running of Pentre Mill, Loggerheads (SJ 1983 6268) and Felin Foelas, Pentrefoelas (SH 8736 5151); the Isle of Anglesey Borough Council, as noted earlier, has undertaken the restoration of Llynon Windmill, and the Pembrokeshire Coast National Park has taken over responsibility for Carew Tide Mill in Dyfed (see Briggs et *al,* this volume, Chapter 4).

The majority of restored mills, however, are privately owned, which generally means that their fate is dependent upon the amount of capital that their owners have to spend on their maintenance and repair and often on their viability as a commercial proposition. The failure of either the owner's reserves (of finance and strength!) or of the business' profitability can lead to the mill's closure and sale with the very real possibility that the new owner will have little or no interest in maintaining it as a mill, but rather convert it to some other use.

There are today some twenty-one working corn mills left in Wales, including several restored to operational order during the past ten years (Fig 42, Map 4). In addition to these are a number of substantially complete or 'restorable' mills; that is, mills retaining most of their machinery, stones and gearing even though the wheel might be broken or missing. The exact number of such mills is not known, but a reasoned estimate would be about forty or fifty. Only one tide mill survives with all its machinery more or less intact, namely Carew Mill in Dyfed. Llynon Windmill, Anglesey, was restored to full working order in 1985, but of the other two mills which still contain machinery, the future of

Kingsland, also in Anglesey, is still uncertain, whilst the mill at Sully, South Glamorgan (ST 1565 6868), is used as a store by a major chemical company.

The mills scene in Wales today is probably at its most favourable for nearly half a century. To ensure a greater degree of motivation and success, potential mill restorers and owners should be afforded the same sort of financial encouragement as is currently available to house owners or those converting redundant rural buildings to new uses. All mills surviving in a reasonably complete condition should be Listed Grade II and those retaining all their machinery in working or workable order should be categorised Grade II*.

There are few problems nowadays in finding buyers for mills that are offered for sale, and there is no shortage of keen enthusiasts willing to undertake the work of restoring them to complete and generally working order. The conflict arises when such mills are purchased by individuals whose sole intention is to convert them to 'desirable residences' with a few token bits of gearing being retained as 'feature conversation pieces'. Whilst it might not be possible or indeed ethical to discriminate against the latter, there may be ways by which one might discriminate in favour of retention and restoration by, for instance, ensuring that a Listed mill remains first and foremost 'a mill', and that grants and public funds are allocated primarily to those projects that set out to preserve or restore mills rather than to those works resulting in conversion to dwellings or holiday accommodation.

But in the end the future of our mills depends on peoples' attitude to the preservation of their built heritage, and a greater degree of encouragement from central government, local authorities and grant aiding bodies will go a long way to achieving this end.

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26 *Panel Archaeoleg Ddiwydiannol Cymru* - The Welsh Industrial Archaeology Panel

by Stephen Hughes

The Third Cadw Archaeological Conference (1986) was the fourth large meeting on industrial archaeology in Wales to be held within a decade. All four were characterised by representatives of the various institutions talking at, rather than to, each other. As a result, no coherent or potentially influential grouping of activists had emerged from the first three. Moves to form a smaller liaison forum in Wales had been discouraged both by the abolition of the CBA Industrial Archaeology Research Panel in Scotland and also of the first Industrial Archaeology Panel.

However, prior to the Cardiff meeting, critical losses of unique machinery and iron structures at the Brown Lennox chain-testing works in Pontypridd highlighted the wastage resulting from the lack of liaison between concerned individuals and institutions. Consequently, after discussion between the Secretary of RCAHM(W) and the Director of Cadw, it was decided at the 1986 Cadw meeting that the Commission should launch a Welsh Industrial Archaeology Panel, a course of action encouraged by the re-establishment that November of the Scottish Industrial Archaeological Panel by the RCAHM(S).

The panel's first meeting was held in the offices of the RCAHM(W) at Aberystwyth, in June 1987. Unanimous support was given for the idea of an active Panel and the following *Terms of Reference* were adopted, closely resembling those accepted by the Scottish Panel. These have since been adopted, with minor alterations, by the regional Panels being formed in England:

> The status and function of the Panel should be that of an informal and wide-ranging forum for the exchange and co-ordination of information relating to industrial sites, artefacts and records, It would not act as a policy-making or management body relating to a specific function, but there might be exceptional circumstances when an authoritative statement from the Panel on some issue might be desirable. In general, however, the Panel would avoid any possible overlap with policy-making bodies concerned with monuments and buildings.
>
> A main objective of the Panel is to give advice on the merits of individual sites or groups of sites. To achieve this it will assemble a corpus of the most significant sites in each of the historic Welsh Industries.
>
> The Panel would be entitled *The Welsh Industrial Archaeology Panel.* It was agreed that the composition of the Panel could reflect the interests of individuals and institutions concerned with protecting, preserving, displaying and recording (including the acquiring of records) industrial sites and artefacts. Invitations to a wide circle of institutions and individuals would be issued as appropriate.

Single-industry lists

The middle section of the Terms of Reference refers to the strategic aims of the Panel as expounded at the first meeting by John Hume, present Chairman of the Scottish panel, and one of the few industrial archaeologists with considerable experience both of field survey and priority assessment in statutory protection work.

John Hume noted that there had already been many pressure groups concerned with tactical responses to the most recent industrial monuments known to be under treat. The functioning of the Panels has allowed a constructive involvement by both 'amateurs' and 'professionals' in the interests of co-operation. The emphasis of the Panels, therefore, had to be upon pooling expertise in order to produce lists or inventories in each of the historic industries, assessing priorities for recording and preserving them.

The central role is emphasised on the notepaper of the Panel which states that:

> The Welsh Industrial Archaeology Panel was formed in 1987, by the Royal Commission on Ancient Monuments in Wales with the agreement of Cadw, to act as a liaison group between workers in this subject, in order to assess priorities for recording and preservation in Welsh Industrial Archaeology

Such a core of work was recognised by Sir Wyn Roberts, the Minister of State at the Welsh Office

responsible for archaeology, when he publicly acknowledged the Panel as the result of the third Cadw archaeology conference at a subsequent gathering.

A Beam engine-houses

The Panel's first few thrice-yearly meetings substantially improved contacts between the practitioners of industrial archaeology in Wales and acquainted them with much local work through peripatetic meetings and site visits. The responsibility for single-industry lists was allocated and discussion ensued on what might be the most useful form for use by Statutory Authorities. It was agreed that David Bick, Chairman of the Welsh Mines Society, should produce a list of important beam engine-house remains on a regional basis that could be readily assimilated for the purposes of Statutory Protection by Cadw. The precedent was established of forwarding such lists, after discussion, directly to the Director of Cadw, and a protection policy has followed. All Wales was eventually covered by this single-industry list (Fig 43), which was circulated to all County and District Councils, many of whom expressed an interest in receiving further lists. A developed inventory was subsequently published in the *Industrial Archaeology Review* (Bick 1989).

B Collieries

By Autumn 1988 it was realised that the coal industry, one of the four most important industries of Wales, was on the brink of extinction. Only eleven of the 220 collieries existing in south Wales at Nationalisation in 1947, or of the 500 or so that had existed during the industry's heyday in 1913, were functioning. It was therefore decided to invite Brian Davies, sometime Curator of the Bit Pit Museum, Blaenafon, to assess priorities for coal mine recording. He reported on the industry's outstanding surviving features to the Autumn meeting and at the same time guided RCAHM(W) in planning and executing an intensive photographic recording programme of the surface features at the surviving pits.

No less than three sub-committees of the Panel were held in 1989 in order to consider the urgency of the task of dealing with the coal mining heritage. Firstly, a colliery sub-committee met in February 1989 at the Welsh Industrial and Maritime Museum under the Chairmanship of the Keeper, Dr Stuart Owen-Jones. This was to examine three matters; to consider what drawings and plans survived of the industry; to assess what photographic and survey recording required to be done, and to see if the future of the last surviving early nineteenth century pit with substantial remains — at Glyn Pits, Pontypool — could be ensured.

It was concluded that the extent of the surviving manuscript plans was largely unknown and would need to be investigated. Brian Davies was requested to draw up a list of recording priorities for the RCAHM(W) to follow. There have since been moves to take Glyn Pits into Guardianship.

Contacts established between representatives at the six sub-committee and full Panel meetings in 1989 led to a number of highly significant indirect results. The WDA Land Reclamation Unit offered to fund the financial infrastructure for improving the difficult access to Glyn Pits and considered the almost total demise of coal, the paramount industry of south Wales to be quite an exceptional circumstance. Under such conditions the Unit was willing for RCAHM(W) to act as its agent in compiling, evaluating and collecting existing records of the coal mining industry and for it to be funded accordingly. This would be undertaken alongside the WDA's work on colliery reclamation. RCAHM(W) has thus been enabled to document the archaeology of the coal mining industry, Cadw's involvement in these meetings led to a consideration of conservation priorities in the colliery industry and the listing of Six Bells Colliery. In order to obviate future oversights, an industrial archaeologist was appointed to the Ancient Monuments Inspectorate in 1990. The Inspector has used the collieries list, and contacts developed through the Panel, to carry forward a programme of Statutory Protection on the remaining collieries.

C Early railways

The horse-worked railways developed in Britain from the beginning of the seventeenth century but railways underwent a profound transformation in the first three decades of the nineteenth century. This transformation led to the first fully-developed modern locomotive-hauled railway with the opening of the Liverpool and Manchester Railway in 1830. Successful bulk transportation sped its industrialisation worldwide. The great majority of railways constructed in that crucial phase were built in south Wales. RCAHM(W) has produced a detailed single-industry list of such internationally significant remains (Fig 44), which was later augmented by the Panel. Cadw is now using this inventory to enhance its Statutory Protection Programme. The inventory has been published by RCAHM(W) as part of *The Archaeology of an early railway system: the Brecon Forest tramroads* (Hughes 1991).

D Other single-industry lists

Gasworks: Unlike England and Scotland where the intact sites at Biggar and Fakenham had been preserved, no complete example of a gasworks survives in Wales. It was noted that fragmentary Estate Gasworks have been recorded at Glynllifon Caernarfon (by Gwynedd Archaeological Trust) and Leighton Park (by the Ironbridge Institute and

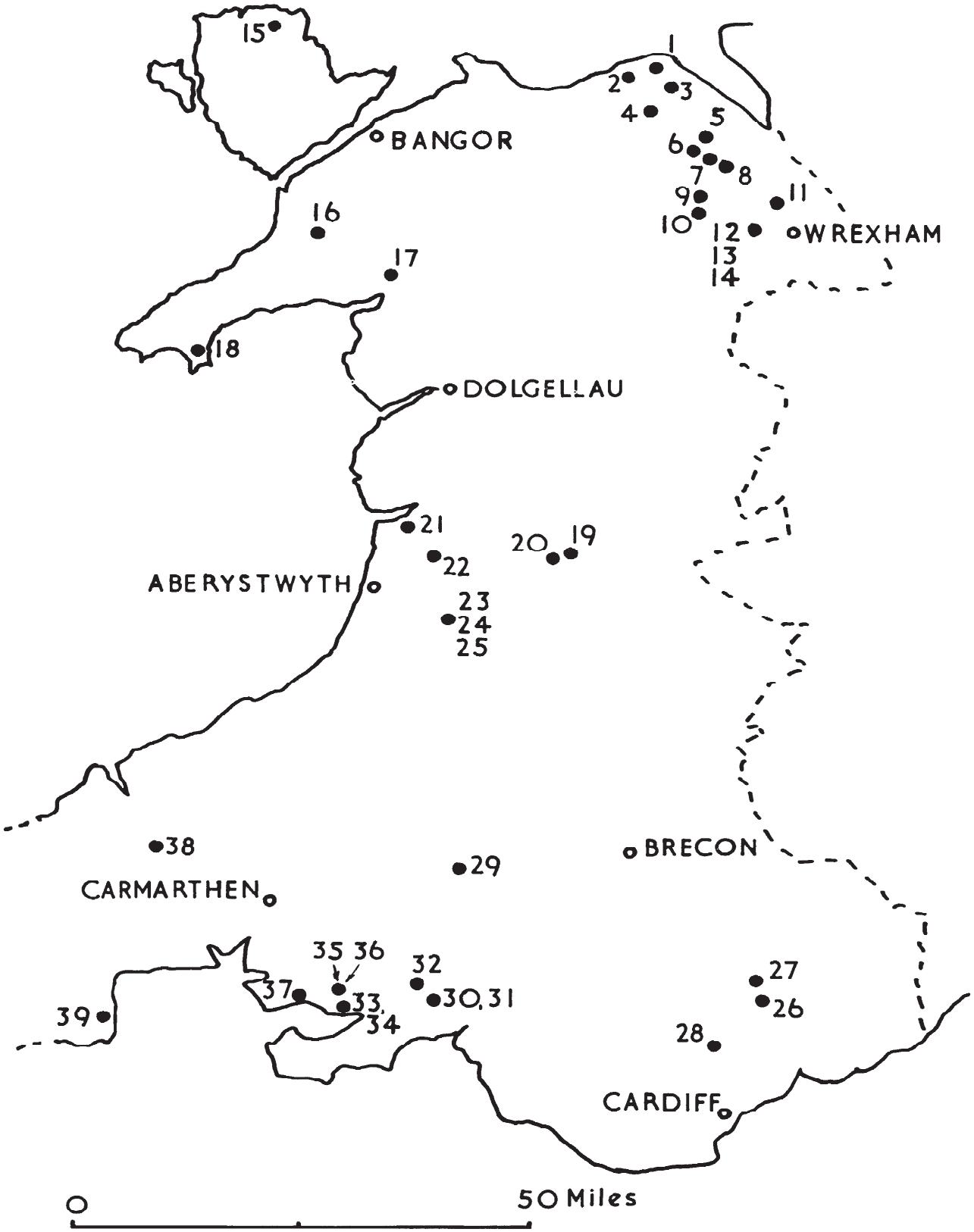

Figure 43 Distribution of surviving engine-house remains used in assessing priorities for recording and Statutory Protection (by D E Bick)

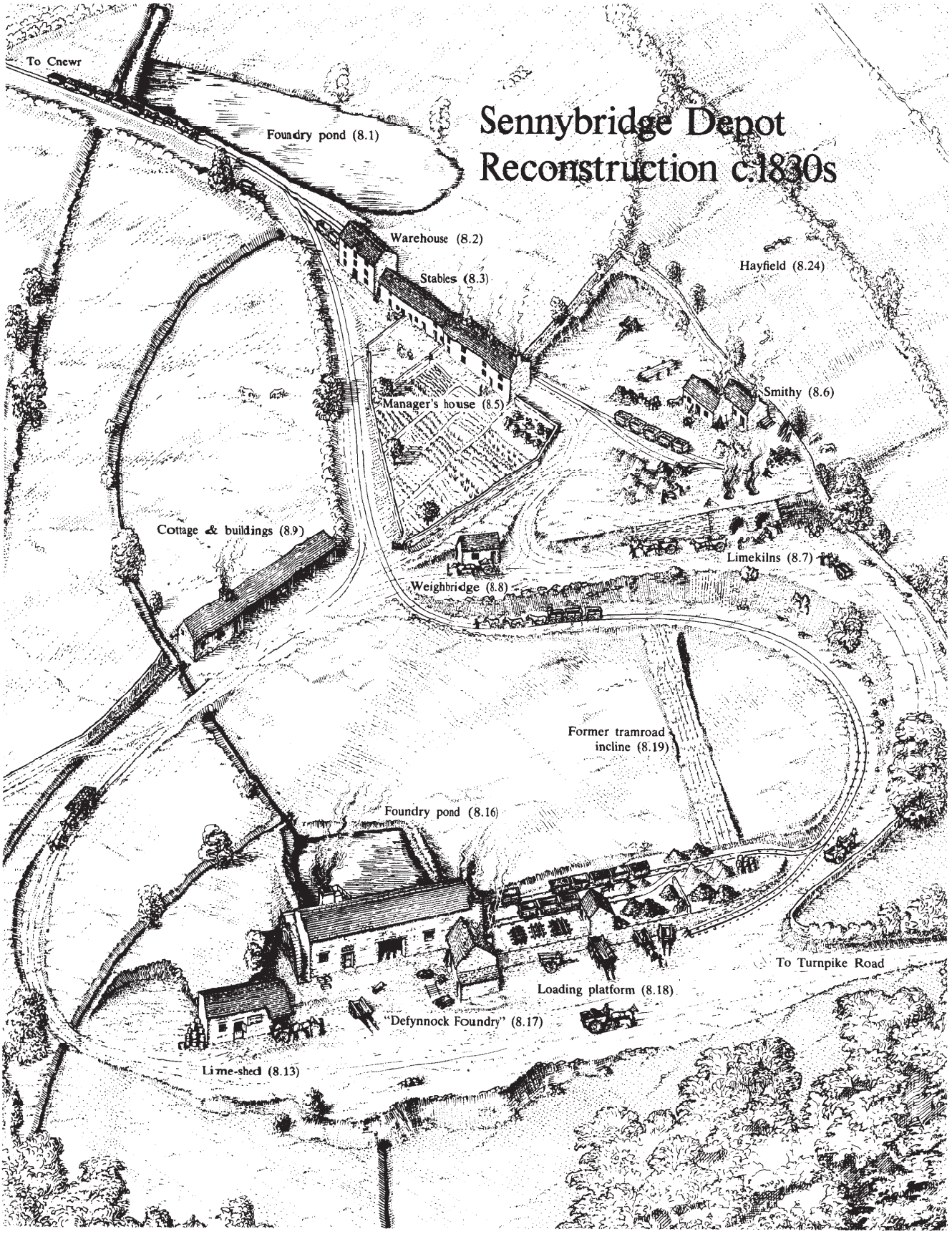

Figure 44 Detail from the Brecon Beacon Forest Tramroads *(RCAHM(W) 1991), a project undertaken as part of a gazetteer of early railway remains in Wales*

RCAHM(W)) and it is clear that the records of British Gas (Wales) need evaluating.

Ice factories: The last working ice factory in Wales has been recorded by A J Parkinson for RCAHM(W) at Milford Haven. The remains of other ice factories have been listed by the Panel.

Ice houses: An ice house excavation at Plas Machynlleth was described by James Barfoot (Machynlleth Civic Society: Barfoot 1986) and other similar structures have been discussed. Dr Eurwyn Wiliam (Welsh Folk Museum) has made an inventory of such structures in Wales in association with the *Subterranea Britannica* survey (Wiliam 1981).

Ironworks: Philip Riden (University of Wales) has examined recording priorities in the Welsh iron industry. He has concluded that the assemblage of mid-sixteenth to mid-nineteenth century iron-making sites in Glamorgan and Gwent was probably without rival in the United Kingdom or indeed even in Western Europe. A list of the early charcoal fired furnaces has been circulated.

Lighthouses: Stephen Hughes, RCAHM(W), prepared an inventory of the most significant remaining buildings and features from the more extensive listing of Douglas Hague (Hague 1979). The automation of Trinity House's diminishing number of manned lighthouses makes more urgent the protection of the surviving remains.

Mills: Dr Gerallt Nash of the Welsh Folk Museum and the Welsh Mills Society has abstracted a list of all Statutorily Protected mills. In 1990 he presented to the Panel a list of the most complete cornmills in Wales, for purposes of protecting or upgrading protection upon important machinery and other mill fittings. An apparent imbalance between the protection of windmills and watermills was also noted (Nash, Chapter 25, this volume).

Non-ferrous mines: David Bick has presented a list of the most important non-ferrous mines in mid-Wales (Bick and Williams, this vol. Chap. 29) before work proceeded on the various reclamation schemes previously reviewed at Panel meetings.

Non-ferrous smelters: Diane Morgan (Delyn District Council) and Stephen Hughes (RCAHM(W)) have itemised the most significant sites in the erstwhile centres of this industry in north-east and south-west Wales.

Railway viaducts: Owen Gibbs (Institution of Civil Engineers) has circulated a list of historic viaducts produced for the Viaducts Committee.

Saltworks: The excavation of the seventeenth century saltworks surviving on the foreshore at Port Eynon on the Gower Peninsula was described by the excavator Paul Wilkinson (Glamorgan-Gwent Archaeological Trust). Other similar sites have been listed.

Industrial structure records

This sub-committee came into existence in 1989, has its own secretary and chairman and includes representatives from the Welsh county archivists, the National Library of Wales, the NMR(W) and the Panel secretary. It was agreed that much needed to be done to establish what archives, particularly plans and drawings, were still held by British Ports Authorities, British Rail, British Coal, British Steel, British Waterways, British Gas and the Electricity and Water Companies. This become more urgent with the government's rolling programme of privatisation. However, it was agreed that the problem of British Coal records was the most urgent. Certain problems were recognised in the Public Record Office's guidelines for the retention of industrial records which seemed to be preoccupied with written documents to the apparent exclusion of both photographs and also of plans and drawings (which had considerable archaeological values).

In Autumn 1989 the Panel met representatives of the Public Record Office and drew up a strategy for gaining access to, evaluating, and safely depositing the most valuable core of the British Coal archives. This has proved difficult because of the huge extent of the archives, the rapidly diminishing but compartmentalised structure of British Coal and the limited number of experienced staff capable of evaluating the huge archives located. These factors have precluded further necessary work by the sub-committee beyond a preliminary assessment of British Rail and British Waterways records.

However, the extent, nature and location of British Coal's records have now largely been ascertained. All original drawings — plans and elevations — of colliery plant and structures, had been disposed of by British Coal after an extensive, but selective, programme of microfilming. The sole exceptions seem to be the drawings of the fine Edwardian collieries of Penallta (Hengoed) and Britannia (Pengam). Negotiations are now proceeding to deposit microfilms of drawings in the NMR(W) and of original drawings in the relevant county record offices. Photographs from British Coal and from private collections have also been copied and placed in NMR(W) and of original drawings in the relevant county record offices. Photographs from British Coal and from private collections have also been copies and placed in NMR(W). Apparent gaps in the records located, as with the fine horizontal pumping-engine at Marine Colliery, have been filled by programmes of aerial and terrestrial photography (Fig 45), and by survey work carried out by RCAHM(W).

Case studies

The Panel's main work is strategic but it has been recognised that it should be able to respond quickly to changing situations and this is why it meets every four months (other Industrial Archaeology Panels in the UK meet every six months). Individual sites considered because of their outstanding importance have included Green's

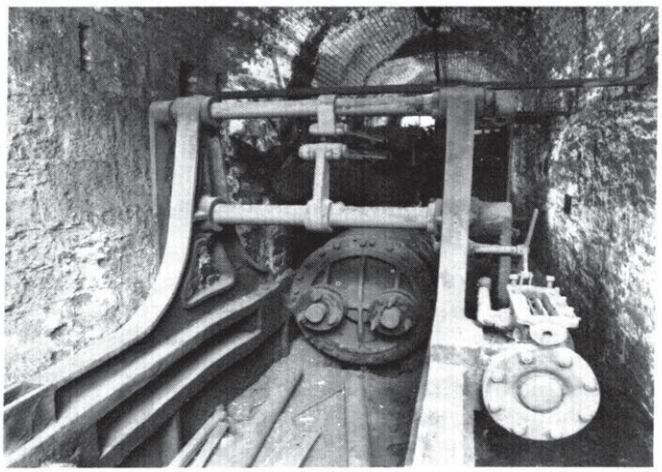

Figure 45 Marine Colliery: horizontal engine (photo: RCAHM(W), Crown Copyright reserved)

Foundry in Aberystwyth; Gwernllwynchwith rotary enginehouse in Swansea; Kingsland Windmill, Holyhead (Nash, this volume, Chapter 25), Parys Mountain Copper mine, Anglesey (Briggs, this volume, Chapter 14), and early industrial landscapes in Swansea. Various results ensued from this activity. Letters explaining the national importance of both Green's Foundry and of Kingsland Mill were despatched to the relevant District Councils and the future of both monuments now seem assured. The Statutory Protection afforded to Pays Mountain and to the atmospheric enginehouse at Gwernllwynchwith was made more satisfactory, to all, after discussion. The importance of Gwernllwynchwith and of the early industrial landscapes in Swansea led to Swansea City Council offering assistance in completing their survey.

The future

The Minister of State responsible for archaeology in Wales has noted that each of the annual Cadw Conferences has brought forth recommendations. The Third produced the Welsh Industrial Archaeology Panel, as the Minister noted, but did not produce specific proposals. The Panel members therefore submitted a letter to the Minister noting their concern over the loss of important original plans and drawings and at the lack of resources with which to record the complete industrial landscapes being rapidly destroyed under the impetus of the Valleys Initiative, opencast coal mining expansion and afforestation. The appointment of a Cadw inspector to deal specifically with the Valleys has already been noted. The need for extra resources for recording industrial archaeology within RCAHM(W) has become widely accepted.

The first phase of the Panel's ability to draw up useful single-industry lists or inventories depended on the expertise of the Panel members and correspondents. It may well be that this fund of existing knowledge has largely dried up and that the future preparation of national single-industry lists will in future depend upon enhanced staffing and resources within the Statutory agencies, the Panel acting as an advisory and checking body for this work. However, the March 1991 meeting was concerned with the formulation of priorities of recording and Statutory Protection in the slate industry and such 'thematic' meetings will carry forward the work already started.

The Panel's existence has prevented duplication of scarce resources, channelling a mass of invaluable knowledge and experience, both amateur and 'professional' directly to those councils and statutory bodies able to safeguard and record the industrial heritage of Wales. The work of the Scottish and Welsh Industrial Archaeology Panels has been widely admired for its success. Consequently the Secretary of the Welsh Panel was asked to organise the CBA meeting to set up Industrial Archaeology Panels in England. The CBA Industrial Archaeology Panel now consists of representatives of all the British Industrial Archaeology Panels and Statutory Heritage Agencies and is drawing positively on the accumulated experience of the Scottish and Welsh Industrial Archaeology Panels.

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27 The future of industrial archaeology in Wales

by C Stephen Briggs

Introduction

Although in the introductory essay it was shown that originally both amateur and professional had worked hand in glove to establish an interest in the industrial past, things have changed since the mid '60s and there are now probably a dozen full-time industrial archaeologists in Wales, with perhaps twice to thrice that number doing it as part of other heritage work. The balance of influence nowadays rests more with these professionals than with the amateurs. From the mid '70s to 1988, much was achieved under temporary employment training schemes which brought new entrants to conservation, few of whom found full-time employment in the heritage field. Nevertheless, there do remain strong amateur interest groups, still based mainly in south Wales (Palmer, this volume, Chapter 8), their valuable work well exemplified at Melingrifith (Williams, this volume, Chapter 24). As tourism expands to cater more for the growing public interest in industrial archaeology, more of this small reservoir of expertise and talent should be put to good use.

Discussion will be under five headings, as presented in the body of the Review. Concluding remarks will then include a consideration of the subject's standing in Wales today.

1 Protection

How many sites have been Scheduled since the publication of Douglas Hague's lists in 1964-5 (Briggs, this volume, Chapter 1) and of Morgan Rees' gazetteer in 1975? Of between 400 and 500 sites mentioned by Rees (1975, 233-73), lamentably few have been properly recorded or planned; even fewer have been offered Statutory Protection; many have been destroyed. Of the 2600 or so monuments Scheduled at the moment, only around 100, or some 4%, are of industrial interest Knight, this volume, Chapter 3).

It is sometimes difficult to appreciate why certain features are Scheduled whilst others become Listed Buildings or (more rarely) they enjoy both forms of protection. Listing is usually offered habitable buildings or parts of their curtilage. Until 1984, Listed Buildings work in Wales was carried out from London, but after the establishment of Cadw, three staff were appointed to undertake the long-awaited task of relisting the whole Principality from Cardiff. This had a radical effect upon the protection of industrial monuments (the details of which are to be found in the excellent Satutory Lists of Listed Buildings distributed by Cadw to local interested local government and other offices). Of forty-one railway structures (including stations) currently listed in Wales, nineteen were added between 1984 and 1989. Prior to the recent resurvey of Bangor, Arfon District Council preserved only five features specifically of industrial interest (in addition to bridges and cornmills). By the time of the published resurvey in 1988, this figure had risen to seventeen. Some towns are still inadequately covered and enjoy particularly low levels of recognition or protection for industrial architecture. In 1989 urban Carmarthen, for example, only had two specifically industrial buildings listed. Even more disturbingly, where industrialisation was originally so important in Swansea and Cardiff, a great deal still remains to be resurveyed. Although the Swansea lists were revised in 1987, the Cardiff Surveys date to 1975 and 1977.

Ignorance and prejudice are amongst the most obvious problems besetting protection, at least as mentioned by both Richard Keen (Chapter 2) and Jeremy Knight (Chapter 3). Prejudice derives in the main from the Industrial Revolution's strong legacy of guilt and resentment. The working class symbols of exploitation are polluted, cluttered industrial landscapes; conversely some surviving industrialists' families harbour a sense of guilt from having created these environments. Such sentiments create fertile beds for the growth and maintenance of a willingness to erase all traces of industry from landscapes that education has taught are far from picturesque, though sadly this erasure is executed quite irrespective of architectural potential or importance to the history of technology.

In 1986 English Heritage initiated a Monument Protection Programme. Its potential efficacy in monument evaluation for selective preservation depended upon a number of variables. In its assessments, much value might be attached to the management situation of a monument, which 'can have a direct bearing on its selection' for Statutory Protection (Darvill *et al* 1988). Unfortunately, such a selection system carries the danger of neglecting crucial criteria of uniqueness or representivity at the point where potential maintenance expense becomes a reason, or excuse, for not affording a site Statutory Protection. Lack of effective Statutory Protection for the Cyfarthfa Furnaces long contributed to their neglect and consequent deterioration. Although such protection is now

afforded, only the establishment of Merthyr Heritage Trust has helped redress that deterioration process (Pearson, this volume, Chapter 22). Parys Mountain remained unprotected for similar reasons (Briggs, this volume, Chapter 14). Some monument types obviously lend themselves to easy management more readily than do others. Many limekilns pose no threat to commercial or urban development; a good number actually lie in coastal areas where their preservation and management would be of undisputed interest to future tourism potential.

Wales has yet to adopt its own Monument Protection Programme (cf Stratton 1990, on England). It was intended that the Industrial Archaeology Panel, established in 1987, would draw upon the advice of several, if not of numerous, individual specialists, in order to make recommendations for the protection of particular site types (Hughes, this volume, Chapter 26). The first submission was a list of Cornish enginehouses by David Bick (cf Bick 1989). Inherent in proposals for the English Protection Scheme was the ideal of offering protection upon a regional basis. Thus, in areas not well endowed with certain types of site, it would be possible to argue for the Statutory Protection of examples surviving in more inferior condition than in areas where the same feature was both quantitatively and qualitatively better represented. Cadw's sympathy to the adoption of such a philosophy was tested in 1990 when the Brecon Beacons National Park Authority requested consideration of fuller protection for the deteriorating Cornish Engine-house at Cae Sara lead mine, Carmarthenshire (SN 753 275). Statutory Protection would have greatly strengthened the Authority's hand in its request for WDA grant aid to stabilise the fragmenting masonary. Unfortunately, this request for protection was turned down on the basis of the mine's lower rating on the national scale, rather than upon its regional rarity, or indeed, upon the apparently advantageous criterion that the local planning authority was making every effort to safeguard a site for landscape potential, education and tourism. As the site continues to deteriorate, it remains to be seen how far regional representation and management potential might enter into future Scheduling assessments in Wales. Difficulties encountered in upholding the Statutory Protection of Glyn Pits colliery enginehouses, Pontypool (Palmer and Neaverson 1990) have been noted elsewhere (Palmer, this volume, Chapter 8).

Other ways of protecting landscapes — often overlooked — are available besides Scheduling and Listing, mainly through the Planning Acts at local government level. Under the Civic Amenities Acts of 1967 and 1974, greater use could be made to create Conservation Areas including industrial monuments (see Memorandum on Structure and Local Plans DoE Circ 22/84; W O Circ 43/84, 'Environmental protection and conservation', 48, para 4.36). Unfortunately, Local Authority attitudes to specifically archaeological planning problems vary a great deal throughout the Principality, as has been documented in detail by John Manley (1987a; b).

Within the National Parks (this volume, Chapter 4), more use could be made of Section 41 management agreements to protect industrial sites. And although it may seem a contradiction in terms, some industrial landscapes (for example in the uplands of the Snowdonia and Brecon Beacons National Parks) might fall within the *Map of Moorland and Heath,* itself a strong conservation document If properly presented, there is no reason why some industrial sites might not even be included to advantage in Areas of Outstanding Natural Beauty.

A further form of landscape designation is currently being proposed for some Gwent industrial sites, and should eventually include others elsewhere in the Principality. This involves their inclusion as important landscapes upon the Register of Historic Gardens, Parks and Landscapes being drawn up for Cadw by Mrs Elizabeth Whittle since early 1990. Although the sister Register of Gardens and Parklands for England, begun in 1983, was completed by 1987, complementary evaluation and Listing of suitable historic English landscapes is still unstarted. The Welsh initiative is therefore extremely important.

Is sufficient protection generally being afforded early industrial sites? The answer must concern: (i) the speed of protection assessment; (ii) the degree to which sites are representative of their class; and (iii) the strength of legislation, particularly its effectiveness in enforcement when the statute or byelaw is violated.

i) The speed of protection assessment has gathered momentum in recent years, but the need for more rapid procedures is clear from several contributions presented here. It is therefore to the credit of Cadw that an Inspector of Industrial Ancient Monuments has been appointed as part of the Valleys Initiative (from September 1990), an appointment which clearly recognises the need for greater protection of coalmines, recent metalworking complexes and smaller industrial buildings as well as out-dated civic installations. The Inspector will be in a position to recommend both Scheduling and Statutory Listing.

ii) Considered thematically, a quite broad spectrum of industries is already represented. Moore-Colyer has listed a well-considered selection of limekilns (this volume, Chapter 5); Parkinson points out the need to select slate quarries (this volume, Chapter 6); the case is argued for rapid assessment of non-ferrous mines (Briggs, this volume, Chapter 7); Davies explains the difficulties of protecting underground coal-workings (this volume,

Chapter 21); Nash documents disturbing inconsistencies in the protection of wind and watermills (this volume, Chapter 25), and Robin Williams (this volume, Chapter 24) shows how effective can be the commitment of a local authority (Cardiff City Council), upon what might otherwise have appeared an insurmountable protection and conservation problem — the rescue and restoration of the Melingriffrth pump.

However, although only so far briefly touched upon, there remain whole classes of monument which are disappearing or have disappeared quite without survivors, and in some cases, without proper record. Although the Nantgarw Pottery is Scheduled, there are few other surviving pottery kiln sites. Perhaps more alarmingly, from an original sample of hundreds, hardly a copper smelting site survives above the ground in the Swansea area, excepting Aberdulais (Hayman 1986; 1987) and the Neath Abbey Copper Works. Other site-types under potential threat are considered in Section 4.

At the moment the Inspectorate entertains, where appropriate, industrial buildings in good condition for Listing, yet only considers other industrial remains for Scheduling in instances where structures are easily recognised above the ground. There appears to be reluctance to Schedule in their entirety buried sites of industrial interest. This reluctance marks the remains of the Industrial Revolution as the poor cousins to monuments of earlier periods, from which, for example, even cropmarks can be accepted for Statutory Protection. Without serious reconsideration of this (unwritten) practice, there will be little encouragement to systematically re-locate and report lost, buried, industrial monuments, or to argue the scientific importance to the history of technology of those in a poor state of repair.

iii) Indubitably, in the Ancient Monuments Acts and in the Planning Laws relating to the environment and to Historic Buildings we do have effective legislation, penalties for the contravention of which can be very costly. That said, the effectiveness of conservation and preservation legislation is not to be measured in its punitive powers. Once a site has gone, possibly without prior survey or excavation, compulsory rebuilding or attempted reconstitution may have little value, though it could still have touristic merit and a limited degree of historical interest. Where the heritage is concerned, when it comes to the carrot and the stick, more carrots are required. As noted below, effective education is far and away a better solution to site protection than is any legislation.

The existing legislation appears weakest where channels of communication between local and national authorities break down; or when local authorities grant themselves LBC to demolish or alter important structures in the local, rather than in the national interest. A major problem here is that Grade II Listed Buildings can be altered internally without the need for consent. Enforcing a uniform standard of protection upon Listed Buildings therefore seems at present to be more dependent upon local Planning Authorities than upon national expertise or enforcement.

The one way in which sites may best be properly protected, is through their being taken into Guardianship by the State, or by some other responsible body. This problem will be further discussed below (Section 4).

2 Recording and survey

Marilyn Palmer (this volume, Chapter 8) has already ably summarised the requisites of an improved industrial recording programme in Wales, drawing attention to the need for more staff at RCAHM(W). It seems appropriate here, however, to examine some needs in greater detail.

Palmer's point is underlined in Stephen Hughes' paper giving a detailed account of record-making at the RCAHM(W) (this volume, Chapter 9). His project work in the Swansea Valley, on the Montgomeryshire Canal and Brecon Forest Tramroads are exemplary in demonstrating the degree of research which can be undertaken with adequate resources. In contrast to this thematic research, emergency recording at RCAHM(W) is at present completely under-resourced. In this regard, one of the Industrial Panel's major achievements has been to bring together scarce manpower to help coordinate rescue surveys in south Wales, particularly of coalmines and larger metallurgical complexes (Hughes, this volume, Chapter 26). However, there remain areas of survey, like abandoned metal mines (Briggs, this volume, Chapter 7) and slate quarries (Parkinson, this volume, Chapter 6) for which adequate resources have not so far been made available.

Concern must be expressed about the rapid reclamation of coalmines without a greater record of their environs and ancillary works. Although a sub-committee of the Industrial Panel is financed to expedite recording collieries currently being made redundant, there exists no official agency properly resourced to systematically cover already abandoned collieries or landscapes of opencast and shallow-driven workings.

For example, massive opencasting currently threatens to subsume a large area around Pwll Du, near Blaenavon, Gwent, an area saturated in derelict mine workings known only from limited published surveys (Parry 1964; van Laun 1979). It is here interesting to compare the approaches and recommendations made on the one hand through site assessments by 'mainstream' archaeology

(Anon 1989), with those from someone with a more specifically industrial concern (Davies 1989). Davies recommends group preservation for small numbers of post-medieval industrial features, offering the concept of retaining complete landscapes (however small), as part of a well-considered educational programme integrated with extant heritage centres. Although mainstream archaeology sees some importance in the industrial remains, there is greater intent on looking for earlier sites beneath this more recent landscape and less emphasis upon its detailed recording or of analysis which might lead to recommendations for landscape preservation.

Perhaps the fact that these assessments were commissioned from two quite different consultants underlines the unfortunate perceptual gap still separating the needs of industrial landscapes from those of earlier periods, although it should be noted that in an outline survey of sites of archaeologicial interest commissioned by the Opencast Executive for Lower Cwmtwrch (cf Powell, this volume, Chapter 12), sites of all periods were afforded equal consideration for recording and conservation (Anon 1990a). As Pwll Du preserves one of the most outstanding collections of opencast and dumps remaining in Wales, archaeologists and planners should treat it accordingly. Ideally, 'clearing-up operations' ought to be limited to rubbish removal, drainage and toxicity stabilisation. Anything more drastic would efface and devalue a unique industrial landscape.

Similar sweeping changes are probably about to affect some of the few remaining historic docks and harbours which are under active consideration by the Tourist Board Wales for future marina development, and others under threat from the contraction of military and petroleum installations around Milford Haven and in Pembroke Dock. The Tourist Board is willing to consult with architectural and industrial historians over marina projects, but for this category of site, as for the others, it must be asked 'Will current levels of resourcing enable detailed recording to be undertaken at any more than a fraction of them in advance of development?'

Recording has been undertaken piecemeal by a variety of agencies outside the framework of State archaeology, though only rarely in response to threat. The National Trust's methodical surveys are mainly for management purposes (Latham, this volume, Chapter 4); University involvement from outside Wales has been mentioned by Palmer (this volume, Chapter 8), and the work of Hughes and colleagues from RCAHM(W) in training Institute of Industrial Archaeology students at sites along the Marches has put both the Montgomeryshire Canal and Leighton Park upon the map (Hughes, this volume, Chapter 26). Over the years, industrial housing has been well studied from the Welsh School of Architecture by Lowe (this volume, Chapter 10), and Powell's study of Cwm Twrch (this volume, Chapter 12), undertaken at Bangor Coleg Normal, demonstrates the value of local observation, survey, and documentation at undergraduate level.

Although industrial monuments are currently being absorbed into the SMRs of the Archaeological Trusts, and the Gwynedd Archaeological Trust established its own regional industrial archaeology panel in 1987, there is apparently no intention for the Trusts to undertake emergency recording or excavation of industrial sites on a national scale. So without a radical policy change, it is obviously desirable for nationwide emergency recording currently undertaken upon threatened buildings and industrial landscapes at the NMR(W) to be afforded vastly more staff and resources.

The papers in Section 2 suggest that a wide range of site types await rediscovery, primary survey and in-depth historical research throughout the Principality. Reflection upon this potential can only underline Dr Marilyn Palmer's call for greater resources to adequately record it before much more disappears (this volume, Chapter 8).

3 Economic development and the industrial heritage

Whilst Gwyn Griffiths' paper (this volume, Chapter 13) clearly illustrates the Agency's enabling role in the restoration of industrial monuments and landscapes, until recently (see Hughes, this volume, Chapter 26), the WDA enjoyed a rather ambivalent relationship with industrial archaeology. Unfortunately, because many sites do not enjoy Statutory Protection, an absence of obligatory consultation resulted on occasion in reclamations damaging to unique heritage features upon which no essential recording or excavation work could first be undertaken. Although some important sites, like the Six Bells Colliery, were swept away in consequence, improved communication has since led to consultation through the Archaeological Trusts which, as already noted, however, are not sufficiently well resourced to deal with industrial sites.

Approaches have been made to the WDA to fund the post of an archaeologist within its establishment and negotiations are believed to be continuing at the time of writing (1991).

Most germane to the future role of the WDA is precisely what other public and private agencies expect it to do with the landscape. Unfortunately, a number of industrial processing areas have already been identified by or for the WDA as 'derelict' sites deserving of 'clearance' or 'development'. In this sense 'dereliction' and 'reclamation' have become political call-words symbolising attempts to compensate the landscape for two centuries of neglect, or, currently, of unemployment and bankruptcy. The term 'dereliction' is one regularly invoked by local authorities as a perjorative

landscape aesthetic providing adequate reason to sanitise old processing areas, quite without due consideration for any historical, technological or socio-economic importance they hold locally or nationally.

A major problem confronting the selector and preserver of rare industrial landscapes is the concept of ugliness beloved of town planners, which has advanced but little since recommendations were being made (admittedly at a time when there was no scarcity of dirt or dereliction) to contour and replant dumps in the 1940s, 'to become part of a reconstructed park system' (Colvin 1948, 239-40).

Interestingly, it is a quarter of a century since industrial archaeologists were warned how

> the industrial history of [their] country is expressed in these hideous terms and shameful acres, just as much as it is in mills, canals and bridges, and industrial archaeology needs to turn a great deal more of its attention to them, and what they contain and reveal, before an awakening national conscience sweeps them away. *(J Ind Archaeol,* **2** (1965-6), 48-9).

The warning seems largely to have fallen upon deaf ears and, sadly, concepts of history and the vision of a balanced landscape aesthetic seem disturbingly absent from some recent studies of disused industry (for example, Bridges 1988). In Wales even safe coal and other mineral tips are now being swept away. A great deal of Snowdonian slate waste will also soon probably be sterilised either to forestry, or to that bright green 'processed-pea' quality so redolent of modern agriculture. That disused processing plant and its attendant debris can present challenging visual contrasts to derelict prehistoric agricultural heathlands is a much neglected facet of landscape aesthetics. Unfortunately, although the *National Park Policy Review* strongly recommends a general improvement in resourcing archaeology within the Parks, it offers little specifically for the industrial archaeologist (Edwards 1991, 31-8). Indeed, the report appears to distinguish between 'large industrial structures' with a quality of design that makes them important landscape features, and cement works, potash mines, and china clay workings, which do not *(idem, 26)*.

It is perhaps the development of public service industries which pose the greatest threats, often imperceptibly changing both urban and rural industrial landscapes. Some of the most striking municipal architecture in Wales, its reservoir barrages, for example in Cwm Elan at Garreg Goch and Caban Goch, currently appear not to be Statutorily Protected. A scheme by the Welsh Water Authority to strengthen barriers at the Beacons (Briggs 1986), Cantref and Llwyn Onn reservoirs (1985-90) was undertaken quite without any requirement to consult over recording alterations to barrage fabric or over any potentially interesting submerged pre-construction features, once the water was lowered. On the Upper Neuadd Reservoir stand unprotected two wonderful whimsical Gothick turrets. Sadly, the original cast-iron core structure of the more westerly is currently rusted to a point of being potentially dangerous.

A most important characteristic, almost a vernacular feature of the original Cardiff Waterworks reservoirs, was their green-painted cast-iron enclosure fences. Here again, time has taken its toll, and recently several lengths have been ripped asunder by crashing joy-riders. There now seems some danger that replacements may have to be of wood; it may be argued that future maintenance of the iron would be prohibitive, with the result that all or most may be removed without due consideration for their unique landscape characteristic and contribution to local history.

At present, there appear to be few records of municipal gas and sewage works in Wales. None have been deliberately protected or preserved. Similarly, there seems to be no policy for recording or preserving a representative selection of electrical transformers, pylons, or power station cooling towers. When (or if, the nuclear reactors at Trawsfynydd become redundant will Dr Blundell's voice (see p 5) echo along the corridors of bureaucracy long enough for us to pause and consider finding a new use for this controversial building which, in the writer's opinion is quite in keeping with its setting, or will it be covered by a pyramid in the way suggested by Nuclear Electric (Abbott 1991)? To some these may seem strange features to record or preserve, but if attitudes to them remain similar to those which obtained towards the steelworks, both blueprints and buildings may soon be swept away.

All too often in the past it has been assumed that records and the odd site would survive. But that has not happened, and what emerges from this brief discussion is that future industrial archaeologists must begin to anticipate the demise of industry and plant. Efforts also need to be made to ensure the greater survival and safe-keeping of construction records.

Although these days most branches of rescue archaeology look to developer-funding for survey and excavation, this was not found possible at Parys Mountain. Developers obviously need persuading of the value of employing historical and archaeological consultants who are also Members of the Institute of Field Archaeologists briefed in the *Developers' Code of Practice*. Of equal importance is the need to establish proper liaison and understanding between those concerned about recording and protection and the bodies which control or own industries or industrial landscapes.

4 Museums, education, and recreation

As it is easy to lose sight of the objectives for which museums exist, it might be useful to recall them. Ideally, they exist to collect, catalogue, and store material for scientific or historical studies; to help promote the educational ideal through display, demonstration, or instruction, and also (though not necessarily), to provide entertainment. Fulfilment of the ideal requires a national collecting policy of specimens (machinery) and co-ordination between educationalists, tourism, or the 'leisure industry'. The question now arises, can industrial museums in Wales conform to this ideal?

Respecting a national collection policy of machinery and plant: there seems not to be one. Sadly, although Dr Jenkins has complained of the plethora of artefacts in the National Collections, his contribution offers little direction to acquire a more representative grouping (this volume, Chapter 17). An undue emphasis upon centralised museums might be seen as deleterious to the development of regional or county collections. Furthermore, there is machine and plant which can only have value if preserved *in situ* (as Dr Jenkins rightly argues). But there should be no discouragement to local duplication of type sites and machine displays without first clearly defining a national policy of what is needed overall, so that posterity is not left asking 'what happened to all examples of that process?'

Brief, though comprehensive coverage of those museums existing a decade ago was given by Brian (now Lord) Morris in his *Report on Museums in Wales* (1981), when a surprising number of the smaller, local authority and privately owned museums already had an industrial theme. At that time it was already possible to identify several problems, of resourcing and development, and, in the main, important recommendations were made which resulted *inter alia* in the reorganisation of the Council for Museums in Wales, a body which now shows considerable interest in the industrial past. Among other problems pinpointed in the report was the growth and concentration of tourist-oriented displays within Gwynedd (p 9). By comparison, because it had a relatively poor showing on the museum display circuit, Clwyd was described as 'the Cinderella of the Welsh Counties as far as museums [were] concerned': (p 11). Thankfully, the then embryonic Bersham spawned a sound and healthy centre with education well to the fore of tourism (Grenter and Williams, this volume, Chapter 19).

A decade after Morris, museums themselves are a burgeoning industry. Maritime museums have been established in Milford Haven, Porthmadog, Rhyl and Swansea. Museums of coal mining exist at Cefn Coed, at Blaenant Colliery, Neath, at Cynonville and Afon Argoed Country Park, Port Talbot. There are now also at least a dozen other new sizeable ventures variously concerned with woollen manufacture, the slate industry, canals and farming (Jenkins 1990).

Although some aspects of present day British life are likened to that of the Victorian era, today's museum administration lies far outside Victorian ideals and practices. This is because, first and foremost, museums must now pay their way. Sadly, making profits from visitors may conflict with collecting policies and educational ideals. All too often nowadays, 'presentation' is the watchword. The question here arises 'who presents most responsibly, the private individual or the State?' And it must also be asked 'Should the State be in a position to advise, or to intervene?'

Concern has already been expressed that Cadw appears unable to accept responsibility for the ownership and presentation of more than a fraction of industrial sites (Briggs, this volume, Chapter 7). Like State Guardianship, it is also exceptional for the National Trust to take industrial monuments into safe-keeping (Keen, this volume, Chapter 18). Dolaucothi, for example, was acquired as part of an eighteenth century estate, long before its archaeological interest or tourist potential was properly appreciated (Clough and Briggs, this volume, Chapter 20). The degree of development involved in presentation to help generate vital income there has not always met universal approval among purist archaeologists worried about potential damage to fugitive early processing features (Briggs 1987; Hall 1987). However, it must be reluctantly accepted that some changes for access and display are inevitably part of the price paid to heighten public awareness, providing recreation and the necessary income to facilitate it.

Nowadays 'heritage landscapes' are being bought, preserved, presented and even surveyed or excavated, by local government, private industry and charitable trusts. Neglect or lack of capital in the public sector has resulted in the growth of a laissez faire heritage industry (Jenkins, this volume, Chapter 17). Sadly, however, without private enterprise, few post-medieval industrial landscapes would have been preserved and presented at all in Wales. Sites like Llwernog, Sygun (Briggs, this volume, Chapter 7), and Big Pit (Davies, this volume, Chapter 21) currently enjoy little or no Statutory Protection. Indeed, it is noteworthy that in the absence of any Statutory Protection at Big Pit, there was no public consultation for development of its 'tourist potential (1984-8), even though the question of 'exploring the possibility of having the buildings etc. either scheduled or listed to afford them some protection' was raised twenty years ago (National Industrial and Maritime Museum MSS, W Gerwyn Thomas Corresp 1972-3; D M Evans to W G Thomas 1 vi 73).

The Rhondda Coal Mining Heritage Museum is currently under construction at a cost of some £12 million. It will be 'one of Britain's foremost tourist

attractions' (Anon 1990b, 31). Although the Rhondda site offers potential for a 'living museum' of the concept so successful in the United States (cf Babbidge, this volume, Chapter 16), it is possible that unwitting assumptions as to relative historic, architectural, and technological values will speedily be made there — particularly in view of the intention to reclaim 'buildings of the period from surrounding areas' (Anon 1990b, 31). Without a system of predevelopment consultation or monitoring at this and similar sites, such reclamation could easily result in landscape losses of national importance.

Although an enormous effort is being put into restoring and marketing some Welsh industrial landscapes, private enterprise alone could never satisfactorily answer the nation's preservation needs for a balanced selection of sites and plant, Dr Stuart Owen-Jones now directs a National Industrial and Maritime Museum housing displays (situated in a handful of buildings) illustrating a wide range of well-considered themes. The museum already possesses an extremely important collection of industrial artefacts, but here collecting policy is and will be determined almost entirely by considerations of resource, rather than through any lack of will or conscience on the part of staff.

Because of this resource deficiency nationally to acquire sites and machinery, there is now all the more reason to encourage local authority and private museums to take on preservation and display, or to adopt imaginative reuse of old processing or manufacturing sites and buildings. Representatives of some currently unvisitable, freshly abandoned sites, complete with plant, need to be chosen for their future historical, educational and scientific potential. Tomorrow will be too late.

The educational factor

Museums and the historical perspectives provided by industrial landscapes are but facets of the educational ideal. And in no branch of archaeology is there a greater need to set in rapid train a process of education starting from the primary school. As early as April 1967, Gerwyn Thomas lectured to a course at Dyffryn Education Centre entitled *Local studies in the junior school* run by Glamorgan County Council (W G Thomas MSS, Nat Ind Mar Mus), but his evangelism seems not to have reached the wider audience it so obviously deserved. Similarly, early attempts to bring industrial archaeology into the primary *(J Ind Archaeol,* **6,** (1969), 308-9) and secondary schools *(J Ind Archaeol,* **6,** (1969), 413-4) in England seem not to have gained much ground. As in so many aspects of archaeological education, the National Museum of Wales was for many years at the forefront with its Schools Museums Service (Morris 1981, 37). It has long been the practice to loan out important exhibits and illustrations; useful cheap publications had also been printed (for example *Children in the mines: 1840-42* (Evans 1976)). Only withdrawal of financial support by local education authorities within the Principality has sadly diminished this service in recent years.

As attitudes to both past technological achievement and present-day industrial landscapes can only be changed through education at the most basic level, it is encouraging that attempts are currently being made to influence its teaching at primary and secondary levels, through the Association of History Teachers in Wales. Its twice-yearly *Welsh Historian/Hanesydd Cymraeg* has already published some articles on industrially-related subjects.

In 1988 Dyfed Education Authority established a Culture and Heritage Scheme, with the cooperation of Dyfed Cultural Services, Archives, Libraries and Museums Department, coordinated by Graham Longster. Two splendid, well-illustrated publications for schools resulted: a teacher's handbook *The Pembrokeshire Coalfield* and one specifically for children: *Living and working in the Pembrokeshire Coalfield* (Harry 1990a; b). It is hoped other local education authorities will follow this welcome initiative.

Some schools have their own history programmes. For example, Tredegar Comprehensive has desk-top published an A4 booklet *Bryniau Tan 'The hills of fire'* (P M Jones 1987), for circulation among older pupils.

From about 1950, BBC Schools broadcasts, with accompanying booklets, and HTV educational programmes, including *About Wales; a series of programmes for the schools of Wales* (n d c 1975-6) have also significantly contributed to an enlightenment about the industrial past, though medieval castles still offer disproportionately greater romance. Successful promotions include a 20-minute film released by United Motion Pictures on *Craftsmen of Dinorwic,* written and directed by Romola Christopherson. Early volumes of the *Journal of Industrial Archaeology* (1964-73) include lists of many more general films on industrial processes, which, if still available, would be of great educational value.

Other noteworthy attempts to bring industrial history into the classroom include, most importantly, *The Bryn Bach resources,* fruits of an MSC Project (1984-6) at Ty'r Morwydd, Kensington (formerly Inner London Education Authority) Advanced Field Study Centre, Pen y Pound. Abergavenny. The boxed educational resource pack, meant for circulation among Gwent Secondary schools includes up to twenty-six A4 booklets each of 20-35 pages, entitled, *inter alia: The charcoal iron industry; The early iron industry in south Wales; The iron industry 1815-1960; The ironmasters; The ironworkers; The coal industry; The steel industry: growth and decline;* as well as *Planning for amenity* and *Derelict land reclamation.*

Since the late '60s, an educational role has been adopted by several County Record Offices in enlightened attempts to demonstrate the value of archive sources to local industrial history in local history studies. The Flintshire (later Clwyd) Record Office first produced its well-illustrated *Early industry in Flintshire* (ed Bevan-Evans) in 1967. The more recent *Early industry in Clwyd* (ed Williams 1986) may be considered its lineal successor. *The River Dee* and *Coal mining,* available in 1987, were specifically produced as teaching aids, each with an introduction, about fifteen facsimile documents and explanatory text. The Caernarvonshire (now Gwynedd) Record Office has similarly produced a number of useful guides to documentary resources on slate quarrying and metalliferous mining clearly aimed at facilitating access to its collections by more general inquirers.

Because the National Museum's main facilities are concentrated in south-east Wales, it is all the more important that provincial industrial displays should adopt an equally responsible role in the presentation of the industrial past. Details of several local site displays and their attitudes to education have been given: projects at Bersham, Big Pit, Kidwelly Tinplate Museum, Llwernog, Merthyr, and to a lesser degree, Sygun have all adopted educational roles. And in 1989 the National Trust responded at Dolaucothi by also launching an educational pack.

The momentum of educational work is therefore now quickening at several levels, in response both to the demands of the new National Curriculum, where industrial archaeology can form component parts of geography, history, and environmental studies, as well as to meeting demands from a more sophisticated visiting public within the competitive and expanding framework of private visitor centres and theme parks.

Discussion: industrial archaeology — a respectable study in Wales?

As was noted in the introduction (Chapter 1), in his invocations for the Establishment to take on a responsibility for industrial archaeology, Douglas Hague was apprehensive of its poor reception in universities and schools. Were his fears well-founded or has industrial archaeology now attained respect as an acceptable study? Obviously any answer must depend upon the index of assessment.

Within Wales archaeological journal space devoted to industrial work has so far been limited. As a glance at the pages of *Archaeologia Cambrensis* will show, there have been only three germane articles in Wales' premier journal in two decades (Rees 1964; 1968; Tucker 1972). Perhaps more telling was the review of Morgan Rees' *Industrial archaeology of Wales* (1975) in which the reviewer exhibited a preference for industrial sites prior to the Industrial Revolution (Jarvis 1976, 184). Jarvis expressed an aversion to the surviving clutter of recent industrial monuments, an attitude which probably still to a degree pervades some national preservation policies. In fact, although Morgan Rees' work was accepted in its day, his publications are already outliving the sites to which he attached so much importance.

The county journals seem to have been quicker to accept studies of the industrial past, but obviously specialist journals based outside Wales have been those most sympathetic to the new interest. Amongst these must be numbered the *Journal of Industrial Archaeology,* the *Bulletin of the Historical Metallurgy Group* (later the *Journal of the Historical Metallurgy Society)* and the *Journal of the Railway and Canal Historical Society.*

At a time of university contraction, now is hardly the best time to judge the impact of this subject upon university teaching in Wales. Apart from courses at UWIST taught by Jeremy Lowe which include a component of industrial archaeology, there appears to be little material history of the industrial period taught in Welsh universities.

When it comes to appreciating, studying, preserving and conserving the industrial past, education is obviously far better than legislation. As long as site presentations maintain an intellectual integrity and accuracy, it does not matter whether or not these are undertaken through low-key recreational approaches by guided tours to privately-owned sites, or through curriculum-oriented coursework. Either way, their effects would soon be felt in a greater future commitment to conservation and judicious preservation.

5 Reusing industrial premises

The size of most industrial properties does not readily lend itself to cosy transformation, and finding new uses for larger, purpose-built buildings is often impossible (Binney *et al* 1990). Whereas old building fabric may be robust, the circumstances of its redundancy can prove more conducive to demolition than can its physical decay. The psychological will to demolish symbols of failed enterprises in the coal industry are well expressed by Ray Proctor (this volume, Chapter 15).

Wales has sadly lost many fine industrial buildings in recent years, including the Weaver's Buildings at Carmarthen and Swansea. Both were of a uniquely reinforced concrete construction. No other examples survive. Both had been Listed Buildings, and although questions were raised about their stability, it seems likely the decision to demolish had more to do with their visual appearance.

At the time of writing, it is believed a buyer has been found for the Dunlop Semtex Building at Brynmawr, architecturally one of the most

important factories in post-War Europe, and long threatened with demolition for lack of occupancy.

Smaller industrial buildings and their landscapes are more readily accommodated, however, and whereas it is sad that many communities of working class houses like the Triangle, Merthyr, have already gone, it is heartening that nowadays many are being rescued and refurbished, both privately, by local authorities, and by Housing Trusts, for example The Square, Nelson, by the Secondary Housing Association, Wales. Old warehouses have also found new residental uses at the slate exporting harbour of Porthmadog, in a model scheme at Swansea Marina, and in Cardiff Dockland. Usually in a more rural setting, small power mills can make ideal homes for the retired, semi-retired or do-it-yourself conservationist (Nash, this volume, Chapter 25).

Overall, however, there is a need to persuade local authorities (and perhaps more particularly their elected representatives) that old industrial buildings need no longer be regarded merely as symbols of oppression, inequality, or ill-health. Solidly built of local materials, some have an architectural dignity or beauty difficult to replicate, and are, in rarer cases, unsurpassed. Reuse or adaption for housing, offices or new light industries can nowadays make greater economic sense than does demolition.

Conclusions

There have already been a number of changes since the conference was held in December 1986: the appointment of a member of the Ancient Monuments Board with special interest in the subject; the establishment of a Panel capable of making recommendations for Statutory Protection direct to the Minister of State. To these can now be added the appointment of an Inspector of Ancient Monuments at Cadw, whose specific brief for three years will be to help Statutorily protect industrial landscapes in the area covered by the Valleys Initiative.

Drawing upon the broad spectrum of viewpoint represented in this volume it is now possible to document a consensus view, with recommendations more detailed than those reached at the conference.

First, industrial monuments are in need of protection by a speedier and more widely-discussed selection process than has hitherto been found possible. Clearly, Wales needs its own Monument Protection Programme.

Secondly, levels of reconnaissance and recording need intensifying over the range of site types, both to help provide a database for selective protection, and to enhance the national archive (NMR) for future study and educational purposes.

Thirdly, national bodies like the WDA and public and private service industries should continue to be given greater encouragement to liaise more closely in development proposals with historians, archivists and archaeologists, in order to prevent unneccessary losses of nationally important sites and records.

Fourthly, taking into account a burgeoning public interest in the industrial past, more ways should be explored (preferably by the State), of permanently preserving and presenting industrial monuments to the highest possible standards, thereby affording greater parity of treatment with monuments of earlier periods in history. Due consideration needs to be given to heightening consciousness about the industrial environment at all levels of the educational process.

Fifthly, besides the educational perspective which can be created through preserving industrial monuments, greater attention needs to be paid to preserving outright, to mothballing *in situ,* some of the now rarer processes and plant, for future scientific and historical purposes, rather than for immediate display.

Sixthly, greater encouragement and incentive should be given industrialists, local authorities and home buyers, to adapt and reuse old industrial premises.

Finally, although a few of these suggestions and recommendations might be undertaken using available manpower, if future generations are not to feel there was a presumption against recording, preserving and presenting industrial monuments during the 1990s, greater resources are immediately required to attain more realistic staffing levels, particularly within those State bodies with national responsibilites.

Acknowledgements

The writer thanks all the contributors, together with M Corin, R Edwards, M Fitton, H Foster, P M Jones, W Jones, J van Laun, C Ledbury, G Longster, P Loveluck, D Macleese, J Manley, S Owen-Jones, staff of the Rhondda Heritage Museum, and S Smith, for kindly providing information which is used in this paper. A J Parkinson generously criticised an earlier draft, preventing the writer from making some of the more obvious mistakes. Nevertheless, the writer alone is responsible for any remaining errors, and for the views expressed.

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Appendices

28 List of Scheduled Ancient Monuments of industrial importance

by David Strachan

Note: Sites marked * are Guardianship Monuments

	SAM number	Name of site	National Grid Reference
CLWYD			
Alyn and Deeside			
Buckley	F 166	Site of Pinfold Lane Pottery	SJ 275 655
Buckley	F 165	Site of Taylor's Pottery	SJ 269 653
Connah's Quay	F 180	Kelsterton Brewery	SJ 277 705
Buckley	F 181	Industrial Tramway near Buckley	SJ 290 642
Delyn			
Holywell	F 160	Greenfield Valley Mills	SJ 189 769 SJ 191 770 SJ 192 772
Glyndwr			
Llangollen Rural	De 175	Pont-Cysyllte Aqueduct	SJ 271 420
Rhuddlan			
Dyserth	F 136	Clive enginehouse, Meliden	SJ 056 800
Tremeirchion	F 137	Pennant Mines winding enginehouse and chimney, Rhuallt	SJ 087 573
Wrexham Maelor			
Esclusham	De 189	Bersham Ironworks, remains of furnace	SJ 308 493
Ruabon	De 190	Wynnstay Colliery winding enginehouse	SJ 293 432
Brymbo	De 202	Early blast furnace, casthouse, and foundary, Brymbo Ironworks	SJ 294 535
Brymbo	De 203	Penrhos Enginehouse	SJ 286 532
POWYS			
Brecknock			
Llanfrynach	B 185	Brynich Aqueduct (Brecknock and Abergavenny Canal)	SO 079 273
Montgomery			
Llanidloes	Mg 159*	Bryntail lead mine	SN 914 869
DYFED			
Carmarthen			
Llangendeirne	Cm 227	Remains of furnace at Pont Henry	SN 474 092
Ceredigion			
Trawsgoed	Cd 133	Abermagwr Sawmill	SN 665 738
Trefeirig	Cd 144	Darren lead mine workings	SN 675 828
Pontarfynach	Cd 146	Frongoch lead mine	SN 723 745
Ysgubor y Coed	Cd 126	Bryndyfi lead mine	SN 683 934

Ysgubor y Coed	Cd 128*	Dyfi blast furnace and charcoal store	SN 685 951
Ysgubor y Coed	Cd 143	Ystrad Einion lead mine buildings and waterwheel	SN 707 938
Pontarfynach	Cd 145	Copa Hill, Cwn Ystwyth	SN 812 753
Dinefwr			
Cynwyl Gaeo	Cm 208	Ogofau gold mines	SN 664 402
Llandeilofawr Rural	Cm 223	Site of forge at Llandyfan	SN 656 168
Llanfair ar y Bryn	Cm 215	Nant y Mwyn lead mine enginehouse, Rhandirmwyn	SN 787 446
Llanelli			
Llanelli Rural	Cm 219	Raby's Furnace	SN 504 015
Preseli			
Llanrian	Pe 376	Aberfelin Mill	SM 835 324
Llanrian	Pe 382	Porthgain harbour and brickworks	SM 814 324
Llanrian	Pe 388	Porthgain limekiln	SM 814 325
Solva	Pe 378	Limekilns	SM 804 241
St Davids and the Cathedral Close	Pe 429	Cottage, mill, and limekiln at Caerbwdy	SM 767 245
South Pembrokeshire			
St Issells	Pe 418	Stepaside Ironworks furnace top area and Grove Colliery	SN 140 072
Penally/Tenby	Pe 436	Blackrock Quarry limekilns	SN 121 001

GLAMORGAN (MID)

Cynon Valley			
Aberdare	Gm 411	Gelli-isaf Tramroad bridge, Abernant Tramroad	SN 990 044
Aberdare	Gm 347	Iron Trambridge, Robertstown	SN 997 036
Aberdare	Gm 438	Gladys Ironworks, remains of furnace	SO 000 030
Aberaman	Gm 266	Remains of iron furnace at Cwmaman	ST 004 994
Hirwaun	B 157	Site of Hirwaun Ironworks	SN 957 058
Merthyr Tydfil			
Cyfarthfa	Gm 331	Ynysfach iron furnaces and enginehouse	SO 045 060
Merthyr Vale	Gm 359	Penydarren Tram Road	
		a) trmroad line	ST 078 984
		b) bridge No 1	ST 094 962
		c) bridge No 2	ST 090 965
Park	Gm 425	Remains of blast furnaces, Cyfarthfa Ironworks	SO 038 068
Troed y rhiw	Gm 306	Early iron furnace, Blaencanaid	SO 037 046
Rhondda Valley			
Porth	Gm 437	Ventilation furnace, Trehafod	ST 044 912
Ogwr			
Cefn Cribwr	Gm 417	Cefn Cribwr Ironworks	SS 851 834
Coity Higher	Gm 265	Remains of iron furnace near Angleton	SS 904 819
Maesteg	Gm 418	Remains of blast furnace	SS 848 915
Ynysawdre	Gm 433	Remains of Tondu Ironworks	SS 892 845
Rhymney Valley			
Bedwas and Machen	Gm 440	Comish type enginehouse, Bryn Gwyn Colliery	ST 162 894
New Tredegar	Mn 168*	Enginehouse and winding engine, Elliot Colliery	SO 147 027
Rhymney	Gm 403	Rhymney Upper Furnace	SO 108 091
Rudry	Gm 357	Rudry Ironworks	ST 195 882
Taff Ely			
Taff's Well	Gm 335	The Pottery, Nantgarw	ST 120 854

GLAMORGAN (SOUTH)

Cardiff			
Whitchurch	Gm 312	Melingriffith water pump	ST 142 800
Vale of Glamorgan			
Rhoose	Gm 318	Early cement works, Aberthaw	ST 038 661

GLAMORGAN (WEST)

Lliw Valley			
Cilypebyll	Gm 400	Remains of branch canal,	
		docks and incline of	SN 737 051
		Ynyscedwyn Ironworks	SN 737 047
Llwchwr	Gm 341	Llwchwr Old Zinc Works	SS 569 983
Penllergaer	Gm 410	Remains of Astronomical Observatory at Penllergaer	SS 622 990
Ystalyfera	Gm 397	Remains of lock and dry dock at Pantyffynnon	SN 758 074
Neath			
Blaengwran	Gm 423	Remains of Venallt Ironworks	SN 864 050
Blaenrhondda	Gm 395	Neath Abbey Ironworks dam	SS 739 988
Briton Ferry	Gm 445	Briton Ferry Dock entrance	SS 736 936
Coedffranc	Gm 394	Section of Tennant Canal	SS 731 969
		with bridge 50 m south-west of Neath Abbey	SS 733 972
Dyffryn Clydach	Gm 389	Neath Abbey Iron works	SS 737 977
Glynneath	Gm 420	Remains of blast furnace at Banwen	SN 868 104
Resolven	Gm 416	Remains of blast furnace at Melin Court	SN 825 018
Port Talbot			
Cwmavon	Gm 393	Pontrhydyfen Aqueduct/Viaduct	**SS** 795 942
Swansea			
Birchgrove	Gm 336	Scott's Pit enginehouse and traces of ancillary buildings	SS 697 983
Bonymaen	Gm 392	Morfa bridge and quays	SS 664 955
Landore	Gm 369	Siemens Laboratory	SS 661 957
Llanrhidian Lower	Gm 398	Penclawdd sea docks	SS 552 961
Llansamlet	Gm 430	Gwernllwynchwyth enginehouse	SS 697 979

GWENT

Blaenau Gwent			
Llanelly	B 161	Clydach Ironworks (remains) and Smart's bridge	SO 229 132
Llanelly	B 160	Iron furnace south-west of Clydach	SO 232 138
Tredegar	Mn 185	Site of Sirhowy Ironworks	SO 143 101
Tredegar	Mn 181	Incline haulage winding engine, Mynydd Bedwellty	SO 153 058
Islwyn			
Crumlin	Mn 166	Enginehouse and winding engine, Crumlin Navigation Colliery	ST 211 987
Monmouth			
Crucomey	Mn 199	Tramway embankment of Grosmont railway	SO 335 212
Llanfoist Fawr	Mn 189	Site of Garnddyrys Ironworks and adjacent tramway	SO 258 118
Llanfoist Fawr	Mn 204	Tramroad bridge, Bailey Tramroad, Govilon	SO 259 133
Monmouth	Mn 203	Redbrook Incline overbridge	SO 536 103
Tintern	Mn 197	Old Furnace blast furnace	**SO** 514 003
Trellech United	Mn 164	Early iron furnace at Coed Ithel	SO 527 026
Trellech United	Mn 177	Early iron furnace in Woolpitch Wood	SO 491 048
Newport			
Rogerstone	Mn 184	Fourteen Locks, Monmouthshire Canal	ST 283 885

Torfaen			
Abersychan	Mn 163	Cwmbyrgwm Colliery	SO 252 032
Blaenavon	Mn 200*	Blaenavon Ironworks	SO 249 092
Pontymoile	Mn 192	Old beam pump and winding engine, Glyn Pits	ST 265 998

GWYNEDD

Aberconwy			
Conwy	Cn 201	Bryniau Tower	SH 785 803
Trefriw	Cn 159	Klondyke Leadmill	SH 785 803
Arfon			
Llanberis	Cn 164	Slate haulage table incline	SH 594 596
Llanddeiniolen	Cn 177	Dinorwic Quarry Barracks 'A' Incline	SH 586 603
Llanddeiniolen	Cn 163*	Dinorwic Quarry workshop complex with ancillary buildings including: waterwheel, Pelton wheel, table incline, waterpipe, and aqueduct	SH 585 602
Llanddeiniolen	Cn 198	Vivien Quarry incline	SH 586 606
Llanllyfri	Cn 165	Dorothea Quarry beam engine	SH 497 531
Llanllyfri	Cn 162	Drws y Coed copper mine	SH 546 534
Dwyfor			
Aberdaron	Cn 207	Mynydd Rhiw axe factory	SH 234 299
Beddgelert	Cn 193	Cwm Erch copper mine	SH 635 530
Dolbenmaen	Cn 170	Gilfach copper mine	SH 526 477
Dolbenmaen	Cn 160	Gorseddau Slate Factory	SH 550 433
Meirionydd			
Ganllwyd	Me 119	Berth-Lwyd and Cefn Coch gold mining complex	SH 720 235
Llangelynin	Me 116	Corn drying kiln near Carn-Gadell-Uchaf	SH 589 084
Penrhyndeudraeth	Me 108	Gelligrin slate quarry (north bank)	SH 629 395
Ynys Mon			
Llanbadrig	A 109	Porth Wen brickworks	SH 402 946
Llanfair Pwll-gwyngwyll	A 96	North weir and smoke tower, Ynys Gorad Goch	SH 545 713

List correct at 1 June 1991

29 List of metalliferous mine sites of industrial archaeological importance

*by C J Williams and David Bick**

Introduction

The list is in four parts, viz: Powys, Gwynedd, Dyfed, and Clwyd. It was first compiled a decade ago to draw attention to the great archaeological and historical importance of non-ferrous metal-mining sites in Wales, a step which has been justifed by recent radiocarbon dating having assigned no less than four mines to the Bronze Age, not to mention the prospect of many more originating in antiquity (cf Briggs, this volume, Chapters 7 and 14; Briggs 1988).

The compilation for Clwyd and Gwynedd was made by the North Wales Caving Club in 1980; the remainder, including the extended section on Gwynedd, being the work of the Welsh Mines Society during 1980-82. It is hoped shortly to complete the task with lists on Gwent and Glamorgan.

In view of the rate of destruction from all causes, the need for urgent recording and protection is very great. Fortunately there is now a growing awareness of the significance of such sites, though funds for arresting the often catastrophic decay of structures seem pitifully small.

Thus far, the circulation of the lists has been limited, but it is hoped this publication will draw more attention to the potential of old mines for amenity, education, and study. Due to the problems of re-examining over 130 sites, only a partial up-dating has been possible, and the authors apologise for any errors. They would also like to point out that many sites are on private property.

Finally, no claims are made for the bibliography, which is intended only as an introduction,

Site names in CAPITALS are considered to be of particular importance. A six-figure National Grid Reference is given after the name of the mine. B = barytes, C = copper, G = gold, L = lead, M = manganese, Z = zinc. SAM is a Scheduled Ancient Monument.

PART I POWYS

The list is arranged in order from north to south, and this conforms approximately to the old counties of Montgomery (Nos 1-15), Radnorshire (161, and Brecon (17, 18).

Llangynog District

1 CWM OROG B L; (SJ 052 274). Ancient site important as an entity. It has a unique system of tramroad routes contouring a steep mountainside, combined with a series of ore slides of unusual design, probably eighteenth century (Bick 1978, 34-6; Williams 1985, 13-19, 94-101).

2 LLANGYNOG L; (SJ 052 257). A fine eighteenth century gunpowder magazine on the hillside above a quarry, circular in plan. The old waste dumps are of mineralogical significance. The Powys estate derived great wealth from this mine (Bick 1978, 25-32; Williams 1985, 21-74).

3 Bwlch Creolen L; (SJ 098 231). An engine-house and tall octagonal brick chimney, *c* 1882 (Bick 1978, 40-1). The chimney is now demolished.

Dylife District

4 Llanerchyraur L; (SN 867 982). Situated on the slopes of a deep valley which has been rendered beautiful by two lakes constructed for the mine in the nineteenth century (Bick 1978, 23-6).

5 RHOSWYDOL L; (SN 837 978). Ruins of a large ore-dressing mill, 1870, powered by a 45 ft (*c* 15 m) diameter waterwheel. This was the most modern mill in Wales at the time (Bick 1978, 8-11; Bick forthcoming).

6 DYLIFE L C; (SN 856 939). The main workings centred around the Twymyn valley for half a mile west of the road. Remnants include the wheelpit of the largest waterwheel (63 ft (*c* 20 m) diameter) in Wales, and dumps of mineralogical importance. The site was overlooked by a long row of miners' cottages, one or two of which have been rehabilitated. This was one of the biggest mines in Wales, famous for its association with Richard Cobden and John Bright (Bick 1977, 20-3; See also Bick 1975a; Bick forthcoming).

7 CASTLE ROCK, DYFNGWM; L, Z, (SN 845 931). The Castle Rock gorge, Dyfngwm area, and intervening high ground across to Dylife, is of geological and industrial archaeological significance, and should be protected as an entity. The gorge exhibits one of the finest

*for respectively the North Wales Caving Club and Welsh Mines Society

natural outcrops of a mineral lode in Great Britain, and old trials, tramroads and wheelpits occupy the Clywedog valley as far as Dyfngwm mine - about a mile (1.6 m) in all (Bick 1977, 14-20).

Llanidloes District

8 VAN L Z; (SN 940 8810. Octagonal chimney of yellow brick, *c* 1869: a local landmark. A similar chimney nearby is ruinous, and hardly worth protecting. Van mine, currently the subject of a reclamation scheme, in the 1870s was the most productive mine in Europe (Bick 1977, 41-5, 47; 1989, 86; Bird 1977, p1 49-50; Rees 1969, 30-4; Richards Moorehead and Laing 199 la).

9 East Van L; (SN 949 884). An identical chimney to that at Van, c 1871 (Bick 1977, 45-7).

10 PENYCLUN L; (SN 930 873). A small and very unusual Cornish rotative engine-house with a separate stack now in ruins. Built about 1864 (Bick 1977, 40; 1989, 86:20).

11 BRYNTAIL; SAM B L; (SN 913 868). Barytes mill at the western end of the mine below the Clywedog dam, nineteenth century. Restored by Inspectorate of Ancient Monuments. There are also ruins of buildings for pumping and winding machinery at Gundry's Shaft (SN 918 870) (Bick 1977, 3540; Rees 1977).

12 Gwestyn C L; (SN 894 861). On a high plateau, this eighteenth-nineteenth century site consists of old grass-grown workings, two shafts and dumps. Is of scientific interest as a whole, being the origin of the geological term 'Gwestyn Shales' (Bick 1977, 34; forthcoming).

13 Gorn L; (SN 980 940). Representative of a number of small workings south east of Llanidloes, this is an ancient mine. The site is largely overgrown (Bick 1977, 47-8; forthcoming).

14 NANTYREIRA C L; (SN 827 874). Deep opencut workings in afforested land. The site has yielded a Bronze Age dating (Bick 1977, 28-30; forthcoming; Timberlake 1988; 1989).

15 NANTIAGO L; (SN 826 863). Leats, a 60 ft (*c* 18 m) diameter wheelpit and a Pelton wheel survive. The whole site is of interest, being one of the highest and most isolated in Wales, and working until 1920 (Bick 1977, 57-9; Rees 1969).

Rhayader District

16 CWM ELAN L; (SN 901 651). A secluded site with leats, nineteenth century crushing house, wheelpit, shaft and office buildings, of interest as an entity (Hall 1971, 80-1; Bick forthcoming).

17 Nantycar C L; Dalrhiw: (SN 890 610). Ruins of wheelpits and nineteenth century mine buildings on both sides of the valley (Hall 1971, 84-5).

Talgarth District

18 TALACHDDU C; (SO 185 342). Shaft in Old Red Sandstone and dumps near stream, seventeenth or eighteenth century. This site is of great geological importance as copper is rarely found in this formation in this country (Hall 1971, 90-1).

PART 2 GWYNEDD

The list is arranged in five basic districts — Anglesey, Lleyn Penisula, Llanrwst, Snowdonia, and Dolgellau.

Anglesey

1 PARYS MOUNTAIN; C (SH 455 906). The biggest copper mine in Britain, of great historic and geological importance currently being reopened. Potentially a tourist and educational attraction. Enormous opencast workings, windmill and early enginehouse (Bick 1989, 86; 15; Briggs, this volume, Chapter 14; Bird 1977, 44; Hydrotechnica 1988; Rees 1969, pl 25; Rees 1975, 144-146; Williams 1980, pls 58-62).

2 Carmel Head: C (SH 295 928). Mine buildings and chimney, on coast.

3 BERW COLLIERY, (SH 295 267). Virtually the only remains of coal mining on Anglesey. Chimney 30 ft (9.0 m) high and mine buildings, near main road to Holyhead. Nineteenth century.

Lleyn Peninsula

4 PENRHYNDDU; L (SH 320 261). An ancient and long-worked mine, using a Newcomen engine. An enginehouse and other features survive, near coast (Bick 1989, 86; 18; Griffith 1989).

5 PORTH NEIGL; L (SH 295 267). Brick chimney c 30 ft (9.0 m) high. Late nineteenth century, the last phase of mining. (Richards Moorehead and Laing 1990c)

6 RHIW/BENALLT; (SW 22 27). The most important manganese mine in Wales, closed in 1945. Opencast workings, inclines, railway route, winding drums, and ironworks (Down 1980, 17-24; Griffith 1989).

Llanrwst

7 Aberllyn; L (SH 796 577). Foundations of mill buildings. Levels in small valley (Williams 1980, 57).

8 LLANRWST; L (SH 779 595). Restored site and interpretation trail. Enginehouse and chimney built about 1878. All pumping gear *in situ* underground (Bennett and Vernon 1988, 12-30; Bick 1982; Bird 1977, pl 54).

9 CYFFTY, L (SH 772 588). Dressing floors, crusher house, etc, remains of balance-bob (Williams 1980, 46-9).
10 HAFNA; L (SH 781 601). Remnants of mill show sequence of gravity flow for ore-dressing. Small smelt-house, flue, and chimney (Bennett and Vernon 1990, 58-83; Rees 1969, pl 21).
11 KLONDYKE; Z (SH 765 622). Big building (SAM) to dress lead from Pandora (Bird 1977, pl 151; Rees 1969, pl 122; Rees 1975, 141).
12 PANDORA; L (SH 762 603). Old workings, various buildings between 1840s and 1920s. Site now part destroyed.
13 Trecastell; L (SH 761 746). Working until 1950s (Williams 1980, 51)
14 Pool Mine; L (SH 772 576). Mill built about 1910 on south side of Afon Llugwy. Ore trammed across bridge, now in ruins.

Snowdonia

See Crew and Williams, this volume, Chapter 4, for details of mines restored in this area.

15 CATHERINE & JANE CONSOLS; C L (SH 633 410). A complete site with remains of Cornish enginehouse, mine buildings, dressing floors, etc, damaged by afforestation (Bick 1982, 15-21; 1989; 86: 17).
16 Gilfach; C (SH 531 477). Ruins of crusherhouse and levels (Bick 1982, 26-30).
17 CWM CIPRWTH; C (SH 526 478). Splendid waterwheel and winding drum still *in situ,* with shafts, levels, leats, and ruins of mine buildings. Restored by Snowdonia NPA, (Bick 1982, 26-30; Crew and Williams, this volume, Chapter 4; Rees 1965, 29, 30).
18 CWM DWYFOR; C L (SH 541 505). A very interesting site with ruins of barracks, crusherhouse, wheelpit, tramway, and incline. Worthy of consolidation (Bick 1982, 30-33; Rees 1975, 149, 237).
19 DRWSYCOED; C (SH 545 534). A major eighteenth and nineteenth century producer. Extensive open-workings and levels, with early ore dressing site and remains of nineteenth century mill (Bick 1982, 33-41; Rees 1969, 149, 238; Williams 1980, pl 67).
20 YSTRAD; (SH 542 574). Levels and inclines at an iron-ore deposit. Well illustrates the workings of a mine.
21 SIMMDE DYLLUAN; C (SH 543 533). Of similar antiquity and importance to Drwsycoed. Shafts, levels, horsewhim, and capstan circles. A site with potentially good access and parking (Bick 1982, 41-5).
22 Benallt; C L (SH 536 535). Levels, inclined plane, and dressing mill (Bick 1982, 45-9).
23 Bryn y Felin; C (SH 589 472). Opencut workings and levels. Stone-lined shaft and powder magazine (Bick 1982, 51-3).
24 NANTMOR; C (SH 602 472). Steel towers of aerial ropeway still *in situ* (Bick 1982, 56-8).
25 SYGUN; C (SH 606 486). Old opencut workings and levels. Remains of an Elmore oil-flotation mill, the second in the world. Now open to the public (Bick 1982, 58-68; Briggs, this volume, Chapter 7).
26 LLWYNDU; C (SH 606 483). Nineteenth century mine complete and undisturbed (Bick 1982, 59-62).
27 Hafod-y-Porth; C (SH 611 506). An isolated site with levels, dressing floors, and mine buildings (Bick 1982, 73-6).
28 HAFOD-Y-LLAN; C (SH 623 523). A small but very interesting mine with nineteenth century crushing mill and tramways including a unique stone-sleeper line. In need of conservation, on the Watkin path to Snowdon summit (Bick 1982, 69-73).
29 LLIWEDD (CWM ERCH); C (SW 635 530). Isolated, but of prime importance, containing a crushing mill more or less complete with nineteenth century machinery, capable of restoration to working order. Unique in potential for interpretative development relating to ore dressing methods (Bick 1982, 76-8).
30 SNOWDON; C (SH 616 547). A well known mine on the shores of Llyn Llydaw and Glaslyn. Many features worthy of consolidation (Bick 1982, 79-84; Williams 1980, pl 65).
31 CLOGWYN COCH; C (SH 603 556). Ruins of crushing mill, inclines; nineteenth century (Bick 1982, 84; Crew 1976).
32 LLANBERIS; C (SH 597 587). Extensive remains of eighteenth and nineteenth century workings and dressing floors (Bick 1982, 84-9; Crew 1976; Williams 1980, pl 66).
33 LLANDUDNO; C (SH 771 831). Extensive and productive. Bronze Age workings on The Great Orme now open to the public (Bick 1982, 94-9; Briggs 1988; Williams 1980, pl 68-9).
34 Ceunant; C (SH 633 645). Eighteenth-nineteenth century working for copper and arsenic. Unique features are stone-lined flues for calcining or sublimation (Bick 1982, 91-2).

Dolgellau

See Crew and Williams, this volume, Chapter 4, for details of mines restored in this area.

35 Cwm Prysor; C (SH 768 394). Open workings on quartz vein, with small waterwheel and pumps (Hall 1975, 58).
36 Prince Edward; G (SH 743 385). Gold mine mainly of this century. Open workings, levels and buildings (Hall 1975, 11; Williams 1980, pl 15).
37 GWYNFYNYDD; G (SH 737 282 and 736 275). A very productive nineteenth century gold mine. Many levels and opencuts, tramways incline and winding drum, buildings, and strongroom. At work recently (Bird 1977, 40-2; Hall 1975, *passim;* Williams 1980, pls 75, 78).

38 Glasdir; C (SH 736 224) Extensive foundations for the world's first successful oil-flotation plant (see also No 25) (Bick 1982, 64, 65, 68; Hall 1975, 99-101; Williams 1980, pl 180).
39 CEFN COCH; G (SH 715 232). Levels, tramway embankments, and mill (Hall 1975, 38, 39, 48).
40 Cwm Mynach; M (SH 678 215). Levels, opencuts and inclines (Down 1980, 46).
41 CLOGAU, G (SH 670 200) (approx). The most famous and important British gold mine, recently again at work. The best features are on Clogau mountain and include open-workings and a fine horsewhim site (Bird 1977, 43; Hall 1975, *passim;* Williams 1980, pls 72-4).
42 Vigra; C (SH 665 195). An ancient copper mine with open-workings, levels, and dressing floors (Hall 1975, 66-7).
43 Hafotty; M (SH 617 185). Largest manganese mine in the area, closed in 1984. Open-workings and tramway route (Down 1980, 43-4).
44 Aberdovey; L (SW 617 992). A typical small mine. Eighteenth century origins, or earlier (Bick 1978, 7-9).
45 COWARCH; L (SH 854 194). The best surviving example of the Dinas Mawddwy mines. Wheelpit and crusherhouse, levels, open workings (Bick 1978, 20-2; forthcoming).
46 TWLL-Y-MWN; C (SH 844 205). Old workings for iron, copper and silver, 2000 ft (600 m) above sea level. Known as 'Friars Coat' in the eighteenth century (Bick 1982, 12).

PART 3 DYFED

Dyfed (south of Lampeter)

1 Llanfyrnach; L (SN 225 315). An important nineteenth century silver-lead producer. Ruins of a Cornish enginehouse and other mine buildings (Bick 1989, 87: 38; Hall 1971, 3-7; Rees 1975, 131).
2 VALE OF TOW (near Llangunnor); BL (SN 437 198). Discovered about 1770 and a large employer from 1852 to 1866. A fine 50 inch (1.27 m) Cornish pumping enginehouse is now demolished (Hall 1971, 17-24).
3 Cae Sara (near Llangadog); L (SN 753 276). An old working in a remote area reopened in 1851. The chief feature is a ruinous 36 inch (0.9 m) Cornish enginehouse with other buildings. Also dressing floors, etc, much overgrown (Bick 1989, 87: 29; Briggs, this volume, Chapter 26; Hall 1971, 32-5; Ledbury and Briggs, this volume, Chapter 4).
4 PUMSAINT; G (SN 665 402). A Roman gold mine belonging to the National Trust. An extremely important site (Hall 1971, 39-48; Bird 1974, 32-5; Briggs 1988; Rees 1975, 119-21; Clough and Briggs, this volume, Chapter 20).
5 NANTYMWYN; L (SN 786 446). The biggest lead mine in south Wales and largely at work in the eighteenth and nineteenth centuries. On the Cawdor Estate, last working in the 1930s. Painted by John 'Warwick' Smith. Many opencasts, buildings, and dressing floors, currently under reclamation by Dyfed County Council (Hall 1971, 51-9; Rees 1975, 131-2; Rees 1977, pl 35; Richards Moorehead and Laing 1991b).
6 Treharne's Mine; L (SN 811 448). A small mine, first worked in 1959. The workings well illustrate how little change has taken place in small scale mining in the past centuries (Hall 1971, 51).
7a Llanfair (leat begins); L, S (SN 655 520). An ancient silver mine of which little remains. A long, wide watercourse or leat contouring the hills above, which deserves investigation (Bick 1974, 38-9).
7b GWENLAS (leat begins) (SN 728 443). Another ancient leat 2 miles (*c* 3 km) long (Bick 1988, 20-1).

Dyfed (north of Lampeter)

8 Abbey Consols: L (SN 744 661). Waterwheel pit of very unusual design (Bick 1974, 36-7).
9 Fairchance; L (SN 746 685). Eighteenth century, if not earlier, shafts, levels, and buildings (Hughes 1980).
10 ESGAIRMWYN; L (SN 755 692). Ancient workings rediscovered by Lewis Morris and let to Lord Powys in 1756. Closed in 1927. A modern mill occupies part of the site (Bick 1974, 32-3; forthcoming; Bick and Davies 1991; Foster-Smith 1979, 188: 83).
11 GLOG FACH/FAWR; L (SN 747 706). Extensively worked in the nineteenth century by John Taylor & Sons, powered by a long leat. Many remains of buildings; wheelpits, shafts, dressing floors (Bick 1974, 14-50; forthcoming; Foster-Smith 1979, 176: 78).
12 LOGAULAS; L (SN 743 717). An ancient and productive mine. Extensive opencuts and many shafts, plus wheelpits and other features (Bick 1974, 22-5; Foster-Smith 1979, 169: 76).
13 LEVEL FAWR; L (SN 739 722). This level, with a fine portal dated 1785, gave access to Logaulas and the Glog mines, with dressing floors near the entrance. A fine accounting house is nearby. This was a site of great activity in the nineteenth century (Bick 1974, 22-5; Bird 1977, pl 36).
14 Grogwinion; L (SN 714 723). Opencut workings on a steep mountainside (Bick 1974, 17-8; Thorburn 1988, 165: 75).
15 GRAIGGOCH: L (SN 703 740). Nineteenth century. Worked by John Taylor & Co. Wheelpits, crusherhouse, shafts, and levels

(Bick 1974, 18-9; Bird 1977, pl 41, 42; Richards Moorehead and Laing 1990, *passim).*

16 FRONGOCH POWERHOUSE; L (SN 710 743). Very large building that housed steam-and water-powered generators for the ill-fated Frongoch reopening *c* 1900 (Bick 1974, 14; Bick *et al* 1986; Foster-Smith 1979, 158: 66).

17 WEMYSS; L (SN 717 742). Workings on the Frongoch lode. A fine wheelpit and dressing mill ruins (Bick 1974 16-17; Foster-Smith 1979, 159: 68); Richards Moorehead and Laing 1990, *passim).*

18 FRONGOCH now partly Scheduled; L Z (SN 723 745). One of the most productive lead-zinc mines in Wales, with quite the most comprehensive mine buildings remaining in the Principality, including three Cornish enginehouses. This site is of prime importance and urgently requires repair if the structures are to survive (Bick 1974, 13-6; Bick *et al* 1986, 86: 23-5; Rees 1969, 22-5; Bird 1977, pls 38-40; Foster-Smith 1979, 158: 68; Richards Moorehead and Laing 1990, *passim).*

19 CWMYSTWYTH; C L Z (SN 803 746). A very ancient and extensive mine visited by Leland. The Copa Hill part only is Scheduled, and has Bronze Age origins. The whole site deserved preserving, particularly the shell of the mill building *c* 1900 (now removed to Llwernog) (Bick 1974, 19-22; Bird 1974, 36-7; Briggs 1988; Hughes 1981; Foster-Smith 1979, 181:80).

20 Ystum Tuen; L (SN 733 787). Opencuts worked by the Mine Adventurers *c* 1706 (Bick and Davies 1991; Foster-Smith 1979, 181: 80).

21 Penrhiw/BWLCHGWYN; L (SN 737 787/739 789). Old workings described by Lewis Morris (Bick 1975, 21-7; Bick and Davies 1991; Bird 1977, pl 37; Foster-Smith 1979 139; 62; 140: 62).

22 TEMPLE; L (SN 748 793). A small mine with a fine wheelpit and dressing floors in the Rheidol gorge near Parson's Bridge (Bick 1975, 27-8; Foster-Smith 1979, 142: 62).

23 Cwmbrwyno; L (SN 714 805). An important nineteenth century mine with reservoir, wheelpit, shafts and other features (Bick 1975, 18-21; Foster-Smith 1979, 106: 52).

24 Llwernog; L (SN 733 809). Now a mining museum (Bird 1977, 38-9; Boyns 1976; Briggs, this volume, Chapter 7; Foster-Smith 1979, 106: 52).

25 GOGINAN; S-L (SN 692 817). An early and very productive mine worked by Thomas Bushell. The surface features have largely been destroyed in recent years, except for the entrance to Taylor's *Inclined Shaft* which deserves preservation (Bick 1975, 35-9; Foster-Smith 1979, 78: 43; Hughes 1988; Richards Moorehead and Laing 1987b; Thorburn 1987).

26 Bwlch; S-L (SN 703 823). Worked by the Mine Adventurers. Mainly bulldozed (Bick 1975, 38-42; Foster-Smith 1979, 101: 51; Hughes 1988).

27 Pencraigddu; L (SN 711 824). Eighteenth century workings described by Lewis Morris and still traceable from his time (Bick 1975, 44; Bick and Davies 1991; Foster-Smith 1979, 178: 79; Hughes 1988).

28 CASTELL; L Z (SN 775 813). Mainly nineteenth century workings; fine crushing mill and opencut workings (Bick 1975, 10-11; Foster-Smith 1979, 113: 55).

29 Plynlimmon; L (SN 795 856). Discovered about 1865, near a route to Plynlimmon summit. Wheelpits, shafts, dressing floors, etc (Bick 1975, 6-9; Foster-Smith 1979, 93: 49).

30 CWMERFIN; L (SN 695 828). Mainly destroyed in recent years, of which the most important feature is Bushell's levels, driven about 1638 (Bick 1976, 6-8; Bick and Davies 1991; Foster-Smith 1979, 69: 40; Hughes 1990).

31 DARREN now partly scheduled; C S-L (SN 677 828). A very celebrated mine worked by Thomas Bushell's level, driven in the reign of Charles I. The whole site needs preservation (Bick 1976, 10-15; Bick and Davies 1991; Hughes 1990; Foster-Smith 1979, 73: 41).

32 BRONFLOYD: S-L (SN 659 835). Worked for silver by Sir Hugh Myddleton and Bushell. Extensive remains of wheelpits, buildings and machinery (Bick 1976, 26-9; Bick and Davies 1991; Palmer and Neaverson 1989; Rees 1969, 25-6; Foster-Smith 1979, 198: 86; Thorburn 1987).

33 CWM DARREN; C L (SN 681 833). According to Lewis Morris a very ancient working, yielding stone artefacts (Bick 1976, 15-16; Bick and Davies 1991; Foster-Smith 1979, 67: 36)

34 CWMSYMLOG; S-L (SN 700 837). The most famous silver mine in Wales, contributing largely to Sir Hugh Myddleton's wealth. A very long and involved history. The whole site including Blaen Cwmswmlog needs preserving (Bick 1976, 19-26; forthcoming; Bick and Davies 1991; Hughes 1990; Foster-Smith 1979, 66: *35;* 94: 49; Lewis 1952a; b; Rees 1975, 133; Thorburn 1987).

35 Lletty Evan Hen; L (SN 695 849). A small, mainly nineteenth century mine with shafts, dressing floors, crushing mill, wheelpit, and tramway viaduct in ruins (Bick 1976, 32; Foster-Smith 1979, 63: 34).

36 Cefn Gwyn; L (SN 679 869). Deep in a valley, with shafts, levels, a horsewhim circle, dressing floors, etc. Eighteenth-nineteenth century (Bick 1976, 33-4; Foster-Smith 1979, 51: 30).

37 Hafan; L (SN 728 879). Worked by the Mine Adventurers under the name Caninog. Extensive workings. with a wheelnit. levels.

and dressing floors (Bick 1976, 46-9, Foster-Smith 1979, 82: 45).

38 ESGAIR HIR/FRAITH; C L (SN 735 912/741 912). A famous if not notorious mine, worked by the Mine Adventurers in the seventeenth century and by many subsequent companies. Remains of buildings, dressing floors, wheelpits, and early level. Much damaged by afforestation and attendant roads. The whole site needs much protection (Bird 1977, pl 45; Bick 1976, 53-61; Palmer 1983; Rees 1975, 135-6; Foster-Smith 1979, 13: 19).

39 Blaen Ceulan; L (SN 716 905). A typical small mine, eighteenth-nineteenth century workings, with remains of steam-engine site, dressing floors, wheelpits, shafts, and levels (Bick 1976, 36-7; Foster-Smith 1979, 13: 19).

40 LLANCYNFELIN; L (SN 651 921). An unsuccessful working. A splendid Cornish-style enginehouse chimney stack deserves preservation as a well-known landmark (Bick 1976, 42-3; 1989, 86: 21; Rees 1969; Foster-Smith 1979, 24: 24).

41 BRYNDYFI; SAM L (SN 683 934). Unsuccessful mine. Fine mill buildings and dressing floors (Bick 1976, 43; Foster-Smith 1979, 20: 23; Palmer and Neaverson 1989).

42 YSTRAD EINION; SAM L (SN 707 938). A small nineteenth century mine well-known for its underground waterwheel with crushinghouse and much in need of repair currently under reclamation by Dyfed County Council (Bick 1976, 43-4; Bird 1977, pls 47, 48; Foster-Smith 1979, 7: 18; Hughes 1981; Palmer and Neaverson 1989).

CLWYD

1 TALARGOCH; L (SJ 056 801). Clive Shaft enginehouse. Built 1862 for 100 in (2.54 m) pumping engine. Sound condition with roof and weather-boarding. Abandoned 1883 (Bick 1989, 85:2; Bird 1977, pl 62).

2 MINERA Listed Grade II; L (SJ 275 509). City (or Meadow) Shaft enginehouse, mid nineteenth century. Separate chimney. Abandoned 1914. Enginehouse restored (Bird 1977, pl 61; Richards Moorehouse and Laing 1987a; Williams 1980, 37-9).

3 PENNANT; L (SJ 088 765). Pennant Mine enginehouse for pumping engine, nineteenth century. Separate square-built stone chimney demolished. Poor condition (Bick 1989, 85: 3)

4 MAESHAFN; L (SJ 193 613). Two large wheelpits on east bank of River Alyn. The larger (on south) overshot to supply power by flat-rods to a shaft about 500 yd (450 m) to east. Pit on north side probably never used, but could have worked ore-dressing machinery. Early nineteenth century (Bird 1977, pls 58, 59). Water was supplied by a leat emerging from a culvert still visible in field to south-east. The leat ran up the east bank of the Alyn for about two miles (3.2 km) to (SJ 187 591) and is still visible for most of its course.

5 LLOC Listed Grade II; L (SJ 145 767). Pumping-enginehouse near crossroads. ?Mid-nineteenth century.

6 Rhosesmor; L (SJ 213 683). Rhosemor Mine enginehouse for pumping engine, nineteenth ten tury. Converted into offices (Flints Caravan Sales).

7 Gronant; L (SJ 098 829). Gronant Mine enginehouse for pumping engine, nineteenth century. Converted into offices (Bick 1989, 85: 1).

8 HENDRE Listed Grade II; L (SJ 198 678). Enginehouse for 100 in (2.54 m) pumping engine with brick chimney adjacent, nineteenth century (in Hendre Quarry) (Bick 1989, 85: 4; Bird 1977, pl 69).

9 Hendre; L (SJ 204 678). Large brick enginehouse built 1917 to hold electric motors for pumps in Taylor's Shaft adjacent. A short distance to south-west is similar brick generating station. Part of emergency pumping scheme financed by Ministry of Munitions (Williams 1987, 27-8).

10 HALKYN MOUNTAIN; (SJ 19 71). Extensive (mostly eighteenth century) workings along veins, and numerous shafts; many shafts capped under Job Creation Scheme. Clearance scheme concerned areas of 1930s mine waste south-west of Penbryn Shaft (SJ 203 707) (Briggs, this volume, Chapter 7; Campbell and Haines 1988; Williams 1980, 27-9).

11 Halkyn Barracks; (SJ 208 699). Barracks for miners working at Halkyn Mine, mid nineteenth century. Converted into a dwelling house.

12 Trelogan; (SJ 123 805). Various buildings near extensive dumps of mine waste. Nineteenth century.

13 THE LEETE; Watercourse built in the 1820s from near Loggerheads (SJ 197 628) to Penyfron Mine at Nant Alyn (SJ 198 663). A public footpath for most of its length. Several shorter leats, wheelpits, tunnels, etc, in lower section near Nant Alyn (Williams 1987, 32-5; 1980, 15-16).

14 Halkyn Deep Level; L (SJ 230 711). Portal of drainage level (begun 1818) with inscriptions c 1818 and 1888 (Bird 1977, pl 63).

15 NANT Listed Grade II; L (SJ 197 577). Enginehouse for pumping engine at Nant Engine Shaft, 1841. Stone chimney short distance to east (Bick 1989, 86: 10).

16 Nant Adda Level; L (SJ 187 579). Portal of drainage level from River Alyn to Nant Mine, early nineteenth century. Dump of mine waste nearby (Bird 1977, pl 60).

17 Glanalyn Mine; (SJ 196 629). Wheelpits each side of River Alyn to work pumps in Glanalyn Mine (Williams 1987, 25, 30-4).

18 Belgrave Mine;L (SJ 198 590). Series of shafts and levels along vein in west-north-west-east-south-east direction. Ruined buildings, dressing floors, etc. Several shafts here and elsewhere in Maeshafn area capped recently by Glyndwr District Council (under grant from WDA) followed consultation with North Wales Caving Club.

19 ABERDUNA Mine Listed Building (Grade II); (SJ 205 618). Enginehouse for pumping engine, nineteenth century. Partly obscured by quarry waste (Bick 1989, 86: 9).

20 Mwynybwll; (SJ 187 670). Ruinous engine-house near Coed Du Hall (Bick 1989, 86:6).

21 Pant Du; (SJ 203 596). Former enginehouse for pumping engine, nineteenth century and stone-built chimney short distance up hill to east now gone.

22 Pantybuarth; (SJ 203 641). Engine-shaft for Pantybuarth Mine. Enginehouse long since demolished but pumping rods still in shaft. Site of 1744 Newcomen engine.

23 Llynypandy; (SJ 197 657). Enginehouse for pumping or winding at Perrin's Shaft, Llynypandy Mine. Newcomen engine known to have been at this shaft in 1743 may have been housed in this building or an earlier one on or near its site. Recently extensively 'done up' and now a dwelling house (Bick 1989, 86: 7).

24 Maeshafn; (SJ 194 612). Small waterwheel in wheelpit a short distance upstream of Site 4 above. Made at Union Foundry, Mold, 1870. May not be connected with mining, but included on account of its proximity to the big wheelpits (4 above).

25 Maeshafn; (SJ 219 608). Powder magazine in good condition, nineteenth century. Used as cattle shed.

26 Bog; (SJ 213 567). Stone chimney and ruins of enginehouse for small (?pumping) engine in Bog East Shaft. (Shaft now used to supply water to nearby quarry).

27 MAESYFFYNNON; (SJ 198 657). Important remains of Boulton and Watt enginehouse of 1783 (Bick 1989, 86:11).

28 PENRHOS; SAM; (SJ 286 532). Very important eighteenth century John Wilkinson engine-house (Bick 1989, 86: 11).

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