Fforwm Cerrig Cymru Welsh Stone Forum

NEWSLETTER

Number 8 March 2011 **Price £4.00**

Welcome to *Newsletter No.8* which contains papers and reports that give a good flavour of the range of research interests and projects that members have been undertaking or involved in during the year, as well as the general activities that were on offer to Forum members.

Philip Clark looks at the changing cultural landscapes that have occurred in Wales over the last 250 years as reflected in changing walling styles, especially those of dry stone walls. His paper is adapted from a presentation that he delivered to the 12th International Dry Stone Walling Congress at Ambleside, Cumbria in 2010. Moving to slightly larger features Jacqui Malpas looks at the stonework of one of Wales' most famous industrial structures and World Heritage Sites, the Pontcysyllte Aqueduct near Llangollen. This is something we all look at in awe but have probably never taken any note of the stonework that comprises this imposing structure. Well, now all is revealed.

John Davies reports on the building stones of St Tanwg's church in Llandanwg, Merionydd in what will hopefully become a regular series of Building Stone Surveys of lesser known buildings from around Wales. We then move from the buildings themselves to the stone that they are built from. Jana Horák reports on new production sources of ornamental stones in the UK and Gareth Owen on newly cleared exposures of the Newmead Sandstone in mid Wales.

Once again the Forum had a busy field meeting programme last year and John Shipton has produced a comprehensive series of reports on this wide ranging programme of visits accompanied by many excellent photographs. I have taken pity on some members who were caught on camera in some amazingly contorted positions in their desire to get the finest detail from what they were looking at by a judicious selection of those we used!

I would like to thank all the authors who have submitted papers for this newsletter and especially John Shipton for his unstinting efforts to record all that happens on our excursions. John has just retired from Cadw after many years service and we wish him a long and happy retirement. Finally, I would like to extend my sincere thanks to Jana Horák for physically putting the *Newsletter* together as once again her IT skills and equipment far outweigh mine.

This year your Council have again put together a varied programme of meetings across Wales and I hope that all of you will find something of interest. In particular can I bring to your attention the seminar/workshop day and associated field meeting in October.

AGM 2011

Saturday 9th April: AGM, St Illtyd's Church, Llantwit Major

11.00 am AGM
11.45 am Presentation on the Galilee Chapel Project, St Illtyd's Church by Gareth Kiddie, Director GKS, (http:/illtudsgalileechapel.org.uk/). We will then break for lunch and spend the afternoon examining the medieval stone monuments in the church, guided by Maddy Grey and Tim Palmer. Time and weather permitting we will continue with a visit to the monastic manor/grange site just west of the church.

2011 Programme

Saturday 14th May: Pebbly Brownstones of the West Brecon Beacons

Meet 11.00 am at Cross Hands Co-operative car park. The trip will look at the use of Old Red Sandstone. You may bring a packed lunch but there will be suitable venues for lunch.

Saturday 12th – Sunday 13th June: Building stone in North Wales

Leaders: Adam Voelcke & John Davies
Meet Saturday 12th 11.00 am at Caernarfon Castle.

The itinerary for Saturday will include a wide variety of local building stones viewed at the following localities; Trefor (granite) Quarry, Clynnog Fawr Church, Pant Glas, Penygroes and Talysarn. Participants should arrange their own accommodation. Caernarfon or Beddgelert are possible options. On the Sunday morning the trip will visit Beddgelert church and Tremadog (Coade Stone gate) and in the afternoon move south to Minfordd, Maentwrog and Trawsfynydd.

Could those wishing to participate please inform Tim Palmer (Meeting Secretary) in case of a change to the itinerary. For those joining the trip just for the Sunday, Tim will confirm the meeting point for that day nearer to the date.

Saturday 16th July: Gwrhyd Quarry

Leaders: Justin Woodfield (Gwyrhyd Quarry) & Jana Horák
Meet at 11.00am at Gwyrhyd Quarry [Rhiwfawr, Swansea, West Glamorgan SA9 2SB] see web site for map, http://www.specialiststone.uk.com/contact.htm.;The quarry is a major supplier of Pennant Sandstone, producing a wide variety of products for conservation and new build projects. Please confirm that you wish to attend this meeting. If possible members should bring hard hats and a high visibility jackets/waist coats.

Saturday September 10th – Building Stone of the Old Radnor Area

Leaders: John Davies & Jana Horák
Meet 11.00 am Harp Inn, Old Radnor [SO 250591]

This trip will examine the local use of the Folly Sandstone of Llandovery Age (Silurian) which outcrops across the Powys-Herefordshire border area. We will visit the Folly Sandstone quarry in the morning returning to the Harp Inn for lunch. In the afternoon we will view examples of the use of Folly Sandstone in local buildings, ending the day in New Radnor.

Thursday 20th October – Visit to the Royal Forest Pennant quarry & works

Leaders**:** Andrew Haycock

Meet: 14.00, Royal Forest Pennant premises, (Bixslade Stone Works, Parkend, GL15 4JS)

Royal Forest Pennant stone has been used for a wide variety of new build and conservation projects (see *Newsletter No. 7, 2010)*. The stone differs significantly from the Pennant Sandstone at Gwrhyd Quarry. The visit will include both a visit to the quarry and the works to view the variety of products. Places are limited for this trip. Please confirm with Tim Palmer or Andrew Haycock if you wish to attend.

Friday 21st October : Identifying Building Stone Seminar/workshop: National Museum of Wales, Cardiff 11.00 – 15.30

Contributors to include: Dr T. Palmer, Dr G. Lott, Dr J. Davies, Dr J. Horák. Mr J. Shipton. Topics will include identification of building stone, (with an opportunity to view hand specimens), recording building stone information and case studies. Registration fee. Please contact Jana Horák (jana.horak@museumwales.ac.uk, tel: 029 20573353) for further details. This meeting is open to non-WSF members.

For further details of the seminar day and AGM please contact Dr Jana Horak (jana.horak@museumwales.ac.uk or tel. 029 2057 3353). For details of the meeting points please contact Dr Tim Palmer (tjp@aber.ac.uk or tel. 01970 627107). Full details of all the meetings will also be found on the Forum website shortly.

Understanding Urban Character

Judith Alfrey

Every town has its own history and character. Understanding that character and how it was formed is a cornerstone for planning, design and management that aims to reinforce a sense of place. Over the last few years, Cadw has been looking at a series of towns to develop a scheme of urban characterisation that provides a consistent, structured analysis of what gives a town its unique identity, and a base-line statement of its character and significance. This work is intended as a foundation for planning and regeneration strategies to ensure that they sustain and strengthen local distinctiveness.

Characterisation starts by identifying the tangible elements of urban character. These lie in the topography of the town - its layout, the patterns of spaces, streets and plots. They lie in its building

stock – the chronology of building and its patterns of development, the types and styles of building, and their materials. They may also lie in underlying archaeological traces. All of these elements reflect the particular history of the place, its origins and development, its society and economy.

In many (perhaps all) of our towns, building stones make a strong contribution to local distinctiveness: recognising their nature and source, and appreciating the range of techniques for working them, is therefore vital. Cadw would like to work more closely with the Welsh Stone Forum as it continues to develop its characterisation programme.

To date Tim Palmer has contributed information on building stone to the Aberystwyth phase of the project. It is hoped that other members, in conjunction with Amgueddfa Cymru - National Museum Wales, will be able to support subsequent phases of the project covering Cefn Mawr and Merthy Tydfil in the first half of 2011.

Re-discovering Newmead Sandstone

Gareth Owen

Recent work is revitalising sections of the Newmead Sandstone for study. The Newmead Sandstone was a vitally important building stone in Mid Wales. Its massive nature and relative ease of working meant it was highly valued. As a result its use stretches far beyond the area of outcrop, which is constrained to the western flanks of the Carneddau between Builth Wells and Llandrindod Wells. Many of the houses in the Builth area have been constructed of the stone, but its most high profile use was as a dressing stone for the Elan Valley dams, that were constructed between 1893 and 1904 to provide clean drinking water for Birmingham. Despite this illustrious history, many of the quarries that provided stone for the dams have long since been forgotten.

Fig 1. Newmead Sandstone quarry.

Fig 2. Conservation work clearing exposures of Newmead Sandstone.

Hanson and the Countryside Council for Wales have recently been undertaking work to re-expose some of these quarries, thus revitalising sections and providing fresh exposures for study [Fig 1]. Near Hanson's aggregates quarry at Llanelwedd are a series of quarries in the Newmead Sandstone that stretch along the line of the former Builth to Llandrindod road. It is from these quarries, amongst others, that stone for the dams were taken. Whilst large in their own right, they have long since been dwarfed by the huge dolerite quarry next door, and have lain overgrown and partially filled for many years.

As part of their Geodiversity Action Plan for the site, Hanson and CCW identified these quarries for clearance, enabling their inclusion in a planned geotrail across the entire quarry complex. Three quarries in the Newmead Sandstone have now been cleared of vegetation, and recent work has provided access up to the face in an area that was previously flooded [Fig 2]. Work on the trail is ongoing, and it is hoped that in time it will provide a valuable asset to the geodiversity community.

Please note that the Newmead Sandstone quarries remain part of the active quarry complex, and so anybody wishing to visit the site must obtain access permission from Hanson.

The Stone of the Pontcysyllte Aqueduct and the Llangollen Canal

Jacqui Malpas

The most remarkable structure in the Dee Valley in north east Wales is the Pontcysyllte Aqueduct near Llangollen. It towers 38m over the valley and carries an iron trough containing the Llangollen Canal, an arm of the Shropshire Union Canal, supported on eighteen stone piers. This navigable aqueduct, built by Thomas Telford and completed in 1805, was ten years in the design and building. It is the longest and highest aqueduct in Britain, a Grade I Listed building and now a UNESCO World Heritage Site.

The Pontcysyllte Aqueduct and Llangollen Canal was inscribed on the World Heritage List in 2009 and its citation says;

'The 18 kilometre long Pontcysyllte Aqueduct and Canal is a feat of civil engineering of the Industrial Revolution, completed in the early years of the 19th century. Covering a difficult geographical setting, the building of the canal required substantial, bold civil engineering solutions, especially as it was built without using locks. The aqueduct is a pioneering masterpiece of engineering and monumental metal architecture, conceived by the celebrated civil engineer Thomas Telford. The use of both cast and wrought iron in the aqueduct enabled the construction of arches that were light and strong, producing an overall effect that is both monumental and elegant. The property is inscribed as a masterpiece of creative genius, and as a remarkable synthesis of expertise already acquired in Europe. It is also recognized as an innovative ensemble that inspired many projects all over the world'. [http://whc.unesco.org/en/list/1303].

Fig 1. Pontcysyllte Aqueduct.

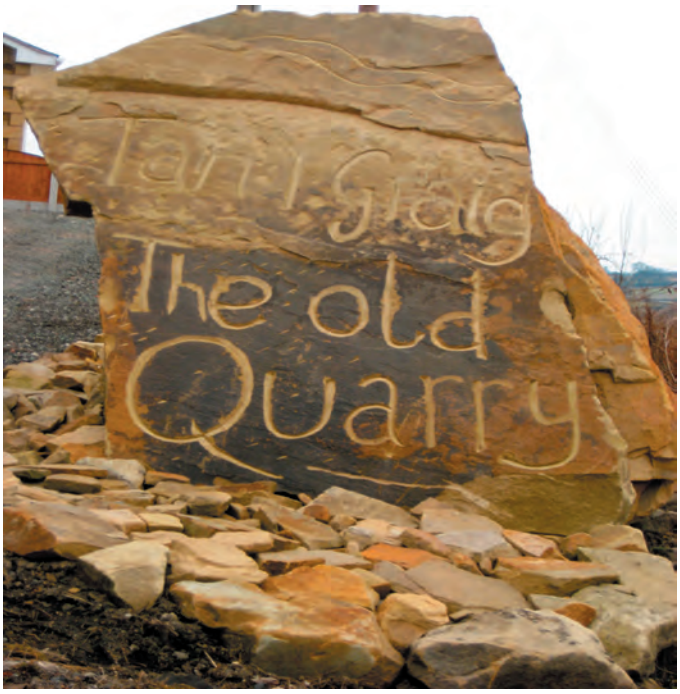

Fig 2. Tan y Graig Quarry, currently working Cefn Rock

Conspicuous by its absence is any mention of the stone used to build the supporting pillars and associated canal bridges. Thomas Telford, as well as being an engineer and architect, was also a stonemason. He would have needed a local source of a strong, good building stone and mortar and although working at a time when geology was in its infancy (the term 'geology' had only been adopted in 1778 and William Smith did not produce the first geological map until 1815) Telford would have had a good working knowledge of the type of stone required. He would have been able to read the landscape and would have had a good knowledge of the stone used in the local buildings. At the same time he was also working on the Chirk Aqueduct, completed in 1801, which in contrast to the Pontcysyllte Aqueduct has stone arches.

Carboniferous rocks dominate the geology around the Pontcysyllte Aqueduct. In this area the 'Aqueduct Grit' (Namurian, Gwespyr Formation) has a faulted contact with the Cefn Rock (Coal Measures, Bettisfield Formation). The Cefn Rock is a pale yellow, massive, quartz-rich sheet sandstone, up to 37m thick, which is still quarried today. It was deposited in a deltaic environment, about 325 million years ago, when Wales was on the edge of a large continent in the southern hemisphere. It forms several roughly N-S trending fault-bounded ridges that have been extensively quarried, as shown by the series of quarries above the aqueduct in the village of Cefn Mawr.

The other engineer on the project was William Jessop, a very experienced canal builder who had built the Grand Canal of Ireland and the River Trent navigation amongst others.

Welsh Supply Chain Strategy - Prince's Foundation for the Built Environment Meeting

Jana Horák

The Welsh Supply Chain Strategy is an initiative of the Prince's Foundation for the Built Environment. It is focused on compiling information on building materials and building skills. The *Building Materials Supplier and Manufacturer Directory* will provide a comprehensive resource, particularly for developers, house builders and architects to help them meet the targets for local supply and labour within a development. It will support companies and individuals who already have a commitment to a more sustainable building culture in Wales and provide information for those that are less well informed.

The project was launched at the Coed Darcy Urban Village development, the former BP Llandarcy Oil Refinery site, in June 2010. The site is being redeveloped by St Modwen plc, with the design specification developed with input from The Prince's Foundation to develop an urban village, similar to Poundbury, Dorest, to enable people to live and work in the same community.

A workshop organised by the Foundation on February 9th and 10th 2011 focussed on the Welsh supply chain for materials and skills to support the Coed Darcy project. The second of these two days dealt specifically with the supply of slate and stone and the associated specialist building skills. The slate industry was represented both by producers and suppliers. A synopsis of the supply of Welsh slate was provided indicating that currently Welsh slate provides less than 5% of the roofing material supplied in the UK. There was then discussion around the ability and willingness of the developers to pay the additional cost of (i) slate (ii) Welsh slate. This centred on the low total building costs for most properties under construction and lack of awareness by purchasers of the life span of a slate (Welsh or otherwise) versus cement tile roofs.

The second topic of stone supply was less emotive. The site is based within an area where Pennant Sandstone is the indigenous building stone. (see programme for July 16th for trip to Gwyrhyd Quarry). Stone from Gwyrhyd has already been used for walling and facing on the site, and there are no issues associated with supply. The discussion focused on areas where Pennant Sandstone could compete on price with either imported stone or concrete based products (e.g. paving) and the use of local concrete products using waste aggregate. The point was made however, that had the Coed Darcey project been located elsewhere in Wales the stone supply issue may not have been so positive.

The discussion then moved to the skills associated with both slate and stone. In both instances it was emphasised that it was essential that craftspeople with the relevant skills were used, and the necessity of this should be more widely promoted. The main issue were that trained slaters were required for slate roofing and builders trained to work with masonry, rather than bricklayers, be employed for stone walling. The Slate suppliers emphasised the need to promote the necessity of a slater fitting a slate roof, rather than a general roofer and the development of masonry skills to lay stone walling, rather than using bricklayers.

Further sessions will be held to progress this topic. The aspiration that this and other development projects will in future focus on using natural and sustainable materials, that are locally sourced or produced and constructed using local labour, will remain at the heart of this project. For further information see http://www.princes-foundation.org.uk/files/coeddarcydesignstatement.pdf.

A recent addition to the cultural landscape of south Wales – success or not?

Philip Clark

There have been three cultural landscapes in south Wales in the past 250 years. The traditional cultural landscape, up to the late C18th, was agricultural, particularly pastoral, with market towns in the richer areas and small sea ports on the coast. Dry stone walling played a minor part in this cultural landscape; field walls were largely confined to the farms above the long narrow valleys flowing south and south west to the Bristol Channel and to the higher regions of the richer farmland in the Vale of Glamorgan and the Usk and Tywi valleys. Dry stone walls are also

found around many of the older churchyards while stone-faced earth banks (*cloddiau* in Welsh) are found particularly in the northern and western areas with stone-faced retaining walls across the area generally.

From the late C18th the cultural landscape changed fundamentally as heavy industry exploited the rich mineral resources of the Carboniferous rocks, especially limestone, coal and iron, turning south Wales into perhaps the earliest "workshop of the world". Even in rural Breconshire the exploitation of the limestone produced an industrial fringe around the edge of the coalfield.

However, a rural culture continued in the rich farmland areas of the Usk and Tywi valleys, the Vale of Glamorgan and on the hills between the long narrow coalfield valleys. These had links with the new, large industrial communities due to their close proximity but these new towns had a culture that both in spirit and visible embodiment were different to the past.

In the mid C20th century the cultural landscape changed again as heavy industry collapsed and its physical monuments were, to a large degree, rapidly swept away. The large towns left in the valleys now had little obvious reason for their existence and their cultural landscape was depressing. One response to this cultural bereavement came from local authorities who, from the 1980s, commissioned new dry stone walls, largely ornamental, as a way of creating instant heritage, linking the communities to an idealised rural past.

These have been placed largely alongside roads, in urban or semi-urban settings, but also where derelict areas have been landscaped as parks, open spaces or even agricultural land. [Fig 1]. Many of the designs have been imaginative and unusual and one Council

Fig 1. Dowlais, Merthyr.

Fig 2. Blaeanau, Gwent.

has occasionally varied local Pennant Sandstone with slate from North Wales [Fig 2.]

But the stone used overwhelmingly has been newly quarried Pennant Sandstone from the Carboniferous, Upper Westphalian Series, which is a very good stone for building well coursed walls. In the more northern communities, such as Brecon in the Usk valley, Lower Old Red Sandstone of the Devonian, Dittonian Series has been used instead. As well as walls both these stones have also been used extensively for facing new buildings, forming a link with other attempts to relate the modern cultural landscape to the historic rural landscape.

Has this experiment been successful? It's certainly been successful for a number of professional walling practitioners. For a small number it has supplied a very large proportion of their work and has paid well. For many years little attention has been given to the maintenance of the traditional rural walling cultural landscape in south Wales, compared to north Wales or other parts of the United Kingdom, so wallers have been scarce and able to ask comparatively high sums for such work; it's paid at least one north Wales waller to spend long periods working in south Wales.

For a number of other professional wallers it's been a small but significant addition to their main work on field and garden walls. Generally, they have found these satisfactory commissions to work on. Other wallers, not wanting the strains of working for exacting main contractors and council officials, have preferred not to go for these jobs at all. Time restraints and penalty clauses are common and payment often slow.

The local authorities have a variety of views on these projects. Some have not undertaken any, partly

because they are not in traditional walling areas, while others have been enthusiastic – the landscape Projects Officer of Blaenau Gwent County Borough Council told me that local communities have so appreciated these works that nearby ones have asked for them too. Recent big walling schemes undertaken by Merthyr Tydfil County Borough Council at Fochriw, an isolated village on a bleak hillside have, I found, given great satisfaction to the inhabitants [Fig 3]. The waller's opinion was that it was the over 30s who appreciated them!

The cost to some authorities has been considerable. The landscape architect of Caerphilly County Borough Council told me that they had spent £100K on one wall and £90K on another. Quite significant sums, which the council officials consider money well spent.

However, some walls have proved not to have been very successful over longer periods of time. The approach roads to Wales International Airport at Rhoose, were handsomely conceived by the then South Glamorgan County Council (1974-1996). Although handsomely conceived, it is true that the architect devised a totally bizarre and impractical

Fig 3. Merthyr Tydfil

design for the specially shaped coping stones, "tower stones", which he designed with long stems to be inserted through the upper courses, which the wallers had to convince him were impractical. I have a particular interest in these walls, as I was the main sub-contractor, although I sub-contracted the work on as I had another job for the Merthyr Tydfil Borough Council at the time.

Today, some Councils rather regret what their predecessors have done. For instance, South

Fig 4. Cardiff airport.

Glamorgan County Council disappeared in 1996 and the approach roads to the airport are now the responsibility of the Vale of Glamorgan County Borough Council. One of their highways officials I talked to recently was vague about whether the walls were even the Council's responsibility - which they certainly are. The problem is that these walls, built twenty or so years ago, were built with no thought of future maintenance. Traditional dry stone walls are very vulnerable to vandalism if built in public places; people help themselves to stones, children scramble over them and once the coping stones come off, the wall soon decays. These walls have been in a poor state for years, and are largely overgrown [Fig 4]. The Council's Conservation Officer takes the attitude that restoration is a low priority because their style is not traditional to the area, which is quite correct, and neither is the Pennant Sandstone of which they're built – the area is underlain by Jurassic Lias – and the 'local' walls that exist nearby are of a different stone and style. Some of these airport walls (including some built after my time) are within the airport curtilage and are now the responsibility of the Airport Authority, and some small effort has been made to repair some of them.

Incidentally, the rural dry stone walls above the valleys were often not built of Pennant Sandstone but of other Coal Measures rocks while the one Old Red Sandstone quarry near Brecon from which nearly all the new walls and facing of buildings have been constructed, is from a geological horizon well below and in many ways different from the Old Red Sandstone of the traditional walls and buildings in the area.

The Merthyr walls for which I was responsible at the same time have fared little better than those at

Fig 5. Merthyr Tydfil : before

Cardiff airport. They were designed to make the area behind the new council offices more attractive by providing a proper base for the truncated remains of the Penydarren ironworks tip, but a new road was dreamed up, half the wall came down and was then rebuilt at yet more cost. Worse, the wall was handed over from the Landscape Architect's Department to the Parks Department. The latter enthusiastically planted shrubs in front of the wall, which have grown up over it, joining with vegetation which had already established itself on the tip so that a lot of the wall is now invisible! [Figs 5 & 6]. These pictures were taken from exactly the same place! But other walls I built for Merthyr Tydfil Borough Council [Fig 1], though not in pristine condition, now look suitable features by the entrances to a park created on part of the Penydarren ironworks site.

Has the money really been well spent? The maintenance issue has certainly been learnt. Wallers tell me that there is always a 12 month maintenance period. Also, one answer to the maintenance problem has been the introduction of mortared copes (the coping stones on the Penydarren Park walls have been mortared on). This is quite sensible, and has been undertaken on some British dry stone walls for years. However, it is now becoming common with some councils to have disguised mortared interiors as well, and that is just not dry stone walling.

Fig 6. Merthyr Tydfil : after

All councils nowadays, I think very properly, demand that wallers should hold a Higher Certification from the Dry Stone Walling Association. However, in the 1980s and early 1990s some walls were built by unskilled wallers who were competent at mortared walls but had no training, let alone certification, in dry stone walling. An example is a quartet of walls,

Fig 7. Hirwaun roundabout

in a very prominent position, on a roundabout on the important Heads of the Valleys trunk road, that are meant to be a proud statement seen by those driving by. The combination of bad workmanship and lack of maintenance has left a sorry sight. [Fig. 7]. The present County Borough Council is not, needless to say, the Council who originally commissioned the wall.

Although there are some excellent examples of work that completely fulfils the aim of enriching the present cultural landscape by providing references to the past, one is left with a rather equivocal view of the whole enterprise.

This article is adapted from a paper delivered at the 12th International Dry Stone Walling Congress at Ambleside, Westmoreland, 4th – 6th September 2010 on the theme "Dry Stone Walling as Part of the Cultural Landscape".

FIELD MEETING REPORTS

Whitland &Whitland Abbey
27th March 2010

John Shipton

On a bright but chilly day in late March members of the Forum met at Whitland Abbey for the first field trip of the season. The owners of the adjacent Home Farm House kindly allowed us to assemble on their drive [Fig.1]. John Davies welcomed the group and with Maddy Gray began the day with a brief history of the Abbey site The Cistercians moved their abbey to Whitland in the early 1150s. Originally a Cambro-Norman foundation it soon came under the control and patronage of Rhys ap Gruffudd.

Fig 1. Group at Home Farm, Whitland.

Moving onto the Abbey site John pointed out the red sandstones, local limestones and a slate-like stone, of variable quality, that were locally readily available for the builders of the Abbey and explained where the outcrops occurred. We examined the base of one of the Abbey's basic rectangular piers, built in the Bernadine style, inspecting the stone used for the dressings and core work. Tim Palmer explained that the stone used for the dressings was a freestone from Dundry, near Bristol. Dundry Stone is a Jurassic limestone that was widely used in Wales and even Ireland until the C15th, by which time the quarries were essentially worked out. There was a brief resurgence in its use during the C19th but the quality of the stone was not as good as that from the earlier workings and quarrying ceased. [The C19th workings were visited by the Forum in 2006 and Tim wrote an article about Dundry Stone in *Newsletter Number 1, 2003*]. Large blocks of stone, called 'gobbits', were

Fig 2. The gate between the Abbey and gardens.

transported by sea and river to the Abbey site and there were dressed to size and shape with the off cuts either being used in the core or burned to produce lime mortar.

An imposing Victorian gate separates the Abbey from the garden area [Fig 2]. It is built of local gritty sandstone and dressed with Bath Stone and Carboniferous Limestone. Although the sandstone and the Carboniferous Limestone were holding up well some of the Bath Stone dressings were beginning to fail.

Fig 3. C13th worked Dundry Stone

Fig 4. An ammonite in Chilmark Stone.

As was normal practice the builders had re-used masonry, probably from the Abbey site, to construct the farm buildings and we found re-used Dundry and Sutton Stone limestones at the farm. Closer inspection of the Dundry Stone revealed the presence of fossil crinoids. At the back of the house there were a number of pieces of limestone dressed in C13th style and closer inspection proved to be Dundry Stone [Fig 3]. This caused some consternation as there was no known documentary evidence of a C13th rebuild. John Davies suggested that this may have been work of the Welsh Princes rather than the Marcher Lords as the activities of the Welsh Princes tend to lack documentary evidence. It was possible that use of different stone at the Abbey may be related to changing political affiliations over time.

The group moved on to the Victorian Church of St Mary's at Whitland, which is built of Ordovician sandstone with Bath Stone dressings. However, the main purpose of this visit was to look at the history of this site prior to the construction of the Victorian church. There is a theory that the Llan in which the church stands could be the site of Hywel Dda's administrative centre. This was the subject of an article by John Davies in *Newsletter Number 7, 2010,* so I would refer the reader to that article rather than repeating it here.

Fig 5. Quarr Stone being examined by Tim Palmer and Jana Horak.

Following a short but informative visit to the Hywel Dda Centre in Whitland we set off for the Kidwelly Tin Plate Museum where excavated stone from Whitland Abbey is stored on pallets for safe keeping. This site was first excavated in 1836 and then again more extensively in the 1920s. During the 1990s work was undertaken by the Dyfed Archaeological Trust to present the site and the stone which came from the re-excavation of the trenches was stored at the Tin Plate Museum.

Most of the dressed stone used at Whitland is Dundry Stone. However, we were shown a large fossil ammonite [Fig 4] that came from the excavation and, following inspection, Tim Palmer thought that the stone in which it was contained was probably Chilmark Stone, an Upper Jurassic (Portlandian) limestone used in the construction of Salisbury Cathedral. It was anybody's guess how that got there. Another find from the re-excavations was a stone that was possibly Quarr Stone, a stone from the Oligocene, Bembridge Limestone Formation from the Isle of White [Fig 5]. It was this stone that was used in the upper sections of the White Tower at the Tower of London. Following a long day that probably posed more questions than answers the meeting finished and we went our separate ways at 4.15 pm.

Welsh Stone Forum AGM; Caerphilly Castle 17th April 2010

John Shipton

For the 2010 Forum AGM we were guests of Cadw at Caerphilly Castle. The meeting was held in what was until recently called the Constables Chamber, now thought to be a grand chamber built specifically for a royal guest, on the 2nd floor of the inner East Gatehouse. The gatehouse has recently undergone a major programme of conservation work allowing this chamber to be reopened to the public for the first time in over one hundred years.

Following the AGM formalities Rick Turner, a Cadw Inspector of Ancient Monuments, gave an excellent talk on the background and history of Caerphilly Castle. This gave an insight into the people and the politics involved with the castle from the beginning of its construction by the Lord of Glamorgan, Gilbert de

Clare, in 1268 right up to the early C20th work carried out by the Marquis of Bute. The talk illustrated the materials used in the construction of the castle and the difficulties in obtaining them.

Following the talk Rick led a tour of the castle beginning on the gatehouse roof [Fig 1]. This gives a good view of the approaches to the castle and Rick explained that the original castle entrance would have been through the south gate, situated opposite Tesco's on the town side. Such proximity to a 'supply' store would have proved useful in times of siege in the C13th had Tesco's been there at the time! The current main castle entrance, through the east gate, would have been the approach from Newport while the west gate would have been access to the hunting grounds between the castle and Senghennydd.

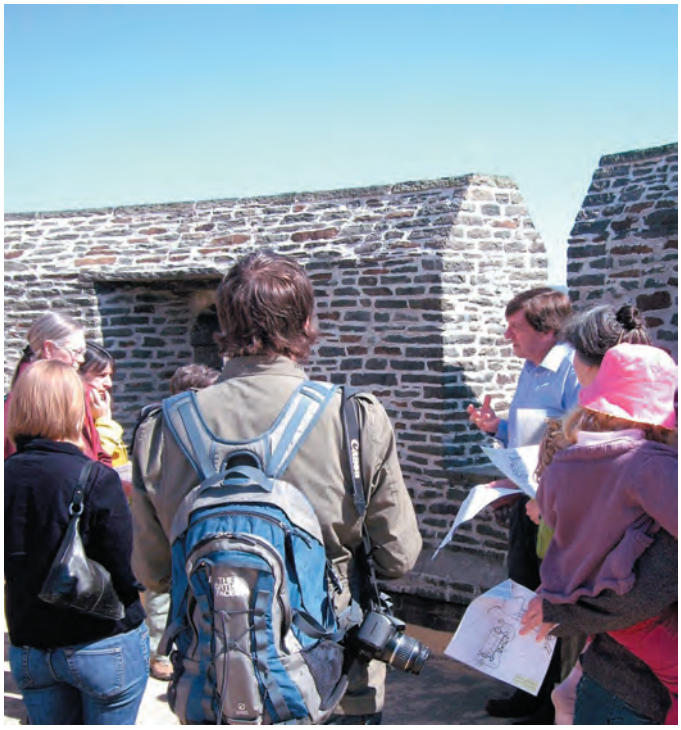

Fig 1. The group on the gatehouse roof.

During the tour of the Castle Rick indicated some of the work carried out by Cadw's craft teams over the past decade. Passing through the much altered Great Hall, Rick explained that the first build would have been a simple box-like structure but, during the C14th, apartments were added, walls and floors were raised and windows altered. The Marquis of Bute carried out major works early in the C20th, including the new roof, but the rather incongruous Bath Stone windows and outer wall cladding was carried out by Cadw's predecessors following pressure from the local community in 1970.

Fig 2. The west gate

The tour highlighted the fact that the different phases of work at the castle could be distinguished by the masonry used. The early work, whilst the castle was under attack from Llewelyn ap Gruffudd, used local sandstone, possibly hastily gathered. In later, more peaceful times, materials from greater distances were used, as indicated by the use of Sutton Stone from near Bridgend in some of the remaining dressings. It was noted that the Blue Pennant Sandstone used to build the C14th kitchen, between the inner east gate and the Great Hall, was of a better quality than that used in the earlier work. The blocks were larger with

Fig 3. Alan Cornish demonstrating masonary skills.

a deeper bed and were similar to the stone used in the C14th century alterations to the Great Hall windows. The work undertaken by the Marquis of Bute work is obvious because of the use of moulded concrete dressings and the cement mortar used as a binder.

Hardy members of the group made their way out through the west gate [Fig 2] to the back of the castle where Cadw's masons have their depot. There they were met by Alan Cornish, Cadw's Regional Foreman and extremely experienced Banker Mason. He gave a short talk and demonstration on how masonry was traditionally cut and carved using hand tools [Fig 3]. The group spent longer than expected here, some even trying their hand at swinging the mason's mallet, but apart from being interesting in its own right it acted as a counterpoint to an earlier Forum visit to Abbey Masonry's works at Cross Hands. There, Anthony Kleinberg demonstrated modern masonry techniques, down loading dimensions onto a computer and cutting masonry with a CNC machine.

So ended another interesting and informative visit. Our thanks went out to Rick Turner and Alan Cornish for generously giving up their time at the weekend and also to Cadw's site operations staff for facilitating the event.

Forest of Dean, 15th May 2010

John Shipton

May's field excursion was based around Mitcheldean in the Forest of Dean and members met on a sunny morning at the Wilderness Quarry, east of Mitcheldean, Gloucestershire. Here, Devonian, Old Red Sandstone from the St Maughan's Group is quarried and sold as Red Wilderness Stone. It is a good freestone, being able to be cut in all three dimensions without loosing strength. Jana Horak laid out the maps and explained the geology of the Forest of Dean.

Fig 1. John Davies, Wilderness Quarry.

John Davies explained how some of the stone varied in colour, quite dramatically changing from deep red to pale grey [Fig.1]. This is due to minor changes in the depositional environment of the iron content. The mica was deposited in layers while the oxidisation of iron, in both the Fe^{2+} and Fe^{3+} form, were affected by the flow of water through the sediments.

Eric Robinson described how stone from the quarry had been used in a new bank building in London. He explained that the Maplin Webb building, part of the Mansion House, was demolished in the late 1970s and a new bank built on the site in the early 1980s. This used bands of red Old Red Sandstone from the Wilderness Quarry along with an Australian Cretaceous stone to create a banded detail. More information can be obtained from Eric's book '*London Illustrated Geological Walks*'.

Fig 2. Mud clasts in Old Red Sandstone.

Examination of the beds in the quarry showed that the beds of stone started off gritty and course at the bottom and fined upwards through the bed. John and Jana explained how these rocks had been deposited in channels on a muddy flood plain where flowing water would rip up the channel bed and re-deposit the material further along the channel. The heaviest particles would fall out of suspension first, creating course gritty layers at the bottom, and then fine upwards into a muddy layer. This process would repeat itself over and over again. Inspecting the large blocks of stone in the quarry we found some with ripples on the underside, further evidence of the action of running water. Much of the stone left lying in blocks was useless as dimensional stone due to the

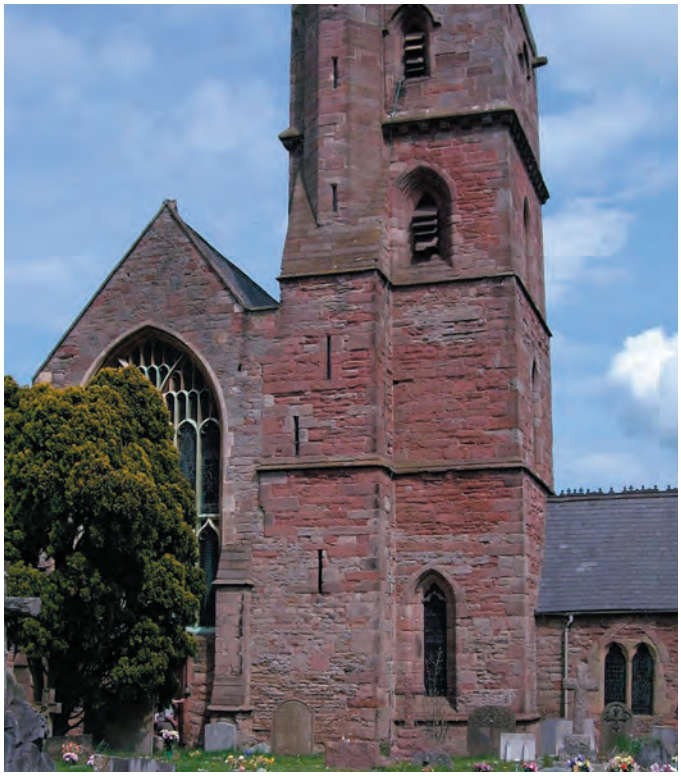

Fig 3. St Michael and all Angles, Mitcheldean

inclusion of mudstone clasts [Fig 2] and mud-filled burrows. At the top of the quarry the beds became very flaggy.

Concluding our visit to the quarry we took lunch in the churchyard of St Michael and all Angels in Mitcheldean. A post lunch inspection of the churchyard revealed gravestones fashioned from local sandstones both Devonian, Old Red Sandstones and Carboniferous, Pennant Sandstone. A pale limestone similar to Hopton Wood from Derbyshire was found, which was thought to be Nabrasina, a limestone from Italy. There were also monuments cut from Peterhead Granite and various exotics.

Fig 4. Unknown yellow sandstone in the porch at St. Michael's church.

The church building [Fig 3] has undergone many changes over the years. The current building was started in the C14th and much altered and extended in the C15th. The stone used during the Medieval construction phases was mostly Old Red Sandstone from the Tintern and the Mitcheldean areas, but Carboniferous Limestone had also been used. Extensive restoration took place in the C19th which included the fitting of new Bath Stone windows. Inside the church we found carvings in Carrara Marble while a yellow sandstone of unknown origin was spotted in the porch [Fig 4]. This might have been Sudbrook Sandstone but could have been Tintern Sandstone as there are some yellowish local outcrops in the Tintern area. However, its provenance could not be confirmed.

On the way back to the car park we looked at the building stones of a number of buildings. The old Post Office is built mainly of Old Red Sandstone in coursed rubble like many of the early buildings in Mitcheldean. Across the road the modern local library is built in cast concrete blocks sympathetically coloured to match the Old Red Sandstone. However, the window details, lintels and cills were failing due to lack of cover over the steel reinforcement. It might have originally been a cheaper option than natural stone but it will all need to be repaired very soon, a disappointing note to end what was another successful trip.

Grinshill Stone: Shrewsbury & Wem areas, June 12th & 13th

Judi Loach & Jana Horák

The two day field event for 2010 focussed on the geology and use of Grinshill Stone from northern Shropshire. The trip was lead by Graham Lott (Geology) and Judi Loach (Architecture). The Forum has viewed several examples of the use of Grinshill Sandstone in previous excursions and this event provided the opportunity to see the source of the stone and its use over several hundred years. In addition

to the usual Forum members who attended we were joined by conservation architects from Arrol & Snell Ltd, which significantly enriched the discussion and contributed to the success of the event.

This introduction and geological section is prepared from the written information provided by Graham Lott for the first part of the trip and from the excellent work on Grinshill by David Thompson (Thompson, 1995). The Forum holds a copy of this work which is available on loan to members.

Historically the ground between Clive and Grinshill in northern Shropshire was a region of intensive quarrying. An area of less than 0.75km^2 provides evidence of activity of at least 30 quarries (Thompson, 1995). Today only the Grinshill Stone Quarry [SJ 525 238] is operational.

The quarries expose a Triassic succession, approximately 240 million years old, comprising, from top to base:-

- Red siltstone and mudstone known as 'fee' of the Bollin Mudstone Formation of the Mercia Mudstone Group (Middle & Upper Triassic). This is the overburden to the quarry.
- 7-9m Grinshill Flagstones of the Tarporly Formation (Middle Triassic). These are whitish flagstones and contain films of green clay causing the sandstones to part easily. They show current ripples, wave ripples, desiccation cracks and replaced salt-crystals, all of which record the involvement of water, if ephemeral, in their deposition.
- White Grinshill Sandstone belonging to either the Helsby Sandstone or Wilmslow Sandstone formations, of the Sherwood Sandstone Group (Lower Triassic).
- Red Grinshill Sandstone of the Wilmslow Sandstone Formation. Both the red and the white Grinshill Sandstones are wind-blown sediments deposited when what is now Britain lay 20° north of the equator.

The sequence dips gently to the east as a result of titling by tectonic processes. Locally the sequence is cut by much younger Palaeocene ('Tertiary') dolerite dykes. It is thought that the heating event linked to these dykes, drove hot fluids through the rock and imparted qualities to the sandstones and flagstone that resulted in sandstones suitable for use as a durable building stone.

Graham Lott outlined the properties that contribute to Grinshill Sandstone as a desirable building stone. These are essentially colour, durability and resilience to weathering. The colour variation in the sandstone is produced by an original film of hematite (iron oxide) which was deposited around each grain under arid conditions. This is preserved in the red sandstones but has been removed, probably by the fluids driven by the igneous intrusion mentioned previously, to produce the white sandstone. Variations on the white variety of stone (e.g. pink-tinged, buff, brown and yellowish shades) result from the partial removal of the iron or re-deposition of it as hydrous oxides.

The composition of Grinshill Sandstone is dominated by quartz (c.70%), with minor components of feldspar (c. 10%), rock fragments (c. 9%) and clay minerals. These grains are cemented together by a secondary growth of quartz and feldspar. Importantly the cement does not contain any calcium carbonate as this provides a 'weak link' in the rock when dissolved by acid rainwater, resulting in deterioration of the stone. The overprint of quartz and feldspar is less in the red sandstone and consequently this is not such a durable stone. The structure of the rock also imparts a favourable porosity of around 25%. This allows water-bearing salts to pass through the rock, or evaporate, reducing damage. A final property of the sandstone is that it is relatively soft when extracted, but harden as the water in the stone 'quarry sap' moves to the surface and deposits a thin layer of silica.

The Quarries

The group first visited a small quarry to the north of Grinshill village, informally known as Grinshill

Fig 1. Graham Lott explaining the geology at Grinshill Village Quarry, in front of exposures of red Grinshill Sandstone.

Fig 2. Bridge Quarry showing numerous tool marks in the sandstone. Note also the variation in colour of the sandstone produced by removal of iron.

Village Quarry [c. SJ 521 236] which worked red Grinshill Sandstone. The quarry is known to have been active prior to 1835 and probably supplied the stone for the walls around the village.

The group then proceeded through the woods to the Bridge Quarries [c. SJ 524 239], so-called as they supplied the stone for numerous bridges during the C18th, in addition to many buildings from the late C16th – early C19th. By the early C19th these quarries had passed into the ownership of the influential Corbet family.

The base of the quarry face inspected displays buff-white Grinshill Sandstone showing evidence of large scale cross-bedding, indicative of deposition by dunes systems. These are overlain by more thinly bedded flagstones of the Tarporly Siltstone Formation, which in turn are overlain by 2m of red mudstone. To the east side of this quarry is a second, inaccessible quarry which is at least 30m wide and 50m deep (Thompson, 1995) and was partially worked by 1835 when the estate maps were drawn up.

This quarry also shows evidence of how the stone was won. Rather than extracting blocks by a more traditional plug and feathers method the stone was worked by a process of channelling and guttering. This involved cutting channels, approximately 20 cm wide, around the block to be extracted with a double headed pick. The block was then 'wedged off' the bed and transported away. This process is recorded today by a myriad of pick marks preserved on the quarry face [Fig 2].

How the stone was used

On Saturday afternoon we began at Moreton Corbet Castle, now one of the most striking ruins in England, and thus in an ideal state for analysis, as we had walls ready sectioned for us! The mediaeval castle (built about 1200) was inherited about 1239 by the Corbets, who own the site to this day. They also owned the Grinshill quarries, which therefore provided the stone for all their constructions. In the 1560s-80s Sir Andrew Corbet, Vice-President of the Council of the Marches (and three times High Sheriff, for three different monarchs), and then his son Robert, 'domesticated' the castle (Elain Harwood, English Heritage), mainly by adding an Elizabethan mansion worthy of the family's position with (according to the latest edition of the Shropshire 'Pevsner'), '*one of the earliest large-scale displays of the classical orders to survive in England'*. Such avant garde and high quality work was due to Robert's exceptional architectural ambition and continental connections (he travelled widely in Italy and as far afield as Bohemia, and then lived as an envoy in Antwerp); but it was also facilitated by the family's ready access to Grinshill's freestone, which made high quality carving possible.

It has been claimed, rather romantically, that the Elizabethan build was never finished and that the house was burned down and left in its present ruinous state after it was taken by Parliamentary forces in 1644, but the truth is more prosaic. Robert

Fig 3. Morton Corbet Castle, thin pink Grinshill Sandstone facing with rubble stone behind.

deliberately demolished part of the mediaeval work, and even some of his father's work, so as to rebuild it in a more modern style, but then died (of plague) in 1583, leaving some historians to suppose that he left it 'ruinous' on purpose. However, recent research by English Heritage concludes that Robert's house was actually completed, together with formal gardens, and that it was inhabited by a nephew, Sir Vincent Corbet, c.1606-23, who had previously built his own house at nearby Acton Reynald, and then by his son. Although the castle was captured in the Civil War, it was probably little damaged at this time. Instead, in the C18th, the family preferred the Acton Reynald house and quietly abandoned Moreton Corbet (hence, no signs of fire damage), which became at least partly roofless by the 1730s. Ironically, the Acton Reynald house was largely remodelled in the C19th, by John and then Edward Haycock (father and son), probably the C19th architects, making most use of Grinshill Stone in Shrewsbury, presumably because they had preferential access to the Corbets' quarry.

The mediaeval castle is largely built of pink Grinshill Stone, carefully coursed as an outer layer, with rubble masonry behind as one would expect for this period [Fig 3]. The finer elements, such as pilasters with foliate capitals, are in grey Grinshill and the gatehouse is also in grey Grinshill, this time ashlar faced, suggesting that this might be part of a late mediaeval (c.1400?) build. Some interior features, from their style and inscribed date or initials, appear to comprise the Elizabethan modernisation of the mediaeval fabric, and seem to be simply added to it.

Fig 4. Morton Corbet Castle. Elizabethan outer skin of Grinshill stone with load-bearing brick structure behind.

The Elizabethan build provoked more interest as here the socially ambitious Corbets, while creating one of the most up-to-date exteriors in the land, with finely carved ornamentation, only used Grinshill Stone for a relatively thin outer skin (the main load-bearing structure being provided by brick) [Fig 4] and as the freestone for the carved elements, despite owning the quarry. The delicacy of the decorative carving demonstrates Grinshill's high quality as a freestone. However, it exhibits differential weathering, which is probably linked to orientation.

Fig 5. Gargantuan buttresses, St Andrew, Stanton-upon-Hine Heath.

From here we then moved into the adjoining churchyard, where several tombs and gravestones again demonstrate Grinshill's quality as freestone. The church itself (St Bartholomew's) is entirely of Grinshill, the lower (and earliest i.e. C12th or C13th) sections being in coursed pink, but most are fine grey ashlar with somewhat oversized corner buttresses that should have given us a hint as to what was to come! Inside two C16th chest tombs for the Corbets seem to indicate the family's seemingly indiscriminate attitude to the stone from their own quarry, in that the carefully carved figures are rather gaudily over-painted (and although the current paint is quite recent, it seems likely that they were originally painted, and probably as garishly!). This building, having been regularly extended and updated into the early C20th,is almost as complex as the Castle.

The next stop was St Andrew's [Fig 5] in the nearby village of Stanton-upon-Hine-Heath. This is a village almost entirely built in local red brick, reflecting the local availability of clay within the Cheshire/north Shropshire basin and suggesting why Moreton

Corbet used this material so extensively. After recovering from the shock of the tower's gargantuan corner buttresses, the biggest anyone present had ever seen, we inspected the exterior in a mixture of pink and grey Grinshill, the earlier parts (Early Norman) coursed and the later ones (NB the upper storeys of the tower) ashlar. Because the buttresses are ashlar and more grey, it was concluded that they had probably been added following movement in the tower (and given the difference in stone, presumably after the late medieval addition of its final storey) but their scale implies that whoever did so was rather excessively terrified!

The south elevation stimulated much discussion. It seemed of a different build (more of a mixture of pink and white sandstones) with windows altered later still. The doorway was simple Norman style but the windows were late mediaeval (Perpendicular style, like the top storey of the tower, but with much C19th restoration). Most odd was the central section

Fig 6. St Andrew, Stanton-upon-Hine Heath. Close up of patchwork white and red Grinshill Sandstone in buttress.

(eastern half of nave) [Fig 6], as this stood proud and was in finer ashlar but more patchwork-like in its use of pink and white stone, which continued into rather haphazardly stripy windows! Inside we discovered that this was due to the south aisle being in-filled (no published source seems prepared to suggest when, but onsite inspection suggests that the C19th restoration is the most likely cause). The way in which this section alone stood so proud of the rest of the south façade remained a bit puzzling, as did the 'patchwork' character,. Had it not been such fine ashlar one might suspect that it had been intended to be rendered (perhaps this indicates a local taste for such contrasting masonary).

Fig 7. St Mary's church, Shawbury. Buttress with part of a reused or unfinished gravestone.

The final stop for most members was St Mary's Church, Shawbury, another Grinshill Stone build begun in the Norman period (with chunky doorways, at least one of which had been reset later) in coarsed, mainly pink stone, but with later additions, notably a later mediaeval tower of fine ashlar in grey sandstone. Again, it was the south elevation that supplied puzzles, this time in one of the buttresses. All of these are grey ashlar and had later additions, presumably a response to walls tipping out under the weight of the rather large stone-flagged roof. At first sight one of these [Fig 7] seemed to be a reused gravestone, but the depth of the stone seemed too great for this. Suggestions please!

On Sunday morning a rather smaller group (re)convened at the large chantry chapel built for Harry Hotspur and over 1,500 others killed at the Battle of Shrewsbury (1403), at St Mary's Battlefield [Fig 8]. Armed with a large key collected from the

Fig 8. St Mary Magdalene, Battlefield. Eroded patches of stonework, view north.

nearby farm shop (highly recommended for picnic provisions, and more) we first inspected the interior, much of which dates from Pountney Smith's, albeit sympathetic, 1860s restoration (largely paid for by a Corbet, so presumably with easy access to the Grinshill quarries); nevertheless it was already evident that the prestige of this commission had allowed an even higher quality of stone (grey Grinshill all used as ashlar) and workmanship than in the previous day's churches. Various features, notably the gargoyles, demonstrated Grinshill's potential as a sculptural freestone but also displayed a surprising degree

Fig 9. Gargoyle, St Mary Magdalene

of erosion [Fig 9]. Various patches in the exterior stood out as being particularly eroded [Fig 8] and much discussion ensued as to why some parts were worse than others, as neither date nor orientation seemed to supply an answer; personally I think the

Fig 10. Grinshill stone , St Mary Magdalene, Battlefield.

Fig 11. English Bridge, Shrewsbury.

sporadic presence of cement mortar can provide the explanation. Having found the church in a fairly ruinous state in c.1860 Pountney Smith completely renewed the frieze, battlements and pinnacles around the top of the walls, and despite these being the most exposed elements they show no sign of serious erosion [Fig 10] ... nor of cement mortar! From here we forayed forth to Shrewsbury where a glance at the bright red Abbey, opposite the car park, made clear that here Grinshill was competing with another more local, and less resistant sandstone. Our first, brief, halt was on the English Bridge (John Gwynne, 1769-74), offering a splendid example of archetypical (grey) Grinshill Stone [Fig 11]. From here we looked across

Fig 12. Old Royal Salop Infirmary, now the Parade Shopping Centre, with flats above.

the Severn and up to the old Royal Salop Infirmary, the first of several fine early C19th civic buildings in grey Grinshill ashlar designed by our Treasurer's namesake, Edward Haycock (1827-30). These have now been converted to the Parade Shopping Centre, with flats above by Arrol & Snell, (1980-83) [Fig 12].

Our first main stop was St Chad's (George Steuart, 1790-92), after passing another Haycock designed building - the old County Savings Bank (1838-9, now flats) and John Haycock's old Allatt's School (1799-1800, now offices) – all in equally fine grey Grinshill ashlar. This was evidently responsible for

Fig 13. Internal wall of the Old Market Hall showing the use of local red sandstone.

setting the tone of late Georgian Shrewsbury. St Chad's probably offers the finest example of Georgian usage of Grinshill Stone, and – given our discoveries during the weekend – we would have liked to know whether the stone was used here too just as facing material, and if so what else was being used. Here, however, the building is in too good a state of preservation to enable us to see what lies beneath the interior's plaster, but the fact that the interior is entirely plastered may imply that it covers something less presentable than ashlar Grinshill; and since the church stands immediately opposite the Quarry, the town park named after the quarry for red sandstone from which much of the town is built (including the

Fig 14. Old Shrewsbury School.

now-ruined Old St Chad's, by the County Savings Bank), it seems most likely that this may be the material immediately behind the plaster.

Passing by another Haycock building in grey Grinshill ashlar (the Music Hall, 1838-40), we arrived at the Old Market Hall (1595-96; converted to an arts cinema and cafe by Arrol & Snell, 2004), where our picnic lunch helped us inspect the exterior. This is of high quality, seemingly load-bearing ashlar masonry in grey Grinshill, with some finely carved ornaments. Inside the sofas – and homemade cake – aided inspection, as did the information from members of the Arrol & Snell practice given the previous day. We looked out for patches where the render was missing, as here the use of poorer quality local red sandstone (probably out of the Quarry only a couple of hundred

Fig 15. Internal wall of Old Shrewsbury School showing construction from rough coursed local stone.

yards away) was evident [Fig 13]. Here, Grinshill had only been used as a facing stone, even in such a prestigious municipal building of this date.

Our next stop, Old Shrewsbury School (1595-1630, now Shrewsbury Library) with alterations by Edward Haycock (1815) [Fig 14] provided a useful comparison as, although much larger than the Market Hall, is almost exactly contemporary and was commissioned by the same client. We therefore suspected that here too the fine ashlar exterior might be less solid than it appeared, and might again be a facing to a structure largely built of cheaper local

Fig 16. St Mary's Church, Shrewsbury, with contrasting stone in the walling and arcade.

sandstone, despite its somewhat superior decorative carving. Our internal inspection (this time venturing down the stairs into the basement!) bore this out [Fig 15] .

Finally, we arrived at St Mary's Church (Late Norman through to late C13th), supposedly of grey Grinshill outside although with a C19th tower in red sandstone, replacing that which had fallen into, and largely destroyed, the nave. This is now the most prestigious church in the town centre, albeit due in part to the outstanding collection of continental mediaeval stained glass (a C19th vicar here was an ardent collector!) and rather wonderful angel roof (part of the C19th repairs), which even the most devoted geologists could hardly ignore! However, its exterior is getting on for 'Elmer the elephant' style, i.e. patchwork quilt in stone, which made us wonder whether it had originally been rendered. Before we could decide on this John fatally stated 'Well, we could spend all day working this out' ... at which ye heavens opened dramatically and we all sped inside, intending to look at the exterior 'when it cleared up' ... which it did not!

Fig 17. Example of moulded plasterwork, St Mary's Church, Shrewsbury

Inside the quality of the grey Grinshill Stone used for the arcade contrasts rather dramatically with the external wall, which is as random inside as it was out [Fig 16]. Part of the wall is still covered with plasterwork imprinted with a mould (think wallpaper in plaster) [Fig 17]. The warden (rather knowledgeable, as this is in the care of Churches Conservation Trust) claimed that it had always been like this, and while the current plaster looked to me like C19th restoration. I think it possible that it had always been plastered over since the stone beneath is such a 'dog's dinner' that it hardly matches the standing of this church. It therefore seems likely that this walling stone might at least in part come from the same source as the internal stone used in the Market Hall and Old Shrewsbury School, i.e. the nearby Quarry. This suggests that further research into patronage of individual buildings could be revealing, as it is striking that this major parish church (the largest in town at the time of erection) had less ready access to the higher quality stone of the Grinshill quarries than did the civic buildings of Market Hall and School later on.

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Brecon Beacons National Park 10th July 2010

John Shipton

During 2008/9 John Davies and Jana Horak undertook a survey of the main lithologies of the Old Red Sandstone that are used as building stone within the Beacon Beacons National Park. This field trip, to the western end of the Park, enabled members to view some of the stone varieties and their use as building materials.

We met at the Common near the Sawdde Bridge, Llangadog. John described the local geology pointing out the Coed Sion Quarry, which boasts the only lava flow in Carmarthenshire, and the Silurian

Fig 1. Jana & John at the Millennium Rock

beds that dip away to the south. He described how the stone recorded in their survey varied in colour from maroon to grey. There was a very large housing stock in the area built from this local stone and yet there is currently very little commercial quarrying in the Park. Because we were close to the Coalfield a large variety of stone was represented in the local buildings. This was also evident from the pebbles and larger cobbles that were lying in the bed of the Sawdde River; coarse grits and quartz sandstones from the Namurian, pebbly Brownstones from the Old Red Sandstone and Carboniferous Limestones were in abundance. In the Sawdde the stone used locally for building is mainly cobbles out of the Drift.

Fig 2. Farmhouse of Sawdde cobbles.

Climbing out of the river bed we looked at the new bridge spanning the river, which was thought that was built from stone from the Black Cock Formation of Silurian, Ludlow age but we could not establish the source of the course sandstone that had been used to make the copings.

Leaving the river, members found a number of large pieces of stone lining the road, the majority of which were conglomerate, some showing where calcrete inclusions had weathered out. However, two stones were different. One, the Millennium Rock [Fig 1], was thought to be Namurian, Basal Grit; the other an Old Red Sandstone with a plaque commemorating the 125th anniversary of a horse race first ran at Llangadog in 1884.

Fig 3. Qwar Glas Quarry

Nearby a farm house had been well built using stone cobbles from the Sawdde, the fronts of which had been dressed-off to create a relatively flat surface [Fig 2]. The dressings and quoins were of a Jurassic limestone which Tim Palmer later identified as Bath Stone. Out buildings at the rear were also built using the local cobbles. However, the barn had quoins that may have come from the Black Cock Formation and a later extension, possibly a garage, had red brick

Fig 4. The porch of St Cadog's church

quoins. To the west of the farm house was a small octagonal building, possibly a 'Ty bach', which was also built from cobbles but on this occasions the quoins had been cut from a Carboniferous limestone showing good examples of fossilised corals.

The next stop was Qwar Glas Quarry [Fig 3] where stone from the Black Cock Formation (Ludlow) had been worked. This stone is slightly calcareous and is ideal for building because of its regular jointing. Between the individual beds shells, that had been transported by tidal currents, formed the base of the beds but had often dissolved out to leave layers of shell debris. The Trichrug Beds also outcrop in the quarry but, having no regular jointing, they are not good for building. Above these lie the Tilestones. These are used for roofing and their outcrop extends from Paxton's Tower in the west to Builth Wells in the east.

Across the road from the quarry was a dwelling that had once been the Three Horseshoes public house. It had been built of stone from the Black Cock Formation, probably from the adjacent quarry. Unlike the front elevation of the building, the pine end fronting the road had been 'rough cast'. However, this had recently been removed and the exposed surface sand blasted. It is unlikely that the rough cast had been applied for decorative reasons and the current occupants of this rather nice building may soon find that they have a damp problem. Leaving this 'ex' pub we moved on to an active pub, the Red Lion at Llangadog where we had an excellent lunch.

After lunch, led by Vince Quatermaine, we set off to view the stone used in the buildings of Llangadog. The Red Lion was well built in stone from the Black Cock Formation and had fine lime mortar joints. The threshold was a dark Carboniferous limestone exhibiting a nice fossil orthocone. Reaching the Church of St Cadog we found the perimeter wall was built of a Namurian, Basal Grit, which probably came from the top of the Black Mountain. The piers and coping were of Carboniferous Limestone. The medieval Church of St Cadog has been much altered over the years and I understand that it was almost totally rebuilt at the end of the C19th. The porch, which may well have been added at that time, was built using stone from the Sawdde and Box Ground Bath Stone dressings [Fig 4].

The last visit of the day was to the medieval Church of St Michael at Myddfai [Fig 5]. It is thought that the church building was built in two stages; the south nave and chancel in the C13th and C14th and the north aisle added later in the C15th. Two major phases of restoration have taken place. The first, between 1868 and 1880, included the addition of two new windows to the west wall and the second, in 1926,

Fig 5. Myddfai Church

when the Vestry was re-roofed. The main building material was sandstone from the Silurian, Wenlock Formation, with the quoin stones and other dressings to windows and doors of pebbly Brownstones. Inside the church the columns and arches were also of pebbly Brownstones. Over the years successive repair work has seen other stone dressings added and

you can now see Carboniferous, Pennant Sandstone window mullions and Bath Stone dressings. In the north wall of the vestry, there are recent window replacements in a red sandstone, probably of Triassic age, which might possibly be Hollington Stone from the Midlands.

Leaving the church at the end of another informative excursion John Davies pointed out the Pennant Sandstone paving slabs in the new path that had been laid up to the church, the ripples on the underside of the beds clear for all to see.

Sudbrook Sandstone and its use in Roman and Medieval buildings

John Shipton

Members of the Geologist Association South Wales Group joined Forum members on 18th September for the last field trip of 2010. The aim was to look at outcrops of the Sudbrook Sandstone, a local freestone, and its use in buildings in the area between the lower Usk and lower Wye rivers. Beginning in the car park of the Roman City of Caerwent, Jana Horák [National Museum Wales] began the day by explaining the geology of the Sudbrook Sandstone and the following is a quote taken directly from her hand out:

Sudbrook Sandstone has a limited distribution. It forms a discontinuous horizon above the Dolomitic Conglomerate, low within the Mercian Mudstone Group of the Triassic succession of south Wales. It was deposited as fluvial sandstone in seasonal braided streams within an undulating Carboniferous land surface.

In the coastal outcrop the sandstone is seen to consist of cross-bedded course pebbly sandstone, which contains partially dolomitized fossils, limestone and dolostone fragments. The rock is dominated by quartz grains (typically monocrystalline) with minor feldspar and pebbles of polycrystalline quartz, cemented by calcite and secondary ferroan dolomite. The medium to fine grained sandstones show parallel laminations and decrease in grain size upwards. These are inter-bedded with a minor component of red mudstone. The finer-grained sandstones contain well sorted monocrystalline quartz grains cemented by calcite and ferroan dolomite. In hand specimen the sandstone ranges from yellow to pink and yellow orange (Munsell colours 2.5Y8/3 – 2.5Y8/6 10YR7/4-6). Although it is widely referred to as the Sudbrook Stone it has no formal stratigraphic status.

Fig 1. John Davies talking at the Basilica, Tim in serious exmination of the geology.

The most comprehensive discussion of the use of this lithology as a building stone is provided by J R L Allen (2005).

From the car park we walked to the site of the Forum basilica [Fig 1], which had been excavated during the 1990s and opened to the public following conservation and safety work by Cadw. Here large blocks of Sudbrook Sandstone had been cut for column bases, steps, box drains and drain covers. It was explained that it is the calcite cement in the stone that bonds the laminations together that makes it a good freestone. However, the calcite cement does not make the stone resilient to weathering. Where the sandstone had weathered away totally, or had been 'robbed', some replacement had taken place for safety reasons, for example in steps or drain covers. These replacements were of Carboniferous sandstone from Yorkshire chosen because of its availability and its visual compatibility with the Sudbrook Sandstone.

The upstanding walls of the Basilica were generally built of blocks of Carboniferous Limestone but there were also some pieces of Old Red Sandstone. John Davies explained that Carboniferous Limestone outcropped to the south of Caerwent and Old Red Sandstone to the north.

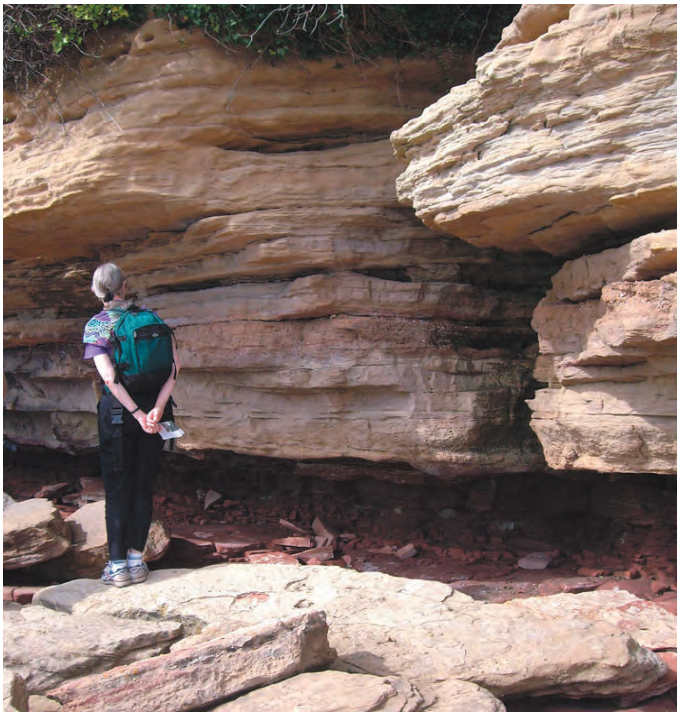

Fig 2. Sudbrook Sandstone, Sudbrook Point.

At the foot of the steps to the Basilica the Forum had been paved with Old Red Sandstone slabs. I explained that during the excavation of this area in the 1990s a fragile surface of Old Red Sandstone slabs was uncovered. This was thought to be of Roman origin, and it was decided to recover the area with a protective layer finishing with new Old Red Sandstone paving. This new paving was obtained from 'delphs' on the Welsh border between Abergavenny and Pontrilas. John and Jana explained that 'delph' was an ancient word for a small quarry, possibly coming from the Anglo Saxon 'delfan' to dig. This term was used in preference to quarry as the latter has connotations of large scale extraction. These 'delphs' are the result of local farmers diversifying their activities by carrying out small scale quarrying operations on their land. These often consist of no more than a large depression in the field where stone slabs or roofing tiles were won, possibly using a JCB or even hand tools.

There was much to see at Caerwent but we had a busy day ahead of us and the next stop was Sudbrook Point [ST 504 876] to view the outcrops of Sudbrook Sandstone [Fig 2]. Parking north of the large Iron Age fort we made our way to the Point where massive blocks of Sudbrook Sandstone littered the foreshore. These beds range eastwards as far as the 'English Stones' in the channel and at Sudbrook Point sit directly on top of soft Mercia Mudstones. Picking our way carefully between the large fallen slabs it was clear where the soft, red Mercia Mudstones had washed away undermining the beds of sandstone causing them to collapse onto the foreshore. Making our way back to the vehicles a number of large pieces of grey Carboniferous sandstone were spotted north east of the Sudbrook Point outcrop. However, no explanation was available as to how they got there.

After lunch we visited St Mary's Church at Caldicot [ST 483 886]. This church, built in the early C12th and extended in the C14th and C15th, sits on the site of an earlier church. The late medieval south porch was faced with Dundry Stone limestone ashlars [Fig 3] but later repairs had been carried out using Bath Stone with Sudbrook Sandstone being used for the sides. Inside the porch there were fine heads carved in Dundry Stone.

The west front was built mostly of Carboniferous Limestone but some blocks of Sudbrook Sandstone and Old Red Sandstone were also visible. The whole had been previously rendered. The widow dressings were of Sudbrook Sandstone and it was thought that the dressings to the west door were of either Dundry Stone or Painswick Limestone. However, it was not possible to confirm this visually. A wide variety of different stone was present in the fabric of the church and we found that buttresses had been built with sandstone that was probably Pennant Sandstone (Carboniferous) from the Forest of Dean.

A short walk from the church brought us to our final stop of the day, Caldicot Castle [ST 486 884]. It is thought that the first masonry structure here

Fig 3. Dundry Stone, St Mary's Church.

Fig 4. Caldicot Catle

consisted of a round stone keep built around 1221, with subsequent work continuing at various times up to the end of the C14th. We assembled outside the imposing south gate, which along with the adjoining curtain wall, was built mostly of blocks of Sudbrook Sandstone.

There was some debate as to the origin of this stone due to the method of construction of the wall. Here some large blocks had been laid in courses above much smaller blocks, which is not an ideal method of construction. I would suggest that this stone would not normally have been used unless a previously unavailable deeper bed was quarried or if the stone had come from the demolition of existing structures and the stone was laid as it arrived on the carts. A similar style of construction can be observed at Beaumaris Castle. J R L Allen writes in his paper that the robbing of stone from the Roman site at Caerwent would not provide the volume required for the construction of Caldicot Castle and suggests a possible quarry site south west of Sudbrook Point as the source but this does not explain the unusual method of construction.

Moving anti-clockwise around the outside of the curtain walls the north east section is built in blocks of Carboniferous Limestone with Sudbrook Sandstone dressings, while the flat faced C14th north tower is built entirely from Sudbrook Sandstone, as is the curtain wall on the west elevation.

Current thinking suggests that the castle is built on an outcrop of Old Red Sandstone. However, examination of a small outcrop in the ditch below the west curtain wall proved to be of sandstone that closely resembles Sudbrook Sandstone rather than Old Red. Visual inspection failed to confirm that it was Sudbrook Sandstone but a sample was sent for analysis. If the results confirm that it is Sudbrook Sandstone then it would suggest that the castle was built on Sudbrook Stone and the ditch where we were walking was the quarry from which much of the castle was built.

Following a tour around the inside of the castle and a rejuvenating cup of tea John Davies wound up the final field trip of 2010.

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BUILDING STONE REPORTS

No.1 St Tanwg's Church, Llandanwg, Meirionydd, [SH 5728]

John Davies

This small church with a circular 'Llan' [enclosure] was the parish church of Harlech until a new church was constructed in 1841. It was rescued from being completely buried by sand dunes in 1884 and is dedicated to Saint Tanwg, who originated from Brittany in the early C6th, and had connections with St Cadfan [of Tywyn] and Ynys Enlli [Bardsey]. The two early medieval inscribed stones in the church suggest that the area was important in the post Roman period – although this may be misleading as in the C19th many such stones from the surrounding area were aggregated in the local church.

Lych-gate

This is a stout structure built of large cobbles, up to 0.50m diameter, derived from the local glacial deposits. Most of these are of Cambrian and Ordovician sediments and volcanics. The structure is devoid of dressed stone.

The Church

This is a simple rectangular building with a western bell-cott. The western half is considered to date from the C13th but the building was doubled in length in the C14th. The walls are built of rubble, consisting of large cobbles from the local glacial boulder-till. The slate roof is modern.

Fig 1. East window of St. Tanwg's Church, Llandanwg.

The east window is gothic although only the incomplete chamfered surround remains [Fig 1]. The hood mould is terminated on either side with two carved heads. The head on the south side is that of a crowned monarch, whilst the one on the north looks female. Both are very weathered. All dressings and carving is worked in yellow Egryn Freestone (see WSF Newsletters 1 and 4 for more details of this lithology) although two blocks of the windowsill remain in place.

The upper part of the gothic window shape was later filled in with round local cobbles and a rectangular 'Tudor' window inserted. The space below this was also blocked with rubble. The Tudor window is carved from pebbly Anglesey Grit which is lithologically similar to the east window of Beddgelert Priory, although this is of a much later style, and matches the coarse grits from the area of Y Foel and Penmon, Anglesey.

There is a small window in the north wall of the chancel. Although the dressings are very weathered, the stone is identifiable as Egryn Freestone. Once again this looks as if it was once part of a larger structure, since the jamb on the east side continues towards the ground.

The rest of the nave is devoid of dressings on the north and west sides and the door arch in the west front is formed by a simple fan arch of silty slates - probably courser beds of the local 'slates' of the Cambrian, Llanbedr Formation. The 1685 date stone above the western door may suggest the time of its construction. The bell-cott is built from locally derived blocks.

In the south wall, a small doorway, now partially blocked as a result of a higher ground level, also has a fan arch of local stone. The southern nave window has no dressings at all. The southern chancel window is constructed from deeply weathered, Egryn Freestone dressings on its western jamb, but has no dressings on the eastern jamb. There is another carved head in the left hood mould stop.

Discussion

A British history for this church would mean that it was certainly in use by the native dynasty of Gwynedd, and the use of Egryn Freestone is consistent with this. For most of the C13th, at least until 1283, this land was in the hands of Llywelyn the Great [1197-1240] and his cousins and their immediate descendants. Llywelyn the Great has left a significant record of building across much of Wales and his relatives and descendants used both Egryn Freestone [Cymer Abbey] and Anglesey Grit [Beddgelert Priory, Cricieth Castle] in their buildings.

Edward I had access to Egryn Freestone which he used to build Harlech Castle (started April 1283) and also Anglesey Grit, but only after 1283 when he defeated Dafydd III (grandson of Llywelyn the Great). Thus the C13th work, unless very late, must be attributable to Llywelyn the Great, or his cousins. Anglesey Grit appears to have been used almost as much as Egryn Freestone in the area until the C19th, when many of the Victorian re-built churches in the area started to have used Egryn Freestone again.

SHORT NOTES

Global Heritage Stone Project

Lead by Dr Barry Cooper (University of South Australia), the International Association of Engineering Geology and the Environment (IAEG) *Commission 10 – Building Stones and Ornamental Rocks* has proposed the development of a Global Heritage Stone Resource [GHSR] stone designation.

This aims to identify and document building stones of international importance with the aim of obtaining international recognition of natural stone resources that have achieved widespread utilisation in human culture. The GHSR designation will be independent of World Heritage status granted under the 1972 UNESCO Convention and will be separate from any other national or international designations or standards. The initiative has also gained support from the International Union of Geological Sciences (IUGS) and a paper in its journal *Episodes* outlines the details of the project (see http://www.globalheritagestone.org/home).

As part of a trial of how this might work, and to help develop the designation process, Terry Hughes and Graham Lott have produced a draft designation for Welsh Slate. This needs to be further developed and WSF members are invited to take part in this process. Contact terry@slareroof,co.uk initially. In a separate initiative a proposal is being prepared for the north Wales slate industry to be inscribed as a World Heritage Site.

http://www.culture.gov.uk/images/publications/WHAF_Slate_Industry_of_North_Wales.pdf.

New Production of Ornamental Stones from the U.K.

Jana Horák

Attractive native marbles have been widely used in many types of buildings throughout the British Isles, particularly in churches, country houses and other high status buildings. In 1885 Salter listed over 50 varieties of English and Irish marbles, many of which were derived from the Carboniferous Limestone. Those worked in Wales included Anglesey Marble and Mumbles Marble (from the Swansea area) [Austin, 1991]. However, by the latter part of the C19th the industry had declined. This has been variously attributed to increased competition from imports of cheap Italian marble from c.1880 onwards, increasing extraction costs, and change whereby the heavy, black ornamentation fashionable in mid to late Victorian times was no longer in vogue. Many marble quarries and works appear to have become disused around c.1900 (Dennison & Richardson, 2007).

More recently there has been resurgence in the demand for indigenous ornamental stone. To supply this market the newly formed company, Britannicus Stone Ltd, has been set up and aims to work between eight and ten of the most distinctive British Isles ornamental stones. The ethos of the company is to promote a wider understanding that ornamental stone extraction is very small scale, perhaps just 200 -500 tons a year. Although some of this might be used as building stone for local use and restoration projects the highest quality stone will be polished for ornamental use.

The founder and director, Orlando Boyne, and Chairman Roger Downing, have researched various options. Many of these are varieties of Carboniferous Limestone and to date two have been selected for production; a mid-brown crinodial limestone from Swaledale, and a limestone from Salterwath, Cumbria.

Wales has not been overlooked. Historically several limestones were exploited for ornamental purposes e.g. Penmon (or Anglesey) Marble, Dinorben Marble, and others were worked for more local markets. Britannicus Stone Ltd has identified three possible lithologies from Wales; red serpentine from northern Anglesey, and two Carboniferous Limestones from the south east of the island. At the time of writing plans have been made to develop the first of these, a mottled (partially dolomitised) grey limestone, a lithology that was used for the recent restoration work on Birmingham Town Hall. It is estimated that 200 tonnes will be extracted. A limestone equating to the Dinorben (black) Marble has also been identified and work is in progress to develop this. Finally, although the source of the red serpentine (Mona Marble, not to be confused with Anglesey Marble) has been identified, the resources and logistics of extraction will require further work before this stone is once again available. Developments in this field will be reported in future editions of the Newsletter.

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