

Chairman's Wanderings

My contemplation of Welsh geology was interrupted at Easter by my wife's quite unreasonable insistence on a holiday, and one with a difference.

It has long been an ambition of ours to travel through the Channel Tunnel on the Eurostar service, and we agreed on Brussels because neither of us fancied Paris, and my daughter had 'already been there and done that'. It came as a surprise to find some interesting geological resonances in this most unlikely location, in addition to the quite superb journey from one of Europe's finest railway stations.

First: The Channel Tunnel follows as its impermeable marker horizon the 'plenus' marl, named after the Lower Chalk belemnite *Actinocamax plenus*, which I saw in situ in quarries in Buckinghamshire while the tunnel was being built.

Second: The EU quarter of Brussels has been much enlarged as a consequence of the accession of new countries, and a great deal of it is faced or paved with superb and well-figured granites in many hues. That our money is being spent in this way is one thing, but I have an unquiet notion that much of this stone is not being sourced from within the EU. As yet I have no further information, but I hope to obtain an answer eventually. More will be heard on this topic elsewhere.

Third: Many of the buildings dating from the time of King Leopold are built in a dark-grey Carboniferous Limestone, meaning that there is always an interesting fossil or two to find lurking in almost any historical site you are visiting.

Around the Royal Palace there is also a pale, laminated and much bioturbated 'Jurassic' limestone to add contrast and lighten the austere atmosphere created by the larger, darker Carboniferous stone.

Fourth: Brussels Travelcards are complemented by 'free' admission to museums of the state, and are a bargain. I could not forgo a trip to the Natural History Museum which is on the edge of the EU quarter and very accessible from the hotel where we stayed. Many of you may know more than I did of the story concerning Gideon Mantell's spike on the nose of *Iguanodon*, which turned out to be its thumb. What I discovered was that the earliest complete skeleton of *Iguanodon* was one of 38 found in a Belgian coal mine in 1878, thus allowing the proper nasal morphology to be determined. So important were these fossils that they



were removed en-masse and some were prepared and articulated, despite terrible problems of oxidising pyrite with which they are endowed in abundance.

During the occupation of Belgium in the First World War the mines were reopened by the Germans so that they, too could have dinosaurs of their own, but it came to nothing.

Many of the dinosaur fossils are presented as found, still partly encased in the rock in which they were removed from the mine, in an intriguing multi-level display with glass walls and floors. Truly excellent, and a great diversion if you are fed up with trams, beer, pate and chocolate.

Unusually for the time of year we are celebrating the first field trip of the year - which coincided with the first rainfall for weeks, it seemed. There is a report inside.

Don't miss the talk by Jeremy Davies later this month. It is highly topical and a tribute to painstaking work by the group still working hard in the Welsh Basin long after it was closed by a funding-cut - sorry, I meant a continental collision. **Jonathan Wilkins**

The Carboniferous Limestone - Field Meeting at Anglesey Masonry and Moelfre. April 2009

The Association held a field meeting in this area many years ago, under the leadership of Tim Guy from Yale College who used that area for supervised student fieldwork, but at that time the focus was on the more northerly section of coast bordering Traeth Lligwy which included the controversial Devonian red-beds. This time, under the inexperienced leadership of the chairman, the itinerary was centred on the convenient coastal village of Moelfre which is well within the outcrop of the Dinantian limestones that dominate the coast of south-eastern Anglesey. The party numbered 14, which was an ideal size for such a trip.



Examining the collection of polished fossils at Anglesey Masonry

The morning session was spent at the quarry and workshop of Anglesey Masonry, where we were welcomed by Justin Kellett, stone mason and quarry manager. The quarry has been in existence since the seventeenth century and has fulfilled the local requirement for building stone until the advent of modern bricks and other materials. His family have operated the quarry for over a hundred years – although it has now expanded across the road due to exhaustion of the key resource on the north side, where the works are located and plant and finished materials are stored. In a climate where traditional stone-masonry is in decline, Justin maintains a market which is focused towards restoration and architectural work, while picking up work that is lost by other producers who are unable to keep their source of stone open on an economic basis.

Thus, paradoxically, he sells limestone grave-stones to Cumbria where the authorities will not allow foreign rock-types in their graveyards but there is now no indigenous supply. Major buildings which have used Anglesey limestone include Birmingham Town Hall (from Penmon), so any restoration work requires a supply of compatible material. The majority of output is in the form of kerbs, lintels and rectangular-sawn blocks. Imported materials such as sandstone are used to create fireplace surrounds and other architectural pieces on demand.

For internal work, much of Justin's material is polished on one or more surfaces, and here the surprise was the shine that could be imparted to such an unpromising material. Certain horizons produce a mottled or leopard-skin pattern in grey and purple hues, and this is assumed to be a diagenetic feature which is often found as a rubbly texture at outcrop. Because the total production is quite small, the quarry is not large and the only aggregate produced is from overburden and offcuts, reduced in-situ by a mobile crusher. The main interest in the quarry is the exposure of the weathered and karstified limestone rock-head, which can be seen with its soil profile in situ. Solution-pipes extend for some metres below ground, and have in places been colonised by very deep roots from the old hedge of hawthorn that borders the road – or the alternative suggestion is that solution was accentuated by the rooting process. The floor of the modern quarry is the flat, upper bedding surface of a thick post of the limestone which Justin refers to as the four-foot, and this is the principal source of workable stone. This dips to the south-east and quickly loses height beneath more fractured materials which are being worked at present. Traditional stone-working techniques such as "plug-and-feather" extraction of large blocks are contrasted with modern machines with hydraulic "hen-peckers" for breaking up the overburden more aggressively. Another surprise here was the relief of the limestone outcrop which is covered in a red-coloured till, showing that considerable erosion pre-dated the last glacial event. The till did not produce any significant erratics at this location.

The large diamond saw was a great fascination and there was much discussion of the low rate of wear to the diamond-sintered tips as a consequence of the purity of the limestone and its low abrasive tendency. During his work, Justin has encountered a number of spectacular fossils which he has polished and set aside in his special collection. Particularly impressive were two large goniatites which demonstrated the fragility of their coiled and mineralised whorls, some fine colonial corals, a very large solitary coral and some beautiful, pearly-white brachiopods in a black limestone from elsewhere on the island. As it was raining persistently at times we were also treated to a very fine view of some pieces of the Mona Marble which remained from a job of cutting and polishing slices from a large erratic boulder of this material which, despite its pink colour, is an ophicalcite and is neither a marble nor a limestone. Some fireplaces at Penrhyn Castle are executed in this material, apparently, and there is no extant outcrop of this material which is more commonly green-black in colour.

The afternoon was devoted to following the Anglesey Coast LDP anti-clockwise from Moelfre to the north of Porth Helaeth, which allowed good visibility of contrasting limestone facies and an excellent vertical section through the limestones and the extraordinary sandstones and conglomerates that typify this coast. The first location was on the gently-dipping seaward side of Trwyn Grupyl, where we were able to examine the very fine-grained and quite closely-bedded limestones seen in vertical sectional view from an earlier point on the path. These are a deep-water facies, where sedimentation of clay-grade material from the water column is largely undisturbed, and where the biota responsible for producing or recycling of the carbonate sediment are reaching the limit of their demand for light for photosynthesis. Prominent on some surfaces are occasional mounds of coral, most likely *Syringopora*, which remain in their original life position. Although other fossils are present, they are fairly sparse. Mudstone horizons separate the limestone beds, but are weathered back and appear as voids in the outcrop. Proceeding to the point, we were able to see limestones comprising a dense mass of fragmental



The large diamond saw apparatus used for cutting the limestone blocks to size in the yard at Anglesey Masonry.

fossils, mostly crinoid columnals but including shells and coral floating in a lime mud. The presence of such widely-disparate grain sizes in this rock would be highly unusual if it were a clastic sediment, but the growth of the macroscopic organisms on a substrate of carbonate mud of biogenic origin (both by secretion and by degradation of other carbonate skeletal materials) are capable of producing this mixture in-situ. In this area there is also a very good development of limestone pavement and classic karst, which is otherwise rare on this coast. The south end of Porth Helaeth is a low cliff formed in channelled sandstone and conglomerate with overlying limestone. Here we were able to examine the contact between the sandstone and the limestone, which is remarkably sharp at this point, and consider the reason for the change in sedimentation. Carbonates, being largely biogenic in origin are not formed where clastic sediments are being laid-down. The organisms require light and are inhibited by fine sediment. The incursion of coarse sediments, which can be seen to lie on a karst surface of pre-existing limestone, must therefore represent a hiatus, and a relative lowering of the contemporary sea level. It is considered that the dominant control on relative sea level at this time was the ground movement associated with Variscan orogeny to the South, with movement being exerted through ancient faults inherited from Caledonian and earlier times. The karst surface there-

fore records a regression, and the subsequent sand and conglomerate are deposits from rapid erosion of adjacent highland areas, and in particular the accumulated soils which have developed in coastal lowlands. Limestone overlying sandstone with a very sharp contact is interpreted as a renewal of carbonate sedimentation on a beach deposit – which implies



Examining colonial coral outcrops on the inclined slabs of Trwyn Grupyl, where we were politely ignored by the anglers sitting in the background. The weather moderated shortly afterwards, and broke into warm sunshine for the remainder of the excursion.

fairly rapid transgression. The cliffs to the South here show the extent to which quarrying has modified the coast, with the thick brown-coloured sandstones underlying the limestone all the way to the distant point, and intervals where the limestone has been removed entirely. A gully in the cliff shows the presence of a fault, with slickensides and demonstrable vertical movement of the sandstone/limestone contact. A remarkable feature here is a very good example of an intrastratal karst developed in the base of the limestone where it is in contact with the sandstone. Water moving through the limestone and along the junction with the impermeable strata has developed extensive solution-features which are now exposed on overhanging limestone outcrop. A very spooky sight indeed! Continuing northwards to the outcrops below the Royal Charter monument, we were able to examine sandstones above limestone which did not show any karst development, although very clear glacial striae were seen beneath a classic red-

brown Irish Sea till which contained clasts of Holywell Chert and an unidentified granite. Here Jan was able to show us goniatite fossils in situ, and as we progressed towards the old quarry which runs inland we were able to look at the sandstone to limestone transition again. Here the top of the coarse sandstone is covered in very fine worm burrows, and it is succeeded by a thick shale which becomes progressively more carbonate rich until it is a limestone packed with brachiopod fossils. XRD work in the laboratory of X-ray Mineral Services determined that the lower shale was rich in kaolinite and illitic clay as well as quartz, though carbonate was the majority component. In this area a prominent rubbly surface to the outcrop is attributed to exposure before lithification, and is indicative of the cyclic nature of the deposition of these limestones. I wish to record the gratitude of the North Wales Geology Association to Justin Kellett and Anglesey Masonry for allowing the visit to their quarry, and to Gill Scott for her assistance with interpretation of the outcrops both before and after the meeting. The patience and enthusiasm of the members of the Association are also commended.

Jonathan Wilkins

References:

- Tucker M., 2001, Sedimentary Petrology, Third Edition.
- Davies, J.R., 1984, Sedimentary cyclicity in...limestones of the Anglesey.....district, Proceedings of the Geologists' Association, 95, p392-395.
- Treagus, J., 2008, Anglesey Geology, a field guide. P152-158



Superb, but small, development of pavement karst on inclined Brigantian Limestone near Moelfre village.

Sunday 14th June
Field Meeting - Leader Jonathan Wilkins
Tal y Fan Circular Walk

The summit of Tal y Fan is dominated by a basaltic intrusion in the form of a sill sufficiently thick to have a thoroughly gabbroic core. It is intruded at the junction of the Cwm Eigiau Volcanic Formation which is mostly sandstone here, and the Crafnant Volcanic Formation, which comprises a series of basaltic tuffs in this area. The basaltic rocks have proved fertile to the effects of the pervasive metamorphism that affected the Welsh Basin during the Caledonian Orogeny. The circular walk will also take in some spectacular glacial features, and an Iron Age hill-fort.

Although the summit of Tal y Fan is moderately elevated (600m) it is not a particularly strenuous walk from Bwlch y Ddeufaen, but participants must be properly equipped for the terrain. A packed lunch will be carried so that we can deal with the geology at a suitably leisurely pace.

Members wishing to join the excursion should contact the chairman, Jonathan Wilkins to obtain full details and field notes. Email and phone number on the back page, as usual.

Also.....

Monday 22 June. Evening presentation (20:00h) by Michael Roberts on Darwin in North Wales at Bangor University (Lecture Room 4, Main Arts Building).

Tuesday 23 June. Evening presentation (20:00h) by Mike Hambrey on Welsh Glaciation at Bangor University (Lecture Room 4, Main Arts Building).

Please pay (£3) at the door, but we do want to advise James in advance of potential numbers attending, so contact Jonathan Wilkins if you wish to attend either meeting. Should be possible to arrange lift sharing from Conwy area.

NEWS ITEMS

Anglesey Geopark Ratified

I was delighted when I was informed a fortnight ago that the Geomon project has finally borne fruit, and the application to join the UNESCO Geopark network has been accepted. We were pleased to hold what must have been one of the very first field meetings to be held in the new geopark, and to visit one of the many jewels in the crown of Anglesey geology.

Coast Hosts Prof.

I was amazed to see Cynthia Burek, a well-known member of the NWGA, on television the other evening on the latest edition of the Coast programme with Nick Crane. Professor Burek from Chester University was explaining the superb outcrops of till that occur along the Wirral coast at Thurston, while other items in the same programme covered the wreck of the Royal Charter at Moelfre, glacial erratics on the North Wales coast, geochronology from the growth rings of Arctic Clams at Red Wharf Bay and the petrology of the Mostyn Grotto on the Great Orme. Make a point of catching-up with this exceptionally geologically orientated episode on-line or in repeats which are bound to follow. My only real criticism is that the Ailsa Craig microgranite is NOT pink - anybody who is interested may view my own erratic specimen in hand-specimen or thin-section.....

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Next Meeting:

Wednesday 20th May 2009
Madoc Room, Coleg Llandrillo, Rhos-on-Sea
at 7.30pm

**The Lower Palaeozoic Welsh Basin: a Window on deep time
Climate Change, Dr. Jeremy Davies, BGS Keyworth**

A twenty-year study by the British Geological Survey and its collaborators has elucidated the complex sedimentary architecture and geological structure of the Welsh Basin. The basin was the site of deep-water deposition throughout much of Ordovician and Silurian times and the mixed sand-mud succession is dominated by the famous turbidites. Thin, burrowed or laminated mudstones preserved between these re-sedimented units represent material deposited from suspension (hemipelagites) either during periods when the basin's bottom waters were well oxygenated (oxic), or when stagnant anaerobic (anoxic) conditions prevailed.

Biostratigraphical work, including the study of abundant fossil graptolite remains, has allowed the basin's sedimentary fill to be dated in detail and revealed complex lateral changes in thickness and sedimentary facies. Periods of rapid subsidence during the late Llandovery and early Wenlock were characterised by high rates of sediment accumulation and intra-basinal tectonism. These contrast with intervals of slower sedimentation which record the influence of external processes including global changes in sea level at various times. More recent investigations of the succession on the adjacent shelf have provided further insight into these contrasting processes and events and have underpinned detailed comparisons with successions of the same age preserved elsewhere in the world.

Such comparisons reveal the influence of glacial events on the palaeo-supercontinent of Gondwana. Periods during which oxic bottom conditions prevailed across the Welsh Basin floor equate with episodes of Gondwanan ice advance and global sea level fall; anoxic conditions were introduced and sustained by the elevated sea levels and warmer waters associated with interglacial episodes. The transitions between oxic and anoxic facies in the Welsh Basin therefore provide a record of repeated and linked changes in Lower Palaeozoic climate and oceanic processes and of their environmental impact. The detailed study of these key intervals allows the rate and impact of ancient global warming episodes and their value as analogues of modern climate change to be assessed.

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Liverpool Geological Society

21 May - Visit to British Gypsum Mine near Penrith

Manchester Geological Association

Date Sunday 7th June 2009
Venue Sandstones of Overton Hill, Frodsham
Leader Duncan Woodcock
Time 10.30 am - 2 pm

Contact :Marjorie Mosley - booking essential—outdoors@mangeolassoc.org.uk