ORS SYMPOSIUM PROGRAMME

3rd - 5th October 2014

Friday 3rd October:

09.00am Registration/Coffee

09.45am Introduction/Welcome: **Cllr Geraint Hopkins** (Chairman of the Brecon Beacons National Park)

09.55am ***First Session: Review of the ORS:*** **(**Chairman**. Paul Olver** Geologists' Association**)**

Keynote Address:

Brian Williams (Manchester University): *The Lower ORS continent – Wales and beyond*

11.05am Tea/Coffee

11.25am ***Anthony Brook*** (West Sussex Geol.Soc/HOGG):

Murchison and Miller: Contrasting founders of the Devonian or Old Red Sandstone.

12.05pm ***Tony Ramsay*** (School of Earth and Ocean Sciences, Cardiff University/ Fforest Fawr Geopark):

Fforest Fawr Geopark - distinguished by its geological, industrial and cultural heritage

12.45pm ***Toby Driver*** (Royal Commission on the Ancient and Historical Monuments of Wales):

Old Red Sandstone landscapes in Wales: the view from the air'

1.25pm Discussion

1.30pm Lunch

2.10pm **Second Session: Palaeontology: (**Chairman. **Tony Ramasy** (School of Earth and Ocean Sciences, Cardiff University/ Fforest Fawr Geopark)

Alain Blieck (CNRS Senior Scientist, University of Lille) and ***David K. Elliott*** (Northern Arizona University,USA):

Pteraspidomorphs (Vertebrata) and the Old Red Sandstone.

2.50pm ***Michael J. Newman, Carole J. Burrow, Robert G. Davidson, Jan L. den Blaauwen, Roger Jones:***

Scottish Lower Devonian ORS: a separate realm or connected with the Anglo-Welsh Basin? The vertebrate perspective...

3.30pm ***Susan Turner*** (Australia), ***Carole Burrow*** (Australia) & ***Roddy Williams*** (Talgarth):

Welsh Borderland Pot-pourri: bonebeds, age control, palaeo(bio)geography and diversity of fish microvertebrates

4.10pm Tea/Coffee

4.30pm ***Jennifer Morris*** (Sheffield University).

Colonisation of the Old Red Sandstone Continent: recent advances in early land plant research from the Welsh Borderland.

5.10pm ***Christian Baars*** (National Museum Wales):

Environmental effects of early land plant evolution – atmospheric CO2 during the Devonian.

5.50pm Discussion

6.00pm Close

7.30pm Conference Dinner: Castle Hotel

Saturday 4th October:

9.30pm Third Session: **Sedimentology and Lithostratigraphy**: (Chairman: **Brian Williams:** Manchester University)

Duncan Hawley:

The Old Red Sandstone of the Black Mountains of Powys & Herefordshire: Filling the 'Black Hole'

10.10am ***Geraint Owen*** (Swansea University)

Soft-sediment deformation structures - their nature and palaeogeographical implications

10.50am Coffee/Tea

11.10am ***John Davies*** (Fforest Fawr Geopark):

The identification of mappable, litho-stratigraphical sub-divisions of the Brownstones across its outcrop.

11.50am ***Kate Andrew*** (EHT Project Manager)

1000 Years of Building with (Old Red Sand) Stone

12.30pm Discussion and summing up

1.10pm Lunch

2.00pm Public Exhibition and Activity Session:

Dilys Harlow (Bristol): Launch of her book *The land of the Beacons Way*

Allan Cuthbertson (SWGA): Film: *The ORS from the air.*

Kester & Elizabeth Webb (Devon): *The hidden edge of Exmoor, north Devon* – low level aerial photographs and topographical drawings

Building Stones of Brecon walk (Welsh Stone Forum)

5.00pm Close

Sunday 5th October:

09.30am Field meetings depart to:

(a) **Fan Fawr & Blaen Llia**: Leader – ***John Davies***

(b) **Tredomen Quarry, Cockit Hill & Tremynfa Quarry**: Leader - ***Duncan Hawley***

16.30 Return to Brecon

The Lower Old Red Sandstone Continent: Wales and Beyond

***Professor Brian PJ Williams*[1]**

[1]*University of Manchester*

The Lower Old Red Sandstone Continent formed in Siluro-Devonian times by the amalgamation of Laurentia with Baltica and the microcontinent Avalonia. Basins containing infills of Lower ORS magnafacies developed on the margins of, and within, this continental landmass - named Laurussia. In contrast to the intramontane basins of Scotland and Norway, external basins formed south of the Caledonian mountain front and include the Anglo-Welsh, Dingle and Gaspe Basins. These basins preserve predominantly continental red-bed infills and record differing depositional architectures reflecting variations in subsidence and tectonic histories, provenance and depositional mechanisms.

The Lower ORS facies of these three basins reveal a transitional contact with the underlying marine Silurian – mainly Ludlovian – sediments of estuarine, barrier/shoreface or deltaic origin. These Lower ORS basins contain broadly punctuated, upward-coarsening sequences varying between 2.8 and 4.5 kms in thickness. The UC character of their fills is in response to the onset of Acadian deformation which climaxed in the Emsian (Wales and Ireland) or Middle Devonian times (Quebec). The infills are dominated by fluvial sediments with some influences from lacustrine, aeolian and shallow marine processes. The fluvial deposits are of varying styles and provenances, both ephemeral and perennial in nature, and show both axial and lateral inputs into the basins.

The Lower ORS has long been of interest due to the presence of early vascular plants and vertebrate faunas, but modern sedimentological research has generated more ideas over the last four decades on lithostratigraphic facies analysis of continental basin fills than any other comparable red-bed sequences. Although relatively poor in biostratigraphic controls, many advances have been made in recent years by integrating palaeobotanical/palynological, microinvertebrate and ichnofacies studies with the sedimentology. Additionally during the last ten years a chronometric time scale, based on radiometric dating of airfall tuffs, has been developed across Lower ORS basins from E. North America, through SW Ireland to the Anglo-Welsh Basin.

A template for this integrated analysis has been the Lower ORS of Wales, in particular that exposed in the magnificent coastal outcrops of SW Wales. From this area the major magnafacies belts can be traced over 20,000 sq. kms. to the Borderlands. The Pridolian facies belt is mudrock-dominated throughout this extensive area whereas the Lockhovian to early Emsian sees a progressive increase in fluvial sandstones to conglomerates, punctuated locally by alluvial fan incursions. This is true of both the Welsh and Irish Lower ORS successions but in Quebec the whole sequence is sandstone to sandstone/conglomerate – dominated.

Many enigmatic sedimentary phenomena are preserved within the basin infill magnafacies. The thick mudrock sequences and their origin are only now being analysed and understood; the ubiquitous pedogenic and non-pedogenic calcrete (so abundant in Wales but poorly preserved in SW Ireland and E. Canada) are hugely important in understanding the climatic and tectonic controls on basin evolution; the source, deposition and dating of the airfall tuff complexes in Wales and Ireland are key to unravelling correlation of the Lower ORS particularly when taken in tandem with palynological analysis. Also, receiving much attention in recent years has been the variations in fluvial style within these basins and the causes of ephemeral fluvial systems in the Pridolian – Lockhovian to the very large perennial rivers of the Emsian – Mid Devonian. The Lower ORS drainage networks of this southern and southwestern margin of the Continent are complex and old models are in need of refinement, as does the connectivity of systems and their relationship to the growth of Acadian deformation.

Fforest Fawr Geopark - distinguished by its geological, industrial and cultural heritage

***Dr Tony Ramsay*[1]**

[1]*School of Earth and Ocean Sciences, Cardiff University/Fforest Fawr Geopark*

Fforest Fawr Geopark became a member of the European and Global Geoparks Networks in 2005 and the first geopark in Wales. The Geopark was established in the western area of the Brecon Beacons National Park, an area with a strong identity in terms of its geology, industrial and cultural heritage. In comparison with the more popular tourist destination in the National Park's eastern area, the area of the Geopark was less well known, more remote in character, and economically less prosperous.

In order to become a member of the European and Global Geoparks Networks, Fforest Fawr Geopark needed to demonstrate that it is geologically significant, has well defined boundaries and is large enough to develop a sustainable strategy for economic development. It was also required to establish its support for education and training and for developing scientific research in various disciplines of the Earth sciences. In addition to its geology, the Geopark also makes use of sites of archaeological, ecological, historical and cultural significance as these are often linked to the underlying geology. The ultimate objective of the Geopark is to use the designation as a vehicle for community engagement in protecting the environment and cultural heritage in order to stimulate geotourism and contribute to its economic development.

The Geopark's 480 million year geological record provides a resource for developing geotourism and for promoting research and educational activities. Nearly 11,500 years of human occupation created a cultural landscape in which ancient monuments contrast with the relicts of industrial activity. With the coming of the Industrial Revolution, the geological resources of Fforest Fawr Geopark were systematically exploited for over 200 years to supply South Wales's expanding metal industry. During this time mining, quarrying and brick making contributed to wealth creation and South Wales was a major player in the new industrial age which changed the world.

In addition, the rich culture of the Geopark's early inhabitants comes to life in myths and legends and some of Europe's oldest stories and myths are associated with Fforest Fawr Geopark.

Old Red Sandstone Landscapes in Wales: The View from the Air

***Dr Toby Driver*[1]**

[1]Aerial Investigator –Team Leader Reconnaissance, Royal Commission on the Ancient and Historical Monuments of Wales

The Royal Commission, based in Aberystwyth, has been carrying out its own pan-Wales programme of archaeological aerial reconnaissance since 1986. Its remit is to record *sites illustrative of the people, landscape and history of Wales*, as well as specifically recording 600 Scheduled Ancient Monuments a year for Cadw for management purposes, and carrying out exploratory reconnaissance for new archaeological sites at the extremes of light and season. The Royal Commission also innovates, working with airborne laser scanning or LiDAR to better understand and document the archaeology of Wales.

Today commercial aerial photography is commonplace. The Welsh Government commissions regular pan-Wales vertical sorties taken in summer light with maximum vegetation to inform a range of work. Unmanned Aerial Systems (UAS) or drones are also more common and cheaper to use, providing low and medium level imagery and video and 3D landscape modelling for a range of users.

However, the archaeological aerial reconnaissance programme retains a unique role to discover and record the landscape and archaeology of Wales, frequently at times of year and in conditions when no

other operators are flying. Flights are often carried out at the extreme of light and seasons, and in optimum conditions for documenting archaeological sites. During extreme summer droughts when parching and variable crop growth can show long-hidden plough-levelled archaeology, conditions for archaeological visibility can change in a few days. A site visible in one week can be erased by a summer rain shower; a blank field can change in a few days with the arrival of hot, drying winds. In winter, drifting snow or differential melt-marks in snow and frost can show known sites with incredible clarity or allow the discovery of new sites. After heavy snowfall the landscape of Wales can be transformed, and the Royal Commission aerial archaeologist may be the only person airborne.

This presentation will provide an overview of Old Red Sandstone landscapes in Wales from the year-round perspective of an aerial archaeologist. High summer sunshine, low evening and winter light, rain and flood, geological cropmarks, heavy snow and melting frost will all serve to show the shape, character and changing personality of the ORS landscapes from Pembrokeshire to the Black Mountains.

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Murchison and Miller: Contrasting Founders of the Devonian/Old Red Sandstone

***Anthony Brook*[1]**

[1]West Sussex Geological Society/HOGG

The 60 million years of the Devonian Period (419-359 Mya) left its mark in 3 areas of the U.K.: 3 Basins in Scotland, from the Orkneys to the Borders; in the extensive Anglo-Welsh Basin, from the Welsh Borders to Pembroke; and in Devon, where the marine equivalents of the Old Red Sandstone enabled this geological time period to be first established by Roderick Murchison and Adam Sedgwick in 1839, giving rise to what is known as 'The Great Devonian Controversy'.

Roderick Murchison (1792-1871) and Hugh Miller (1802-1856) were two geologists of this so-called Heroic Age of Geology who made significant contributions in presenting the strata and fossils of this Late Palaeozoic era in the scientific literature and in the popular imagination. However, there could hardly be a greater contrast in their lives and lifestyles: they were poles apart. Both were born and brought up in the Scottish Highlands, had strong-willed wives, and a life-long obsession with rocks and fossils; otherwise, they were completely different personalities, living in completely different social worlds, and only slightly acquainted. Indeed, Miller, the overworked and overwrought newspaper editor, shot himself, aged only 54, whilst Murchison lived on, as a greatly-honoured scientist, into his late 70s and died a natural death. Miller published his marvellous work The Old Red Sandstone in 1842 for the general readership; Murchison published his mighty volumes for science and posterity---to give just a few examples.

Although Murchison and Miller are such 'Contrasting Founders' of the Devonian/O.R.S., both Scotsman, in their own separate ways, have earned an honoured place in the pantheon of those who helped to establish the science of Geology.

Pteraspidomorphs (Vertebrata) and the Old Red Sandstone

***Alain Blieck* [1] *& David K. Elliott* [2]**

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Pteraspidomorphi are Ordovician to Devonian, jawless and finless vertebrates that have developed a variety of phenotypes of mostly aquatic demersal animals of the neritic province. Some, however, were active swimmers in the water column or near to the surface. They show many convergences in adaptive variations with the other ossified agnathan vertebrates or ostracoderms, that is the osteostracans, galeaspids and pituriaspids. They are traditionally known as Old Red Sandstone (ORS) fish, and have been interpreted as fresh-water inhabitants. However, recent palaeoecological and sedimentological analyses have shown that they were near-shore, shallow-marine fishes in the Ordovician, that they occupied marine environments on the Silurian Baltic platform and a wide variety of environments in the Devonian, including those of the ORS (lagoonal, estuarine, deltaic, and open platform). Their peak of diversity was reached in the Early Devonian, and they all disappeared before the Frasnian-Famennian boundary biotic crisis. Within Earth sciences, they are used in biostratigraphy, palaeoecology, and palaeobiogeography. They are good tools for dating siliciclastic sedimentary series of the Silurian and Devonian, including the ORS, and they are good markers of the margins of Ordovician to Devonian palaeocontinents (Laurentia, Baltica, Siberia, Gondwana). Finally they are also important for history of sciences with the discovery of strange morphological patterns as early as the 19th Century (Zych, Kutorga, Miller), of life in the Devonian a.k.a. the 'age of fishes' (Scotland, England, Baltic States, Russia), and of stratigraphic correlations between marine (Devon, Boulonnais) and 'non-marine' facies (the ORS).

Scottish Lower Devonian ORS: a separate realm or connected with the Anglo-Welsh Basin? The vertebrate perspective...

Michael J. Newman, Carole J. Burrow, Robert G. Davidson, Jan L. den Blaauwen, Roger Jones

Lower Old Red Sandstone fossil vertebrates from Scotland and the Welsh Borderland were first described by Louis Agassiz in 1835. His initial descriptions were of disarticulated jawless fish. Agassiz later described disarticulated remains of jawed fish which consisted for the most part of acanthodian fin spines. Agassiz first described these fin spines in 1837 from the Welsh Borderland and in 1844 from Scotland (although Hugh Miller had mentioned them in 1841). Many other species have been raised and described since then from both regions. *Cephalaspis lyelli* was the only species thought to have occurred in both regions but this was shown to be incorrect by Lankester in 1868. Because no species were found in both regions it was assumed that they were separate realms. However, in 1968 Allen, Halstead and Turner recorded that the jawless thelodont *Turinia pagei* occurred in both regions. This species has a much wider distribution across the whole of the Old Red Sandstone continent and so does not show that there was necessarily a direct connection between the two regions of interest here. Cornuate osteostracans including *Cephalaspis* and *Zenaspis* occur in both r ealms but this group should be treated with caution for correlation for the time being as their taxonomy is currently in a state of flux. It was not until 2013 that the acanthodian *Parexus recurvus* was shown to occur in both regions. Furthermore, only this year (2014) have the authors discovered that the acanthodian *Euthacanthus macnicoli* occurs in both regions. It is probably only a matter of time before other species are shown to co-occur in both basins, demonstrating the close connection between the Scottish and Welsh Borderland Lower Old Red Sandstone.

Welsh Borderland bouillabaisse: bonebeds, age control, palaeo(bio)geography lifestyles and diversity of microvertebrates (thelodont, acanthodian, 'shark', placoderm scales)

Susan Turner[1] [2], Carole J Burrow[2] & Rod Williams[3]

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Microfossils of thelodonts, heterostracans, cephalaspids, anaspids and various gnathostomes (hereafter 'microvertebrates') are common throughout the later Silurian to Early Devonian in the Welsh Borderland ('WB', generally Worcestershire, Shropshire, Herefordshire, Gloucestershire, and eastern Welsh counties). The range in space and time and environment of many taxa reveal interesting patterns, the most interesting being that nearly all microvertebrate taxa have a wide geographic distribution and thus do not support a wholly freshwater provenance for the LORS in this region. There are few endemic taxa within the WB. This can be biostratigraphically useful as well as revealing, and their significance is sometimes overlooked. For instance, is the Ludlow Bonebed (LBB) mid Ludlow or basal Pridoli in age? The fish say the latter. What of the other bonebeds? The last part of the Silurian (late Pridoli) represented by the Downton Group needs refining, but the middle part is generally barren except for a few notable localities. The Silurian–Devonian boundary has been defined by the incoming of *Turinia pagei* at the base of the Ditton Group, a level about 30 m below the *Psammosteus* Limestone (PL) in the Brown Clee Hill; this level is not yet certain in SE Wales but Talgarth gives a good continuous stream section with the Townsend Tuff Bed located in Talgarth itself.

Taxon occurrences need updating since the last major publications over 10 years ago. The oldest known taxon is still the thelodont *Loganellia scotica* from the mid-Llandovery (Aeronian) of Shropshire. Silurian taxa include at least 20 thelodonts with few endemics known so far; fewer heterostracans, cephalaspids and anaspids (mostly not till the late Silurian); up to 15 acanthodians; and one stem actinopterygian *Andreolepis* sp. *Gomphonchus volborthi* is the dominant acanthodian of the LBB, with *Radioporacanthodes porosus* s.l., *Cheiracanthoides* sp., *Nostolepis linleyensis* and *Nostolepis striata* also represented. Up to the Siluro-Devonian boundary beds, which are exceedingly difficult to locate in this area, a major change in taxa occurs in the Upper Downton Group/Raglan marl [URD] at the end of the Pridoli with a fauna including a different thelodont assemblage (termed L-G-K by Turner 1973) including *Trimerolepis* cf. *timanicus*, *Paralogania kummerowi, P. tarrenti*, *Loganellia cuneata* and *L? unispinata*. Acanthodian "*Gomphonchus* sp. cf. *G. hoppei*" predominates here; other incoming acanthodians of note include *Nostolepis* sp. cf. *N. alta*, *Nostolepis robusta* s.s, *Gomphonchus mediocostatus*, *Gomphonchoporus hoppei*, *Radioporacanthodes porosus* s.s., *Radioporacanthodes* sp. cf. *R. subporosus*, *Poracanthodes punctatus*, and *Machaeraporus stonehousensis*. Two ?stem chondrichthyans *Altholepis* sp. and *Polymerolepis whitei* appear at the S/D boundary, as well as scales ornamented with elongate ridged tubercles that could derive from a radotinid-type placoderm and acanthodians *Nostolepis arctica*, *Parexus*, and *Cheiracanthoides* sp. cf. *C. rarus*. Poracanthodid acanthodians disappear during the early Lochkovian, below the Ditton Group (DIT). The DIT sees the incoming of around 12 different thelodonts including *Turinia pagei* (with rare articulated specimens), *Turinia polita, Boreania minima*, nikoliviids and *an apalolepid*, as well as scales referred to the acanthodians *Nostolepis gracilis*, *Nostolepis robusta* s.s., and *Nostolepis* spp. cf. *N. applicata* and *N. musca*. The youngest known WB microvertebrates are in Wales where *Turinia pagei* apparently ranges up into the Brownstones. Lochkovian LORS acanthodian taxa based on articulated fish (especially the type material from the LORS in Scotland) are being intensively revised, and include comparisons of squamation, teeth and fin spines with isolated elements from microvertebrate assemblages. Several tooth whorl forms are known from the WB, with most being of the gomphonchid-type sensu Gross, which could derive from any of the ischnacanthiforms represented by scales. One rare form has a pair of large lateral cusps in each tooth on a robust bone base, with this cusp arrangement resembling that of the diplodont chondrichthyans from the Devonian elsewhere. Each fish can tell us something about biology, evolution, environment and overall biodiversity in this fascinating time of transition.

Selected Reading

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Colonisation of the Old Red Sandstone Continent: recent advances in early land plant research from the Welsh Borderland.

Jennifer L. Morris[1], Edwards Dianne[2]

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The Lower Old Red Sandstone sequences of the Anglo-Welsh Basin and Welsh Borderland have been vital to the study of early land plants. Since Lang's seminal paper in 1937, new records, along with the development of imaging techniques (e.g. scanning electron microscopy), has led to the detailed description of several megafossil plant assemblages, spanning Ludfordian to Pragian in age. More recent discoveries from Tredomen Quarry, near Brecon (lowermost Lochkovian) and Craswall, Herefordshire (middle to upper Lochkovian), augment the observation of progressive diversification through this time period, albeit still of simple organisation when compared to elsewhere in the world. The main changes observed are increases in overall size, complexity of branching and improved spore dispersal efficiency. These changes are interpreted as responses to increased competition for light and space in these early terrestrial ecosystems.

However, the effects of plant taphonomy on diversity and disparity patterns cannot be overlooked. This is exemplified by rare, middle Lochkovian mesofossils of exceptional preservation via charcoalification. These fossils provide an insight into a component of early land plants of very small stature (a few millimetres in height) that are often missing from megafossil assemblages. Work on this group has led to several new taxa and the reconciliation of some dispersed spore taxa with their parent plants. Of particular interest are a group of cryptospore-bearing plants, named cryptophytes, some of which may be stem group embryophytes or tracheophytes, while others are more closely related to bryophytes.

Environmental effects of early land plant evolution – atmospheric CO2 during the Devonian

Christian Baars[1]

[1] Amgueddfa Cymru-National Museum Wales

A substantial decrease in atmospheric carbon dioxide (CO_2) concentration during the mid-Palaeozoic is likely to have been partially the consequence of the evolution of rooted land plants. The earliest land plants evolved in the Ordovician but these were small, moss-like organisms without any roots. Plants with large rooting systems did not evolve until the mid Devonian. The evolution of roots resulted in an increase in chemical weathering of silicate rocks. This, in turn, caused a contemporaneous drop in atmospheric CO_2 concentration from approximately 25 times present concentration in the Cambrian to twice the present concentration by the late Carboniferous. The supposed mechanism for CO_2 removal from the atmosphere involves oceanic carbonate precipitation, enhanced by chemical weathering of Ca and Mg silicates and transport of the weathering products to the sea.

The Old Red Sandstone of the Black Mountains of Powys & Herefordshire: Filling the 'Black Hole'.

Duncan Hawley

The Black Mountains form a dissected upland plateau comprising both Lower Old Red Sandstone and Upper Old Red Sandstone rocks, roughly delimited by the Wye Valley to the north and the Usk Valley to the south. They occupy a central position within the Anglo-Welsh Basin nestled between the traditionally better studied areas of ORS to the west (Brecon Beacons and west Wales) and to the east (Shropshire and the Marches and the Forest of Dean). The lithologies comprise a broadly coarsening-upward sequence of mudstones and silty mudstones, tuffs, sandstones (red, green and grey), gravels and calcretes that occur in varying relations and proportions, enabling litho-stratigraphical divisions to be recognised. However, serious study of the ORS in the Black Mountains in the past has been sporadic and limited rather than systematic - the area to some extent formed a 'black hole'. This presentation will review the development of past and recent advances in the lithostratigraphy, sedimentary geology and palaeo-environmental interpretations of the ORS in the Black Mountains and indicate some possibilities for future study and understanding.

The identification of mappable litho-stratigraphical sub-divisions of the Brownstones across its outcrop

John Davies[1]

[1]Fforest Fawr Geopark

The currently accepted dvisions of the Lower Devonian comprising the St Maughan's, Senni and Brownstones formations are reviewed. This sedimentary sequence is dominated by three major regressions, the earliest - St Maughan's regression – occurred at the base of the sequence, followed by a second event at the base of the Senni Formation and a third, previously undescribed regression in the middle of the Brownstones. The latter has been termed the, Llyn-y-fan Regression.

Intensive mapping of the outcrop suggests that at least two of these events, at the base of the Senni Formation and the Llyn-y-fan involve soft-sediment deformation. The Llyn-y-fan event also records the influx of course-grained exotic materials into the area of deposition and is associated with chaotic sedimentary depositional structures. It is thus suggested that the present Brownstones Formation could be sub-divided into four – Lower Brownstones arenites, and then argillites below the Llyn-y-fan sedimentary event, the event itself, and the normal Upper Brownstones above. Suitable litho-stratigraphical terms might be - Craig-y-fro Arenites – Bryn Melyn Argillites - Caeras Rudites and Fan Fawr Arenites.

It would appear that each of these regressions form part of a coarsening upward sequence of sedimentary events associated with soft sediment deformation suggesting increasing tectonic activity reflecting the imprint of the Arcadian Orogeny.

A Thousand Years of Building with (Old Red Sand) Stone

Kate Andrew[1], Beth Andrews[2] and Elliot Carter[3]

[1]Project Manager, HWEHT

[2]Community Officer, HWEHT

[3]Technical Officer, HWEHT

Herefordshire and Worcestershire Earth Heritage Trust is undertaking a 42 month project funded by the Heritage Lottery Fund. The project aims to determine the geological provenance of historic stone buildings from 19 representative cluster areas across Herefordshire and Worcestershire. The clusters were selected to encompass the range of geology and architectural heritage exhibited in the region.

Teams of volunteers have been recording stone built buildings and quarries in the field and undertaking archival research to investigate documented sources of stone for specific buildings.

A significant number of outreach events have been held, introducing the concept of variety in building stones to the public with over 6,000 in-person contacts made to date.

With 12 of the cluster areas lying on the uppermost Silurian and Devonian, many of the building stone types being recorded are from the Old Red Sandstone. The broad-brush approach to mapping and the lack of differentiation of horizons within the Old Red Sandstone is proving problematic in our work to match buildings to potential source quarries. Added to this, the very variable nature of the facies, exhibiting as it appears to, repeated time-limited and geographically-limited environmental episodes makes even a clear identification of stone used difficult. One particular puzzle is that medieval masons seem to have favoured pale coloured sandstones rich in white quartz pebbles for church and castle towers, for example at church at Holme Lacey and the keep of Goodrich Castle; no good exposure has yet been located of these.

This project will result in the establishment of an online database, which sets out to be a useful tool for conservationists, planners and enthusiasts, vastly improving resources available to source suitable stone for building or restoration work.

Field Meetings:

A Fan Fawr and Blaen Llia
Leader: John Davies

This excursion will examine the transitional relationship between the Lower Devonian - Senni Formation and the overlying Brownstones and discuss palaeo-environmental implications of this sedimentary sequence. The morning will involve a fairly stiff climb up a stream section on Fan Fawr in order to examine evidence for a potentially more meaningful sub-division of the Brownstones-Senni Formation in their total outcrop. The afternoon at Fan Llia will then involve an examination of soft-sediment structures within the lower part of the Brownstones and their interpretation in relation to the proximity of major contemporary tectonic activity.

B Tredomen Quarry, Cockit Hill and Tremynfa Quarry

Leader: Duncan Hawley

This excursion will examine the sedimentary geology and discoveries of hard-body fossil faunas in the St Maughan's Formation and associated ichno-faunas in the succeeding Senni Formation of the Llangorse area. There will be an opportunity to discuss interpretations of sedimentary facies and palaeo-environmental changes . The visit will hopefully be able to examine some of the fossil fish and other fossil finds from Tredomen Quarry.