Earth Matters

The Newsletter of the Geology Section
of the Woolhope Naturalists' Field Club

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MESSAGE FROM THE CHAIRMAN

Travelling to Scotland for my work in the last few months I saw the enthusiasm generated by the question of independence. Many commentators have pointed out how beneficial this has been for politics, a subject not normally high on peoples' minds as indicated by the sadly low turnout on polling days. I wonder if similar enthusiasm is about to hit geology. The question is 'fracking'. Never before have I heard geology mentioned 'down the pub' yet now the subject arises frequently and is discussed with passion. It's even starting to appear on the national news.

Myths like earthquakes and water pollution are so heavily promoted that most people think they're true. So the fear of 'will it happen here?' is expressed by almost everyone, even in places where there is no chance (like most of Herefordshire). That fear needs to be addressed. Clubs like ours have a role to play here. Not only can we benefit from new members hoping to learn the subject but we can also contribute to the debate. For example, every year there are Rock and Fossil Roadshows which are very popular with the children. While little Jimmy draws trilobites there could be a talk next door on "Fracking here in Bloggstown". I bet it would draw the crowds. And then the passion 'down the pub' could at least include some actual understanding.

It's no secret that our club is ageing and needs new blood, but Twitter and Facebook seem far more important than rocks to anyone under the age of 50. If I'm right about a renewed enthusiasm for geology then it may even attract that younger generation. I hope so. And maybe they'll even buy me a pint. Butty Bach please.

Geoff Steel, *Chairman*

WYE VALLEY PARTNERSHIP, 2013 -14

by Moira Jenkins

The second year of the Wye Valley Partnership project funded by Defra via Natural England gave EHT the opportunity to carry out the further valuable and useful work listed below, much of which was carried out with help of volunteers from the WGS.

- Conduct a baseline audit of geodiversity, soil, glacial and fluvial features. Write a summary report.
- Produce a management plan for an LGS
- Designate seven new Local Geological Sites (LGS).
- Perform geoconservation work at two sites.
- Lecture about the geology of the area.
- Conduct two guided geology and landscape walks.
- Make a cast of desiccation cracks at Huntsham Hill.
- Update the database of geological sites.

Some of this work is described here.

Baseline Data

A series of days were spent by Duncan Hawley and Elliot Carter doing fieldwork and recording data about geological, geomorphological and glacial sites. Some of this work is described separately by Duncan on pages 8 to 11.

This year in January and early February there were record amounts of rain and floods were widespread. This affected the fieldwork. On some days sites could not be reached because roads, such as that from Huntsham Bridge to Yat Rock, were closed by flood water. The opportunity was taken to compare the views with floods to those without.

On the left is the view from the Prospect at Ross-on-Wye looking north up the Wye Valley on 13th February 2014. Compare it with the same view taken in 2004 seen in the photo on the right.

As well as glacial and fluvial features, sites with Devonian and Carboniferous rock outcrops were investigated and recorded.

Designation of Local Geological Sites

Seven new Local Geological Sites were designated by a panel of assessors. These were a variety of sites, some geological, some glacial and some fluvial. There was a river cliff showing a section of the Raglan Mudstone Formation and a landslip area. There was an area of peat which formed when the climate improved after the Ice Age. There was a former quarry in Carboniferous Lower Limestone Shales, now known as the Avon Group. There was a section of a tributary valley of the Wye showing incised meanders on which smaller wavelength meanders have developed related to the smaller amount of water now that the stream is not swelled with glacial meltwater.

Site Clearance

With permission from the Forestry Commission and Natural England, Beth Andrews and volunteers carried out

Redbank Cliff near Mordiford showing a section of the Raglan Mudstone Formation.

site clearance work on Great Doward and at the Biblins. The pictures below shows the deposit of calcareous tufa at the Biblins. The approach to the site was very overgrown and was almost impassable in summer months making access very difficult.

The Carboniferous limestone cliffs here are coated by irregular deposits of calcareous tufa. This is deposited from solution in water which drips down the cliff from Dropping Well above. A waterfall can be seen in the photo after all the rain we had last year. The tufa is full of air holes and contains inclusions of twigs, beetle carapaces and other organic debris which has been 'petrified' in the rock. A moss grows on the tufa and aids its formation. Initial work had been carried out by the Forestry Commission to erect a fence at the base of the cliff.

The Biblins site before clearance and the clearance party by the new fence .

Capping Great Doward are sandstone rocks which overlie the Carboniferous Limestone. These mark the change from marine to terrestrial conditions. This Drybrook Sandstone, now called the Cromhall Sandstone Formation, was laid down by streams crossing a land surface. (It underlies the Coal Measures found in the Forest of Dean.) This sandstone is found as detached blocks all over the hilltop but rarely in place as outcrops.

Near the top of the hill, we enlarged an outcrop of Drybrook Sandstone by removing some of the leaf mould around this rare exposure of the rock. Freshly exposed surfaces were seen to be grey in colour whilst the weathered rock is orangey brown. Some of the rock is poorly cemented and breaks down into individual grains on being rubbed. This has led to the formation of deep fissures along these weaker lines. The rock is seen to be current bedded with coarser layers containing quartz pebbles.


Clearing the Drybrook Sandstone rock face

Walks

Two walks were led. One looked at the glacial history of the Wye Valley in the Breinton area, with glacial moraine, kettle holes, melt water channels and the diverted course of the River Wye through Breinton Gorge.

The second looked at some of the varied geology on Huntsham Hill. There are crags of Quartz Conglomerate, outcrops of Tintern Sandstone, the transition to marine conditions in which the Lower Limestone Shale (Avon Group) was laid down, the overlying Lower Dolomite (Black Rock Limestone) and a recent landslip area,

Production of a Cast of Desiccation Cracks

On Huntsham Hill is a line of crags of Quartz Conglomerate, part of which is an LGS. Permission was granted by the Forestry Commission for work towards the production of a cast of the underside of an overhanging rock layer.

The cliff face is undercut at the base where a softer mudstone band has been worn away. Underneath an overhang of a few metres, interesting features are found which are difficult and dangerous to view. About 400My ago, the surface of a layer of mud dried and a series of polygonal mud cracks developed. These cracks were filled as a succeeding bed of sand was deposited. Now the softer mud has been eroded away. Under the overhang the consoli-

The overhang from which the cast was made. It is difficult to examine in situ.

The weather caused problems in making the cast. The silicone rubber solution, which is painted on the rock surface, cannot be used in the wet or in temperatures lower than ten degrees, so it was necessary to wait until the last moment to obtain suitable meteorological conditions.

The cast produced is 1.5m x 2.5m and was cut into three sections to enable it to be transported. It shows that the desiccation cracks are up to 10cm in depth. The front section has been eroded and smoothed to some extent and has less relief. Within the areas between the desiccation cracks are networks of irregular smaller ridges which appear to be traces of burrows of some of the first creatures to emerge from the sea to live on the land. The production of the cast will enable further scientific research on these fascinating features and will enable them to be used for educational purposes. The funding for this project has provided a wonderful opportunity to view important examples of desiccation cracks and burrows which are dangerous to show to children in the field.

Photograph of the cast

Breinton Gorge

Two river terraces overlooking the Wye in Breinton Gorge

Breinton Gorge was cut by the River Wye during the Ice Age when its previous course, now followed by the Yazor Brook, was blocked by ice and moraine. River terraces in the gorge show previous levels of the valley floor. One is in the middle of the picture above and a higher terrace has houses built on it

An inaccessible cliff in red mudstone in Breinton Gorge.

A meeting to discuss the present state of research on the Old Red Sandstone (ORS), particularly in the area of the Forest Fawr Geopark, was held in Brecon from 3rd to 5th October 2014. It was sponsored by the Geopark, the Geologists' Association, the National Museum of Wales (Cardiff) and the Palaeontological Society. The presenters were drawn from the body of professional researchers but many of the 104-strong audience were from

THE OLD RED SANDSTONE – A SYMPOSIUM

Report by John Payne

the local geological societies. WGS, EHT, Mid-Wales Geol. Soc., Teme Valley Geol. Soc. and the Open University Geol. Soc. were all well represented and manned exhibition stands, along with the GA, BGS, Geopark and others. A full account of the meeting will appear in due course in a special issue of the Proceedings of the Geologists' Association.

The meeting opened with a keynote presentation by Prof. Brian Williams. He described current knowledge about the Lower Old Red Sandstone (LORS) in England and Wales. The LORS encompasses most of the Upper Silurian and Devonian strata exposed in Herefordshire; the Downton Castle Sandstone, Raglan Mudstone, St Maughans, Senni and Brownstones Formations. The Quartz Conglomerate and the Tintern Sandstone are part of the Upper ORS. Prof. Williams noted that research into the LORS had been strong in the last couple of decades but had been centred mostly on the excellent coastal exposures in Pembrokeshire, at the western end of the Anglo-Welsh Basin. He drew attention to the differences and similarities of this basin with two related LORS depositional basins, at Dingle in SW Ireland and at Gaspé in Canada. Amongst many unknowns are the linkages between these basins, the provenance of the sediments, why deposition was shut down from time to time and the effects of the Acadian orogeny. An integrated approach would be needed to resolve these questions, employing mapping and dating of the various marker horizons throughout the system (calcrete, air fall tuffs), sedimentology and the various forms of fossil study (botany, palynology, ichnology, etc.).

Paul Olver introduces Professor Brian Williams

Tony Brook described the lives and very different characters of the two founders of the ORS, Hugh Miller and Roderick Murchison. Tony Ramsay gave an overview of the Forest Fawr Geopark, in which the ORS is the dominant rock. The Geopark shows effects from two orogenies and from wide changes in climate and environment. He outlined the main research areas at present active in the Geopark. These are studies of the still active principal fault systems (Neath Disturbance, etc.) and of samples from the last Ice Age (including the novel approach of studying DNA attached to sand grains). Finally in this session, Toby Driver showed many fine aerial photographs of Pembrokeshire and the Black Mountains and explained their use in geological work.

Craig-y-fro quarries; Senni Beds Formation

The second session was concerned with palaeontology. The first paper described Pteraspidomorphs, traditionally known as ORS fish. They. have been interpreted as fresh water inhabitants but have recently been shown to occupy shallow marine environments in the Ordovician and Silurian. They are dispersed worldwide and this led to a heated but unresolved discussion on how this could occur if they were creatures of fresh water. The second paper discussed the possible linkage between the basins of the Scottish and Anglo-Welsh LORS basins. This is based on the discovery of a few fish species common to the two regions. Susan Turner discussed various aspects of microvertebrate fossils and then Jenny Morris spoke on the evolution of land plants, including discoveries from Craswall in Herefordshire. Lastly, Christian Baars linked a substantial decrease in atmospheric CO_2 concentration during the mid-Palaeozoic with the evolution of rooted land plants which resulted in increased weathering of Ca and Mg silicate rocks and transport of the weathering products to the sea.

Llech Llia — soft sediment deformation near the base of the Brownstones.

The final session of the meeting discussed sedimentology and lithostratigraphy, and was begun by a paper from Duncan Hawley in which he described the Black Mountains and south-west Herefordshire as 'black holes' as far as geological research was concerned – so little work has been done. He described his own extensive work in the area, some of which is detailed elsewhere in this newsletter. Geraint Owen (Swansea Univ.) spoke on soft sediment deformation structures and their several possible modes of origin. For numerous local examples, including

those on the Cat's Back in Herefordshire, he seemed to favour the mechanism of water escape following liquefaction of the wet sediment by movement on nearby faults. John Davies showed many pictures in support of his observation of a newly recognised regression boundary in the Brownstones, possibly a result of the Acadian orogeny. Finally, Kate Andrew and Elliot Carter reported on the EHT '1000 Years of Building with Stone' project, with particular reference to the ORS. The database of local stones is likely to be useful for wider geological purposes.

A very informative discussion session led by Prof. Williams ended the meeting. The many unknowns which still exist in ORS research were noted and the need to combine the results of all the disciplines described in the symposium was widely recognised.

A walk around Brecon to see the local building stones was led by John Davies. On the following day there were two whole-day excursions.

Excursion to Fan Fawr and Llech Llia led by John Davies. (Report by John Stocks)

The A470 from Brecon to the Storey Arms passes upwards from the St Maughans Formation into the Senni Beds Fm. Exposures in the Senni Beds were examined in the Craig-y-fro quarries. 500m to the south-east, the Nant y Gerdinen cascades down the slope from Fan Fawr (SO 974205) over a series of waterfalls in the Brownstones Formation. Looking upwards, the results of repetitive cycles of fluvial processes rise steeply and are exposed in a 'staircase' sequence. At the top, a thick bed of softer mudstone has created a broader platform interrupted higher up by more sandstone outcrops, with random boulders showing soft sediment deformation.

During the ascent John Davies drew attention to some key features of the exposures:

Sandstone beds with ripple tops, channel lag deposits, calcrete clasts, and mud-clast cavities.

Senni Beds: grey/green colour, greater organic matter preservation, and higher mica content.

Brownstones: colour change to purple, lower mica content, higher sandstone component.

Unusually, several examples of possible Beaconites trace fossils were observed on sandstone surfaces.

Llech Llia (SO 919189) is in the Brownstones Fm. in an area of broad sloping moorland below Fan Llia. A scattered sandstone blocks exhibit soft sediment deformation (SSD). The trigger for such extensive deformation is not yet clearly understood, although the area is close to the multiple faults of the Swansea Valley disturbance.

Excursion to Tredomen, Cockit Hill and Bwlch Quarry led by Duncan Hawley.

Tredomen quarry has been the location for exciting fossil discoveries of plants, fish, arthropods and a spider. During our visit a good fish fossil was found and numerous Beaconites burrows were noted. The St Maughans rocks show widely varying facies. These, and their relationships, were discussed with special importance placed on the calcretes, which provide evidence of basin shutdown.

The climb to the top of Cockit Hill was worthwhile both for the view over Llangorse and far beyond and for the range of ichnostructures (trace fossils) which Duncan pointed out.

Tremynfa Quarry exposes conglomerates and channel sandstones in the Senni Formation. A broad channel about 45m wide and 3m deep is the most evident feature in the main face of the quarry. The rocks are sandstones and conglomerates. A layer, apparently a simple mudstone, was seen on close examination to be a mudstone conglomerate with rounded mudstone clasts up to 10cm in size.

Duncan Hawley explains Tremynfa Quarry

The BGS Memoir '*Geology of the country between Hereford and Leominster*' states that landslides are uncommon in the district but that on the Leominster - Bromyard plateau there have been some within the St Maughans Formation, and 'The largest slip forms a belt 1.3km long [SO 567517] on the south side of Dudale's Hope valley'. It was at SO 591508, some 3 km to the east of Dudale's Hope, that on 1 April 2014 we visited the site of a recent landslide. This affected Shortwood Farm and we are grateful to Mr and Mrs David Legge for their permission to inspect the site.

Fig 1 Looking east at the rear backscarp of the landslide on the south side of the drive to Shortwood.

The landslide occurred on 7 February 2014 at the top of the steep slope above the village of Ullingswick and was, in the words of the BGS classification of landslides (see the BGS website), 'a reactivation of an ancient landslide. The reactivation is a shallow translation with flow features at the toe.' About two acres of agricultural land were affected, but no buildings, and the road between

A Landslide at Shortwood

by Charles Hopkinson and Moira Jenkins

Pencombe and Ullingswick, which runs north/south more or less through the centre of the disturbed area, was so severely damaged that it had to be closed. It was not until August that the road was reopened. The repair was difficult because of the geological instability of the site. The rear backscarp, running east/west at the top of the slope, damaged the farm drive to Shortwood (*Fig 1*) which has since been repaired. Below it a large oak and other trees (*Fig 2*) have been moved down the slope. A scarp running southwards from the backscarp marks the eastern limit of the landslide (*Fig 3*). At the toe of the landslide the flow rode over a previous earth movement, with

buckling of the road surface (*Fig 4*), and in the adjacent field to the west of the road the flow exhibited similar typical 'roll over' features. Cracks higher up the road showed how the ground had dropped and moved laterally (*Fig 5*).

The 2014 landslide covered much the same area as that affected by the one in 1947 and, to the west of the road, there is evidence in the disturbed landscape of earlier landslides. Two photographs of the 1947 landslide show damage to the Shortwood drive and to the road very similar to the damage caused in 2014 and illustrated here.

Fig 2 A mature oak tree which has been moved down the slope with the eastern scarp (Fig 3) in the background.

Fig 3. The scarp marking the eastern limit of the landslide which runs south down the slope with the Shortwood drive in the background.

The causes of the landslides of 1947 and 2014 are attributed respectively to periods of melting snow and to heavy rain. Again, in the words of the BGS report: 'Groundwater seepage, from pervious layers of calcrete, sandstone and conglomerate within the St Maughans Formation saturates and weakens the underlying mudstones; in wet weather the increase in pore water pressure is the likely cause of movement.'

Much of this note is based on the BGS Report and National Landslide Database (ID19624/1-3) which can be found at: www.bgs.ac.uk/research/engineeringGeology/ shallowGeohazardsAndRisks/landslides/shortwoodhtml

Fig 4 Damage to the road at the toe of the landslide showing a typical 'roll over' feature.

Fig 5…A crack across the road with the entrance to the drive to Shortwood Farm to the right (east) behind the barrier. The

pole is marked in half-metre lengths. The crack extends into uneven ground in the field to the left There is another, small-

er, crack across the road a few yards below the one in the photograph.

A Visit by the Friends of the Sedgwick Museum, Cambridge

by Gerry Calderbank and Paul Olver

In October 2013, members of WGS hosted and guided a visit by the Friends of the Sedgwick Museum in Cambridge. On the initial evening, 1st October, Gerry set up his slide show *'The Geology of the Woolhope Dome and Malvern Hills'* for a presentation which was delivered by Paul and was greatly appreciated.

On the following day the party travelled to Hereford. Paul led a tour of the building stones of the cathedral and finished with an exposition of the City Library architecture, including an interpretation of its sculptural ornamentation. After lunch at the Yew Tree Inn it was a short ride to Swardon Quarry. Rosamund here explained the local exposures, including the bentonite layers – and she found a hitherto unnoticed fossil exposed in the quarry face. Sadly, the view from the upper viewpoint was greatly restricted by haze; nevertheless, the cathedral and a few of the most prominent city buildings plus some middle-distance landmarks were identifiable.

Next, to Wellington Heath and the Loxter Ashbed Quarry. This had been completely cleared of its overgrown vegetation and silt by the Champions group and was in tip-top condition. One of the visitors was both a local Champion and a Cambridge geology graduate living just up the road and so we received an enthralling account of the site in its wider Silurian context! Dinner as guests of the Friends in the Burgage Hall in Ledbury ended a very enjoyable day

The group was staying in West Malvern and the second full day began with a short journey to the British Camp car park. This day was marred by poor weather as the party made its way to Clutter's Cave. Here, basaltic pillow lavas of the Warren House Formation were examined and the party was challenged to pick out individual pillows. With the weather improving, the Herefordshire Beacon, thrust west over younger Palaeozoic strata, emerged from the low cloud and its displacement from the main Malvern axis could be seen.

To escape the strong wind and showers, the group retreated to the former Lower Tollgate Quarry to look at the early phase peridotite forming the buttress between it and the upper quarry. Now metamorphosed to an amphibolite, its alteration zone in contact with a later pegmatite dyke, now unfortunately unexposed, was examined. Everyone was pleased to find small 'books' of black biotite mica in the metasomatic zone close to the pegmatite. Recent work by WGS and the Malvern U3A suggests that these unusual 'biotitites' pass right across the Malvern ridge at this point.

The party moved on to the Dingle Quarry where early diorites can be seen intruded by later pegmatites and finally, after shearing, by a sill of microdiorite. The whole history of the Malverns is encapsulated within the two levels seen in the quarry. Down the road, the group stopped briefly at St. James' Church built in characteristic Malvern-style with angular blocks of Precambrian Malvernian largely derived from Dingle Quarry. The variety of rocks in the quarry gives rise to the colourful outside walls of the church, pale-green epidote being particularly noticeable. Everyone was relieved to break for lunch at the nearby Elim Centre and here the visit ended.

THE GEOLOGY OF THE 'LOST' TRACT OF THE WYE VAL-

With the Wye Valley flanked by the Woolhope Dome to the east, the Black Mountains to the west and Symonds Yat/Forest of Dean to the south, each with their 'classic' geology, it could be easy to disregard the relatively lower-lying tract of land in south Herefordshire occupying the space between, where outcrop seems almost non-existent. But geology is continuous, of course, albeit apparently hidden, and in this sort of countryside it is often a matter of using clues on the map and in the landscape to find 'hidden' outcrops and landforms that will reveal the geological history of the area. The aim of this article is to highlight some of the outcrops and features discovered in the geological survey of a 'space between', stretching from Bredwardine down the Wye valley to Breinton, then across to Kingstone, Kilpeck, Garway Hill, Orcop, St Weonards and Langarron and the Garren valley down to the Wye at Whitchurch.

Lower Old Red Sandstone rocks underlie much of Herefordshire and are largely responsible for the red soils that characterise the area. Old Red Sandstone (ORS) was often given scant attention in the past, not least because early geological workers, back in the mid-19th century found relatively little of interest compared to the fossil-rich rocks of the grey Silurian rocks beneath. However, more recent geologists recognise the importance of looking for more than obvious remains of former organisms and also that close attention to the sedimentary structures can reveal good evidence for palaeoenvironmental interpretation and re-construction.

The oldest part of the Lower ORS is dominated by mudstones and silts which, at intervals, contain white-grey nodules of impure limestone and are punctuated by occasional bands of sandstone. These strata are classified as the Raglan Mudstone Formation (RMF) and they were deposited around 420 million years ago, give or take a few million years (exact dating is a difficult science that requires error margins, particularly as time becomes deeper). As such, the RMF has been recognised as belonging to the uppermost Silurian period within the Pridoli Stage.

Good exposures of the RMF in this region are not common – they are often considered to be 'soft rocks' which create the low-lying terrain of the Herefordshire plain. The full explanation is, however, a little more sophisticated. The siltstones of the RMF are often laminated – in very thin mm-scale layers caused by small but frequent pulses of deposition, with the laminae surfaces representing tiny breaks in sedimentation. The breaks create microscopic horizontal planes of weakness and parting. At intervals there were longer breaks in deposition, which have resulted in the silts being organised into larger depositional units of beds. With careful observation it can frequently be seen that the beds show signs of bioturbation – the sediments were occupied by burrowing organisms (*Fig 1*). Some beds are densely packed with burrows – the interface of each with the original sediment produces a weak vertical or sub-vertical plane in the rock.

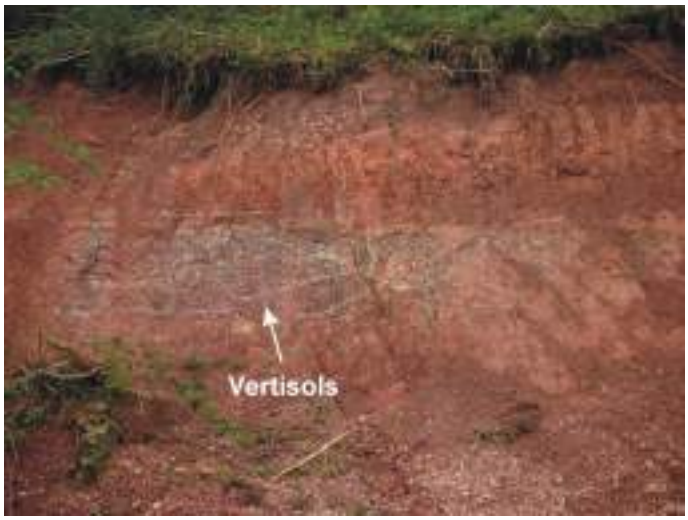
Fig 1. Fossil burrow in the Raglan Mudstone, Westonhill Wood

There are other fracture planes that can often be seen in the silts of the Raglan Mudstone Formation – at least where there is a sufficient area of exposure, as at **Westonhill Wood** near Bredwardine[1] (SO 312 452) (*Fig 2*). The most prominent of these are curved planes, which

when examined often show signs of a form of smooth polishing (or slickensiding). This is produced by shear stress in the sediment resulting from differential movement of the sediment on either side of the fracture plane due to uneven expansion and contraction of the clays under alternate wetting and drying. These features can be seen in semi-arid regions of the present day which experience periodic (seasonal?) wetting from rainfall or flooding. On

Fig 2. RMF Vertisol fractures at Westonhill Wood

drying, a pattern of vertical cracks springs up, which on the next wetting, enables moisture to penetrate the weathered sediments and swell the clays. These soils are called vertisols, which also develop columnar to prismatic peds (a 'ped' is a small aggregate of soil particles), resulting in planes of weakness in the soil sediment which result in a



blocky structure. This is frequently seen in the RMF siltstones and mudstones, now identified as palaeosols, i.e. fossil vertisols. As a result of the (multiple) fracture planes within the rock, it is easily weathered as water can penetrate the planes and weaken the rock. Consequently,

[1] *The Westonhill Wood site is a private track that has been cut into the hillside by the landowner to provide access for removing timber and stone, exposing an excellent section of Raglan Mudstones Formation rocks. As you ascend the track you also travel up the geological sequence.*

when the siltstones of the RMF are tapped with a hammer, the rock crumbles into small pieces, even though the individual fragments can be quite compact and hard. Once broken and exposed to the elements, the clay minerals of the siltstone and mudstone react with water to break the rock down further. This a major reason why much of the Old Red Sandstone plain of Herefordshire is made of 'soft' rock and deeply weathered soils, with little in the way of 'solid' or upstanding exposure.

Another characteristic of vertisol formation is calcium carbonate accumulation at the interface between the soil and the underlying unweathered sediments, usually occurring as nodules, which displace the surrounding host sediment. The nodule horizons are known as calcretes. It is thought that this process is controlled by equilibrium between illuviation (downward movement) and eluviation (upward movement) of calcium-saturated water, so that the longer the process can continue without being significantly interrupted, the larger the growth of the carbonate nodules. Consequently, it is possible to estimate periods of relative stability (or change) within these mudstones. For a mature calcrete (with fist-sized or larger nodules) a residence time of typically 10,000 to 500,000 years is required, meaning sedimentation rates as low as 2.0 to 0.02mm per year. Locally, interruption to the process occurred when floods swept across the ancient floodplain, removing the top horizon of the soil and creating an incomplete palaeo-profile and intermittently depositing tabular fine-grained sandstone sheets. Occasionally thicker red, grey or green coarser-grained sandstones with scoured bases occur, as at **Breinton**. This is evidence of a main trunk river channel occupied by a flashy river during the wet season.

At Westonhill Wood, there is a rubbly mature sequence of cobble-sized calcrete nodules about 0.9m thick. However, elsewhere in Herefordshire the calcrete at the same stratigraphic level is a thick coalescence of nodules, which result in a limestone of 'massive' appearance. This is the Bishop's Frome Limestone member (BFL), which can vary between one and four metres thick.

One of the best exposures of the limestone is in the area between Kingstone and Wormbridge (*Fig 3*). Here the BFL member comprises a massive limestone of at least 2m thickness overlain by 1.5m of red siltstone with vertisol features, capped by 0.5m of rubbly nodular calcrete which is increasingly coalesced towards the top. The BFL was extensively quarried here, probably because it is relatively thick and easy to excavate. The calcrete was used to charge two large lime kilns located on the bank leading up to the quarry.

The BFL represents a major hiatus in sedimentation across the region at this time, lasting somewhere in the order of one million years. It is difficult to identify the cause clearly but it likely to have been due to changes in the supply of sediment caused by orogenic uplift in what is now the mid and north Wales area.

Fig 3. Bishop's Frome Limestone calcrete mature profile

Above the BFL the proportions of the rock lithology reverses with sandstones predominating, although there is evidence that finer-grained silts and muds were still present. However, the sedimentary geology indicates a change to much swifter rivers that frequently re-worked much of the finer sediment deposits and swept them downstream. Recognition of these changes allows these rocks to be classified into a group called the St Maughans Formation (SMF) which outcrops in the area. Most of the SMF in the area of the survey crops out to the south-east of a geological boundary near Kilpeck. Here there is a low scarp slope aligned NE to SW, which is interpreted as an

extension of Neath Disturbance - one of the great a structural lineaments that cut across the Welsh borderland. Exposures of the SMF in this area are few and far between but two outcrops on the scarp near Kilpeck, only 1km apart, dip in different directions (east and south-west), indicating upheaval along the fault line. Other scattered outcrops of the SMF occur in streams e.g. near Allen's Hill Farm (SO 4597 2995), or in deeply rutted lanes, as at Orcop (SO 4252 2571).

The regional dip of the rocks is to the south-east. Therefore, towards the River Wye, the SMF dips under younger sediments of south Herefordshire that are increasingly dominated by sandstones. These sediments are marked on the geological map, over a large area, as the Brownstones Formation. However, this classification is contentious, as further west in the Black Mountains and Brecon Beacons there is an intervening Senni Formation, characterised by a mix of red and grey/green beds with plant remains.

Behind a cottage near **Cole's Tump** (*Fig 4*) is a rock face excavated into the bank (SO 46356 28064) comprising red medium sandstones with low-angle cross-stratified planar beds that fine upwards, topped by more muddy heterolithic units. These are frequently not complete due to being eroded and cut-out by overlying sandstone units. The cross-stratification indicates these sediments were deposited as sand bars in high sinuosity river channels with fluctuating water levels. Abundant vertical burrows (*Skolithos* sp) and plant rooting structures penetrate the sands, extending down from the top of foreset surfaces, suggesting rapid and dense colonisation by organisms and plants on the bars and at channel margins in low water conditions.

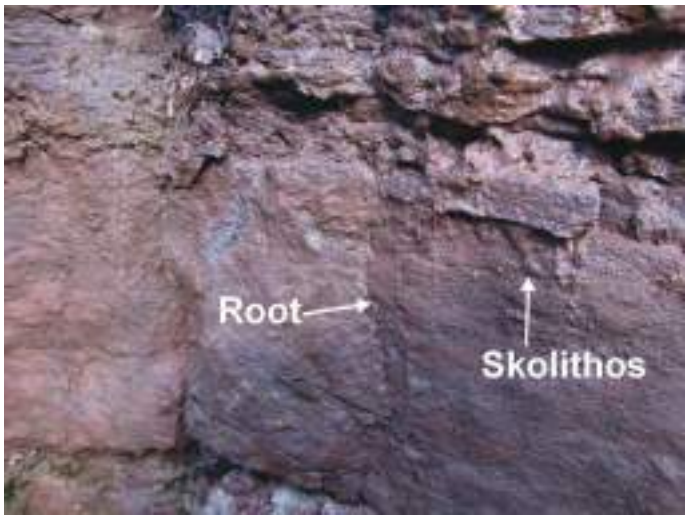
Fig 4. Brownstones Formation rooting structure (bifurcates downward) and Skolithos burrows, Butt's Cottage, Cole's Tump.

The overall sedimentary architecture and fossil content in these rocks is typical of that found in the uppermost SMF or the Senni Formation elsewhere, so there is a debate as to whether the rocks at this locality are part of the Brownstones Formation as indicated on the geological map.

Fig 5. Brownstones Formation cross-stratified sandstones, Fishpool Farm

A more 'typical' example of the Brownstones Formation

is exposed at Fishpool Farm situated 1km north east of St Weonards (*Fig 5*). Here (on the site of a demolished farmhouse) an excavation has exposed two perpendicular sandstone faces. These reveal four red medium- to coarse -grained cross-stratified sandstone units with foresets inclined at an angle between 10º and 15º.



Two units have foreset directions indicating currents flowing SE but the intervening unit indicates flow in an ENE direction. At the base of this middle unit is a poorly-sorted gravel lag with sub-rounded fragments of quartz and calcrete and disc-shaped clasts of green mudstone in a matrix of weakly cemented quartz sand and coalified pieces of organic, possibly plant, material. This unit displays mudstone 'lenses' on the north face, but close observation reveals these are made of mudstone gravel.

There is no significant evidence of 'rip-up' clasts, which suggests the gravel material results from regular reworking of previous channel deposits. Interpreting this evidence suggests these rocks were formed in a semi-arid environment of shallow braided rivers with high energy flashy discharge producing sand/gravel bars and channels that migrate both laterally and downstream. The river actively eroded into its banks, re-working earlier deposits in mid-channel bars and entrapping organic material growing along the banks and bars.

The uppermost rocks of the Brownstones Formation are dated at about 370Ma - and there the evidence for the geological history of the area would end if only 'solid' geology was considered. However, the area has some interesting geomorphology and superficial deposits that help fill the gap in understanding geological events between the mid-Devonian and the present day.

The south of the survey area is dominated by the Garren valley, which follows a winding course through the underlying Brownstones. The valley is incised and is oversized in comparison to the current-day Garren Brook. Many stretches of the valley are deeply cut into the bedrock, in a meandering form with 'classic' features of steep outer bends and more gently sloped spurs on inner bends.

Fig 6. Garren Valley incised meander and stepped slope with benches in distance (at Llangarron)

The underfit stream of the Garren valley has developed a different meander pattern on the recent alluvial infill of the incised valley floor. The valley was one of the locations studied by the fluvial geomorphologist GH Dury in the early 1950s and which formed the basis for his classic and enduring studies on misfit streams. Dury cited the Garren valley as a prime example where incised meanders could not be explained by downcutting resulting from river capture. Thereby he inferred that these outsized meander landforms were created by higher discharges (typically twenty times that of the present) resulting from increased storminess during the Pleistocene and early Holocene epochs. By comparison, the present-day channel and meanders are much reduced in dimension reflecting the present 'moderate' temperate conditions and climate.

There are several locations where these features can be viewed but perhaps the best is from pubic footpaths downstream from the village of **Llangarron** (*Fig 6*).

Here, in addition, the surrounding slopes are a series of 'stepped' bench surfaces. This suggests stages of uplift

followed by stasis and erosion, with the lowest bench subsequently incised due to a further change in base level and increase in fluvial discharge, creating the present meandering steep-sided valley landforms. The bench landforms provide evidence of broader tectonic events during the Neogene and Quaternary. These events are not represented in the rock record in this region nor are they generally well-represented throughout southern Britain.

The final stage of this geological tour of the survey area returns to the Wye Valley, to the **Cage Brook near Clehonger**. Before flowing into the River Wye in the Breinton Gorge, the brook has incised a valley through glacial till deposits down to bedrock of the Raglan Mudstone Formation. However, it is superficial deposits and landforms that provide an insight into the late geological history here**.**

Underlying the ancient monument of the adjacent **Eaton Camp** and forming the terrace feature on which it sits is an unconsolidated deposit of poorly sorted pebble- to cobble-sized sandstone clasts set in a red-brown gravel matrix, exposed at the crest of the valley slope (SO 4554 393) (*Fig 7*). The clasts are of two types; locally derived ORS material and more 'exotic' pebbles of grey-green sandstones. The latter are probably of Lower Palaeozoic origin and include occasional pebbles of vein quartz (from central Wales) brought englacially to this area. The clasts are imbricated (long axes oriented), indicating deposition in a current flowing NE to ENE (parallel to the orientation of the lower Cage Brook).

Fig 7. Eaton Camp Terrace - illustrating imbricated clasts

This gravel, much different to the surrounding glacial till, suggests deposition by a proto-Cage Brook flowing into the Wye. To form a deposit, the Wye must have been aggrading – which means it must have paused for a short time in its post-glacial erosion of the Breinton Gorge. The age of this event is difficult to establish but it pre-dated the formation of the present-day Cage Brook valley and it may have been due to a cold period reducing the fluvio-glacial discharge from the retreating Wye glacier up the valley, resulting in the river depositing some of its load, around 23,000 to 20,000 b.p.

Up the valley, beyond **Ruckhall Mill** lies a terrace or bench (SO 4054 3827) about 3m above the Cage Brook, backed by a steep-faced bluff and disconnected from the present-day channel that forms the western slope of the valley. Exposures indicate the bench material is composed of red silty clay with a mix of pebble clasts, varying in shape and size (up to 20cm long) composed of a mix of local and exotic lithologies. Using this evidence and comparison with other terrace deposits in the Wye, phases of formation of the Cage Brook valley can be established:

1) initial incision and rapid downcutting to match that of the Wye downcutting in the Breinton Gorge. The size and form of the valley suggests that large discharges of available, pro-glacially produced surface waters occurred. These facilitated the large scale of erosion, which may have been aided by permafrost conditions,
2) a pause in the downcutting of the Wye leading to aggradation and 'ponding' of the tributary Cage Brook valley leading to the deposition of the terrace bench. The ponding resulted from the narrow width of the gorge of the Cage Brook downstream of Ruckhall Mill which constricted and reduced the discharge of surface water contributed by tributaries draining the plateau into the Wye. The fines of the terrace bench deposits may have been chiefly from suspension, whilst the pebbles may be from mass wasting of the bluff slopes.
3) renewed down-cutting to the new base level of the Wye (3m lower) created the present day channel bed.

GEOLOGY SECTION MEETING REPORTS, 2013 - 14

by Geoff Steel

Friday 18th October 2013:
The Falklands and South Georgia

James Creswell is the founder of GeoWorld Travel. He leads tours and holidays to sites of geological interest in exotic far-away places and also in his local area around Hay-on-Wye. In this talk he took us to the South Atlantic where he has been many times.

He started with the oldest rocks which are at the southern tip of West Falkland. They are gneisses about 1000My old. The rest of that island and the north part of East Falkland are Silurian to Devonian sediments of which the top part, the Port Stanley Formation, is a white quartzite more than 1km thick. It forms the rocky outcrops which were the scene of intense fighting during the Falklands war. Carboniferous to Triassic sediments form the remainder of East Falkland. These include tillites from the Carboniferous ice sheets and also the well-known *Glossopteris* flora. They are cut by Triassic dykes formed during the early stages of Atlantic rifting.

That same rifting produced the oldest rocks of South Georgia: the igneous and metamorphic Drygalski Fjord Complex. It is the most spectacular part of the island. James showed amazing photographs of high mountains and huge glaciers. Pillow lavas and Jurassic turbidites form the rest, including the central spine of mountains. They were folded 90My ago. The folds are well displayed above Grytviken which is where the blue whale came from in the Natural History Museum.

James described more of the wildlife, including penguin colonies numbering in tens of thousands (they smell like chicken farms). He finished by describing the complex plate boundaries which separated 34My ago allowing cold water to circulate around Antarctica. This started the glacial episode which still continues.

Friday 6th December 2013: Members' Evening

In the notices at the start of the meeting Tony Geeson drew attention to plans by Herefordshire Council to reduce the museum services and limit the opening hours of the library. There are questions about how this will affect the Woolhope Club, in particular our access to the meeting room on Friday evenings.

Geoff Steel talked about a recent trip to Tyrone in Northern Ireland. The rocks include an ophiolite sequence of Ordovician age from which he showed samples of gabbro, dolerite and pillow lavas. Chris Fletcher followed with a talk about gypsum, showing a fibrous form from Kent and a crystalline form called a 'desert rose'.

Four members then concentrated on the local area: Nicky Geeson showed extracts from the interactive BGS map of geology and topography with a focus on the area around Stretton Sugwas. Sue Hay brought a sample of coarse grit from Brampton Bryan. Most of the village is built of it. The rock has never been dated but is mapped as Precambrian and resembles similar types on the Longmynd. Tony Geeson showed glacial erratics from his allotment, originating from as far away as mid-Wales. Jean Hopkinson described Herefordshire as an excellent place to find flints. None occurs here naturally so all have been brought in by rivers, glaciers or humans. She showed a photo of Wall Hills, the Iron Age fort near Thornbury where she has found good examples.

Discussing exhibits at the Members' Evening

Richard Edwards showed photos of Galicia in Northern Spain. The rocks were metamorphosed by Variscan folding and he noted the difference between syn-tectonic

granites (foliated by compression) and post-tectonic granites (unfoliated). Finally John Payne showed photos from San Diego. The Mineral and Gem Society Museum is the old-fashioned type with specimens and labels, while the Natural History Museum has some impressive samples including a section of the KT-boundary layer.

Friday 24th January 2014:
Interpretation of an Unconventional Gas Discovery

Tim Wright and Sarah Dominey work for Merlin Energy in Ledbury. They have been studying a gas field in Poland which has been known since the 1970s but not exploited because the geological conditions were too challenging.

Tim described 'conventional gas' as occurring in porous rocks, typically 15 to 20% porosity, with an impermeable seal above. Simply drilling into the porous rock allows gas to flow out under its own pressure. A recent alternative has been 'shale gas' which occurs in organic sediments and can be recovered by hydraulic fracturing (fracking) from horizontal wells. The Polish field is neither. It is a Permian sandstone with porosity below 10% which is too low for its internally trapped gas to flow out. This condition is known as 'tight gas'.

A possible means of recovering tight gas may be to work with the natural fractures that already exist in the sandstone. But there is a problem of scale. The reservoir is 5km down so seismic maps have very poor resolution with scales in the order of hundreds of metres - not good enough to understand the true structure.

At this point Sarah took over and described her research. Several exploration wells have been drilled and cores are available from them. She showed us one. A faint diagonal line revealed a tiny fault with a displacement of just a few mm. Using these cores she has built up maps of micro-faults in the immediate vicinity of each well. The scales are too small to be of direct interest, but she has shown that her maps line up with faults already known from seismic data. In other words the sandstone has a mathematical 'fractal' property which is the same on all scales. This is very exciting as it may be the key to commercial exploitation of the field.

Friday 28th February 2014: AGM and Dinner

Geoff Steel, our Chairman, welcomed members and stated that Charles Hopkinson would act as Secretary because Paul Olver was unable to attend. Charles read Paul's report in which he gave notice of two forthcoming GA events: a conference on the Old Red Sandstone and a series of Geolab educational days. In her Treasurer's report Beryl Harding stated that a slight loss has been made over the year. Part is due to expenses for our book *Herefordshire: its rocks and scenery* but a grant from the WNFC Walter Smith Fund will be available following publication and will more than cover this. A grant from the WNFC Central Committee has been received for purchase of a projector. Charles Hopkinson reported that work on the book is continuing with John Payne as the new editor. Moira Jenkins reported visits to the county by researchers from Glasgow and Birmingham universities and she asked for volunteers to help with site clearance.

Tony Geeson led a discussion about the future of the Library and Museum services. Restricted opening hours may affect our use of the Woolhope Room and Sarah Skelton is no longer employed by the Council so we have no representative from the Museum.

Sue Hay commented on various aspects of the EHT and Geopark's activities including the Heritage Lottery funded project 'A Thousand Years of Building with Stone'. Gerry Calderbank reported on a proposal to extend the Geopark westwards into Herefordshire, to include such sites as Shucknall Hill and the Woolhope Dome.

After the AGM we held our Annual Dinner. This year it was at the Merton Hotel; we thank them for their hospitality and an enjoyable evening.

Friday 21st March 2014: Eyjafjallajökull - Aerial Geohazards

Iceland's unpronounceable volcano caused huge disruption to air travel in the spring of 2010. Sue Hay and Gerry Calderbank joined forces to describe the event. They showed a film made by a local farmer.

Seismic disturbances began in 2009 at a position several miles to the east. In December activity moved to below the volcano and in early March 2010 the ground started rising by 1cm per day. Fire fountains began on 20th March. The eruption was of alkali-olivine basalt and was spectacular to watch, especially at night, drawing crowds of people. But by volcanic standards the activity was only minor and the crater was not near any ice.

Then on 13th April there was a 'seismic storm'. A two-kilometre fissure opened up, emitting andesitic tephra which is much more explosive than basalt. And it was under ice! The blast sent 500 tons of ash per second to a height of 9000m. European airspace was closed for five days with the cloud reaching as far as Turkey. Yet surprisingly little ash fell in Iceland. The farmer's film showed only a few cm on his buildings and fields, all the rest had gone straight up. Explosive activity continued until 20th May with occasional bursts from June onwards. By October it was finished.

Eruption though ice caused the ash to cool quickly which made it very angular and abrasive. A particular hazard was the mixture of poisonous gases, notably hydrogen fluoride which can dissolve rocks and can remain for a long time in dried grass so is dangerous to animals.

Sunday 13th April 2014: Penarth

South of Cardiff the coastal section from Penarth to Lavernock is well known and gives its name to the Penarth Group of the upper Triassic. Tom Sharpe was our guide on this bright and sunny spring day.

We started from the Cliff Parade car park. A new sea wall has been built of Jurassic limestone with a decorative cap of Triassic conglomerate. This gave a good introduction to the local geology. Above the wall we could see red Triassic mudstone, a terrestrial deposit with a gentle dip towards the south. Walking in that direction led to the overlying Blue Anchor Formation which is grey mudstone of marine origin. Continuing along the beach there was a sudden change to dark pyritic mudstone, the Westbury Formation, indicating a deep water oxygen-starved environment. Above this the lighter coloured Lilstock Formation is made up of ripple-marked siltstones, some of which have a network of desiccation cracks indicating formation in shallow tidal conditions.

The rocks are folded into a syncline then an anticline so walking further we returned down the sequence, past several prominent faults, back to the red mudstone. In this area it contains bands of gypsum. They erode out of the cliff and look like white tennis balls on the red-coloured beach. A further syncline brought back the upper layers, and here Tom showed us the transition from Lilstock Formation to Blue Lias which is the Triassic to Jurassic boundary. At Lavernock Point a path led up to the church, the site of Marconi's early radio experiment, and back is along the cliff top to the car park.

The Jurassic / Triassic boundary at Penarth

Sunday 1st June 2014: The Brecon Anticlinal

Eight members and a visitor joined Duncan Hawley for this visit to an area of folded Silurian rocks about 7km north of Brecon and on the south-westward extension of the Church Stretton fault system. Duncan explained that the area was of particular importance in the work of R Murchison; the similarities in facies and fossils with those at Ludlow allowed him to correlate the two areas and hence to build his ideas of the overall geological structure of the region. Duncan asked us to seek evidence of the origin of the rocks in the first of three quarries. The rock was principally grey siltstone but, in addition, a brown, sandy, light rock containing near-surface fossils was found in loose pieces sandwiched between the deep-water siltstones. It was found in the quarry face by Sue. Members offered suggestions for its origin but it required Duncan to reveal that this material, already largely solidified had slid from the east down the edge of a marine platform

into the deeper waters of the Welsh Basin; it was a part of a rock slide. This was a most instructive lesson in geological deduction. (The brown rock was termed 'gingerbread rock' by Murchison.)

We visited two other quarries, both also in Ludlow rocks but with significantly different facies and, with dip measurements, confirmed the anticlinal nature of the area.

Duncan and Sue demonstrate the rock face in the first quarry on the Brecon anticline.

Sunday 13th July 2014: The Stiperstones

This was a joint field trip with the Black Country Geological Society. It was led by Andrew Jenkinson. We met at the Bog Visitor Centre, the site of an old mine which worked both lead and barytes. A short drive took us to the Stiperstones where we walked to the top of the ridge and examined the well-known quartzite which forms such a prominent feature. The rocks are of Lower Ordovician age. Andrew pointed out the view to the east, across the underlying Precambrian rocks of the Long Mynd, and to the west across the Ordovician rocks of the Shelve inlier which is the main area of mineralisation.

Returning to the Bog we studied the remains of the mine. The lead ore formed a thick vein heading east-west though the site and dipping steeply towards the north. It was worked by a method called 'stoping' in which horizontal galleries were cut along its length, with an engine shaft to pump the water. In the 19th century the main focus was lead mining but attention switched to barytes after about 1900.

After lunch at the Visitor Centre we drove to Shelve to see the Hope Shales, the next layer in the sequence.

Andrew Jenkinson and the group at Stiperstones.

Next we drove past the 'Roman Gravels', another large mining area, to the village of Hope. Here the shales form an impressive cliff in which they are sharply folded. Andrew showed us a display board in the bus shelter which describes how the locals cleared vegetation to reveal the structure. Finally we drove to Snailbeach which as one of the largest mines. Despite many years of collecting there is still plenty of galena on the waste tip.

Saturday 16th August 2014:
Worcester Building Stones

Andy Harrison from the Black Country Geological Society was our guide. He emphasised that the building stones show not just geology but also human history, in particular the availability of transport, initially via the River Severn then later by canals, railways and roads.

We started at the Guildhall. Built in 1721 it is brick with Jurassic oolitic limestone around the windows. Nearby is the much earlier St Helen's church, built of Bromsgrove Sandstone. The tower has the typical red colour which occurs locally but the rest is paler so Andy suggested a source near Warwick where the same Triassic rock has a different character.

Round a corner is the old fire station with its base of Portland limestone. And opposite is the College of Technology. It is faced with slabs of Jurassic ironstone which appear to have well-preserved ripple marks. But closer inspection shows that the marks are machine-cut; an art inspired by nature. Next to it is St Alban's church. It dates from 1175 with parts perhaps earlier. Having been rebuilt several times it is a mixture of more stones than we saw anywhere else.

After a pub lunch by the canal we walked to the Cathedral. There is so much history and geology that it cannot be described in a few words, but some special features which Andy showed us included the fine marble and limestone floor, the tombs of King John and Prince Arthur (both of Purbeck stone) and the huge decorative pulpit carved mainly from alabaster. Climbing a narrow spiral staircase gave a superb view across the city from the top of the tower.

Geology Section Programme for Early 2015

LECTURES are held in the Woolhope Room, Hereford Library, Broad Street, commencing at 5:30pm unless otherwise stated. The Annual General meeting is this year at a different venue and time; please note the item elsewhere on this page.

***Friday* 23rd January**
'Idar-Oberstein: a gem (stone) of a town'
Talk given by Dr Sue Hay.

Friday 27th February
Section AGM followed by the section dinner. Booking forms will be sent out electronically in January.

Friday 20th March
'EARS. The East African Rift System in Kenya'
Talk given by Prof. Bill Fitches

Sunday 26th April
Huntsham Hill; geology and landscape.
Walk led by Moira Jenkins

Further information from Sue Hay, 01432 357138 or email svh.gabbros@btinternet.com.

Editor's Note

WITH this eleventh issue of Earth Matters your editor has at last achieved a long-standing goal. This is to fill the newsletter with articles solely about our local area, Herefordshire and just beyond. In addition to our usual items, the Chairman's message, a report from EHT and Geoff's always excellent write-up of the year's activities, we have two major articles stemming from the EHT's DEFRA-funded programme in the Wye Valley and nearby areas, an on-the-spot report of a landslip in Herefordshire, details of a weekend visit to the county by a party from Cambridge and a report on a symposium on the Old Red Sandstone. The article by Duncan Hawley on some of his work for the EHT project follows his excellent lecture which many WGS members attended in Ross earlier in the year.

I wish to thank all the authors for their efforts in (very nearly) meeting my deadline for delivery of their articles. Despite their generally being much longer than I requested, I have managed to incorporate almost all of their material.

As last year, I have again not sought an article about WGS's major research task at the Martley Rock, in conjunction with EHT and the Teme Valley Geol. Soc., with financial input from the latter. Readers will, I hope, have noted the paper on this work in a recent issue of TWNFC (with, regrettably, a few errors). That paper was based on the first set of trenches dug at the site some years ago. Since then, the diggings have been considerably extended (although they must be filled in each time after a short period for our recording and analysis work). The further observations have allowed a much better interpretation of the geology. The structure, as a series of older rocks thrust over younger ones, has been confirmed; the extent of the outcrop is known; fossil evidence shows the quartzite to be of Cambrian age (as at Malvern); and the line of the East Malvern Fault across the field has been determined. The results are to be published in the Proceedings of the Geologists' Association in due course.

Subscriptions

THE ANNUAL SUBSCRIPTION to the Geology Section is currently £7.00. This is due on 1st January (as for all other WNFC subscriptions). Please pay this directly, and on time, to the Section Treasurer, Beryl Harding, 'Bramley', Lugwardine, Hereford HR1 4AE. **Do not** send it to the WNFC Secretary with your WNFC subscription. Cheques should be made payable to 'Geology Section / WNFC'. Members are encouraged alternatively to pay by Standing Order; forms are available from Beryl.

Annual General Meeting

MEMBERS are asked to accept this as notification of the Geology Section AGM to be held on **Friday 27th February 2015** starting at 6pm in the Berrows Business Centre on Bath Street (near the junction with Commercial Road). After the AGM we will retire for dinner to the Merton Hotel. Booking forms for the dinner will be e-mailed to members in January. The officials and committee for the coming year will be elected. Section members are invited to submit nominations for election to the committee. Nominations, with the names of the proposer and a seconder, must be received by the Section Secretary in writing (letter or email) before 27th January 2015.

LIDAR Data

READERS have probably recently seen, or heard mention of, the use of LIDAR data in geological and archaeological studies. Measurements of ground altitude are made using an airborne laser pulsing at a high repetition rate. The raw information is an array of ground altitudes with a spacing of 25 to 200cm, depending on the data-set, and an altitude accuracy of about 10cm. This allows representations of large areas of the ground surface to be generated showing far more detail than has previously been possible from, say, Ordnance Survey data.

Data for most of the country is now available to the public but is limited to areas susceptible to flooding and their surroundings. Thus, for instance, the Malvern Hills south of the Wyche Cutting are excluded. Nevertheless, these data have proved to be of great use to the Earth Heritage Trust in its current Building Stones project in finding old quarries now lost in woodland. Your editor has used the data to investigate landslips near Symonds Yat and on Merbach Hill.

To apply for access to the data, go to https://www.geomatics-group.co.uk/geomatics/login.aspx. Use of the data needs specialist software; I am advised that Manifold is good. It costs about $300.

Members of the WGS Committee

(December 2014)

Dr Geoff Steel, ***Chairman***

Gerry Calderbank, ***Vice-Chairman***

Dr Paul Olver, ***Secretary***

Beryl Harding, ***Treasurer***

Dr Sue Hay, ***Programme Secretary***

Moira Jenkins, ***Section Recorder***

Dr John Payne, ***'Earth Matters' Editor***

Charles Hopkinson, ***Minutes Secretary***

Tony Geeson

H&W Earth Heritage Trust and Abberley & Malvern Hills Geopark

As usual we have had a busy year at the Trust. Unfortunately Peter Oliver stood down as a trustee in November 2013 and then as Geopark Chairman in early 2014 on health grounds after being advised to take a complete rest. Nina Jeniec, the office manager, also left the Trust at Christmas 2013. In her place we have welcomed Rachel Howell.

The Building Stones project, which is designed to raise awareness of and appreciation of local stone across the counties of Herefordshire and Worcestershire, continues to make good progress with lots of new information being discovered by the volunteers. One unexpected problem has been getting the volunteers to record all the time they spend on the project. The Trust has to provide evidence of volunteer time in order to obtain the full project funding from the Heritage Lottery. To date we have recorded about 42% of the required volunteer hours.

Nineteen clusters are now active – rather more than originally intended. During the summer some work experience students have been crosschecking quarries on different editions of maps and Lidar data and have in the process found significantly more quarries than are mapped. The database which will store all this information is currently being built. It will be available on line for at least ten years after the project is completed. Data transfer should start towards the end of the year.

The trustees are still working to raise money to support the Trust's core activity. Something that many people do not realise is that this has never been fully funded. Funding for a new project aimed at the younger generations within the two counties is still being sought. This project will include the design of mobile phone apps.

Geofest 2014 was opened by the Geopark Chairman, Chris Darmon, at Hartlebury Castle in late May and continued as usual until the end of August. The organisation and publicity for this year's Geofest has been supported by a grant from the Petroleum Exploration Society of Great Britain and the sponsorship money from the walk last autumn. Along with the usual range of walks and talks there were family events covering a wide range of topics, a painting workshop and exhibition of works by John Ruskin.

Over the winter the Geopark Forum members will have to decide how to take forward the Geopark, and the Geofest in particular, without the major input that Peter Oliver has put in from the beginning.

Dr Sue Hay, *Chairman, EHT*

A Thousand Years of Building with Stone – an Update, Autumn 2014

Two years into the project and to date over 140 volunteers have donated their time to the project, recording and photographing the locations of stone buildings in our target areas across the two counties, researching the histories and sources of stone used in these buildings, discovering 'lost' quarries and locating and visiting potential building stone quarries as well as assisting at events.

The research has highlighted the importance of stone as a building material across the two counties, with over 2500 stone buildings listed so far. We have now commissioned a website which will make the information found during the project freely accessible.

Many of the buildings recorded are the result of a desk study by a single volunteer using the Pevsner guide to buildings in Worcestershire, which is proving to be a very useful source of background information. We are now looking for a volunteer to repeat the exercise for Herefordshire.

The task of researching building and quarry history has been made harder by the temporary closure of the Herefordshire Record Office. While it is shut we are aiming to focus on the recording of buildings and quarries, laying the groundwork for research when it reopens next year.

The project has also revealed that there is very little recorded information on historic quarries, quarrying methods and quarry workers. We have been using Lidar data to look for potential quarries but we have yet to confirm whether these sites have provided building stone.

We are still looking for volunteers to help with the project and are especially keen for volunteers to come forward for Ledbury, Hereford and the Golden Valley. If you are interested in getting involved then please do get in touch at *building.stones@worc.ac.uk*.

Beth Andrews, *Community Consultant, EHT*