

## Herefordshire & Worcestershire

In this issue we highlight the benefits of using geology and landscape and associated trails for walking and keeping fit and healthy.

# WALKING FOR HEALTH ON THE GEOPARK WAY

**N**ATURAL ENGLAND HAS MADE AN AWARD to the Trust from the Aggregates Levy Sustainability Fund to develop geological trails that 'Walking the way to health' groups can use as part of their established programmes.

Four routes along parts of the Geopark Way are to be researched in partnership with the established walking groups. Promotion of geology and landscape as an enjoyable and educational part of walking is in the project as is the production of simple leaflets for participants.

As well as the walking groups there are three Geopark partners participating in the project – Shropshire Geological Society, Gloucestershire Geology Trust

and ourselves. A great way to improve your health and stay fit. Look out for the leaflets.

For more information contact Andrew Jenkinson; [Andrew@Scenesetters.co.uk](mailto:Andrew@Scenesetters.co.uk) or Dr Adam Stinton on 01905 855184

There is more information about the Geopark Way long distance footpath in our regular section about the Abberley and Malvern Hills Geopark on the centre pages.



Geology is there for all to see in most towns.



## The Floods

**T**HE WORK OF TRUST GEOLOGISTS was seriously affected by the floods across the region in the summer.

The Geopark Way project saw parts of the proposed route washed away and the geology and geomorphology audits taking place as part of Geodiversity Action Plans were put on hold in certain areas. There was also major damage and subsequent disruption to the Severn

Valley Railway. The Trust has a geology and landscape trail and guide for the Kidderminster to Bridgnorth route which is used with schools and general interest groups. There are also recently completed trails in the Abberley and Malvern Hills Geopark, around

Highley Colliery and Stanley Quarry and developed in conjunction with Shropshire Geological Society. All of this work with SVR has been put on hold.

On 19th June 2007 torrential rain in the Severn Valley resulted in embankment slips at 45 locations along the railway line. The unconsolidated ashes and rock fragments that make up most of the embankments were soon washed out onto the flood plain and in to the river. Luckily this damage

occurred at night when no trains were running. There has long been an engineering problem associated with the unconsolidated ground and head deposits along the route of the railway; no doubt such mass movement processes were active during most of the Holocene. Landslips and debris flows must have been common during similar wet periods after the Ice Age. Now there is a railway line for Mother Nature to remove as well (but hopefully only on a geological timescale!).

A flood damage appeal has already raised significant sums towards the £2 million that SVR estimates will be required to reinstate the track (go to [www.svr.co.uk/appeal](http://www.svr.co.uk/appeal) for more information).



Left: A washout of the railway embankment between Arley and Highley on the Severn Valley Railway and the resultant debris fan on the flood plain.



Right: Destruction of the bridge over Dowles Brook in the Wyre Forest.

# BOOK A GUIDED TRAIL

**W**E NOW HAVE 25 TRAILS AND PRINTED GUIDES AVAILABLE over the two counties. Some have become so popular with groups that we have decided to offer a programme of guided walks.

For the next twelve months there are seven walking trails that are available to be booked within this project. They are Abberley Hill and Churches, Worcester Cathedral, Severn Valley Railway, Midsummer Hill and Raggedstone Hill in the Malverns, the Geopark Way, Kington and Whitman's Hill Quarry. There is a fee of £3 per person with a minimum charge of £25. The fee includes a copy, if available, of the full colour information guide for the trail for each person. Group numbers are restricted to a maximum of 25 people.

Just to whet your appetite:

- On the Abberley trail after an invigorating walk over the Hill there is afternoon tea in the Manor Arms in the centre of this lovely village
- Spectacular scenery and some of the oldest rock in England await you on the Malvern Hills trails



The Abberley Hill trail ends here for tea and cakes.

## New RIGS in Herefordshire

EIGHT SITES WERE DESIGNATED as part of the River Landscapes Discovery Guide project funded by the European Union EAGGF and DEFRA as part of the LEADER+ Herefordshire Rivers Programme. Half of these are geological and half glacial sites. The geological sites include Bishop's Frome Limestone, a pedogenic limestone and St Maughan's Formation with river channelling and mudstones.

The glacial sites are kettle holes an esker and a kame terrace. The Arrow Valley project is continuing and more sites have been surveyed and will be designated in the autumn.

Further sites have been designated as part of the Whitman's Hill Project funded by English Nature through the Aggregates Levy Sustainability Fund and others for Malvern Hills Area of Outstanding Natural Beauty.

Below:  
Interpretation panels help to explain the geology and landscape along the trails.

- In Worcester cathedral beautifully carved stones from around the world sit alongside the local building stones that make up the structure of the cathedral. The added bonus is that this trail is not affected by the weather!

- The Kington trail is a pleasant walk through wonderful scenery alongside the River Arrow

- The Geopark Way is an 80 mile walking trail with fabulous geology and scenery but we have chosen a special small section for this guided trail

- The Severn Valley Railway offers some excellent geology from the comfort of a railway carriage. A walk from one of the stations takes you to the old mines and quarries with their fascinating geological history

For more information contact the Geological Records Centre. Remember walking is a great way to keep fit



# DEVELOPING GEODIVERSITY PARTNERSHIPS

FUNDING HAS BEEN SECURED for a new project to be delivered by The Geology Trusts in co-operation with UKRIGS and Natural England.

The purpose is a) to bring some assistance to all of the organisations, in each region of the country, that have a responsibility for, or an interest in geoconservation, and b) to deliver some training and funding opportunities that will help county groups who are involved with the promotion and protection of their local geodiversity.

The project will seek to encourage the development of regional partnerships by drawing together all relevant organisations. This may include geological groups such as Geology Trusts or RIGS groups, as well as planners, tourism officers, staff from National Parks, the Forestry Commission, the National Trust, Wildlife Trusts, museums, education, Natural England and other individuals with relevant knowledge or expertise.

Funding is coming from both the Aggregates Levy Sustainability Fund

and directly from Natural England. The tangible output of the project is expected to be the production by most county groups of a geological site management plan. Funding will be available to all groups producing a suitable plan.

The project will be launched in each region of the country with a one-day workshop. The morning session will present the experience of the West Midlands, where following a proposal from the Earth Heritage Trust, a regional geodiversity partnership was formed last year. This will be followed by discussion with all of the groups and agencies present. It is hoped that an initial action plan will be drawn up by participants on the day, allowing them to pursue the development of a geodiversity partnership appropriate for their region.

During the afternoon session a template for the writing of site

management plans at aggregates sites will be presented and the requirements for individual groups to receive funding from the project will be explained. Those attending the workshop will be invited to share their ideas and experience of activities that have worked well for them.

Later in the year, all groups will be invited to a single national workshop presented by various funding organisations, giving training in completing funding applications. The hope is that groups will be able to apply for funding to carry out the actions in their site management plan and for future projects of their own.

The first workshops were held in September and are running through to the end of the year – all organised by Julie Harrald and Chloe Brooks. More information from [julie@glosgeotrust.org.uk](mailto:julie@glosgeotrust.org.uk)

Below: Chloe and Julie of the Geology Trusts.



## FROM THE CHAIR...

# VOLUNTEERS — WE NEED YOU!

PROBABLY ALL READERS ARE AWARE that EHT relies heavily on its members to undertake voluntary work on the Trust's behalf. Nearly all members are active in this way and their work is crucial in maintaining the large output of high quality work which the Trust delivers. The extent of such voluntary work is not always apparent though and it seems worthwhile to give a brief account of its full range.

Perhaps the most widely known need for members' efforts is in the Rock & Fossil Roadshows. Since the end of our fully funded programme for the Roadshows, the Trust is now totally reliant on unpaid manning of the events. For this reason the frequency of Roadshows is much reduced from that of the initial three years. However we still aim to mount about three per year, each requiring up to twenty volunteers for a full-size show. It is delightful to work with the small children on these occasions, and their parents are always on hand to help them. At the other end of the scale, each show throws up a number of interesting but seldom too challenging questions for our experts, from members of the public. Amongst the volunteers are

most of EHT's paid workers. An unfilled job at present is the maintenance of the stock and equipment for the shows.

Most members live in the Trust's two counties and in total have great knowledge of local geology. They are encouraged to report interesting finds, especially temporary exposures, to EHT using whatever degree of technical formality they wish; mere locations and a few comments are often enough.

Some of our members have high-level technical expertise in areas relevant to EHT's projects and are prepared to deploy it to our benefit. For instance, two members are currently helping with an audit of Quaternary and



Volunteers lend a hand at a Rock & Fossil Roadshow.

geomorphological sites in Worcestershire.

Probably the least known voluntary activity is that of the trail testers. They walk new geological trails for the Trust using a draft version of the guide and make comments which are invaluable in bringing the guides to the desired standard. The comments range from pointing out ambiguities in the route directions through to technical issues which might confuse the eventual guide users. This is part of our programme of promoting geology and landscape walks as an enjoyable way of staying healthy.

The members of the EHT Executive Committee make a major voluntary input. They spend long hours in committee meetings and other work on the members' behalf. This is a reflection of the constantly increasing complexity of the Trust's programme of work and interactions.

A last and very important voluntary role is that of the President, currently of course Professor David Dineley whose constant support we greatly value. This is the one voluntary post for which you can't volunteer.



The Mercian Cycle Route is researched as a possible geology trail as well.

# HEREFORDSHIRE GEODIVERSITY ACTION PLAN AUDIT



## Worcestershire Partnership Environment Group (WPEG)

WITH CLIMATE CHANGE AND THE RECENT FLOODS high on the news agenda, WPEG (of which the Trust is a member), has been asked to set the afternoon programme for the Worcestershire Assembly this November.

The Assembly is the annual gathering of the Worcestershire Partnership. The Partnership itself is a body that brings together local government, public services, education, and voluntary and community



Regionally Important Geological Sites (Local Geological sites) are being given prominence in the programmes being developed by WPEG.

groups, to discuss and plan for the future of the county. WPEG is one of six theme groups of the Partnership, and its crucial role is to provide information to the Partnership about the Environment, as well as being the voice for the Environment within Worcestershire and the wider region.

The Trust has been asked to advise on the geodiversity aspects of information that is going forward to act as the basis for future Planning Policy within the county. Despite the apparent dryness of this article and its content, now has never been more crucial for geoconservation organisations to shout their corner and enable RIGS and geodiversity to be included as an integral part of the future of conservation and planning.

**W**ORK IS UNDERWAY to record as many geological, geomorphological, glacial and fluvial sites as possible for the audit of the county. As the project must be finished by mid March, time is short. We would be grateful for any suggestions of interesting sites to visit.

Community involvement is an important part of the project. If you would like to help with field surveys and find out more about the geology of Herefordshire, please contact Moira Jenkins.

The picture above shows the Whet Stone, a glacial erratic of gabbro, deposited on Hergest Ridge. This has come from Hanter Hill, which can be seen behind. The distinctive gabbro rock can be found widely spread over Herefordshire and shows the direction in which the ice travelled in the Pleistocene Period. The erratic is resting on siltstones which are Silurian in age.



Supported through Defra's Aggregates Levy Sustainability Fund

# THE LEOMINSTER CANAL

Gerry Calderbank continues with his account. Abstracted from 'Notes for Civil Engineers on the Solid and Economic Geology'.

**T**HERE'S A CERTAIN PARALLEL between the engineering geology and the purely topographical aspect of the canal: from Kington they both start out simply – and uniformly, in the case of the geology – but things become more complicated as we follow the proposed course of the canal eastwards.

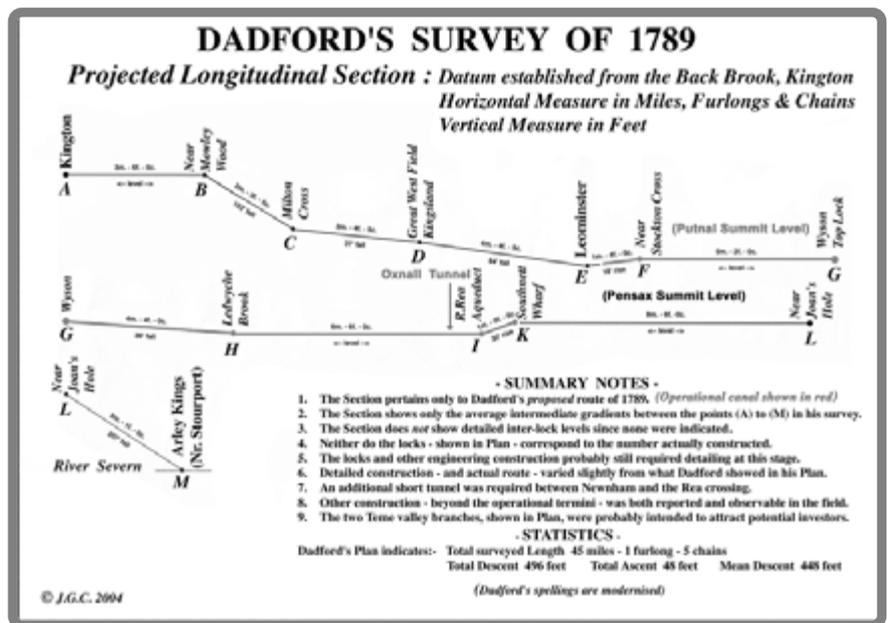
Dadford's route was intended to descend, via a series of locks, from its point of origin on the Back Brook at Kington to the first sump level at Leominster – whereupon the complications started.

Beyond Leominster, the most significant problems en route are attributable to the awkward topography caused, in turn, by superficial deposits of glacial origin forming a low watershed – the Orleton Moraine – at Putnal and, much further eastwards, by the requirement to cross the decidedly more formidable watershed barring the route from the Teme/Rea valleys to Stourport. Both watersheds required tunnelling, and each was problematical, with only the Putnal Tunnel eventually completed, albeit only after a prolonged and costly delay. At Putnal the blame for this delay was attributable to the difficult geology; to inadequate funding; but was – in the opinion of John Rennie – largely due to Dadford's unorthodox (allegedly deficient) design of the tunnel profile.

Dadford's survey records an operational distance of 19 miles, preceded by a theoretical (but unbuilt) stretch of just over 13.25 miles from Kington to Leominster, much of which is underlain by rocks of Lower Old Red Sandstone (O.R.S.) age. These succeed, apparently conformably (i.e. without interruption) from

underlying rocks of Silurian age: this transition is marked by a bed of coarse, micaceous sandstone containing fish remains with some carbonaceous and phosphatic traces – known as the Ludlow Bone Beds – that was considered by Dr.G.H.Mitchell, of the British Geological Survey, to mark the base of the Devonian System hereabouts. This stratigraphical classification – of the Lower Old Red Sandstone – has subsequently been altered so as to bridge the Silurian/ Devonian systems. It should not be thought that these O.R.S. rocks are monotonously uniform. There is considerable variety in the lithology, bedding, and colouration: they include siltstones, mudstones, sandstones, cornstones, conglomerates, marls,

shales and limestones but, collectively, these sedimentary rocks form the underlying basis to almost the whole of the operational canal. They are known as the 'Raglan Mudstone Formation' and are detailed by the British Geological Survey in their various publications. Stratigraphically, they are succeeded by the beds of the 'St.Maughan's Formation' which are generally harder and more resistant to weathering; thus forming the prominent higher ground (the East Herefordshire Plateau) on the right flank of the canal between Leominster and Newnham. However, although adjacent, the canal route doesn't actually impinge on these later rocks.





## On your Christmas list

Yes, we know there are still three months to go but it will soon be here. We think one of our Explore series of trail guides would make an excellent Christmas present. They retail at £1.95 and £2.00 plus 50 pence postage and packing. There are four new ones - Abberley Village Churches, Clent Hills, Malvern Hills 2 and Lickey Hills - bringing the total to 25. Order by phoning or downloading a form from the website [www.EarthHeritageTrust.org](http://www.EarthHeritageTrust.org).

## RAISING THE PROFILE

**D**URING 2007 THE TRUST has organised a programme to raise the profile of the Abberley and Malvern Hills Geopark by placing posters about the Geopark in official locations.

Long-term arrangements were made with official bodies and private organisations to feature Geopark publicity and information. Organisations participating include parish and town councils, tourist information centres, museums, village halls, caravan parks and visitor centres.

During August a team from the Trust, Gloucestershire Geology Trust and Shropshire Geological Society visited many of these places to gauge the public interest. Also checked out were interpretation panels along established trails. The latter at eight locations provide excellent stopping points for the walkers using geology and landscape as means of keeping fit and healthy.

## A Walk in the Park

AN EXHIBITION WHICH COMBINES Geology and Art is taking place at Worcester Museum and Art Gallery and is the result of a year long residency in the Abberley and Malvern Hills European Geopark by landscape artist Sandra Masterson. The Geopark stretches from Bridgnorth in Shropshire, through the hills of Abberley, Suckley and Malvern, and onto the open landscape of Westbury-on-Severn in Gloucestershire. In the Victorian Period this area, rich in outstanding geological features, excited the interest of natural historians. Sandra Masterson has retraced their steps to explore and re-interpret

this beautiful and ever-changing landscape. The exhibition which runs until the 27 October 2007, includes a number of fine specimens from the Museum's significant geological collection as well as paintings, drawings photographs and a short video piece.

A 32 page illustrated publication 'A Walk in the Park' edited by Janet Harrison, with contributions by Dr Peter Oliver and Rosemary Roden accompanies the exhibition.

The booklet costs £6.00 and can be purchased from the Art Gallery or from the Trust.



Information Point at Bewdley Museum.

# THE EMBRYONIC GEOPARK WAY GETS AN EARLY TESTING

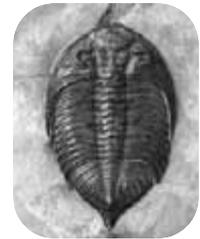
**W**HAT INTERESTING EVENTS WERE WITNESSED over the recent months with the flooding of our rivers, streams and brooks. Luckily for most, the flooding was watched from a comfortable distance, for others though it was a totally different story.

Though not comparable to those that lost so much to the floods, the Geopark Way project did take a bit of a bashing. Since the waters receded it has become evident that sections of the proposed Geopark Way trail have been washed away – footbridges lost and rock exposures damaged. It has been necessary to rethink the routing of these sections of the trail. On a more positive note some rock exposures benefited from erosion and a face lift as the fast flowing waters filled with abrasive materials flowed past them.

The weather can only get better!



The trilobite Dalmanites which will be the Geopark Way logo.



The net result of all this is that the duration of this project has now been extended to allow time to carry out this extra work. The project will now be completed by September 2008.

The new route of the trail has now been fixed. The autumn and winter will be dedicated to interpreting the geological and non-geological features found along the trail. With so much to see the most difficult part of this project will be to condense all that information into a 110 page A5 trail guide.

The Geopark Way project is funded by DEFRA and Advantage West Midlands and will be launched over 8 days starting on Saturday 23rd August 2008. Each day there will be an event at a different location along the Geopark Way and these will also celebrate the local Earth Heritage and local distinctiveness. Many ideas have been put forward and the launch committee is developing these further. If anybody wishes to join this committee to help organise the launch events please contact Natalie Watkins. E-mail: [geoparkway@yahoo.co.uk](mailto:geoparkway@yahoo.co.uk). Phone: 01905 542014.

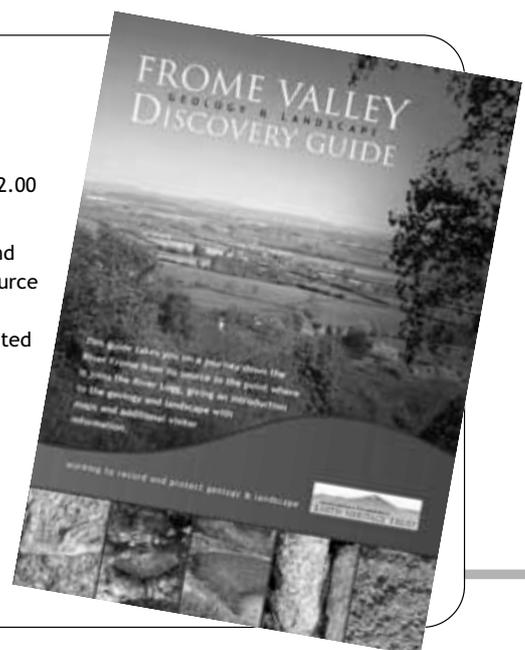
## The Launch of the Frome Valley Geology and Landscape Guide

THE LAUNCH OF THE Frome Valley Guide will be on 18th October 2007 at 7.30 at Bromyard Public Hall, 5 Rowberry Street in Bromyard. All are welcome. Come and look at displays and see a slide show of the interesting and beautiful geology and landscape features which are described in the guide. Light refreshments will be served at this free event. This wonderful area marks part of the eastern boundary of the Geopark.

The view from Shucknall Hill looking across the Frome Valley to the Malvern Hills is featured on the front page of the 24 page Frome Valley guide, which can

be purchased from H&W EHT for £2.00 (£1.50 for members).

The guide describes the geology and landscape of the valley from its source to its confluence with the Lugg, describing places which can be visited with maps to help you find them. There are plenty of colour photos, maps and diagrams and also pages listing other visitor attractions and places to stay.





The ridge of the Malvern Hills – one of many photographs taken as part of the Trust's recent aerial survey.

## A NEW GEOLOGICAL MAP OF THE GEOPARK

Bill Barclay and Keith Ambrose of the British Geological Survey report on a significant publication.

**B**GS IS CURRENTLY WORKING ON A NEW MAP showing the bedrock geology of the Geopark. The map, at 1:100 000 scale, will show the distribution of the rocks, with marginalia incorporating simplified cross-sections, a vertical section showing the stratigraphy of the rock succession and photographs of representative rock outcrops. Also shown will be the location of the Trust's geological trail guides and the Geopark Way.

Nine periods of geological time are represented in the rocks of the Geopark. In addition, a tenth period (the Quaternary) is represented by the unconsolidated sediments deposited by the glaciers and rivers of more recent time.

The rocks, which give rise to their own characteristic topography and landscape, provide a fascinating

insight into almost 700 million years of Earth history, dating back to the intrusion of the meta-igneous Late Precambrian Malverns Complex, itself the product of melting of much older sedimentary rocks up to 1600 million years old.

An explanatory booklet will accompany the map. This has been written by Bill Barclay and Cheryl Jones, with an account of the

### Abberley & Malvern Hills Geopark



building stones of the Geopark by Peter Oliver. The booklet is part of the BGS Earthwise popular publication series and is aimed at both the non-geologist and A-level student. Geological time, the beginnings of life on Earth and rock-forming and tectonic processes are explained in an introductory section, before the rocks of each geological period represented in the Geopark are described briefly. The best localities to examine the rocks are also listed, and the booklet is well illustrated with photographs and simple diagrams.

Publication of the map and booklet is scheduled for Summer 2008, to coincide with the launch of the Geopark Way.

# Worcestershire County Council fund superficial deposits & fluvial geomorphology Baseline Data project

UNFORTUNATELY BOTH THESE ASPECTS OF THE BASELINE DATA PROJECT have been badly affected by this summers floods, as this has meant that during those times, fieldwork has been impossible, (due to the nature of the project, most of the work takes place close to, or alongside, water courses!). However, the data collection is still progressing, a report is hoped to be produced within the next couple of months.

The project has thrown up a couple of things that may interest readers. Firstly, the link between river terrace deposits, climate change and early human activity is something that is often overlooked by “hard rock” geologists. The Shotton Project, which was a major effort to co-ordinate the work of Quaternary Geologists, Archaeologists and the Quarrying Industry in the study of the last Ice Age and early human activity in the Midlands, was a fantastic scheme that enabled much information to be gathered from quarries and archaeological digs.

Unfortunately the Project appears to have been put on the back burner in recent times. This is a disappointing state of affairs, as

this project, quite separately from the Shotton Project, has been surprising in terms of how important Quaternary deposits are for understanding more about early human occupation of the land, as well the obvious environmental interpretation that it can bring. In addition, a lot of this information has only come to light via quarrying activity or archaeological digs. It is this conclusion that leads to the suggestion that a big resurrection of the Shotton Project should begin. Keep your ears to the ground for that one!

The second thing that the project has revealed is the relative importance of the rare peat deposits that Worcestershire has.

Peat has now been included as a priority habitat within the UK Biodiversity Action Plan, meaning that it should be afforded the highest levels of conservation and protection. This is due to the obvious fact that, as well as supporting a vast amount of flora and fauna, peat is a vast store of carbon. With the climate change agenda well and truly at the fore, peat sites and the conservation of them can play a key role in combating climate change.

Instead of digging them up and potentially releasing vast amounts of carbon dioxide, these sites should be conserved and protected, thus reducing the human Carbon Footprint. Something to think about indeed!



River Sever at Arley.



Rock fragments showing well developed imbrication on the stream bed.

The Trust contracted Dr Ian Maddock and Graham Hill from the Department of Applied Sciences, Geography and Archaeology, University of Worcester to accumulate baseline data for fluvial geomorphology. Assisted by Alison Lee and Les Morris from the Trust, the team have been conducting a survey of Worcestershire's streams and rivers. The first stage of the work involved a desk-based study of the County's rivers and streams to characterise them and then group them into similar 'types'.

This involved identifying the entire drainage network for the County, and then looking at features such as catchment size, mean altitude, mean gradient, drainage density and land-use for each catchment. Statistical analysis, using 'Fuzzy Discriminant Analysis' enabled the identification of four groups within the County, each with a different type of stream, namely, 1) small

steep catchments at higher altitude, 2) small catchments at lower altitude, generally on the floodplain 3) large catchments with low gradients, and 4) the major rivers of the County – the Severn, Avon and Teme.

Based on these four groups 22 sites were identified for field surveys. There were some good representatives of each group whilst others bordered two or three groups or were of particular interest, e.g. below areas due for development. Fieldwork has been progressing throughout the summer (floods permitting!) to carry out two types of surveys along 500m reaches at each site. The first, using the Environment Agency's River Habitat Survey (RHS) characterises the geomorphic features within the reach that are also important in determining habitat for species associated with the aquatic environment. The second survey method applied is

the Environment Agency's new Geomorphological River Habitat Survey (GeoRHS). This provides additional information on key geomorphic aspects such as channel, bank and floodplain morphology, and other erosion and depositional features.

With the fieldwork almost completed, these data are currently being analysed to assess the overall status and character of the fluvial geomorphology of the County's streams and rivers, propose potential RIGS sites, and identify the individual streams and/or stream type(s) that may be particularly sensitive to geomorphic change or degradation in future and therefore make them ideal locations for ongoing monitoring.

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*For further details, please contact either Tom Richards or Dr Ian Maddock (i.maddock@worc.ac.uk or 01905 855180).*

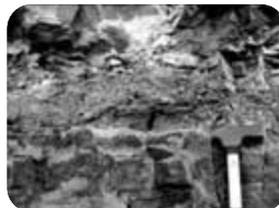
# WORCESTERSHIRE GEODIVERSITY AUDIT

**T**HE TRUST HAS RECEIVED A GRANT OF £60,900 from Aggregates Levy Sustainability Fund, to undertake a geodiversity audit of the county, as a first step to producing a Geodiversity Action Plan for Worcestershire.

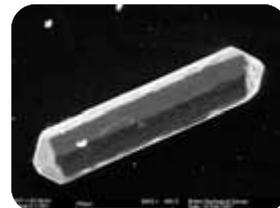
The audit will consist of assessing the total potential geodiversity resource, alongside the resource that is currently available and accessible. As well as a major field surveying programme this will be achieved by auditing RIGS and other sites on the Trust's database, as well as recording new sites during the course of the project.

There will also be an audit of the people, skills and resources available from museums and schools, to find out how many people and institutions are teaching or working on the geology within the county. In addition, attempts will be made to find out the effects that aggregate extraction has had on the local community, and what can be done to mitigate any negative effects (i.e. where geoconservation can step in and have a positive influence). From all this information, an assessment of the state of the geodiversity resource can be determined, and a Geodiversity Action Plan drawn up to take geodiversity and geoconservation forward in the county.

If anyone wishes to help in the audit of the county's wonderful geodiversity, then please contact Tom Richards: [thomas.richards@worc.ac.uk](mailto:thomas.richards@worc.ac.uk). A similar project is underway in Herefordshire. Contact Moira Jenkins for information: [m.jenkins@worc.ac.uk](mailto:m.jenkins@worc.ac.uk). Both can be contacted on 01905 855184.



Bentonite layer.



Zircon crystal.

## The Trust gets technical

ONE OF THE MOST EXCITING studies made at the Trust's Whitman's Hill quarry geology reserve was that of the nine bentonite horizons. The first of these is close to the start of the succession in the Coalbrookdale Formation. Subsequent bentonites occur throughout the sequence up to the thickest (5cm) which occurs close to the top of the sequence.

These bentonites were sampled for further analysis and then processed by Heavy Minerals Consulting. Apatite crystals successfully isolated from four of the bentonites were analysed by LA-ICP-MS (Laser Ablation Inductively Coupled Plasma Mass Spectrometer) at the University of Bristol for magmatic provenance.

It was demonstrated that the magmatic source changed through the sequence, from acidic to less evolved

(mafic/intermediate) magma. Whether this was as a result of a changed magmatic supply to one volcano, or stratification within the magma chamber, or the result of several different volcanoes with different magmatic supplies is not known, but it is now known that these bentonites are not all from the same magmatic source.

Additionally, it was decided to use zircon crystals to generate radiometric age data for one of the bentonites in the sequence (bentonite number two, 7.68m from base). This U-Pb geochronology analysis was undertaken using the Sensitive High Resolution Ion Microprobe (SHRIMP II) at the Australian National University in Canberra. A provisional age of  $422.7\text{Ma} \pm 3.2\text{Ma}$  has been obtained for this sample.

The data produced from these analyses, as well as being of geological interest, have been directly utilised in the development of National Curriculum and Science GCSE specification-linked educational resources, in particular as part of a "How Science Works" case study soon to appear on the Trust's web site.



Supported through Defra's Aggregates Levy Sustainability Fund



Left: Permian Bridgnorth Sandstone at the Devil's Spittleful between Kidderminster and Bewdley.

Look out for the new interpretation panel on the Bredon Hill trail...

## The Geology of Bredon Hill

**YOU ARE HERE**

Legend:  
 Oolitic Bredon Hill rock  
 Clay rocks  
 Sandy limestone  
 Silts and sands  
 Clay rocks and some limestone

### Outlier

Bredon Hill is an outlier of the Cotswold Hills. Outliers are younger rock masses left isolated by erosion from the main mass. They rise in and are surrounded by older rocks.

Original hill range removed by erosion over millions of years

### Bredon Hill: Geology

Bredon Hill is built of tilted layers of sedimentary rocks. These rocks were formed from deposits of sediment on the floor of an ancient sea nearly 200 million years ago, at a latitude roughly the same as that of the Mediterranean today. Later, the rocks were tilted by earth movements and became land, near to their present latitude. The limestones are more resistant to erosion than the other rocks and form the striking features of the landscape. The clay rocks are weaker and on the steep slopes are liable to give way, resulting in landslips.

### 'Gull Rock' or Limestone Breccia

Tufa - the cement crystalline calcium carbonate (calcifer) deposited from groundwater flowing out of the limestone at the end of the Ice Age.

Angular fragment of oolitic limestone shattered from the wall of the gull by frost action during the Ice Age.

### The Banbury Stone

In the hollow close by this display board is the Banbury Stone (formerly called the Banbury or Banbury Stone). It is also known locally as the Elephant Rock because of its shape when viewed from certain directions. The hollow in which the stone stands is actually a very old quarry and the stone is a remnant left by quarrymen, who were mainly interested in removing the layered limestone. The Banbury Stone is an example of what the quarrymen called 'gull rock' because it was formed in 'gull', or huge joints in the limestone. The 'gull' developed over a long period of time as the limestone capping the hill became stretched over the underlying clay rocks and cracked open. The geological name for gull rock is 'limestone breccia' (see photograph to the left). It is very common on Bredon and the Cotswold Hills. In the past, gull rock was used in ornamental garden features such as grilles.

### Oolitic Limestone

Oolitic limestone forms the top of Bredon Hill. It can be examined in the loose slabs on the ground nearby. This layered rock has been quarried extensively on the hill in the past. The slabs of rock have been used mainly to build field boundary walls and some of the farm buildings. The photograph above shows a close-up view of both weathered and unweathered limestone. In the weathered portion, the tiny pellets called 'oolites' are easy to see. They were formed by water moving to and fro on the bed of an ancient tropical sea. Look closely at the unweathered rock at the bottom of the photograph and you will detect similar oolites, this time firmly cemented together.

Photographs by L. Morris  
 Drawings by L. Morris and J. Paine

If you would like to know more, a self-guided trail leaflet is available locally and from the Geological Records Centre.

This panel is placed here with the permission of Banbury Farm Estate.

This panel is sponsored by the Cotswolds Conservation Board, the organization that exists to conserve and enhance the Cotswolds Area of Outstanding Natural Beauty (AONB).

Hereford & Worcester Earth Heritage Trust, Geological Records Centre, University College Worcester, Henwick Grove, Worcester, WR2 6AJ.  
 www.EarthHeritageTrust.org, tel: 01905 833184, email: ohs@hwtrc.ac.uk

WORKING TO RECORD AND PROTECT GEOLOGY AND LANDSCAPE.

# HITTING A HIGH NOTE WITH BEDFORD SCHOOL CHOIR

THE TRUST BELIEVES THAT LEARNING should be fun and developed its rock and fossil roadshow programme with this in mind. Ideas from roadshows together with trails have produced new approaches.

Children enjoy being active learners and our 'Dinosaur Detective Trail' is always popular as is our 'In Search of Fool's Gold' trail on the Severn Valley Railway at Highley.

Recently the Choir from Bedford School took a break from their singing duties at Worcester Cathedral to take part in a new and untried geological quiz and trail. After explanations about geology and building stones, King John's tomb with its Viviparus gastropods in Purbeck Marble, was inspected minutely with hand lenses as were the oolitic limestones of Prince



Left: Students crowd around King John's tomb.

Arthur's Chantry and the granites and alabasters of the Earl of Dudley's tomb. Then using the Trust's building stones trail guide and a quiz sheet 35 boys aged from 8 to 18, enjoyed themselves identifying the geology of the building stones and effigies. From Triassic sandstones to fossil corals in the Carboniferous Limestone floor 'tiles'; from tufa transept vaulting to the marble pulpit, this turned out to be a very productive afternoon.

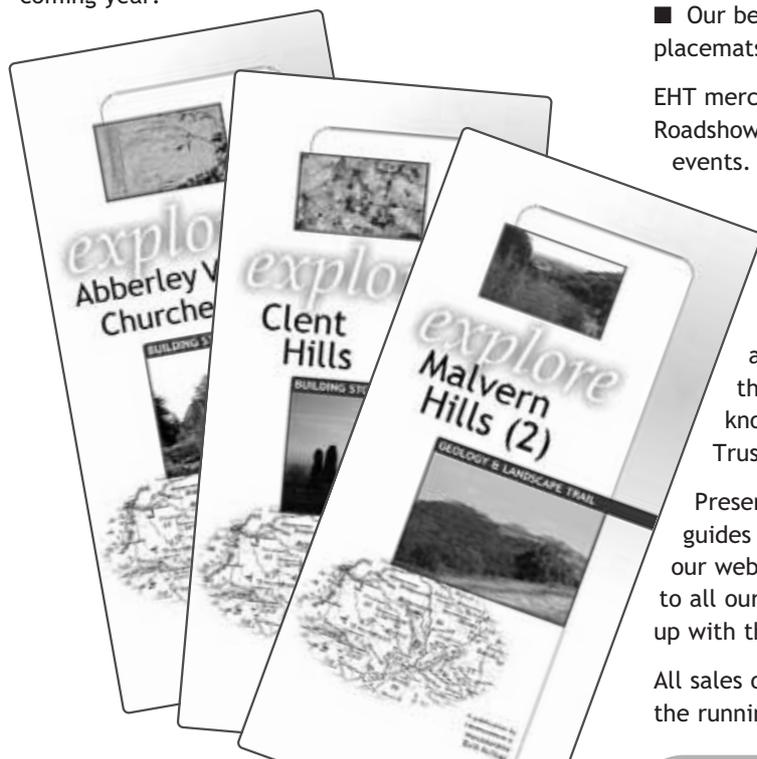
Thus another co-operative venture with the Cathedral proved a success in this wonderful building.

# MERCHANDISE

**S**ALES OF OUR MERCHANDISE have continued to bring in those extra pounds and pennies to the Trust this year which is great.

There are a few new bits and pieces this year – some have been really successful, such as the dinosaur sticker books, other not so successful!

Also there are several new ideas in the pipeline which we hope to be able to make available over the coming year:



## GEOLOGY & OUTSTANDING NATURAL BEAUTY

The Malvern Hills Area of Outstanding Natural Beauty (AONB) has asked the Trust to take the lead in this year's Joint Advisory Committee (JAC) Study Tour. The members of the Committee will be taken to quarries and viewpoints where the importance of geoconservation and interpretation will be explained. In particular the JAC will hear about the progress in the research and development of the Geopark Way long distance footpath. This trail runs the full length of the AONB area and it will do much to highlight the influence of geology on landscape, biodiversity, culture and land use within the area. The geodiversity audit currently underway will be discussed; as well as how the writing of the follow on Action Plan will work alongside the AONB Management Plan.

- Stationery sets with the roadshow logo and fossils printed on them (all made from recycled products)
- Jute shopping bags displaying the EHT logo
- Kids' pump bags with the Rock and Fossil roadshow logo printed on them.
- Rock and fossil badges – with the option of the kids (and adults!) designing and making their own badges at the venue.
- Fossil painting sets.
- Our best geology and landscape photographs on placemats and coasters.

EHT merchandise is mainly sold at Rock and Fossil Roadshow but selected items are also taken to other events. However the Trust is always looking to expand the opportunities to both highlight the work of the Trust and sell some merchandise. This year the Trust attended the Malvern Charity fair in September at the Malvern Theatre. Ideally attendance at several of these events across the two counties each year is desirable. If you know of any such fairs please do contact the Trust with the details.

Presently you can order the Trusts 'Explore' trail guides and the Frome Valley Discovery guides via our website. Hopefully this facility will be extended to all our merchandise very soon. You've got to keep up with the times!

All sales of our merchandise and trails help towards the running of EHT.

## West Midlands Geodiversity Partnership

FOLLOWING A PROPOSAL from the Trust the West Midlands became the first region in England to set up a Geodiversity Partnership. The Partnership consists of the geoconservation organisations for The Black Country, Herefordshire, Shropshire, Staffordshire, Warwickshire and

Worcestershire and also Natural England. The West Midlands is the only region in which all of the counties are carrying out or have completed a Geodiversity Action Plan. Representations are being made to the Regional Assembly to make sure that geodiversity is included in regional policies.

# Successful completion of the first phase of the Whitman's Hill Project



Above: Schoolchildren get to work at the site.



A FORMAL LEASE ARRANGEMENT with the Madresfield Estate was agreed at the very start of the project and the Estate has remained closely involved throughout, as a founder member of the Steering Group.

It has financially contributed to the project by repairing fencing and gates and funding the extension of the existing fence, as well as putting up signs and generally dealing with local residents' issues etc. Many local people became involved with various aspects of the project, in particular the studies of local heritage and the biodiversity of the site, but also by assisting with events and through representation on the Steering Group. The project exceeded all matched funding requirements. The target of £27,000 worth of volunteer time was achieved by July 2006,

nine months before the end of the first phase of the project.

Several successful events, including seminars, workshops and exhibitions were held in association with Cradley Heritage Group. As well as hosting these events and assisting with all logistical details, including very much appreciated catering services, they also distributed posters and flyers advertising these events. The involvement and commitment from CHG has been consistently strong and there is great determination that the project will continue indefinitely. The Woolhope Naturalists' Field Club has been extremely active throughout the project. They undertook several detailed biodiversity surveys of the quarry and woodland, and erected and monitored nest boxes and dormouse tubes. They produced the Natural History final report and leaflet, as well as giving talks, producing displays for events and through representation on the Steering Group. A significant outcome is the publication of 4 page leaflets on natural history and heritage, and an 8 page leaflet on geology (all available free of charge from the Trust).

A large amount of support from Trust volunteers was provided and contributed to exceeding matched funding targets and the Steering Group will continue to meet regularly to ensure the continuation of the programme.

## NEW PEVSNER GUIDE

THE NEW EDITION of 'The Buildings of England – Worcestershire' by Alan Brooks and Nikolaus Pevsner (ISBN 978-0-300-11298-6) has just been printed. Pevsner's first edition was published in 1968.

This famous series started by Sir Nikolaus Pevsner (1902-83) offers descriptions of every building of architectural importance in every county in England. Jonathan Meades writing in the *The Observer* describes the new publication as 'The greatest endeavour of popular architectural scholarship in the world'. It was an honour therefore, to be asked to write the section on geology and building stones (by Peter Oliver) and promote the importance of geology in the built environment.



## NEW GEOLOGISTS

**A** WARM WELCOME TO  
Evelyn Chapman and  
Adam Stinton.

Eve joins the Trust as a field geologist specifically working on the geodiversity audit in Worcestershire. She has the impressive background of a MSci from Birmingham and thus continues the strong link that the Trust has with the Department there.

Adam takes on the role of Data Manager having just completed his PhD at the University of Buffalo where he studied topographical influences on pyroclastic flows associated with active volcanoes in the Andes.

More geologists are being recruited as work expands.



Below: Executive Committee members review the success of the Open Day.



## Programme of The Woolhope Geology Club Section for late 2007

Lectures are held in the Woolhope Room, Hereford Library, Broad St. commencing at 6pm. unless otherwise stated. Non-members may attend most events by prior arrangement (contact John Payne or Moira Jenkins at EHT). New members are welcome.

**Friday 19th October:** 'Geology of Bottled Water'. Talk by Professor John Mather

Most bottled waters available in Britain originate as ground water, the comparison of which is controlled by a number of interacting processes. An understanding of these enables the hydrologist to unravel the geochemistry of individual bottled water and say something about its origin.

**Saturday 20th October:** 'Water and the Malvern Hills'. Field excursion led by Professor John Mather.

**Friday 16th November:** Members Evening. Bring a rock, fossil, some slides or anything else geological.

**W/B 3rd December:** Midweek visit to the Ludlow Museum and Resource Centre (date to be confirmed).

**Friday 25th January:** Section AGM and Dinner

**February:** 'A Grand Staircase – USA Style'. Talk by Dr Sue Hay (date to be confirmed).

**March:** Talk by Eddie Bailey (to be confirmed)

**Saturday 19th April:** Field excursion to Hanter Hill. Led by Sue Hay and Geoff Steel.

The Geology Section has had a successful year. It has currently about forty members, mostly from Herefordshire. A recent noteworthy event was a talk on geological mapping by Bill Barclay of the BGS followed by an excursion, led by him, around west Herefordshire and beyond. The section mounted a Rock & Fossil Roadshow in collaboration with EHT at Leominster as a contribution to the Marches Festival of Geology. Also as a part of the Festival, the Section staged a re-enactment in period costume of the third field outing of the Woolhope Club, to Aymestrey in September 1852.

### PERSONNEL AND CONTACT INFORMATION

All can be contacted by telephone on 01905 855184 and 542014 or by email on [eht@worc.ac.uk](mailto:eht@worc.ac.uk) (unless indicated otherwise)

Chairman: **Dr John Payne**

Vice-Presidents: **Les Morris** and **Dr Peter Oliver**

Treasurer: **Cherry Oliver**

Membership Secretary: **Rosamund Skelton**

Geodiversity Manager for Herefordshire: **Moira Jenkins**, [m.jenkins@worc.ac.uk](mailto:m.jenkins@worc.ac.uk)

Geodiversity Manager for Worcestershire: **Tom Richards**, [thomas.richards@worc.ac.uk](mailto:thomas.richards@worc.ac.uk)

Geopark Way Trail Manager: **Natalie Watkins**, [geoparkway@yahoo.co.uk](mailto:geoparkway@yahoo.co.uk)

Office Manager: **Liz Elston**, [e.elston@worc.ac.uk](mailto:e.elston@worc.ac.uk)

Data Manager: **Dr Adam Stinton**

Researcher: **Rollo Gillespie**, [r.gillespie@worc.ac.uk](mailto:r.gillespie@worc.ac.uk)

Field Geologist: **Evelyn Chapman**, [e.chapman@worc.ac.uk](mailto:e.chapman@worc.ac.uk)

Graphics & Website Consultant: **Jude Payne**, [jude@netpointproject.net](mailto:jude@netpointproject.net)