

# Earth heritage

HERITAGE  
ART  
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HERITAGE

The geological and landscape conservation magazine



## Face Lift

Eight years of  
achievement  
under grants  
scheme

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Issue  
**26**  
Summer 2006

## Geoparks

How Fforest Fawr  
became a  
Welsh first

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## Landmark publications

Welcome to the Summer 2006 edition of *Earth Heritage* – 32 pages packed with a veritable geo-diversity of news and features.

Usually we review new publications at the end of the magazine, but this issue sees some significant newcomers that deserve deeper scrutiny. Among these is Geological conservation: a guide to good practice, published by English Nature. This important document updates and re-focusses the geoconservation effort in England to reflect a raft of recent political, legislative and practical developments. The revised guidance is published in advance of English Nature becoming part of a new agency – Natural England – in the autumn and signals its successor's continuing commitment to geoconservation. We also take a look at the highly successful A Landscape Fashioned by Geology series, produced jointly by Scottish Natural Heritage and the British Geological Survey. Its 14 published titles (six more to come) have sold over 100,000 copies and set an admirable benchmark for anyone seeking to explain the geological foundations of landscape in an understandable, informative way. Not to be outdone, Wales has broken new ground by producing a user-friendly soils booklet that explains the principles of soil science in straightforward terms, provides numerous possibilities for field visits and places soils in their landscape context – not an easy task!

Finally, congratulations to Fforest Fawr for becoming Wales' first Geopark and to the NEWRIGS Group for completing its two-year-long site survey, and for establishing a network of 127 RIGS! Reports on these and a great many more topics lie in the pages ahead. I do hope you enjoy the issue.



Managing Editor

## Earth heritage

*Earth Heritage* is a twice-yearly magazine produced by the Joint Nature Conservation Committee, English Nature, Scottish Natural Heritage and the Countryside Council for Wales. The voluntary geoconservation sector is a

major contributor. We would like to thank all those who have assisted with the preparation of the magazine. However, the opinions expressed by the contributors are not necessarily those of the above organisations. A database listing all the articles carried up to issue 17 is available on CD. Contact any member of the editorial board.

Key articles from this and previous issues of *Earth Heritage* can be found on the Web at: [www.seaburysalmon.com/earth.html](http://www.seaburysalmon.com/earth.html)

Offers of articles should be directed to the relevant members of the editorial board, who are:

### Managing Editor

**STEWART CAMPBELL**, Countryside Council for Wales, Maes-y-Ffynnon, Ffordd Penrhos, Bangor, Gwynedd LL57 2DN. Telephone 01248 385693, e-mail: [s.campbell@ccw.gov.uk](mailto:s.campbell@ccw.gov.uk)

### Editors

**DAVID EVANS**, English Nature, Northminster House, Peterborough PE1 1UA. Telephone 01733 455204, e-mail: [david.evans@english-nature.org.uk](mailto:david.evans@english-nature.org.uk)

**COLIN MACFADYEN**, Scottish Natural Heritage, 2 Anderson Place, Edinburgh EH6 5NP. Telephone 0131 446 2055, e-mail: [colin.macfadyen@snh.gov.uk](mailto:colin.macfadyen@snh.gov.uk)

**NEIL ELLIS**, Joint Nature Conservation Committee, Monkstone House, City Road, Peterborough PE1 1JY. Telephone 01733 562626, e-mail: [neil.ellis@jncc.gov.uk](mailto:neil.ellis@jncc.gov.uk)

**MICK STANLEY**, Geodiversity Consulting, Park House, 8 King Street, Ripon, North Yorkshire HG4 1PJ. Telephone 01765 609479, e-mail: [mick.stanley1@btopenworld.com](mailto:mick.stanley1@btopenworld.com)

**CYNTHIA BUREK**, UKRIGS Geoconservation Association, Centre for Science Communication, University of Chester, Parkgate Road, Chester CH1 4BJ. Telephone 01244 375444, e-mail: [cburek@chester.ac.uk](mailto:cburek@chester.ac.uk)

### Production

**Seabury Salmon**, Seabury Salmon & Associates, The Old Pound, Ludford, Ludlow, Shropshire SY8 1PP. Telephone 01584 877442. Fax 01584 875416. e-mail: [eheritage@seaburysalmon.com](mailto:eheritage@seaburysalmon.com)

### Circulation

*Earth Heritage* is free. Contact your local Editor to be placed on the mailing list.

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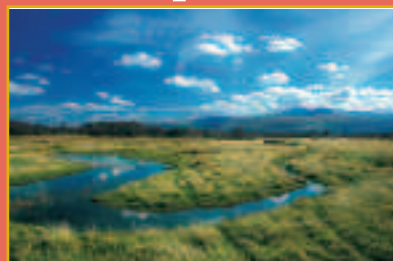
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## Cover photo



The majesty of the Brecon Beacons – part of the Fforest Fawr Geopark – comes through in this view of Pen-y-Fan and Corn Du from Mynydd Illtydd.

Photo courtesy Fforest Fawr Geopark

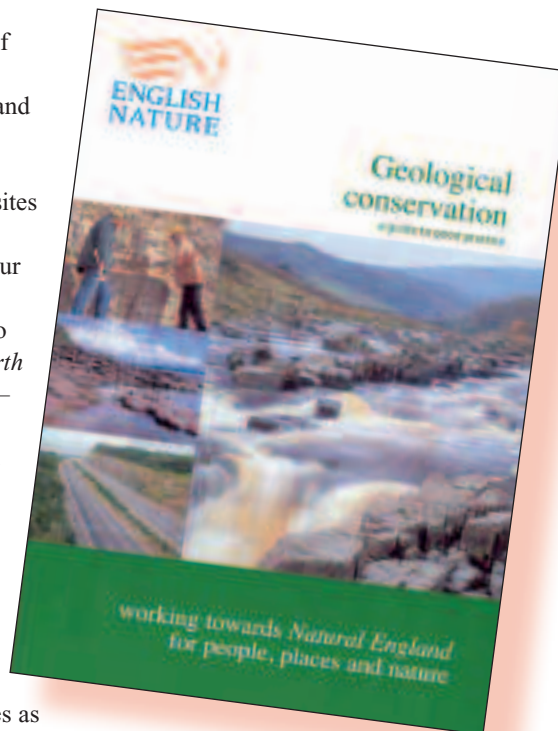


## Guide to good geological conservation

There is often an understandable lack of knowledge amongst decision makers, landowners, local planning authorities and those involved in wildlife conservation about the importance of geological conservation, the threats to geological sites and approaches that can be taken in conserving, managing and promoting our geological heritage. In an attempt to improve the situation in England, and to update guidance produced in 1990 (*Earth Science Conservation in Great Britain – A Strategy*: Nature Conservancy Council), English Nature has published *Geological conservation: a guide to good practice*.

The 145-page colour document draws on the practical experience of English Nature's partners in the voluntary geological conservation sector, geological societies and local authorities as well as our own experience managing our network of nationally important geological Sites of Special Scientific Interest.

The *guide to good practice* is based on a revised site-type classification and describes the importance of our geological heritage and the need for its conservation. It provides management solutions to a wide range of threats and opportunities and illustrates good practice through 35 case studies. It also includes guidance on



site condition monitoring, the preparation of site management plans and the production of Local Geodiversity Action Plans.

The *guide to good practice* reflects the many political, policy and legislative changes that have affected geological conservation in the UK since the NCC guide was published. These include:

- the rise of the voluntary geological conservation sector;

- new conservation legislation;
- government targets for the management of protected geological sites;
- the inscription of the Dorset and East Devon World Heritage Site;
- the declaration of a number of European Geoparks;
- the provision of resources for geological conservation through the Aggregates Levy Sustainability Fund;
- the initiation and growth of Local Geodiversity Action Plans; and
- the recent government policy described in *Planning Policy Statement 9: Biodiversity and Geological Conservation*.

*Geological conservation: a guide to good practice*, aims to capture and share good practice within the context of all these changes and is available free by visiting English Nature's website (see below) or contacting Colin Prosser on [colin.prosser@english-nature.org.uk](mailto:colin.prosser@english-nature.org.uk).

It can be downloaded from [www.english-nature.org.uk/pubs/publication/PDF/GeologyHandbookPart1.pdf](http://www.english-nature.org.uk/pubs/publication/PDF/GeologyHandbookPart1.pdf) and [www.english-nature.org.uk/pubs/publication/PDF/GeologyHandbookPart2.pdf](http://www.english-nature.org.uk/pubs/publication/PDF/GeologyHandbookPart2.pdf)

Colin Prosser  
Head of Geology, English Nature

## Welsh RIGS groups unite on leaflet

The Association of Welsh RIGS Groups, currently comprising North East Wales RIGS Group (NEWRIGS), Gwynedd and Môn RIGS Group and Central Wales RIGS Group, has produced a new general leaflet about Regionally Important Geodiversity Sites (RIGS) and RIGS groups in Wales.

Aimed at landowners and the public, the leaflet describes what 'geodiversity' and 'geoconservation' are, what RIGS are and how they are chosen, and what RIGS groups do and how to get involved in their activities.

The leaflet was based on the original RIGS general leaflet, updated and made more relevant for RIGS in Wales. It follows the usual third-A4 format, is bilingual and illustrated with examples of Geodiversity sites from the three regions covered by the Welsh groups. All three groups have received Aggregates Levy Sustainability Fund (ALSF) grants, administered by the Welsh

Assembly Government, to establish comprehensive networks of RIGS in their areas. The leaflet stems from the need to inform landowners and tenants of RIGS on their land, and to explain the role of RIGS groups in geoconservation. Although NEWRIGS has now finished its project (see pages 12-14), the other two groups still need to contact landowners and tenants about the geological features on their land. The leaflets should make this easier and more professional.

Although the leaflet started as a NEWRIGS project, some joined-up thinking by the groups at their regular liaison meetings resulted in the all-Wales leaflet. Funding for the design of the leaflet was kindly provided by NEWRIGS via an 'Awards for All' grant.

Stewart Campbell, CCW



## Seeking your views on fossil code

Fossils are an irreplaceable and finite resource used for scientific investigation, education, recreation and commercial purposes. However, this element of Scotland's geological heritage is vulnerable to abuse and damage, as illustrated in the case of Birk Knowes SSSI, and consequently requires safeguarding and considered management to ensure its survival for future generations. To help achieve this, Scottish Natural Heritage (SNH) has been given the task of preparing the Scottish Fossil Code.

SNH considers that continued fossil collecting in Scotland is vital for the advancement of palaeontology and the development of geological science

generally. However, collecting should be undertaken responsibly, with due care given to the fossil resource, collected fossils and fossil collections. The Scottish Fossil Code will therefore provide guidance on best practice in the collection, identification, conservation and storage of fossil specimens found in Scotland. The Code is intended to encourage fossil collectors – institutional, academic, amateur and commercial – to collect responsibly and to manage collections so that they will be useful to future generations.

The Code will comprise:

- an introduction to fossils, the fossil heritage of Scotland and the legalities of collecting;
- general guidance for collectors on

responsible collecting;

- further guidance for specialist groups and others with a particular involvement with Scotland's fossil heritage;
- advice on donating fossil specimens to museums and general information on the role of museum and other public bodies in the care and maintenance of fossil collections in Scotland;
- sources of further information including the identification, collection and care of fossils.

SNH would welcome your views on a draft version of the Scottish Fossil Code which will be available in the autumn of 2006 at

[www.snh.org.uk](http://www.snh.org.uk)

Colin MacFadyen, SNH



### Dot com site upgraded

Begun as a listing of events for the Scottish Geology Festival 2001, the [www.scottishgeology.com](http://www.scottishgeology.com) website has grown substantially to become an important gateway to Scottish geology on the web.

Launched officially at the start of Scottish Geology Festival 2003, the site carries a range of information pertinent to Scottish geology including: the development of Scotland through geological time; 'classic' geological sites; famous Scottish geologists; RIGS in Scotland; useful web links; and information on collecting in Scotland (soon to include the Scottish Fossil Code – see above). During 2005, there were over 3,000 'hits' (visits) per month to the site.

## National geology fest goes annual

From 2006, the 'Rock On' Scottish Geology Festival will be run on an annual basis. Its organising partnership has taken the decision because of the willingness among individual enthusiasts, geologists in industry and various groups, societies and museums, to organise and run events to meet the public's growing appetite for geology.

Throughout September 2006, there will be the usual popular mix of fun, informal and formal geological events for all ages, held across the length and breadth of Scotland.

The organising partnership behind the festival comprises the Hunterian Museum in Glasgow, the National Museums of Scotland, Scottish Natural

Heritage, the British Geological Survey, the Scottish Earth Science Education Forum, Our Dynamic Earth and the geological societies of Glasgow and Edinburgh. The partnership is led this year by the Hunterian Museum.

If you wish either to host or run an event, you can do so by filling out the registration form on [www.scottishgeology.com](http://www.scottishgeology.com)

which will list all the locations that offer something for the geotourist in terms of interpretation, available either on-site or through leaflets and/or guidebooks.

Check out the revitalised [www.scottishgeology.com](http://www.scottishgeology.com) for events for Scottish Geology Festival 2006.





## SESEF plans to continue development

The Scottish Earth Science Education Forum (SESEF), the network which promotes and supports the teaching of Earth Science in Scotland's schools, is continuing to develop its activities and experience some changing faces.

SESEF appointed Clare Britton as the new development officer in January 2006 to maintain its successful projects and plan new initiatives.

SESEF plans to make its 'Continuing professional development' workshops for teachers of the Scottish 5-14 curriculum more widely available. The workshops, provided in collaboration with the Earth Science Education Unit, saw their 1,000<sup>th</sup> participant in 2005.

The organisation has developed a new 5-14 workshop resource on landscape and weather, in collaboration with the Royal Meteorological Society and Edinburgh District Council. This is now being piloted. A new project, funded by the Petroleum Exploration Society of Great Britain, is under way to provide direct in-school support for current and aspiring teachers of the Higher Geology course.



Initial teacher training (ITE) Students at the University of Edinburgh, taking a close look at the resources that SESEF offers with its Scotland's Journey workshop. Photo by Alan Doherty

The SESEF Steering Committee also has a new chairman, Neil Clark of the Hunterian Museum in Glasgow, who hopes to involve more teachers in its meetings, and thus ensure that SESEF support is constantly tailored to meet their needs.

An Earth Sciences Trust has been established to facilitate initiatives and resources that support and promote geology in the secondary curriculum. Its Chairman is Stuart Monro (scientific director for Dynamic Earth). Other members include professional geologist Alan Parsley and

Sylvia Jackson (Member of the Scottish Parliament).

All current and future projects and initiatives could be aligned with the ethos and outcomes of *A Curriculum for Excellence*, the Scottish Executive's current comprehensive review of the Scottish curriculum. SESEF is working to ensure that the curriculum review incorporates more on the teaching of Earth science and of science in general.

**Clare Britton**  
Development Officer SESEF

## Earth Science teachers fix conference dates

The 2006 Earth Science Teachers' Association Course and Conference will be held at the University of Bristol from 15-17 September. The meeting will include workshops for primary and secondary teachers, keynote lectures by leading Earth scientists and field excursions. Residential accommodation will be at Clifton Hill House, a short walk from the Earth Science Department in the Wills Memorial Building of the University.

The first day comprises in-service training and workshops for local teachers and ESTA members. INSET for teachers of pupils at Key Stages 1 to 4 is aimed at improving the teaching of the Earth Science component of the National Science Curriculum. Professor Mike Benton will deliver a keynote lecture on 'Mass Extinctions'.

Day two includes lectures on climate change, the Mendips and volcanic geohazards, an open forum on 'Facilitating Fieldwork',

and break-out sessions specifically tailored for primary and secondary teachers.

Day three will offer a variety of trips. These include: Sediments and structures along the Portishead coast; Unrivalled geodiversity and biodiversity in Vallis Vale; In the Footsteps of William Smith - classic localities south of Bath; Burrington Combe - some of the best karst scenery in Britain; A walking tour around central Bristol looking at building stones.

Attendance is open to all with an interest in Earth science education, either as a day visitor or on a residential basis. The keynote lecture is free, but there are modest fees for other aspects of the conference. Details and booking forms are obtainable from the Conference Organiser, Dr Martin Whiteley, 16 Amberley Gardens, Bedford MK40 3BT or the ESTA website [www.esta-uk.org](http://www.esta-uk.org)

## All-action on Anglesey plans

There has been a frenzy of activity on developing a Local Geodiversity Action Plan (LGAP) for Anglesey and on formulating a bid to secure European Geopark Network (EGN) status for the island.

As a result, the draft LGAP will be distributed for consultation this autumn and the Anglesey Geodiversity Partnership (AGP) has also just submitted its geopark application for consideration by the EGN.

The Anglesey LGAP draws on the Cheshire region LGAP process, but uses six interrelated themes, with background and explanatory text, to make the plan accessible to potential partners who may have little knowledge of geoconservation. The LGAP forms a major strand in Anglesey's geopark bid.

On that front, the Partnership hopes that the EGN will consider its application during the Belfast



Geoparks Conference in September (see page 10). The Partnership has already secured funds from the Countryside Council for Wales, the Welsh Assembly Government (from its Aggregates Levy Sustainability Fund) and Leader+ for a geoparks officer to work on the project, known as GeoMôn, for three years.

Gwynedd & Môn RIGS Group, one of the chief drivers of the Anglesey LGAP and GeoMôn projects, has, in the meantime, completed three related projects.

First, it has published a soils booklet (see page 20). Second, it has collaborated with Isle of Anglesey County Council to design and install interpretation boards in South Stack Lighthouse and Breakwater Country Park – two of Anglesey's most visited Precambrian sites. Third, it has established a new logo to spearhead the GeoMôn project and to 'brand' potential geopark products and events. The logo was drawn and donated by Sir Kyffin Williams RA, GeoMôn Patron and leading artist. The logo (above left) depicts two standing stones, Penrhos Feilw, near Holyhead Mountain, and depicts with great simplicity the essence of Anglesey's geology, landscape and cultural inheritance.

- Stewart Campbell, CCW

## Waiting for the lion to roar into public ownership

*The Lion of Scotland lies beneath Salisbury Crags, its Corrennie pelt ruffled with symbolism. Has time tamed it to a domestic tabby whose petulant yams – the politicians' "I am"s – make a mockery of a hundred men? Twenty tons of granite sits unblinking, letting you make up your own mind.*

© Rowena M. Love

Rowena Love's poem reflects the public opinion that cries for the Scottish Parliament, in its unfinished-looking building just across the road from Holyrood Park, to buy the 'Lion of Scotland' for the nation. The Corrennie granite sculpture has been titled the 'Lion of Scotland' by the public and feeling is high for the country to own it. More than 100 people from all walks of life gathered to hear a passionate tribute to the genius



Ronald Rae with his 'Lion of Scotland'.  
Photo by Mick Stanley

and dedication of Ronald Rae to his hand-carved art from Bishop Neville Chamberlain and Richard Holloway, Chairman of the Scottish Arts Council.

The Makar Press poets also recited their poetry in celebration of the opening of

Ronald Rae's sculpture exhibition in Holyrood Park in May.

Rowena Love's 'A Lion, lying' was one of six poems in tribute to the granite sculptures. There are 12 stretching along Queen's Drive and The Duke's Walk and a further nine around Holyrood Palace.

Sponsorship for the year-long show is from the Scottish Executive New Arts Sponsorship Awards in conjunction with Arts & Business Scotland, Hughes Associates, Aggregate Industries with granite from Bardonia Aggregates quarries and supported by *The List* and Makar Press.

- Mick Stanley, Geodiversity Consulting

Dino Jaws, a new family exhibition at the Natural History Museum, London, this summer introduces the fascinating, and sometimes disgusting, subject of dinosaurs and their food.

More information at  
[www.nhm.ac.uk/dino-jaws](http://www.nhm.ac.uk/dino-jaws)





# Close

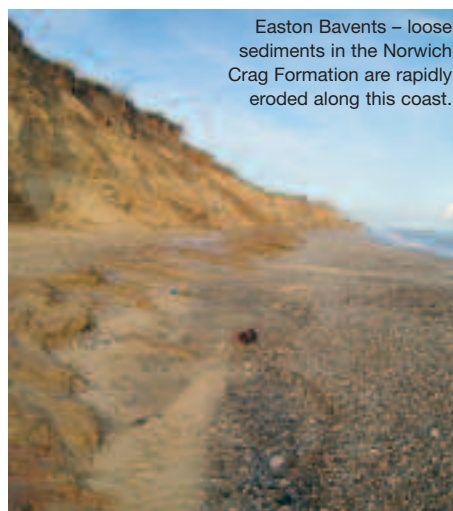
## to the edge

At Fairlight plans for a revetment, similar to an earlier one in the middle ground of this picture, are currently the subject of an objection because of the likely impact on the geology.

**C**oastal geological SSSI often produce challenging casework because they sit on cliffs that are unstable or being rapidly eroded. This is particularly the case where property and developments are affected.

**Hastings Cliff to Pett Beach SSSI** in East Sussex contains extensive exposures of sandstones and clays belonging to the lower part of the Lower Cretaceous Hastings Group. These sediments have yielded fossil fish, reptiles (crocodiles, turtles, dinosaurs and pterosaurs), early mammals and a variety of invertebrates as well as trace-fossils. In addition, the site has yielded an extensive fossil-plant assemblage. Sedimentary structures can be seen on all scales. The site has provided many insights into the terrestrial environments of the Weald Basin during the early Cretaceous and will remain of great importance for future studies. Two reverse faults (the Haddocks and Fairlight Cove faults) provide examples of how the Weald Anticline developed. There are many landslips along this coast. Recent activity in the landslide that fronts part of the village of **Fairlight** has resulted in properties being lost. The residents fear that further losses of property are inevitable unless some action is taken to stabilise the slip. A planning application for a scheme to grade and drain the landslide and to support and protect its toe with a revetment on the foreshore has been submitted. English Nature is concerned about the potential impacts of the scheme on the geology and has objected to the application. It is in

### David Evans, English Nature



Easton Bavents – loose sediments in the Norwich Crag Formation are rapidly eroded along this coast.

At Lyme Regis (below), plans to stabilise a section of the sea front further could affect the Blue Lias Formation in the SSSI foreshore.

All photos by David Evans



discussion with Rother District Council over the issue.

Active landslides and coastal erosion are also concerns at Lyme Regis. In recent years several phases of engineering have helped stabilise sections of the sea-front. Until now, these works have had no direct

effect upon the **West Dorset Coast SSSI**. But Phase 4 proposes works within the SSSI that will affect the foreshore and cliff in front of Church Cliff and East Cliff to the east of Lyme Regis. Potentially, any scheme here could result in a decrease in the available exposure of the Blue Lias and Charmouth Mudstone formations, as well as having an impact on the fossil fish and reptile features of the site. English Nature has been working with West Dorset District Council since the initial stages of the project and has been advising on the impacts that different options might have on the SSSI.

The sands, clays and gravels that form the Norwich Crag between Easton Bavents and Covehithe on the Suffolk coast form the type site of the Baventian Stage of the British Early Pleistocene. This coastline recedes so rapidly that the landward boundary of **Pakefield to Easton Bavents SSSI** was below high-tide, and the cliffs, as well as part of the foreshore, were no longer within the original SSSI boundary.

The southern end of the site has been the subject of a controversial, privately funded, coastal defence scheme that has largely obscured the geological interest of Easton Bavents Cliff. To address this and other issues, the site has been re-notified with a landward boundary at the estimated position of the coastline 50 years hence. This highlights how vulnerable to erosion this stretch of coast is. English Nature considered objections to the notification at its Council meeting in June. Approval to confirm the notification was given ■



## FACE LIFT

# Looking great at

**E**nglish Nature's Face Lift Programme for enhancing geological Sites of Special Scientific Interest (SSSI) is now in its eighth year. Since Face Lift was initiated in 1999, more than 250 projects have been undertaken with a total spend of almost £600,000. Most have involved clearing vegetation or scree to re-expose geological faces which have become concealed over time due to neglect and lack of management.

Since we last reported on Face Lift in *Earth Heritage* in 2004, several important sites have been enhanced and good exposures re-created.

**Michael  
Murphy,**  
English Nature

Southerham Grey Pit, Lewes, is designated as an SSSI for Cretaceous stratigraphy and vertebrate palaeontology. The site is of considerable stratigraphic importance, providing the only inland section in England or northern France of Chalk Marl and the lower half of the Grey Chalk. In addition, Lewes is renowned for its large diversity of fossil fish and the site is the main resource of fossil fish in the area.

Much of the section at Southerham Grey Pit had become concealed by scree as the face gradually collapsed in the years since the quarry was last used. Because of a major road running behind the face, an engineering assessment was necessary to ascertain how removing the scree would affect face stability. Scree was then cleared from a 100-metre section in February 2006, providing an excellent exposure.

Cleared section of Southerham Grey Pit, Lewes, East Sussex.

Photo by Mick Murphy/English Nature



Cleared section of Quaternary loess at Pegwell Bay, Kent.

Photo by Mick Murphy/English Nature



Pitt's Cleave is a large disused quarry near Tavistock, Devon, which exposes a thick dolerite sill of Lower Carboniferous age. Vegetation had concealed most of the exposures prior to a clearance project in 2005. Because the faces were otherwise inaccessible, climbers were contracted to clear growth, revealing good representative exposures of sections through the sill.







The cliffs at Pegwell Bay, Kent, are designated for several features of geological interest, including Cretaceous, Palaeogene and Quaternary stratigraphy and for Palaeogene vertebrate palaeontology. The site also exposes an important unconformity between the Cretaceous chalk and the Palaeogene sediments. The cliffs had become very overgrown following the construction and subsequent abandonment of a hoverport, concealing most of the features. A number of sections, representing the entire stratigraphy of the site, were selected for clearance, which was undertaken over three years.



This section at Pitt's Cleave Quarry, Devon, showing columnar-jointed dolerite, was cleared in 2005.

Photo by  
Mick Murphy/English Nature

Other sites which have been enhanced under the Face Lift Programme in the last two years include Stony Furlong Railway Cutting, Gloucestershire, and Milford Quarry, Staffordshire.



Climbers clearing scrub from a face at Milford Quarry, Cannock Chase, Staffordshire.

Photo by Angus Tillotson

This section through Mid-Jurassic limestone at Stony Furlong Railway Cutting, Gloucestershire, had been concealed by vegetation and scree for many years before clearance works in 2006.

Photo by Mick Murphy/English Nature



Purfleet Chalk Pits is a Quaternary site in Essex that is important both for research and education. It is close to London, in an area where there are few sites suitable for student field trips. Vegetation clearance was undertaken in 2005 to improve exposure of faces.

Students examining a recently cleared section at Purfleet Chalk Pits, Essex.

Photo by Natalie Bennett/English Nature

**Although we have made significant progress in the enhancement of geological sites, much work remains. Increasingly, Face Lift is tackling more complex and large-scale enhancement works, such as Southerham Grey Pit. It is also important to establish agreed management on many of the enhanced sites to ensure they remain in good condition in years to come. ■**

**For more information about the Face Lift Programme, please contact [michael.murphy@english-nature.org.uk](mailto:michael.murphy@english-nature.org.uk) or tel: 01733 455216**

# A Welsh first

**The Fforest Fawr (Great Forest) Geopark became the first Welsh Geopark and the 24<sup>th</sup> member of the European and Global Geopark Network at the annual meeting of the European Geopark Network (EGN) on the Greek island of Lesbos in October 2005.**

The status was achieved as a result of the concerted efforts of the Brecon Beacons National Park Authority, Cardiff University and the British Geological Survey. Representatives from these organisations put together the successful application and received contributions to the submission from the communities within the Geopark area.

The Fforest Fawr Geopark was launched at the Mountain Centre in Libanus on 21 April 2006 by Lord Kinnock of Bedwellty, the Honorary President of the Geopark. The event not only celebrated the first European Geopark in Wales, but it was also the first National Park in the UK to be awarded the designation. Special guests included Rt Hon Rhodri Morgan (First Minister) and Dr Patrick McKeever (Vice-Co-ordinator of the European Geopark Network), Dr Tony Ramsay (Honorary Fellow of Cardiff University and Director of Fforest Fawr Geopark), local schools, communities and the Aberhonddu Male Choir. The award-winning Cambridge University 'Time Truck' made a special appearance, providing hands-on experiences of fossil rubbing, gold panning, rock sculpture, earthquakes, volcanic eruptions, continental drift and rising sea-level consequences. Geologists, archaeologists and academic experts were on hand to identify rock, fossil and mineral specimens.

The Fforest Fawr Geopark covers an area of some 763 km<sup>2</sup> and contains some of the most outstanding mountain scenery in southern Britain. The rocks and landscape record over 480 million years of geological history.

In the west of the Geopark are the Ordovician and Silurian rocks of the Welsh Basin, including the internationally known Llandeilo and Llandovery type sections.

Eastwards, the looming mass of the Black Mountain (Y Mynydd Du) forms a ridge that divides these ancient rocks from the Devonian Old Red Sandstone which underlies much of the Geopark and forms the spectacular Fforest Fawr/Brecon Beacons escarpment. In the southern area of the Geopark are exposed Carboniferous Limestone, Millstone Grit and Coal Measures which fuelled the Industrial Revolution in Wales. The limestone hosts some of the largest cave systems and underground passages known in Europe.

The geomorphology is varied. Eight peaks within the Brecon Beacons and Fforest Fawr escarpment rise to over 610m (2,000 feet), including Pen-y-Fan (891m), Fan Fawr (734m), and Fan Hir (712m) and the lowest point is just 122m above sea level. Across the area, the evidence of the last (Devensian) ice age is clearly visible, from the morainic deposits within the Usk Valley and the beautiful glacial lakes at Llyn y Fan Fach and Llyn y Fan Fawr.

The geopark spans the transition from rural mid-Wales to the industrial valleys of South Wales. It illustrates the relationship between geology, landscape, altitude, flora and 8,000 years of human influence which together contribute to a rich natural and cultural heritage. This is acknowledged in the designation of two National Nature Reserves, 31 Sites of Special Scientific Interest and 166 Sites of Interest for Nature Conservation.

The Fforest Fawr area has been the subject of significant research and mapping since the mid-19<sup>th</sup> century when Adam Sedgwick and Roderick Murchison studied the Old Red Sandstone and underlying rocks. The geopark's varied geology offers opportunities to examine many important concepts.



The glacially sculpted landscape of the Brecon Beacons from Fan Gyhirych.

These include:

- the relationship of geology to landscape;
- the relationship between depositional environment and palaeontology;
- tectonic evolution of an area;
- the importance of stratigraphy;
- basin evolution and the influence of eustatic sea-level changes;
- the effects of rapid climate change on the terrestrial environment;
- environmental change and human influence.

With this breadth of concepts to explore, the geopark appeals to diverse audiences, including educational parties, casual visitors (both day-trippers and those on extended stays) and research scientists.

The diverse partner bodies involved in managing the Geopark ensure an even-handed approach which weighs all interests and views in decisions over strategy and day-to-day running.

By joining the EGN, Fforest Fawr is committed to encouraging sustainable development through geotourism. A grant from the Welsh Assembly's Aggregates Levy Sustainability Fund is allowing the

## CONFERENCE CALL

The second International Conference on Geoparks will be held in Belfast, Northern Ireland, from 17-21 September. The four-day event promises plenary sessions and education workshops for delegates and will explore the benefits of the designation, as well as the processes involved in taking a geopark from idea to entity. More information is available via the website [www.geoparks2006.com](http://www.geoparks2006.com)







## What is a Geopark?

In 2000, four groups from France, Germany, Greece and Spain formed the European Geoparks Network (EGN). Their aim was to promote their geological heritage to visitors and their own communities through designating each area as a European Geopark. The title denotes an area which has a geological heritage of European significance, a coherent and strong management structure and a sustainable economic strategy.

A geopark management group aims to use its area's geological heritage, as well as aspects of natural and cultural heritage, to bring sustainable and real economic benefit to local people, usually through developing sustainable tourism. There are currently 25 European Geoparks, linked in a network that facilitates co-operation and exchanges (of expertise, experience, staff etc.) between members. In February 2004 the EGN and eight Geoparks in the People's Republic of China amalgamated to form the UNESCO Network of Global Geoparks.

**Jane Davies,** Fforest Fawr Geopark  
**Adrian Humpage,** British Geological Survey  
**Tony Ramsay,** Cardiff University & Fforest Fawr Geopark

management team to develop a series of geotourism-related products. These will be aimed at both the casual visitor and the amateur or undergraduate geologist markets.

Although many sites have statutory protection, numerous other important sites fall outside the SSSIs and NNRs. Fforest Fawr is working with CCW, RIGS groups and the South Wales Regional Group of the Geological Society to identify sites suitable for detailed recording to help the development of a Local Geodiversity Action Plan for Fforest Fawr. Communities both within and outside the geopark are proposing initiatives which are being incorporated into the geopark management

plan. Many of the gateway towns, such as Brynamman and Merthyr Tydfil, have a history of deprivation since the decline of heavy industry and recognise the benefits that the geopark can bring to them.

Fforest Fawr is working with other members of the EGN to raise the profile of geological heritage and is also working hard to involve communities and businesses in developing the future economic health and vibrancy of the region. The designation is the start of an exciting opportunity. ■

Right: Sgwd Clun-gwyn, a spectacular waterfall on the Afon Mellte. Below: Carreg Cennen Castle is on a craggy outlier of Carboniferous Limestone which has been faulted into the Old Red Sandstone.

All photos by Jane Davies





# A ton of n

## 100 new sites identified to date in Welsh audit

**Jacqui Malpas and Cynthia Burek,**  
North East Wales RIGS Group

**T**he North East Wales RIGS (NEWRIGS) Group has lived up to its acronym by identifying 127 Regionally Important Geodiversity Sites (RIGS) – 100 of which are listed for the first time.

The NEWRIGS audit spanned the counties of Conwy, Denbighshire, Flintshire and Wrexham, and is part of a comprehensive exercise to examine potential RIGS throughout North Wales.

All the sites have been fully documented, including details of location, a statement of RIGS importance, the geological background, references, practical considerations, ownership and planning control, and condition, use and management. An assessment was made of the potential for using each site to raise public awareness of geoconservation and for possible geotourism. The sites have been registered with the relevant local authorities, the Countryside Council for Wales and their owners and/or tenants, and documentation supplied to all relevant parties.

Thirty-eight sites are considered to have potential for use in education. Of these, eight are of particular significance and have prompted discussions on their further development with Yale College, Wrexham and the Open College Network (Wales). Seventeen limestone pavements have been identified. The Cumbria-based Limestone Pavement Action Group and the national Limestone Pavement Biodiversity Action Plan Steering Group have been informed. Documentation for Limestone Pavement Orders has been prepared for each. One hundred and thirty-five potential RIGS have also been identified

and these will require further assessment and documentation.

As part of the project, NEWRIGS carried out extensive promotional activities to raise public awareness of geoconservation, geodiversity and RIGS. These activities have included participation in the Wrexham Science Fair, many presentations and talks to conferences and local interest groups, the organisation of field visits, and producing a range of publications.

The project has yielded two particularly exciting highlights. The first is the rediscovery of the sites used by two geologists, Ethel Woods and Margaret Crosfield, in pioneering work in the early 20<sup>th</sup> century on Silurian graptolite biostratigraphy. This led to the finding of their previously lost specimens and field notebooks in the Grosvenor Museum, Chester and at BGS, Keyworth, and a renewed appreciation of the importance of their work was prompted by a paper in the *Role of women in the history of geology* conference (see page 30). However, the 'jewel in the crown' of the audit has been the discovery of the Carboniferous fossil forest on the site of the old steelworks at Brymbo, Wrexham (see page 14). This is a discovery of international significance that would have had no chance of conservation if it had not been identified by the audit.

The audit work is part of a partnership between Gwynedd and Môn RIGS Group and the NEWRIGS Group which has received backing from the Welsh Assembly and Aggregates Levy Sustainability Fund, to undertake a comprehensive RIGS audit of North Wales. Work on the remainder of the audit is ongoing and funding has also been secured for similar work in Central Wales. ■



All photos by Jacqui Malpas/NEWRIGS except Holt Castle - Stewart Campbell



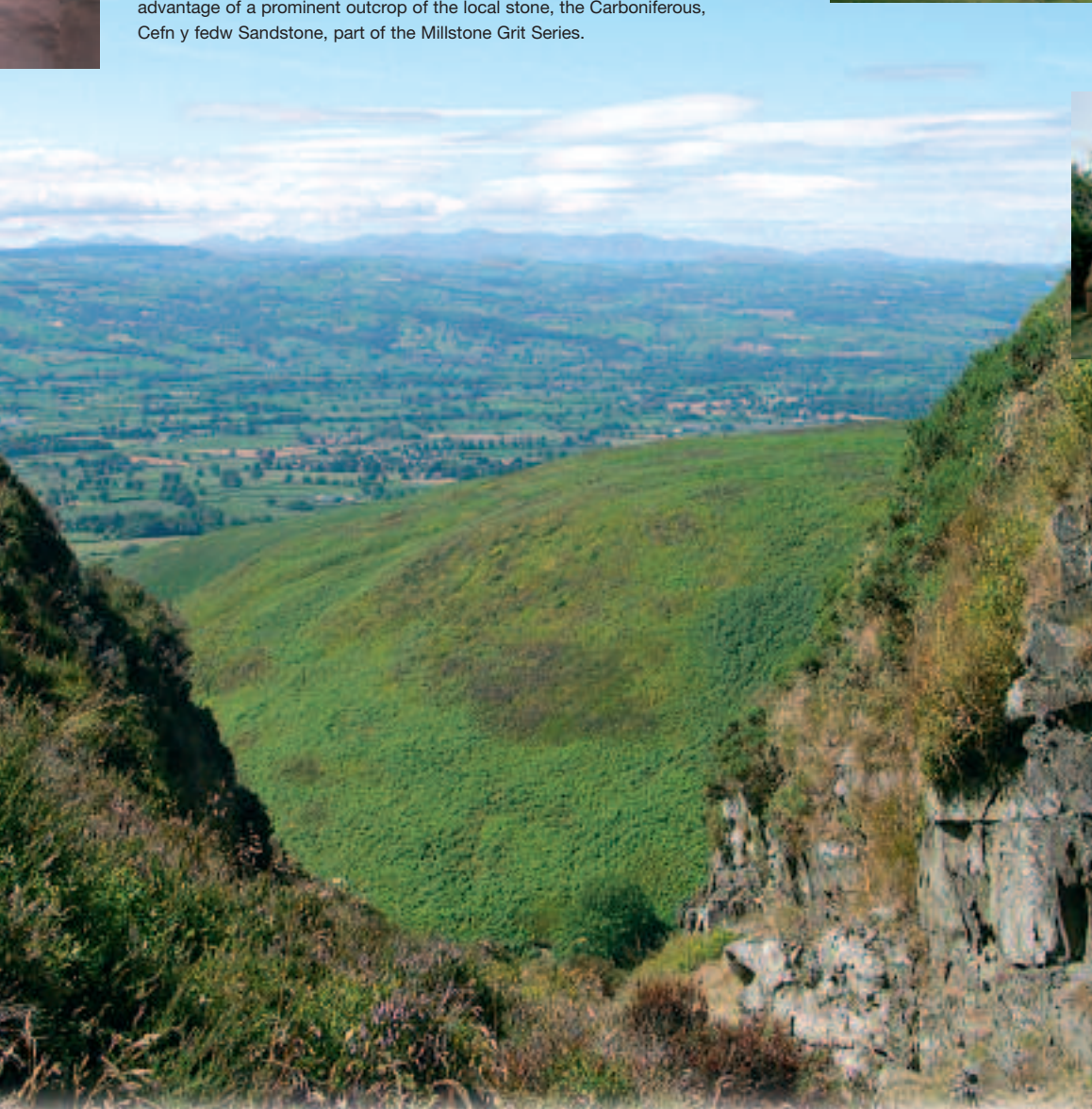


# new RIGS!

Main picture, below: Nant y Ne ravine RIGS is an important fossil locality that was described by pioneering women geologists during the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. Ethel Woods and Margaret Crosfield investigated the rocks and fossils, mainly graptolites, of the Silurian Period that were deposited 430 to 425 million years ago. See also page 30.

Left: Erbistock Farm RIGS on the banks of the River Dee near Wrexham is a type section of the Upper Carboniferous, Erbistock Formation. This red sandstone bluff has good sedimentary structures such as ripples and cross-bedding with sharp bases and channel features (bottom of image), indicating fluvial deposition and a return to well-drained, oxidising, alluvial floodplain conditions throughout the area to the north of the Wales Brabant Massif (high ground to the south of the district), during the latest Westphalian.

Right: Caergwrle Castle RIGS is a fine example of a mediaeval castle taking advantage of a prominent outcrop of the local stone, the Carboniferous, Cefn y fedw Sandstone, part of the Millstone Grit Series.



Above: Holt Castle RIGS demonstrates Perno-Triassic sandstones in a series of exposures frequently used by educational parties. The castle is a Scheduled Ancient Monument, and attempts underway to strengthen its foundations are likely to cause severe damage to the RIGS. We hope to report on this in a future issue.

Centre left: Pentre Chert RIGS is the type section of the Carboniferous, Namurian, Pentre Chert Formation. The cliffs consist of colour-banded glassy cherts and siliceous (cherty) mudstones with subordinate thin siltstone and silicified crinoidal limestone beds that were deposited in an offshore to basinal environment approximately 300 million years ago. The picture shows cyclic deposition of beds of light and dark grey, glassy chert with subordinate mudstone.

section of the Ffernant Formation. This site is part of a network that marks the initial fluvial phase of the Lower Carboniferous transgression prior to the flooding of North Wales by the sea approximately 350 million years ago.

Right: Cegidog Valley RIGS is a reference section for the Holywell Shales Formation. The rocks in and beside the stream contain marine bands with important marine fossils. This site is part of a network of goniatite sites that show how far the sea flooded North East Wales during the Upper Carboniferous.



Left: Basement Beds in Ffernant Dingle RIGS are the type



# Race to save fossil forest

**Jacqui Malpas,**  
North East Wales RIGS Group

**T**he race is on to find funds that will conserve the spectacular fossil forest discovered during the redevelopment of the former Brymbo steelworks near Wrexham.

At present the Brymbo Fossil Forest is open to the elements and rainwater is damaging the fossils. Unless it is made weather-proof, the fossils from this – one of only four fossil forests known in the UK – will be lost for ever. Further work on the discovery site cannot proceed until the forest and the associated Industrial Heritage Area are conserved for the nation.

The discovery of the fossil forest was reported a year ago in *Earth Heritage 24* (Rainforests in the rock) and there have been significant developments since then. In particular, the owners and operators of the site, Parkhill Estates Ltd, and the North East Wales Regionally Important Geodiversity Sites (NEWRIGS) Group have staged several open days to allow allcomers to visit this remarkable site. Parkhill Estates is now fully committed to the conservation of the forest and its development for geotourism.

NEWRIGS became involved while conducting a geodiversity audit of north-east Wales, funded by the Aggregates Levy Sustainability Fund for Wales (pages 12–13). It quickly became apparent that the Brymbo site had an unprecedented number of huge lycopod stumps up to two metres in diameter and just as tall. Each visit revealed more lycopods, together with *in situ* stands of *Calamites* (giant horsetails), as well as beautifully preserved leaves, seed cones and ferns.

At this stage in the discovery, it was thought that the site could not be saved, but discussions between NEWRIGS and Parkhill led to an agreement to incorporate the fossil forest site within the Industrial Heritage Area. The Heritage Area is a remarkable ironworks complex from the

18<sup>th</sup> century. It contains an ancient monument (Number One Blast Furnace) and an important collection of listed buildings, including the forge, machine shop and pattern shop. There was an existing plan to conserve the Heritage Area as a monument to Brymbo's industrial past. This agreement means that the fossil forest site, adjacent to the Heritage area, can become an important part of the story of iron and steel production. This is in stark contrast to the previous situation, where it was thought that the site could not be saved. Then, access was limited to field trips in the form of fossil-collecting days, during which many spectacular fossils were taken.

Since the NEWRIGS agreement with Parkhill Estates Ltd, excavation has continued. To date, 25 lycopods including *Lepidodendron* and *Sigillaria* with complex, detailed root systems (*Stigmaria*), branches (*Lepidophyllum*) leaves (*Lepidophylloides*) and cones (*Lepidostrobus*) have been found. These plants represent the canopy of a tropical rain forest. There is also evidence of the understorey or lower canopy, with stands of *Calamites* gently bent over, all at the same angle and with beautiful detail of the plants and sediment layers. It is just as if the swirling sediment-laden water flooded them yesterday. The mudstone layers contain a large number of fern-like plants including *Alethopteris*, *Neuropteris* and *Sphenophyllum*, which grew on the forest floor. The detail is stunning.

There has been recent extensive coverage of the Brymbo forest's discovery in the national and local press and on BBC radio, television and web. Brymbo is the only known fossil forest in Wales. The other three in the UK are two Carboniferous sites – Fossil Grove in Glasgow and Wadsley, Sheffield, as reported in *Earth Heritage* in Summer 2004 – and the Great Dirt Bed Forest of Jurassic age near Lulworth Cove, Dorset. ■

Right: *Neuropteris* fern leaflets, one of the finds at the Brymbo site.

All photos by Jacqui Malpas



Above: Abundant leaf debris including *Calamites* (left and top) and lycopod (bottom).

Below: Re-development of the Brymbo steel works site revealed *in situ* Lycopod and *Calamites*. The close proximity of these two types of plants gives an idea of the tropical rainforest palaeoenvironment during the deposition of the Upper Carboniferous, Coal Measures.





# A quarry for the community

**Abigail Brown,**  
Herefordshire & Worcestershire  
Earth Heritage Trust

**A** former quarry which was once threatened with landfill and off-road vehicle activities is being turned into an educational and research resource, with a busy programme of associated community events.

Herefordshire and Worcestershire Earth Heritage Trust has secured a 10-year lease on Whitman's Hill Quarry, a RIGS near Malvern, Worcestershire, and it has also won a Geodiversity Discovery Venture grant, funded by English Nature through Defra's Aggregates Levy Sustainability Fund. As well as offering guided visits to parties of geologists and other adult interest groups, the Trust will be inviting local schools, students at the nearby Outdoor Centre and community groups to visit the quarry and take part in workshops from September 2006. Leaflets and trails dealing with the geology and wildlife of the site and its quarrying heritage are being developed to support these visits.

The project was launched by Bill Wiggin, MP for Leominster, in January at Cradley Village Hall. The event drew about 120 local people, intrigued to find out about the venture and take part in various fun geological activities. It also attracted strong local media coverage. A series of monthly seminars is now being staged at the village hall and attracting enthusiastic audiences. A comprehensive study of the stratigraphy and palaeontology seen at Whitman's Hill is underway and numerous samples from a bioherm at the site are being analysed by Chris Forster of the University of Birmingham, as part of his PhD research into the architecture and development of Silurian reef systems. Ten new RIGS are also being designated in the area, adding to the overall geodiversity interpretation. New RIGS have so far been selected in the Mercia Mudstone, St Maughans and Much Wenlock Limestone formations.

Additionally, Woolhope Naturalists' Field Club is conducting a long-term biodiversity audit of the quarry and the surrounding



Bill Wiggin MP at the project launch with Abigail Brown.

© Worcester News

woodland, as well as siting and monitoring bird and dormouse boxes. Cradley Heritage Group is researching the historical and community aspects of the quarry and associated lime kilns and recording memories of quarrying at Whitman's Hill from local residents. A range of digital educational resources, including e-Learning materials, virtual field trips and film clips, is being prepared for the Trust's website, to equip teachers and group leaders preparing to bring parties to the quarry.

To find out more, or to arrange a guided visit to Whitman's Hill (from September), contact the Herefordshire & Worcestershire Earth Heritage Trust, Geological Records Centre, University of Worcester, Henwick Grove, Worcester WR2 6AJ.

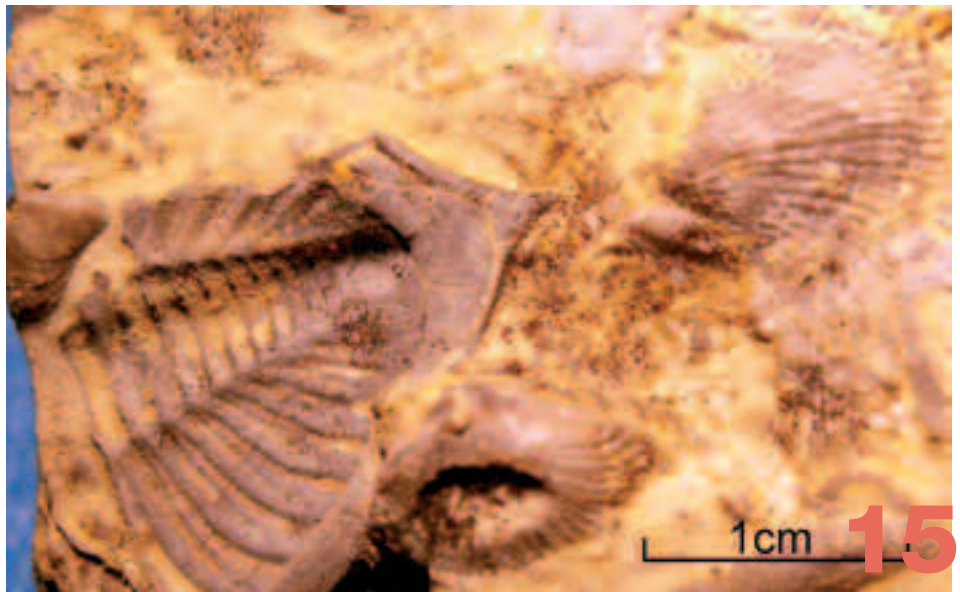
Tel: 01905 855184.

E-mail: [abigail.brown@worc.ac.uk](mailto:abigail.brown@worc.ac.uk)

Website: [www.EarthHeritageTrust.org](http://www.EarthHeritageTrust.org) ■

Below: Fossiliferous slab from the Much Wenlock Limestone Formation. Fossils include the pygidium of the trilobite *Dalmanites ?myops* and several brachiopods, all *Atrypa reticularis*.

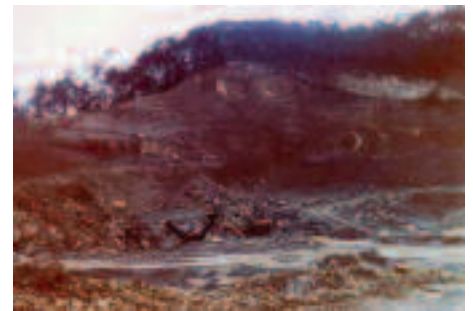
Photo: Herefordshire & Worcestershire Earth Heritage Trust



## Silurian sections

Whitman's Hill Quarry was used for limestone extraction for aggregate until 1988. The site now offers excellent sections through the Silurian Coalbrookdale and Much Wenlock Limestone formations and illustrates re-colonisation by lime-loving plants.

In 1999, the site was designated a RIGS for its Wenlock succession, impressive exposures, educational value, and abundant fossils - mainly crinoids, corals, brachiopods, trilobites, algae and bryozoans. The rocks here are about 425 million years old, and formed at a time when this area was about 15 degrees south of the equator.



Above: Whitman's Hill Quarry in 1977, whilst being worked for aggregate. Below: The quarry today, displaying Much Wenlock Limestone Formation overlying Coalbrookdale Formation.

Photos by John Milner and Les Morris



# Celebrating a landscape fashioned by geology

**Alan McKirdy,**  
Series Editor – *A Landscape Fashioned by Geology*

**S**ince the first title was published in 1992, the *Landscape Fashioned by Geology* series has become the most popular publication of its type produced by Scottish Natural Heritage, having sold over 100,000 copies. With 14 titles published, the series will be completed with the appearance of six more titles within the next two years.

The formula for success is simple. We take the landscape of Scotland – as celebrated by painters and poets through the centuries, and explain in plain but engaging English the way in which the familiar views and landscape features have developed over time.

Since the series was initiated, we have reached a wide cross section of the public and, we hope, convinced them that geology is not just for the academic or the enthusiast. The subject has something to say to everyone with an interest in the countryside.

The British Geological Survey is a partner in the writing of the series. This partnership has endured since the first in the series – *Edinburgh; the Athens of the north* (and in many ways the cradle of modern geology), was written about. Edinburgh was the birthplace of James Hutton, the 18<sup>th</sup> century geologist who developed the concept of deep time and the idea that we can learn so much about our geological past by observing the way in which the Earth works today. The landscapes of his birthplace inspired Hutton's interest and curiosity in the workings of the Earth. He knew the dissected remains of the Arthur's Seat volcano well, as his house overlooked the rocky crags of the Queen's Park. His visit to Siccar Point with his companion



A raised beach backs the present shore at Gruinard Bay which is underlain by ancient Lewisian gneisses. River-deposits are visible in the foreground. [Page 37 from *Northwest Highlands Landscape Fashioned by Geology*].

Photo by Lorne Gill, SNH

and biographer, Dr Playfair, stimulated an account of the place that is one of the classics of scientific literature. We have attempted to take the accepted scientific explanations for the renowned natural landscape features we see around us in Edinburgh and many other areas of Scotland covered by the series, and explain their origins in non-technical language.

Photography plays a big part in the success of the Landscape series. We are fortunate in having the services of photographers Lorne Gill and Pat MacDonald at our disposal. Lorne works for SNH and has won many awards. Pat served as a Main Board member with SNH. In her spare time, she took up flying and her expertise and acclaim as an aerial photographer is now well established.

The series has also used diagrams to convey some of the more challenging geological concepts. The Mull volcano is beautifully illustrated in all its complexity in the diagram shown above right, drawn by BGS scientist and part-time illustrator Emrys Phillips. It appears in *Mull and Iona Landscape Fashioned by Geology*.

The *Landscape* series seeks to enhance the enjoyment and appreciation of the

countryside by tourists, school groups and locals alike as they spend time in the outdoors. Green tourism is a growing industry in Scotland, as in many other parts of the world. As more geological attractions, such as Our Dynamic Earth in Edinburgh and Knockan Crag in the







visited Torridonian sandstones form the mountains to the

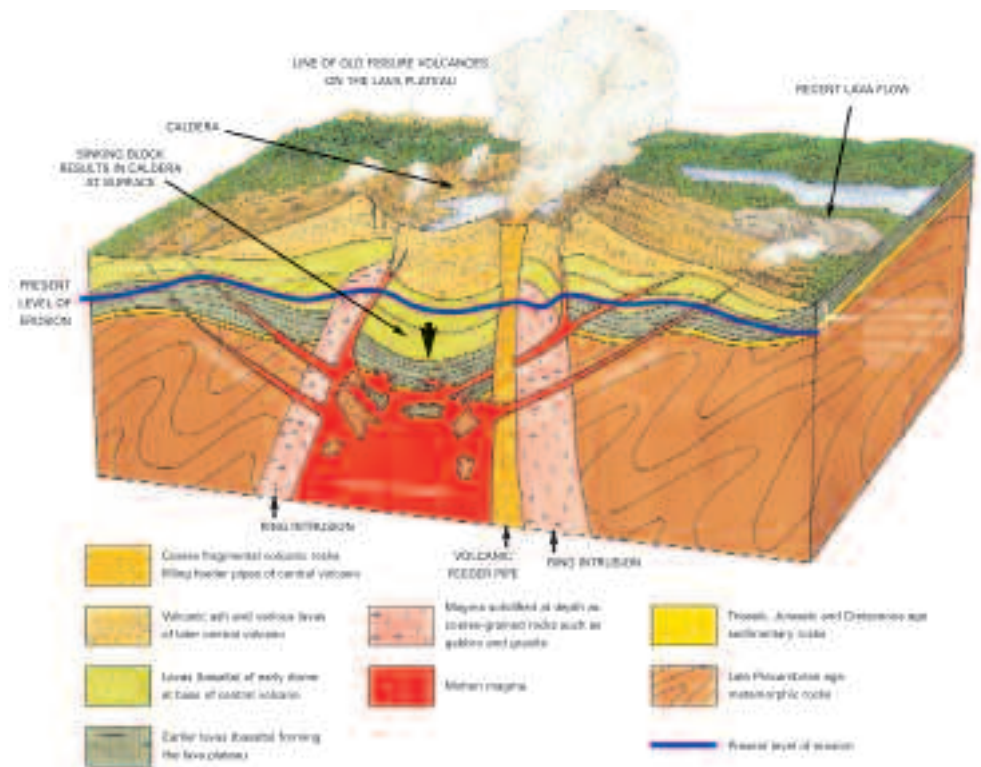
Northwest Highlands, are created, so geo-tourism also thrives (see page 29). Visitors go out of their way to see these special sites and the local economy benefits from the increased visitor traffic.

The *Landscape* series plays a role in



explaining these sites to those visiting for the first time and wishing to take away a memento of their trip.

The 14 published titles cover many of the popular areas where there is a good geological story to tell. An agreement has been signed with BGS to complete the coverage across Scotland, with a further six titles covering Ben Nevis and Glencoe, the Western Isles, Caithness and the Moray Firth Area, Northeast Scotland, Argyll and the Islands and Southwest Scotland. ■



See 'Latest Publications', page 31

The view from Iona over the Ross of Mull, composed of 410 million-year-old pink granite, toward the 60 million-year-old lava pile of the Mull volcano forming the Ardmeanach peninsula. This scene was made famous by among others the late 19<sup>th</sup>/early 20<sup>th</sup> century painters Peploe and Cadell. It is the cover of *Mull and Iona – A Landscape Fashioned by Geology*.

Photo by Lorne Gill, SNH



# Soils:

## raising the

**S**oil is something most of us take for granted – it's just there, isn't it? But soil is very important. We grow our food in it and it provides us with essential minerals as a consequence. It filters our water, can act as a sponge to absorb excess water, and helps to remove pollution. We build on it. It protects our cultural heritage and can provide clues to environmental conditions in the past. We rely on it to store excess carbon, and we use it as a raw material. It supports our habitats and contains a vast amount of biodiversity in its own right. Soil itself is hugely varied, according to the geology it has developed on and the conditions it has developed in. Maybe we shouldn't take it for granted?

But what is soil? Engineers, geologists and ecologists all view it differently. Some are interested only in the surface features, others in looking at the whole profile, its characteristics and how it has developed. Soil starts from weathered and eroded rocks. These are acted on by chemical and physical processes, for example by rainfall and other climatic factors. Organic matter is added from growing and decaying plants, and from soil fauna (see *Earth Heritage 6*). Time and land management are also key factors in soil development. Over time, soil develops a profile, with the parent material towards the bottom, and layers of different material above, with the organic material nearer the top. This profile is determined by all the processes that have acted on it. Put more simply, soil = rock + organic matter + beasts + rain + time.

There have been moves afoot to raise the profile of soil (an interesting concept for soil scientists due to our interest in soil profiles!). Defra has led on developing the England Soil Action Plan, and the Environment Agency has published *The state of soils in England and Wales* along with its strategy for considering soils in their own work. Scotland and Wales are also developing soil strategies. Soil is a key concern for agriculture, and there is a selection of guidance, for example on improving soil structure, and requirements for cross-compliance for soil management in agri-environment schemes. There are also



# profile of a downtrodden asset

## Anna Wetherell, English Nature

guidelines for managing soils in the quarrying industry, and there is likely to be an EU Soil Framework Directive. A very useful website ([www.silsoe.cranfield.ac.uk/nsri/services/cf/gateway/ooi/nmsoilscapes.cfm](http://www.silsoe.cranfield.ac.uk/nsri/services/cf/gateway/ooi/nmsoilscapes.cfm)) provides a range of soil information for England and Wales, using the 'soilscapes' mapping, developed by the National Soil Resources Institute.

There are three actions within the England Soil Action Plan which English Nature is involved in, namely 41, 42 and 43. Action 41 looks at the benefits and options that might arise from establishing a national series of benchmark sites for soil biodiversity. Activities towards this include looking at soil types in existing SSSIs, and also considering how RIGS could link in, especially bearing in mind the series of RIGS for soils in Wales. SNH commissioned a specific project looking at correlations between soil diversity and SSSI coverage in Cairngorm and Dumfries, which has been extended to the Tern and

Eden catchments in England. The outcomes of the project are still being assessed, but the analytical techniques developed provide an interesting way of assessing soil diversity.

Action 42 required English Nature to produce a position statement on the role of soil management and protection within statutory sites, which has been completed via a paper to English Nature's Council. This focuses partly on issues arising from common soil management practices. Some farming can result in diffuse pollution due to nutrient leaching and increased silt loading in rivers. The paper also acknowledges the importance of soil as part of the ecosystem, providing ecosystem services such as nutrient recycling, and it also identifies soil as being of importance for biodiversity.

Action 43 requires English Nature to publish guidance on the use of soil information in the restoration of wildlife and wildlife habitats. This guidance is of particular interest to those of us involved in site management and restoration, including quarry operators. The outcomes of the

project will be published as an English Nature Research Report in September, and a summary document will also be available.

The key messages include:

- There are many different soil types which have different properties and characteristics, such as pH, chemistry and moisture. These support different vegetation and habitat types.
- Understanding the soil types and characteristics on-site are critical to choosing restoration objectives and achieving outcomes. Soil analysis (which can be done at a variety of levels and complexity) is an essential part of any restoration project.
- Choosing objectives and outcomes based on existing soil type is more likely to result in successful and cost-effective restoration.
- Soils often take time to (re)establish, in particular for the organic matter and the soil fauna to become re-established and for important soil processes to function again. For complex restoration, such as re-creating wetlands, this time factor may need to be built into a project in order to achieve successful long-term outcomes.

This project did not set out to re-create existing guidance, but to create an overview of available guidance, summarise it and list key sources of information. The Research Report will therefore contain an extensive bibliography and details of a range of websites. It will give guidance on what types and levels of soil survey may be appropriate, which habitats are generally found on which soil types, and where to find more information.

But what does all this mean for us, apart from potential information overload? The importance of soil is increasingly recognised, and forthcoming legislation reflects that. Soil can be regarded as part of our geodiversity, as well as a key part of the interactions between land, air and water. There are many opportunities and ways to promote the importance of soil. Perhaps now is the time to think about some of these, and even put them into action? ■



Soil profiles, like this iron-pan stagno-podzol of the Hiraethog Series on the Denbigh Moors, Clwyd, are invaluable indicators of past climatic conditions and events. Photo by John Conway

# Breaking new ground

**Dylan Williams,**  
Countryside Council for Wales

**T**he publication of a ground-breaking booklet on studying soils in the field comes at a time when soil science is enjoying a bit of a renaissance.

There is increasing awareness among policymakers of the importance of soil resources and the ecosystem services they provide for society. Recent soil policy initiatives such as EU Thematic Strategy for Soil Protection and Defra's Soil Action Plan illustrate this. So does the introduction of soil protection measures under the Common Agricultural Policy's new 'cross-compliance' regime and the related agri-environment schemes which break the links between farming and productivity in favour of encouraging land management that is more environment-friendly and sustainable. The wider appreciation of the significance of soil as a carbon sink is shown in action plans for climate change and sustainable development.

However, it is becoming increasingly apparent that there are significant knowledge gaps. For example, the public's awareness of the need to protect soil is low, and the understanding of soils by school-children and students can be improved. The lack of documented and accessible field sites to help illustrate the relationship between soils, landscapes and land use is an obstacle to raising public awareness, meeting National Curriculum needs and indeed the training of future soil scientists.

This field-based guide nicely fills the gap for North Wales, providing sites where examples of major soil groups can be seen and which should remain accessible. This bilingual English and Welsh booklet is well structured, progressing logically from simple overview of what soil is and how it is formed to more detailed accounts of soil classification, major soil types (lithomorphic, brown soils, etc.), soil properties and finally soil landscapes –



limestone pavements, the mountains, coastal fringes etc.

The appetite for soils is whetted to such a degree that I suspect that many, especially students, will be disappointed with such a limited further reading list (only four references).

The bulk of the booklet is devoted to giving a picture of the major soil types found in Wales. Each soil type is briefly introduced in the context of parent material, topography, land use and vegetation. Photographs and profile descriptions are used to describe example soils at various locations in North Wales (grid reference and directions supplied!), from the raw gley soils of the Porthmadog saltmarsh to rankers on the slopes of Crib Goch in Snowdonia. The association of soil type to a particular landscape allows the visitor to find similar soil profiles in many other places in that particular landscape.

The booklet is rounded off by scaling up the study of soils to landscape level and

good use is made of landscape features and scenery photographs with insets of profiles of associated soils. The depiction of soil patterns in the landscape and how this variety is the essential basis of biodiversity and of types of land use illustrates the fundamental importance of soil management - the previous section having usefully introduced the reader to common threats to soil quality and what is being done to address those threats.

This 32-page booklet is testimony to the author's persistence in trying to get soil, that 'softest' wing of geology, better understood. His enthusiasm for Welsh soils clearly shines through. It is a superb attempt at making the study of soils more relevant and informative to non-specialists. The booklet can be used as a model of how to present regional soils for a broad audience. Other parts of the UK can emulate and improve upon it. Let's hope this is the first of many such educational booklets! ■

*Soils in the Welsh Landscape (A field-based approach to the study of soil in the landscapes of North Wales). J.S. Conway. Association of Welsh RIGS Groups. £5.00. A4 softback. ISBN 0-9546966-1-1. Available from Dr Margaret Wood, College, Llansadwrn, Menai Bridge, Anglesey LL59 5SN.*



# Soft-sediment challenge

**T**he Bubbenhall area of eastern Warwickshire is well known for a succession of Quaternary tills and fluvial sands and gravels. Professor Fred Shotton of Birmingham University had probably recognised a clear stratigraphy by the early 1930s, and he proposed these sediments as the stratotype of the penultimate glaciation in Britain.

Bubbenhall quarries have yielded several important finds over the last 20 years, including highly fossiliferous channel fills, teeth and bones of the straight-tusked elephant *Palaeoloxodon*, and a series of magnificent Palaeolithic hand axes fashioned from andesitic volcanic rock



(above). Most recently, Palaeolithic specialists have recovered up to 50 roughly fashioned quartzite tools, providing the promise of important finds to come.

Several classic Quaternary sites have been notified as Sites of Special Scientific Interest or registered as Regionally Important Geological Sites (RIGS). However, these pose real conservation challenges, given the rapid deterioration of the loose strata once exposed.

Recently, the Warwickshire Geological Conservation Group (WGCG) obtained funding from the Aggregates Levy Sustainability Fund (ALSF) to pilot a soft-rock conservation scheme in a working sand and gravel pit – Wood Farm Quarry near Bubbenhall, south of Coventry. In close liaison with John Green, quarry manager, we chose a section for the soft-sediment conservation project and cleaned, graded and stabilised it. A waterproof cover (a vehicle tarpaulin sheeting) was secured to a steel frame and anchored to the face at top and bottom. With the cover in place, the WGCG aims to monitor the section periodically as part of its next ALSF-funded project that will extend soft-rock conservation schemes to other local sites.

**Jon Radley,  
Clark Friend,  
Warwickshire Museum**

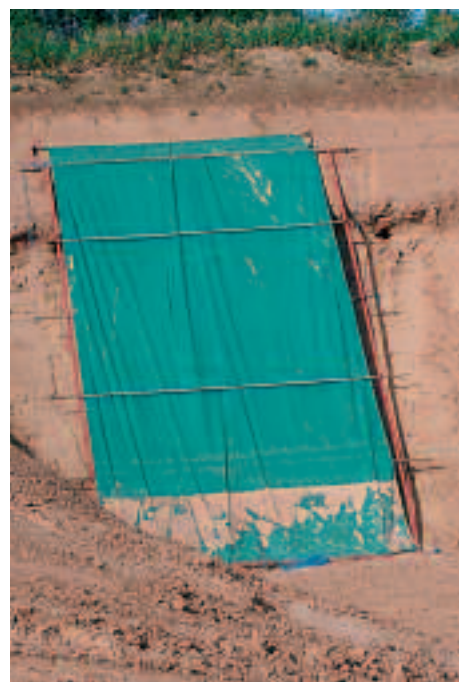
The project has been a successful profile-raising exercise. The WGCG's conservation sub-committee has produced a leaflet that has been distributed to a variety of outlets, including Warwickshire County Council's Ryton Pools Country Park, an area of former gravel workings adjacent to Wood Farm Quarry. Talks have been delivered to local residents, the WGCG and a regional quarry biodiversity conference on the area's rich ice-age heritage and the importance of the Bubbenhall quarries. Additionally, the funding has paid for a geological information panel, recently erected at Ryton Pools Country Park.

Work continues on refining the design of the protective screen and a series of sediment peels have been constructed for display at the Country Park Visitor Centre. ■



The section through the Baginton Sand and Gravel and Thrussington Till at Wood Farm Quarry presents a real conservation challenge. The Warwickshire Geological Conservation Group is experimenting with a protective screen made from vehicle tarpaulin.

Photos by Jon Radley



## Wood Farm Quarry specialities

Wood Farm Quarry, operated by Smith's Concrete, will become a RIGS because it has yielded numerous remains of straight-tusked elephant and several Palaeolithic hand axes. The axes are amongst the oldest recorded in Britain and they also pose an intriguing question because the rock types do not appear to be matched locally. In fact, they resemble rocks found in the Lake District. This prompts thoughts about the possible extent of former glaciations as represented by erratics, and the possibilities of human migration routes or even trade routes.

At Wood Farm, the Thrussington Till overlies the fluvial Baginton Sand and Gravel. Beneath the sands and gravels, the quarry floor consists of eroded Triassic Mercia Mudstone, locally cut into by pre-Baginton channels and their sedimentary infills. The infills comprise organic-rich silts and clays with some sandier layers. The Baginton sands and gravels were deposited in cold climatic conditions but, in contrast, the microfossils in the channel fills record a warm climate.

When freshly dug, the sections in the Baginton Sand and Gravel present an amazing range of sedimentary structures. In particular, the upper, finer-grained part displays beautifully preserved channels with trough cross-bedding, showing how the main river channel moved laterally and indicating deposition in a high-energy river environment. The overlying red-brown Thrussington Till, largely comprising re-worked Mercia Mudstone, is notable for its remarkably planar base and lack of far-travelled erratics.

**C**rouching in a muddy subterranean passage somewhere under Somerset, I could only watch in horror as the soles of my friend's wellies disappeared rapidly down a narrow tunnel ahead. My reluctance to follow must have annoyed the experienced caver behind me. "Come on, if Hazel can fit through there, so can you!"

I was introduced to caving by my friend Hazel Oliver, a fellow postgraduate student at the University of Portsmouth's Geology Department. Always keen to recruit new members to the University's caving club (UPCC), Hazel had dragged me along on a caving trip to the Mendip Hills. That is why I found myself hesitating at the start of a tight phreatic passage known as The Drainpipe. This is within Goatchurch Cavern, a small but interesting system considered suitable for novice cavers.

Ten years on, I am still caving, but I am frequently asked why. So, why do cavers relish the prospect of struggling through claustrophobic squeezes, dangling on ropes and ladders, clambering on boulder slopes, grovelling in mud and diving in freezing water? Some admit that they view it as a sport, a physical and technical challenge to be met and overcome. For others, caves are the ultimate in unexplored territory and offer the chance to discover something new to science. Perhaps understandably, some people are only tempted underground to marvel at the beauty of natural structures created by the movement of water and the deposition of minerals. For a scientist, caves are a study site for many disciplines, from geology and chemistry to biology and archaeology. However, there are obvious physical barriers which make cave studies a little more difficult than most types of scientific fieldwork. Perhaps this sense of exclusivity is part of their attraction.

Caving is often said to be a 'dangerous sport', and occasionally we hear of accidents and fatalities. However, I argue that people do far more damage to caves than caves do to people! A trip to many well-known and accessible caves reveals a sorry state of desecration due to previous visitors plundering calcite formations for their mantelpiece or museum collections.

But the effects of humans on caves can be more subtle than this. From the moment we enter the cave environment, changes take place, some of which are irreversible. The ecology of the cave could potentially be affected by the introduction of foreign bacteria and fungi on the clothes of cavers.

**Lorna Steel,**  
University of Portsmouth

**Crawling**

**Climbing**

## The joys of caving



Calcite formations which may have taken thousands of years to form are easily damaged by careless movement or discoloured by muddy hands. Sediments and crystal pools on the floor are destroyed by careless or thoughtless trampling. Light and noise disturb the dark, silent environment, and cave dwellers such as bats may be disturbed. Carbide lamps also leave sooty stains on low ceilings, and cavers tended to dispose of the spent powder underground. Nowadays, most of us have switched to more cave-friendly, battery powered LED or halogen lamps.

So what is being done to help conserve caves and their contents?

The National Caving Association has a Cave Conservation Code, Minimum Impact Caving Code and Code of Ethics to protect caves and people from each other. Many cave entrances are securely gated, and the keys are held by caving clubs. Although gated entrances are unnatural and unsightly, there are good reasons for their presence. Gating ensures that caves remain accessible to cavers but not to farm animals. Within many caves, no-go areas are marked with



# Digging Diving



brightly coloured tape. Again, this is an unattractive intrusion, but taping protects delicate formations and sediments from clumsy hands and feet. For some specially protected caves, an approved leader supervises the trip and ensures that the codes of conduct are upheld. We can all help by minimising our impact on the caves that we visit, and by setting a good example for others to follow.

Humans and caves have been interacting in various ways for as long as people came on the scene. Caves provided shelter, one of

our basic needs, but they also had a place in superstition and ritual, hence the diverse artefacts and art left behind. For many years, archaeologists and geologists have studied cave sites around the world, but excavation and recording techniques of the past were not always up to modern standards. Occasionally, new caves are discovered, and these undisturbed sites provide an opportunity to use modern scientific techniques to date cave deposits and place artefacts and bones in context. There are many reasons to conserve caves and their contents, but perhaps the most



Above: Lorna Steel in Sidcot Lobster Pot.

Photo by Lorna Steel

Left: flowstone on a sediment formation in County Fermanagh, Northern Ireland.

© Environment and Heritage Service, Northern Ireland

compelling is that caves are like 'time capsules', trapping evidence of past environments, events and beliefs.

Have I returned to Goatchurch Cavern? Yes, I've been back a few times, and introduced a few more fresh-faced novices to The Drainpipe. If you fancy a privileged peek into the underground world, join one of the many caving clubs. For a modest membership fee, you can use club accommodation and equipment, but you'll probably need to buy your own kneepads. Believe me, you'll need them.

As a return on that investment you will gain an up-close experience of some fantastic geology. Just make sure you look but don't touch so that it continues to evolve as it has done over unspoken amounts of time previously. ■

## More information

Find out more on these websites:

**[www.caveinfo.org.uk/nca](http://www.caveinfo.org.uk/nca)**

(National Caving Association)

**[www.bcra.org.uk](http://www.bcra.org.uk)** (British Cave Research Association)

**[capra.group.shef.ac.uk](http://capra.group.shef.ac.uk)** (Cave Archaeology and Palaeontology Research Archive)

**[www.pengellytrust.org](http://www.pengellytrust.org)** (William Pengelly Cave Studies Trust)

# Beyond Aust – South Gloucestershire's geological treasures



Left: The new interpretation board at Wick Quarry in South Gloucestershire.

Right: Detail of the new Wick Quarry interpretation board.

Photos by Avon RIGS Group



**A**sk a crowd of geologists to name a place of geological interest in South Gloucestershire and most will probably put Aust Cliff SSSI at the top of their list. There is no doubting the importance of this site in our understanding of Upper Triassic biostratigraphy. The famous *Ceratodus* bone bed has attracted university students and academics for over a century. It is visited by more people, geologists and non-geologists, than any other geological site in South Gloucestershire.

But South Gloucestershire has many more geological and geomorphological treasures. Its geological pedigree spans almost 500 million years. There are numerous disused and active quarries, as well as rocks exposed in road cuttings and river cliffs. To date there are over 70 RIGS and SSSI in South Gloucestershire with the potential for many more. These places provide the raw material to help people understand the geology of the area in which they live. This increased understanding encourages people to help protect and conserve the rocks and landscape.

So Avon RIGS Group was delighted when it had the opportunity to work with South Gloucestershire Council to review all its current RIGS sites and provide interpretation for a small number.

## Simon Carpenter, Chair, Avon RIGS Group

The Council secured funding through Defra's Aggregates Levy Sustainability Fund (ALSF) administered by English Nature. This work is spread over two years. The first year (mid-2005 to early 2006) saw the creation, production and installation of six geological interpretation boards. The second year (early 2006 to early 2007) is seeing a further three interpretation boards installed, all RIGS reviewed (site visits made and all associated documentation updated) and a website and booklet created to extend the learning experience to the public. The website will link many of the sites through geological time as well as carrying a level of background information that the largely pictorial interpretation boards cannot accommodate. The website will also provide an overview of the geology of South Gloucestershire from its oldest Silurian rocks to the present day.

The first phase of work was dedicated to creating interpretative boards for five key geological locations. To meet ALSF criteria, we chose a variety of sites that included active and non-active aggregate quarries. It was essential that the sites represented the different ages of rocks in the district. Site visits by the project team helped establish best positions for board installations. The team also established a

themed approach to the boards, by avoiding use of photographs or illustrations that duplicated views that people could readily see at the individual sites.

The project team also paid attention to the readability and accessibility of the interpretation boards, which are designed with the public in mind. As well as explaining the geology of each site, the boards also detail industrial links, especially at sites where quarrying has ceased. At working quarries, where access is not permitted, the boards are installed to afford views of the quarry without jeopardising safety. At these sites, large rock specimens support the board uprights so people can examine the fossils and rock types there.

Good promotion to the public is central to the project. Schools, colleges, community and wildlife groups will all be contacted and press releases sent to local papers to inspire more people to visit lesser known geological sites in South Gloucestershire – as well as visiting Aust Cliff.

The South Gloucestershire Council project will have succeeded largely as a result of collaboration between South Gloucestershire Council, the Avon RIGS Group, Bristol Regional Environmental Records Centre (BRERC) and landowners who have allowed interpretation boards to be installed on their land. ■



# More sparkle in northern jewel

## Coastal plain reinstated

**Morrich More is a magnificent 34km<sup>2</sup> low-lying coastal plain on the southern shore of the Dornoch Firth, on the north-east coast of Scotland. Composed of successive dune-capped ridges separated by lower, wetter areas of saltmarsh, this vast coastal sand dune system extends 7km seawards from the Holocene (post-ice age) cliffline which runs to the nearby historic village of Tain. During the 1990s part of the site was developed into a pipeline assembly facility for the offshore oil industry, including a launch site, railway, roadway, buildings and winching facilities extending across the site. Fifteen years on, the facility has been removed as part of the site's reinstatement. Now that the natural processes are operating again, time will tell how quickly and how successfully the site will recover.**

### **The geomorphological evolution of Morrich More**

A peat deposit under the oldest dune ridges (at the foot of the Holocene cliffline) has allowed the creation of Morrich More to be dated to around 6,500 years ago. The dune ridges were deposited at the peak of the Holocene transgression, when global sea levels rose rapidly after the melting of the ice caps. As the rebound of the Earth's crust caught up and started to outpace sea-level rises, beach ridges were deposited, forming a staircase of features, each at a successively lower altitude, extending towards the present shoreline. The older beach ridges are closely spaced, relating to what was once a very healthy input of sediment into this coastal environment following the Ice Age.

However, as coastal sediment became scarcer about four thousand years ago, fewer ridges were deposited, and further apart. Given the splendour, scale, and diversity of this coastal strandplain, it became a Geological Conservation Review Site (GCR Site) and was designated a Site of Special Scientific Interest (SSSI).

Although the dune-capped ridges lie above the reach of the tide, the hollows between ridges are normally inundated with each high tide, resulting in a diverse range of saltmarsh habitats. In fact the saltmarsh at Morrich More makes up 5% of Scotland's natural saltmarsh habitat. Reflecting the complex geomorphology, the wider site incorporates an excellent range of sand dune, dune grassland, heathland and saltmarsh habitats as well as transition

Morrich More, a magnificent strandplain extending into the Dornoch Firth.  
Photo by Scottish Natural Heritage

### **Alistair Rennie,** Scottish Natural Heritage

between them. These, together with rarer dune juniper scrub, contribute to the site's European status as a Special Area of Conservation.

### **Industrial development of Morrich More**

The pipeline assembly area was developed in 1990 following a planning consent granted in 1987. The Nature Conservancy Council (SNH's predecessor) had opposed the plan at public enquiry because of the likely damage to the SSSI. However, once consent was granted, the relevant planning conditions were adhered to and impact on the site was minimised.

Although only directly affecting a small proportion of the SSSI, the possible indirect impacts were likely over a much larger area. This was primarily due to the 20m-wide development corridor which cut across the natural drainage pattern on the site. The development comprised an access road and a line of regularly placed concrete plinths which supported the pipe. After the first pipe construction contract, this was partly amended by building a narrow-gauge rail track on which the pipe would rest.

**continued next page**





Oblique aerial photograph of the fabrication facility, with the winching points in the dunes extending back towards the interior of the site. The sand dunes were temporarily removed during the pipeline launching and reinstated afterwards.

Photo by Smit Land & Marine

Heavy plant equipment was used to remove the aggregate off site. Some of the aggregate has been put to good use in the construction of a new school nearby.

Photo by Scottish Natural Heritage



A whirlpool above one of the culverts draining the saltmarsh 45 minutes after high tide.

Photo by Scottish Natural Heritage

## from previous page

At the seaward end of the corridor there was an elaborate system of winches to help launch the long length of fabricated pipe through the sand dunes.

## Geomorphological and ecological changes

Ponding of water on the 'inland' side of the pipeline corridor led to changes in vegetation, with saltmarsh replaced by bare mud in extreme cases. The removal of the structures and the restoration of former levels and flow patterns should, in time, allow the former vegetation to return, though it may be decades before all the damaged areas achieve the quality of the sections that were unaffected by the pipeline work. The pipeline corridor itself presented an ecological barrier that bisected the site, and now that this has been removed the process of uniting the two sections biogeographically is under way.

## Reinstatement of the Morrich More

In 2005, SNH met Smit Land & Marine to discuss how it could conclude its obligations under the planning consent to return the site to its former use, and to allow processes and habitats to become re-established. The organisations worked closely on a strategy and the work was carried out in conjunction with other stakeholders, consultants and contractors.

In most coastal systems, the ecology is driven by geomorphological processes. For this reason we aimed to reinstate natural processes which would allow the habitats affected by the pipeline corridor to revert to a more natural state. The presence of the pipeline corridor and culverts over the last 15 years had a variety of effects. The constriction of the flood and ebb tide through the culverts caused scour channels and increased undermining within adjacent





tidal creeks. However, the nature of the flood and ebb tides was also adjusted as the water was held back by the pipeline corridor as it was forced through the culverts. This often led to the saltmarsh draining like a sink rather than over saltmarsh and through tidal creeks. This altered the duration of the flood and ebb tides, affecting the velocity and direction of water flow across the wider site. These changes in flooding frequency and duration affected the site's ecology.

## Removal of the pipeline corridor

The reinstatement started in November 2005 at the seaward end of the pipeline corridor, where the winching facilities, aggregate and concrete plinths were removed. This area is dominated by aeolian processes and sand that had accreted around the winch points over the last 15 years was re-profiled towards adjacent levels.

Further inland, on lower areas, tidal processes dominate. Reinstating these habitats required levelling the aggregate which supported the access road to the same height as adjacent habitats. This was considered the best option, given the absence of appropriate fill material and the risk of creating a new drainage system if all the aggregate was removed. Tidal creeks were re-created with sinuosity comparable to adjacent sections.

## What about the future? How successful will it be?

Although the reinstatement works are now complete and each successive tide continues the processes of returning the site towards its natural state, it will be many years before the evidence of the pipeline corridor disappears. This reinstatement work marks the newest stage of this site's 7,000-year history. It will make the site more able to adjust naturally to future changes, in particular those that climate and sea-level change will bring. ■

Reinstated tidal creeks along the pipeline corridor. The sand bars started to migrate immediately after reinstatement, adjusting to natural processes.

Photo by J. McKeown/RAF Tain



Above: Reconstruction of the tidal creeks aimed to reflect the channel sinuosity on adjacent 'natural' sections.

Photo by Scottish Natural Heritage

Right: Reinstated corridor and tidal creeks

Photo by J. McKeown/RAF Tain



Below: Reinstated intertidal muds, showing the crescentic scour marks, a legacy of the culverts that in time will hopefully disappear.

Photo by J. McKeown/RAF Tain



## GLOSSARY:

**Culvert** – A drainage pipe (in this case 0.5m diameter) used to allow water under the aggregate.

**Eustatic sea-level change** – the worldwide changing of sea level due to the growth or decay of glaciers.

**Holocene** – the last 10,000 years associated with the most recent interglacial period

**Holocene cliffline** – cliffline created at the end of the most recent Ice Age.

**Holocene transgression** – submergence of coastal areas at the end of the last ice age due to increased ocean volume fed by glacial melt.

**Strandplain** – a low-altitude coastal plain (in this case) formed by emerged coastal features.

## For more information contact:

A. Rennie – Alistair.Rennie@SNH.gov.uk

P. Wortham – Peter.Wortham@SNH.gov.uk





Above: James Carter (interpreter) and Max Nowell (mason) at Hutton Wall/Sculpture in Jedburgh. Right: Aubrey Manning opens the Trail at Auchencrow Farm Shop. Photos by British Geological Survey

**I**n May, the Borders Foundation for Rural Sustainability, launched its Scottish Borders James Hutton Trail and the permanent James Hutton Exhibition at the Reiver Farm Shop at Auchencrow near Reston in Berwickshire. With local television and national press interest, the exhibition and trail were opened by the inimitable Professor Aubrey Manning.

This substantial interpretative project has been long awaited by many who were keen to see the life and work of the ‘father of modern geology’ celebrated in his local area, and at the locations in the Borders made famous by his brilliant geological insights.

The project has produced a series of interpretative panels with an accompanying trail leaflet and a developing website ([www.james-hutton.org.uk](http://www.james-hutton.org.uk)). One of the panels is at Hutton’s farm at Slighhouses Farm south of Grantshouse, with another at its old marl pit, where Hutton extracted marl in an effort to make agricultural improvements on the farm. A board has also been placed at his hill farm at Nether Monynut in the Lammermuir Hills. Another panel is located above the classic unconformity section at Siccar Point, a site long overdue for interpretation.

For those of us who have long thought access was difficult, even to the top of the 60-metre high steep and grassy bank above the internationally famous Siccar Point, there is now a way-marked trail to the site from the lane leading to Drysdale’s Turnip Factory, the former access route to Siccar. A new signpost by a farm gate (NT 8012

# Hutton Trail opens

**Mike Browne,**  
British Geological Survey  
& Lothian and Borders  
RIGS Group  
**Jim Floyd,**  
British Geological Survey

7051) now leads the visitor past the ruins of St Helen’s Chapel and through kissing gates to the site. Improved access down the grassy bank to the famous view of the unconformity is still being considered in the light of its biodiversity and slope stability. The information board is by the last kissing gate that gives access to the top of Siccar Point (NT 8112 7085).

Following the launch of the Scottish Borders James Hutton Trail, John Dent of Scottish Borders Council launched the Max Nowell sculpture of the Hutton unconformity site at Jedburgh. Crafted using greywacke sandstone and blonde Carboniferous sandstone from Swinton Quarry (Berwickshire), the sculpture is situated in Lothian Park in front of

Jedburgh Abbey. The sculpture and an interpretation panel nearby bring the unconformity to the tourist, as the real unconformity site, used by Hutton to help develop his ‘Theory of the Earth’, is rather overgrown. Also known as Inchbonny RIGS, the actual unconformity can be viewed from the opposite bank of the Jed Water at Allar’s Mill.

For Hutton fans the world over, the good news does not stop there. The Lothian and Borders RIGS Group (LaBRIGS) has just published a new leaflet *James Hutton: A man ahead of his time*. It was prepared by volunteers, supported financially by Scottish Natural Heritage and Borders Foundation for Rural Sustainability (BFRS) with the British Geological Survey (BGS) also providing ‘in-kind’ staff time. The leaflet is a treasure trove of places, people and art associated with Hutton including an image of a painting of Hutton meeting with Robert Burns and Sir Walter Scott and others of the Enlightenment in Sciennes House, Edinburgh in 1787. The leaflet had its first public airing at the Exhibition launch.

The funding for this substantial project was from Making Tracks (Leader Plus and the Scottish Executive) and Scottish Natural Heritage. BGS and LaBRIGS provided professional and volunteer support as the main providers of geological information. Local Borders businesses (e.g. Simprimstudio) provided the design team. Denise Walton, Chair of BFRS, who introduced Professor Manning, set up this project, obtained sufficient match funding and has managed the project to this point. ■

Mike Browne and Jim Floyd publish with permission of the Executive Director, British Geological Survey (NERC).



# TRAINING helps travel trade BOOST GEOTOURISM



**F**or years, the Isle of Arran has hosted generations of geology students, numerous geological society excursions and geotourists keen to learn about the hugely varied geology the island has to offer. Often described as a microcosm of Scottish geology, the island is cut by the Highland Boundary Fault and offers an incomparable teaching ground with a huge variety of Palaeozoic and Mesozoic sedimentary rocks, poly-deformed Precambrian Dalradian rocks and the heart of a Palaeogene volcano.

It was the island's hoteliers, B & B owners and coach-tour operators who had asked SNH to run the course in March, following the success of the first two courses in 2004 and 2005. The course followed a now-familiar two-day format. The first day included discussions on the importance of natural heritage tourism, ways in which the island can be marketed as a wildlife tourism destination and how that concept has been taken on successfully elsewhere in Scotland. There was then a walk to see some shoreline wildlife at first hand.

On the second day the trainees boarded a bus to visit more of the island's best wildlife-watching and geological sites. At lunch, there was a short lecture on the geological development of Arran which included a rundown of the top geotourist locations. Day two continued with the trainees being briefed on topics such as: responsible rock and fossil collecting and wildlife watching; how to meet visitors' needs and expectations; and access and safety legislation. The last stop of the day was a walk through 90 million years of geographical and environmental history from the top of the Devonian through the entire Carboniferous to the base of the

**When Scottish Natural Heritage (SNH) ran a natural heritage training course on the Isle of Arran, it was no ordinary course – the participants were hoteliers, B & B owners and coach-tour operators on the island! Stimulating interest in Arran's spectacular scenery, geology and bird life among those in its tourist industry will enable them to pass that knowledge and enthusiasm to visitors.**

**Colin MacFadyen,**  
Scottish Natural Heritage

Permian, afforded by gently dipping strata at Corrie on Arran's east coast.

Although aware of the importance of Arran's geology and bird life in attracting student parties and tourists, the course participants will be more confident and better informed in talking about these aspects of the local natural heritage to visitors. Many visitors to the island will not know of the varied and spectacular natural heritage features that can be experienced beyond the picturesque northern mountains, picture-postcard villages, and peaceful ambience. It is expected that increased awareness of the island's natural heritage, in part as a result of the training courses, may help extend the tourist season on Arran into the early spring and late autumn, as well as attracting people to some of the less visited parts of the island.

The course was run in conjunction with Destination Arran, the National Trust for Scotland Ranger Service and the RSPB. SNH is assisting VisitScotland (the public-sector agency providing leadership and direction for the development of Scottish tourism), to deliver a range of similar training courses across the country in 2006. ■

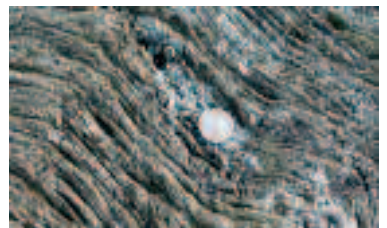


Above: Dalradian meta-sedimentary rock and several species of seabird provide the natural heritage interest at this location near Imachar on Arran's west coast.

Photo by Colin MacFadyen

Left: Cobbles and boulders on a beach on Arran's west coast, provide an excellent introduction to the geodiversity of the island.

Photo by Graeme Walker, SNH



Above: Dalradian meta-sediment illustrating small-scale folding – a location that proved popular with the course trainees.

Photo by Colin MacFadyen

Arran has a tremendous geological heritage that spans over 600 million years of Earth history with all but the Silurian geological period represented. Long regarded as a microcosm of Scottish geology, Arran has made a major contribution to the understanding of the geological evolution of Scotland. Visited by James Hutton in 1787, the island offered evidence to support his celebrated *Theory of the Earth*. Since then it has provided the training ground for thousands of geology students and geotourists.

## **Arran's geological highlights include:**

- The Highland Boundary Fault that separates the Highlands from Scotland's Central Belt
- A slice of the floor of the Iapetus Ocean, complete with pillow lavas
- The remains of a Palaeogene volcano
- Sill and dyke intrusions some of which are composed of pitchstone
- Corries, erratics and glacial outwash fans associated with the last glaciation
- Spectacular examples of raised beaches and associated sea stacks and caves
- *Cheirotherium* (reptile) tracks and one of the few *Arthropleura* (giant centipede) trackways known in the UK
- Hutton's Unconformity – an unconformity used by James Hutton to support his *Theory of the Earth*.



A silhouette of  
Etheldred Bennet

# UNSUNG HEROINES



Top: Catherine Raisin (in the dark hat) and other women at the International Geological Congress in Toronto in 1913. Above: Maria Matilda Ogilvie Gordon, one of Scotland's most prolific research geologists of the late 19<sup>th</sup> century. Below: Margaret Crosfield (left) and Ethel Skeat (right) on a Geologists' Association field trip in Oswestry, Shropshire, in 1908.



**A** recent conference highlighted the work of women whose contributions to the evolution of geology as a science are often overlooked or understated.

'The Role of women in the history of geology' conference in London was the first of its kind and was attended by over 80 people.

It divided the important contribution that women made into four areas:

- Women as wives or family members
- Women as academics
- Women in geological institutions as museum workers or collectors
- Women as geologists overseas.

Women as helpers within their families and the so-called wife assistants, included spouses such as Lady Prestwich, Mary Mantell, sisters such as Anne Phillips or George Cuvier's two daughters, his step-daughter Sophie Duvaucel and his biological daughter, Clémentine.

The second grouping, women as academic geologists, only emerged once women had entered higher education in the second half of the 18<sup>th</sup> century. The role women played in the development of geological education was covered using Catherine Raisin and Gertrude Elles in Britain specifically looking at Bedford College, London and Newnham College, Cambridge and Florence Bascom in the US.

Before then they used two methods of communication to educate themselves. The first was to attend lectures and field trips. (Here the Geologists' Association must be applauded for including women within its membership from the very beginning [1856] – unlike the Geological Society of London, which withheld membership until forced to do so by legislation in 1919!) The second form of communication was the letter. Women such as Maria Ogilvie Gordon and Etheldred Bennet corresponded with gentlemen geologists such as Archibald Geikie and William Buckland to debate and question, as it would have been unladylike under the strict protocol of Victorian society to have done anything else. Ladies corresponded with each other too, and the first female geological (or perhaps it is more correct to call it the palaeontological "old

## Cynthia Burek, University of Chester

girls' network") emerged in Cambridge in the 1890s. Gertrude Elles, Margaret Crosfield, Ethel Wood and Ethel Skeat regularly helped each other with identification and interpretation.

The conference also highlighted a third grouping, the large number of women who were involved either as collectors, illustrators, classifiers, cataloguers, researchers or field assistants. In the important area of women working within museums, the so-called 'Quiet workforce' of Patrick Wyse Jackson, Mary Spencer Jones from Trinity College Dublin, showed the often unpaid work undertaken by women across the country during the early 1900s and Chris Cleal and Helen Fraser covered the importance of women in palaeobotany during the late Victorian years and the early 1900s. The role of early 19<sup>th</sup> century palaeontologists was covered in a comparison of conditions within Germany. In another paper, Dorothea Bate working in the Natural History Museum in London was highlighted. The role of women in geological societies was discussed by Susan Brown, former president of the Geologists' Association, who gave the second part of her talk in a wide-brimmed and flowery hat. The importance of hats was subsequently noticed in many of the photos shown. The Association was shown in a very good light, especially the part it played in organising fieldtrips and lectures. Eric Robinson discussed the particular contribution of Muriel Arber to the GA.

The position of women overseas both as geologists and their place within society was covered in three papers. Australia was highlighted by Susan Turner from Brisbane, herself a great advocate of Geoparks. The lost women of Ireland too were highlighted, especially Susanna Drury, the first geologically accurate Giant's Causeway artist, and several Marys, namely Mary Ball, Mary Rosse, and Mary Ward. The role women played in the Geological Survey of Ireland highlights the pioneering work of Dylis Jones and, later, Loreto Farrell and Jean Archer. The position of women in our discipline was taken up to present day with a poster on 'Is there gender bias in the

geological science?' The role that society played in inhibiting female geological development in Germany also showed the unusual position women in Britain were in during the evolution of the science. Another paper dealt with the role of women in Quaternary geology, itself an often overlooked (until recently) part of the geological column.

All this raises a couple of issues of general interest to geoconservation.

- In this day of electronic communication, as the letter seems to be a thing of the past, where will tomorrow's historians of geology find the vital comment or sketch which brings the people behind the science alive?
- Another paper highlighted the importance of finding and preserving the sites and specimens of these women (see also pages 12-13). Often the samples are there in museums but frequently the name of the donor, not the finder, is documented. Sometimes the specimens have no names at all or only initials, which means the gender is missing.

Overall the conference was considered a remarkable achievement in a discipline still largely dominated by men (as demonstrated in one of the posters). The 16 papers and two posters from the conference will be published as a book by the Geological Society of London in 2007. This is geoconservation of an unusual kind – role models. ■



## A sparkling tribute to agates

*Agates – Treasures of the Earth*. Roger Pabian with Brian Jackson, Peter Tandy and John Cromartie. Natural History Publishing. £16.99. Hardback. Available from: [www.nhm.ac.uk/buy-online](http://www.nhm.ac.uk/buy-online) or tel: 01752 202301

Although agates are probably the most common gemstones on Earth, they are some of the most beautiful, and this new A5-size, full-colour hardback from the Natural History Museum does them justice in every respect. Its 184 pages, virtually all illustrated, take readers through every facet of the world of agates, from their names (mineralogical, geological, local, trade and trivial), modes of formation and properties to their sources all over the world. Subsequent chapters deal with lapidary (techniques such as sawing, grinding and polishing), uses of agates through the ages and collecting. The book is appropriately referenced and has a useful glossary.

The book successfully presents the current state of knowledge of these gems in a way that will appeal to



novices (like me) and to advanced collectors and experts alike. It also reminds of us the cultural significance of these beautiful stones.

I particularly like the tour of the geographical distribution of agates around the world. I was aware of agate-bearing terrains in the USA and South America, particularly Brazil, but oblivious to the fact that Scotland has more known locations and varieties of agate than anywhere else in Europe. I was also interested to learn of agates from Ordovician rocks in North Wales. These were first studied in 1899 by Catherine Raisin, a geology student who was one of the first to relate agates to their environments of deposition.

The chapter on the use of agates through the ages is equally fascinating, aided by the beautiful photographs of agate artefacts from all over the world. The standard of illustration throughout is exceptional, superbly complementing the authoritative and informative text.

- STEWART CAMPBELL  
Managing Editor

Photos  
© Natural History  
Museum, London.



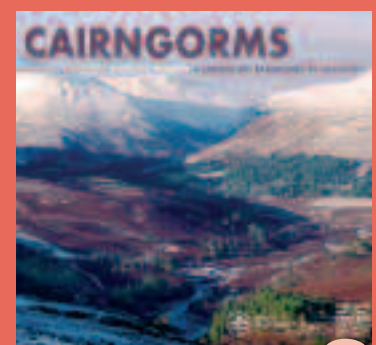
Scottish Natural Heritage has published the latest titles in its *Landscape Fashioned by Geology* series. (See also pages 16-17)

*Glasgow and Ayrshire*. ISBN 1 85397 451 x  
Price £4.95, Scottish Natural Heritage  
[pubs@snh.gov.uk](mailto:pubs@snh.gov.uk)

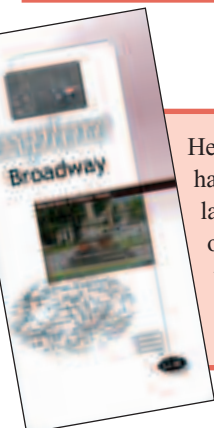
This booklet expertly peers beneath the unassuming rolling lowlands of Scotland's industrial heart to reveal an amazing rocky underworld forged by 450 million years of tectonic forces, wind, fire, water and ice. Like any good detective story, it finds that the clues to this region's remarkable journey through time lie scattered all around us, sometimes in the most surprisingly familiar of places.  
- Dr Iain Stewart, geologist and broadcaster

*Cairngorms*. ISBN 1 85397 455 2 Price  
£4.95, Scottish Natural Heritage  
[pubs@snh.gov.uk](mailto:pubs@snh.gov.uk)

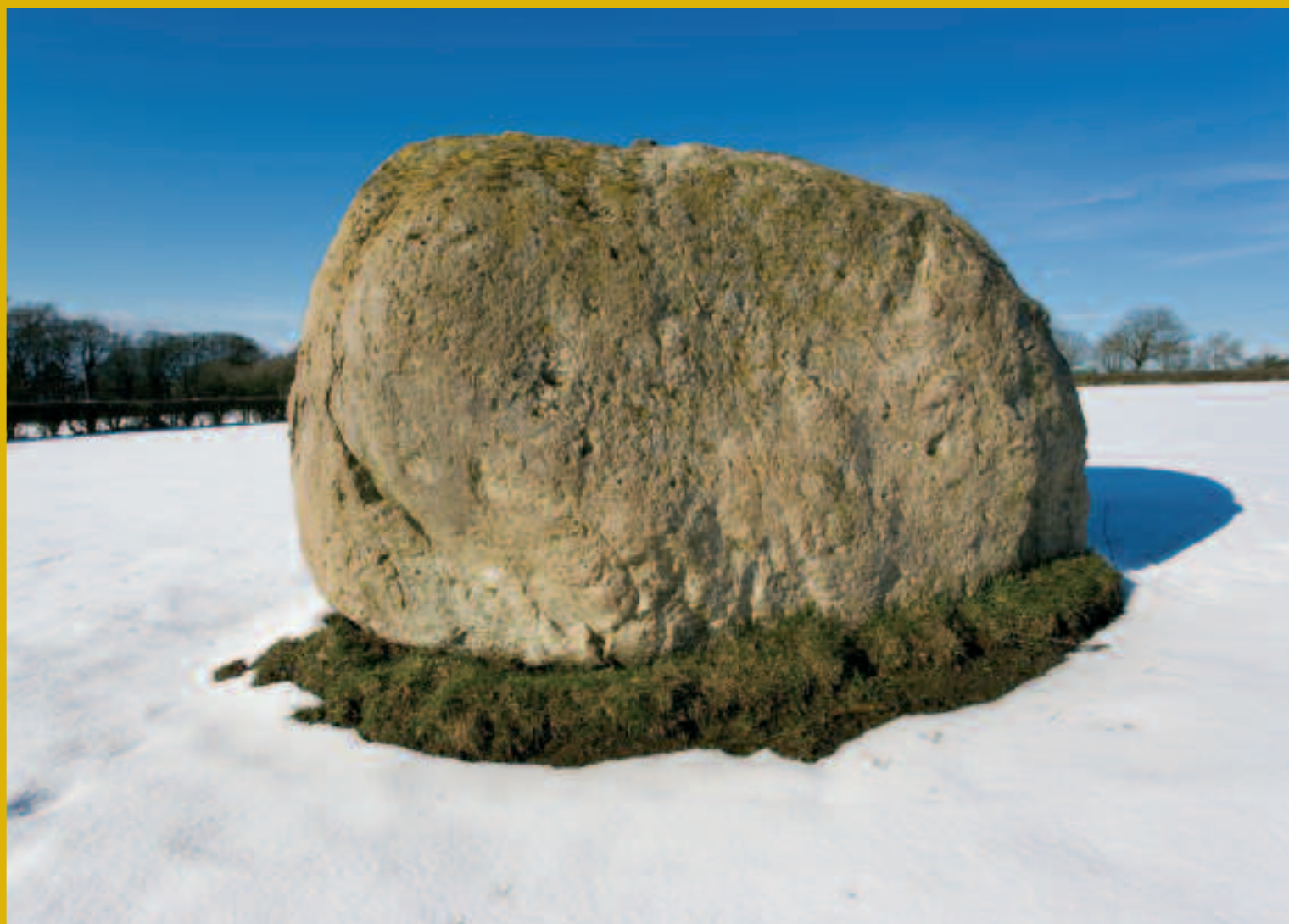
The Cairngorms landscape is one of the most fascinating, spectacular and magical environments in the whole of Britain – a place where you can whisk yourself back through time to the Ice Age and even earlier. From the wild, sub-Arctic conditions on the mountains to the precious fragments of native pinewoods in the glens, this diverse area is a “must” for anyone passionate about the outdoors – and this beautifully illustrated booklet will be an essential travelling companion.  
- Vanessa Collingridge, author and broadcaster



Herefordshire and Worcestershire Earth Heritage Trust has published the two latest in its *explore* series of laminated guides, taking walkers on routes at opposite ends of Worcestershire, Lickey Hills in the north and Broadway in the south. Both are priced at £2. Lickey Hills ISBN 0-9548360-4-9. Broadway ISBN 0-9548360-3-0



*Earth Heritage magazine is published twice a year to promote interest in geological and landscape conservation.*



Plas Captain, Flintshire, is a huge boulder (probably Ordovician volcanic tuff) transported and dumped far from its source by Wales' last great ice-sheet, some 18,000 years ago.

This imposing lone stone is registered as a

Regionally Important Geodiversity Site, one of 127 recorded to date by the NEWRIGS Group in a joint exercise between RIGS groups in North and Central Wales to create a network of RIGS in the region. See pages 12-13 for more on these sites.

Photo by Stewart Campbell

