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Earth

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The geological and landscape conservation magazine

Issue
28
Summer 2007

Economy

How one geopark
is helping to
build local trade

Education

Initiatives in
England and
Wales can boost
geology in schools



Education, Education, Education

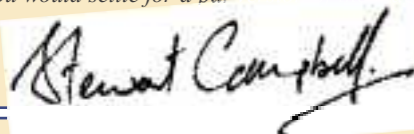
It's an oft-repeated phrase, but it is much needed to boost geodiversity. Unless people are on board with geological conservation it just won't happen! This issue of *Earth Heritage* looks at some of the methods that geoconservationists are using as they strive to popularise our awesome subject.

Two features underline the importance of providing geodiversity sites and information relevant and accessible to schools. The UKRIGS Education Project has produced activities and materials for 12 former aggregate sites across England. New Welsh research pinpoints exactly what school teachers and pupils want from geodiversity sites. Then there's Scottish Natural Heritage's stunning new poster series targeted at educational establishments.

Geoparks represent a fantastic opportunity to build our awareness of and liking for geodiversity among those of us no longer at school. This issue looks at how they are taking up this challenge, and, indeed, how marketing geodiversity to a niche sector, cyclists, is boosting at least one local economy.

One of our most important features describes the development of a National Geodiversity Action Plan to complement the increasing numbers of LGAPS being produced. What should such a plan do – provide guidance, set standards? Notwithstanding the many questions, the possibility of a National GAP, taken seriously by politicians, planners and other decision makers, raises the allure of geodiversity and geoconservation gaining the sort of status that has long been taken for granted in the biodiversity world.

Finally, we're always aware of the need to conserve resources. Please take a moment to look at the *Earth Heritage* subscription form on the facing page and let us know if you would settle for a pdf version of the magazine.


Managing Editor

Earth Heritage is a twice-yearly magazine produced by the Joint Nature Conservation Committee, Natural England, 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

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Scottish Environment Minister Michael Russell with Abbey Hill Primary School pupils Emilie Walton and Keiran Walton during the launch of Scottish Natural Heritage's Scottish Fossil Code consultation. See story on facing page.

Photo by Dougie Barnett/SNH

Scottish Fossil Code: your views wanted

Scottish Natural Heritage (SNH) is running a public consultation on the draft Scottish Fossil Code and wants to hear from those interested in Scotland's fossil heritage, which constitutes an incredibly important scientific, educational and recreational resource.

The consultation which runs until 7 September, was launched on 5 June by Scotland's new Environment Minister, Michael Russell, at a fossil workshop for schoolchildren at Our Dynamic Earth, in Edinburgh.

Electronic copies of the draft code may be downloaded from www.snh.org.uk/fossilcode. Paper copies may be obtained from Scottish Natural Heritage, Great Glen House, Leachkin Road, Inverness IV3 8NW. Comments can be sent either to the above address, or submitted via the SNH website. If you have any queries in relation to the consultation please contact fossil.consultation@snh.gov.uk.

Following the consultation, the draft Code will be revised and SNH will report the comments received. It is expected that the



final version of the Code will be launched early in 2008.

In producing the draft Code, SNH has called on the assistance of palaeontological researchers, landowners, fossil collectors and others with an interest in Scotland's fossil heritage. The Code provides best practice advice in the collection, identification, conservation and storage of fossil specimens and will be the first national code of its kind in the world.

Under the Nature Conservation (Scotland) Act 2004, SNH was given the duty to prepare and issue the Scottish Fossil Code. – *Colin MacFadyen, Scottish Natural Heritage*

LETTER TO THE EDITOR

A worthwhile publication

Sir,

Courtesy of Scottish Natural Heritage, we receive about a dozen copies per issue of *Earth Heritage* here at the Hugh Miller Museum in Cromarty, which we make available free to interested visitors. They always run out well before the next issue, and I thought it was about time you heard from a 'customer' just what a useful resource this magazine is.

The writing in general terms seems to be pitched at just the right level, with enough detailed content for the trained scientist, and clear exposition for the enthusiastic Field Club member. The high production values are also laudable. So please keep going.

– *Martin Gostwick*
Custodian, Hugh Miller Museum, Cromarty (NTS)

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The geological and landscape conservation magazine

At present *Earth Heritage* magazine is printed and posted to individuals and sent by carrier to RIGS group co-ordinators.

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If you want to continue receiving *Earth Heritage* as a printed magazine, then you need do nothing. Please ignore this form.

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A triple celebration in the Marches

Geological organisations on the English-Welsh border are collaborating to stage the Marches Festival of Geology in celebration of three significant anniversaries.

These are the 200th anniversary of the founding of the Geological Society of London; the 175th anniversary of Murchison's epic visit to the Marches that led to publication of *The Silurian System*; and the 150th anniversary of the founding of the Geologists' Association.

The core event will be a one-day symposium at the Ludlow Assembly Rooms, south Shropshire, on 13 September, entitled *The ground beneath our feet: 200 years of geology in the Marches*.

All the speakers have a special interest in the geology of the Marches and their contributions are intended to appeal to the public as well as the committed geologist.

Other events will be run throughout the summer months. These include exhibitions and a number of field trips for fossil hunting, studying bedrock geology and raising awareness of the landscape. Shropshire's Wenlock Edge and Ironbridge Gorge, the Wigmore area of Herefordshire and the Malvern Hills straddling Herefordshire and Worcestershire are among locations for events.

A series of geological trails is being prepared, in part to support the workshops and field trips, and in part as self-discovery guides. These include:

- In front of the last glacier in South Shropshire
- The landslides of Ironbridge Gorge
- A revision to the Teme Bank Trail
- The building stones of Ludlow.

Among the organisations involved in the festival are Shropshire and Herefordshire councils, the Hereford and Worcester Earth Heritage Trust, Shropshire Geological Society, West Midlands region of the Geological Society, Ludlow Research Group and the Woolhope Naturalists' Club geology section.

Full details at www.shropshiregeology.org.uk/festival

Why it's worth making tracks to Elgin



Large trackway from Clashach Quarry, Hopeman, now in the display area adjacent to the quarry. A 2 pence coin is used for scale.

Elgin Museum has been home since 1843 to a superb collection of local fossils from the Devonian to the Triassic. Most were collected in Victorian times.

Although they have always attracted visitors, it was a surprise when two researchers from Chicago asked to borrow specimens to subject them to modern methods of analysis. On the back of the consequent discoveries, The Moray Society is organising *Sea to Sand*, a geology conference on 22 and 23 September 2007.

The theme will be new insights into life in what is now North East Scotland, particularly the period of emergence of complex life from the sea. The event promises to be of interest to the

specialist geologist and those with a more general interest in natural history.

A visit to the museum is always a treat, and there will be the bonus of access to specimens from store, and model fish and reptiles on display to bring the rocks to 'life.' To stretch legs and minds after a day of lectures from an impressive line-up of speakers, there will be at least one field trip to the present seaside. Cost £25 (£20 Moray Society members; £15 students and ES40). Further information and a booking form may be obtained from The Moray Society, The Elgin Museum, 1 High Street, Elgin, IV30 1EQ, www.elginmuseum.org.uk, curator@elginmuseum.org.uk, tel: 01343 543675.

- Janet Trythall

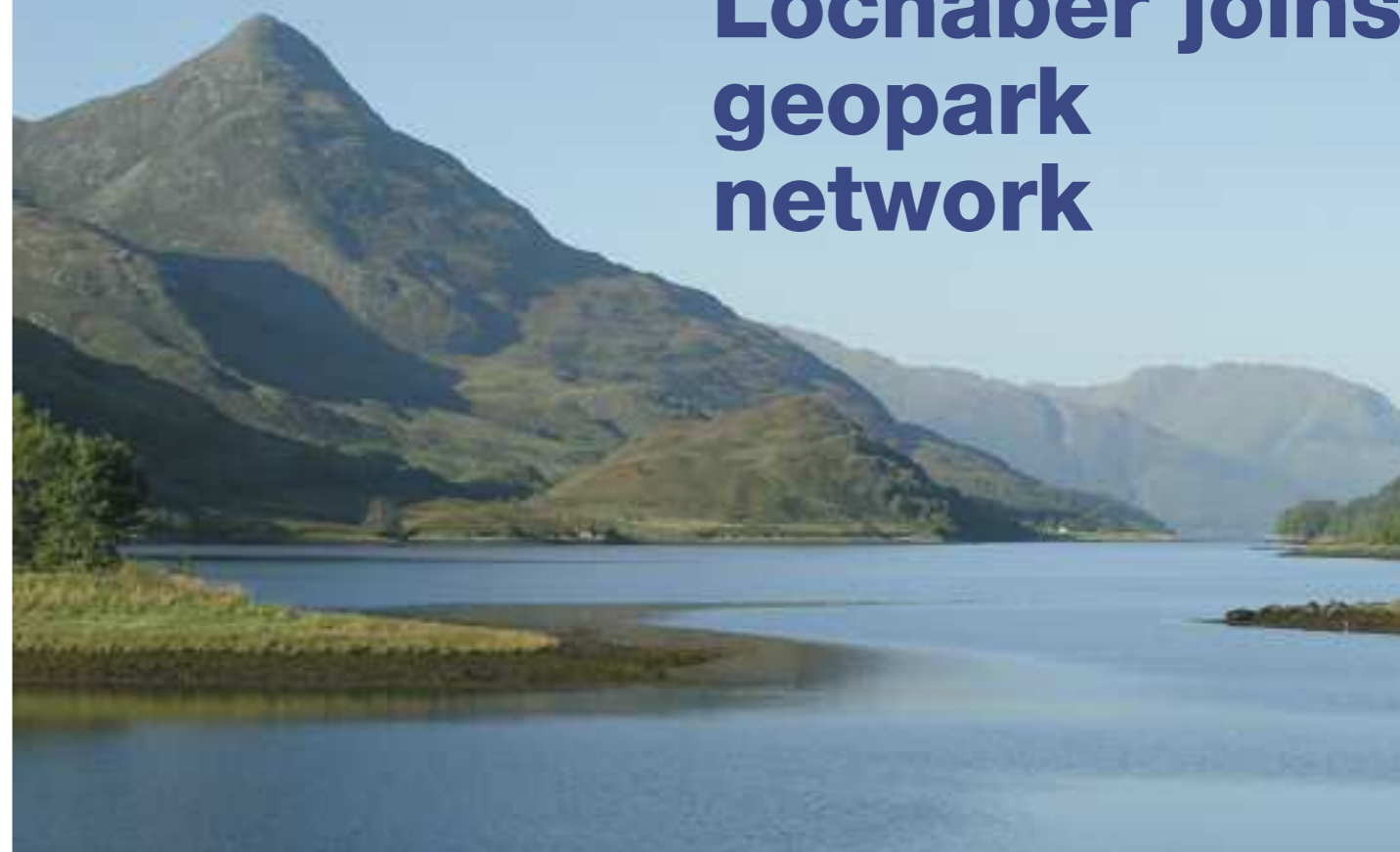


Permian tetrapod trackway with tail drag from Clashach Quarry, Hopeman. Scalebar = 10 cm. Photos by Carol Hopkins.

Timespan's funders

Timespan (*Earth Heritage issue 27*) wishes to acknowledge the financial support of Forward Scotland, Scottish Natural Heritage, The Jordan Foundation and The Curry Fund that made the Timespan Geology Garden in Helmsdale possible, and apologises for inadvertently omitting this important information from the original article.

Lochaber joins geopark network



Looking west down Loch Leven with the Pap of Glencoe on the left.

Photos by Noel Williams

The European Geoparks Network (EGN) has awarded European Geopark status to the Lochaber area in the western Highlands of Scotland. Lochaber is the second area in Scotland to be awarded geopark status, the first being the North West Highlands which achieved this accolade in 2004. There are now 31 European Geoparks.

Stretching from Rannoch Moor in the south to Knoydart in the north and from the Small Isles in the west to Glen Spean in the east, Lochaber encompasses a great wealth of Earth heritage. The area is unique among European Geoparks in having a rock record that includes both plate collision and plate rifting. The Caledonian mountains formed through collision and the associated Caledonian igneous rocks of Glen Coe and Ben Nevis, famous for volcanic collapse structures, have a research history dating back over a century. The term 'cauldron subsidence' was coined in Lochaber, to describe the events that took place over 400 million years ago.

Further volcanic activity occurred much later, during the opening up of the North Atlantic. Spectacular evidence of this more recent igneous history is found on Rum and the other Small Isles. The most recent moulding of the Lochaber area was brought

Noel Williams, Lochaber Geopark Association



The unveiling of a new display panel at the Kilmallie Stone Circle in Corpach marked the launch of Lochaber European Geopark. In attendance were Charles Kennedy MP (centre), David Sedgwick (right) and Lochaber Geopark Directors. David Sedgwick is a descendent of the famous geologist Adam Sedgwick.

about by glaciation and many wonderful examples of glacial landforms are seen in the area.

The decision to seek European Geopark status for Lochaber followed a public meeting in Fort William in January 2004. The first application to join the network, made in 2005, was turned down. The EGN was impressed by the outstanding Earth heritage of the area, but required a more formal management structure. So in February 2006, a community-based company, Lochaber Geopark Association,

was set up with a number of local interests represented. With funding from Scottish Natural Heritage, Highland Council, Leader+, Lochaber Enterprise and Heritage Lottery Fund, a full-time project officer, Keith Hoole, was appointed in October 2006. As Chairman of the Lochaber Geopark Association, I am delighted to learn of the award. We now have to work hard in promoting Lochaber Geopark and becoming a worthy member of the European Geoparks Network. ■

● See Ben Nevis and Glencoe, page 26.



The North Pennine escarpment and Cross Fell, the highest hill in the North Pennines. In the foreground are dry stone walls containing local red Triassic sandstone from the Eden Valley. © Natural England/Charlie Hedley

Making rocks work for the area economy

Elizabeth Pickett, North Pennines AONB Partnership

Rockworks, a four-year, £600,000 project in the North Pennines Area of Outstanding Natural Beauty, is bearing results in Earth science interpretation, education and conservation, which are aimed at supporting the local economy and communities.

The AONB was awarded UNESCO European Geopark status in 2003 in recognition of the world-class geological heritage and local efforts to utilise it to encourage sustainable development, in particular geological tourism.

The North Pennines AONB Partnership started the Rockworks project in 2005 in partnership with the British Geological Survey and with funding largely provided by the Heritage Lottery Fund. The project came about following completion of a geodiversity audit and action plan in 2004.

The character of the North Pennines has its foundation in the underlying rocks. The AONB's rich geodiversity is being used to tell the story of the North Pennines and the

way the geology has influenced natural habitats and human activity over thousands of years. Among the outcomes of Rockworks are these projects:

Teesdale Time Trail

Exploring the rocks and landscape of Upper Teesdale and beyond, it includes four trail leaflets, a 'geological time' sculpture made by a local sculptor and schoolchildren, and geological displays in the Bowlees Visitor Centre. A 'human sundial' encourages people to think about the concept of time. Several interpretation

panels help people find out how the landscape has been shaped by tropical seas, molten rock and ice sheets, and also highlights local services and businesses.

Wheels to the Wild

Launched in May 2007, Wheels to the Wild, a geological cycle trail uses a waterproof guide to provide directions for a three-day main route and three day-rides, and an interpretation of the geology and landscape along the way. It includes an accommodation guide and a leaflet highlighting other cycling



ABOVE: Children from the Forest of Teesdale Primary School helped make this geological time sculpture as part of the Teesdale Time Trail. Photo by K. Gibson

RIGHT: Ashgill Force in the South Tyne Valley displays a typical Carboniferous cyclothem sequence and is easily accessible from the Wheels to the Wild cycle route. Photo by K. Gibson

FOOT OF PAGE: Discovering the area's rich lead mining heritage through guided 'Rockwalks' and events in the Northern Rocks Festival. © NPAP/Elizabeth Pickett

What gives a geopark its character

The North Pennines Area of Outstanding Natural Beauty (AONB) and UNESCO European Geopark stretches across large parts of County Durham, Northumberland and Cumbria. Its wild moors, remote fells, green dales and scattered settlements are directly related to the area's unique geodiversity.

The character of the North Pennines has its foundation in the underlying rocks. Terraced hillsides are made of Carboniferous limestone, shale and sandstone, and the Whin Sill forms spectacular cliffs and waterfalls. Centuries of mining for lead ore and other minerals have left a legacy of mine shafts, ruins and spoil heaps. On the dramatic North Pennine escarpment, Ordovician and Silurian slates and volcanic rocks form steep conical hills. Villages of red Permo-Triassic sandstone from the Eden Valley nestle along the escarpment foot. During the last glaciation, a vast ice sheet smoothed the landscape, creating glacial landforms and deposits. After the ice melted, a thick blanket of peat developed on the uplands.

opportunities in the North Pennines. Cycling infrastructure has been improved around the route, with new facilities in B&Bs and attractions. A marketing campaign in the cycling press has led to over 800 responses so far.

Northern Rocks

Northern Rocks, the North Pennines Festival of Geology and Landscape, runs for a fortnight every May and June, in celebration of European Geoparks Week. This year's festival – the fourth – had 45 events run by the

North Pennines AONB Partnership and our many partners. Events included walks, talks, exhibitions, mine tours, geological holidays and children's activities. At the time of writing, results were not available for the 2007 festival, but it is calculated that participants in Northern Rocks 2006 spent £29,000 – £38,000 on food and accommodation in the North Pennines.

This is just a flavour of Rockworks. Also produced are education resources with teachers' packs and 'rock boxes', and evening classes, guided 'Rockwalks' throughout the year, geodiversity training events, children's geology clubs and much more. All these activities are helping local people and visitors to discover and explore the North Pennines – and by doing this they are contributing to the local economy.

Why not discover the North Pennines' stunning landscapes and fascinating geological heritage for yourself?! ■

More information:
www.northpennines.org.uk



Anglesey decision is nearer



Visitors on a Geopark Week trip enthuse about the pillow lavas on Llanddwyn Island, near the new Anglesey Geopark HQ. Photo by Stewart Campbell

A revised application for geopark status by the Anglesey Geopark Project, GeoMôn, should be considered by the European Geopark Network (EGN) panel before the North West Highlands Geopark Conference in Ullapool in September.

Anglesey's first Geopark Week (26 May-3 June) was a great success. Experts and wardens led trips to some of the island's most spectacular and important geosites – Rhoscolyn, Llanddwyn Island, Lligwy Bay, Red Wharf Bay, Parys Mountain and South Stack among others. The weather was kind and the programme well received.

Activities designed for children, gold panning and fossil making, were also well attended, and stem from bi-monthly Young Geologist Club meetings run by Kate Riddington of Grosvenor Museum, Chester.

Following recommendations from the joint CCW/RIGS education project (see pages 14-15), several education projects have been initiated for the Geopark. These include a teacher-training project for primary schools, and students' and teachers' packs (Key Stages 3 & 4 and A-level) for selected fieldwork sites. The Geopark now has its own HQ and offices, at the Prichard Jones Centre in Newborough, and its own website www.geomon.org.uk. With momentum building, it has also produced posters and leaflets. These have been made

available on all Stena Line and Irish Sea Ferries to and from the island to attract visitors. Isle of Anglesey County Council is now heavily involved in the Geopark, and joint interpretation displays have been

produced for South Stack Lighthouse and Breakwater Country Park, Holyhead. – **Margaret Wood, GeoMôn** – **Stewart Campbell, Countryside Council for Wales**

Fun in the Beacons

Fforest Fawr Geopark hosted a series of activities during European Geoparks Week (26 May – 3 June). This annual event is designed to raise public awareness of the European Geoparks Network and to introduce visitors to the rich natural and cultural heritage of its members.

This year the Geoparks Week offered seven walks and included themes ranging from geology and landscape, and the flora and conservation of a peat bog, to the pond life of Mynydd Illtud. The walks were organised and led by volunteers from the Brecon Beacons National Park and by members of partnership organisations, including the Brecon Beacons Park Society and Cardiff and Swansea universities. There were also three guided bus tours. The week's activities also catered for Welsh speakers. Dr John Davies, Countryside Council for Wales, led an excursion with information delivered in Welsh. Peter Brabham, Cardiff University, gave a talk which included a 3D virtual tour of the Geopark.

The Geopark Challenge, held at Craig-y-nos Country Park, included hands-on geological

activities provided by the British Geological Survey and Cardiff University. Children were able to examine and make rubbings and plaster casts of fossils. They also had the opportunity to use hammers and chisels to find fossil plants in Coal Measures shales and to learn gold panning techniques in the bed of the River Tawe, but the Upper Swansea Valley is definitely not another Klondyke!

Tony Ramsay, Fforest Fawr Geopark



Adrian Humpage (British Geological Survey) and Tony Ramsay (Scientific Director, Fforest Fawr Geopark) demonstrated gold panning and showed children how not to get rich quickly. © NERC

LETTER TO THE EDITOR

'Commercial exploitation': a response

Sir,
As a professional fossil collector based near Lyme Regis, with a serious and long-standing interest in geoconservation and fossil collecting issues, I was much concerned not only to read in *Issue 27* about the illegal removal of *in situ* dinosaur trackways from an SSSI at Barry, South Wales, but also at the way in which the incident was then used to try to discredit those involved in the 'fossil trade', particularly in the Lyme Regis area.

On visiting the site at Barry as a result of reading the article, it was immediately clear that the *in situ* excavation involving the removal and break up of unique trackways had caused real damage to its scientific interest. The person responsible, who was from South Wales, was not a professional collector. He was cautioned for an offence under the Wildlife and Countryside Act of 1981 (as amended by the Countryside and Rights of Way Act 2000). Footprints were confiscated from one shop in Lyme Regis, and that was the extent of the Lyme Regis 'connection'. Hopefully these prints will be added in due course to those in the existing collection at the National Museum of Wales. For the future, might it not be worth placing signs at the site explaining its scientific importance and particularly as to why the footprints should remain undisturbed *in situ*? Of course there is a risk involved in drawing attention to them, but there is also a fascinating story to be told here, and raising public awareness and understanding of the site could well prove beneficial to its conservation.

Other matters of concern in the article include the allegation that the 'head-end' of a dinosaur was sold to one purchaser, and 'the other half of the skeleton appeared months later on offer to another'. This is a mistaken reference to parts of two *totally different*, very incomplete specimens. A simple inquiry would have established this fact.

The Bridgwater Bay NNR incident occurred some seven years ago and involved two professional collectors from the Lyme Regis area who illegally removed a large number of *ex situ*



Probable *Ichthyosaurus communis*, Obtusum Zone, Lower Lias, Lower Jurassic, Black Ven, Lyme Regis, Dorset. Preparation by David Costin of Lyme Regis. Photo by Richard Edmonds

nodules and a small piece of *in situ* crinoid. This resulted in the collectors being banned from the site for five years, Taunton Museum benefited by being able to select from the fossils all those it needed, and important lessons were learned. The collectors were allowed to keep the remaining fossils, which could then *legally* be offered for sale. It is an exaggeration to describe this as 'pillaging' the site, and any damage to it was insignificant compared to that at Barry. It is a 'solid' fact that nobody was charged following the Bridgwater Bay and Barry incidents, and any suggestion to the contrary is entirely wrong.

With regard to the collecting of fossils from 'protected' SSSIs along the Dorset coast, these are robust sites, none of which list fossil collecting as an 'operation likely to damage the special interest', and none has yet suffered *in situ* damage by fossil collectors that can be compared to that at Barry.

On a coastline where there is erosion, once any fossils become *ex situ* (and sometimes before they do), sooner or later (usually sooner) they will be damaged or destroyed by the sea if not collected. Obviously in the interests of conservation they should be collected before that happens. The threat is not from experienced collectors, but from the sea. Fortunately in West Dorset erosion can be relied on to replenish the supply of *ex situ* fossils, particularly during stormy periods in winter and early spring, and a beach apparently 'stripped'

of fossils one day may produce plenty the next.

With regard to the claim that at some coastal sites 'practically everything of interest exposed by erosion is hauled off before anyone can see it', in so far as this refers to *ex situ* material, it is not 'a major issue for British conservation' provided certain fossils are recorded as required by the West Dorset fossil collecting code. As already pointed out, if not collected, the sea would destroy them. It *would* be an issue, however, if *in situ* material was 'hauled off' as claimed, unless it was at imminent risk from the sea. The code rightly recognises this essential distinction by banning *in situ* collecting without permission in order to protect the interests of researchers and the integrity of the SSSIs, whilst not seeking to restrict *ex situ* collecting. Thanks to the code and pressure from fellow collectors, there is now very little *in situ* collecting in West Dorset without permission.

In conclusion, although some professional collectors have clearly made mistakes in the past and similar incidents may occur in the future, there is much to be said in their favour. Collectively they constitute a valuable resource of experience, skill and time not only in searching for and recovering fossils, but also in preparing them for research and museum display. Museum collections would be much the poorer without their contribution.

– **David Sole, Lyme Regis, Dorset**

New trail reveals

hidden assets

Visitors to the Hamps and Manifold valleys have long admired their subtle beauty and magnificent scenery. Many will no doubt have gazed in awe at the towering limestone crags or been puzzled by the caves and old mineral workings perched high on the valley sides. Perhaps others will have been bemused by the sudden disappearance and reappearance of streams on the valley floors and wondered about their origin. But with the launch of the Hamps and Manifold Geotrail by Staffordshire RIGS, the stories behind these and other phenomena have at last been revealed to visitors.

Creating a trail along the route of the old Leek & Manifold Valley Light Railway had been a glint in the eye of Staffordshire RIGS members for some years and now it has come to fruition. While others have produced excellent geotrails in other parts of the Peak District, the development of a Hamps & Manifold Geotrail had always been regarded as a bit special. Staffordshire RIGS members would argue that in no other area locally was the geology so varied or interesting, or was there such a close and obvious relationship between bedrock geology and surface geomorphology. With particularly good access for all, this geotrail presented a golden opportunity to improve public awareness about the importance of local geodiversity and to promote geoscience to a wider audience.

The 13km (eight mile) geotrail runs between Hulme End and Waterhouses in the south-western corner of the Peak District. It has a gentle gradient and is tarmaced throughout. Although the trail was envisaged for southbound travellers, it can be easily completed in reverse, or in smaller sections using the mid-trail access points at Weag's Bridge and Wetton Mill.

A waterproof trail leaflet (including a simplified geological map) and Staffordshire RIGS marker posts guide the visitor to 32 points of interest on the route. Copies are available from the Hulme End Visitor Centre, the cafés at Wetton Mill and

Patrick J. Cossey
Staffordshire University & Staffordshire RIGS

THE HAMPS & MANIFOLD GEOTRAIL broadly follows the axis of the Ecton Anticline, and exposures of highly fossiliferous limestone (some turbiditic) and carbonate mudmounds of Lower Carboniferous age are seen along the route. Into the limestone bedrock the Hamps and Manifold rivers have carved their spectacular passage and a variety of remarkable fluvio-karstic features including swallets (watersinks), subterranean passages and resurgent springs, caves and dry valleys are displayed. Perched caves, incised gorges, sediment fans, and cemented scree deposits formed during the Ice Age also occur. The caves, which have yielded a treasure-trove of archaeological and fossil remains, reveal a fascinating history concerning rates of valley erosion. Other highlights of the trail include the Apes Tor fold structures, mineral veins, the Ecton Hill Copper Mines and Brown End Quarry Geological Nature Reserve.



Professor Cynthia Burek and the Staffordshire RIGS geotrail team at the launch event.
Photo courtesy of Staffordshire Sentinel News & Media Ltd

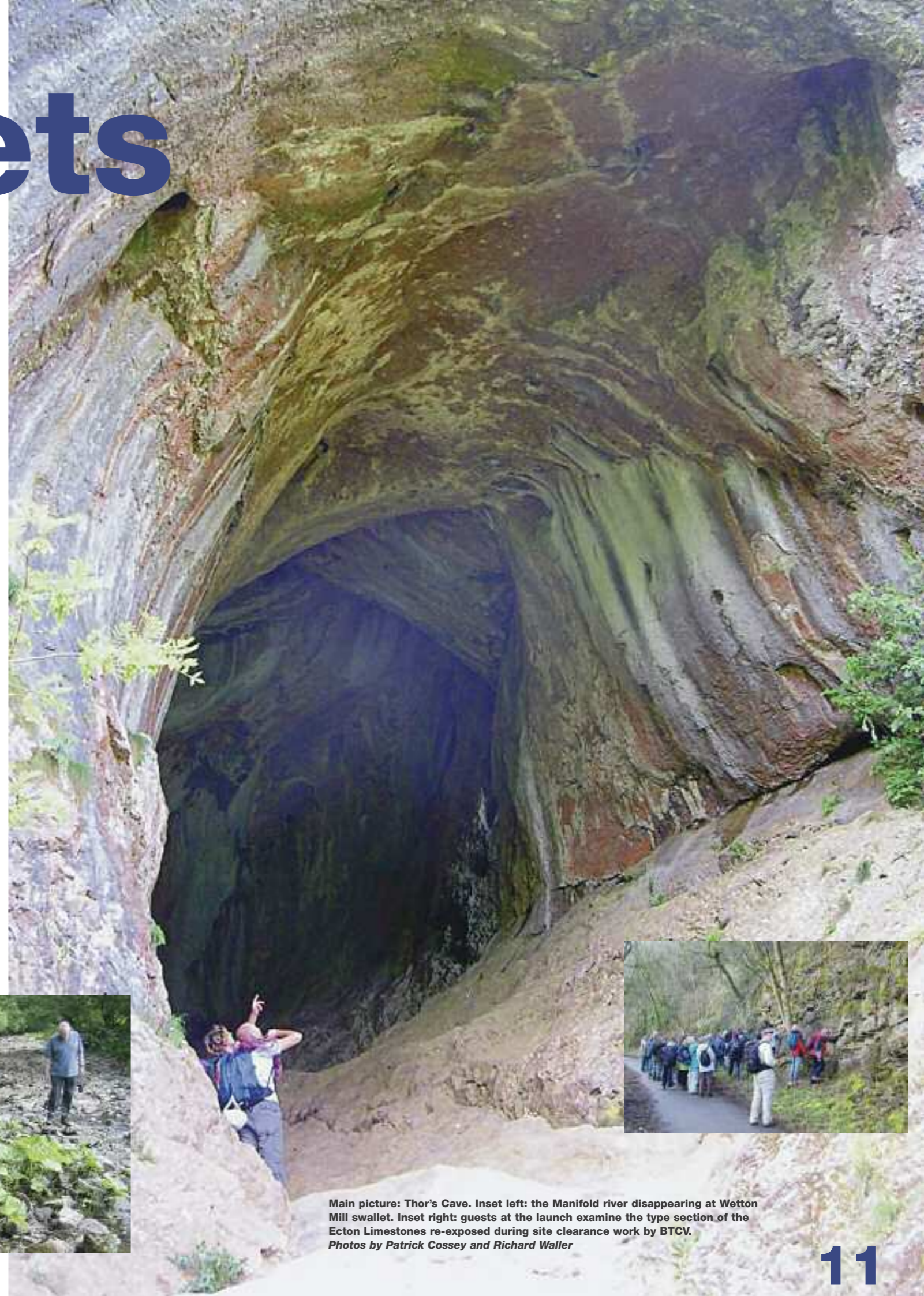
Lea House Farms, the cycle hire outlets at Brown End Farm and Waterhouses, and other local sources. Copies of the leaflet can also be downloaded from the Staffordshire RIGS website: www.esci.keele.ac.uk/srigrs

Prior to the trail launch, volunteers from local geological societies and community groups trialled the trail and site clearance work was undertaken by Natural England and the British Trust for Conservation Volunteers. Important sections were re-exposed, including a carbonate

mudmound contact within the Milldale Limestones and one of the type sections of the Ecton Limestones. Many other organisations and individuals also contributed to the project. Among them were Staffordshire and Keele universities, National Trust, Staffordshire Wildlife Trust, British Geological Survey, Staffordshire Moorland District Council and members of the North Staffordshire Group of the Geologists' Association. The project was funded by Staffordshire County Council's Aggregates Levy Scheme.

The trail was launched with much acclaim at Hulme End Visitor Centre by Professor Cynthia Burek of the University of Chester and UKRIGS.

Following the opening, leaflets in hand, some 60 or more invited guests guided themselves down the trail to a celebration lunch at Wetton Mill café. It was a great day for geoconservation and Staffordshire RIGS. ■



Main picture: Thor's Cave. Inset left: the Manifold river disappearing at Wetton Mill swallet. Inset right: guests at the launch examine the type section of the Ecton Limestones re-exposed during site clearance work by BTCV.
Photos by Patrick Cossey and Richard Waller

12 good reasons to get out of school

The UKRIGS Education Project – Earth Science On-Site – has succeeded in producing high-quality Earth science field teaching activities for schools at 12 former aggregates sites across England.

The projects are geared:

- to encourage non-specialist science teachers to undertake Earth science fieldwork with pupils from primary to GCSE level;
- to demonstrate the educational value of Regionally Important Geological/geomorphological Sites (RIGS) and Sites of Special Scientific Interest (SSSI) to local planning and education authorities, to the aggregates industry and to the public;
- to foster the wider use of RIGS and

John Reynolds UKRIGS and Earth Science Teachers' Association

SSSI by providing an exemplar and formula for the production of teaching materials that can be applied at similar sites elsewhere;

- to provide links between these field teaching activities and the classroom or laboratory practical activities produced by the Earth Science Teachers' Association www.esta-uk.org, the Earth Science Education Unit www.earthscienceeducation.org and other partners, hosted on the Joint Earth Science Education Initiative website www.jesei.org.

The project has been funded by the Aggregates Levy Sustainability Fund and

all the materials have been written in collaboration with partners in the Earth Science Teachers' Association, the Earth Science Education Unit and the National Stone Centre. The outputs are devised to address the requirements of the National Curriculum at Key Stage 2 [7-11 yrs], KS3 [11-14 yrs] and KS4 [14-16 yrs - GCSE].

The materials for each site comprise six elements of information designed to help group leaders and teachers plan their field activities:

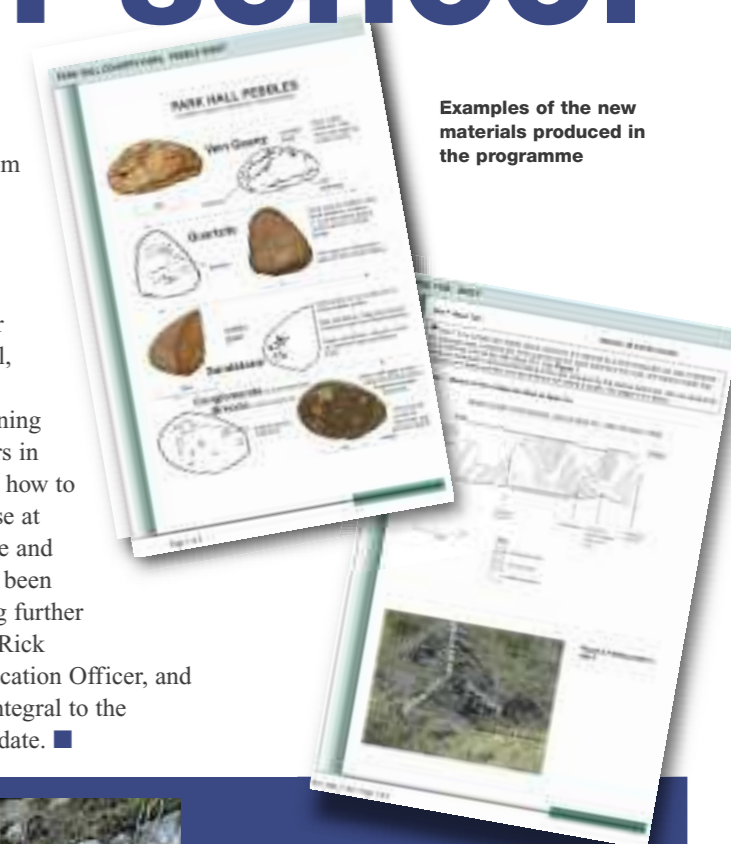
1. Introductory note explaining the background to the project.
2. Map and details of location, access and initial risk assessments.

3. Background information relating to the site and its geological and geomorphological interest.
 4. Details of National Curriculum links and Attainment Targets addressed at Key Stages 2, 3 or 4, and the requirements of the various GCSE examination boards.
 5. Suggested links for preparatory and follow-up work, including CD animations.
 6. Materials to support field activities, including teacher notes, worksheets, reference material and related items.
- (Separate versions of items 3 to 6 have been produced to match the appropriate Key Stages of the curriculum.)*

The authors anticipate that teachers and others will freely adapt the materials to suit their own context and their own programmes of study. All the Earth Science

On-Site materials produced to date are downloadable as pdfs from www.ukrigs.org.uk/html/esos.php

The partners have now prepared a bid for further funding and, if successful, will use it to produce an increased element of training for non-specialist teachers in the use of these sites and how to adapt the materials for use at other sites. Wenlock Edge and the Great Whin Sill have been earmarked for developing further materials. The efforts of Rick Ramsdale, UKRIGS Education Officer, and many others have been integral to the success of the project to date. ■



Examples of the new materials produced in the programme

The sites and sights for pupils...

These are the 12 sites within the project to date, and the teaching materials available for each.

1. The National Stone Centre [SSSI], Wirksworth, Derbyshire

Key Stage 2: Teaching trail, using rock types seen, including the Millennium Wall. Fossils and minerals.
KS3: Rock cycle - rock types, their origin, weathering and use.
KS4: Different limestones of a reef environment in Carboniferous times.

2. Black Rock RIGS and Dene Quarry, Matlock, Derbyshire

KS2: Extension of National Stone Centre visit - view into Dene Quarry.
KS3: Dene Quarry – processes, development and environmental impact of quarrying Carboniferous Limestone for aggregates.
Black Rock extension of National Stone Centre work.
KS4: Dene Quarry - In-depth consideration of local impacts of quarrying.
Black Rock, & Barreledge Quarry – gritstone use. Cromford Moor lead mine.

3 Apes Tor and Ecton Hill [Hamps & Manifold SSSI], Wetton, Staffs

KS3: Ecton Hill: rock cycle, gravity on mine dump and scree, river action.
KS4: Apes Tor. Folding of muddy

Carboniferous limestones, model of card and foam strips, field sketching and uses. CD animation.

4. Park Hall [Hulme Quarries SSSI], Stoke-on-Trent, Staffs

KS2: Identification of pebbles using reference sheet. Uses of sand and gravel.
KS3: Sandstones, pebble beds and cross-bedding - flash floods in Triassic desert environment. CD animation.
KS4: Later faulting, determining movement. Field sketch. CD animation.



Rick Ramsdale, UKRIGS Education Officer, casting an eye over rounded pebbles in a small aggregates quarry in the Long Hill Esker, Mosedale, Cumbria. Photo by John Reynolds

5. South Elmsall Quarry SSSI, near Doncaster, West Yorkshire

KS 4: Evidence for the environment of deposition of Permian reefs in shallow seas with high evaporation rates.

6. Dryhill Picnic Site RIGS, near Sevenoaks, Kent

KS 2: Test and identify sedimentary rocks. Weathering, soil and plants.
KS 3: Rock cycle, marine environment of Hythe Beds, uplift, folding, weathering and erosion.
KS 4: Deformation - mapping the fold structures to visualise 3D geometry.



Late-Carboniferous aplite [microgranite] intruding already-baked hornfels, showing signs of original bedding. Meldon Aplite Quarry West, Okehampton, Devon. Photo by John Reynolds

7. Ercall Quarries SSSI, Telford, Shropshire

KS 2: Four hard aggregates investigated for their igneous or sedimentary origin.
KS 3: Origin of the rocks and their unconformable [Precambrian/Cambrian] relationships.
KS 4: More detailed investigation, additional work on ripple marks and faulting.

8. Barrow Hill RIGS, & St Mark's Church, Pensnett, Dudley

KS 2: St Mark's Church - rock types & weathering. Cracks from the 2002 Dudley Earthquake.
Barrow Hill - dolerite, soil formation, geological resources.

KS 3: St Mark's Church - more detail on rock types, weathering, use of stone in walls and other geological resources.
Barrow Hill - dolerite [Late Carboniferous] underlies the Dudley volcano.

9. Tedbury Camp Quarry RIGS and Vallis Vale SSSI, Frome, Somerset

KS 2: Tedbury Camp – formation of two limestones [Jurassic on Carboniferous] and unconformity. Weathering, soils and growth of plants.
KS 3: Two limestones at both localities, unconformable relationships - two separate rock cycles.
KS 4: Wider structural context of the Carboniferous Limestone. Ecology of the

Jurassic sea floor - the unconformity surface.

10. Ryton Pools Country Park RIGS, adjacent to Wood Farm Quarry RIGS, Bubbenhall, Warwickshire

KS 2: Sands and gravels link with soils and vegetation. Afteruse of site for waste disposal.
KS 3: Rock cycle, changing environment of the Quaternary, modern weathering and erosion.

11. Mosedale Quarry RIGS, School House Quarry and adjacent glacial gravels, Mungrisdale, Penrith, Cumbria

KS 2: Identification and use of rocks in buildings and walls, links to local exposures. Origins.
KS 3: Range of rock types, igneous [gabbro], sedimentary [flags] and metamorphic [slate]. Gravels from different recent environments linked to the rock cycle.
KS 4: Interpret the geology of Schoolhouse Quarry. Quaternary gravels from scree, esker and modern river deposits.

12. Meldon Aplite Quarries SSSI, Okehampton, Devon

KS 2: Local rocks used in walls and buildings and seen in exposures.
KS 3: Intrusion of aplite into sedimentary rocks and the effects of metamorphism. Periglacial landscape.

How RIGS can give schools what they want

Cathie Brooks & Alwyn Roberts

Research commissioned by the Countryside Council for Wales has provided a bank of information on what schools want from geological field sites, and how RIGS groups and other site managers can help teachers meet curriculum needs.

The research identifies:

- new opportunities in the teaching of school geology (summarised in the box below);
- existing resources which show good practice for investigating geology in the field;
- the views of teachers, advisory staff, residential fieldwork centres and Welsh Joint Education Committee [WJEC] officers and examining personnel.

The recommendations are summarised here. They provide geologists with some exciting insights and opportunities to produce resources that can help to satisfy the needs of schools. Meeting this challenge can only help to popularise geology among teachers and students. While the findings are specific to Wales, the issues that are raised apply more widely.

With opportunities like those outlined on these pages, the challenge ahead for geological conservationists is to fund and produce accessible, imaginative resources that teachers like, and that will help them stimulate their students. Teachers and local geologists need to work together to make this happen. RIGS groups could take the initiative by contacting local schools.

Changes in education create new opportunities for geology

Educational changes mean there are greater opportunities to introduce geodiversity into the school curriculum. Geodiversity need not be confined to geology, geography and science classes. There are many curriculum areas where field-based geodiversity resources could be used.

The research suggests that the priorities for new resources should be:

Foundation Phase (3-7 year olds):

A new curriculum is to be introduced into Wales in 2008 called *The Learning Country*. This places a greater emphasis on first-hand experiences outdoors. Few geodiversity resources are currently available. New, stimulating resources are needed to capture the fascination of geology in the very young.

KS4 Science:

Science, taken by all pupils, contains Earth science topics. Few schools have a geodiversity fieldwork programme. The development of suitable field resources could encourage outdoor activities and foster an increased interest in Earth science to a wider audience.

A-level Geology and Geography:

New specifications were submitted in February 2007 for first examination 2009/10. There are new topics in WJEC Geology, for example climate change and groundwater which need updated field geodiversity resources. WJEC Geography also has a new climate change section and river flood management will become an obvious topic for AS Geography field investigation. Current Alpine tundra conditions is added to existing topics of glacial or coastal landforms and their management. The approach to the assessment of fieldwork is to change. Resources are required to support these changes.

Cross-curricular themes: These are compulsory and many contain topic areas where geology would be the ideal context. Examples include: Personal and Social Education [PSE], which contains such demands as 'develop a sense of personal responsibility towards the environment... understand the key issues of sustainable development.' (PSE, KS3). Welsh Assembly Government [WAG] has recently consulted on the new theme to be developed in all Welsh schools



A spectacular potholed surface in Carboniferous rocks at Traeth Bychan, eastern Anglesey, where student and teacher packs have been trialled.
Photo by Stewart Campbell

'Education for Sustainable Development and Global Citizenship' [ESDGC]. 'What is needed is a clear set of criteria that illustrate what constitutes a whole school approach to ESDGC' (WAG, 2006). Exciting resources are needed to encourage teachers to illustrate the themes by using geodiversity rather than, as currently, through other examples.

Other new curriculum developments offering scope for geology include the Welsh Baccalaureate Qualification, which is now being extended to 75 establishments in Wales.

Further information on issues highlighted in this article can be found in *Using field-based geodiversity information in schools. What do schools want? How can RIGS and CCW help?* Cathie Brooks & Alwyn Roberts, CCW Research Report No: 06/43. Downloadable from www.geomon.org.uk

How to help primary schools

- Resources, especially for the younger pupils, should concentrate on ways of exploring the school environment.
- Any visits to the local area must not take longer than a school day.
- For older pupils, there are many resources on soils and quarries. Other materials that would be useful include the investigation of geomorphological features. Teachers were keen to have more information on local beaches.
- Resources should address processes, people's effect on the environment, sustainability issues.
- There was great enthusiasm for the RIGS local urban geological trails but these need modification to be suitable for use by schools. (A suggested common framework for these changes is given in the report.)
- 'Hands-on' activities which take an investigative approach are most successful at arousing and retaining pupils' interest.
- Most primary teachers do not have geological training and they find the terminology used in some existing resources both baffling and daunting. The confidence of teachers and accessibility for pupils would be raised if there were a minimum use of 'technical' language.
- Help from visiting 'geological experts' is essential for the success of any initiative. Sharing of ideas and information about the local area is best approached through school cluster meetings. See *How primary material was developed*, overleaf.
- Resources would be welcome in both electronic and paper formats.
- Teachers request that resource providers liaise since there are many resources on some topics and none on others.
- A loan scheme allowing teachers to borrow sets of rock and fossils for classroom use should be re-introduced.

More articles overleaf

How RIGS can give schools what they want – 2



Bethesda slate quarry: 'The slate industry in North Wales' was one of the stories prepared for a primary school audience. Photo by Margaret Wood

How to help secondary schools

- There is a wide variety of approaches to geological fieldwork in different schools and between different subjects. Science has little tradition of geological fieldwork, and even geology and geography teachers are finding it increasingly difficult to gain permission to undertake study in the field. There is an increasing need for resources to include risk assessment and an analysis of benefits to the students from field visits. The fastest-developing area is resources for virtual fieldwork.
- Fieldwork with secondary students can be undertaken across a wider travel area than primary pupils but the sites must: be suitable for larger groups; be safe; have good access; show a variety of obvious and interesting features.
- As with primary schools, survey participants stressed that resources should encourage an interactive investigative/enquiry approach where students must find out information for themselves.
- There was, again, great enthusiasm for local urban geological trails, especially for the secondary Key Stage 3 students (age 11-14). Trails need modification for use by schools. The report suggests a common framework for change.
- Older, exam students need resources which accurately reflect the needs of their courses. There is little time to 'indulge' in other projects. One observation made to the researchers was that take-up of new resources would be higher if there were more liaison between providers and Examination Boards. The examiners have said they would welcome new resources linked to their specifications.
- **The changes in the school curriculum are summarised on page 14. In particular teachers require new resources for:**

- the Earth Science component of the revised Key Stage 4 Science. An example in the report is a Welsh Joint Education Committee-approved geological fieldwork 'task' that can be submitted as part of the exam;
- revised GCSE and A-level geography exams which have to take a different approach to fieldwork since 'coursework' is no longer valid;
- revised GCSE and A-level geology exams which now incorporate topics such as climate change and sustainability.

The report details websites cited by A-level teachers as suitable for student research and virtual reality sites which

help prepare students for fieldwork. Cross-curricular themes are often forgotten, yet conservation and sustainability are at the heart of these topics. Exciting resources are needed to encourage teachers to illustrate the themes by using geodiversity rather than, as currently, through other subjects.

For example, the core of the expanding Welsh Baccalaureate Qualification requires four components: Key skills; Wales, Europe and the World; Work-related education; and Personal and Social Education. What better way to combine all these than by a group of students developing a geodiversity field site?

How primary material was developed

Discussions in Dwyfor led to the idea of forming clusters of teachers to prepare Welsh-language geodiversity materials on the local area, based on the new Foundation Phase, which could then be distributed to other schools. It was felt that this would encourage other teachers to do the same and to build a bank of materials which could be shared and adapted. It was decided to work with Careers Wales, which has close links with schools.

After meetings to discuss the scheme and decide on the type of material to be prepared, two clusters of five teachers were set up – one in the Dwyfor/Meirionnydd area and the other on Anglesey. With bursaries in place to fund teaching cover in schools while the teachers worked on the project, the two clusters met separately on five days on employers' sites. The first day introduced geodiversity to the teachers through workshops at Llechwedd Quarry in Blaenau Ffestiniog and the Countryside Council for Wales at Bangor. From there, Dr Margaret Wood visited schools on Anglesey to give teachers local geodiversity information. The other days were spent at sites such as Wylfa Power Station, Snowdonia National Park, Menter Môn linked with the National Museum of Wales and Oriol Ynys Môn.

Two CDs were prepared and distributed to local schools for use on interactive white boards. It is hoped that they will eventually be available on the Careers Wales and CCW websites. The Anglesey material is also available in Big Book format.

The Dwyfor/Meirionnydd cluster prepared simple stories about the slate industry in the area based around two characters, known as 'Llew Llechen' and 'Lleucu Llechen' (Llechen is the Welsh word for slate) and prepared work on the sea shore.

The Anglesey cluster linked geodiversity directly with the syllabus producing work in the classroom linked to the study of rocks and fossils (e.g. 'The Mathematics of Rocks', 'Creating Rocks', 'Story Writing', 'Musical Rocks!', 'Box of Natural Treasures' and 'Dough Rocks').

Coreholes: a widespread problem

Colin MacFadyen,
Scottish Natural Heritage

The appearance of 'When coring = geovandalism' (*issue 27*) prompted me to take a look at the exposures on the Garvellachs islands, near Oban, that have reportedly been damaged through coring and sampling for scientific research. Although I had seen irresponsible coring in many areas, I was not prepared for the scale of the damage inflicted on the internationally important exposures of the Garvellachs.

The exposures on the Garvellachs represent some of the least deformed rocks within the Dalradian Supergroup, a deformed and metamorphosed, predominantly sedimentary, succession that spans the Precambrian and early Palaeozoic. The Dalradian represents the foundation of the Grampian Highlands landscape and extends into the southern Inner Hebrides and Ireland.

Scientific value

Of particular significance on the Garvellachs is the occurrence of a marine tillite, or 'boulder bed'. Termed the Port Askaig Tillite Formation, it was formed as glaciers deposited sediment onto a Late Precambrian sea floor. The tillite has immense lithostratigraphical and chronological value throughout the Dalradian, with time-equivalent examples found elsewhere in the world.

Obviously an important location for Scottish and world geology, the glacial marine sedimentary sequences have been the focus of research involving detailed mapping and extensive core sampling. Unfortunately, some of the coring undertaken to extract data from the tillite has damaged the exposures. When it happened is not known,



Internationally significant exposures on Garbh Eileach, demonstrating the consequences of an irresponsible approach taken by geologists undertaking coring for research purposes. Photos by Colin MacFadyen



but the image at the top of the page shows an exceptionally fine outcrop, illustrating varved deposits, that has been peppered with core holes resulting in its permanent disfigurement. Six clusters, each with up to seven core holes, were apparent in an area of only a few square metres, effectively ruining it for photographic purposes.

Clearly this sampling was undertaken either in complete ignorance of, or with complete disregard for, existing fieldwork good practice guidelines, such as the Geologists' Association *Code of Conduct for Rock Coring*. One has to ask if the research could have been undertaken in a more outcrop-friendly manner that would have preserved the appearance of the exposure? At the very least the holes could have been plugged!

Following my visit to the islands, SNH has designed and produced an information sheet that has been given to all local ferry operators in the Oban area who transport geological researchers to the islands. The

information, which hopefully researchers will read before they set foot on the Garvellachs, highlights the status of the island group as a Geological Conservation Review site and Site of Special Scientific Interest, and contains coring

best practice guidelines provided courtesy of the Committee of Heads of University Geosciences Departments (www.chugd.ac.uk).

In the longer term SNH is considering producing a leaflet to be distributed to geological researchers nationwide, given, as illustrated in *issue 27*, that the problem of sites being damaged through scientific study extends far beyond the Garvellachs. It seems that irresponsible coring has become truly ubiquitous.

Responsible working

We should welcome continuing scientific scrutiny of the outstanding geology of the Garvellachs as this will reveal fascinating insights into the formation of the Port Askaig Tillite, elucidating further the nature and extent of Late Precambrian ice ages. However, this important work must be undertaken responsibly in order that others can visit the islands and experience some unvandalised exposures. ■

Moving towards a National GAP

In 2001, English Nature commissioned Jac Potter and Cynthia Burek to research the benefits of Biodiversity Action Plans for Geodiversity Action Planning. In 2002, pilot projects were set up in Cheshire and Warwickshire, resulting in the Cheshire region LGAP (CrLGAP) being launched in 2003. Since then, over 30 LGAPs have been published or are in the process of production. While the LBAPs fall within the framework of a UKBAP, there is no such national policy or strategy for LGAPs.

Cynthia Burek,
University of Chester
Stewart Campbell,
Countryside Council for Wales
Jonathan Larwood,
Natural England

Meanwhile LGAPs are being developed across the UK. Their growth has led to the suggestion that a National GAP

(NGAP) is necessary, perhaps for standardisation, certainly for guidance. Representatives from England, Wales, Scotland and Ireland, along with UKRIGS, met in October 2006 at the University of Chester to discuss the rationale and need and even question what constituted 'national'.

A further meeting to encourage discussion and consultation across a wider section of the geodiversity community was funded by Natural England and convened by Cynthia Burek

at the same location. The remit was to come up with a partnership approach to forming an aim and supporting objectives. Meaningful targets and achievable actions would follow.

Below, Mick Stanley summarises key contributions and gives his account of the day.

References

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Mick Stanley, Geodiversity Consulting

In 2000, I proposed in the *Earth Science Strategy of the Royal Society for Nature Conservation* that there should be Geodiversity Action Plans (GAPs) to promote geodiversity. Seven years later I joined 40 other interested 'GAPpers' in Chester to explore the idea of a National GAP.



Hulme Quarry SSSI, Staffordshire, one of potentially thousands of sites that could benefit from an NGAP.

Photo by Paul Glendell/Natural England

I had expected that discussion of the need for GAPs would have started with a national view rather than the Local GAP (LGAP) approach that was promoted in England as the delivery mechanism for geoconservation at the local level.

Jonathan Larwood of Natural England summarised the state of development of what is now some 30 LGAPs and Company GAPs. He noted that geodiversity features in Planning Policy Statement 9 and the Defra Local Sites Guidance which specifies LGAPs as a mechanism for work with local government.

Colin Prosser of Natural England said that the LGAP process was bottom up whereas Biodiversity Action Plans (BAPs) were top down. To secure government support for the LGAP concept, geologists needed to give their plans a wider remit and set them in a national context, with promotion, awareness raising, education and planning.

Murray Gray pleaded for inclusion of the wider landscape and geomorphological processes in the LGAP procedure so that it could gain recognition at international level. John Reynolds insisted that education, education, education should be

integral to the NGAP as the national curriculum pushes learning outside the classroom.

Elaine Tilson reviewed the mechanics of action plans and examined how they worked. Dave Owen outlined the Gloucestershire Cotswolds LGAP, which contained an area audit and a plan that was specifically aimed at district and parish councils, landowners, wildlife organisations and educational groups. Discussion centred on the need for, and range and extent of, audits. Different views were expressed depending on the local or national viewpoint.

Some speakers felt more audit work was necessary to provide the baseline to measure how resources change. But do we not already have audits at national and international level in the forms of GCR and Local Geological Sites, including RIGS? National Parks, AONBs, Geoparks and other designations also constitute an evaluation of most of the wider landscape.

Jac Potter used the National BAP to illustrate an action plan process using a 'top-down' approach from government which broke a seemingly complex issue into more manageable parts. It was driven

by national targets and indicators which were fed by regional and local data. She stressed that action plans had to be underpinned by sufficient resources if they were to succeed. Evaluation of their progress was therefore essential; plan, monitor, review were the three important words in any action plan, but funding and political buy-in should be the fourth and fifth!

Alan Cutler endorsed the case for necessary funding to be in place and that political input was needed at local, regional and national levels. But what is national? Jonathan Larwood introduced this question. Is it more coherent to focus delivery at country level? Graham Worton proffered the view that the geological resource did not acknowledge human boundaries. Focus should be on the outcomes and the extent of the resource should be assessed irrespective of geo-political boundaries.

Colin Prosser acknowledged that it was possible to have a plan written at one level (i.e. UK or European) and to have delivery at another (e.g. individual countries). The overarching plan needed to be attractive to encourage people to sign up, and this factor could help create the scale and the boundaries of the plan. "European money could be accessed if the Republic of Ireland is included," he said. "A shortage of resources for delivery may have implications for the overarching plan and each country's implementation of it. We need to be pragmatic about drawing in money, perhaps a dual structure and UK then country interpretation."

National politicians were absent from the meeting but could have learnt a lot from the passion and common sense spoken.

Developing a national GAP

In summary, 'GAPpers' wanted to consider a plan at a supra-national level that:

- included the wise use of sufficient resources;
- was dynamic, engaging and allowed for an understanding of geodiversity;
- had an overarching framework;
- conserved geo-heritage;
- raised awareness and appreciation;
- contributed to sustainable development;
- was educational, enriched the environment and geo-tourism;
- improved the quality of life; and
- had political support.

Not much then!

Local distinctiveness had to be included and my definition of geodiversity aimed at linking geology, heritage, history and architecture, conveys the fact that geodiversity underpins everything!

But what should be the aim? Graham Worton again: "To provide an environment in which the rich geological diversity of the UK (or whatever) can be appreciated and developed dynamically for the benefit of all." The results of the discussion groups are in the table (right), compiled by Tamara Hunt (CrLGAP and University of Chester) and Hannah Townley (Natural England).

So how would we measure the progress of the yet-to-be-written NGAP? Overlooking the clichéd 'milestones', 'benchmarks', 'targets' and so on, the one I liked most was 'celebrate achievement'.

Who would be the key partners in an NGAP? Selection criteria required for the partners were enthusiasm with time to engage in the process. A predictable list of participants emerged. The passionate assemblage of 'GAPpers' also agreed that, in these days of celebrity, it was imperative that a personality be appointed to champion the cause.

How 'NGAPpers' see the way forward

OBJECTIVES	ACTIONS
Conserving and enhancing the whole resource - identification and management	<ul style="list-style-type: none"> ● Protection of geo-sites at international, national and local levels and within the wider landscape ● Promote sustainable management through good practice ● Enhance the condition of the geological resource ● Collation of databases / audit of audits – web resource? ● Produce common standards/ guidance for recording sites ● A national recording scheme for key scientifically important specimens? ● An enhanced FACELIFT programme, tied into scientific study and/or educational activity and perhaps forcing academics to be proactive in disseminating their work (talks and events?). Corporate sponsorship opportunity?
Getting geodiversity into national, regional and local policies	<ul style="list-style-type: none"> ● Secure political backing ● Promote geodiversity in public policy and practice ● Help to deliver government policy in relation to PPS9 and local sites guidance ● Support local distinctiveness and character ● Encouraging, guiding and supporting LGAPs ● Developing good practice and guidance ● Integration of geodiversity with biodiversity, landscape, archaeology and built environment delivery (parity within planning and development process) ● Communicate threats and opportunities to show why geodiversity matters ● Timetable of when relevant policies are to be renewed
An activity audit / LGAP coverage	<ul style="list-style-type: none"> ● Identify gaps between LGAP areas and encourage production of LGAPs to fill the holes ● Where is there geo-activity and what is it: LGAPs, RIGS, Geoparks, etc.
Increase public awareness and appreciation	<ul style="list-style-type: none"> ● Clarification and clarity of language used ● Encourage geotourism activity ● A national programme of events/walks ● A national photographic competition with geodiversity as a theme
Geodiversity and education	<ul style="list-style-type: none"> ● Lobby for inclusion in national curriculum ● Link up with Department for Education & Skills 'Learning Outside the Classroom' manifesto
Sustaining the NGAP process	<ul style="list-style-type: none"> ● Set up a UK (area) geodiversity partnership ● Mechanism for reporting back, evaluation, being accountable ● Identify champions/good practice that can be used to promote GAPs ● Identify sources of funding and actively involve the grant-giving bodies
Developing links	<ul style="list-style-type: none"> ● Between users and developers of knowledge; for example, site users with NERC/BGS/academics ● Between users and interested communities ● Greater role for museums in site management and more opportunities for museums and their collections
Setting context for standards at every level	<ul style="list-style-type: none"> ● Promote good practice, examples of works ● Establish mechanism for communication ● UK geodiversity partnership?

Conclusion

A document summarising the meeting and the outcomes has been circulated to all attendees, those unable to attend, and to a wider

group. An initial core group was suggested and volunteered and the current plan is to develop a draft NGAP which would go out to wider consultation in the autumn of this year. ■

threats to Scottish soils

Soils produce a range of benefits to society and there is increasing recognition that soil has perhaps been taken for granted in the past (see *Earth Heritage 26*).

The proposed EU Soil Framework Directive clearly identifies the role of soil as a biodiversity pool for habitats, species and genes and the need to maintain the capacity of the soil to continue to deliver that role. A number of valued habitats in Scotland, such as machair grassland, calcareous grassland and blanket bog, have a direct relationship with some key properties of the underlying soil.

Scottish soils differ markedly from those of the rest of the UK in that the majority have

Willie Towers,
Macaulay Institute

never been recently cultivated and are highly organic. For these reasons, their role in landscape conservation and sustaining biodiversity is considerable. Additionally they represent a considerable pool of carbon and there are wider environmental implications if that pool were to become destabilised. Aberdeen's Macaulay Institute, in collaboration with the University of Stirling, was commissioned by the Scottish Executive to report on the status of Scottish soils and to identify threats to them. Some of the findings related to the biodiversity value of soils, threats to it and

possible mechanisms to protect it are outlined here.

The diversity of life (invertebrates and micro-organisms) in soils is vast and unexplored. Soil biodiversity is therefore a true scientific frontier. The major impediment to evaluating any loss in biodiversity is the lack of systematic data that describe its current status, how it varies spatially and temporally as well as the key links between biodiversity and function. Work funded by Scottish Natural Heritage has already identified strong relationships between rare or valued habitats and rare and valued soils in Scotland and, in the short term, this offers the best opportunities of filling this knowledge gap. Protecting soil biodiversity as a component of rare



Above: lazy beds (man-made soils) represent a significant component of the cultural heritage of the Western Isles. These are at Rhenigidale, North Harris, in the Outer Hebrides. Photo by W. Towers

Left: humus-iron podzol, the characteristic soil under Scots Pine woodland. Photo by C. J. Bown



Above: blanket peat, a valuable habitat for moorland birds and a valuable store of carbon. Photo by D. W. Futtly

habitats is probably the only practical way of ensuring this biodiversity is not lost in advance of obtaining a more informed opinion on its extent and importance. There is potential for using valued or rare habitats as surrogates for below-ground biodiversity and research into this aspect is required.

Conservation designations indirectly provide soils with some protection from activities such as development. However, other threats, such as atmospheric contamination by nitrogen or heavy metals, are very difficult to control and do influence the capacity of the soil to fulfil its nature conservation role. There is evidence that contamination by heavy metals may alter and reduce specific components of the soil microbial community and higher nitrogen levels in nutrient-deficient soils promote invasion of grass species into valued habitats such as heather moorland.

There are some large areas of eroded peat in upland Scotland, for example the Monadhliaths between the Spey Valley and the Great Glen. It is possible that erosion could increase in frequency and severity under certain climate change scenarios such as prolonged dry hot spells



Above: the unique landscape of the machair, here at Kilphedit, South Uist, relies on the protection of the calcareous windblown sands upon which it has developed. Photo by W. Towers

interspersed with intense rainfall. Research has demonstrated that peat erosion is likely to have been triggered by climatic perturbations during the last millennium. It also reveals that other factors, such as heavy grazing or burning, have exacerbated the process. In addition, recent work in England and Wales has shown dramatic decreases in levels of soil organic carbon in highly organic soils over the last 25 years. If this trend were to be also occurring in Scotland, there could be serious consequences for a number of our most valuable habitats, most notably our blanket peats. Research at the Macaulay Institute will help confirm these findings or otherwise in the Scottish context. The report has provided the basis for the development of the Scottish Soils Strategy.

A project group has been established consisting of staff from the Scottish Executive (SE), Forestry Commission (FC), Scottish Environmental Protection Agency (SEPA), Scottish Natural Heritage (SNH), Historic Scotland, Scottish Rural Properties and Business Association (SRPBA), the Crofters Commission and the National Farmers' Union Scotland (NFUS) and it is being used to inform more focussed considerations by satellite groups on the range of topics described in the report. ■

The report *Scotland's Soil Resource – Current States and Threats* can be found at:
www.scotland.gov.uk/Publications/2006/09/21115639/0

Are we really conserving sites for the distant future?

Mick Stanley,
Geodiversity Consulting

Conservation is defined as the wise use and management of a resource and the question in the heading is set in this context.

I remember vividly my first trip to Haute Provence to the first European Conference on Geoconservation at Digne-les-Bains in 1991. Guy Martini of the Réserve Géologique de Haute Provence showed us two sites where an *Ichthyosaurus* was protected *in situ* within a metal and perspex lockable shelter and a roadside site which contained a fibreglass replica. While this did not stimulate an instant study of how to protect sites in Britain, three years on, in 1994, Hull Geological Society launched England's first geological site protected from the elements by an industrial farm building.

Conceived by the Society, with funding from English Nature and the Geologists' Association Curry Fund, and project managed by the late Don Beveridge, the simple structure continues to protect from rain and frost the small but significant exposure of Albian/Aptian chalk on Jurassic sediments at Rifle Butts Quarry, Goodmanham, East Yorkshire.

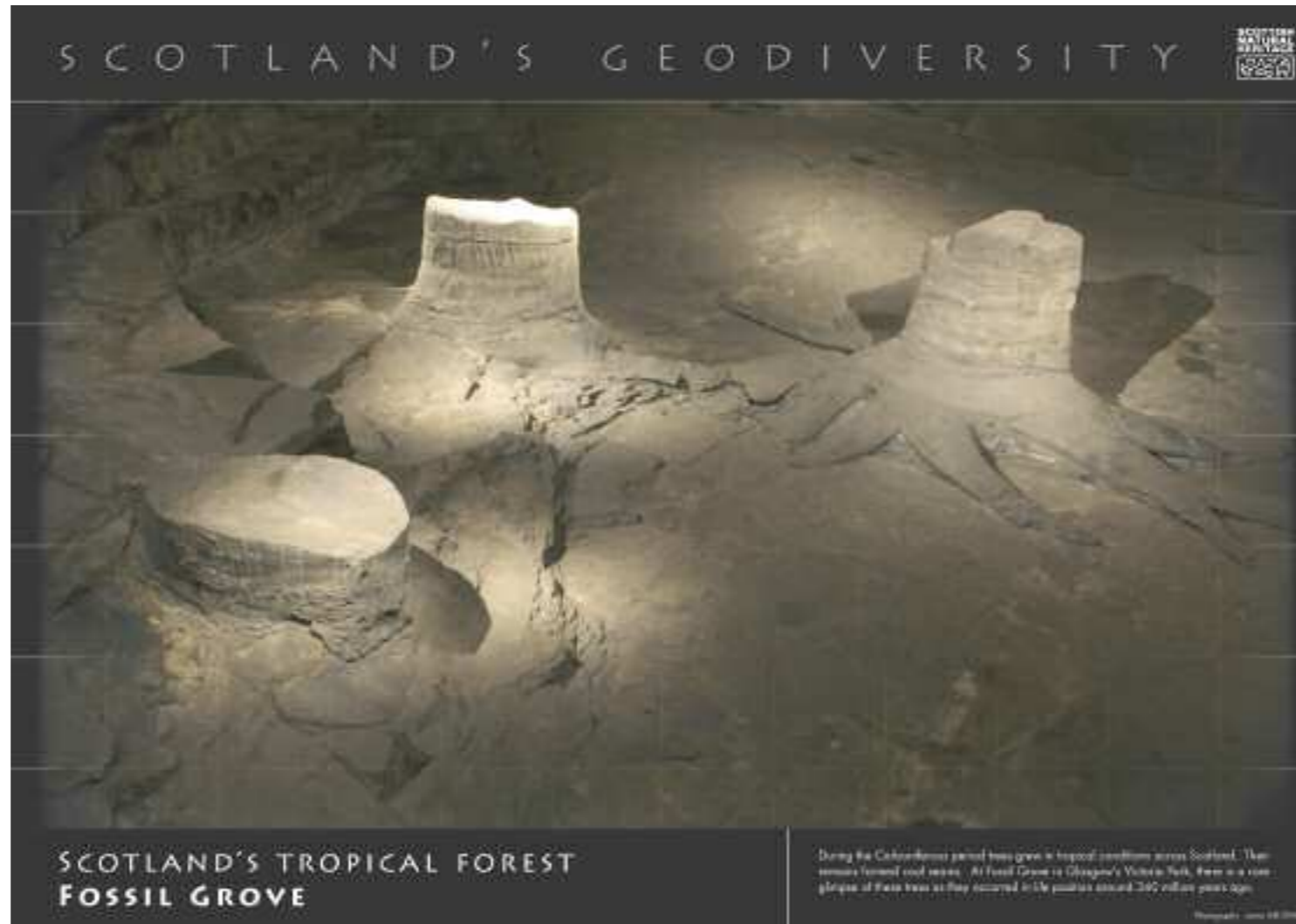
Rifle Butts was the second site protected from the elements in Britain. The first was at Victoria Park, Glasgow, in 1887 when Fossil Grove was excavated and covered to create what must be the world's first fossil visitor centre. It is managed by Glasgow Museums.

These are the only protected sites in Britain that remain open for visits. Wadsley fossil forest, Sheffield (*issue 22, Summer 2004*) is arguably protected by a cover of soil, but is certainly not accessible! One site in Warwickshire has a cover of plastic, but should existing funds be used, or more funds be found, to keep sites like this in good condition and maintain their accessibility? Should we be forever face-lifting and removing natural protective covers?

How much longer will some sites survive without physical protection? It is arguable that the small and limited Rifle Butts exposure would have disappeared by now – 13 years later – had it not been protected from the devastating effects of frost on the fractured Chalk. Every year and for several years up to 1993 members of Hull Geological Society cleaned the low face by removing debris, but it was decided that the exposure would disappear in a few years if the frost continued to force material off the face and the Society continued to remove the debris created.

Protected for 120 years

Fossil Grove has had protection for 120 years, but other equally worthy sites of international importance have no physical protection. Several spring to mind, including the magnificent fossil site of Horn Park featured in *issue 24 of Earth Heritage*. It could be effectively protected in a building like Fossil Grove to encourage the public to visit and learn about stratigraphy, zone fossils and preservation. It would also facilitate research and allow people to



Glasgow's Fossil Grove (top) is an effectively covered site that is also one of the subjects of a new poster series (see page 24). Above, the fossils of Horn Park could benefit from similar measures. Photos by Lorne Gill/SNH and Robert Baron Chandler

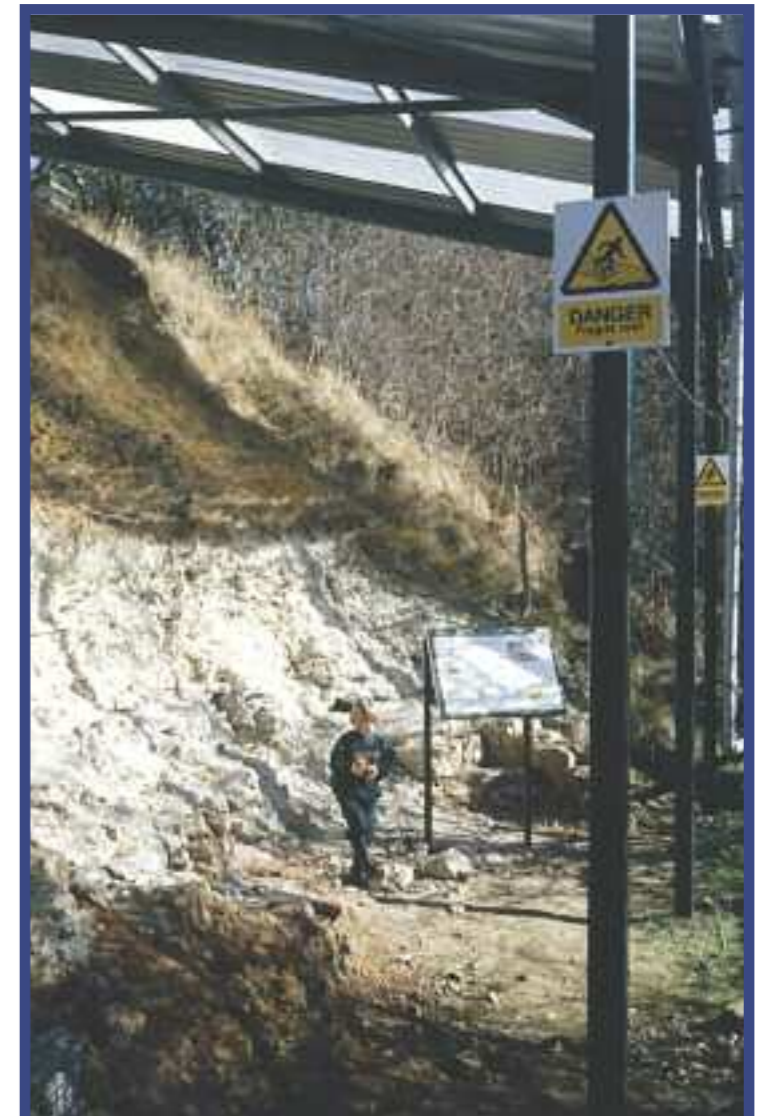
view experts examining the ammonite and gastropod fauna similar to the Dinosaur National Monument Visitor Centre in Utah, where excavation since 1904 has revealed 1,400 *in situ* dinosaur bones. We need to be bold and imaginative in our protection and interpretation and should not continue to hide our science from the gaze of the public.

I am not advocating that all sites are physically protected, but a choice few should be 'conserved' to promote the science, to promote the understanding of fossils, rocks and minerals, and to encourage and raise awareness of their beauty and splendour. Time Team caught the imagination of the public 15 years ago and still maintains a large viewing audience. There is nothing to suggest that a similar programme designed to investigate spectacular fossils, inspiring landscape or magnificent minerals would not also impress.

More sites like Writhlington

We need more sites like Writhlington, where the public can search for and find Coal Measure fossil plants and insects enjoyably, easily and safely. People should not have to travel to deepest Somerset to find Carboniferous plant fossils when there are numerous fossil-rich coalfields scattered across Britain.

Sadly the race to remove all traces of the coal mining industry over the past 41 years since the Aberfan disaster means that spoil heaps are few and far between. Can we have fossil 'dumps' in other parts of Britain that are rich in fossil-bearing strata? What better way to encourage and enthuse new geologists and palaeontologists. ■

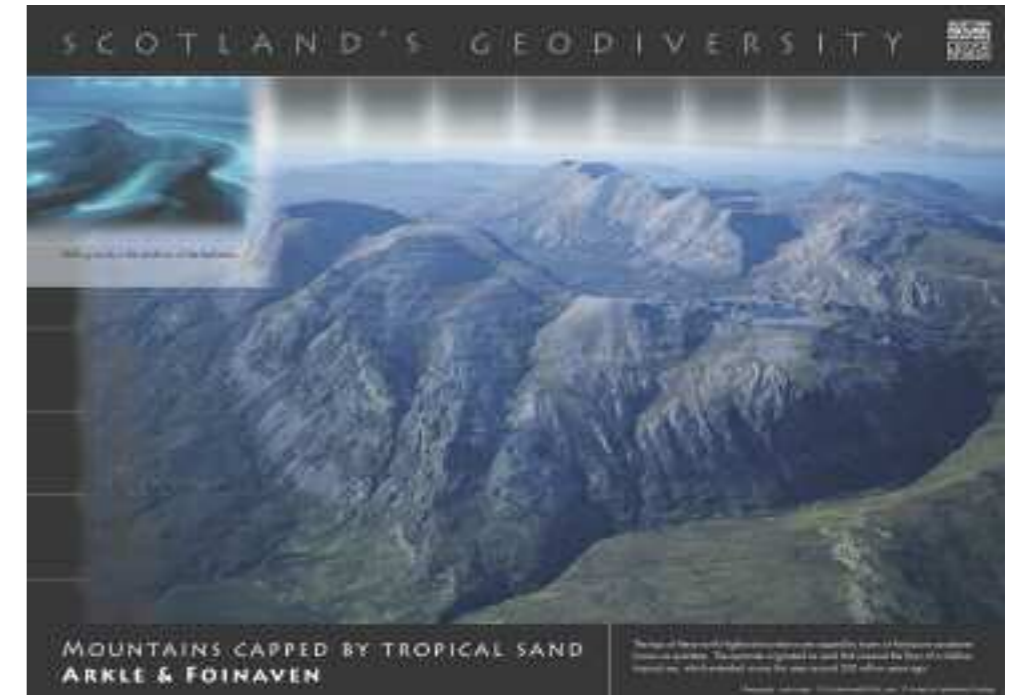


The roof at Rifle Butts SSSI.

Photo by Mick Stanley

Rifle Butts Quarry SSSI was opened in the 1860s and later rented to the local Rifle Club until the 1940s. It was designated as a Site of Special Scientific Interest for its geology in 1952, bought by the Yorkshire Wildlife Trust in June 1964 and excavated by the Yorkshire Geological Society. A new and enlarged exposure was cut by the Nature Conservancy Council and Hull Geological Society informally adopted the site keeping it clean and tidy. In 1994 an industrial roof was erected over the exposure to protect it from rain and weathering at a cost of £6,500, met by the Curry Fund of the Geologists' Association, English Nature and the Yorkshire Wildlife Trust. Permission to visit the site must be obtained from the warden or the Hull Geological Society Secretary (e-mail mj.horne@hull.ac.uk).

The three rock types exposed in the quarry are Lower Chalk of the Ferriby Formation, Red Chalk (or Hunstanton Formation) and Jurassic sediments. This low exposure of three metres compares with other exposures of 100 metres such as the cliffs at Speeton and Buckton North of Bridlington and the quarries at Melton and South Ferriby, either side of the River Humber.



Eye-catching posters are designed to ignite young interest in Scotland's remarkable geodiversity

Scottish Natural Heritage (SNH) has produced a successful range of quality posters, carrying images of dolphins, ospreys, otters, red squirrels and suchlike, used to promote an appreciation of Scotland's biodiversity. Now SNH has published a range of posters designed to raise interest in, and an awareness of, Scotland's remarkable geodiversity.

The images featured on the 12 posters, range from dynamic contemporary environments such as the Culbin sand bar on the Moray Coast, to famous fossils and well-known rocky landscapes such as the Torridonian sandstone mountain of Liathaich, and the ice-sculpted mountains of Northern Arran. In an effort to bridge the gap between the geological past and

today, some posters such as views of Staffa and the mountains of Arkle and Foinaven, contain inset images, illustrating contemporary environments akin to those in which the rocks forming the landscapes were produced. Other posters are simply stunning pictures such as that of billion-year-old gneiss which hopefully provoke thought and stimulate the imagination. The poster of the meandering upper reaches of the River Clyde, as viewed from the air, is intended to challenge the perception of the Clyde as simply the canalised city river.

A poster of Scotland's best-preserved *in situ* dinosaur footprints accompanied by an inset image of a *Megalosaurus*, the animal thought to have produced the prints, and images of limestone

caverns in the Northwest Highlands, promote aspects of Scotland's geodiversity which are less well-known and which are generally more strongly associated with other countries.

Aimed primarily at older school pupils, all the posters carry a quirky or provocative eye-catching title and a simple message revealing a story. It is hoped that they will find their way into classrooms and onto bedroom walls.

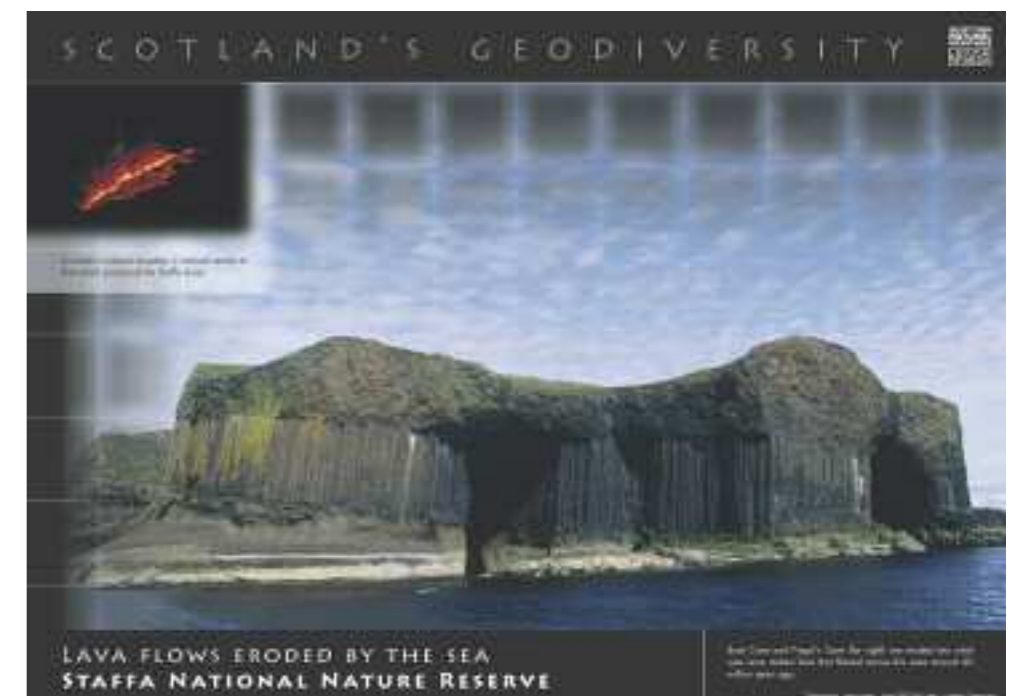
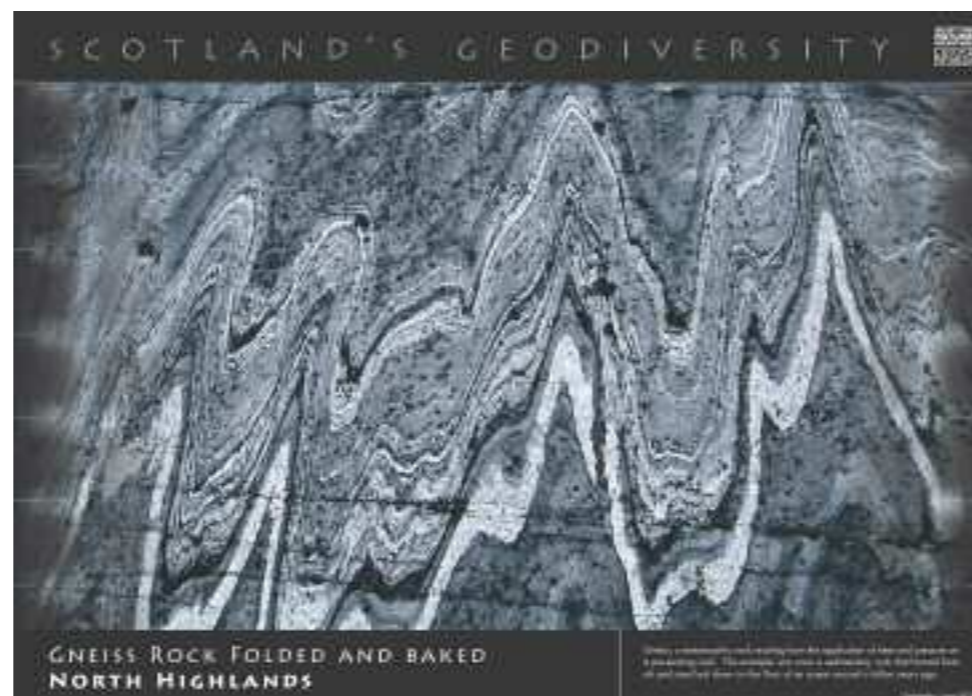
It will be interesting to see how folded gneiss, fossil fish and a Torridon landscape compare to the biodiversity series in terms of arousing public interest. A measure of preferences for particular posters and popularity of the Scotland's Geodiversity

series as whole, may be useful in the design and development of future interpretative products.

– Colin MacFadyen
Scottish Natural Heritage

The Scotland's Geodiversity posters are available on request, free of charge, to schools and other educational establishments.

Please contact:
colin.macfadyen@snh.gov.uk

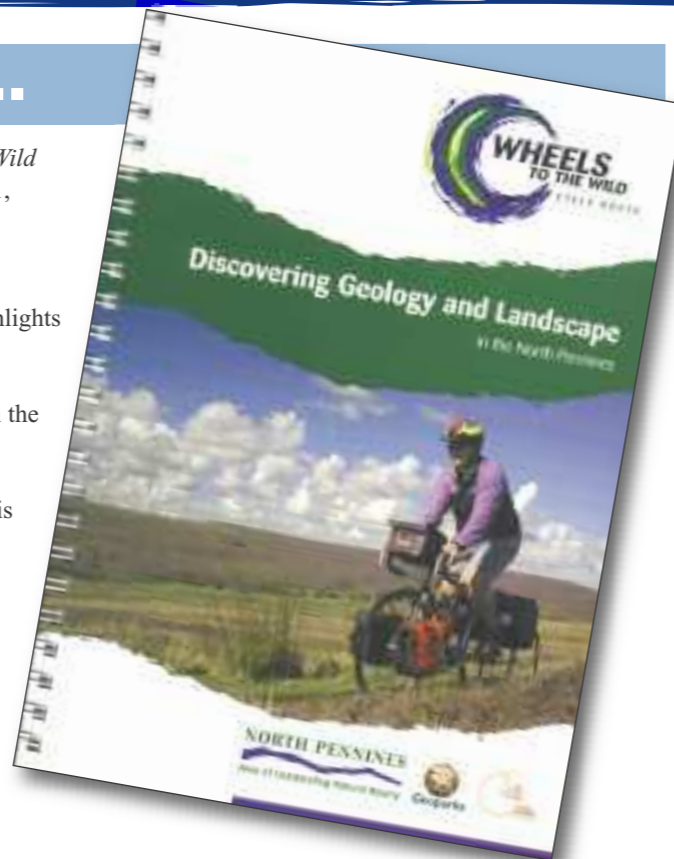


Geology? On your bike...

Discovering Geology and Landscape in the North Pennines. Wheels to the Wild Cycle Route Guide – North Pennines AONB Partnership (tel: 01388 528801, www.northpenninesaonb.org.uk). £5.00. ISBN 0-9511971-4-1.

This lavishly illustrated, weatherproof A5 geological guide provides some enjoyable routes for cyclists while dispensing nuggets about geological highlights along a main route taking three days and three circular day routes, all well-enough mapped within the publication's pages to make it usable without an additional OS map. There's even an accommodation and services booklet in the back to make touring as easy as possible.

The geology and landscape explanations are not hugely detailed; the guide is purposely pitched at a level that cyclists with a casual interest in their surroundings should find worthwhile and understandable. It's an innovative way of extending geology to a wider market and in using geology to extend tourism. Triggered by well-targeted marketing, the initial response to the trail from cyclists has been hundreds of enquiries. See page 6.



RIGS explained

Many *Earth Heritage* readers take the acronym RIGS for granted. However, for the sizeable number of people who have never heard of a Regionally Important Geodiversity Site, help is now at hand in the form of this explanatory leaflet published by UKRIGS.

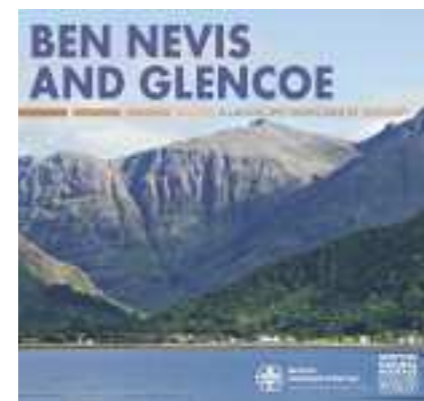
The leaflet is available free of charge via the UKRIGS Executive, www.ukrigs.org.uk



Big Ben's wonders explained

Ben Nevis and Glencoe: A landscape fashioned by geology – Kathryn Goodenough and David Stephenson. Scottish Natural Heritage. £4.95. ISBN 978 1 85397 506 6

The area around Ben Nevis and Glencoe is one of the most popular in the Scottish Highlands. Easy road and rail access brings thousands of visitors



to walk, climb, ski, cycle, sail, canoe, soak-up the turbulent history or just to marvel at the dramatic landscape.

The shapely peaks of the Mamores, fashioned from 700 million-year-old sandstones, contrast with the towering near-vertical cliffs of Glencoe and the north face of Ben Nevis, which exhume the remains of 400 million-year-old volcanoes. But the mountains, deep glens and sheltered sea-lochs were carved by glaciers in the last two million years, with many of the most obvious features only 12,000 years old or less. It is an ideal place to ponder the vastness of geological time and the forces that have shaped the landscape. This book is the ideal companion for doing that. Superb photography, rich graphics and clearly worded explanations give the reader excellent understanding of the area.

The North East Wales RIGS Group (NEWRIGS) has added to its *Walking through the past* series with information-packed geodiversity trails for St Asaph and Llangollen. Each 1/3rd-A4 fold-out leaflet follows the formula that has been successful in a series of other guides to North Wales towns. One particular feature, the geological timescale, provides an instant reference to the age of many of the geological examples on show.

The guides are available at North Wales Tourist Information Centres or from Cynthia Burek, Centre for Science Communication, University of Chester, Parkgate Road, Chester CH1 4BJ, or from NEWRIGS Secretary Wendy Owens, www.newrigs.org.



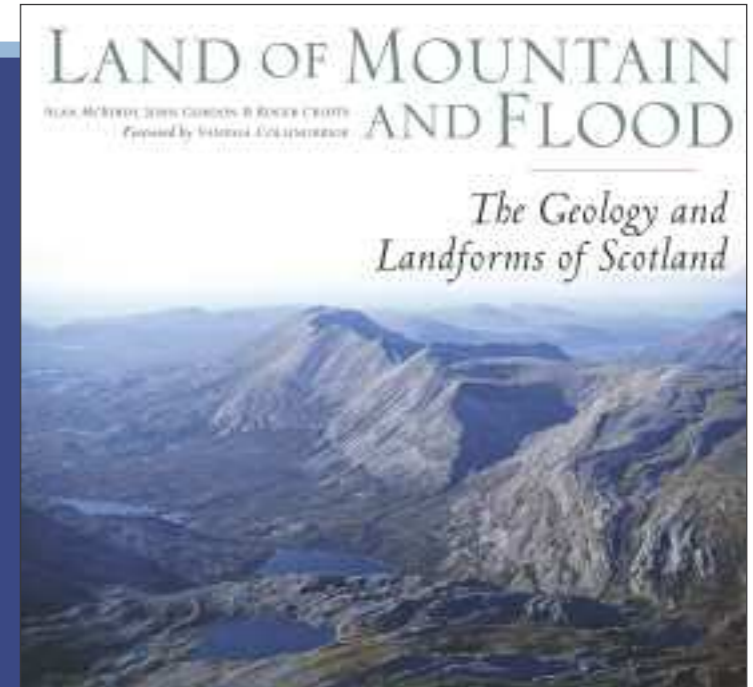
One to treasure

Land of Mountain and Flood. The Geology and Landforms of Scotland – Alan Mckirdy, John Gordon and Roger Crofts. Published by Birlinn. £30.00. ISBN 184158357X

Scotland is justly famed for its wonderful scenery of mountains, lochs, islands, wild rocky places and sandy beaches. The sheer diversity of Scotland's rocks and landforms is a physical reminder of the fascinating journey through time, an exciting geological story which has been 3,500 million years in the making and which is still continuing.

This accessible and well-presented book tells that story, unravelling and explaining the present-day landscape and how it came to be the way it is. It contains a huge amount of detailed information told in clear and comprehensible language supported by clear specially commissioned illustrations, diagrams and photographs.

'This book is guaranteed to reveal the hidden magic of Scotland's landscape' – Vanessa Collingridge



Getting the most out of gentle countryside

Frome Valley Geology & Landscape Discovery Guide – Herefordshire & Worcestershire Earth Heritage Trust. £2.00. ISBN 978-0-9548360-8-5

Visitors may not recognise the gentle Frome Valley as bursting at the seams with geological interest. However, they will quickly change their minds if they see this booklet.

In a radical departure from its well-established 'Explore' leaflet formula, the Herefordshire and Worcestershire Earth Heritage Trust has published a 24-page A4 guide. Rich in photography and clear diagrams, the publication is an excellent guide to the geology around and about the River Frome from its source north of

Bromyard to the point where it joins the River Lugg south-east of Hereford. The Frome flows through a cultivated and wooded landscape where the geological interest is not always apparent, but this guide makes the most of it for the reader.

The Earth Heritage Trust has also extended its 'Explore' series by adding trails around Abberley Village Churches, Clent Hills and a second leaflet on the Malvern Hills. Full colour and laminated throughout, the leaflets are available at £2.00 each. Details at www.EarthHeritageTrust.org or 01905 855184



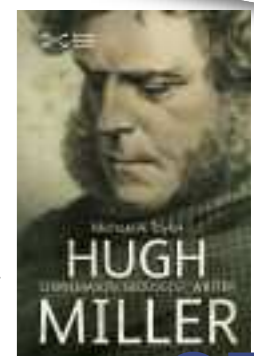
Miller's tale of geological progress

Hugh Miller: Stonemason, Geologist, Writer by Michael A. Taylor (Principal Curator of Vertebrate Palaeontology, National Museums Scotland). NMSE Ltd. (publishing@nms.ac.uk, tel: 0131 247 4083). £12.99. ISBN 978 1 905267 05 7.

Born in Cromarty, Ross-shire, in 1802, Hugh Miller was a self-educated stonemason turned journalist and

geologist. Miller brought many qualities to science, helping to convince worried Victorians that geology was not un-Christian.

This new biography, quoting generous chunks of Miller himself, reveals the man of whom Professor Sir Archibald Geikie FGS, FRS said: "He clothed the dry bones of science with living flesh and blood".



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



South Stack Regionally Important Geodiversity Site, Anglesey – a planned resource for school field trips. See pages 14-15.

Photo by Stewart Campbell