

Earth Heritage

The Geological and Landscape Conservation Magazine



**Voyages in
Deep Time**



**Geosite
maintenance
in the Malverns**



**50 Years of
Earth Heritage**

**Jurassic Coast
Story Book**



**2019 INQUA
Field meetings**



COVER - Dynamic geomorphological sites like Culbin sand spit on the Moray Firth support changing habitats and spectacular scenery, as well as providing a natural defence against coastal flooding. © P&A Macdonald/SNH. These are discussed further on page 20.

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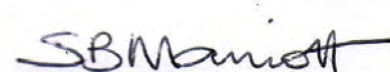
EDITORIAL

Earth Heritage in its current format has reached its golden issue number 50 and with that also celebrates 50 years of being the newsletter and public information 'magazine' of work in the field of geological and landscape conservation. A look back at the articles that appeared in the first few issues of the *Nature Conservancy Information Circular* (appearing in 1968 as the forerunner of *Earth Heritage*) is provided by Colin Prosser in Genesis - *Earth Heritage* Fifty Years ago. The launch, in November 1967, of the geological trail at Wren's Nest National Nature Reserve was mentioned in the first circular and in this current issue Outcrops marks the long-term dedication and handwork of the team at Wren's Nest that was formally recognised by the Geologists' Association.

There are two articles reflecting on 25 years of developments in geological and geomorphological conservation in Scotland that have been documented in *Earth Heritage* since issue number 1 in 1994. These articles highlight the difficulties faced by conservationists over the years due to irresponsible track building, sampling, collecting and hammering. Another silver anniversary is celebrated by Lars Erikstad in his article about ProGEO - The European Association for the Conservation of Geological Heritage, which was founded in Germany in 1993.

As usual *Earth Heritage* is packed with inspirational articles about the work conservation teams are carrying out to help everyone enjoy our geological and geomorphological heritage. Among these, Hereford and Worcestershire Earth Heritage Trust have developed two smartphone apps to help students and visitors learn about their local geological sites. The Jurassic Coast Trust has a new interpretive framework *The Jurassic Coast Story Book* that gives an overview of geodiversity and geoheritage along the Jurassic Coast.

The *Earth Heritage* Editorial Board is already planning Issue 51 and would be very happy to feature articles about both new and ongoing geological and landscape conservation projects. To contribute, please contact the most appropriate editor.



Susan Marriott - Guest Editor

Seeing the rocks for the trees.

In 2017, the wardens at Wren's Nest National Nature Reserve, Dudley, West Midlands, were formally recognised by the Geologists' Association for excellence in geoconservation and facilitation of fieldwork and for the long-term dedication and hard work which they have demonstrated over the last 3 decades (see *Earth Heritage* 48).

As well as presenting individual certificates marking the warden's achievements, the Geologists' Association also made a financial award from its Baker-Arber Fund to help support their work managing the reserve for the benefit of visitors. This award was used by Ian Beech (Senior Warden) and his team to acquire a new chain-saw and to undertake additional associated chain-saw training. The wardens and volunteers have subsequently been very busy removing trees to create new views of geological exposures across the reserve. In particular, they have opened-up a fabulous new view of the enigmatically named 'Fish and Chip Hole' at the southern end of Wren's Nest Hill, revealing the Lower Quarried Limestone Member and Nodular Member of the Silurian Wenlock Limestone Formation. This new view adds further interest to the area of the reserve known as Murchison's View and represents another step in the enhancement of Wren's Nest, improving the experience for geologists and casual visitors alike which come to enjoy the reserve.

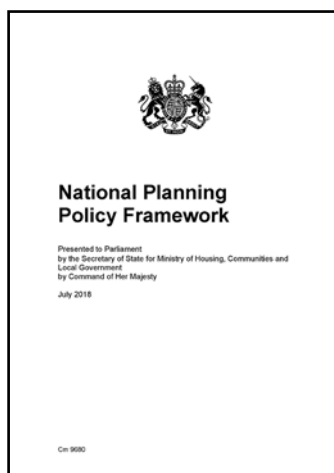
Ian Beech with the newly opened-up exposure in the distance. Photo by Colin Prosser.

Colin Prosser, Geologists' Association & Natural England



All is not lost

Updated planning policy in England weakens support for geological conservation - but all is not lost.



The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied by local planning authorities. In July 2018, the NPPF was updated, including the section on 'Conserving and enhancing the natural environment'. Prior to the update, this section included several phrases about geodiversity. Local planning authorities were instructed that they should be 'protecting and enhancing valued landscapes, geological conservation interests and soils' and that 'to minimise impacts on biodiversity and geodiversity, planning policies should aim to prevent harm to geological conservation interests'.

The July 2018 update names geology / geodiversity twice and still requires it to be protected and enhanced, but gives no further detail within the subsequent paragraphs, which are almost entirely focused on the actions needed to support biodiversity. Specific mention is made of Sites of Special Scientific Interest (SSSIs), which remain protected as before, but the lack of detail generally on geological interests weakens the likelihood of protection for Local Sites.

Built developments, such as this housing scheme near Lowside Brickworks SSSI, are controlled by local plans which are in turn adopted following the guidance set out in the NPPF.
Photo by Colin Prosser.

This could be rectified by the provision of adequate detail in the supplementary documents, known as Planning Practice Guidance (PPG), that are made available to planning authorities. Therefore, several leading organisations in England with an interest in geoconservation have come together to provide the Ministry of Housing, Communities and Local Government with an outline of the essential points that need to be included as the PPG is updated in the coming weeks.



Geological organisations responded individually to the consultation on the NPPF update, and did not achieve the best of outcomes. It is hoped that the combined weight and advice of the English Geodiversity Forum, the Geoconservation Committee of the Geological Society, the Quaternary Research Association, Chalk Rock Ltd., Geoconservation UK and The Geology Trusts, will help Government to understand the value of our geological sites and result in useful content in the PPG.

Julie Harrald, The Geology Trusts

Making geological fieldwork accessible for all

We are often told that the more rocks you see the better geologist you will become. However, for many sites it is not always straightforward for all students to get access to the rocks. Also, over the past decade the proportion of students with disabilities has increased significantly, with the largest proportional increases from students with mental health issues, social or communication impairments, and specific learning difficulties.

As part of the broader *Embedding and sustaining inclusive STEM practices* initiative, a collaborative project between the Open University, University of Leeds and University of Plymouth is looking at developing ways to enable equal opportunities for students with disabilities who study geology, in particular in relation to fieldwork. A recent fieldtrip to Anglesey was designed to explore which methods assist inclusion and accessibility in the field and to develop and share good practice. Planned field-based methods included the use of local wireless networks, video streaming, tour guide audio systems etc. Remote learning methods (for use in a vehicle or back at base) included virtual reality, aerial and hi-res photographs, hand specimens and thin sections.

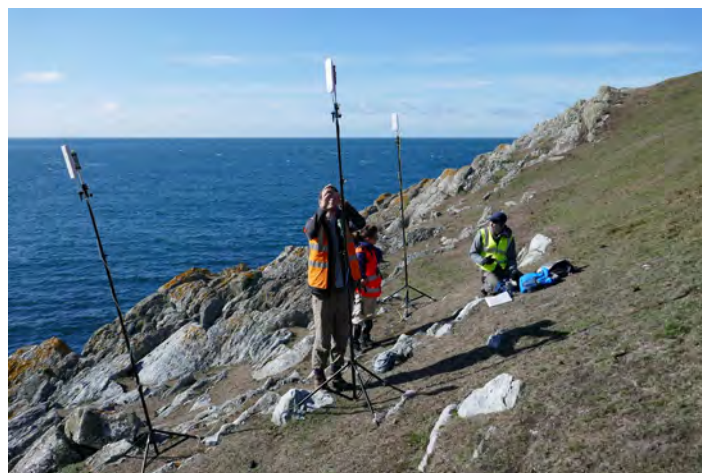
During their fieldtrip the students visited a suite of sites covering Precambrian to Carboniferous geology in order to develop a model for the geological evolution of Anglesey. Localities included the Marquess of Anglesey Column, Rhoscolyn, Lligwy Bay, Red Wharf Bay, Parys Mountain and Llanddwyn Island. In addition to the varied geology the sites offered different logistical and access challenges in coastal and inland localities.

A full-length article on the fieldtrip and its findings will be in the next issue of *Earth Heritage*.

Raymond Roberts, Natural Resources Wales and
Jacqui Houghton, Leeds University



Llanddwyn Island and Newborough National Nature Reserve offered the opportunity to study the famous pillow lavas. Access to the beach was by 4x4 and allowed students to look at the exposures independently. Photo by J. Dunford.



Setting up the wireless technology on the low promontory at Rhoscolyn. Students unable to descend the steep slope were able to see the geology on a live feed as well as joining in with discussions. Photo by Clare Gordon, University of Leeds.

The Garron Slips in Co. Antrim, Northern Ireland. The rotational slips are due to the nature of the contact between the limestone and the underlying Jurassic mudstones, after glacial oversteepening of the cliff. Photo by Michael Dempster/Northern Ireland Environment Agency. For more details, see the article on the INQUA field trips on page 44.



Genesis – *Earth Heritage* Fifty Years ago

Colin Prosser, Natural England

2018 marks 50 years of the ‘magazine’ now known to us all as *Earth Heritage*. Starting as a Nature Conservancy Information Circular in 1968 (the Nature Conservancy (NC) was the first nature conservation agency in Britain and ran from 1949 to 1973), it has evolved through a number of formats and titles (see table), settling as *Earth Heritage* in 1994. Coincidentally, this means that this issue is the 50th issue of *Earth Heritage* in its current format, as well as it being the 50th year of the magazine across all its formats.

So what is *Earth Heritage* (used here to include all of its incarnations over the last 50 years) and what contribution has it made to geoconservation? Quite simply, it has been the vehicle in the UK, but also internationally, through which those interested in geoconservation in its widest sense, have shared news, examples of good practice, legislation and policy updates, research findings and innovative ways of doing things. It has been the ‘flagship’ around which the geoconservation community has rallied, highlighting opportunities to get involved and perhaps inspiring people to take an interest in geoconservation. I, for one, subscribed to the magazine (at the time known as Earth Science Conservation) in the 1980s before being employed in geoconservation. So, given the longevity

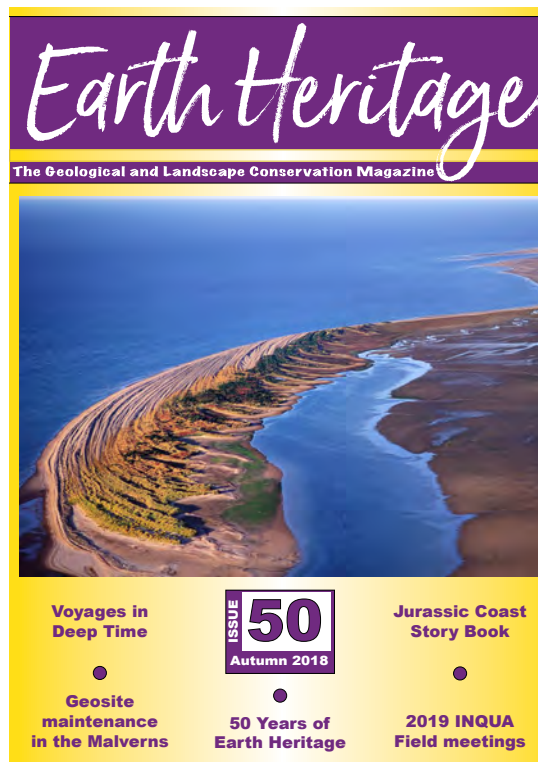
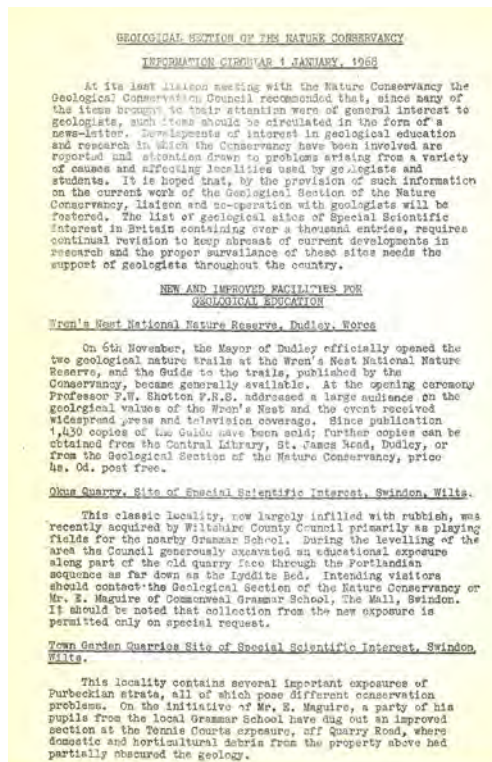
of the magazine, the importance of its role, and its value as a chronicle of 50 years of geoconservation, it is appropriate to mark its 50th year. With this in mind, I have ‘dug-out’ circulars 1 and 2 from 1968 to explore both the origin of *Earth Heritage* and the topics that were being reported on in 1968.

In January 1968, with the Beatles album *Magical Mystery Tour* at Number 1 in the album charts, Information Circular 1, comprising four-sides of typed text held together by one staple, was produced and distributed. Having established a ‘Geological Conservation Council’ some years earlier, the NC, with the aim of bringing its staff together with external geologists to discuss issues of mutual interest, Circular 1 opens by explaining that this Council had realised that topics they discussed would be of general interest to a wider group of geologists. It was, therefore, decided to circulate this information in the form of a newsletter – the birth of *Earth Heritage*. It was hoped that the newsletter would foster greater liaison and co-operation between NC staff and external geologists, and provide a network through which to stay up-to-date on research and ‘developments’ on SSSIs – 50 years on, it’s fair to say that it did just that!



George Black was head of geology with the Nature Conservancy when *Earth Heritage* was initiated in 1968. Photographed at Yellow Craig in East Lothian.
© Natural England.

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The first issue of the Information Circular, issued in January 1968, several typed sheets, mostly covering site-based information. This contrasts starkly with the recent full-colour covers of *Earth Heritage*.

Topics covered in Circular 1 include 'new and improved facilities for geological education' reporting on the launch, by Professor Shotton of Birmingham University, of the geological trail at Wren's Nest NNR on 6th November 1967, enhanced exposures at Bugle Quarry, Aylesbury, and at Okus Quarry and Town Garden Quarries in Swindon, Wiltshire (the latter a result of clearance work by a party of local grammar school pupils), and creation of a 'demonstration centre' at Buckfastleigh in Devon. Access arrangements for visiting Skellow Clough, Lancashire and Kilmersdon Road Quarry, Somerset, are set out, a list of sites where new exposures of potential research interest are likely to be created is given (Mundesley Cliffs – a gas terminal, M4 South of Swindon, and Ullswater and Windermere due to a Manchester Waterworks Scheme), and proposed coastal protection schemes at Pegwell Bay, Kent and Highcliffe to Milford Cliffs, Hampshire and Dorset are announced. Interestingly, coastal protection schemes have continued to come forward at Highcliffe to Milford Cliffs and have featured in *Earth Heritage* a number of times over the last 50 years.

Finally, Circular 1 highlights (in those pre-GCR days) three surveys under way aimed at revising the SSSI coverage (a recurrent theme in *Earth Heritage*), these being a review of Jurassic SSSIs, a review of important sites falling within 'derelict land' including disused quarries – it appears 'tidying' of derelict land was seen as an imminent threat in 1968 and finally, a review of geological SSSI coverage in Devon and Cornwall.

In October 1968, Circular 2 appeared, opening by stating that Circular 1 had generated a number of questions about the NC's 'responsibilities, powers and mode of operation' which it hoped would be answered by an attached leaflet entitled 'Geological conservation for industry, education and research'. An appeal is once again made for information about important localities, explaining that in order to protect them, the NC needs to know about these sites before planning applications are granted which might damage them.

Circular 2 is nine-sides long and provides updates on geological NNRs, noting that 2500 copies of the Wren's Nest trail guide launched in November 1967 had been sold in the first year of its

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publication, that excavations had been taking place at Swanscombe NNR, Kent, and that Ebbor Gorge, Somerset, had been declared as an NNR. It goes on to describe issues at a number of sites, including deflection of a proposal to tip waste in Weydale Quarry, Caithness (the first mention of a Scottish site in *Earth Heritage*). Under the heading of 'General Topics', the circular highlights the existence of the NC's card index on geological literature, arranged by county, which could be accessed on request, and describes a survey of Limestone Pavements of northern England that was under way. Under the heading of 'Education', proposals for a survey to assess where geological fieldwork is taking place is announced; this data would be used in defending the value of sites if threatened, in managing demand for fieldwork, and in determining the culpability, or otherwise, of geological parties accused by landowners of damaging walls, crops and stock. A feature on erosion resulting from students hammering in Pembrokeshire, and a call for teaching of conservation in geology departments to help reduce such damage, represent the first consideration of Welsh sites in *Earth Heritage*.



First notified in 1955, Ingleborough SSSI is particularly noted for its extensive limestone pavements, dry valleys and gorges, shakeholes and sinkholes. A survey of this site in 1965 led to a much wider survey of limestone pavements across the north of England in 1968. Photo by Countryside Agency/Simon Warner.

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The importance of road cuttings for geoconservation and scientific research has been reported many times in *Earth Heritage* magazine and its predecessor publications. One example is the Swansea bypass and the extension to the M4 at Earlswood near Briton Ferry, first alluded to in Circular 2 in 1968. By issue 32 of *Earth Science Conservation* in 1993, readers were able to see a map, cross-sections and photographs to enhance the descriptions of the local geology. Importantly, the extension to the M4 cut through a GCR site selected as the best available section through deltaic facies of the Upper Carboniferous Lower Pennant Measures. The new cuttings, seen here during construction works in May 1992, provided excellent dip and strike sections and the potential to study parts of the succession not previously visible within the site. The site was consequently re-notified as an SSSI to include the new exposures. Photo by Stewart Campbell, CCW.

Further reading

Download pdfs of Information Circulars or Earth Science Conservation at:
www.earthheritage.org.uk/earth-heritage-circulars/

Evolution of Earth Heritage

Title of 'magazine'	Volumes	Year	Produced by
Information Circular	1 - 5	1968 - 1970	Geology Section of the Nature Conservancy
Information Circular	6 - 14	1971 - 1978	Geology and Physiography Section of the Nature Conservancy (Nature Conservancy Council from volume 9, 1974)
Earth Science Conservation (A5 format)	15 - 22	1978 - 1985	Nature Conservancy Council
Earth Science Conservation (A4 format)	23 - 33	1987 - 1993	Nature Conservancy Council until volume 28, 1990; country conservation agencies Countryside Council for Wales, English Nature, Scottish Natural Heritage from volume 29, 1991.
<i>Earth Heritage</i> (numbering of volumes starts again)	1 - 50	1994 - present	Expanding editorial board including the country conservation agencies (now Natural England, Natural Resources Wales, and Scottish Natural Heritage), The Geologists' Association, the Quaternary Research Association, and at times representatives from GeoConservationUK, the Geology Trusts, JNCC and other independent interested parties.

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The circular concludes with a large section on research undertaken on exposures created during road schemes, including on the M5 north of Bristol, Elloughton Bypass, near Hull, the Swansea Bypass, Crickley Hill, Gloucestershire, and possible sections on the proposed M40 linking London and Oxford. Anyone wishing to access motorway exposures are encouraged to contact the NC, who would direct their requests through appropriate channels, but it is pointed out that this offer does not apply to educational parties as the authorities 'are still cautious over letting single individuals walk on the hard shoulder, and will not countenance parties of more than two or three'; another world in terms of health and safety! Finally, there is brief discussion of research opportunities arising from sinking of pipelines and access to temporary sections, and a commitment that the NC will highlight such opportunities in the circular, despite there being no long-term conservation interest.

In summary, the origin of *Earth Heritage* stemmed from the desire of the statutory conservation agency of the time to inform and stimulate two-way engagement with the geological community. Whilst the content in 1968 and 2018 is similar in many ways, updating readers on threats to sites, research digs, site enhancement and access arrangements to support education, there is a different emphasis between then and now. In 1968, identification of sites of importance, research opportunities arising from temporary sections resulting from road building, pipe laying and general construction, and managing the impacts of damage arising from student fieldwork have a higher prominence than they do today. In 2018, there is a much broader geoconservation community, now reflected in the magazine's editorial board, which is generating varied content relating to local geological sites, community engagement, UNESCO Global Geoparks and World Heritage Sites. This gives *Earth Heritage* a breadth, richness, appeal and relevance that is much wider than the research and geological education focus of 1968. In short, *Earth Heritage* has been a major pillar of geoconservation for 50 years. It has continually evolved to reflect contemporary challenges and opportunities but it still does what it set out to do 50 years ago but for a far wider audience. It surely has an important role to play in *Earth Heritage* conservation for many years to come!



Issue 31 of *Earth Science Conservation* (1992) carried a feature – Pant-y-llyn – the first Welsh turlough? - exemplifying the role of the magazine in publicising new sites, research and geoconservation issues. This feature was the first comprehensive description of the ephemeral lake at Pant-y-llyn, near Ammanford in South Wales, and of preliminary research at the site. The potential threat of proposed quarrying activities to the hydrological function of the turlough was also raised. Here, the dry floor of the turlough at Pant-y-llyn is seen in July 1995. The estavelle through which the turlough fills and drains is seen in the lower centre of the photograph. The stage board (far left) was installed to provide continuous measurement of the turlough's filling and drainage cycles through the seasons. Photo by Stewart Campbell, CCW.

A 25-year journey in geodiversity conservation and promotion in Scotland

Colin MacFadyen, Scottish Natural Heritage

Reflecting on three items in the first issue of *Earth Heritage* illustrates the developments in geodiversity conservation and promotional activity in Scotland that have taken place in little more than a generation.

Developments in the conservation management of the best and most representative aspects of Scotland's geodiversity

An item in issue 1 (*Earth Heritage* 1, page 25) reported on the discovery and efforts to provide a continuous and permanent exposure of one of Britain's rarest rock types at the side of Loch Urigill in the Northwest Highlands. Known as carbonatite, and thought to originate from a melt derived directly from the mantle, this exceedingly rare rock was discovered as loose blocks scattered at the loch-side. The project to reveal an actual *in situ* exposure of the carbonatite was a partnership effort undertaken by Edinburgh University with support from Scottish Natural Heritage (SNH) and with the agreement and cooperation of the local authority and Forest Enterprise.

What this work demonstrated was the ongoing research interest in one of the world's most celebrated igneous intrusions – the Loch Borralan intrusion. Of international importance and being the only plutonic igneous complex composed of silica-undersaturated rocks in the British Isles, the Loch Borralan intrusion was selected as one of Britain's Geological Conservation (GCR) sites. The

The last 25 years in a nutshell

In the last 25 years the statutory network of protected geological sites has been maintained with the GCR as its high quality dynamic heart. The network has benefited from advances in management through site documentation and site condition monitoring with codes of conduct for fossil collecting and coring helping to encourage responsible use of the geological resource. Voluntary conservation activity has developed considerably with more enthusiasts than ever before getting involved in geological conservation with the establishment of geoconservation groups. There are now over 100 Local Geodiversity Sites in Central Scotland. Voluntary promotional activities have extended to the creation of Geopark projects and there are currently two UNESCO Global Geoparks in Scotland. Social media is having an increasingly significant role in bringing the geodiversity to a wider audience. With the value of geodiversity to tourism now established its wider role to society as an integral and vital part of our environment, economy and future sustainable development, as set out in Scotland's Geodiversity Charter, is also finally being realised. The Scottish Geodiversity Forum, a bulwark for voluntary geoconservation and promotional activity, is widening the profile of geodiversity beginning to influence national and local policies. Crucially the Forum is connecting people with geodiversity with projects such as the '51 Best Places' (*Earth Heritage* 49, page 30).

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scientifically rigorous evidence-based GCR is a high quality and dynamic network in which every site selected is of the highest conservation value meriting statutory protection as a Site of Special Scientific Interest (SSSI). Given the GCR's underpinning of the geological SSSI network, SNH, at the time of issue 1, had just embarked upon a major project that aimed to document each and every GCR site in Scotland such as the Loch Borralan intrusion. The objective was to provide documentation that would describe the site in plain English, identify the most important areas of the site, identify key management issues and include a catalogue of images. These 'Earth Science Site Documentation Reports', that became known informally as 'Site Doc' reports, allowed the non-specialist reader to understand the essential interest of the site, be able to identify it and have an understanding how it should best be managed. The reports became and remain essential management tools used by SNH staff dealing with development and other proposals. Today only a few sites remain undocumented with reports continuing to be prepared for new sites that are added to the dynamic updateable GCR network.

The 'Site Doc' reports became additionally important in that they formed the baseline for Site Condition Monitoring (SCM) of the SSSI that had an underpinning GCR site including many SSSIs that had mixed biological-geological interests. The photographic record contained within each report proving invaluable in the determination of how a site was fairing. There have been three cycles of monitoring that has helped guide management of particularly threatened sites. Interestingly the types of development affecting sites have increased since issue 1 with small (micro) hydro and windfarm renewable energy projects becoming significant.

77% of Scotland's GCR sites have statutory protection though designation as SSSI. It is hoped that the other 23% will in due course receive a measure of safeguard an aspiration being to try and secure material consideration of the remaining unprotected GCR sites in Scottish Planning Policy. By this means should any activity arise that threatens the integrity of the site it could be possible to find a workable solution. In this way it is hoped that the internationally important and incredibly rare rocks of Loch Borralan intrusion will be adequately safeguarded and remain exposed with a little help from its 'Site Doc' report.



An intertidal rock platform on the Isle of Arran. Internationally important for exposing Triassic reptile tracks, the best examples have high conservation value meriting addition to the Geological Conservation Review (GCR) site register. Such locations attract the interest of local people and tourists alike. Geodiversity gems are being utilised by The Arran Trust to connect people with geodiversity and boost the local economy through the Isle of Arran Geopark Development project. © Lorne Gill/SNH.



One of the entrances to Alva Silver Mine, a GCR site in Central Scotland, the location of the largest native silver deposit in the United Kingdom. Over the period it was worked, in the eighteenth century, it is estimated that it yielded 5-6 tonnes of silver. Lacking statutory protection the site may be safeguarded through revision of Scottish Planning Policy. © Colin MacFadyen/SNH.

Milton Ness SSSI, a geological SSSI underpinned by two separate GCR sites, Non-Marine Devonian and Quaternary of Scotland the former only relatively recently being added to the GCR. Both interests were documented as part of the SNH Earth Science Site Documentation project. The project delivered a powerful management tool that has provided the baseline for SNH's SSSI Condition Monitoring duty.
© Colin MacFadyen/SNH.



Connecting people with geodiversity - the burgeoning of voluntary geological conservation and promotional activity

An article in the first issue (*Earth Heritage* 1, page 27) reported on the attempted restoration of an accessible and usable section in a disused sand pit in Edinburgh. Comiston Sand Pit south of the City centre provided a superb example of a substantial glacial erratic resting above glaciofluvial sands and gravels. Natural regeneration and degradation of the pit had all but obscured the erratic and the article focussed on the efforts in 1993 to reveal, through SNH funded excavation, the base of the lava erratic and sands below. The article ended seeking advice on maintaining a section for education and research in unconsolidated deposits.

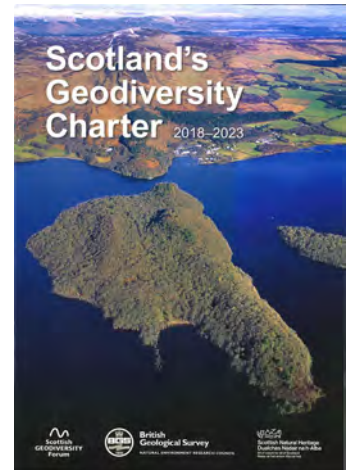
The article highlighted partnership effort involving volunteers, SNH, local authorities and conservation bodies, the pattern for a geoconservation and geodiversity promotional activity, which has been the cornerstone for many achievements in the subsequent 25 years.

Around the time the article was being written Regionally Important Geological/Geomorphological Sites (RIGS) groups were becoming established with the aim of conserving sites which merited conservation management. In Scotland there was a distinct focus on preparing interpretive material for RIGS, most usually in the form of leaflets to provide an accessible overview of the geodiversity interests for the general public. With the arrival of the term 'geodiversity' there was a name change to Local Geodiversity Sites. Organised geoconservation activity has now advanced to the point that geodiversity audits that are incorporated into Local Development Plans that can serve to conserve and promote geodiversity, have been prepared for some local authorities, such as City of Edinburgh Council.

Since issue 1 there has been the recognition that geological highlights and 'gems' in Scotland could be promoted as Geoparks and voluntary effort led the way in seizing the opportunities that promotion of the geodiversity can bring in stimulating local economies. Today Scotland has two UNESCO Global Geoparks and other aspirant Geopark projects.

Voluntary activity has made a significant contribution to the series of Scottish Geology Festivals and the creation of www.scottishgeology.com. The website was the first portal to Scottish geology on the web, sharing geological heritage information and connecting people with geodiversity. Smart-phone apps and other social-media platforms spread the word about Scotland's geoheritage often as a resource to be visited and enjoyed from the aesthetic perspective. In 2017 there was the launch of the '51 Best Places' to see Scotland's Geology: a network of classic sites that offers scope for considerable further development for geotourism development in Scotland.

Continuing the theme of increasing awareness of geodiversity, and making it more relevant and accessible, in 2010 the Scottish Geodiversity Forum was established to present a Scotland-wide



Front cover of the Scottish Government endorsed 2018-2023 Charter which is a world first. The Charter sets out a vision 'that Scotland's geodiversity is recognised as an integral and vital part of our environment, economy, heritage and future sustainable development to be managed appropriately and safeguarded for this and future generations'.

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Front cover of the leaflet promoting events taking place during the 5th nationwide 'Scottish Geology Festival'. After a long break, in part due to difficulties associated with the economic downturn, the new 'Scotland's Geoheritage Festival' was facilitated by the Scottish Geodiversity Forum in October 2017 forming an appropriate backdrop to the launch of the '51 Best Places' to see Scotland's Geology. The '51 Best Places' represents the most significant geotourism development in Scotland in 25 years and is all due to the hard work and dedication of volunteers.

united face for voluntary conservation and promotional activity with SNH, BGS and others having an advisory input and supporting partnership effort as required. In 2012 and 2017 significant milestones were passed with the launch and subsequent re-launch of Scotland's Geodiversity Charter, a world first, that promotes the recognition of the vital contribution geodiversity makes to the economy, society, cultural heritage and the rest of nature. With 88 signatories the aspiration is that the role and value of geodiversity becomes increasingly better recognised.

Voluntary geoconservation and promotion has evolved considerably from ad hoc restoration of sites such as Comiston Sand Pit in Edinburgh. As for Comiston, which is now a Local Geodiversity Site, the challenge remains of maintaining an open and permanent section, for all to see, in loosely consolidated sandy deposits. However, with technological development we shall see what can be achieved in the next 25 years!

Enhanced efforts to ensure a resource for all in the future – the promotion of responsible collecting and sampling

A short item by the author at the end of *Earth Heritage's* first issue highlighted the quandary that may be faced by geologists concerning rock and fossil material collected during their geologically formative years, often as curios, sometimes little more than mementos of a particular locality or field trip. An approach taken by the author was to 'recycle' such collections by putting specimens that would otherwise be discarded to good use by means of donation to a local geology club or school. The author put some specimens collected during trips to various volcanoes on a tour of local libraries prior to being given away to a geo-enthusiastic youngster. What was not aired in the article was the point that much of the material students remove from the field should not really have been collected in the first instance. Until the publication of the Geologists' Association 'Geological Fieldwork Code', in the late 1980s, there was little in the way of guidance for individuals and groups regarding responsible activity in the field. It was quite normal for student parties visiting localities to 'sample' and sometimes treat rock exposure without regard for the resource and other users that would follow. There were few if any voices that attempted to ameliorate needless rock hammering and sampling and defacing of rock faces.

An extension of this has been the most unfortunate and disappointingly selfish actions of some researchers whose sampling ethos has had a long-lasting and detrimental impact on rock exposure particularly those that have utilised small-diameter core drilling machinery. This type of irresponsible activity has been ongoing for decades and the effects have become cumulative. However, it is probably irresponsible fossil and mineral collecting, sometimes on an industrial scale, that eclipses any other non-developmental damage to our geoheritage. These conservation

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issues have been tackled during the 25 years of *Earth Heritage* with many of the efforts being featured in the pages of the magazine.

It was in responding to thoroughly irresponsible and reckless collecting at vulnerable fossil locations, such as Shiel Burn and Birk Knowes SSSIs in south Lanarkshire, that were largely responsible for the Nature Conservation (Scotland) Act 2004 giving SNH the duty to prepare the Scottish Fossil Code. This, the world's first national code of its type, has helped promote responsible fossil collecting.

Large-scale quarrying of vulnerable fossil resources for selfish and possibly commercial ends, such as the removal of Devonian stromatolites from Orkney, are becoming quite rare events. Following publication of the Scottish Fossil Code the Scottish Core Code was produced and widely circulated. Based on the aforementioned Geologists' Association guide the Scottish Core Code has been too late to save some classic outcrops from being defaced including globally significant Precambrian glacial deposits on the Garvellach islands. However, the Code will hopefully bring about a more responsible attitude by new generations of researchers. The core sampling issue is still with us but attention is now being given to developing methodology for restoring core-affected faces at classic localities.

The messages that collecting just for the sake of it, destroying vulnerable fossil resources and drilling and sampling without due care and attention is unsustainable and simply unacceptable are hopefully now being heard, particularly to those that are educating students and setting an example.



Graffiti created by geology students of many a UK Geoscience department is now weathering from a superb example of an exposed fault plane in marble within the Strath SSSI, Skye. This is an encouraging sign that the promotion of codes of conduct in recent years may be starting to encourage sustainable and responsible use of the geodiversity resource to ensure that it is not defaced and treated as a personal resource by individuals. © Colin MacFadyen/SNH.

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Fossil collecting at Achanarras. The Scottish Fossil Code encourages the responsible collection of fossil material with the aim of maintaining a resource that can be used well into the future. There are similar collecting pressures and conservation challenges concerning mineralogical sites but reaching agreement on how best to safeguard mineralogical resources has proved problematical. In time there could be a legislative direction to prepare a mineral specimen collecting code. © Ian Sargent/SNH.

A glimpse into an uncertain future

Currently world leaders including Scotland's First Minister are becoming mindful of the value of natural capital which will be vital for a resilient 21st century society. Geodiversity is a crucial element of our natural capital and in the years ahead its role and contribution to a society, facing up to and dealing with climate change, is probably assured. However, human nature as it is will mean that there will probably always be a place for the conservation management and protection of the best and most representative elements of our geodiversity. This could be particularly challenging as adjustments to infrastructure, to take into account rising sea level, and other factors associated with a changing climate, will have an impact. As the GCR network adjusts and develops, in the years ahead, future monitoring of special sites and areas may take advantage of likely advances in monitoring technology and recording as evidenced by projects such as e-Rock (<https://www.e-rock.co.uk/>). Such data gathering, and its public availability, will provide a powerfully practical and educationally useful tool. In turn this will hopefully encourage the outdoor multi-sensory experience of actually visiting the geoh heritage in its natural habitat. Despite the uncertainties ahead we can perhaps look forward to enjoying the Scottish Geodiversity Forum's recommended '200 Best Places' to experience Scotland's geodiversity.

Progress in conserving our geomorphological heritage in Scotland

Vanessa Brazier, Scottish Natural Heritage, **John E. Gordon**, University of St Andrews, **Alan Werritty**, University of Dundee and **John McManus**, University of St Andrews.

Twenty five years ago we wrote in *Earth Heritage* about the Scottish experience of conserving nationally and internationally important geomorphological sites (designated as Sites of Special Scientific Interest, selected through the Geological Conservation Review, Table 1 on page 16), and identified the main groups of threats to the survival of both dynamic land systems and inactive assemblages of landforms and deposits. The objective for dynamic systems was to conserve the land-forming environment, rather than individual ephemeral landforms. In contrast the objectives for conserving static sites were more complex, depending on the extent of the resource, but following the principle that these features were being conserved on behalf of both science and society. The approaches we described in 1994 are largely adopted as routine now, but at the time they were radical as they pointed the way to adopting a landscape-scale approach for effective conservation, for example at a catchment or coastal cell scale.

Since then, two significant drivers have helped to embed these approaches and enhance the conservation of geomorphological sites and features: 1) the development of natural approaches to flood management; and 2) the recognition of the scenic value of geomorphological landscapes both for geotourism and as iconic places to visit promoted through visual arts and social media.

The development of natural approaches to flood management

The challenges facing river conservation in the early 1990s, a time of unprecedented flooding, demonstrated the need for integrated catchment management. At that time, river works were often initiated by individuals in response to localized needs or desires (such as building fishing croys), rather than as part of a coordinated catchment scale approach addressing common issues such as flooding and erosion. Since then there have been significant changes in the organisations, roles and responsibilities across all sectors responsible for delivering improved management of coasts, rivers and now latterly the uplands. There have been significant improvements in the way rivers and coasts are managed, heralded by the founding of the Scottish Environment Protection Agency (SEPA) in 1996 and supported by legislative changes (e.g. the adoption of the Water Framework Directive in 2000 and The Water Environment (Controlled Activities) (Scotland) Regulations 2011), which together have brought about integrated river basin management planning and licencing for river engineering works. Although not perfect, these changes have brought consistency to the management of rivers and coasts, where major climate-driven threats of flooding and



A family enjoying Bonnington Linn at Falls of Clyde. A tourist attraction for Victorians in search of awe inspiring landscapes, the location is equally popular today. ©beckyduncanphotographyLtd/SNH.

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Dynamic geomorphological sites like Culbin sand spit on the Moray Firth support changing habitats and spectacular scenery, as well as providing a natural defence against coastal flooding.
© P&A Macdonald/SNH.

erosion can be assessed and responded to in a more strategic way. The repeal of the 1941 Land Drainage Act in 1999 reflected changing priorities with the need for better flood storage outside towns and cities, after a spate of floods in the early 1990s. Dredging and remodelling of specific ‘statutory’ river channels like part of the upper Clyde near Carstairs, and managing flood banks are no longer bound by law on specific rivers. There is better acceptance that floodplains should be used for flood storage, arising from The Flood Risk Management (Scotland) Act 2009, with Scottish Government supporting a sustainable flood management group and research into natural flood management. Our understanding of our dynamic coasts has also improved. The Dynamic Coast project presents a GIS resource of historical coastline evidence and predicted configurations of the soft sediment coastline, in support of the Climate Change (Scotland) Act 2009.

Importantly, these changes have brought benefits for the geoconservation management of active river and coastal systems and their associated landform assemblages as they all accommodate a degree of natural rates of change, and construction and destruction of ephemeral landforms. Giving space for nature to move, recover and evolve has become the mantra of managing dynamic geomorphological environments in a changing climate.

Of course flooding remains a significant and widespread problem, and the pattern observed by us in 1994 of increased flood frequency has continued. Natural flood management has been promoted by Scottish Government as an alternative to traditional land drainage methods, but as the Tweed Forum has noted, there needs to be much metaphorical bridge building between those who manage the land, and those who regulate rivers, to achieve real change on the ground. Their intensive studies of pilot projects in the Tweed catchment demonstrate the benefits to people and nature from restoring straightened channels and planting trees (Eddleston Water, Scottish Borders), as have the inclusion of flood storage areas in urban planning (White Cart flood prevention scheme, Glasgow).

Change has also come to the management of upland environments, particularly the restoration and regeneration of areas of native woodland, and the increased number of tracks to access renewable energy generation on windfarms and small scale hydro schemes, and for sporting estate

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development. From a geoconservation perspective, the most significant threats to some of our relict landforms have been from track building, cutting through landforms. The obscuring of whole landform assemblages is another significant but benign change, which has been most noticeable in the unnaturally treeless uplands, where woodland regeneration has been most successful. Pines germinate and grow most prolifically on disturbed bare ground, particularly gravel and shingle bars, and degraded river banks. It remains to be seen how these dense thickets of young native trees cope with flooding and channel changes, and if they modify the active floodplains of wandering gravel bed rivers. On open hillsides areas of woodland management have had greatest visual impact on geomorphological interests where woodlands have been fenced and unmanaged. On the highest ridges, summits and plateaux the pressure of people and grazing animals provides local stresses to the vegetation cover, and in some cases has either interfered with active periglacial processes through trampling, or exposed the organic soil to erosion. The peatland action project funded by Scottish government is providing benefits for Quaternary geoconservation interests, with better peatland management.

Sgurr nan Gillean on the Cuillin Ridge Skye with peatland in the foreground from Sligachan. This is a landscape underlain by hard igneous rock and sculpted by glaciers. It is popular with tourists searching for the sublime landscape thrill, which has moved on from the Victorian 'Grand Tour' to the desire to capture personal dramatic photographs to share on platforms like Instagram. The Instagram #Highlands alone has over 1 Million posts, with 250,000 posts for the #Munros, 750,000 just of #Skye alone. ©Lorne Gill/SNH.

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Recognition of the scenic value of geomorphological landscapes

Scottish Government (2014) states that: 'our principal asset is our land' and that Scotland has a 'world class environment – our nature and culture are inextricably linked'. Scotland is a place for living and enjoying the landscape, by local people and visitors alike. It is indeed a bold statement, but it is fundamentally true. It also reflects the distance we have come in 25 years, where our focus was on site management. The wider view now is of a living landscape and, remarkably, geodiversity is seen as an integral part of that landscape. We say remarkably, because for so long geoconservation has been relegated to a niche interest at the margins of mainstream conservation. However, the seeds of the current vogue for scenery go back a long way (Gordon and Kirkbride 2009).

In the 1800s the Victorians discovered travel for pleasure in an age where thrill seeking became a leisure pursuit. The Victorian tourist travelled around Scotland and grew giddy at the sight of towering mountains, raging rivers, plunging waterfalls and the all-powerful coast. Today we see a second wave of this enthusiasm for the awesome and windswept landscape focused again on many of the same sites that the Victorians loved, which are coincidentally some of our most enduring geoconservation sites.

The Clyde Meanders is a highly dynamic geomorphological river and floodplain, providing many challenges for practical conservation management as the centre line of the river typically constitutes the land ownership boundary. Over the last 25 years floodplains have been valued for natural flood management, where water is retained away from cities. Formerly low-lying land was protected from and cleared of floodwater as fast as possible under the provisions of a now repealed land drainage act. ©P&A Macdonald/SNH.



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Scotland's scenery is one of the main attractions that underpin Scotland's contemporary tourism industry, which generates an incredible £12 billion of economic activity a year (Scottish Government, 2015). So from a wider landscape perspective, there is a boom in scenic tourism, but does it have any benefit for geoconservation? A brief and bruising look at Trip Advisor and Instagram reveals that many of our geosites are valued for their drama, but unlike the Victorians there is little comment by the modern tourists to indicate any noticeable contemporary curiosity about their formation or scientific significance. Today, valuing our static and dynamic geomorphology has two divergent audiences, with popular and voluble interest in the scenic qualities of dramatic places, and a second but steady support from the voluntary and scientific communities who value the scientific interests of Scotland's geoheritage. Does the fact that these sites are designated matter to the scientific community? The support for the 2015 public petition for the retention of the National Nature Reserve in Glen Roy would suggest that both the scientific community and the interested public really do care about how we protect our geomorphological heritage, no less so than they have done in the past. Indeed over the last 25 years (see pages 16-17) there have been many walking festivals, pamphlets, guided walks, educational visits, and booklets like the Landscape Fashioned by Geology series that have successfully popularised geoconservation interests of landscapes. Public engagement by a few is not long lasting, and while the growth of voluntary geodiversity groups that support the Scottish Geodiversity Forum is encouraging, geoconservation is not mainstream, nor is it likely to become so unless we change what we do. Yet what is managed through geoconservation has a fundamental impact on the way we live. Improvements in site management in how we manage our rivers and coasts are for the benefit of people, as well as for geodiversity and biodiversity. We are now part of a more holistic approach to these sometimes challenging aspects of our celebrated landscapes. It may be timely to engage in a wider debate about whether alternative conservation solutions in addition to SSSIs might be appropriate to meet the needs of a changing world.

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ProGEO's silver anniversary: 25 years dedicated to geoconservation

Lars Erikstad, ProGEO & Norwegian Institute for Nature Research

This year it is 25 years since ProGEO was formally established. ProGEO is the short name of The European Association for the Conservation of the Geological Heritage, and was founded in Cologne, Germany, in 1993. Its predecessor was a working group for 'Earth Science Conservation' in Europe and at that stage it had already been active for 5 years. Over these years, one of the main aims for ProGEO has been to inform about our rich geoheritage and to promote its conservation. This has been gradually achieved as ProGEO has built a scientific and practical platform in developing geoconservation as a field of interest within Europe and beyond.

This year, the 9th International ProGEO Symposium on Geoheritage was held in Chęciny, Poland. The 9 symposia have been complemented by a series of regional and national meetings which in total has resulted in a rich documentation of geoconservation efforts in Europe. A few years ago, this effort was supplemented by the book 'Geoheritage in Europe and its conservation', edited by Wimbledon and Smith-Meyer, still available in our website. ProGEO has also been active in the meetings of the International Union of Geological Sciences and the European Geosciences Union with symposia and courses. The greatest scientific achievement is perhaps that our journal, GEOHERITAGE, issued by Springer, is now publishing its 10th volume and has achieved a citation index of 2.333. Most of our activities are documented in our website, where all issues of our newsletter 'ProGEO NEWS' can be found.

After the financial crisis, it has been difficult for many who work with nature conservation in Europe, as the priority of these activities has been reduced. This has been more so for geoconservation, as it has an even lower priority for most institutions that work with nature conservation. This is



Excursion in a Dutch nature reserve with boulder clay and glacial erratics at the meeting in The Netherlands when the first working group on geoconservation was formed in 1988. Photo by Lars Erikstad.

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Participants on the 9th International Symposium on Geoheritage celebrating 10 years with the journal GEOHERITAGE. Photo by Małgorzata Bieñkowska-Wasiluk.



especially problematic because EU directives have no well-defined place for geoheritage. ProGEO wants to improve this situation and contribute to mainstream geoconservation within international nature conservation. To promote this, in 2011 we became a member of the International Union for Conservation of Nature (IUCN) and have been working actively through this organisation to achieve this goal. ProGEO has participated in the last two quadrennial World Conservation Congresses (2012 and 2016), and in the decadal World Parks Congress (2014). In close collaboration with two IUCN members, the Geological Society of Spain and the Spanish Society for the Defence of Geological Heritage and Mining Heritage, different motions were submitted and approved by the IUCN as resolutions: *Conservation of geodiversity and geological heritage* (Res. 4.040, approved in Barcelona 2008), *Valuing and conserving geoheritage within the IUCN Programme 2013-2016* (Res. 5.048, approved in Jeju, 2012), and *Conservation of moveable geological heritage* (Res. 6.083, approved in Hawaii, 2016).

It is our hope that this long-term work will eventually result in improvements that will make practical geoconservation work in each and every country easier and more accepted. To achieve this, we need international awareness and engagement, as well as a high level of cooperation between all interested parties, and it is the strategy of ProGEO to keep contributing to this objective in times to come.

Further reading

Download issues of ProGEO News and find out more about our work at www.progeo.ngo

Explorations in Deep Time: Hugh Miller Writing Competition winners announced

Lara Reid, freelance Geoscience writer

*'A wide-toothed comb of stone
 Transient as a scar
 And no longer than a fingernail,
 Legs floating like the tentacles of a jellyfish,
 A beautiful arrangement by the sediments
 Clearly thinking ahead.'*

From '*Pneumodesmus newmani*' by Alex Woodcock,
 1st prize in poetry for 2017-18

In June 2018, at the fitting venue of the Scottish Poetry Library near Arthur's Seat in Edinburgh, the winners of the second Hugh Miller Writing Competition gathered for a celebration and prize-giving. All six winners were there on the day, some of whom had travelled some distance to be there, and the event itself was well attended with every seat taken.

For this year's competition, entrants were asked to write prose or poetry inspired by fossil discoveries made in Scotland in the last 30 years. What seemed like a tight brief has, once again, proven to be the trigger for beautiful, evocative new writing inspired by Scotland's geoheritage, following confidently in the footsteps of Hugh Miller himself.

This year's winners included poets Fiona Ritchie Walker and Alison Seller, both from Scotland, who received highly commended awards for their entries. Runner-up in prose was Ross Barnett, evolutionary biologist at Durham University, who recalled time spent fossil hunting as a young child on the Isle of Raasay in his thoughtful piece entitled 'Impressions'. A poem that oozed atmosphere and

texture won Gillian Dawson the runner-up in poetry prize. Gillian works at the University of the West of Scotland, and her poem 'The Last King of Scotland' is a delightful piece to read aloud and caught the judge's attention as a piece that would be enjoyed by all ages.

Prose winner Thomas Halliday is a Fellow at the University of Birmingham and a Scientific Associate of the Natural History Museum in London. That our writing competition attracts entries from people of all ages and backgrounds is one of the prime reasons why it has become the successful venture it is today.



Competition organiser Lara Reid congratulates prose winner Thomas Halliday on his beautiful piece, 'Landward'. Photograph by Angus Miller.

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'The sun reluctantly skilents beneath the clouds to cast long afternoon shadows along the strandline at Yellowcraig. A stiletto of an east wind blows in from the Bass, scattering the sand.'

**From Landward by Thomas Halliday,
1st prize in prose for 2017-18**

For the judges, Thomas' beautiful, lyrical piece of prose stood out for its unusual turns of phrase and language use. The author's presence both in the landscape and within Deep Time, and indeed the choice of fossil described, made this piece unique.

In a lovely stroke of fate, our first prize in poetry winner, Alex Woodcock from Bexhill in East Sussex, is a writer and stonemason by trade, just like Miller was. I spoke with Alex about the inspiration behind his poem, '*Pneumodesmus newmani*', and about his new-found links with Hugh Miller.

"I had never read Miller until I heard about the writing competition and thought about entering," he says. "It was delightful to discover through reading *My Schools and Schoolmasters* that he was also a stonemason, and I was really taken by his unusual way of recounting the day-to-day elements of his work. So many descriptions of working the quarries and labouring with rock focus on the hardship, tedium and difficulties associated with working stone. Miller, on the other hand, is more reflective and appears to revel in the work at times."

"I love the way he sets himself and the rocks firmly into the landscapes around him, and into Deep Time," Alex continues. "It was partly this that I wanted to capture in my own piece for the competition; the layering of time and how so many different worlds have existed within that incredible span. It's amazing to consider our own lives in that context, and to think that, in reality, anyone can pick up a fossil and make a connection with these intricate layers of time."

To expand on the writing competition's growing success, I am currently working with my fellow competition judge, Elsa Panciroli, to compile a book in tribute to Hugh Miller's legacy. The book will bring together all the winning entries from both writing competitions, and will also include essays and short reflective pieces on aspects of Miller's life and work from some leading names, including Miller expert Michael Taylor and writer Robert Macfarlane. The book will, with luck, be ready in the early spring of 2019.

In the meantime, all this year's winning entries can be read online on our website: www.scottishgeology.com/hughmiller/. The Hugh Miller Writing Competition 2019-20 will be launched in the autumn of 2019.

As competition organiser and committee member for competition partners the Scottish Geodiversity Forum and the Friends of Hugh Miller, I would like to extend my sincere gratitude to all the organisations and individuals who have supported the competition in recent years and donated prizes. We are grateful to Scottish Natural Heritage for helping fund the 2017-18 project by linking the competition with promotion of the Scottish Fossil Code.

Offers of help, suggestions regarding future aims, prize donations and so on can be directed to Lara at: reid.lara@gmail.com

Making the most of it – geosite maintenance in the Malverns

Dick Bryant, Vice-President, Herefordshire & Worcestershire Earth Heritage Trust

Collaboration between interested organisations, and just a small amount of funding combined with volunteer effort, is transforming the maintenance of geological sites in the Malvern Hills

For a number of years, a successful partnership has existed between the Herefordshire and Worcestershire Earth Heritage Trust (EHT), the Malvern Hills AONB, and the Malvern Hills Trust (MHT, formerly the Conservators), to undertake geosite maintenance. Although the work is organised by EHT, it is sustained by modest annual grants from both the AONB's Sustainability Development Fund and from the Conservators, amounting in total to about £2000 per year. This money is used primarily for the support of volunteers (travel expenses and modest lunch allowance), purchase and maintenance of field equipment, and the organisation and oversight of the project. Financial support for work of this nature is, like all funding, hard to obtain, but at least in this case, a little money does go a long way.

Since 2014, four seasons of fieldwork have resulted in positive intervention on about 27 sites, of which 17 are within the Malvern Hills SSSI, and 8 are nearby Local Geological Sites. All sites lie within the AONB or on land managed by MHT.



Volunteers at work in the lower part of Dingle Quarry, West Malvern. A quasi-horizontal microdiorite sill traverses the middle of the picture (just above the heads of the volunteers), and is intruded into the diorites, granites and pegmatites of the Malverns Precambrian complex.

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Work on Coneygree Quarry near Ledbury, in folded Much Wenlock Limestone.

All photos by Dick Bryant.

The volunteer team working on the project is drawn not only from EHT, but from other local geological groups: Malvern U3A Geology section, the Woolhope Naturalists Field Club, and the Teme Valley Geological Society. In addition, the group has been joined for work at particular sites by volunteers from Worcestershire Wildlife Trust. Other sessions have involved workers from MHT and the Environment Agency.

The fact that the work receives material support from the AONB and the MHT, acts as a considerable incentive to volunteers to participate regularly in the programme: they know that their hard labours are 'officially' recognised and valued.

Gaining permission to work on geosites within the Malvern Hills SSSI (largely confined to the rocks of the Precambrian Malverns Complex) is usually not a problem, although work needs to be undertaken between October and March to minimise interference with wildlife. Not all is necessarily plain sailing outside of the SSSI area. Some private landowners are reluctant to grant access largely because of (unfounded) fears of future public encroachment, and at least one parish council has steadfastly refused access for geomaintenance work on their land. However the good offices of the AONB have been crucial in a number of other instances in negotiating access, and for this EHT is very grateful.

Notable sites tackled during the past four years have included Dingle Quarry (see photograph); Gullet top quarry with its famous unconformity between the rocks of the Precambrian complex and the shoreline deposits of the Silurian sea; Quaternary scree sites; several quarries in Silurian limestone; and the large exposure of the major East Malvern Fault next to North Quarry (see before and after photographs). In North Quarry, the exposure by industrious volunteers of much bare rock met with great approval by local butterfly conservationists. It appears that the rare grayling butterfly likes this type of surface, and the hope is that the new exposures will encourage it to colonise this new ground.

The main threat to many of the exposures in the Malverns area (and undoubtedly elsewhere) is rapid vegetation encroachment, particularly on the softer strata. In order to address this, one key element of the project has been to establish, in conjunction with the AONB and the MHT, a regular schedule of supported maintenance. Too often in the past, geological maintenance of sites has taken place at long and irregular intervals, and the ambition in the Malverns programme is that this current partnership will enable the sustained management of local sites well into the future.



Before- and after-clearance images of part of North Quarry, Great Malvern. This is the only known exposure of the major East Malvern fault line, separating Precambrian rocks on the right from down-faulted Permo-Triassic strata on the left (not seen in the photo). The fault plane itself reveals examples of slickensides.



Every Landscape Tells A Story

Brian Ellis, Warwickshire Geological Conservation Group and **Martin Haslett**, Midlands Royal Geographical Society with Institute of British Geographers

Geographers and geologists came together in June 2018 for a field outing that bridged their interests and was enjoyed by all.

The idea of a joint field trip arose at a social event of the Midlands Royal Geographical Society (with IBG) when the Regional Committee Chair Martin Haslett met up with Brian Ellis from the Warwickshire Geological Conservation Group. The RGS (IBG) has regular field trips but they usually feature human geography. Here was an opportunity to redress the balance using a leader with local geological knowledge who could help interpret the physical geography. The planned walk followed a circular route centred on the village of Berkswell, which lies just to the west of Coventry.

The three elements of the physical landscape are plain to see. The western edge of the Warwickshire Plateau, with its Carboniferous sandstones and mudstones, is marked by the Warwick fault (last active in 2000). In contrast, the Plateau gives way further west to the down-faulted Knowle Basin, of predominantly red-coloured Triassic Mercia Mudstone. The third element is Pleistocene sediments – till on the plateau and outwash sands and gravels along the valley of the River Blythe and its tributaries which drain the Knowle Basin.

Draped across this physical landscape is an altogether more subtle historical landscape which cannot be ignored and which pays little regard to the topography. It is the story of the settlement and eventual clearance of the wood-pasture of the north Warwickshire 'Forest of Arden'. The earliest clues are in the frequent place names 'ley', 'green' and 'end' indicating small hamlets in scattered woodland clearings.



Blind Hall, a yeoman farmer's house from about 1600. The foundations are sandstone, probably from the 'Quarry Field' and the bricks use mudstone probably from 'Claypit Field', both of which are marked on old maps of the farm.

All photos are by Martin Haslett.

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A deep quarry, currently working the Pleistocene sand and gravel, lay alongside the footpath the group were following, giving an indication of the volume of material deposited.



The crypt of the Norman Church in Berkswell built using local Carboniferous sandstone



The Normans imposed a greater level of organisation with the growth of the village of Berkswell, with its Norman church (see photograph), its deer park, the grants of land to their placemen to found manors and the institution of the open field system. When communal farming declined, early enclosure by yeoman farmers was evidenced by their substantial farm houses (see photograph). Later Parliamentary Enclosure can be traced through Georgian and early Victorian farmsteads. All of this historical evidence gives a picture of over 1000 years of landscape change.

The walk also gave the group the opportunity to discuss issues related to modern-day landscape change. Berkswell is situated within the Green Belt which separates Coventry from Birmingham. Keeping them separate is a long-standing concern. This countryside is currently under threat from housing development planned at various places on Coventry's western edge. The nearby, now demolished, Massey Ferguson tractor factory, is the only available brownfield site, and has already been used for housing. Here was an irony of landscape evolution: in the late 1980s there were plans for a new coal mine to be sunk alongside the Massey plant, but now there are houses instead. The walk also took in part of the route of HS2 on the western edge of Berkswell parish. Here the group saw evidence of drilling, exploring the sub-surface geology in the valley where they had already observed the depth of the Pleistocene deposits in a quarry (see photograph).

The walk was just over five miles long and the gaps between the points of interest, together with a picnic lunch, encouraged the two groups to mix socially. The participants brought different backgrounds and interests, which led to stimulating questions and discussions. This suggests that the idea of a joint field trip was successful.

Voyages in Deep Time

Julie Harrald, Herefordshire & Worcestershire Earth Heritage Trust

Voyages in Deep Time is a significant and exciting project, supported by the Heritage Lottery Fund and the Bransford Trust, which has developed free smartphone apps to encourage people to visit and enjoy learning about local geological sites that tell us what our part of the world was like millions of years ago – in deep time.



Evidence of ice ages and some spectacular views can be seen from Cat's Back ridge above the Olchon Valley in Herefordshire.

All photos by Julie Harrald.

The rolling hills in the north of Martley parish, Worcestershire are underlain by Silurian rocks.



There is an app called *Deep Time Voyager* which is a game taking the user on a voyage of discovery and survival in ancient environments. This is aimed at children (aged 11 – 15) or tourists, although it should be interesting and fun for everyone to use.

A second app, called *GeoExplore*, aimed at 'A' level students or adults with some geological knowledge, asks the user to carry out a geological exercise at a local site. It digitally provides the tools needed to do so, such as compass, clinometer, rock naming charts, a simple logging tool and GPS-located note, image and sound recording. The various exercises include geological mapping, examining the structure of rocks, looking for palaeoenvironmental evidence and interpreting the ice age features of the landscape.

Voyager and *GeoExplore* apps have been written for each of four locations - the Lickey Hills (south-west of Birmingham), Martley (in the Abberley Hills, Worcestershire), Little Doward (above the Wye Gorge, Herefordshire) and the Olchon Valley (south-west Herefordshire, bordering the Black Mountains). Although both apps are intended to be used in the field at these locations, the well-illustrated *Voyager* app can also be used anywhere indoors, providing an engaging and informative class-room exercise, or at a fixed location outdoors for people with mobility problems.

Voyager routes will be added soon for Bredon Hill (Worcestershire), the Malvern Hills, and Wren's Nest in Dudley. There are also plans to make available a template for the apps via the project

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website, so that teachers and others can write content for their own local area. Details about the apps can be found on the website at: <https://deeptime.voyage/>

The three-year project has been led by Herefordshire & Worcestershire Earth Heritage Trust. It has drawn on the expertise of several school teachers and education professionals. It has also been supported by a number of geologists, and digital design work has been carried out by students at the University of Gloucestershire. Additional funding for publicity came from the Tomlinson Brown Trust. The technical expertise for the development of the apps has been provided by Mike Brooks of BrooksDesign and member of the Earth Heritage Trust.



Top: 'A' level student test one of the GeoExplore exercises.

Bottom: Youngsters aged 12 - 13 years (Key Stage 3) on a *Voyage in Deep Time*.



The sun shines on GeoWeek



Chris King and John Stevenson, Earth Science Education Forum.

GeoWeek is a national event that introduces members of the public to their local geology. GeoWeek ran for the first time this year with events across England and Scotland (see below) – and the sun seems to have shone on all of them.

The events were varied – ranging from town centre walks to quarry visits and full blown field trips. Hundreds of people took part in the nine-day ‘week’ of visits.

More information on the background to GeoWeek and the free-of-charge events offered across the UK can be found on the GeoWeek website at: <http://www.bgs.ac.uk/geoweeek/about.html>



GeoWeek visit to Bats Coombe quarry.
Photo by Adel Avery



Stories told by building stones during GeoWeek. Photo by Adel Avery



GeoWeek building stone tour and Wells Cathedral. Photo by Adel Avery



GeoWeek explanations in the field.
Photo by Chris King

GeoWeek will be held again in 2019, running from 4-12 May. Do please join in by organising events in your own area. Everyone, from schools to universities and geological societies to conservation groups or individuals can help to raise the profile of our fabulous geology during GeoWeek. You or your group will need to plan, organise and advertise the event yourselves, since GeoWeek is a voluntary initiative with no background funding. But evidence has shown the ‘power of the volunteer’ in bringing Earth Science to a public audience. With your help, next year’s GeoWeek can be even bigger and better, moving the public understanding of geoscience forward by leaps and bounds. Register your event for 2019 at <http://www.geoweeek.org.uk/>.

For more information, contact Chris King or John Stevenson at esefew@gmail.com

The Jurassic Coast Story Book – a new interpretation framework for the Dorset and East Devon Coast World Heritage Site

Sam Scriven, Jurassic Coast Trust

‘Interpreting geological heritage is easy!’... said no one, ever. Geodiversity is a challenge for heritage interpretation wherever you go. On the Jurassic Coast we have the added problem of a 95 mile linear site and over 185 million years of time. Did I say problem? Of course I meant opportunity, and there is no doubt that it is a HUGE opportunity. Making sense of the near-overwhelming stash of stories along this World Heritage Site (WHS) has been an ongoing mission since its inscription in 2001. This year the Jurassic Coast Trust, with support from the Heritage Lottery Fund, has launched a new interpretation framework for the Jurassic Coast with the express purpose of making its geodiversity accessible and inspiring. In this regard, ‘The Jurassic Coast Story Book’ has become a foundational resource and important advocacy document.

Who’s it for?

Back in 2005 the first ‘Interpretation Action Plan’ was created for the Jurassic Coast. Whilst this set a useful strategic context for interpretation projects, it did little to develop the geoheritage stories at the heart of the WHS. The Jurassic Coast Trust does not own any of the Jurassic Coast, or run any of the interpretation centres and museums found along its length – we therefore rely on influence and advocacy to steer interpretation projects and content. The key audience for a new interpretation framework was not the public, but those wishing to develop interpretation about the Jurassic Coast WHS, from community volunteers to museum professionals or national non-governmental organisations.



The Jurassic Coast Story Book, full of case studies and tips for interpretations.
© Jurassic Coast Trust.



During the major redesign and refit at Bridport Museum, the Jurassic Coast Trust worked closely with museum staff to plan and create the new geology and fossil displays. One of the overall priorities for the museum was to connect local social history with the unique geological heritage of Bridport and the Jurassic Coast. Photo by Jurassic Coast Trust.

Why bother?

A review of interpretation delivery since 2005 identified positive impacts across site protection, learning, community engagement, visitor management and the local economy and fundraising. To demonstrate the role of good interpretation in wider site management, *The Story Book* has brought together case studies that illustrate these outcomes provide evidence to support future funding applications.

Getting to grips with geodiversity

To give users of *The Story Book* an overview of geodiversity we turned to the England Geodiversity Charter (see www.englishgeodiversityforum.org) and the excellent summary it includes on page 3. The Charter's broad description of the UK's geodiversity is accompanied by a set of geoheritage narratives and principles that attempt to re-frame geodiversity based on how people experience it. These principles were created as part of the development of *The Story Book* and provided the basis for our approach to interpretation. They emphasise the importance of the human perspective in landscape stories, the intimate connection between people and geodiversity and the importance of imagination as a means to participate in geoheritage.

What is the Jurassic Coast?

There are many ways to tell a story. Eric Langham, commissioning editor for the journal of the Association of Heritage Interpretation, recently wrote that 'Interpretation is about taking a view. It is not a neutral discipline, but one that is inherently editorial. It can set an agenda, generate debate or create a viewpoint that provokes...' In this way, by selecting certain ideas about the nature of the Jurassic Coast over others, by 'taking a view', we are not just curating and communicating information, we are making a statement about what the Jurassic Coast WHS is. To help our partners understand the geoheritage of the Jurassic Coast we developed two key concepts that define its geodiversity, which in turn is explored using seven themes.

Key concept 1 is 'A Walk through Time'. This is, in a nutshell, why the Jurassic Coast is a WHS - a near complete record of the entire Mesozoic era accessible along the coast and largely in sequence. The oldest strata are in the west, near Exmouth, and the youngest in the East, near Swanage. Crucially, this concept unites the diverse coastal landscape with a single, compelling idea.

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Marine reptiles brought to life at West Bay. Photo by Sam Rose.

Interpretation panel created with community input which helps visitors understand why rocks matter at Beer, East Devon. Photo by Steve Belasco.



Download *The Story Book* here:

https://jurassiccoast.org/wp-content/uploads/2018/05/Jurassic-Coast-Trust-Toolkit_WEB.pdf

GEOINTERPRETATION

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Key Concept 2 is 'I didn't realise rocks mattered'. This recognises that the heritage values of the World Heritage Site are not always the highest priority for interpretation projects along the coast. The unique geology exposed on the Jurassic Coast, however, is the foundation for many of Dorset and East Devon's distinctive qualities. Geodiversity can help further illuminate interpretation about other types of heritage and in turn help people understand why geology matters.

The seven themes are set out below, but it is worth being aware that a 'theme' in heritage interpretation is something very specific. To put it simply a theme should communicate a coherent idea in a thought-provoking way. This is where the editorial aspect comes in. These seven themes are how we have chosen to define the geodiversity of the WHS. They are designed to provoke further thought and discussion, and to be flexible and open to adaptation within specific projects. We hope they will inspire our partners and provide a crucial starting point for any interpretation they seek to produce about the Jurassic Coast.

Theme One: Earth Stories

Like a locked library, the Jurassic Coast's geology contains a hidden history of the entire Mesozoic Era. Science and imagination open the door.

Theme Two: Life's Legacy

Jurassic Coast fossils chronicle the evolution, extinction and survival of Mesozoic species. Like all life today, we live and breathe as part of their legacy.

Theme Three: A Landscape Adventure

The Jurassic Coast is a landscape laboratory, continually shaped and reshaped by unique geodiversity. Explorers, students and scientists thrive on its varied, distinctive beauty.

Theme Four: The Power of Nature

Erosion created this dynamic coastline. Time, tide and natural change are at the heart of its heritage.

Theme Five: Outstanding Universal Value

The Jurassic Coast is in a global family of World Heritage Sites that illuminate humanity's collective history, identity, and relationship with nature.

Theme Six: The Land and its People

The Jurassic Coast's geodiversity nurtures discovery, creativity and distinctive communities. It adds meaning to life and landscape, binding people to stories of stone.

Theme Seven: The Wild Coast

This diverse and dynamic coast harbours rare habitats, providing a vital refuge for the wildlife that shares our world.

What next?

Take a look at *The Story Book* and tell us what you think, there is lots more in it than could be presented here, and we would love to hear your views. The next stage for us is promoting *The Story Book*, putting it to use and evaluating its impact. This will take time. Feedback so far is positive and *The Story Book* has already been taken on by professionals helping to develop large interpretation projects, including the complete refit of Dorset County Museum. If you are particularly interested in the development of *The Jurassic Coast Story Book* a forthcoming paper in the *Proceedings of the Geologists' Association* discusses the process at length.

The Museum of the Portuguese Centre of Geo-History and Prehistory

Silvério Figueiredo & Fernando Coimbra, Centro Português de Geo-História e Pré-História, Lisboa; Polytechnic Institute of Tomar; & Geosciences Center, University of Coimbra, **Mário Antas**, Centro Português de Geo-História e Pré-História, Lisboa; National Museum of Archaeology, Lisboa; & University Lusófona of Humanities and Technologies, Lisboa, **Sofia Silvério & Fernanda Sousa**, Centro Português de Geo-História e Pré-História, Lisboa

This museum, the ‘Núcleo Museológico do Centro Português de Geo-História e Pré-História’ was founded in 2013 in a former primary school in Golegã, a small town in the middle Portuguese reach of the River Tagus, c. 35 km north of Santarém and 150 km upstream of Lisbon. It comprises a Natural History exhibition and a library specializing in palaeontology, prehistory and archaeology, with over a thousand books and articles in hard copy, as well as digital support. Themes within the exhibition include evolution and Rock Art, as well as interactive media devices and the palaeontological and prehistoric archaeological collections of the Portuguese Centre of Geo-history and Prehistory, a body formed in 1993 and recognized by the Portuguese Government in 2017 as a public institution. Several partnerships have been forged with municipalities, schools and other museums, giving rise to exhibitions, conferences, lectures and seminars.

The central themes of the Museum of the Portuguese Centre of Geo-History and Prehistory in Golegã, are the evolution of life and the physical and technological evolution of humankind. It can be enjoyed by the local inhabitants and by visitors from other locations in the country and abroad and has attracted interest from local and national media (newspapers and television).

The rural Tagus valley location is within an area that has an ageing population, which led to the closure of the school that now houses the museum, the latter providing a new use for the building (only built in 1980, albeit with a traditional style from the 1950s) and a new central point for the village of São Caetano, helped by the small cafeteria that operates within the Museum.



Exterior of the former primary school of São Caetano, Golegã, now the Núcleo Museológico do Centro Português de Geo-História e Pré-História (Main central Portuguese Museum of Earth History and Prehistoric Archaeology). Photo by Centro Português de Geo-História e Pré-História.

All photos by Centro Português de Geo-História e Pré-História.

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The exhibition, designed as an educational and interactive facility, is divided into five sections:

- Introduction to the geology of Portugal: the main rocks and their relation to industry.
- Evolution of life, consisting of five explanatory panels and three displays with fossils from the Palaeozoic, Mesozoic and Cenozoic eras.
- Multi-themed section, with fossil displays, panels, interactive elements and a landscape model. One theme is trace fossils, with trilobite trails, a cast of dinosaur footprints and dinosaur eggs. This can be linked to another theme, dedicated to palaeontology of Cape Espichel, a site on the coast south of Lisbon where sauropod trails can be seen on near vertical bedding plains exposed in the cliffs. There are also themes devoted to fossil invertebrates, to the evolution of the horse lineage (Golegã is considered the national capital of the horse) and to human prehistory, the last with replicas of artefacts and of skulls of *Homo erectus*, *H. heidelbergensis*, *H. neanderthalensis* and *H. sapiens*.
- Section on Prehistory, with archaeological remains, including food-related items.
- The final section is dedicated to rock art, with an explanatory panel and three large rocks on which engravings typical of various periods of prehistory and proto-history have been reproduced, these being prominent in the archaeology of Portugal. One is Palaeolithic and represents horses and abstract figures, one is Neolithic/Chalcolithic, with rock art motifs typical of the Tagus valley (pecked schematic anthropomorphic figures, concentric circles, spirals, and sun like images), and the third is Iron Age, with characteristic incised zigzags, net-patterns, pentagrams and tree branches.



Views of the exhibition.
1-Showcase of the Palaeozoic; 2 – table showing the evolution of tetrapods; 3-Model with the main groups of dinosaurs; 4-thematic showcases with vertebrates, palaeontology of Espichel and the event-toed ungulates.

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The panel dedicated to rock art and three stones with replica of engravings (left) and detail of one of the rock art replicas (right).



The exhibition is designed to be highly visual and attractive to young people and has so far received 1771 visitors between September 2013 (when the museum was inaugurated) and September 2017. Educational events include re-enactments of ‘a day in prehistory’ (live simulations of various activities of early humans, such as a lunch prepared using prehistoric technology, replica prehistoric tools, fire, ceramics); ‘be an archaeologist for a day’, in which participants dress as archaeologists, simulate excavation and the study of archaeological materials; or ‘be a palaeontologist for a day’, with participants studying fossils (or replicas).



The activities: 1 – ‘a day in prehistory’; 2 – ‘Archaeologist for a day’; 3 – Rock art laboratory; 4 -Palaeontology laboratory.



2019 INQUA Congress in Dublin: Field meetings to visit a wide range of British and Northern Irish geoheritage sites

David Bridgland, Durham University, Geologists' Association and QRA Vice-President, **Eleanor Brown**, QRA Conservation Officer & Natural England, **Michael Dempster**, Northern Ireland Environment Agency and **Vanessa Brazier**, Scottish Natural Heritage

The 20th Congress of the International Union for Quaternary Research (INQUA) will be in Dublin in July 2019. Amongst a wide choice of pre-congress and post-congress field trips are several to be based in Britain and Northern Ireland, being organized under the auspices of the Quaternary Research Association (QRA), some making extensive use of designated Quaternary geoheritage sites (see <http://www.inqua2019.org/qra-fieldtrips-pre-and-post-congress>). Other INQUA field trips will also visit iconic Northern Irish geoheritage sites such as Giant's Causeway.



The MIS 9 former Thames deposits dating from 330,000 BP at Bluelands, which is within the internationally important SSSI at Purfleet Chalk Pits, Essex. Photo by Eleanor Brown, Natural England.

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The Quaternary Fluvial Archives of the Major English Rivers (Becky Briant, David Bridgland, Tom White, Eleanor Brown)

This pre-congress field trip will highlight fluvial sedimentary sequences, with biostratigraphical and Palaeolithic components emphasized and section visits reinforced by displays of fossils and artefacts. Many of the localities to be visited are geoheritage sites, where discussion both on site and in the field guide will include future conservation and management issues as well as the scientific importance. Starting in Central London, with a walk across some of the built-over Thames terraces, the excursion will visit (day 2) key sites in the Lower Thames, including the Swanscombe Skull Site SSSI (Site of Special Scientific Interest) and NNR (National Nature Reserve) and the Purfleet Chalk Pits and West Thurrock (Lion Pit) SSSIs. It will then visit (day 3) the erstwhile Solent River system, the axis of which is now drowned beneath the seaway separating Hampshire from the Isle of Wight; SSSIs to be visited here range from Barton-on-Sea cliffs (Highcliffe to Milford Cliffs SSSI) to the Woodgreen Gravel Pit (Hampshire Avon) and Dunbridge Pit (River Test) Palaeolithic river terrace localities. The Severn system is represented by its Worcestershire Avon tributary, with a visit to the classic terrace sequence around Crophorne, including the Crophorne New Inn Section SSSI. Finally the Bytham River (destroyed by the Anglian glaciation) and the Trent (in many ways successor to the Bytham) will be visited, including the karstic system in its north-bank tributary, the Derwent, which is a former Bytham tributary and thus older than the Trent itself. The intention is to look at show caves and valley morphology around Matlock, which provide evidence in relation to the evolution of the Derwent. The geoheritage site at Waverley Wood Farm SSSI, planned to be the final locality on the excursion, provides an overlap between these Midlands drainage systems, as Bytham gravels and pre-Anglian interglacial deposits here are overlain by glacial till and then Avon terrace gravels, with flow now reversed and towards the Severn.



The Parallel Roads of Glen Roy, looking into the National Nature Reserve. © Pat MacDonald, Scottish Natural Heritage.

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Kilkeel Steps ASSI, County Down, is notified for its glacial deposits, laid down at the margins of an ice sheet in a marine basin. Photo by Michael Dempster/Northern Ireland Environment Agency.



The Nature and Timing of the ‘Younger Dryas’ Glaciation of Scotland (Adrian Palmer & John Lowe)

This four-day pre-congress field trip will tour the scenic southern, central and eastern Grampian Mountains, home of the West Highland icefield, the largest ice mass to develop in Scotland during the Loch Lomond (‘Younger Dryas’) Readvance (LLR). En route, key sites will be visited that provide secure ages for the timing of the maximal limits of the LLR glaciers. A whole day is devoted to the classic features of Glen Roy, famed for the ‘Parallel Roads’, distinctive shorelines of former ice-dammed lakes. This area proved pivotal in early debates concerning the controversial ‘Glacial Theory’ in the 1840s, and was subject to conservation controversy in 2016 (see EH45, p. 4, Brazier *et al.*, 2017). <https://www.nature.scot/enjoying-outdoors/places-visit/scotlands-national-nature-reserves/glen-roy-national-nature-reserve>

Several of the locations to be visited are Geological Conservation Review (GCR) sites and SSSIs, designated for their nationally and internationally recognised Quaternary landforms and deposits. In particular delegates will spend time in Glen Roy NNR and associated GCR sites, which are part of the extensive Parallel Roads of Lochaber SSSI, and within the Lochaber Geopark. <http://lochabergeopark.org.uk/>

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A moraine in the Mourne Mountains, Co. Down, Northern Ireland. Photo by Michael Dempster/ Northern Ireland Environment Agency.

Different Styles of Younger Dryas Glaciation in the Northwestern and Central Scottish Highlands (Sven Lukas, Clare Boston, Benjamin Chandler)

This post-congress meeting will also visit the wild and beautiful glaciated landscapes of the Highlands of Scotland. A number of internationally important GCR sites will be visited along this tour of the Highlands, starting at Inchnadamph, including Knockan Crag, and passing An Teallach, the Wester Ross Readvance moraine, and passing through the ice-dammed lake drainage scenery of gorges, terraces and raised beaches of Glen Spean near Glen Roy. Further sites to be visited include the Monadhliath Mountains and the Gaick and Drumochter areas. Delegates will see many geoconservation sites designated as SSSIs for their nationally and internationally recognised Quaternary landforms and deposits. The North West Highlands are also a UNESCO Global Geopark. <https://www.nwhgeopark.com/>

The Isles of Scilly: Tracing and Dating the LGM Ice Limit (James Scourse)

This excursion will review the stratigraphical and morphological evidence for the limit of the Last Glacial ice sheet across the Scillies archipelago, with discussion of its dating within the context of the BRITICE-CHRONO project (see <http://www.britice-chrono.group.shef.ac.uk/>). It will visit some of the Quaternary GCR sites and SSSIs including Bread and Cheese Cove, Chad Girt, Porth Seal and Battery (see Scourse, 1998), as well archaeological monuments.

Late Quaternary Landscape Evolution, Palaeoenvironments and Human Occupation in the North of Ireland (Helen Roe, Nicki Whitehouse and Jasper Knight)

The post congress, QRA run trip to the region, includes visits to Lough Neagh and the lowlands to the north, Greyabbey Bay on Strangford Lough, the Glens of Antrim and Clogher Valley Eskers in Co. Fermanagh. Other key geoheritage sites included in the itinerary are the Marble Arch Caves, a Global Geopark <https://www.marblearchcavesgeopark.com/>, and the Giant's Causeway UNESCO World Heritage Site <https://www.nationaltrust.org.uk/giants-causeway>, where conservation and management issues will be discussed. This is a very varied trip with lots on offer for all Quaternary scientists, regardless of their individual interests!

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Other INQUA Excursions to geoheritage sites in Northern Ireland

Several of the other INQUA 2019 Congress field trips visit important Quaternary locations in Northern Ireland. The mid-congress excursion to the Giant's Causeway in north Antrim, which is within the Giant's Causeway and Dunseverick Area of Special Scientific Interest (ASSI), may have solid geology as its focus but the Antrim coast owes much of its dramatic appeal to glaciation. Two excursions (Deglaciation of the Northern Ireland Sector of the Irish Sea, and The Quaternary Glaciation of the Mournes) will examine the glacial landforms and sediments in south County Down. The Eastern Mournes have been designated an ASSI in part for their glacial geology and the Mourne Plain to the south of the mountains contains numerous Earth Science Conservation Review (Enlander, 2001) glacial moraine sites. Kilkeel Steps on the Mournes coast is a purely glacial interest ASSI, where cliffs of mud, sand and gravel record ice marginal deposition in a marine basin, with foraminifera that have been dated to around 19,000 years ago.

The use of these sites for this large international meeting underlines the value of geoconservation in that visitors are able to see the best that Britain and Northern Ireland have to offer in terms of Quaternary localities. The sites themselves benefit from discussions amongst experts about their scientific interest, conservation and management, and soft sediment sites will also benefit from the careful clearance of vegetation and opening of sections. The necessity of conservation and management in ensuring the availability of key sites for international meetings is particularly acute for Quaternary interests, as often sites consist of ephemeral exposures in unconsolidated sediments. Geoheritage will also be included in the INQUA Congress itself (<http://www.inqua2019.org/>) via a session on Valuing the Quaternary: Nature Conservation and Geoheritage. This session aims to showcase the latest in international Quaternary geoconservation best practice, as well as to demonstrate how Quaternary science can support nature conservation more widely. The call for abstracts for talks and posters is now open until 9 January 2019 <http://www.inqua2019.org/call-for-abstracts/>. The QRA is pleased to support the 2019 INQUA Congress and its field trips, and will continue to support the delivery of Quaternary geoconservation via its Geoconservation Award. <https://www.qra.org.uk/blog/55/New-QRA-Geoconservation-Fund>

Further reading

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Geoconservation in Ireland: Global to Local

Michael Dempster, Northern Ireland Environment Agency

The Geological Society of London's Geoconservation Commission held their annual gathering on the 19th November 2018 at Collin's Barracks, Dublin. This was a sister event to the one held in Belfast in 2017 and had the theme Geoconservation in Ireland: Global to Local. The event was well attended and included members of the Geological Society of London's Geoconservation Commission along with geoconservationists and stakeholders from England, Scotland, Wales and of course Ireland.

A total of seven speakers from across the island of Ireland delivered presentations on a range of geoconservation topics:

Geoparks in Ireland – national supports for community actions

Sarah Gatley, Head of Geoheritage and Planning, Geological Survey of Ireland

'South from Malin Head', progress with audits of County Geological Sites in the Republic of Ireland

Matthew Parkes, Natural History Museum Ireland

Eskers and drumlins – iconic Ice Age landforms; but how do we define site boundaries?

Ronan Hennessy, Geoscene/University College Cork & Robert Meehan, Antalamh



The Giant's Causeway and Dunseverick ASSI exposes the Antrim basalts (the Giant's Causeway is in the middle distance). Photo by Michael Dempster.

MEETING REPORT

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Lisnaragh ASSI is a cross valley moraine terraced by glacial meltwater. The conservation of moraines was one of the key topics discussed at the gathering. Photo by Michael Dempster.



Conserving Northern Ireland's geological heritage

Michael Dempster, Northern Ireland Environment Agency

Geoconservation and geoheritage in the Garden of Ireland - A Local Authority Perspective

Deirdre Burns, Heritage Officer, Wicklow County Council

Geology and Planning – Wexford County Council experience

Graeme Hunt, Executive Planner, Wexford County Council

GeoWeek – Active Geoscience for the public

Kirstin Lemon, Geological Survey of Northern Ireland

The gathering was a useful snapshot of the current state and progress of geological conservation across the island of Ireland. At an international level there are currently three UNESCO Global Geoparks in Ireland – the Marble Arch Caves (the first transnational UNESCO Global Geopark in the world), the Copper Coast in county Waterford and the Burren and Cliffs of Moher of county Clare. There are a number of aspiring UNESCO Global Geoparks in Ireland/Northern Ireland at different stages of development and it is hoped the Mourne-Gullion-Strangford application (counties Down and Armagh) will be ready for submission to UNESCO during 2019. All UNESCO Global Geoparks of

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course have geology at their core but have the advantage of not being a regulatory designation, so are viewed as a 'soft' way to encourage geological conservation.

For the Republic of Ireland, the success and value of County Geoheritage Audits and the positive site protection outcomes from local authority engagement and consultation were highlighted. However, not all counties have completed their audit though a target of 2022 has been set. Innovative ways of interpretation were also raised, with an excellent example provided in the form of the 'River Liffey Stories' - a series of short films (available on Facebook) that explain different cultural as well as natural history aspects of the river that runs through Dublin. The importance of promoting and viewing conservation of larger areas of geoheritage as important elements landscape preservation was also noted. The current absence of statutory designations such as Natural Heritage Areas (NHAs) for purely geological reasons while perhaps surprising has not hampered the enthusiasm of the geoconservation effort, indeed there appear to be some benefits to what local people view as protecting local heritage without direct central government involvement. The recognition of the importance of geoheritage through designation of NHAs for their geological interest would still be a very welcome development.

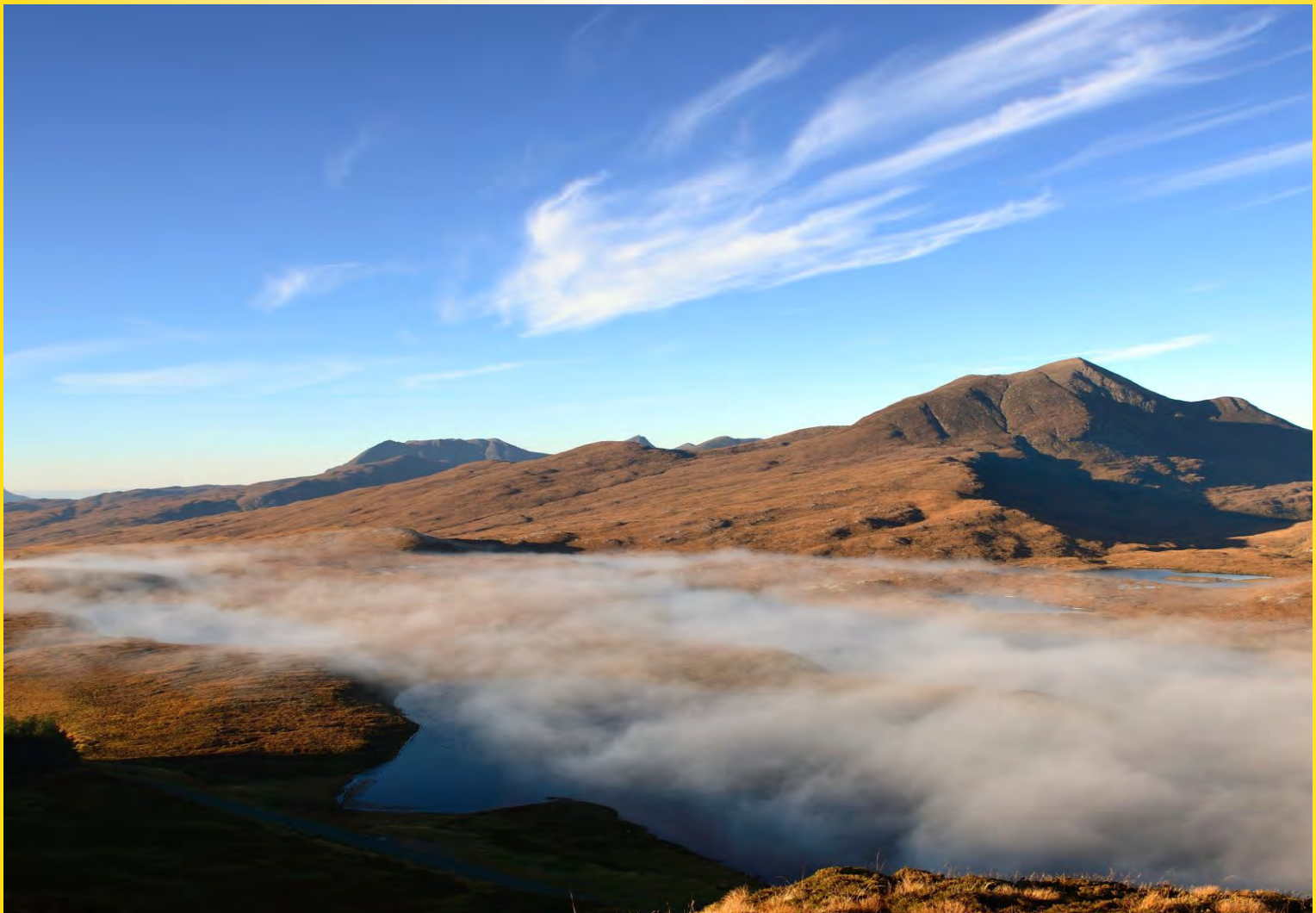
In Northern Ireland, progress has been made in statutory designation for geological sites but much remains to be done to complete the site network. Formal designation as an Area of Special Scientific Interest (ASSI) is seen ultimately as the best way to protect and help manage sites, though there are currently some difficulties with the process. A new approach may be needed for effective conservation of some sites in the absence of statutory designation. Local Development Plans are taking account of geological sites which will help conserve features in advance of possible ASSI status, but perhaps more importantly will also protect sites that remain of local significance. The importance of engagement and interpretation in order to encourage everyone to value geoheritage was common to all speakers. It is appropriate then that the last of the talks was an introduction to GeoWeek (see page 36). There were no GeoWeek events recorded on the island of Ireland in 2018 and Kirstin Lemon of Geological Survey Northern Ireland hoped the Irish geoscience community could change that in 2019.

The day was rounded off by a discussion on the creation of a Geodiversity Charter for the Republic of Ireland. After some debate as to the nature of what a charter provides, delegates felt it was a welcome proposal for Irish geoconservation.

Matthew Parkes of Natural History Museum Ireland is thanked for organising and facilitating this successful event.

Further reading

<https://en-gb.facebook.com/leinsterheritage/>



Earth Heritage in print

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Assynt area of the North West Highlands UNESCO Global Geopark as viewed from Knockan Crag National Nature Reserve and one of the INQUA fieldtrip localities (see article on page 44). This remote area includes some of the most well-known and important geological structures in the UK and played a crucial role in the development of ideas about mountain building. The area remains a focus of research, is a first-rate teaching resource and is included in the 51 Best Places to explore Scotland's Geology. © Lorne Gill SNH

