

Earth Heritage

The Geological and Landscape Conservation Magazine

ISSUE

48

Autumn 2017

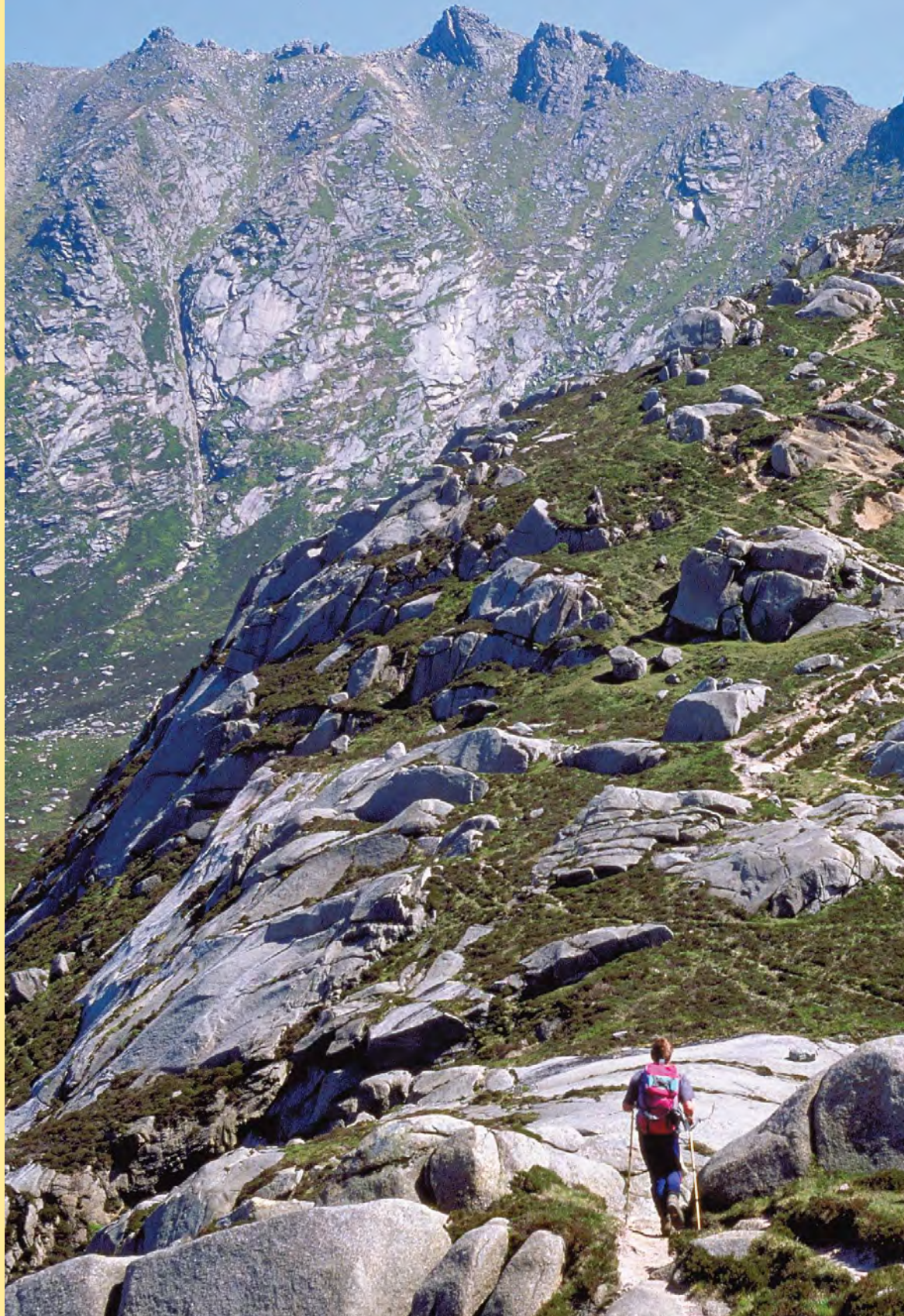
**Quaternary
Research
Association
partners
Earth Heritage**

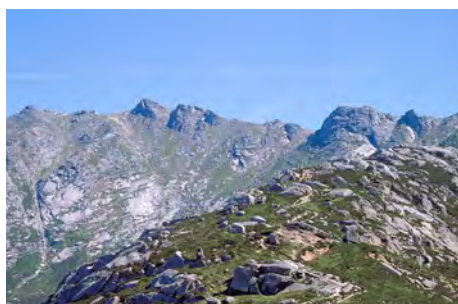


**Wren's Nest
celebrates
80 years of
geodiversity**



**Rock Stories
raise
awareness
of Scotland's
outstanding
geoheritage**





COVER - The Isle of Arran contains some of Scotland's most spectacular scenery and outstanding geodiversity, including the granite-formed peaks of northern Goatfell. Such is the quality of the visitor experience, that the island is currently being considered for application as a UNESCO Global Geopark (see page 15). © Lorne Gill/SNH



Scottish Natural Heritage
Dualchas Nàdair na h-Alba

All of nature for all of Scotland
Nàdar air fad airson Alba air fad



Cyfoeth
Naturiol
Cymru
Natural
Resources
Wales



Quaternary Research Association

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EDITORIAL

Welcome to Issue 48 of *Earth Heritage*. You can download it free, together with back issues, as pdf files at any time by visiting www.earthheritage.org.uk (see back cover).

In Issue 47 of *Earth Heritage* we noted the regrettable ending of our long partnership with our production team led by Seabury Salmon. However, we are absolutely delighted to note that Seabury has since been awarded the Halstead Medal by the Geologists' Association for his outstanding work on *Earth Heritage* 1995-2017 and his continuing work for the GA's *Rockwatch* (see page 48, this issue) – many congratulations Seabury! We would like to reiterate our thanks to Seabury, and his partner Shirley, for all their hard work and professionalism over the years, and for getting *Earth Heritage* into such good shape.

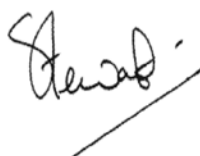
In Issue 48, we also have to say goodbye to another stalwart and long-time friend of *Earth Heritage*, Professor Cynthia Burek, who has retired from our Editorial Board after long years of service representing the voluntary geoconservation sector and flying the flag (extremely vigorously) for geodiversity and geoconservation! Cynthia contributed many features to *Earth Heritage* over the years, helping to broaden our appeal and adding an international dimension to our publication. Cynthia, you will be missed! At the same time, we are delighted to welcome Julie Harrald, The Geology Trusts & English Geodiversity Forum, to the editorial team, and look forward to working with her as our new voluntary geoconservation representative.

On a personal note, I thank my fellow editors and our new Graphic Designer, Barbara Silva, for shouldering far more work than normal in producing Issue 48. Without them and our generous sponsors, now including the Quaternary Research Association (joining the GA as a non-Government Agency participant), we would have been unable to produce this issue.

Finally, congratulations to the Cornish 'Man Engine' (featured in *EH* 47) which has won the National Lottery Best UK Arts Project Award.

As ever, we want to hear your views and to learn of new projects. To contribute, please contact the most appropriate editor (left).

Enjoy your reading!



Stewart Campbell, Managing Editor

People counter at Siccar Point

Early in 2016, at the request of Lothian & Borders Geoconservation, Scottish Borders Council installed a step or pressurepad counter at the gateway to Siccar Point SSSI. The intention is to determine visitor numbers and to guide aspirations for touristic development at this internationally significant locality.

Between mid-February and the end of November 2016, around 1,300 people visited the site. If this footfall compares favourably with that of other tourism hotspots along the Berwickshire coast, it could support the formalisation of the access route to the site and its associated care and maintenance. It is hoped that this may be achieved by 2026 - the tercentenary of James Hutton's birth.

Colin MacFadyen, Scottish Natural Heritage



Regarded as one of the most important geological locations in the world, it is hoped that by Hutton's tercentenary an access solution to the problems faced by visitors to the site may be in hand.



This kissing gate lies on the informal public path leading to the cliff top overlooking Siccar Point. A pressurepad counter in this area detects when footfall occurs. A signal is sent to the control box where a counter is activated.

Photos by Colin MacFadyen/SNH

Lake District on the world stage

On the 9th July 2017, at its World Heritage Committee meeting in Kraków, Poland, UNESCO inscribed the Lake District as a World Heritage Site (WHS). It joins Egypt's pyramids, the Grand Canyon and the Great Barrier Reef - all considered to have Outstanding Universal Value (OUV). This is the UK's 31st and largest WHS and the only UK National Park that will be entirely a WHS.

The English Lake District WHS is in the 'Cultural Landscapes' category that represents the 'combined works of nature and of man'. This is reflected in the three themes that underpin its OUV.

Located in the north-west of the English Lake District, Buttermere is a classic U-shaped glacial valley containing the lakes of Buttermere and Crummock Water.
© Andrew Locking

Identity

The acknowledged beauty of the Lake District is the result of thousands of years of industrial (including quarrying and mining) and agricultural activity within the spectacular natural landscape of mountains, valleys, lakes and woodland. It is a cultural landscape of international significance.



Inspiration

The beauty of the Lake District inspired artists and writers of the Picturesque and Romantic movements and generated ideas about landscape that have had global influence.

Conservation

The Lake District has been enjoyed and valued by local people, visitors and the wider public for 250 years. Concern to protect it was the inspiration for the birth of the conservation movement, including the National Trust and protected areas including UK National Parks.

Jonathan Larwood, Natural England

Find out more about the bid and activities over the coming months at: <http://lakesworldheritage.co.uk/> and UNESCO World Heritage Sites at: <http://whc.unesco.org/en/list/>

Vandalised world-class geo-feature

Regular readers of *Earth Heritage* will be aware of the ongoing issue of irresponsible core sampling that has damaged many geological sites across the UK and farther afield and SNH efforts to encourage responsible coring through the publication and promotion of the Scottish Core Code.

Early in the summer of 2017, SNH photographed the geological exposures below during a site-condition monitoring visit to the remote Garvellachs Site of Special Scientific Interest located between Jura and Mull. Thought to have been undertaken in the 1970s, and considered to be one of the most damaging instances of irresponsible core sampling in Scotland, this thoughtless action has damaged this internationally important rock outcrop both in terms of its aesthetic quality and for future photographic illustration.

Despite the passage of decades, this ‘geo-vandalism’ is as clear as the day it was undertaken. This photograph is published here to remind researchers to take more care and adhere to long-established codes of conduct when sampling rocks. The drilling takes minutes but the effects could last millennia.

Colin MacFadyen, Scottish Natural Heritage



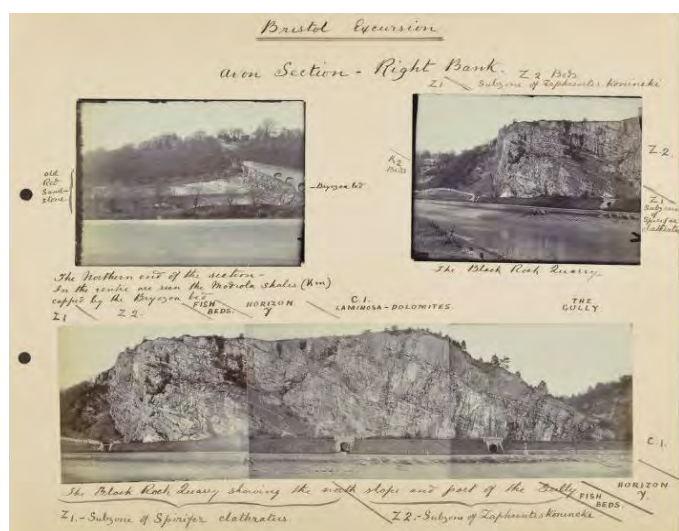
Nine core-holes deface this wonderful ice-moulded exposure of Port Askaig Tillite Formation rhythmites (folded by compaction around a sandstone wedge) at Sloc a Cheatharniach on Garbh Eileach. An additional 152 holes affect the associated rock sequence nearby. The researchers could have used less obvious and visible rock faces for their sampling. This rock face will bear the scars of their thoughtless actions for millennia. Photo by Colin MacFadyen/SNH

Geologists' Association Carreck Archive now on-line

The Geologists' Association photographic archive is now on-line. Thanks to the sterling effort of the British Geological Survey, the first selection of albums from the GA Carreck Archive is now available to browse as album pages, with the facility to zoom in on the details.

The Carreck Archive spans much of the history of the GA, in particular photographs of its field trips (both locality and the people enjoying the excursion), as well as a range of other ephemera including letters, postcards, notes, illustrations and menus. In this first tranche are albums compiled by E.E.S. Brown, T.W. Reader, H.D. Hewitt, E. Martin and Rosalie Yeates.

Here are some examples of what you will find.



Right: There is little known about Edmund Martin. He joined the GA in 1913, was then resident in Shepherd's Bush, and in 1915 he is listed among those GA members serving in the Great War — he was a member of the Honourable Artillery Company. His donated album spans his participation in geological excursions from 1912-1958 — this page considers erosion of the chalk sequence to the east of Seaford (between 1923 and 1948).

Left: T.W. Reader is among the most important contributors to the GA Carreck Archive. His albums document GA excursions between 1907 and 1919 and his photographs were widely used to illustrate the *Proceedings of the Geologists' Association*. This is a typical annotated image illustrating the GA's April 1919 excursion to the Bristol area.



To find out more about the GA Carreck Archive, and link to the new on-line resource, please go to: <https://www.geologistsassociation.org.uk/archive.html>. For further information about the GA Carreck Archive, please contact Jonathan Larwood at archive@geologistsassociation.org.uk.

Jonathan Larwood, Geologists' Association Archivist

Black Country geological champion honoured



Alan Cutler receives his MBE from HRH the Prince of Wales. Photograph courtesy of British Ceremonial Arts Limited

Alan Cutler has been recognised with an MBE in the 2017 New Year Honours list for his significant contribution to geological conservation, particularly in the Black Country. Alan embodies the tradition and spirit of the very best of British naturalists, taking what was essentially a hobby and developing his interest to ensure that geological conservation gets the recognition and consideration it deserves.

Alan's great commitment to geological conservation led him to devote a great deal of the time that he could have spent enjoying geology in the field, to attending meetings, conferences and building networks to influence Local and Regional policies. This resulted in key decision makers being aware of the geological heritage and geological conservation being considered when important decisions were being made. Alan also played a key role in developing and implementing many projects to improve the wider environment of the Black Country.

Highlights of Alan's long contribution to geology and conservation, almost entirely carried out in a voluntary capacity, include:

- Founding, with fellow enthusiasts in 1975, the Black Country Geological Society (BCGS) which he went on to Chair for over 25 years.
- Playing a central role across the UK in supporting and guiding geology groups, through GeoConservationUK, in adopting a consistent approach to local geological site conservation, showing the professionals how local geoconservation can work on the ground.
- Championing, as a member of the Black Country Environment Forum, the cause of geology and the wider environment in the Black Country.
- Chairing the Birmingham and Black Country Biodiversity and Geodiversity Partnership. This group promoted nature conservation in Birmingham and the Black Country and has been critical to the development of successful funding bids to deliver nature improvements.
- Playing a significant part in the development of the Birmingham and Black Country Nature Improvement Area (NIA).
- Volunteering with Natural England, providing management advice to staff and working with geological SSSI owners to ensure their sites are well managed.
- Serving as a member of the Management Team for the Black Country's bid to become a UNESCO Global Geopark.

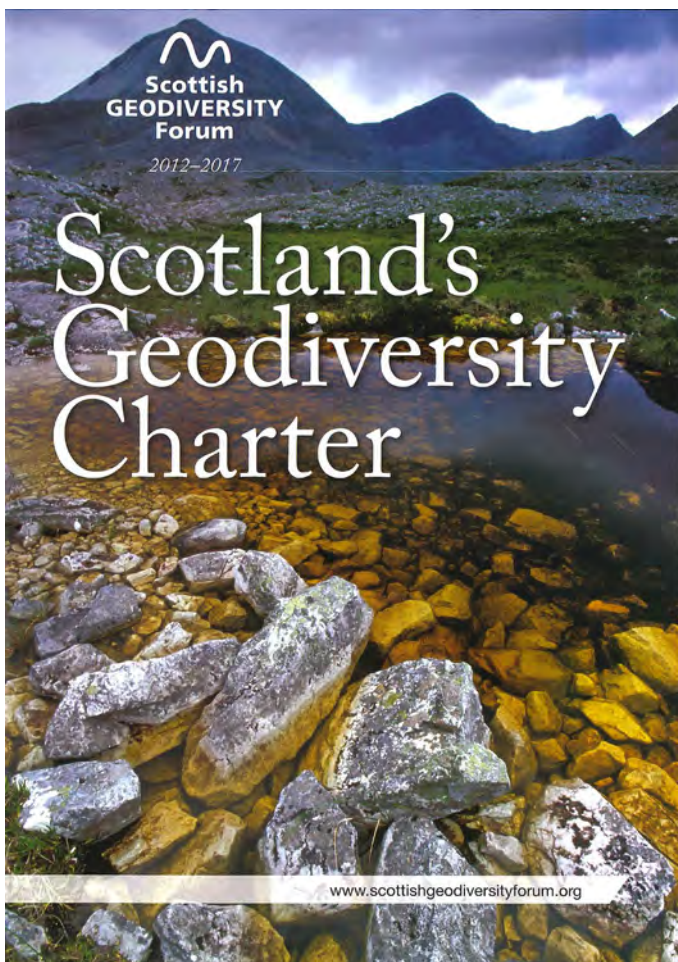
Alan received his MBE from Prince Charles at a ceremony in Buckingham Palace at the end of March.

Congratulations Alan on your well-deserved recognition!

Chris Hogarth, Natural England

Renewal of Scotland's Geodiversity Charter

Scotland's Geodiversity Charter was launched in June 2012 and has attracted the support of 61 signatory organisations. Various initiatives have helped to take forward the vision of the Charter: 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. The Scottish Geodiversity Forum has worked with partners to revise and update the Charter during 2017.



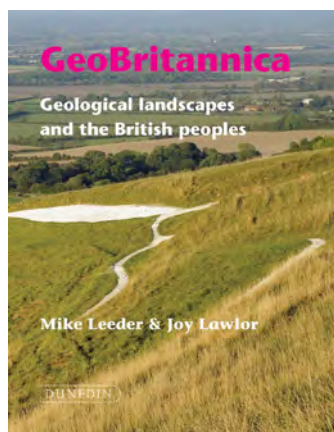
Organisations were invited to confirm their support for the renewed Charter by **15 September 2017** - see <https://scottishgeodiversityforum.org/charter/>. This renewed Charter will then be launched at a significant Scottish geodiversity conference at Dynamic Earth in Edinburgh on Thursday 16 November 2017 – celebrating what has already been achieved and encouraging further activity.

Contact:
 Angus Miller
chair@scottishgeodiversityforum.org
 0131 555 5488

Angus Miller, Chair of the Scottish Geodiversity Forum

The Scottish Geodiversity Forum is a Scotland-wide voluntary organisation with a membership of over 200 people and 17 organisations. About 30 volunteers are actively involved running the Forum, while others provide help and support for different aspects of its work. Since it was founded in 2010 the Forum has made huge strides to raise the profile of Scotland's extraordinary geodiversity, highlighting its value in education, ecosystem services and the economy through tourism.

GeoBritannica: Geological landscapes and the British peoples



By Mike Leeder and Joy Lawlor, Dunedin, Edinburgh (2017), 281pp., ISBN: 9781780460604, £24.99 (Hardcover)

GeoBritannica concerns the geological legacy of Britain, an inheritance bequeathed by its bedrock to the peoples who have lived on the island for the eleven millennia since the Ice Ages. The authors provide a modern interpretation of the geological history of Britain and place this in its historic, social and artistic contexts. They explain the geological foundations of the landscape and the raw materials it provides showing how this geology has been utilised by society and by individuals in creative acts of the imagination. The reader will discover how regional environments and interests have been tackled by geologists in endeavours as diverse as mining, quarrying, architecture, literature and the visual arts.

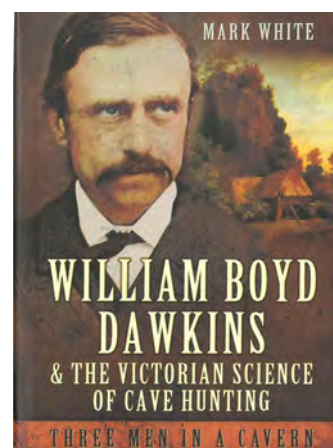
This full-colour hardback book is for those wanting to develop a better understanding of where we live and how we develop our love and understanding of the island which we inhabit.

Colin MacFadyen, Scottish Natural Heritage

William Boyd Dawkins & the Victorian Science of Cave Hunting: Three Men in a Cavern

By Mark John White, Pen and Sword Books Ltd, Barnsley (2016), 302pp., ISBN: 9781473823358, £25.00 (Hardcover)

The subject of this monograph, which belongs within the 'history of science' category, was a prominent geologist, palaeontologist and archaeologist of his era, who is largely forgotten today, despite being implicated in controversial and potentially fraudulent 'discoveries' that were perhaps akin to the infamous Piltdown hoax (*Earth Heritage* 40, p. 15). Boyd Dawkins was an advocate of Darwin but also an enemy of the (future) geoconservation movement in that, as with many Victorian speleologists, he oversaw the complete removal of the contents of the caves he encountered, generally leaving nothing for future generations. Prominent amongst Dawkins' work was that undertaken in the caves at what is now



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the Creswell Crags SSSI, in the border area between Derbyshire and Nottinghamshire and recently found to host the first Ice Age cave art to be discovered in Britain (*Earth Heritage* 20, p. 4). The controversy that besmirches Dawkins' reputation surrounds two prominent finds from here, a canine from the sabre-toothed cat (*Homotherium latidens*), interpreted as a possible pendant, and an indeterminate rib bone sporting a horse engraving. The exact provenance of these, the most notable artefacts from the entire Creswell Crags complex, has been strongly contested, with more than a hint that they might have been 'planted', a suggestion that stemmed from co-worker Thomas Heath, curator at Derby Museum.

White's book is a captivating read, splendidly documenting the intrigue and rivalry amongst the personalities involved, who included the Reverend John Mello, a close ally of Dawkins, and the aforementioned Heath, as well as John Plant, curator of Salford Museum, another contemporary who would seem not to have been an avid fan of the great man. However, this is not a character assassination; instead there is much sympathy for Dawkins, despite the lamentation about the sparseness of his note-taking and the selection, for the book's cover, of a photograph of the budding speleologist shortly after his appointment as curator at Manchester Museum in which his countenance can only be described as 'shifty'.

The limestone gorge at Creswell Crags SSSI contains several caves occupied during the last Ice Age.

© Creswell Heritage Trust

David Bridgland, Durham University



Wren's Nest – celebrating 80 years of service to geodiversity and geoconservation

Jonathan Larwood, Natural England and the Geologists' Association

In June the Geologists' Association (GA) visited the Wren's Nest National Nature Reserve (NNR) staff to recognise and celebrate their unparalleled contribution to geology and geoconservation.

The Wren's Nest NNR is well known to many: Wenlock Silurian Limestone exposed in the heart of Dudley, a source of limestone for the Industrial Revolution and the eponymous Dudley Bug (*Calymene blumenachii*), a subject of Murchison's research into the Silurian System, an NNR since 1956, and a place of immense value to the people of Dudley and visited by geologists from around the world.

Its time, history and challenges as an NNR have been regularly reported in *Earth Heritage*, most recently celebrating 60 years since its declaration. It is an exemplar of geoconservation in an urban setting, and an unparalleled demonstration of the role NNRs play in research, education and public engagement (Prosser and Larwood, 2008). Over the last quarter of a century this success has been down to a small dedicated group of Wardens who have managed the Wren's Nest's geology, facilitated and welcomed visitors, and ever strengthened the link between the Wren's Nest and its surrounding communities. Today, the Wren's Nest is the jewel in the crown of the much anticipated Black Country UNESCO Global Geopark.

In recognition of these achievements, the GA, which has been visiting the Wren's Nest for more than 100 years, has made a Special Award (from the Baker-Arber Fund) of £500 to the Wren's Nest, and its Wardens each received a certificate recognising excellence in geoconservation. The Wardens - Dave Hill (27 years of service), Rob Earnshaw (25 years), Trevor Conroy (volunteering 4 days a week for 26 years) and the Senior Warden, Ian Beech (5 years), have collectively contributed over 80 years of dedicated service. Over the last 25 years they have received and welcomed over a quarter of a million visitors and each of them has walked at least 20,000 miles (approaching the circumference of the Earth) in their day-to-day Wren's Nest work.



The Wren's Nest NNR Warden team is seen here in green with members of the GA. From left to right: Di Clements (GA Secretary), Trevor Conroy, Dave Hill, Colin Prosser (GA President), Graham Worton (Dudley Museum and Art Gallery), Ian Beech and Rob Earnshaw.

Looking back, the first reported visit of the GA to the Wren's Nest was in 1863 on the invitation of the Dudley Society; on this occasion they also enjoyed a demonstration of iron smelting and a trip down a coal mine to see the 'Thick' seam. Under the leadership of Professor Charles Lapworth they returned in August 1898 when they

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Further reading

Lapworth, C., Jerome Harrison, W., King, W., Wilson, S. and Watts, W.W. (1898). Long Excursion to the Birmingham District: Thursday, July 28th, to Wednesday, August 3rd, 1898. *Proceedings of the Geologists' Association*, 15, 417-428.

Prosser, C.D. and Larwood, J.G. (2008). *Conservation at the cutting edge: the history of geoconservation on the Wren's Nest National Nature Reserve, Dudley, England*. From: Burek, C.V. and Prosser, C.D. (eds). *The History of Geoconservation*. Geological Society, London, Special Publication, 300, 217-235.

travelled underground by canal boat (avoiding the rain) emerging onto the Wren's Nest through candle-lit limestone caverns. The last visit was in 2016, led by GA President Colin Prosser, taking in the NNR, a canal boat trip into Castle Hill caverns and finishing in Dudley Museum and Art Gallery – one of the last visits to the museum before its doors finally closed to the public.

Today, on receipt of their award, the Wardens were humbled, very surprised and delighted with such recognition - it was unexpected and comes at a time when such services are often overlooked and undervalued. Simply put by Ian Beech, "Positivity is the key to us all doing well" and that is ever true on the Wren's Nest.



The Silurian reef knolls are seen here against the backdrop of the Wren's Nest Estate.
Photos by Jonathan Larwood

Quaternary Research Association partners *Earth Heritage*

David Bridgland, Vice President, Quaternary Research Association

The Quaternary Research Association (QRA) was founded in 1964 as the Quaternary Field Study Group, its name changing to the Quaternary Research Association in 1968.



Quaternary Research Association

The organisation currently has an international membership of over 1,000, with a large and thriving postgraduate student component. It has an active meetings programme, including an Annual Discussion Meeting each January, field meetings, usually held in April and May or September, and an annual Postgraduate Symposium.

The QRA has a wide-ranging membership including archaeologists, botanists, civil engineers, geographers, geologists, soil scientists, zoologists and others interested in research into the problems of the Quaternary. The QRA maintains a website (<https://www.qra.org.uk/>) with up-to-date information about its publications, meetings, grants, awards and prizes, outreach and membership. The QRA and its members also undertake activities that support and promote the geoconservation of Quaternary sites, landscapes and museum collections. Its latest move in that direction has been to become a partner in the production of *Earth Heritage*.

The present Executive Committee of the QRA includes three former and present employees of the government conservation agencies. The President (since January 2017) is Neil Glasser, who worked as a Quaternary geologist for English Nature between 1992 and 1995 and is now Professor of Physical Geography and Director of the Institute of Geography, History, Politics & Psychology at Aberystwyth University. The Vice President (since January 2016) is David Bridgland, employed in the Geological Conservation Review Unit (GCRU) by the Nature Conservancy Council between 1980 and 1992, although as a freelance consultant towards the end of that period. He is now Professor of Quaternary Science at Durham University and has been a member of the *Earth Heritage* Editorial Team, representing the Geologists' Association, since 2012. The QRA also has a Conservation Officer, who is none other than *Earth Heritage* Managing Editor Stewart Campbell, of Natural Resources Wales, also a former GCRU worker and *QRA Newsletter* Editor.

One of the QRA's principal activities is the organisation of field meetings, many of which visit geoconservation localities, especially when the theme is related to longer-timescale Quaternary stratigraphy. The unconsolidated nature of most Quaternary sediments means that sites often require considerable management if exposures are to be maintained, unless they are sea cliffs where active erosion is taking place or working quarries. As the former have become increasingly subject to erosion-limiting schemes and the latter have become less common, so the use of SSSI and other conservation localities (RIGS/LGS) has increased. The use of geoconservation sites for QRA meetings has been reported in recent issues of *Earth Heritage*: on the Durham coast in 2013 (*EH* 41, p. 34) and in the Lower Thames and Essex in 2014 (*EH* 42, p. 12 & *EH* 43, p. 26).

Arran – another potential Geopark in Scotland?

Stuart Blake, Director Lochranza Field Study & Activity Centre and Co-ordinator of Arran Geopark Project

Arran in the Firth of Clyde, on Scotland’s south-west, is widely regarded as ‘Scotland in miniature’. The sheer variety of rock types and structures on Arran has for many years provided an excellent teaching ground used by students of Geology as part of their A-level or degree-level studies. However, the stories of shifting continents and ancient environments and the cultural association with James Hutton, who used now-classic features of the island’s geology to help develop his *Theory of the Earth*, transcend academic research and teaching and are there for all to explore and enjoy. Little wonder that moves are afoot to develop Arran Geopark.

Arran’s oldest rocks, in the north of the island, akin to those of Highland Scotland, are separated from younger rocks in the south by the Highland Boundary Fault. Hence the ‘Scotland in miniature’ nickname echoing the mainland’s Highland and Lowland topography and geology. Rocks that floored the ocean which once existed between the areas we know as Scotland and England are testimony to the tectonic events that brought together the foundations of the island and for that matter Britain. If ever you fancied being a time lord, then there cannot be many places in the UK where you can walk



King’s Cave lies near Blackwaterfoot on the west coast of the Isle of Arran. The coastline between here and Drumadoon Point to the south is characterised by high cliffs and a well-developed wave-cut platform fashioned from Permo-Triassic sandstone, some beds of which contain reptile footprint trace fossils. Several natural caves have been cut into the cliffs. The largest of these is where Robert the Bruce may have watched the famous spider.

©Lorne Gill/SNH

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through 90 million years of geological history, as you can on Arran, from the Devonian to Permian, and observe the evidence of huge environmental change. As part of the North Atlantic Igneous Province, some 50% of the Island is igneous in origin. A large granite pluton shot through by smaller dolerite dykes makes up the core of the north of the Island. Large sill intrusions at Drumadoon in the south-west and the dyke swarm at Kildonnan in the south testify to continental crust being split apart with the opening of the North East Atlantic. Whatever quarter of the island you visit there is always something of geological interest to be seen.

Given this enormous and accessible geological heritage, in 2014 the whole island was voted one of the best Geosites in the UK in a poll undertaken by the Geological Society. In 2017 Arran was included in the list of Scotland's 50 Best Places for geological tourism. This leads to the question is there scope for development of Arran's geological heritage to augment the tourism opportunities on offer? Currently there are two (and one aspirant) UNESCO Global Geoparks in Scotland, each with their world-renowned geological heritage. Arran with its geological wealth crammed into a space 30 miles long and 15 miles wide, with the sea as a natural boundary, has the making of an ideal fourth Geopark.



Over the years the National Trust for Scotland, Isle of Arran Heritage Museum and Lochranza Field Study & Activity Centre, amongst others, have tried to bring home to visitors and locals alike the very special nature and potential of the island's geological heritage. Thanks to the support of the Coastal Communities fund in April 2017, the Arran Access Trust will be able to provide increased interpretation through a new centre based at the Field Studies Centre and update existing materials, signage and pathways. The project will last two years and will employ five staff, including a project officer, footpath development team and seasonal ranger, which for a small island is very important. This considerable investment is a significant step forward in Arran becoming an aspirant UNESCO Global Geopark.

I hope, if you are reading this and have not visited Arran before, this will put it on the must-see list. In September 2017 we held our second 'Geofest' weekend. For further details please contact:
stuart@lochranzacentre.co.uk.

The granite-formed peaks of North Goatfell on the Isle of Arran provide stunning views across south and west Scotland and a fine hillwalking experience. ©Lorne Gill/SNH

Fforest Fawr celebrates four more years as a UNESCO Global Geopark

Tony Ramsay, Cardiff University and Fforest Fawr Geopark

Fforest Fawr Geopark, in the Brecon Beacons National Park, is celebrating retaining its status as a UNESCO Global Geopark by the award of a ‘green card’ following the geopark’s revalidation in 2016. The award is based on a progress report, a detailed questionnaire and a field evaluation mission involving two evaluators from different countries and the assessment of their report by the UNESCO Global Geoparks Council in September 2016. This achievement builds on successful revalidations in 2008 and 2012 and ensures four more years in which to progress the work of the geopark.

Fforest Fawr Geopark, the first geopark in Wales, became a member of the European and Global Geoparks networks in 2005 and a UNESCO Global Geopark in 2015. Like many Global Geoparks, it is situated in a rural area, has a significant geological heritage and is large enough to support a strategy for sustainable economic development. In addition to its geology and landscape, the geopark makes use of sites of industrial, archaeological, ecological, historical and cultural significance. The geopark’s ultimate objective is in accord with that of all UNESCO Global Geoparks, namely to use the designation as a vehicle to engage communities in protecting these assets in ways which contribute to the economic development of their territory. During the field evaluation mission, Vesa Krökki (Rokua Geopark, Finland) and Manfred Kupetz (Muskau Arch Geopark, Germany/Poland) met with the geopark’s partner organisations and visited some of its significant geosites.

Fforest Fawr Geopark has, since its inception, provided a strong and effective framework for co-operation between geologists and specialists in other disciplines, including biology, archaeology, industrial and cultural history and tourism. It functions through co-operation between its communities and partner organisations including the Brecon Beacons National Parks Authority, the British



The evaluators met with members of the Brecon Beacons National Park, one of the geopark’s partner organisations. Photo by Manfred Kupetz

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Bwa Maen shows a spectacular fold within Carboniferous Limestone and has a long history as a geological educational site. Photo by Tony Ramsay



Gorge walking in the Afon Sychryd is a popular all-year-round activity in the geopark. Photo by Tony Ramsay

Geological Survey, Natural Resources Wales, Dyfed Archaeological Trust, the Brecon Beacons Park Society, Cardiff and Swansea universities, local businesses and tourism providers. However, its real strength lies in its bottom-up approach involving the active collaboration between specialists, communities and local businesses.

In co-operation with its communities, the geopark has, in common with all European UNESCO Geoparks, created 'Geopark Corners' which are based in community centres. They inform and up-date residents and visitors about the geopark and its activities and also include examples of available geo-trail leaflets. The nature of the local geology is explained using rock samples, some of which relate to past industrial activity and geo-exploitation. Each Corner also contains a map showing the locations of other European Geoparks. The community centres also provide locations for geopark presentations, management group meetings and can be starting points for guided walks. The geopark also engages with local businesses, exemplified by the presence of a Geopark Corner in the Hub, a café with Bed and Breakfast provision in Abercraf. The geopark was also involved in designing the exhibit showing the source of groundwater in Penderyn Whisky Distillery's Exhibition Centre.

Since 2012, the geopark has organised twice a year a two-day training programme for tourism providers who wish to become Fforest Fawr Geopark Ambassadors. The Ambassadors, now 80 in number, use their specialised knowledge to inform and assist visitors to make the most of their stay in the area. Through a process of mutual learning and an exchange of expertise between specialists, the communities, local businesses, tourism providers and the geopark's management group, all are increasingly aware of the need to protect the environment and the potential of Fforest Fawr UNESCO Global Geopark's landscape, geology, cultural and industrial history for developing geotourism.

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To maintain high-quality standards in management and the services provided to visitors and the communities, UNESCO Global Geopark membership is, however, restricted to a period of four years and renewal of the status is dependent on the outcome of another revalidation mission. If the required criteria are not fulfilled, the geopark is awarded a 'yellow card' and its management body is allowed two years in which to address any issues arising from the mission. Failure to satisfy the required criteria following the two-year period results in a 'red card' and the loss of the UNESCO Global Geopark designation.

Fforest Fawr Geopark's successful revalidation in 2016 together with previous successes in 2008 and 2012, recognises the achievements of its initiatives resulting from its engagement with its partners and local communities. This huge achievement confirms that the geopark is on a par with other UNESCO Global Geoparks. It also ensures that Fforest Fawr UNESCO Global Geopark will continue to engage with the European and Global Geoparks networks to progress the exciting geopark concept in which all partners are united in achieving wealth creation through sustainable economic development.



Penwyllt is a site of former industrial activity with tramways, quarries, lime kilns and a brickworks which manufactured firebricks for the South Wales metal industry. Photo by Tony Ramsay

North Pennines hosts annual UK Global Geoparks Forum

Raymond Roberts, Natural Resources Wales

Delegates from the UK's UNESCO Global Geoparks, together with representatives from Natural England, Scottish Natural Heritage, Natural Resources Wales, Geological Society of London, BGS and the UNESCO UK National Commission, converged on Teesdale in May for the annual meeting of the UK Committee for UNESCO Global Geoparks (UKCUGG).

Hosted by the North Pennines AONB and UNESCO Global Geopark, this meeting provided an opportunity for Geoparks to discuss active applications, revalidation, general Geopark business and, most importantly, strengthen collaboration and update each other on exciting Geopark projects and initiatives. The active UK Geopark applications, currently the Black Country and Lochaber, had the valuable opportunity to discuss and seek advice on the recent UNESCO decision on their applications - both were commended for their work and progress, but a decision was deferred by UNESCO pending further clarification on some issues.

This year we also had the opportunity to hear from the Kenya National Commission for UNESCO and the Baringo aspiring geopark, which provided a fascinating perspective from Africa. One of the ambitions for Baringo is to have a visitor centre in the Great Rift Valley which would straddle the Equator. The meeting also provided the opportunity for aspiring geoparks and interested areas to update on progress and discuss the application process. This included representatives from Arran, Causeway Coast, Jersey, Mourne Gullian, Peak District and the North Yorkshire Wolds.

The highlight though is always to see the geology and wide-ranging projects of the host Geopark. On the first evening we visited the new Community Observatory and restored mine buildings in Allenheads – all part of the Allen Valleys Landscape Partnership Scheme. The observatory design



Skilful local artists and stonemasons have produced impressive carvings which can be spotted alongside the riverside walk (here a mayfly).



Chris Woodley-Stewart, Director of North Pennines AONB/UNESCO Global Geopark, leads delegates along the riverside walk to High Force.

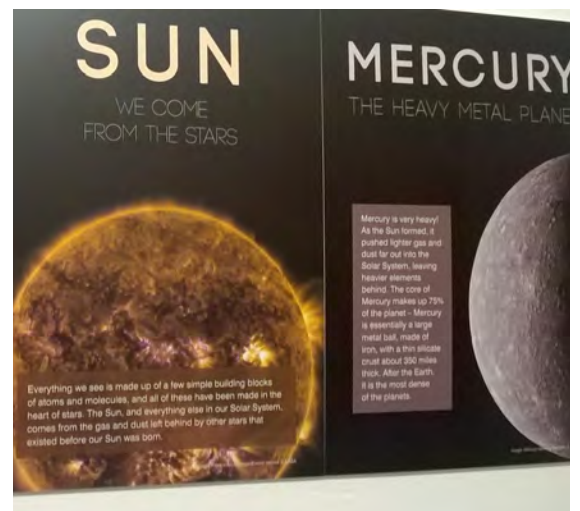
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was the product of a competition run amongst architectural students from the region with the winning design created by three Newcastle students.

During the day we walked from the meeting venue at Bowlees Visitor Centre along the River Tees to the spectacular High Force where the North Pennines AONB/ UNESCO Global Geopark has provided a mix of traditional interpretation boards and a geo-trail. Natural England has produced innovative interpretation of the surrounding Moor House National Nature Reserve.

The meeting concluded with a visit to Nenthead Mines near Alston. The remote valley is covered in the remains of former lead and zinc mines, part of which is designated a geological SSSI (Smallcleugh Mine SSSI), and is notable for rare lichens and plants growing on the metal-rich mine dumps. Most of the valley is also a Scheduled Monument for its industrial archaeology. Although owned by the Cumbria local authority the Nenthead Mines Conservation Society, a volunteer charity, manages the site and provided

UKCUGG delegates visited one of the newest projects in the North Pennines Geopark – an observatory with geological interpretation of our solar system. Located in England’s highest village at 410 m above sea level, the observatory at Allenheads will allow the local community and visitors to enjoy Northumbria’s inky black skies while learning more about planetary geology.



High Force is one of the most spectacular waterfalls in England. It falls some 21 m over the Whin Sill into the plunge pool below. Delegates appreciated the good access and viewing areas located on both sides of the river. Photo by Matt Rabagliati, UK National Commission for UNESCO

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us with a guided tour of the underground mine workings.

The UKCUGG goes from strength to strength and provides an essential forum for members to learn from each other and exchange ideas. The 2018 UKCUGG will be in Fforest Fawr Geopark.

Further information on the UNESCO Global Geopark application process can be found at the UNESCO website - <http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/unesco-global-geoparks/>.

Nenthead Mines offer a wealth of industrial archaeology for visitors to explore.



Underground tours at Nenthead Mines, led by expert volunteers, provide an invaluable opportunity for the public to appreciate the hard working conditions endured by the miners.



Photos by Raymond Roberts, Natural Resources Wales, unless otherwise stated

Stories in the rocks: raising awareness of Scotland's outstanding geoheritage

Robina Barton, Scottish Geodiversity Forum

For over 200 years those in the know have been aware just how special Scotland's geology is. This 'Land of the Mountain and the Flood' is where people first began to figure out how the world works. Thanks to James Hutton's theory of 'deep time' and Peach and Horne's explanation of how mountains are built, Scotland is justly known as the birthplace of modern geology. Our rocks and landscapes tell mind-blowing stories that cover some three billion years of Earth's history – of continental drift, volcanism, oceans opening and closing, ice ages, ancient rivers and the rise and fall of mountain chains. Geology enthusiasts, experts and students visit Scotland to engage in their studies, complete mapping projects, or just marvel at the rich diversity and what it can tell us. A new project aims to highlight and promote some of the most outstanding examples of this geoheritage.

The last 200 years have seen many people visit Scotland for the aesthetic pull of the landscape. Many have been inspired by its dramatic beauty to create poems and paintings. Others have been driven to explore, walk, climb, sail and pit themselves against the challenges of the wild. Scotland today is hugely popular as a tourist destination, and people still flock to conquer Ben Nevis, or experience the haunting atmosphere of Glen Coe. But most of these people come and go without ever realising the incredible stories that the rocks and landscapes have to tell.



Achanarras Quarry, Scotland's 'fossil quarry', is one of the most famous fossil localities in the world. It offers a unique opportunity to learn about, and to try and find, the fossil remains of 380-million-year-old fish. Photo by Iain Sarjeant/SNH

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The Falls of Clyde near New Lanark are part of the New Lanark World Heritage Site, a location of great visual appeal that has a glacial legacy. One of the Clyde's three great waterfalls, this site has attracted tourists since the 19th Century.

All that is about to change, thanks to a Scotland-wide project that aims to 'reveal the stories in the rocks' to visitors and residents alike. The Scottish Geodiversity Forum has secured £10,000 from the Heritage Lottery Fund to identify, interpret and promote 50 of Scotland's top geosites and to celebrate this work with a month-long Geo-festival in October 2017 (<http://www.scottishgeology.com/geoheritage-festival/>). The project is linked to the Visit Scotland year of History Heritage and Archaeology 2017, providing a perfect opportunity to reach out to a new and varied audience.

The 50 Best Places project will draw on the wealth of knowledge and expertise among Forum members to tell stories of 50 of the best geological sites across the length and breadth of Scotland. The project will highlight places that are easy to visit and explore, and lend themselves to engaging interpretation, bringing to life both the stories in the rocks and how they have influenced Scotland's inhabitants throughout history. Geodiversity is responsible for the mix of highlands and lowlands, the intricate coasts and islands that make Scotland special. It has been used by people in different ways over millennia, and had a profound effect on them.

Given the sheer wealth of material available, selecting only 50 sites presented the first challenge, and a lot of good-natured debate among Forum members. Site selection criteria were drawn up to allow each site to be assessed in terms of its geological story, attractiveness, accessibility, educational value, interpretative potential, links to other heritage features and proximity to other attractions. Volunteers assessed the sites assigning scores based on the criteria, resulting in a lengthy list of possibilities scored in order of suitability.

This list was then subject to further refinement at the Scottish Geodiversity Forum AGM in March 2017. It was essential to ensure that the final list provided a good geographic spread, and suitable coverage of all Scotland's key geological time periods and events. It was also essential to ensure that no site of vital importance had been missed, which it had! Somehow Siccar Point, arguably the most famous and important geological site in the world, had been omitted! That small matter rectified, it remained to put the newly refined list out to final scrutiny by Forum members. Finally, a list of 50 sites

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was agreed, with a few extras in reserve. The next stage of the project is to develop interpretation – informative and engaging site descriptions and explanations supported by good-quality and attractive photographs. Site descriptions are being written by volunteer geologists across Scotland, and compiled by a scientific editor, ready to share with and enthuse the public. The material will be made available online, within the existing scottishgeology.com website, and in a free booklet that will be distributed through visitor centres, attractions and museums. It will be officially launched during the Geo-heritage Festival at a celebratory public event at Dynamic Earth in Edinburgh on Saturday 14th October and will be shared through social media channels via Visit Scotland and Scotland's Geoparks.

For more information contact robina@scottishgeodiversityforum.org



These spectacular folds occur in one-billion-year-old metamorphosed rocks at Loch Monar. The fold structures are beautifully clear occurring on rock that has been glacially smoothed. They also have international value and scientific significance. Their aesthetic value in the context of a wild landscape is well worth a visit.

The internationally important and impressive Parallel Roads of Glen Roy in Lochaber are ice-dammed lake shorelines developed toward the end of the last glaciation. The location provides a dramatic landscape-scale story with an intense history of debate.



Photos by Lorne Gill/SNH unless otherwise stated

Promoting Edinburgh's 30 Local Geodiversity Sites

Oliver Buchanan, photographer and final-year Geology student, Edinburgh University

The Geoscience Outreach & Engagement course at Edinburgh University gives final-year students the chance to undertake projects and develop them with relevant, well-established partner organisations.



Harlaw is not only a beautiful Sunday walk but demonstrates a wide range of Lower Carboniferous sediments including sandstones, mudstones and dolostones dated accurately through the discovery of fossilised plant spores.



Cramond - A heron frequents the weir in the lower course of the River Almond. As well as providing excellent exposures of Carboniferous sandstone of educational value, the river also has features of industrial archaeological significance.

My brief was to produce a comprehensive, engaging and clear photograph-led archive of Edinburgh's Local Geodiversity Sites (LGS) under the supervision of Edinburgh Geological Society and Edinburgh City Council. This has resulted in an accessible and picture-led guide to the City's key geodiversity.

My passion for the geology and landscape of the city and experience as a photographer, resulted in a unique slant on this large and ambitious geodiversity recording/archive project.

Project planning began at the start of 2017 and ran in parallel with, and involved, a working group comprising Edinburgh City Council and Edinburgh Geological Society formed to review and update the City's LGSs. The working group helped in establishing the project brief, providing helpful guidelines and comments on initial drafts.

Each LGS was visited and photographed during the early Spring with the production of the associated site descriptions. This material will now be published on both Edinburgh Geological Society and Edinburgh City Council's websites. The web coverage will consist of a master page with a map and some background information allowing easy navigation between LGSs.

A key aim of the project is to engage members of the public who have little or no knowledge of geodiversity, and to provide them with relevant and stimulating information. Thus, the photography abandons the usual 'coin on

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This well-walked stretch of coast along South Queensferry offers a range of geodiversity features ranging from beds of oil-shale, that have been preferentially eroded to form quiet bays, to igneous sill intrusions, that comprise the hard rocky headlands.

Water of Leith - Colinton Dell is a geomorphological site of regional importance providing cliff exposures of mudstone and sandstone, and raised river terraces, tracing the route of glacial meltwater during the last glaciation. The geodiversity provides an important stage for understanding the local biodiversity.

exposure for scale' approach and captures the more aesthetic and artistic elements of the sites. It was therefore important for the project to capture not just the geodiversity but the outstanding scenery and related heritage.

This celebration of the City's geodiversity will hopefully be an effective companion to the more technical, but equally necessary, documentation required for the City's LGSs prepared by the Edinburgh Geological Society, British Geological Survey, Lothian and Borders Geoconservation group and Edinburgh City Council. Hopefully the guide will augment the technical reports and help to influence planning solutions to potential environmental, climatic and developmental pressures that may arise in such areas in a positive and constructive way ensuring the sustainable use of Edinburgh's geodiversity.

Photos by Oliver Buchanan



A celebration of Scotland's geology with a difference

Lara Reid, Freelance Science Writer

The Hugh Miller Writing Competition winners at the StAnza International Poetry Festival 2017

*"Beneath the bubble of the atmosphere
The rocks move, shift, settle and seethe
Fossils swim upwards again
surfacing together in ancient shoals
Exposed by wind and wave and hammer"*

Excerpt from *Romer's Gap* by Justin Sales, 1st prize in poetry winner, The Hugh Miller Writing Competition 2015-2016

We were delighted that the organisers of StAnza, the St Andrews International Poetry Festival, were so impressed by the first Hugh Miller Writing Competition winning entries that they hosted our winning poets for a reading event at the Byre Theatre in St Andrews on Saturday 4th March 2017. The event was run with support from the Scottish Geodiversity Forum and the Friends of Hugh Miller, and part-funded by the Edinburgh Geological Society. It was one of several successful linked geological-related events run in the town during the festival.

Five of the six winning poets from the first Hugh Miller Writing Competition were able to take part. Annabelle Fuller, the under-16 winner, travelled all the way from Leeds to be there and gave a delightful recital of some of her recent work. Geologist and artist Elizabeth Pickett entertained the audience with her beautiful haiku and wonderful accompanying artwork. Joint third-prize winners, published poets Jim MacKintosh and Michael Davenport, gave insightful commentaries on their fascination with Miller alongside reading recent poems. And finally, Justin Sales read his epic, first-prize-winning poem 'Romer's Gap': the judges felt this poem brought Miller up-to-date, and retained much of his spirit as both a geologist and lover of literature.

StAnza also organised a linked event; a talk by the eminent Scottish author James Robertson on Miller's efforts as a poet in his younger years and how this latterly influenced his popular science writing.

All in all, StAnza 2017 provided a highly successful and well-attended set of events related to Miller and Scotland's geology and landscapes. Oh, and keep your eyes peeled for the second Hugh Miller Writing Competition, being launched in October 2017!

One of the pieces of artwork created by Elizabeth Pickett for our StAnza events, whose geo-inspired haiku poems won a highly commended award in the first Hugh Miller Writing Competition.

*Desert lakes stacked high
tell Orcadian sagas
on flags of red-gold.*

Elizabeth Pickett 2017



Nature Conservation Order to protect dinosaur fossils on Skye

Colin MacFadyen, Scottish Natural Heritage

Fossil remains of dinosaurs, dating from the Middle Jurassic, are rare in the world. Scotland is lucky that dinosaur fossil-bearing, Middle Jurassic rocks occur on the Isle of Skye. However it has only been in the last 35 years that dinosaur trace fossils (tracks and/or individual footprints) and ‘body’ fossils (such as bones and teeth) have been found.



These extremely rare dinosaur fossils - a fragment of bone (above) and a footprint (below) occur in north-eastern Skye. Without the necessary safeguards, they could be collected illegally and lost to science. The proposed NCO will help to protect such fossils.



Compared with well-known fossil-bearing coastal locations on the south coast of England, the fossil remains on Skye are being eroded from harder more erosion-resistant rocks. Fossils are therefore not so readily revealed and consequently finds are rare amongst the broken rock on the beach and associated water-washed beach deposits.

Research on these fossils provides crucial insights of global significance into vertebrate evolution and Jurassic ecosystems. Given their global rarity and the paucity of material available for collection and research, it is important to safeguard the fossils that do occur, ensuring they are properly collected and available for scientific research.

Several incidents in the past have highlighted the vulnerability of Skye’s dinosaur-fossil material to damage through ignorance, inexpert collecting and even perhaps wilful damage. An incident in late 2016 highlighted the threat to *in situ* dinosaur footprints when there was a misguided and naive effort by a member of the public to try and take a plaster cast of the famous An Corran *Megalosaurus* prints at Staffin at the north-east of the island. Although the prints were not damaged, the incident has prompted a concerted effort to give statutory protection for Skye’s dinosaur fossils. The mechanism being proposed is a Nature Conservation Order (NCO). The NCO will identify activities that will be prohibited, namely: damaging, excavating and removal of vertebrate body and trace fossils.

A functioning NCO should deter damage to, and the collection of, dinosaurian fossil remains. However, given there is ongoing scientific research on the remains, and the associated geology, it is important a mechanism will be in place to allow the continuation of this work *in situ* and, where necessary, extraction and removal of fossil material to allow laboratory investigation, accession to museum collections and public exhibition.

Photos by Colin MacFadyen/SNH

Rising seas, greenhouse gasses and mass extinctions - future warnings from the Yorkshire Jurassic

Dan Normandale, University of York

On the turning tide

For about one and a half hours either side of low water, an extraordinary geological world is revealed between Whitby and Saltwick Bay on the Yorkshire coast. The rocks and fossils in the towering cliffs and the foreshore tell a global story of climate change and environmental catastrophe in the Lower and Middle Jurassic periods, 200 to 160 million years ago.

Death on the seabed

In the Jurassic, the Whitby to Saltwick rocks, collectively termed the Whitby Mudstone Formation, were mud layers at the bottom of the Cleveland Basin, a shallow inland sea. The Basin supported an invertebrate fauna of ammonites, belemnites and bivalves, as well as reptilian crocodiles, ichthyosaurs and plesiosaurs. Ammonites, due to their abundance and rapid evolution, are key biostratigraphical markers. One part of the Formation, the Mulgrave Shale Member, records the nature and impacts of the global Toarcian Stage (183 to 175 million years ago) Oceanic Anoxic Event (T-OAE). During the T-OAE, the bed of the Cleveland Basin became toxic to marine life due to deoxygenation. All the dissolved oxygen had been used up in breaking down vastly inflated amounts of carbon-rich organic matter which had sunk to the sea bed. Fossil invertebrate abundance and diversity were badly affected (Danise *et al.*, 2013), with many bottom-dwelling, benthic, species becoming extinct, while others, such as the bivalve *Pseudomytiloides dubius*, adapted to deoxygenation by decreasing in size to use the scant resources more efficiently. However, above the sea bed, life carried on, with fish, reptile and ammonite fossils indicating much more-oxygenated conditions. Why had organic matter deposition gone into overdrive?



Lower and Middle Jurassic sandstone and mudstone occur in the cliffs just south of Whitby's East Cliff and Abbey.



These *Pseudomytiloides dubius* bivalves are embedded in the Whitby Mudstone Formation.
© Annette McGrath

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Much evidence has been gathered from the Mulgrave Shale Member, ideal for research because of its widespread exposure, good preservation and abundant fossil record. Palaeotemperatures in the Toarcian seas, estimated to have been 12-29 °C from oxygen isotopes studies, were at their highest point in the entire early Jurassic. Oxygen dissolves less readily in warmer water, meaning fewer supplies for sustaining life and breaking down organic matter. In the Cleveland Basin, analysis of mudstone carbon isotope ratios and belemnite oxygen isotope ratios indicated an abrupt water temperature increase of 6-7 °C. This warming accelerated the hydrological cycle, ultimately increasing the input of nutrient-rich sediment into the seas from continental weathering. In warmer oceans, continental shelf gas hydrates may have dissociated, releasing methane, which oxidised into carbon dioxide (CO₂) and caused mass extinction. Elevated levels of CO₂ may also have come from the degassing of erupting magma during the intrusion of Karoo-Ferrar Large Igneous Province sills, which metamorphosed carbonate sediments, releasing more CO₂.

Plankton proliferated in nutrient-rich conditions and on death they, and their predators, added to organic matter on the seabed. Eustatic sea-level rise caused more organic matter to be deposited as terrestrial plant material was submerged. Climate changes detected in mudstones from Saltwick Nab correlate well with known changes in the Earth's orbit relative to the Sun, affecting the amount of solar radiation warming the surface and influencing its temperature.

Life leaves an impression in the sand

The Cleveland Basin was uplifted and folded in the late Toarcian to Aalenian stages, leading to extensive erosion of the Whitby Mudstone Formation which was then overlain unconformably by the Dogger Formation, a heterolithic condensed marine sequence. However, by the Middle Jurassic, around 170 million years ago, Whitby was now part of a network of sandy, silty coastal deltas, sandbanks and beaches on the western edge of the Tethys Sea. Plants thrived on the delta plain and in upland forests, including evergreen ferns, conifers, cycads and ginkgos, all indicating a warm and humid but non-tropical climate. *In situ* plant rootlets are evident in the Saltwick Formation. Carnivorous and plant-eating dinosaurs also have their footprints preserved in the Saltwick Formation rocks. The area is part of a globally important 'megatracksite', and recently sauropod fossil bones have been found.

The great geologist Charles Lyell, who wrote the seminal book *Principles of Geology* in the 1830s, once said that '*...the present is the key to the past*'. However, at Whitby this concept is turned on its head, with the past being the key to the present as well as the future. The Earth is currently experiencing climate change with echoes of the early Jurassic T-OAE. In Europe alone, 216 coastal areas (see https://c2.staticflickr.com/6/5182/5555966192_037f31f236_b.jpg) are experiencing oxygen-deficient conditions, in many cases tantamount to miniature OAEs. Carbon dioxide levels are at their highest for 650,000 years and 9 of the 10 warmest years on record have occurred since 2000 (NASA, 2016).

Burying carbon dioxide under the ocean floor in disused oil and gas reservoir rocks may be a potential answer to removing this greenhouse gas from the atmosphere. Carbon dioxide can even be turned into rock. In Iceland, carbon dioxide dissolved in water (carbonic acid) is being pumped into volcanic basalt where 95% turned into the mineral calcite within two years (Toor, 2016).

It is remarkable how such a short stretch of coast can tell us so much about the distant past, present and future. Rest assured, the geological significance of Whitby to Saltwick does not go unnoticed, it is a SSSI and considered of international importance for the Jurassic rocks, plant and reptile fossils.

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Further reading

Danise, S., Twitchett, R.J., Little, C.T.S. and Clemence, M.E. (2013). The Impact of Global Warming and Anoxia on Marine Benthic Community Dynamics: an Example from the Toarcian (Early Jurassic). *PloS One*, 8 (2), 1 -14. [Online]. Available at <http://eprints.whiterose.ac.uk/76703/>

NASA (2016). Global Climate Change – Vital Signs of the Planet. [Online]. Available at <http://climate.nasa.gov/>

Toor, A. (2016). *Scientists turn carbon dioxide into stone to combat global warming*. [Online]. Available at <http://www.theverge.com/2016/6/10/11901368/carbon-dioxide-capture-storage-stone-climate-change-study>



Saltwick Nab headland bears the scars of industrial-scale alum mining of the Mulgrave Shale Member. Alum was used as a fixative for clothes dye and for tanning leather.

Photos by Dan Normandale unless otherwise stated

Clearing the Crags at Sutton Knoll

Barry Hall, GeoSuffolk

Sutton Knoll (Rockhall Wood SSSI) featured prominently in the early pioneering researches of Charles Lyell, Searles Valentine Wood and Joseph Prestwich whereby the Red Crag and Coralline Crag shell assemblages contributed to an understanding of a time when the climate at Suffolk latitudes was irrevocably trending towards cool and, ultimately, very cold. This early importance is reflected today by designation as a SSSI, and the continued interest and enthusiasm of geologists, in particular GeoSuffolk.

Since 2004 GeoSuffolk has cleared sections, revealed new sections, erected interpretation panels, and planted a modern-day Pliocene Forest at Sutton Knoll. Throughout these endeavours Sir Guy Quilter of Sutton Hall Farms has been an invaluable supporter, alongside the funding support received from English Nature's Face Lift Programme and the Geologists' Association Curry Fund (Hall, 2012; Markham, 2012; Brown, 2014).

To keep everything in good shape, GeoSuffolk initiated a routine of voluntary Pliocene Forest work parties who came to include in their remit not only the management and maintenance of the Bullockyard and North Face exposures but also the equally unique Chicken Pit exposures just outside the SSSI boundary. These meetings were also invaluable not only for their sociability but also as a forum for impromptu discussion and for exchanges of ideas.

In 2013 this management became formalised under a Natural England Conservation and Enhancement Scheme (CES) agreement and a regular income assured for five years. Few, I feel, really appreciate the benefit of fixed routines and the horticultural mantra of 'little but often'. Routinely, therefore, any talus accumulations are removed and exposures kept clean of weed or other vegetative incursions and access maintained via mown foregrounds and paths. All visitors and geological groups have voiced their appreciation of these practical benefits as did the Reading



This was the North Face before clearance in February 2011.



This was the North Face during clearance in 2016.

GEOCONSERVATION

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Geological Society, on a visit in September 2015. An additional benefit has been the ability to extend, renovate and even amalgamate, where possible, the various Crag exposures (using the gifted expertise and versatility of Rod Pryke and his JCB).

What of the future? Maintaining the quality and ease of access to all existing exposures is our primary aim. Assisting professional research, accommodating visiting geological groups, walkers and hikers, managing the increased appeal of the Pliocene Forest as it matures, plus maintaining and updating all of this to the GeoSuffolk website, will be ongoing. As time progresses it is hoped to establish a representative Pliocene wildflower meadow using the researches of Clement and Eleanor Reid (in *The Pliocene Floras of the Dutch-Prussian Border*, 1915) as a guide. However, other challenges remain. The south face of the historic Bullockyard pit could be cleared and maintained whilst the Quarry Pit sycamores and increasing undergrowth remain problematic.

Bob Markham of GeoSuffolk observes “Conservation and enhancement of ‘soft-rock’ exposures are a fight against gravity and botany – talus quickly builds up and moss, algae and weeds thrive and cover faces. Special measures are called for and GeoSuffolk is fortunate to have Barry Hall, powered by an agreement with Natural England, to carry out this part of our work at Rockhall Wood. The site is a showpiece for what can be achieved via dedicated routine.”

Further information

www.geosuffolk.co.uk

Hall, B.P.N. (2012). Life, the Universe and Sutton Knoll. In: *A Celebration of Suffolk Geology*, ed. R. Dixon, 65-76.

Brown, S. (2014). Grants that helped grow a Pliocene forest. *Earth Heritage*, 42, 21-22.

Markham, C. (2012). GeoSuffolk’s Paradise Lost is discovered at open day. *Earth Heritage*, 38, 6.



Members of Reading Geological Society are seen here standing on a four-million-year-old seabed, examining fossiliferous submarine sandwaves of Coralline Crag in the North Face section.

Photos by Barry Hall

Conserving Swindon's geological SSSIs

Dick Millard, Geologists' Association



The old railway cutting is seen here before (above) and during (below) clearance works.



Old Town, Swindon, is built on an inlier of late Jurassic and early Cretaceous rocks which has been quarried since Roman times. Quarrying was extensive from the 17th Century, and largely ceased in the second half of the 19th Century when much of the quarried area was turned into a public park. In the late 19th Century a railway was built around the southern edge of the hill exposing lower stratigraphic levels than in the quarry. The railway was closed in the 1960s and the track removed in the early 1970s. Shortly afterwards, the railway cutting and some remaining faces in the former 'Great' quarry were designated as two SSSIs – Old Town Railway Cutting and Great Quarry.

Taken together, the sites expose the very latest Kimmeridgian rocks (the Swindon Clay), all of the local Portlandian and much of the local Purbeckian. The sections have been well described (Bradley, 1940; Arkell and Bradley, 1941) and include four major marine regressions or sequence boundaries which are traceable from Dorset to Oxfordshire (Coe, 1996).

The rock faces were last cleaned in about 2000 (as part of the English Nature Face Lift initiative) and have since become overgrown. In 2016 permission was obtained to remove vegetation from three selected locations in the Railway Cutting and the south-west face in the Great Quarry, with the objective of re-exposing the local stratigraphy from top to bottom.

Workdays were advertised via the BBC, posters on the well-used path through the cutting, and to local conservation groups. The local Sustrans volunteer ranger group generously lent its tool collection. Employee volunteers from Nationwide, contacted via Involve Swindon (www.involveswindon.co.uk), also spent a day at

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the south-west face of the Great Quarry. The three photographs show before, during and after views of one of the locations in the Railway Cutting.

One of the many enjoyable aspects of doing the work was having the opportunity to talk to interested passers-by, many of whom were surprised to learn about the site's important geology. Next season, we plan to maintain the standard of exposure we have achieved in the Railway Cutting and do more to make the rocks visible in the Great Quarry. It is also hoped to re-establish an interpretation board in the Railway Cutting for the benefit of the many interested people who regularly use it.

I thank Natural England and Swindon Borough Council for help getting the work going, and the 21 volunteers who did the work.



A revitalised railway cutting, with massively improved exposure, is seen here following the clearance works.

Photos by Dick Millard

Further reading

Bradley, P.S. (1940). The Purbeck Beds of Swindon. *Proceedings of the Geologists' Association*, 51(4), 349-372.

Arkell, W.J. and Bradley, P.S. (1941). Notes on the age of the Swindon Purbeck beds. *Proceedings of the Geologists' Association*, 52(4), 321-327.

Coe, A.L. (1996). *Unconformities within the Portlandian Stage of the Wessex Basin and their sequence-stratigraphical significance*. Geological Society, London, Special Publications, 103(1), 109-143.

Walk-on geology maps, past and present

Phil Murphy, University of Leeds

To celebrate the bicentennial of William Smith's pioneering geological map of England, Wales and southern Scotland in 2015, the Yorkshire Philosophical Society and the York Museums Trust commissioned a walk-on geological map installation of Yorkshire in the Museum Gardens at York. This impressive 4 x 4 m mosaic by artist Janette Ireland used geological materials to demonstrate many of the important points illustrated by Smith. Details of the map including explanatory leaflets can be found at <https://www.yorkmuseumgardens.org.uk/the-mosaic-map/>. This however is not the first walk-on geological map installation in the county.

The curator of Leeds museums between 1947 and 1957 was Dr David Owen, a geologist trained at King's College London. He reinvigorated the geological collections including turning the vaulted cellars beneath the museum building into a replica coal mine (Brears, 1989). When Kirkstall Abbey came under the care of the museums service in 1954 he realised that the parkland surrounding the abbey offered opportunities for geological education. An area of lawn near the river was raised up as a sloping terrace and a coastline of England and Wales (but not Scotland) was cut out and filled with concrete. Blocks of stone sourced from quarries were then erected tombstone-like in appropriate locations (see image) with simple two-word labels being carved into the blocks – for example, "Granite, Shap". Other geological specimens were also added including a sandstone slab showing a five-toed *Chirotherium* footprint from Storeton on the Wirral (often mistaken for a human footprint) and a fossil tree from Meanwood in north Leeds (Brears, 1989). The installation, called the geological garden, was opened by Professor Henry Cherry Versey of the University of Leeds in 1957. Professor Versey was a tireless geological educator across the region having a lifelong commitment to the Workers Education Association in addition to his university work. In his obituary Professor Versey is given credit for the layout of the geological garden (Hemingway and Rayner, 1991). The development of the geological garden was of some note, being mentioned in *Country Life* in 1957 and *The Children's Newspaper*, issue dated December 3rd 1955.

Sadly the garden fell into disrepair through the 1990s though is still fondly remembered by Leeds residents who visited the site as children, especially the 'human' footprint which I have been assured was a size 4. By this time one of the sandstone blocks had cracked and fallen apart. Rather surprisingly the garden did not receive a mention in the entry for Kirkstall Abbey in the definitive guide to the building stones and geoh heritage of Leeds (Dimes and Mitchell, 1996). By 2001 the site had been vandalised and some slabs were broken or missing. The garden was still in existence in 2003 but had gone by 2005. Should you visit the site today it is grassland though the vague outline of the raised terrace can just be discerned. The *Chirotherium* slab is believed to be in the Leeds Museums and Galleries geology collection.

It is a great shame that such an innovative educational resource developed by two of the great geological educators of the city of Leeds, which pre-dated the York map by 48 years, should have been allowed to disappear. We must be vigilant that a similar fate does not befall other such inspirational geological exhibits, for example the spectacular fossilised tree root in Lister Park,

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Bradford which is now surrounded by a geological time line, see <https://www.bradford.gov.uk/media/2272/manningham09listerpark.pdf>, are not allowed to decay and disappear in these times when financial pressures threaten the future of our urban recreation spaces.



This undated image shows the geological garden. The River Aire is in the background. The horizontal slab with the *Chirotherium* footprint can be seen in the position of Cheshire on the map. Reproduced by kind permission of Leeds Library and Information Services www.leodis.net

Further reading

Brears, P. (1989). *Of curiosities and rare things. The story of Leeds City museum*. Friends of Leeds City Museum.

Dimes, F. G. & Mitchell, M. (1996). The building stone heritage of Leeds. *The Leeds Philosophical and Literary Society*.

Hemingway, J. & Rayner, D. H. (1991). Obituary: Henry Cherry Versey. *Proceedings of the Yorkshire Geological Society*, 48, 345.

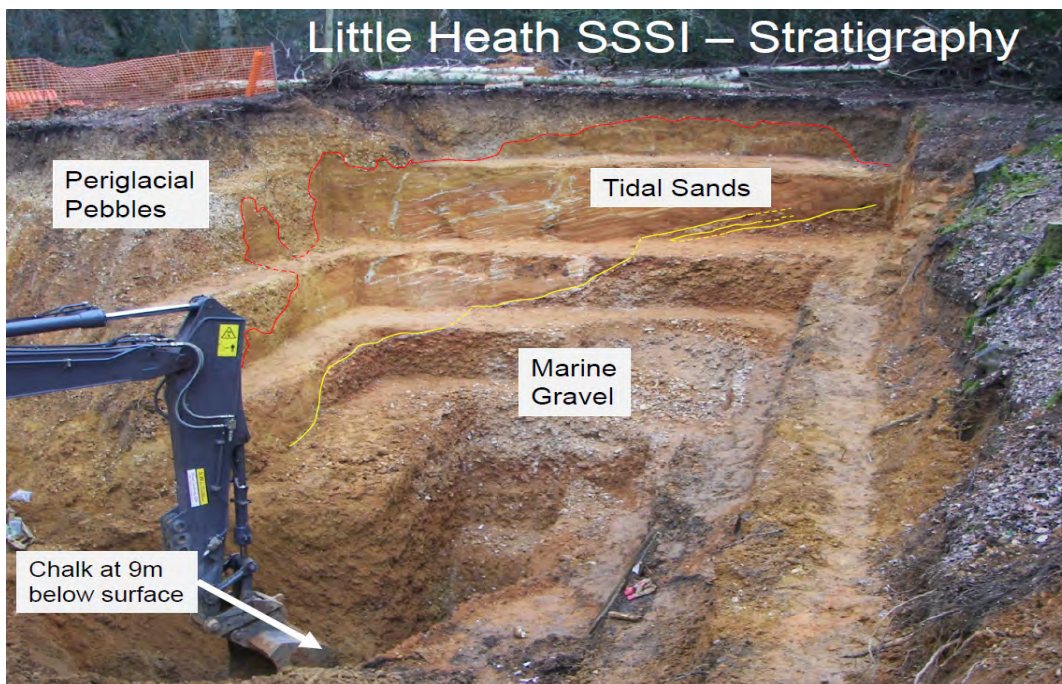
Geoconservation of the Little Heath SSSI, Hertfordshire

Nick Pierpoint & David Bridgland, Geologists' Association

Enhancement of a Geological Conservation Review (GCR) site and SSSI at Little Heath, Hertfordshire, was reported in the June 2017 edition of the Geologists' Association (GA) Magazine, having been undertaken by the Hertfordshire Geological Society (HGS), affiliated to the GA.

The site at Little Heath SSSI was reported in GCR Volume 7 (*Quaternary of the Thames*, 1994), within which it represents the starting point of the Middle Thames story, since it was acknowledged that it supposedly exposed 'pre-Thames' and probably pre-Quaternary Pliocene marine deposits. It has always been notoriously difficult to distinguish between ancient fluvial sediments from the earliest Pleistocene and marine or littoral deposits from the latest Tertiary, both of which occur high on the dip slope of the Chilterns. The difficulty stems in part from the abundance in the ancient fluvial sediments of material reworked from the predominantly marine Palaeogene of the London Basin, including highly rounded flint pebbles. Early workers were thus divided between marine and fluvial interpretations for the high-level gravels of the Chilterns, with much of the 'Pebble Gravel', regarded by many as marine, being re-attributed in subsequent years to early rivers. When selected for the GCR in the early 1980s, a section had recently been reopened at Little Heath and studied by Andy Moffat and John Catt, who cited the occurrence of glauconite in the sediments as evidence for a marine origin.

The original pits at Little Heath were excavated by the Hemel Hempstead Corporation for road material and sand, the latter used for sandbags during WW1. After abandonment, the 'Heath' became woodland, now managed by the National Trust as part of the Ashridge Estate. A new section, excavated in 2012, revealed upper and lower flinty gravels separated by a sand/silt



The sequence of deposits at Little Heath SSSI is clearly revealed following the excavations in 2012.

Photo and annotations by Clive Maton

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sequence and overlying clays and sand of the Upnor and Reading formations, with thin Lower Greensand below and Chalk a further nine metres lower. From this new exposure, a view has emerged of the well-bedded lower gravels as marine deposits, with the overlying sands and silts attributed to tidal deposition and the upper gravels to periglacial slope movement. The marine deposits have been correlated from their mineralogy with the Red Crag, which occurs near sea-level in East Anglia, although the present-day elevation of the Little Heath marine sequence is some 170 m higher, reflecting uplift of the inland region relative to the margins of the subsiding North Sea Basin.

The recent clean-up was undertaken, with consent from Natural England and the land owners, before the onset of the bird-nesting season, so as not to conflict with wildlife interests. The workforce from the HGS used hand tools to clear vegetation and clean the sections (see below for before and after views). Additional samples were collected for further micropaleontological analysis, which may help constrain the age and depositional environment of the sediments more precisely. The enterprise has energised the HGS to consider organising future working parties at other local geosites that warrant similar attention.



These photographs illustrate the dramatic improvement in exposure facilitated by the clearance work, showing key stratigraphical units exposed during the 2012 excavations.

Photos by Nick Pierpoint



Further reading

Pierpoint, N. (2017).
Geoconservation Little Heath,
Near Berkhamsted, Hertfordshire
(Leader: Clive Maton,
Hertfordshire Geological Society).
*Magazine of the Geologists'
Association*, 16 (2), 20-22.

South Wales to host GA conference on Climate - past, present and future

Raymond Roberts, Natural Resources Wales

The Geologists' Association's 2017 annual conference will be held at National Museum Wales in Cardiff on 21-22 October.



The Gower trip will visit the Quaternary deposits at Hunts Bay, some seven miles west of Swansea. These deposits have played an important role in helping to interpret the Last Glacial Maximum (LGM) ice limit in South Wales. The site offers the opportunity to study excellent sections of head, colluvium and reworked till deposited during the Devonian when this part of Gower was not glaciated. Photo by Steve Howe

Based at the historic National Museum in the centre of Cardiff, and visiting some spectacular South Wales sites for the fieldtrips, the conference will look at how our climate has changed over the last 650 million years of Earth history. Conference speakers include Colin Summerhayes (Earth's Climate Evolution - a New Geological Perspective, the keynote address), Ian Fairchild (Snowball Earth), Dianne Edwards (The impact of pioneering colonisers of the land on biosphere, lithosphere and atmosphere), Chris Berry (Devonian), Chris Cleal (Come visit the jungles of South Wales – the Carboniferous coal-swamps), Andy Newell (Triassic), Hugh Jenkyns (The Cretaceous greenhouse climate), Carrie Lear (Caenozoic), Suzanne Bevan (Quaternary) and Jan Zalasiewicz (Anthropocene).

There will be three fieldtrip options for the Sunday. The Gower trip will be led by John Hiemstra and look at the Quaternary history of the area with visits to Broughton Bay, Hunts Bay and Rotherslade. The Fforest Fawr UNESCO Global Geopark trip will be led by Alan Bowring and explore Carboniferous stratigraphy, Variscan tectonics, glacial legacy and industrial



Cribarth will form part of the Fforest Fawr fieldtrip and is one of the key sites in the Fforest Fawr Geopark. It lies in the upper Tywi Valley near Abercrave some 20 miles north-east of Swansea. Sometimes referred to as the 'Sleeping Giant', owing to its profile when seen from down-valley, Cribarth has been extensively quarried and is criss-crossed by former tramroads. The Cribarth ridge extends along a NE to SW-aligned anticline of Carboniferous limestone, flanked by the Twrch Sandstone and lies alongside the 'Cribarth Disturbance'.

Photo by Alan Bowring, Fforest Fawr UNESCO Global Geopark

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archaeology of the Cribarth and Penwyllt area in the western part of the Geopark. The third trip will be an opportunity to examine the varied building stones of the city. Cardiff was once the world's greatest exporter of coal, reaching a peak of some 11 million tonnes in 1913. Rapid expansion in the late 19th Century and the world-wide trading links have left a rich legacy of building stones which can be seen around the city.

For early arrivals there will be an opportunity to see the *Evolution of Wales* exhibition and a behind-the-scenes tour of the internationally important geological collections at National Museum Wales.

More details including conference flyer, booking form and accommodation options are on the GA website <https://geologistsassociation.org.uk/conferences.html>. The conference will be organised by the South Wales Geologists' Association, National Museum Wales, Natural Resources Wales and the Geologists' Association. The event is sponsored by Elsevier.



The building-stones fieldtrip will explore some iconic Cardiff buildings. The geology of Wales was at the heart of the design of Cardiff's iconic Millennium Centre with the exterior of the building clad in multi-coloured slate - purple (Cambrian) from Penrhyn Quarry near Bethesda, blue (Ordovician) from Cwt y Bugail Quarry, Blaenau Ffestiniog, green (Ordovician) from the Nantlle Valley, grey (Ordovician) from Llechwedd Quarry, Blaenau Ffestiniog, and black (Silurian) from Corris. Photo by Raymond Roberts

A Thousand Years of Building With Stone

Kate Andrew, Herefordshire & Worcestershire Earth Heritage Trust

A Thousand Years of Building With Stone has been the flagship project of Herefordshire & Worcestershire Earth Heritage Trust (EHT) since 2013. With the support of the Heritage Lottery Fund, seven local funders, Grants for the Arts and a huge amount of volunteer input, this major project costing just under £400,000 was successfully completed in June 2017. Project team members have been Kate Andrew (Project Manager), Beth Andrews and Sue Knox (Community Consultants) and Elliot Carter and Ella Young (Technical Consultants).

Trustees of the EHT had developed the project following the Trust's participation 2007-2011 in the Strategic Stone Study (SSS), an initiative by English Heritage to document all the major building stones in each county of England. The SSS was carried out in response to the recommendations of the Symonds Report of 2004 into Planning for the Supply of Natural Building and Roofing Stone in England and Wales. It recognised the need to identify and protect sources of building stone for the repair of historic buildings. It was also clear at the end of the SSS, that a lot more work remained to be done in identifying the sources of the building stones in Herefordshire and Worcestershire and that there was scope to involve local communities in the work.

A Thousand Years of Building With Stone concentrated on what were termed 'cluster areas', each with distinctive building stone characteristics. Sixteen clusters were covered in detail, two in less detail and some data came from outside the county. Much of the work was 'crowd sourced' thus being undertaken by a huge team of volunteers, 192 in total, who contributed just over 8,760 hours to the project. To an extent, volunteer preferences governed from where we were able to collect data.



Elliot Carter, project Technical Consultant, explains features of the local building stone while leading a guided walk in Kington, Herefordshire.

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Project volunteers were given the opportunity to attend a wide variety of training days, which included learning how local stone has been used and some of the skills involved. At Bodenham, Herefordshire, several of the volunteers learned how to construct a dry-stone wall.

Our project was the first EHT had undertaken using the Heritage Lottery Fund outcomes framework. Its four outcomes were:

- Re-discover local building-stone quarries
- Research the skills, techniques and people involved in exploiting this resource
- Raise awareness and appreciation of local stone, providing people with a sense of place
- Create a database linking stone to quarries and particular buildings

Rediscovering building-stone quarries

When the project started, there were no quarries in Worcestershire producing dimensional stone and only two, plus some roofing-stone delves, operating in Herefordshire. The EHT's Local Geological Sites database had good records of 80 quarries used for building stone. It was therefore surprising that the project mapped 718 building-stones quarries and a further 15 had a record but no grid reference, including an elusive quarry somewhere in Shropshire documented as the source for the 18th Century re-build of Worcester Bridge.

Building-stone skills, techniques and people

The project has been a journey of discovery. It has visited active extraction sites, researched approaches to quarrying, delved into local and family history and company archives and gathered all this information either into records for sites or as supporting information on the web database.

Raising awareness and appreciation

Over 29,000 people have interacted with the project, learning about the distinctiveness of local building stones and their contribution to place. Most engagements were in person at one of the 113 events we ran – roadshows, talks, walks and exhibitions, but several hundred more logged one of our seven Earth Caches. By the time the project ended, 317 people were following our Twitter account [@BuildingStones](#).

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The project team held outreach events throughout the project, at country shows and local festivals, to engage the public in the project and help them develop an appreciation of local stone. At several of these events, visitors could participate in creating artworks, such as this batik based on the shapes and colours they viewed in a thin-section slide from some local oolitic limestone.



Outreach work included mounting exhibitions at museums and libraries, highlighting the characteristics of the various building stones of each county and the sense of place that they impart.

Photos by Herefordshire & Worcestershire Earth Heritage Trust

The project also created three new 'Explore' trail guides for Bromsgrove, Bromyard and Malvern and one re-worked guide to Hereford is in the final stages of production.

Creating a database

The project web database (www.buildingstones.org.uk) contains records for 733 quarries and 4,870 stone buildings together with a wealth of supporting useful information; it will remain live for at least another seven years.

In many cases, it has still not been possible to make a definite link of building to quarry source – but we have now been able to make well-informed assumptions - a rubble-walled vernacular building, especially one built before mechanised road transport, is not likely to be more than a mile from its quarry source. We have found that where a good stone source existed, or was needed, even the shallowest streams were used to access the major transport routes of the Severn and Wye. In a few cases, such as the Rotunda in Gatley Park, we were lucky enough to achieve a complete record of quarryman, zone fossil, quarry, selection technique, building, architect, phases and dates and a personal account of the process.

However, over the course of the project we have identified good-quality building-stone horizons within previously undifferentiated 'Old Red Sandstone', considerably more variation in most horizons and have also had some promising results with a hand-held X-ray fluorescence (XRF) detector that have allowed us to distinguish between different-coloured sandstones used in buildings and their likely quarry sources.

Given more funding we would like to explore more than the 18 cluster areas in Herefordshire and Worcestershire. The database could also be used to deliver a similar project in other areas without a significant development cost. The EHT would be pleased to hear from potential partners and funders.

***SchoolRocks!* – making geological resources available to our schools**

Haydon Bailey, Hertfordshire Geological Society & Geologists' Association
Alison Barraclough & David Ward, Reading Geological Society

The objective of *SchoolRocks!* is to provide standard sets of geological specimens nationwide, to both Primary schools (targeting Year 3) and Secondary schools (targeting GCSE Geography). The initiative arose from two sorts of requests which often come into the Geologists' Association office. First, queries from the families of deceased GA members wondering what might usefully be done with unwanted rock collections and, secondly, requests from schools trying to teach Earth sciences but lacking the resources and training to present the subject fully. Perhaps the two could be brought together? Add to this a conversation at the GA conference on Building Stones where a geologist from the Building Research Establishment (BRE) in Hertfordshire acknowledged that their rock samples go to land fill after testing. This was too good an opportunity to miss and the seed of an idea began to grow.

Soon we had a basic team comprising David Ward who provided the logistics, pricing boxes and collating the specimen sets, Alison Barraclough who provided the educational expertise, including teaching notes and the guidance on which specimens needed to go into the boxes to cover the GCSE syllabus requirements. Haydon Bailey, as retiring GA President, came up with the original idea and maintained that it was possible to finance the project.

We're now at the pilot-study stage attempting to get our Rock Boxes into schools. We recognise that they can't afford to pay for them, but they also have a value, so we charge a £25 deposit which is returned to the school once the box comes back to us intact. Effectively, therefore, the scheme is free.

Each box contains the six basic rock types as stipulated by the GCSE syllabus, namely two sedimentary rocks (sandstone, limestone/chalk), two igneous rocks (granite, basalt) and two metamorphic rocks (slate, schist). All these are fully labelled. In addition we've added Carboniferous limestone, a mudstone, two mineral specimens (selected from quartz, calcite or selenite) and two fossil specimens (ammonite, echinoid). We've also included a box of small brachiopods which can go as rewards to enthusiastic students, especially at the primary level. We decided early on that we should use real specimens throughout, as it's the magic of holding an 85-million-year-old sea urchin which excites that primeval need to learn about past creatures.

Each box also contains hand lenses and, most importantly, a memory stick with six lesson plans designed for the Year group the school is intending to teach, principally Year 3 and Year 11. The stick also has basic membership information about the GA and *Rockwatch*.

Initially, we'd like to get boxes into about 25 to 30 schools to get feedback from the teachers and see how the system works. Any necessary modifications can then be made before involving more schools. We've already split our BRE rock specimens in half to provide students with real, rather than sawn, surfaces whilst at the same time providing classes with twice as many specimens.

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So far the whole programme is on a small scale. However, we recognise that there are hundreds of schools across the country that are expected to teach the basics of geology, but without the specimens to do it. This is where *SchoolRocks!* comes in. So if you know a local school which would benefit or if you would like to help us as a volunteer, please contact schoolrocks@geologistsassociation.org.uk. We are really excited at the prospect of being able to extend the scheme.



Each of the *SchoolRocks!* boxes includes six key rock types as stipulated by the GCSE syllabus (two each of sedimentary, igneous and metamorphic rocks). A £25 deposit is initially charged to the school, but is refunded when the box is returned. The scheme is therefore free.



Geoconservation thrives at the GA AGM

David Bridgland, Geologists' Association

At the May 2017 Annual General Meeting of the Geologists' Association there was much of interest for the geoconservation community.

Colin Prosser's first President's Address was entitled *Conserving Rocks! – How did that come about? A brief history of Geoconservation in the UK*. This lecture is available to members of the GA as a video via the GA website.



The award of the Halstead Medal was made to Seabury Salmon for his work on the production of *Earth Heritage* 1996 - 2016 and his continuing work for *Rockwatch*, for which his input to the magazine and website, his constant availability, his professional editing skills and his collaboration with science editors and website designers and with the GA *Rockwatch* team have all been second to none.

There was a special award to Allen Fraser, who has been instrumental in setting up Geopark Shetland and in promoting an interest in geology for many visitors to Shetland through Geotours. A further Special Award was given to the Wren's Nest National Nature Reserve team in recognition of excellence in geological conservation and the facilitation of fieldwork at the NNR (see *Outcrops*, page 12, this issue). In addition, individual certificates will be presented on-site to the four wardens in recognition of excellent and dedicated service to geological conservation and the facilitation of fieldwork at the Wren's Nest.



There was a new award inaugurated in 2017: the President's Medal. This will be awarded in acknowledgement of a long-service contribution to the continued administration and benefit of the Geologists' Association and, uniquely, is open to members of GA Council as well as to other members of the GA. It was awarded to Susan Brown by the current and three past Presidents in recognition of her long and exemplary service to the Geologists' Association in numerous roles, including Council Member, organising committee member for the Festival of Geology, Curry Fund Committee Secretary for more than 25 years, Chair of *Rockwatch* since 2001 and GA President (2000-2002). Susan's work leading *Rockwatch* has introduced many young people and their families to the joys of geology. Her invaluable contribution to the Curry Fund Committee has enabled a wide range of geological and geoconservation initiatives across the country, as reported in many articles in *Earth Heritage*.



Earth Heritage in print

If you prefer to read *Earth Heritage* on paper, you can order it as a full-colour, laserprinted, A4 hard copy via www.earthheritage.org.uk. Clicking on the Print link will take you to the ordering and payment facility provided by the Geologists' Association.

Issue 48 or any back issue* displayed on the website can be ordered online with individual copies and delivery costing £7.00, payable (online) to the Geologists' Association. There is a discount for GA members.

* Early issues may not be reproduced in print to the standard of more recent ones, because production technology has improved over time.

Good photography and easy-to-appreciate geodiversity information are central to getting our geoconservation message across. Oliver Buchanan (page 26) describes a project on Local Geodiversity Sites in Edinburgh which uses attractive images and simple information to supplement technical records.

Pictured here are exposures of Carboniferous sandstones frequented by a heron in the lower course of the River Almond at Cramond.

Photo by Oliver Buchanan

