

Earth Heritage

The Geological and Landscape Conservation Magazine

ISSUE **52**
Winter 2019

GeoWeek 2019



**20th INQUA
Congress**



**Celebrating
Edward &
Annie Greenly**



**Scotland's first
geological Nature
Conservation Order**



**Community
Earth Heritage
Champions**



**A Tale of Two
Quarries**





Close-up of one of the Calder Stones. The stones display Neolithic carving of spirals, concentric circles, cup and ring marks, arcs and parallel lines. There are also some more recent Medieval carvings. See article on p 41. © The Reader.

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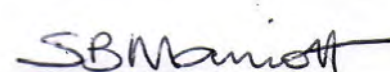
EDITORIAL

With a new government in place we need to keep geoconservation and geodiversity at the forefront of environmental discussion in Parliament. I do not know if any MPs read *Earth Heritage* but, if they do, within these pages they will find reports of inspirational events and activities that we hope will enable them to support conservation issues.

Earth Heritage 52 is packed with a wide range of articles and reports on conferences, funding successes and other geoconservation news, starting with its pioneer, William Macfadyen, who implemented the 1949 National Parks and Access to the Countryside Act. He visited and scheduled for designation over 600 geological and geomorphological SSSIs and now his field notebooks and site index cards have been acquired and will be available through the Geological Society of London.

GeoWeek is a nationwide education initiative that promotes geoscience through various activities such as field visits and museum-based events during a 9-day 'week'. In 2019, 76 events took place across England, Scotland and Northern Ireland and involved hundreds of people. The aim for the future is to attract over 10,000 participants and to schedule events across the whole of the country (i.e. including Wales).

The *Earth Heritage* Editorial Board is actively planning Issue 53, which will be published in the spring next year. We want to hear your views and to learn of new projects so to contribute, please contact the most appropriate editor (left).



Susan Marriott - Guest Editor

Pioneering geoconservation work archived

Many of the field notebooks, files and detailed site index cards of William Macfadyen, the Nature Conservancy's first geologist, who pioneered geoconservation during the first 10 years of statutory conservation in Britain between 1950 and 1960, have now been acquired, archived and made available through the Geological Society of London.

Macfadyen, the first professional geoconservationist in the world, took on the task of implementing the 1949 National Parks and Access to the Countryside Act, which allowed for the identification and designation of sites of special scientific interest on account of their 'geological or physiographical' interest. Mostly working alone, he visited and scheduled for designation, well over 600 geological and geomorphological SSSIs, developed detailed records to support their conservation, addressed practical conservation issues relating to site damage and enhancement, established a geological advisory committee to support his work, published an account of some of the sites protected and successfully applied his geological expertise to wider issues relating to wildlife conservation. During his 10 years in post, Macfadyen, who was meticulous in both his approach and his record keeping, laid the foundations of geoconservation in Great Britain, and in doing so, influenced its development worldwide.

This unique archive, formerly held by Natural England, provides an invaluable resource for those interested in the history of conservation and in the thinking behind the first SSSIs to be designated for their geological and geomorphological interest, and the Geological Society is to be applauded for securing it and making it available. In addition to this archive, it is worth noting that some of Macfadyen's notebooks for this period are held by the Sedgwick Museum, Cambridge, and it is necessary to access both archives to appreciate the full scope of Macfadyen's geoconservation work.

Details of the Geological Society archive are available at:

http://geolsocarchives.org.uk/Record.aspx?src=Catalog&id=LDGSL%2F39&utm_source=Adestra&utm_medium=email&utm_term=&utm_content=William%20Archibald%20Macfadyen&utm_campaign=Geological%20Society%20Library%20Newsletter%20-%20Issue%2033

Further reading

Prosser, C.D. 2012. William Archibald Macfadyen (1893–1985): the 'father of geoconservation'? Proceedings of the Geologists' Association, 123, 182-188.

Colin Prosser, Natural England



William Macfadyen at Swanscombe Skull Site NNR in 1959. Although the site looks quite different today it is still well visited by scientists, see INQUA article page 21. © Natural England.

Learning about fossils

In the summer of 2019, palaeontologist Elsa Panciroli delivered a series of Scottish Fossil Workshops to rural schools across the Highlands of Scotland.

Funded by the Palaeontological Association, the aim was to teach pupils about the science of palaeontology, and encourage them to protect their natural heritage – incorporating SNH’s Scottish Fossil Code. Elsa covered 1,500 miles and spoke to over 300 pupils, sharing stories of Scotland’s amazing fossils and what they tell us about evolution through geological time. SNH was among the many supporters of the project. To find out more about the workshops visit Elsa’s blog (www.giantsciencelady.blogspot.com) and follow the link to watch her video about the project.

Fossil-handling session for pupils, with palaeontologist Elsa Panciroli. Photo by Matthew Humpage.

Item secured by the Scottish Editor



Call for Volunteers –The Geological Society Geoconservation Committee

The Geological Society is seeking volunteers to sit on its Geoconservation Committee. The aim of the Geoconservation Committee is to develop and support activities that help to conserve the diverse geology and rich geological and geomorphological heritage of the UK and Ireland and to ensure that it is passed on in good order to future generations for their investigation, education and enjoyment.

Past activities overseen by the committee have included:

- Oversight of the 100 Great Geosites project (www.geolsoc.org.uk/100geosites)
- Liaison with the statutory bodies for the environment across the devolved nations of the UK to highlight the value of geoconservation and geodiversity to society
- Discussion around ethical sampling and implementation of preventative measures and awareness raising

This is a general call for volunteers who might be interested in helping to deliver the work of the committee and to raise awareness of the value of geoconservation. We aim to recruit a minimum of two new members where one position is filled by an individual with an interest or background in geoconservation matters in Scotland and familiarity with Scottish environmental policy and site protection.

Committee members are asked to attend three meetings per year, usually February, May and October, at the Geological Society in London. Attendance can be either in person or by video conference. There is more about the committee on the Geological Society website: <https://www.geolsoc.org.uk/About/Governance/Committees/External-Relations/Geoconservation-Committee>. Those interested in applying for a position should get in touch via email to policy@geolsoc.org.uk.

Flo Bullough, Head of Policy and Engagement,
The Geological Society



The Geological Society and partner organisations launched the 100 Geosites project in 2014 (www.geolsoc.org.uk/100geosites) which celebrated the diverse and beautiful geoheritage of UK and Ireland. One of the sites selected under the Educational category was Bendrick Rock in South Wales. Notified within Hayes Point to Bendrick Rock SSSI, the Triassic Red Beds exposed along the coast near Barry include two GCR sites which were selected for the stratigraphy and exceptional fossil reptile trackways. The footprints and trackways were made by several different dinosaur species and are found over a wide area and at different horizons. Although a key locality for education and scientific research the coastal site is open to the public and has historically suffered from illegal activity with acts of vandalism and theft. See previous *Earth Heritage* Issue 27. © Alan Beattie.

International council backs Black Country Geopark bid

The Black Country's bid to become a world famous UNESCO Global Geopark has received international backing. The UNESCO Global Geoparks Council recently announced that it has recommended the Black Country UNESCO Global Geopark bid be endorsed by the Executive Board of UNESCO when it meets in the spring.

Although the recommendation is no guarantee, the team behind the bid sees this as an extremely positive step forward in its efforts to secure this international status. Councillor Yvonne Davies, chair of the Association of Black Country authorities, said, "If we are able to secure UNESCO Global Geopark status, it would be the biggest recognition the Black Country has ever had for the quality of its geological and cultural heritage."

There are many world-class features in the Black Country and the geopark would link many different heritage sites and features across the area to tell the story of the landscape. In the case of the Black Country, the significant part it played in the industrial revolution is at the heart of the bid and the proposed UNESCO Global Geopark.

The four Black Country authorities (Dudley, Sandwell, Walsall and Wolverhampton), with the backing of the UNESCO National Commission and the UK's seven existing geoparks, first submitted an application to become part of the UNESCO Global Geopark family in 2016.

View across Doulton's Claypit, one of the 40 geosites within the bid area. Interpretation across the area has been given common branding, helping to increase awareness and visibility of the geosites, underpinning the idea of a single territory within the four boroughs. Photo by Colin Prosser.



In 2017, after assessing the application, the UNESCO Global Geoparks Committee (UGGC) made a number of positive recommendations and gave the Black Country Geopark project a further two years to address their recommendations before resubmitting a final application.

The final decision will be made by the Executive Board of UNESCO when it meets in the spring 2020.

Hannah Townley, Natural England

Hugh Miller Writing Competition 2019-2020

“The natural features so overtop the artificial ones – its hollow valleys are so much more strongly marked than its streets, and its hills and precipices than its buildings – Arthur’s Seat and the Craggs look so proudly down on its towers and spires.”

Hugh Miller on Edinburgh in *Edinburgh and its Neighbourhood; Geological and Historical, with the Geology of the Bass Rock*, 1863.

The Hugh Miller Writing Competition carries the name of one of Scotland’s most endearing geologists, Hugh Miller (1802-1856), and aims to honour his legacy by inspiring new, original prose and poetry on the theme of Scotland’s geoh heritage. The competition is organised by the Scottish Geodiversity Forum and The Friends of Hugh Miller.

This year, poetry and prose entries are invited that are inspired by one or more of the ‘51 Best Places to See Scotland’s Geology.’ The list, compiled by a panel of experts, aims to help you find out more about Scotland’s geological heritage, and guide you to the best places to see different elements of the story laid out in our country’s beautiful landscapes. You can find full details here: www.scottishgeology.com/best-places.

While Miller himself visited many of the locations on our list, entries are most certainly not limited to his haunts alone. We hope that this writing competition, open to all ages, will encourage both a renewed interest in Miller’s work, and contribute to a catalogue of new writings inspired by one of Scotland’s greatest nature writers. We also aim to highlight the role that Scotland’s geology plays in our daily lives and foster greater awareness and appreciation of Scotland’s geodiversity.

For more details, including entry rules, please visit: www.scottishgeology.com/hughmiller

Lara Reid, Freelance Science Writer & Organiser of the Hugh Miller Writing Competition

THE
HUGH MILLER
WRITING COMPETITION
2019-2020

Invites entries inspired by one or more of the

51 Best Places
to see Scotland's Geology

Prose and poetry entries from all ages are welcome. It's free to enter. The competition launches on the 10th of October 2019. The closing date for entries is midnight on the 15th of March 2020.

For more details, visit:
www.scottishgeology.com

Geoheritage recognized as Outstanding Publication by the Association of Earth Science Editors

***Geoheritage: Assessment, Protection, and Management*, edited by Emmanuel Reynard and José Brilha (see EH 49 for publication details) received the 2019 Award for Outstanding Publication from the Association of Earth Science Editors. A single book each year receives this award, given for outstanding contributions to geoscience publishing that stimulate new discoveries and the advancement of the field.**

Written by an expert team of 46 authors from 14 countries (including several academics and geoconservation practitioners from the UK) *Geoheritage* covers geoconservation, geotourism, and geoparks along with the relationship of geoheritage to other subjects, such as landscapes, conservation and tourism.

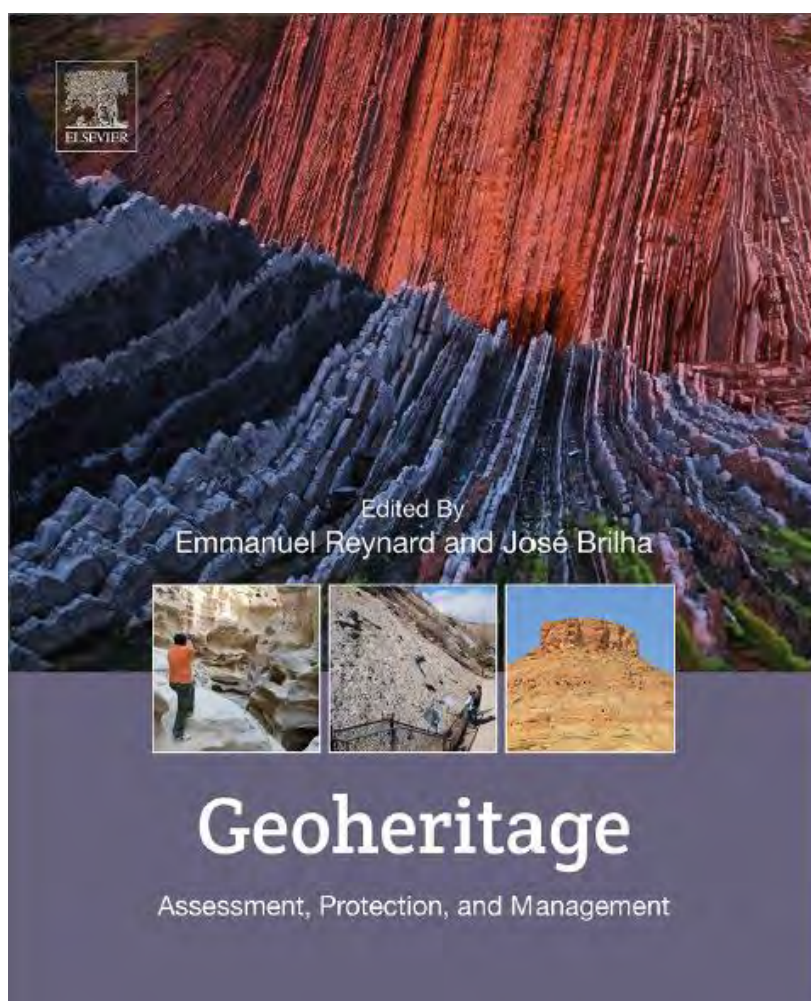
“Geoheritage is an emerging discipline in Earth sciences, and *Geoheritage* is the first and only book to discuss sites around the world that are both geologically and historically important,” says Elsevier Acquisitions Editor Amy Shapiro.

Collecting such a wide array of knowledge into one book was no easy feat, but editors Reynard and Brilha saw it as an important addition to the field. “In preparing this book,” Reynard says, “as scientific editors, we wanted to provide an overview of geoheritage research on a world scale, but also to document examples of geosite management, regulation, promotion, and protection at the national or local level.”

The reviewers of the AESE Outstanding Publication Award recognized the quality of *Geoheritage*, with one reviewer remarking that it was “one of the most well-written, well-edited, and important Earth-science books [he] had read in some time.”

Congratulations to all involved in the publication.

Hannah Townley, Natural England



A view along the coast of north-east Skye, in the Valtos area. An important locality for Middle Jurassic stratigraphy and vertebrate fossils discussed further on page 31. © Colin MacFadyen/SNH.



GeoWeek 2019 – bringing Earth Heritage to thousands of people

Chris King and John Stevenson, Earth Science Education Forum

‘GeoWeek’ is a new initiative, started in 2018, that aims to promote active geoscience via a 9-day ‘week’ of activities taking place across the UK and Northern Ireland. GeoWeek seeks to introduce as many members of the public to geoscience as possible, mainly through outdoor activities such as urban, rural or coastal field trips.



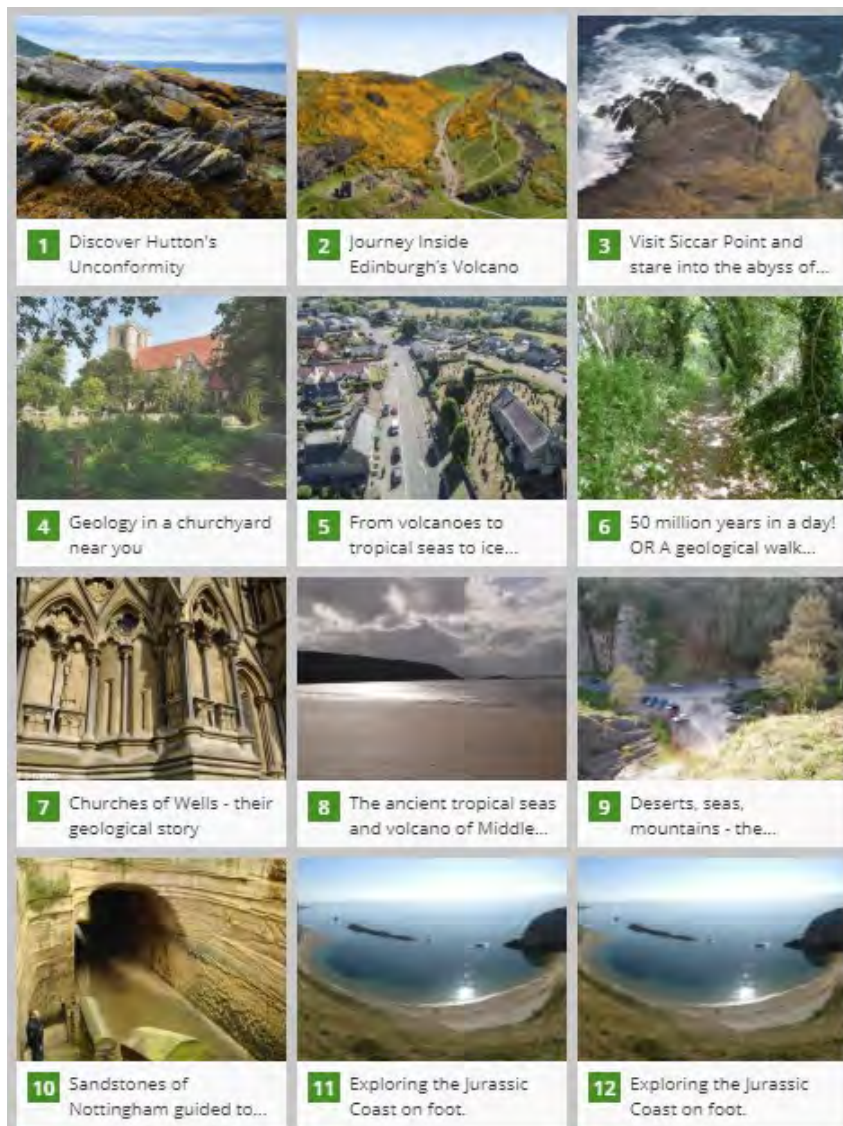
GeoWeek 2019 was even more successful than GeoWeek 2018, with a 130% increase in events and participants this year. GeoWeek 2019 saw 76 events being planned, covering all areas of the UK and Northern Ireland (apart from Wales – a target for next year). A flavour of some of the events is given by the montage below, taken from the website: <https://www.bgs.ac.uk/geoweek/>.



Map of GeoWeek events 2019.

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GeoWeek events 29 to 44 of the 76 that took place in 2019, from the GeoWeek website.

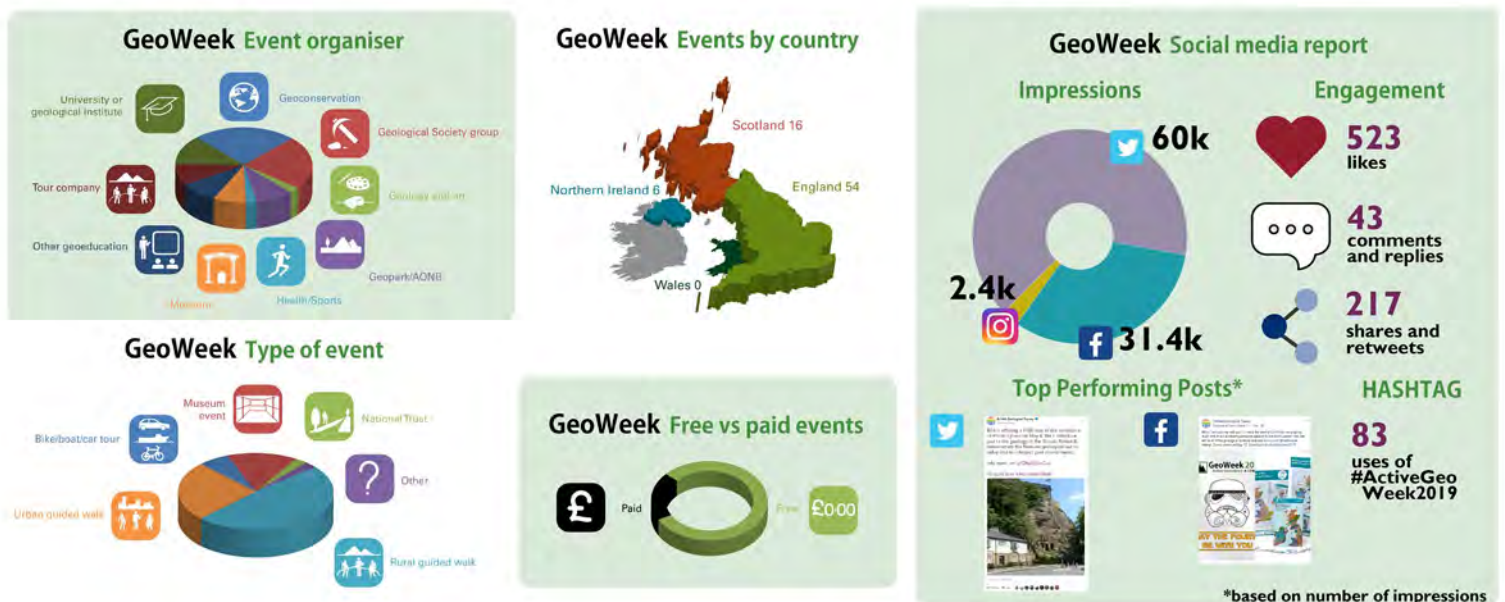
The events included 28 field visits, 21 urban walks, 17 museum-based events, 5 sport-related activities and two active quarry visits. These are the titles of some of them:

- Geology in a churchyard near you
- 50 million years in a day – or a geological walk over Bowsey Hill
- The churches of Wells, their geological story
- Night hike the Jurassic coast
- Belfast's greatest hidden asset
- Geosail to St Kilda
- A Geological treasure hunt in Hertfordshire
- Walk 600 million years in 20 minutes at the Brandon Marsh GeoWall
- 'Ask a geologist' – Wells and Mendip Museum
- Rock solid evidence that Jurassic Park came to Banbury
- The stone of 'the Auld Grey Town' – Kendal
- Kinghorn to Kirkaldy: a walk through the mid-Carboniferous
- Vitrified fort e-bike ride – Lochaber Geopark
- Gold in them thar Burton Dassett hills?

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- Hidden geology in Buckingham buildings
- GeoTour around Castleton – a walk through 330 million years of Earth's history
- Kenilworth Rocks! Meet 'The stones'
- Slieve Gullion e-bike exploration
- A fell run over and around Carrock Fell
- Stone stacking on the Lecale Coast
- Explore Conlig's mining history
- Rocking all over the Bowlees
- Jurassic fossils at Kirtlington Quarry, Oxfordshire
- Geology of Mount's Bay – 400 million years in the making! What's next?
- Geoconservation visit to the De la Beche unconformity, Vallis Vale

This is our analysis of all these events, and their social media impact:



Based on this success, we are planning ambitious targets for the future, of more than 10,000 participants within ten years and representation in all UK regions within seven years.

An analysis of GeoWeek 2019 events and social media impact.

This might sound very challenging, but the Spanish Geolodía (the day of geology) initiative has grown to 56 geological field visits across the Spanish provinces and islands, involving more than 10,000 members of the public on a single day each year. So it must be possible for us to eventually involve more than 10,000 members of the public in geoscience events across the UK.

If you would like to become involved, please consult the GeoWeek website, which gives guidance.



E-bike geotour of the vitrified fort (Lochaber).

Photo from <https://lochabergeopark.org.uk/vitrified-fort-e-bike-geotour/>

The website also contains a publicity toolkit and details on how to submit and evaluate an event. However, if you need more guidance, please just ask us through the contact details on the website. Most participants this year were attracted by advertising through the local press, posters in prominent places, social media and three local radio broadcasts.

Feedback from 95% of those who organised events this year was that their 'experience of leading a GeoWeek event' was 4 or 5 stars (5 stars = very good) with comments like:

- "It definitely makes you feel fulfilled in your job when the public you are communicating to are engaged and leave informed about geoscience. Outdoors is the best learning and communicating environment in my opinion!"
- "It always amazes me how interested people are. The landscape and rocks beneath Britain are so varied that it is easy to captivate people and to surprise them with facts like England and Scotland were once separated. Also helping them to realise how useful rocks and minerals have been (and still are) whether that's for storing water, supplying building materials or for future geothermal energy."
- "It shows the value of Earthcaches (and GeoWeek that gave me the impetus) and how we can teach Earth Science to a class even when we are not there!"

So, please put 9th – 17th May, the GeoWeek 2020 date, in your diary and think about what you can do for next year. With your help, GeoWeek 2020 will be the best yet – and will help us on our way to 10,000 and more members of the public inspired for geoscience.



Top left: Sandstones of Nottingham guided tour;

Top right: Discover Scotland's rocks at 'Dynamic Earth' in Edinburgh;

Left: Stone stacking on the Lecale coast;

Right: Exploring Conlig's mining history;

Bottom left: Belfast's greatest hidden asset;

Bottom right: A group of Geocachers visiting the 'Death in Paradise' Earthcache in the Cheadle area. Photo by Pete Loader.



Warwickshire Geological Conservation Group's GeoWeek 2019

Max Down, WGCG GeoWeek Coordinator



Many organisations around the country now hold events for GeoWeek. Here we tell what we have been doing in Warwickshire and give our tips for how to make a GeoWeek event a success.

GeoWeek seeks to introduce members of the public to 'Active Geoscience' mainly through outdoor activities such as urban, rural or coastal field trips. There were 76 events nationwide. Warwickshire Geological Conservation Group (WGCG) organised five free events which proved very successful and attracted a number of visitors, as well as our own members. For each venue free printed leaflets gave an overview of the geology of the location and also served to provide website and contact details for the group.



On Sunday 5th May a very short 'walk' of just a few yards along the 'Wall' at Brandon Marsh Nature Reserve, HQ of Warwickshire Wildlife Trust near Coventry, was led by Brian Ellis and Frank Wells who explained the nature of Warwickshire geology.

Tuesday 7th saw our second GeoWeek event held at Upton House, a National Trust property, in South Warwickshire. With Norman Dutton leading, assisted by Max Down, WGCG offered several 45-minute tours of the exterior of the mansion and grounds.



That same evening on 7th May, visitors were shown the nature of building stones in a walk around the centre of Banbury led by Norman Dutton.

On Thursday 9th May, Ian Fenwick led a walk which followed the route laid out in the WGCG trail guide to Old Kenilworth and examined some of the building materials.

Visitors to a WGCG GeoWeek event.
Photos by Mike Heath

The final GeoWeek event was on Sunday 12th May at Burton Dassett Hills Country Park led by John Crossling.

Key elements of our week-long programme included:

- Collaboration with other organisations with a wide range of contacts and the scope to reach the public
- Holding a range of events on different days and times of day
- Holding events at places that already have a big visitor footfall, so we had the chance to add geology to the visitor experience.

Promoting GeoWeek took time and ideas. Credits for the success of publicity go largely to Mike Heath for sterling innovative work, Kathrin Schutrumpf for social media postings, and our web controller Ben, although many WGCG members played key roles by networking and tweeting their contacts.

GeoWeek promotion needed several things: leaders, event descriptions, locations, (which all included car parking and toilets), dates and times plus multi-channel public communication. Details of

events needed to be submitted for publication, sometimes 6 – 8 weeks in advance, so forward planning is essential.

There is no ‘silver bullet’ to communicate GeoWeek. People who attended said they learnt about the events via Facebook, e-mails, the WGCG website, GeoWeek website, local newspapers, radio, newsletters or e-mails and through many other local organisations, e.g. U3A groups and Natural History societies who also publicised our events.

Judging by conversations with participants, WGCG had successfully fulfilled its role in engaging the public in local geoscience. The lesson: try everything and another time, advertise in the ‘local events’ list in a relevant parish newsletter or similar but do so well in advance.



Celebrating the achievements of Edward and Annie Greenly

Cynthia Burek, NEWRIGS & GeoMôn, **Margaret Wood**, Director GeoMôn and **Stewart Campbell**, Natural Resources Wales

This year marks the centenary of the publication of Edward Greenly's two-volume geological memoir for Anglesey. Next year will be the publication centenary of the accompanying 1:63,360-scale map, which has served generations of geologists.

To celebrate these centenaries, and the enormity of Greenly's achievement, Anglesey's UNESCO Geopark, GeoMôn, has published a geotrail for the cemetery of Eglwys St Cristiolus, on the eastern edge of Llangristiolus in Anglesey, where Edward Greenly (1861-1951) and his wife Annie (1852-1927) are buried. The geotrail was launched on 29th September 2019 at the cemetery. A party of 15, led by Cynthia Burek and Margaret Wood, walked the new trail, examining notable rock types used in the church and graves.



In recognition of his major contributions to geology, Edward Greenly was made an honorary member of the Geological Society of Edinburgh, the Geological Society of Liverpool and of the Anglesey Antiquarian Society. In 1920 he was awarded the prestigious Lyell Medal by the Geological Society of London and an honorary doctorate by the University of Wales. In 1933 he received the medal of the Liverpool Geological Society.



Annie Greenly was heavily involved in the proof reading of Edward's two-volume geological memoir. According to Edward Greenly (1938), "some sheets she pronounced to be hopeless and these, no less than 127 in number, she rewrote altogether". She was also instrumental in resolving the vexed question of which colours to use on the accompanying map. Greenly noted, "She had a remarkable faculty for foreseeing the effects of colours even in quite small samples. Our problems were quickly solved. The one inch map is a thing of beauty, distinct from side to side, and has won general admiration".

Top and top right: Photos from from the Hand Through Time, Greenly 1938

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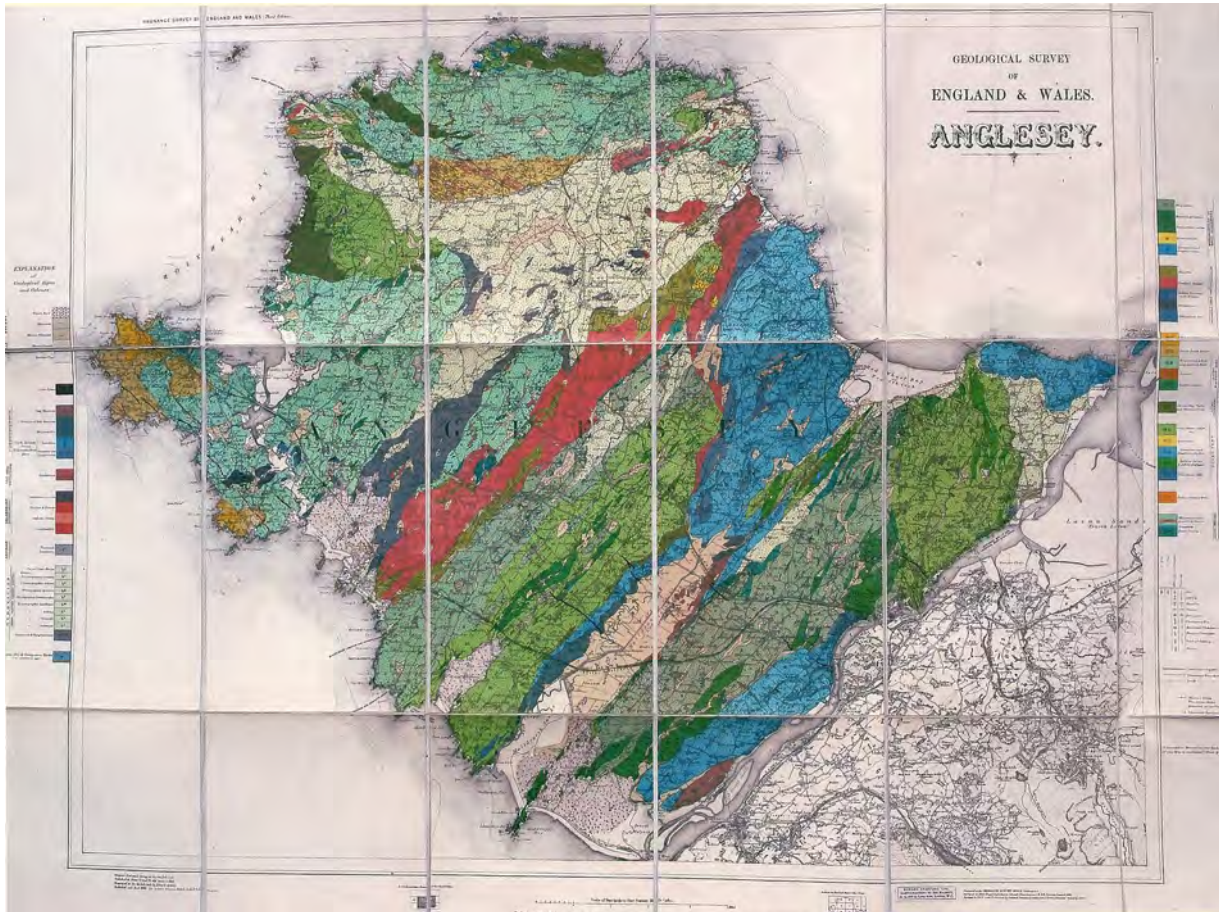


Annie and Edward Greenly's grave is found in Llangristiolus Church 2-3km south-west of Llangefni on Anglesey. The striking red granite gravestone forms a key locality in a geotrail recently published by GeoMôn and is also a Regionally Important Geodiversity Site (RIGS). Photo by Stewart Campbell

The highlight of the trip was examining the grave of Edward and Annie Greenly. Fittingly, it lies on Precambrian Gwna green-schist, although rather surprisingly it is made from the Balmoral red granite, quarried in Finland and imported through Aberdeen. Its large red orthoclase feldspar crystals are set in a matrix of black and grey minerals. Not a local rock, it was probably his own choice for his wife Annie who died 24 years earlier. The headstone takes the form of an open book with Edward's name and qualifications on the left-hand side, Annie's on the right. The poignant inscription hints at the closeness of their relationship. Annie, although not a trained geologist, was instrumental in helping Edward with his geological work in the Scottish Highlands and later in Anglesey. She compiled the index for the monumental two-volume Anglesey memoir and chose the colours for the accompanying map, which she stated should be "beautiful". In addition to proof reading and offering suggestions, she helped him tirelessly in the field and was indispensable to the colossal task.

Greenly's grave has been selected as a RIGS to commemorate and honour his outstanding contribution to the understanding of the geology of North Wales and, in particular, the geology of Anglesey. He served the Geological Survey from 1889 to 1895, and was involved in the survey of the northern Scottish Highlands. He resigned to carry out a detailed independent geological survey of Anglesey. This resulted in *The Geology of Anglesey*, published by HMSO in 1919 as the Geological Survey Memoir, but partly at Greenly's expense, and a new '1" to the mile' geological map of the island. The latter is almost unique in having continued in print unaltered to the present day.

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Countless geologists will have a well-thumbed copy of Greenly's 1920 map. A framed pristine copy is an artwork to behold! Greenly's map can be viewed online and paper copies purchased from the British Geological Survey (<https://www.bgs.ac.uk/data/maps/maps.cfc?method=viewRecord&mapId=10569>)

Further reading

Greenly, E. (1919). *The Geology of Anglesey*. Memoirs of the Geological Survey of Great Britain. HMSO, London, 980pp. (2 vols).

Greenly, E. (1920). 1:50,000 (and 1 inch to 1 mile) Geological Map of Anglesey. Geological Survey of Great Britain, Special Sheet No. 92 and (93 with parts of 94, 105 and 106).

Greenly, E. (1938). *A Hand Through Time: Memories Romantic and Geological; Studies in the Arts and Religion and the Grounds of Confidence in Immortality*. T. Murby & Co., London, 293pp.

Williams, T.P.T. (2007). The role of Annie Greenly in the elucidation of the geology of Anglesey. In: Burek, C.V. & Higgs, B. (eds) *The Role of Women in the History of Geology*. Geological Society, London, Special Publications, 281, 319-324.

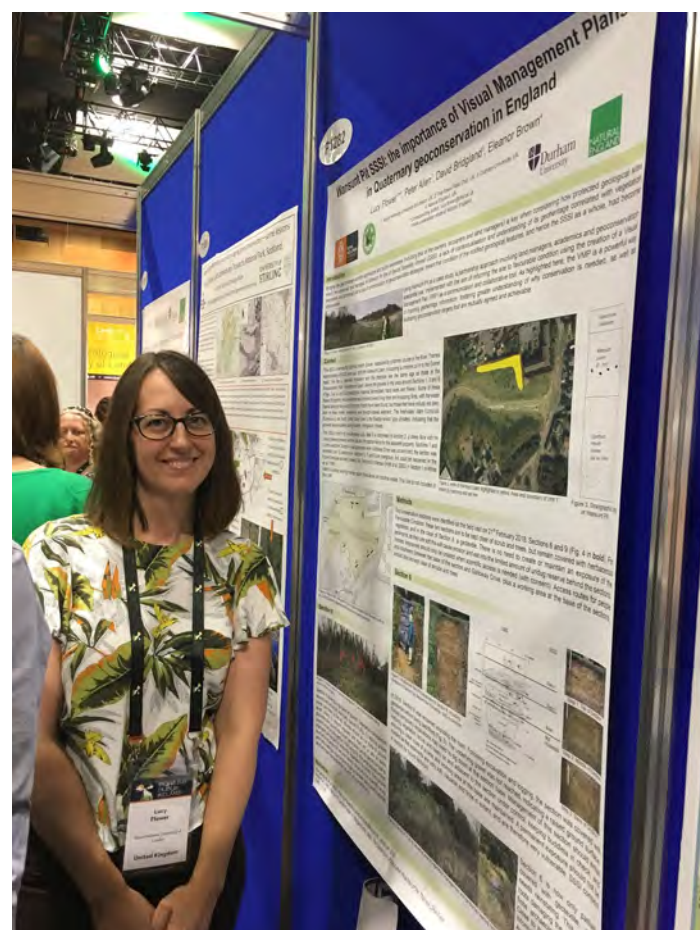
Valuing the Quaternary at the 20th INQUA Congress, Dublin, July 2019

Vanessa Brazier, Scottish Natural Heritage, David Bridgland, Durham University, Aaron Rawlinson, Durham University, Eleanor Brown, Natural England.

In Earth Heritage Issue 51, the article by David Bridgland and others (p.44-48) previewed the 2019 20th International Union for Quaternary Research (INQUA) Congress in Dublin and its associated field trips. Here we report on the outcomes of the Congress, which considered Quaternary geoconservation for the first time, both in a Congress session and in a field trip organised by the Quaternary Research Association (QRA).

INQUA Session: Valuing the Quaternary – Nature Conservation and Geoheritage (Convenors: Eleanor Brown, David Bridgland, John Gordon, Vanessa Brazier and Fraser Mitchell)

The INQUA Congress session Valuing the Quaternary – Nature Conservation and Geoheritage was part of the INQUA Commission on Humans and the Biosphere. The session was chaired by Lucy Flower (Royal Holloway University of London) and there was a variety of international speakers and poster presentations.



The Quaternary palaeoenvironmental record is a vital source of information for conserving and managing the natural environment. Quaternary geoscience provides the long-term baseline data that can be applied to the understanding climate change and its effects on the natural environment. It also informs the restoration of ecosystems, identifies the physical constraints for sustainable development and helps us understand how ecosystem services have changed over time, as well as their resilience and vulnerabilities. However, Quaternary terrestrial and marine sites are under increasing threat from human activity, including development and land-use change.

Conserving our Quaternary geoheritage is important because it celebrates the history of

Lucy Flower (Royal Holloway University of London) presenting presenting a poster on the Wansunt Pit SSSI as part of the session ‘Valuing the Quaternary: nature conservation and geoheritage’ at INQUA, Dublin, 26 July 2019 (see below, p.23). Photo by Vanessa Brazier, Scottish Natural Heritage.



Participants in the INQUA pre-congress field meeting 'Quaternary Fluvial Archives of the Major English Rivers', co sponsored by the Quaternary Research Association (QRA), the Geologists' Association (GA) and the Fluvial Archives Group (FLAG) at the Swanscombe Skull Site National Nature Reserve in Kent. Photo by Becky Briant, Birkbeck University of London.

science, conserves scientifically valuable field sites for education and research, underpins natural landscapes and habitat diversity, provides carbon storage and delivers important elements of natural capital and ecosystem services.

There is growing international recognition of the importance of applied Quaternary geoscience for nature conservation as well as the need to take action to conserve our important Quaternary geoheritage, particularly as this is often overlooked in the development of policies relating to planning, nature conservation and the natural environment. The INQUA session examined the value of the Quaternary for understanding nature and we invited abstracts that explored the application of Quaternary geoscience to modern nature conservation issues or that illustrated the importance of conserving and managing our Quaternary geoheritage.

Matthew Parks (National History Museum, Dublin) spoke on progress in identifying Quaternary sites for conservation in Ireland. Vanessa Brazier (Scottish Natural Heritage) outlined how the Quaternary of the seabed has been used as an additional and supporting factor in the selection and designation of Marine Protected Areas in the north-east Atlantic. David Bridgland (Durham) compared geoconservation challenges for conservation of River Thames localities in urban north Kent and south Essex with similar sequences in the River Tagus in Portugal. Ahmet Serdar Aytac demonstrated the value of the Kula UNESCO Geopark in Turkey for both archaeology and geoconservation. In contrast we then moved to the forest steppe of Kungur in the pre Urals of Russia, where Lyudmila Shumilovskikh described the value of palaeoecological records in understanding the evolution of open grassland and forest encroachment on the edge of the steppe. The final talk by Helen Shaw (Maynooth), entitled 'Beyond the Bog', reflected on the usefulness of palaeoecological work in identifying recent past land cover for habitat restoration, using examples

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The Quaternary Fluvial Archives of the Major English Rivers Field Guide

from Scotland and Ireland. The talks were well attended and generated wide-ranging questions and lively discussion.

The posters presented ranged from strategies to conserve individual sites, through the relationships between geoconservation and conservation of Palaeolithic archaeology, to Quaternary geoconservation audits in different parts of the world, and the application of palaeoecology to conserving the historic environment and priority habitats.

Pre INQUA Field Meeting: The Quaternary Fluvial Archives of the Major English Rivers (Organisers and Field Guide Editors: David Bridgland, Becky Briant, Peter Allen, Eleanor Brown and Tom White)

Nearly 30 international scientists, students, geoconservation practitioners and members of local geodiversity groups attended the INQUA pre-Congress field meeting organized on behalf of the Quaternary Research Association (QRA), the Geologists' Association (GA) and the Fluvial Archives Group (FLAG) on The Quaternary Fluvial Archives of the Major English Rivers. The field meeting started with introductory lectures at Birkbeck, University of London, which included a presentation on geoconservation by Eleanor Brown (Natural England). The field meeting visited a range of local sites, Sites of Special Scientific Interest (SSSIs) and the National Nature Reserve (NNR) at Swanscombe, which all provoked discussion of a variety of geoconservation issues. Alongside this, the meeting also provided the opportunity to discuss and compare Quaternary geoconservation and interpretation strategies around the world, including (given the backgrounds of participants) in Portugal, Israel, Russia and Great Britain. Highlights (apart from the warm and sunny weather, always a bonus!) included seeing sampling in action for luminescence dating, visiting the amazing Palaeolithic collections and displays in Salisbury Museum, and finding a piece of rhinoceros tooth at the Eckington Railway Cutting SSSI in Worcestershire.

Following the opening lectures and discussion, Day 1 was completed by a walking tour down the terraces of the Thames from Birkbeck to the river at Embankment, with discussion of Palaeolithic finds from early developments, mainly in the 18–19th centuries, but including the earliest recorded

handaxe at Granville Square in 1690. A highlight was Trafalgar Square, which is an internationally important site where last interglacial sediments are preserved below part of the built-up area. Since no viable geoconservation site can be notified here, and archaeology is unknown from the last interglacial (dating from ~125,000 years ago), the site has no formal protection.

Day 2 saw the highest concentration of formally notified geoconservation sites on the itinerary. Indeed, all sites visited are SSSIs: Purfleet Chalk Pits, Lion Pit Tramway Cutting, Swanscombe (part of which is also the celebrated NNR) and Wansunt Pit, Dartford Heath. These sites are in an area of high development pressure because of their proximity to the Dartford–Purfleet (M25) crossing and the Channel Tunnel Rail Link (HS1). Indeed, developments of various types have provided much funded research at and around the Purfleet Chalk Pits SSSI, leading to significant further knowledge (as presented at the meeting). The sterling work by Essex Wildlife Trust, with assistance from GeoEssex, in maintaining the area of the Lion Pit Tramway Cutting has seen considerable improvement in SSSI condition at a site which also serves as valuable green space. On the Kentish side of the Thames, the Swanscombe NNR is managed with conservation as a priority. In preparation



The INQUA Quaternary Fluvial Archives of the Major English Rivers fieldtrip visiting the conservation section at Greenlands, part of the internationally important MIS Stage 9 (approximately 320,000 years BP) site at Purfleet Chalk Pits SSSI in Essex. Professor Danielle Schreve (Royal Holloway) is holding the macaque monkey finger bone found at the site. Photo by David Bridgland.

for the INQUA visit, vegetation clearance was carried out by Swanscombe and Greenhithe Town Council to enable sections to be opened more easily. This was guided by a Visual Management Plan for the site (see article on these plans by Dave Evans, *Earth Heritage* Issue 34, p4-5). The Dartford Heath locality is more problematic, however, as parts of the Wansunt Pit site are difficult to access and the undug reserve of sediment behind the former quarry faces is limited. These faces include exposures of the important Wansunt Loam, a source of well-preserved artefacts seen by the excursion party. The location of this deposit has been reconstructed from early documentation on file with Natural England (via its predecessors) and from photographs of the working quarry published in the Proceedings of the Geologists' Association (see the article on the Geologists' Association archives by Jonathan Larwood, *Earth Heritage* Issue 42, p19-20). A Visual Management Plan for Wansunt Pit, developed between Natural England and London Wildlife Trust with advice from the relevant scientific experts, was presented as a poster at INQUA by Lucy Flower and others (see page 21), and this plan is due to be implemented on site in due course.

On Days 3–5, geoconservation sites formed a smaller component of the itinerary, which comprised visits to the erstwhile Solent River, the

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The opened section at Swanscombe NNR (above), with Mark White holding a twisted ovate handaxe (below), a type characteristic of the Upper Loam and belonging to the third of three superimposed Palaeolithic industries represented there. Photos by Eleanor Brown.



Severn system and the Trent, with emphasis in the last case on geomorphological localities. The Severn was represented by Eckington Railway Cutting SSSI, in the valley of its Avon tributary, where a section in fossiliferous last-interglacial sediments had been prepared by members of the Herefordshire and Worcestershire Earth Heritage Trust. It was here where sampling for optically stimulated luminescence (OSL) dating took place, allowing the group to compare conventional OSL methodology (driving a metal tube into the section), with the experimental procedure used by Ian Bailiff (Durham University), who disappeared beneath a black plastic sheet in 34°C heat to sample quartz pebbles in what was essentially a (very hot and humid!) temporary darkroom.

The field meeting was made all the more successful by the excellent work carried out at a number of sites to clear sections for viewing, with volunteers from GeoEssex, Herefordshire and Worcestershire Earth Heritage Trust and others providing essential support and spade power. The various land managers, site owners and museum staff are thanked for giving their permission for the visits and Natural England area team staff assisted with SSSI consent for excavations. As a result of the field trip, connections have been made and renewed between scientists, geoconservation practitioners and site managers, which will hopefully lead to ongoing and enhanced management and interpretation. The field guide, which provides a description of 12 SSSIs and one NNR, is also a valuable resource for managing and interpreting these sites.

The INQUA Congress and its associated field trips provided a unique opportunity to showcase Quaternary geoconservation on an international stage, make new connections and share ideas. We hope that Quaternary geoheritage and geoconservation will feature just as strongly in the next INQUA Congress, due to be held in Italy in 2023.

The Community Earth Heritage Champions Project: 'The End is Just the Beginning...'

Julie Schroder, Herefordshire & Worcestershire Earth Heritage Trust
Champions Co-ordinator



The Background and the 'End'

“The end is just the beginning...” is how project manager Eve Miles summarised the situation as the funded part of the Community Earth Heritage Champions project drew to a close in 2011. The three-year project was run by the Herefordshire and Worcestershire Earth Heritage Trust (H&WEHT) following a major award from the Heritage Lottery Fund. Its initial progress was reported in the pages of *Earth Heritage* magazine in 2008-9, where it was dubbed “one of the most innovative projects in UK geoconservation”. Its great strength was that the concept of sustainability was built into its framework. By recruiting local volunteers or ‘Champions’ the project’s objectives could reach well beyond the end of the funding.

Meetings were held to recruit volunteer Champions to learn about their local geology and how to maintain and promote their Champions sites. The project ended with 19 sites renovated and interpreted with leaflets and information panels, and crucially, with around 80 well-briefed ‘Community Conservation Champions’ armed with clearance tools and loads of enthusiasm and with on-going access to H&WEHT equipment and support. Part of this support network was to appoint a volunteer ‘Champions Co-ordinator’, to maintain links with the Champions groups and report regularly to the H&WEHT Board of Trustees. As a member of the Lickey Hills Geo-Champions group and (at the time) a member of the H&WEHT Board, it fell to me to take on this role, which I have been proud to fulfil ever since.



The Holding Pens at Bewdley.

All photos by Julie Schroder unless otherwise stated.



Champion Ray Whiley with the commemorative bench he built at Little Doward.

Browsing through back issues of *Earth Heritage* and other geological magazines, there are many reports of active or recently completed geoconservation and geo-outreach projects, but little mention of the legacy of such projects some years on. In a substantial article in the *Proceedings of the Geologists' Association* in 2012, project manager Eve Miles summarised the great success of the Champions project to the 'End' date, but in this article I want to show how the subsequent 'Beginning' has been taken on by the Champions and sustained, with many innovative developments on the way.

The 'Beginning' and Onwards...

As Champions Co-ordinator, my first job was to communicate with all the registered Champions, and in due course to visit all the sites. It also became necessary to revise and up-date the newly created Community Conservation Champions website (ehtchampions.org.uk) to establish and publicise it as the main repository for information, and as a place where Champions could post their news and photos. Since 2013, there has been an annual post-project round-up of Champions' news published in the H&WEHT's Newsletter (see H&WEHT's website: earthheritagetrust.org).

Inevitably some of the Champions sites have fared better than others; some are in places well frequented by the public, some have been fortunate in having a sustainable group of Champions or an individual with time, energy and enthusiasm to keep things going. Bewdley Champion Ian Williams deserves mention here, as an individual who cares for the 'Holding Pens'. He built the frame for the information panel, and hosted a visit for all the Champions in 2015. Some Champions groups have gained renewed impetus from subsequent projects: the four Malvern Hills sites have benefited from additional clearance during an on-going H&WEHT project managed in liaison with the Malvern Hills AONB, and most recently, the Lickey Hills and Little Doward have been included in the H&WEHT's 'Voyages in Deep Time' educational Apps, opening these areas up to a younger generation and a whole new digital world of exploration.

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Champions at the Lickey Hills working at Barnt Green Road Quarry.

Photo by Keith Woolford.

A group visit to King Arthur's Cave on Little Doward.



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Spotlight on Champions sites

Lickey Hills

There is space here to highlight only a few of many Champions' achievements, and it seems fitting to start with the most recent, a new booklet by Lickey Hills Geo-Champion Alan Richardson entitled 'The Lower Palaeozoic Geology of the Lickey Hills'. This is available to view or download from the Champions website. The Champions project has fuelled a deluge of new research to increase our understanding of the complex geological structure of the Lickeys. Alan has recently been in the forefront of this drive, leading him to some innovative new interpretation which he summarises in this welcome update to earlier published papers. The Lickey Hills Geo-Champions group has had some involvement with this, whilst also fulfilling the Champions maintenance and outreach objectives. They have hosted numerous visits from eminent geologists, geological societies and walks for the general public, along with open days with family activities. This all happens thanks to the interest and co-operation of the Lickey Hills Country Park rangers. A major triumph was the installation of a new interpretation panel in 2018, in a spin-off from the H&WEHT's 'Voyages in Deep time' project. This is truly a Champions success story!

Malvern Hills

Four sites are described in the Malvern Hills Champions booklet, but things have moved on considerably since then. Thanks largely to the efforts of Tank Quarry Champion Richard Edwards, working in liaison with the Malvern Hills Trust, there is new interpretation and a range of new rock specimens in Tank quarry. In addition, Richard has added the nearby North Quarry to the Champions 'map', with a new interpretation panel. This adds substantially to the geological story of the Malverns for visitors.



The Lickey Hills Champions and graphic designer Mike Brooks with their new information panel in the Lickey Hills Country Park.

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Little Doward

This Herefordshire site was initially maintained by one intrepid Champion, Ray Whiley, who in his eighties not only managed the sites and led walks on the Little Doward Champions trail, but built a commemorative bench on the hill summit! The on-going appeal of the Champions was realised in Ray's appeal for a successor, and another lone Champion, Jim Handley, has taken up the mantle and injected new life into this beautiful Champions trail by extending it to Great Doward, thereby encompassing another Champions site, King Arthur's Cave.

Conclusion

This snapshot gives nothing more than a glimpse into the legacy of the Champions project. To find out more about the geology and activities of the Champions, have a look at the Champions website and H&WEHT Newsletters.

To summarise, I think I can speak for many of those involved in saying that this project has opened doors previously unimaginable. It has brought new knowledge and understanding, the pleasure of passing this on to others, and the satisfaction of feeling of being part of a much bigger network working with a common objective. Surely this is geoconservation at its best.



A public guided tour of Tank Quarry in the Malvern Hills.

Scotland's first geological Nature Conservation Order

Colin MacFadyen, Scottish Natural Heritage

On the first of August 2019 Mairi Gougeon, the Scottish Government's Minister for Rural Affairs and the Natural Environment, signed into being the *Skye Nature Conservation Order 2019*. This is the first time in Scotland that protection of this sort has been employed to safeguard features of geological interest. It is hoped that a Nature Conservation Order, or NCO, that is more usually associated with prohibiting shellfish extraction in Scottish firths, will help end instances of globally significant Middle Jurassic vertebrate fossil material being damaged or removed.

Further Information

The *Skye Nature Conservation Order* is available for view on the Scottish Government's website at <https://www.gov.scot/publications/nature-conservation-scotland-act-2004-skye-nature-conservation-order-2019-notice/>

In December 2016 there were reports in the media of a key tourist attraction in Skye being damaged. The attraction was a trace fossil, a footprint of a dinosaur, which had been infilled with plaster in an attempt to take a cast. This action was undertaken by an individual who probably meant no harm to the fossil but who it seems was unqualified and inexperienced to undertake the casting of such a feature. The police were called to the incident but fortunately it was ascertained that no damage had taken place. The potentially damaging incident took place at An Corran a stretch of beach at Staffin, in the north-east of Skye, an important point on the Skye tourist trail. It is a Geological Conservation Review Site (GCR) of national and international importance for its Middle Jurassic vertebrate fossils; a status shared by another three sites on Skye.

Although a GCR site, An Corran is not a Site of Special Scientific Interest (SSSI). Consequently in the wake of the 2016 incident there were calls for adequate protection of the site. However, instead of opting for designation as a SSSI SNH decided that in this particular incident where the main, and arguably only, threat to the interest of the locality was from curio hunters and irresponsible collectors a different and more targeted approach would be applied. Hence the decision was taken to secure a

A view along the coast of north-east Skye, in the Valtos area. An important locality for Middle Jurassic stratigraphy and vertebrate fossils. This area is now protected by the *Skye Nature Conservation Order 2019* which help safeguard vertebrate fossil remains including dinosaur body and trace fossils. © Colin MacFadyen/SNH.



GEOCONSERVATION

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Nature Conservation Order (NCO) from Scottish Ministers. A NCO is a means to protect the natural features of specific areas from damage when there is no other adequate means of protection. It was acknowledged that if An Corran GCR site could be protected in this way then by extension the other globally important vertebrate fossil localities on Skye could similarly be safeguarded. These include some areas which, although having SSSI designation that already provides good and robust protection, have been affected by irresponsible and damaging fossil collecting. In the past dinosaur bones have been hammered either out of ignorance or to secure a portable hand specimen of what the collector mistakenly believes to be fossil wood.

The Order prohibits damage and removal of vertebrate fossil material in five coastal areas of Skye, four of which occur in the north-east. The fifth area represents the coast to the north of Elgol on the Strathaird Peninsula. The prohibited operations also include the infilling of dinosaur footprints with plaster or similar setting material, the action that initiated the call for protection the first place.

Up until August 2019 there were five Nature Conservation Orders in force in Scotland. Typically these prevent operations such as shellfish extraction by mechanical means in places such as Dornoch Firth SSSI. Until then there has never been an Order in force in Scotland to protect geological interests. Securing the Order introduced a significant challenge in that a mechanism had to be derived that could allow prospecting for fossil material for research purposes and the rescue and safeguard of vertebrate fossil material that comes to light through natural processes. An exclusion was derived that could allow those that have the qualifications and experience to remove fossil material to do so provided they are affiliated to an accredited institution in UK and have the landowner's permission. Importantly in the areas affected by the Order where there is also an SSSI designation the normal consents procedure for the extraction and removal of fossils and rock still applies.

Scottish Government Ministers recognised the crucial role that the local community in north-east Skye has in helping to safeguard and promote the fossil heritage of the island. In recognition of



Found on a beach in Northern Skye, in an area affected by the Nature Conservation Order, this loose block of rock shows the eroded remains of two dinosaur footprints. This is an example of vertebrate trace fossils that could be recorded and reported to allow removal for the purposes of research and public exhibition by those with the credentials to do so.



A boulder containing a piece of bone (black), on a beach in Northeast Skye, in an area affected by the Skye Nature Conservation Order 2019. It is hoped that collectors discovering such vertebrate fossils will record and report these globally important finds to allow those with the required qualifications, experience and affiliation to safeguard and research them.

All photos © Colin MacFadyen/SNH unless otherwise stated

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Ammonite fossils found on a beach in north-east Skye. Invertebrate fossils such as this are not affected by the Skye Nature Conservation Order 2019. However, in areas that are also Sites of Special Scientific Interest (SSSI) restrictions on collecting can also apply.

**The Skye Nature Conservation Order 2019 being signed by Mairi Gougeon, Scottish Government Minister for Rural affairs and the Natural Environment, at Staffin Museum. The Museum houses an important collection of Jurassic fossils including the remains of vertebrates.
© SNH/Andrew Woodhouse.**



this, the Order includes specific mention of Staffin Museum allowing continuation of its important role in the extraction, removal and safeguard of vertebrate fossils.

A concern for SNH has been that the Order may be perceived as a ban on fossil collecting. To address this SNH's guidance on the NCO, www.nature.scot/Skyefossil includes the dos and don'ts of collecting on Skye in the areas affected by the Order, maintaining encouragement for collecting of fossil material. With adherence to the Scottish Fossil Code it should be possible for children, family groups and amateurs to collect fossil material even within areas affected by the Order provided collecting is restricted to invertebrate species. This is where the public and amateur collectors have an important role in recording, reporting and even helping to safeguard, fossil specimens that they suspect may be vertebrate in character. With some dinosaur finds having been found as hammered fragments, indicating that the original discoverer may not have known what they were hammering, the Order will hopefully deter such thoughtless action in the future. Those collecting invertebrate fossil material from loose fragments on a beach where the NCO is enforced will hopefully err on the side of caution before hammering a fossil that they are unfamiliar with.

Discrete signage will be placed at access points to the areas affected by the Order and will carry information on the prohibited activities. Pictorial instruction will convey a key message that will cross language barriers and a link will be provided to the online guidance. Efforts are under way to promote the Order and encourage the help and participation of the local community and visitors alike to support fossil conservation activity on Skye and help the Order work for the benefit of a globally significant fossil resource that we can all learn from and enjoy.

MacCulloch Bicentennial Exhibition in the Outer Hebrides

Jean B. Archer, Retired geologist and resident in North Uist

Lochmaddy, the capital of the Outer Hebridean Isle of North Uist, is home to Taigh Chearsabagh, a bijoux Museum and Arts Centre with accredited Museums Galleries Scotland status. The museum display, mounted annually by the North Uist Historical Society (Comann Eachdraidh Uibhist a Tuath) (CEUT), in 2019 has been devoted to the remarkable geological heritage of North Uist. This exhibition, 'Islands carved in Stone', has been staged in celebration of the bicentenary of the publication of *A Description of the Western Isles of Scotland* by leading Scottish geologist of the early nineteenth century, Dr John MacCulloch.

His lavishly illustrated three-volume geological tome on the Western Isles includes the first published geological map of NW Scotland, the first reasoned British account of the rock types he grouped as gneiss and stood for decades as the primary source of information about the rocks now collectively known as the Lewisian Gneiss Complex. Lochmaddy's central geographic location in the Outer Hebrides, the largest single exposed area of these, Britain's oldest, rocks makes Taigh Chearsabagh a singularly appropriate location for the celebration of this MacCulloch bicentennial.

Two superimposed chronological strands run through the exhibition's two sections - a longer bedrock section followed by a shorter geomorphic section. The emerging descriptive and interpretative picture of Uist's rocks and/or landforms (geological strand) underpins the panels representing the successive geological explorers (human strand) who have come and gone from Uist during the last two hundred years, from MacCulloch down to the most recent – those behind



Taigh Chearsabagh stands on the shore of the remarkable six-mile-long sea loch (drowned valley) which shares its name (Lochmaddy) with the capital of North Uist. The distant summits are shaped in erosion-resistant rock, toughened by repeated movement on the Outer Hebrides Fault Zone, and mark out the line of this major thrust fault. It extends the length of the eastern side of the Outer Hebrides and may have originated as a plate boundary in the distant geological past. © Taigh Chearsabagh.



The long, eastward-facing slope of Eaval, North Uist's iconic summit, reflects the dip-slope of the Outer Hebrides Fault Zone – a major thrust fault with a history of episodic movement, from Precambrian times down to the Caledonian Orogeny. Outcrops of pseudotachylite at summit level have helped armour it against weathering.
© Jean Archer.

the 1:100,000 bedrock Geological Map of the Outer Hebrides (BGS 1981) and the separate BGS Quaternary survey.

This bipartite approach facilitates the exhibition's little-by-little introduction to Uist's Lewisian rocks and their geological complexities. The Outer Hebrides Fault Zone (OHFZ), for instance, is introduced through the evolving nomenclature applied to the pseudotachylite which distinguishes this fault from most of the world's other major faults (Sibson Panel). Pseudotachylite, which is an outcome of frictional melting and typically occurs around major meteor impact craters, MacCulloch called "Trap Shotten Gneiss" (MacCulloch Panel). It was renamed 'flinty crush rock' early in the 20th century (John Wilson Dougal Panel), while the 1920s brought recognition of its coincidence with the line of a major thrust fault (Jehu and Craig Panel) i.e. the Outer Hebrides Fault Zone. Half a century later, Uist's veins of pseudotachylite became informally known as 'fossil earthquakes' to the geologist whose research firmly placed the OHFZ on the international stage of fault-mechanic studies (Sibson Panel), as well as identifying the OHFZ as one of Scotland's greatest faults.

Sibson's moniker post-dates the 1960s unravelling of the geological structure of Uist's Lewisian Gneiss by Janet Watson's students (Cowie and Graham Panel) in the light of her earlier identification of the Scourie Dykes as chronological markers in the Lewisian Gneiss (Watson Panel). BGS geologists introduced plate-tectonic interpretation to Uist's Lewisian rocks in the early 1990s (BGS Panel). But, plate tectonics are only touched on in an exhibition designed to encourage the outdoor appreciation of Uist's rich geological heritage.

The exhibition's bedrock section ends with a chronologically ordered display of North Uist's kinds and ages of Lewisian rocks attractively arrayed below a timeline which spans 2.5 billion years of Earth history, commencing three billion years ago. Tacked on to the display of specimens from the depths of geological time, and the depths of the Earth's crust, are specimens of Palaeogene igneous rocks. They date back a mere 60 million years, or so, to the opening of the North Atlantic and the separation of the future Outer Hebridean archipelago/continental shelf from Greenland.

The geomorphological panels – especially the Campbell of Islay and Geikie of Auld Reekie Panels - were prepared with the assistance of internationally acclaimed historian of geology Professor Gordon Herries Davies who sadly passed away in his North Uist home, shortly before the completion of the exhibition. At CEUT's suggestion, the exhibition is devoted to Gordon's memory.

'Islands carved in Stone' remains open until the end of 2019.



Entries in the Visitor Book illustrates how well the exhibition has been received:

“One of the most accessible accounts for the ‘non-geologist’ I have ever found. Should be published.”

“Fascinating exhibition – beautifully executed. Thank you for helping us understand this important geology.”

“Having visited the Uists for more than 40 years, I now realise how little I know of the processes that have formed this wonderful place. Thank you for a wonderful exhibition.”

“This exhibition underlines the power of the natural world and – to me – our responsibility to conserve it.”

And, in the hand-writing of a young visitor:

*“I loved the different rocks and the time-line.
Thank you!!!”*

An appreciative viewer examines John MacCulloch’s geological map of the Isle of Skye in the *Transactions of the Geological Society of London* for 1817, when published geological maps were still individually coloured by hand, usually by women colourists. Others of MacCulloch’s geological maps, including his pioneering, posthumously published, Geological Map of Scotland (1836), are displayed in the exhibition in full-size facsimile. © Lorraine Burke.

Further information

The mounting of the exhibition was organised and managed by the Operations Manager of Taigh Chearsabhagh, Norman MacLeod, working with the Committee of CEUT. The contents were devised and scripted by Uist-resident geologist (retired), Dr Jean Archer. The display panels were designed, prepared and printed in Lochmaddy by Lorraine Burke of Hebridean Graphics, while Marri Morrison (CEUT) oversaw the translation of the text into Gaelic – all panels are bilingual. Taigh Chearsabhagh gratefully acknowledges the funding of this exhibition by CEUT, The Western Isles Council and Creative Scotland.

A Tale of Two Quarries

Audrey Brown, President, Cumbria GeoConservation

Over the past 5 years, members of Cumbria GeoConservation have been instrumental in getting information boards set up at two of their Local Geological Sites (LGS), Birkhams Quarry and Brown Howe Quarry. Both have been really successful, though the processes have been very different.

Birkhams Quarry is high on the cliffs on the west coast of Cumbria, south of Whitehaven. Here Marshalls are extracting Triassic St Bees Sandstone, though the quarry is run on a 'campaign basis', with activity generally restricted to winter months to minimise disturbance to nesting birds. The warm red sandstone provides dimension stone, some for conservation work on buildings such as Carlisle Cathedral, as well as architectural stone for cladding of new buildings throughout the UK and as far away as Iceland and Dubai. The footpath alongside the quarry is part of the Coast to Coast Walk and the Cumbria Coastal Way. The land on which the boards are sited, beside the footpath, is owned by the National Trust and forms part of their Colourful Coast area, that runs from Whitehaven to St Bees.

Cumbria GeoConservation is alerted whenever there is a planning application relating to one of our sites, and that is how we became involved at Birkhams. In response to a planning application in 2015 for a time extension to the quarry, we raised no objection but recommended that an interpretation board be set up there for the benefit of the many walkers who pass the site. This was welcomed by Marshalls and their agents, Stephenson Halliday, a firm of landscape architects in Kendal, and the revised plans were duly submitted to Cumbria County Council. We built up a good rapport and worked closely with all parties to achieve a very successful outcome. Two boards were designed,



Sands of Time board at Birkhams Quarry, south of Whitehaven. The board illustrates the origins of the Triassic St Bees Sandstone in a braided river system.

Photos by Audrey Brown, Cumbria GeoConservation unless otherwise stated.

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Top: Quarry board at Birkhams Quarry, south of Whitehaven, showing the extent of the quarry and the buildings in which stone from the quarry has been used.

Middle: St Bees Sandstone being extracted from Birkhams Quarry, south of Whitehaven. To avoid disturbance to wildlife, the quarry is only worked during the winter months.

Bottom: Board at Brown Howe Quarry, Blawith, near Coniston. This disused quarry was into a pink microgranite dyke, probably an offshoot from the Shap granite.

one covering the geology and the other, the story of the quarry. The geology was wonderfully well presented by Elizabeth Pickett, using her artistic skills to produce a block diagram of the environment 250 million years ago when the sands were deposited, with illustrations of how the various features displayed in the rocks now, were originally formed. Graphic designer Marcus Byron ensured that the text fonts and the overall design matched the National Trust's other Colourful Coast boards. We then had to consider how to mount the boards. We chose a couple of blocks from the quarry, which were taken up to Locharbriggs Quarry near Dumfries to be cut and shaped. When we went up there to check on them, we were delighted to see that the cut faces demonstrated the features in the sandstone even better than we had dared hope, with a lovely channel visible on one of them. Finally the blocks were returned to Cumbria and carefully positioned, ready to be drilled, for the boards to be mounted on them. All went according to plan and the boards were officially unveiled in July 2016 by Mervyn Dodd, who had originally proposed the site as a Local Geological Site (then a Regionally Important Geological Site (RIGS)) in 1997. The cost of the whole project was borne by the quarry owners, Marshalls, and the work was excellently coordinated by David Forsyth of Stephenson Halliday.

Our second board at the disused Brown Howe Quarry near Blawith, close to the shores of Coniston Water, was an entirely different project. This quarry was into a pink microgranite dyke, probably an offshoot from the Shap Granite, intruded into dark grey Windermere Supergroup rocks. The quarried rock was crushed and used for roadstone. The quarry was closed in the 1950s but older people can still remember when the roads around Coniston were pink. The quarry was designated as a Local Geological Site (RIGS) in 1993 but on a routine visit in 2014, it was found to be seriously overgrown, with only one Windermere Supergroup face being clear of vegetation. That face was regularly used by outdoor activity centres, bringing children to get experience of rock

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Top: Brown Howe Quarry board, mounted on a block of Windermere Supergroup rock, from Kirkby Moor Quarry, showing a sliver of the pink microgranite dyke rock, left in situ by the quarrymen near the quarry entrance.

Bottom: Brown Howe Quarry board unveiling, by Richard Leafe, Chief Executive of the Lake District National Park. The quarry is into a pink microgranite dyke, probably an offshoot from the Shap Granite. A sliver of the dyke material is visible in the background. Also present, left to right, Sylvia Woodhead, Cumbria GeoConservation, Donald Kelly, retired manager of Kirkby Moor slate quarry and Ian Kelly, his son, current manager of Kirkby Moor Quarry, who provided the block on which the board is mounted.



climbing. Subsequently, in 2016, we were able to arrange for a working party of Lake District National Park (LDNP) volunteers to clear most of the young trees, brambles and other vegetation from the other faces and that revealed the geology more clearly than we had anticipated, with pink dyke material clearly exposed on both sides of the quarry entrance. This provided us with the impetus to go ahead with the planning of an information board here. However, we found it to be a much more difficult task than at Birkhams Quarry.

We found it hard to identify who could give up permission to erect an information board. The quarry was worked by Lancashire County Council, but now lies within Cumbria and is owned by the LDNP, who were not certain if the board should be considered an advertisement requiring planning permission. The land lies within a biological SSSI which meant getting permission from Natural England; it is common land, so we were recommended to get in touch with the commoners. Then there was the not insignificant matter of finance for the board. We were able to allocate some funds from our own reserves, including money given to us for a project of this sort by the NW GeoDiversity Partnership. We tried various other sources, including most of those listed above, but support for our efforts did not translate into financial support. However, we were delighted to receive a significant grant from the Curry Fund of the Geologists' Association and that enabled us to go ahead and employ the same consultants that had been used for the Birkhams Quarry board, Elizabeth Pickett and Marcus Byron, to prepare and design the board, and then to get it manufactured. We wanted to make the information on the board accessible to the young climbers and we were very happy that Elizabeth chose to represent the quarry as it might have looked while active, alongside the explanation of the geology. We considered various options for mounting the board, including metal legs, and a granite plinth, but finally decided that it would be best mounted on a piece of the local Windermere Supergroup rock. We would have

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liked to use a block from the quarry itself but there was nothing suitable and we were kindly offered a block from Kirkby Moor Quarry, by Burlington Stone. Using a local contractor, the stone was collected from the quarry and put into position, along with some chippings to make a firmer surface for those standing to read the information. Finally, with sighs of relief all round, and a promise to ourselves never to embark on such a project again, we mounted the board on the stone and it was complete. We had a grand unveiling by Richard Leafe, Chief Executive of the LDNP in October last year and since then have visited regularly to check that all is well. Members of the Westmorland and of the Open University Geological Societies admired the quarry and the interpretation board on a recent field visit and an Earthcache has been set up there to encourage geocachers to visit too. The icing on the cake was to learn in March that we had been awarded a Curry Fund Certificate of Merit, awarded to the project completed in the previous year that best fulfils the aims and objectives of that fund. We were delighted that the Curry Fund Chairman, Dr Haydon Bailey was able to come and present us with the award in June.



Presentation at Brown Howe Quarry, of the Certificate of Merit, by Dr Haydon Bailey, Curry Fund Chairman, Geologists' Association, to Dr John Lackie, Chair, Cumbria GeoConservation, with members and friends of Cumbria GeoConservation. Photo by Carolina Goodship, Cumbria GeoConservation.

5,000 years of local history come back to life in Calderstones Park

George Hawkins, Head of Facilities & Capital Development, The Reader

After a three-year, £5 million refurbishment, The Reader (a national charity based in Liverpool) has reopened the doors of the Calderstones Park's 200-year-old Mansion House. Along with lots of spaces for people to enjoy, the Grade II listed, Georgian mansion is now home to a dedicated heritage exhibition, with the Neolithic Calder Stones that give the local area its name taking pride of place.



Close-up of one of the Calder Stones. The stones display Neolithic carving of spirals, concentric circles, cup and ring marks, arcs and parallel lines. There are also some more recent Medieval carvings. © The Reader.

The Calder Stones are six large blocks of red, Triassic sandstone that were first erected in Liverpool around 4,800 years ago. The Calder Stones are decorated with elaborate carved symbols that are similar to markings found at other megalithic heritage sites around the British Isles and beyond. It is now believed they originally formed part of an ancient tomb built by a settled farming community who lived at this time in what is now Calderstones.

Records of the Stones date back to a boundary dispute in the 1500s and have been the subject of intense local speculation since then. Who placed the Stones here? Who carved them? What do the markings mean?

Most recently, the Stones could be seen in a circular formation, locked away long-term in a glasshouse, which unfortunately led to their deterioration, and they were only periodically available to see up close. Before this, they had been placed by the man who built the Mansion House, lead shot merchant Joseph Need-Walker, in a circle at the entrance to what was his estate. This area was later named Druids Cross. Due to their circular layout, it had become common knowledge over time that they were 'something to do with the Druids'.

The conservation work on the Stones was done by Orbis Conservation in London, who painstakingly lifted each of the Calder Stones and applied a variety of specialist techniques to reverse some of the damage done by their environment. This included using a sling to move each of the (up to three ton) Calder Stones on a specially designed overhead gantry, and packing each on a purpose-built padded crate for their journey to the capital. Once at the conservation studio, the team from Orbis performed additional laser scanning to record the condition of the Stones, and all of the markings on their surface, revealing previously unknown, ancient cup marks.

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The scanning was repeated once the Stones had undergone their conservation treatment, providing us with a record of the effects of it. The final stage of the conservation work was to place the Stones into their new home, ensuring they would be protected from damaging environmental effects and safe from vandalism. Orbis coated the base of each Stone in a special waterproofing treatment, durable yet easily removed, and have left a steel plate engraved with instructions for its safe removal, should future archaeologists discover them!

The new home for the Stones, with the new interpretation and opportunities for people to visit them in an urban setting, is also something quite innovative and special. The architect, Austin Smith Lord, designed a purpose-built enclosure taking inspiration from surviving Neolithic passage graves such as that at Barclodiad Y Gawres and Bryn Celli Ddu on Anglesey. One vital consideration with the design was to remove the Calder Stones from their misleading circular arrangement. In consultation with experts from Merseyside Archaeological Society, National Museums Liverpool and Historic England, as well as individual academics and the local community, it was settled that they would be presented in two lines of three stones. Complete with a living roof, that will start to crawl down the sides, this new setting has been specially designed to hint at ideas of a passage grave. The architects also made sure the markings made by Neolithic people, and those added later, would be clearly seen by visitors walking between the Stones.

An interactive exhibition next to the Calder Stones is a permanent space that tells the stories of the people who lived alongside them and the significance of the carved markings, along with their national and global importance. Designed with interpretation specialists, Core Creative (formerly Leach Studios), the exhibition has special parts for younger children, along with audio-visual elements, to bring the stories to life. This includes interactive timelines charting the development of written language, a child-sized topographic map of Merseyside set into a bench (which reveals details of ancient burials) and a replica tomb with atmospheric soundscape.

This storytelling effort is mirrored in another space inside the Mansion House, where we tell the stories of the people who lived there, and the wider park, which was opened by the then-Liverpool Corporation in 1905. The centrepiece here is the re-creation of the study of a shipping magnate who owned the Mansion House, Charles Maclver, with some hats for people to try on that tell more of the history through period costume.



The Calder Stones are a group of six decorated sandstone monoliths. They were formerly arranged in a circle and located in the Harthill Greenhouses in Calderstones Park.
© The Reader.

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The Calder Stones on display today. Here they have been arranged in two rows to give the impression of a burial chamber. © The Reader.

Maclver's desk has a 'magic lantern' on it displaying some key pieces from the new digital archive. As well as being custodians of the story of the Mansion House and the Calder Stones, The Reader is also curating records people have given to us over the years. So wherever you live, you can explore fragments of local life in Liverpool, such as newspaper clippings and census documents online for the first time.

The Calder Stones are the earliest evidence of people 'making meaning' together in Liverpool; and what The Reader has done for almost 20 years is help people come together to do just that. When we first arrived at Calderstones, we found that only 65 per cent of local people had heard of the Calder Stones and only five per cent could speak with confidence about their significance. We could see that the rich history of the Calder Stones was steadily slipping from local people's awareness and, as people who believe in the power of great stories, we knew we this needed to change.

The Calderstones Story is free, accessible to all and open seven days. We're delighted the Calder Stones have now been properly conserved for future generations and that visitors can now get up close to learn their story.

The overall costs of the project, including capital and programming, were met through grant funding from National Lottery Heritage Fund, Tudor Trust, Garfield Weston Foundation and other independent charitable funders, along with an investment from our landlord and partner Liverpool City Council.

We hope to see visitor numbers to The Reader at Calderstones of 44,000 in the first year, with at least 6,000 joining in with our fantastic new programme of activity, themed around the idea of being 'recalled to life', from Charles Dickens' *A Tale of Two Cities*. The Reader at Calderstones is a reading home with heart, where anyone can come to experience great literature, explore 5,000 years of local life and develop new skills. Calderstones Park is an incredible community asset, owned by the city, and we're delighted to have the opportunity to help share its treasures.

Find out more

The Reader: <https://www.thereader.org.uk/what-we-do/>

Calderstones digital archive: <https://www.thereader.org.uk/calderstones-archives>

The Geology of Yorkshire and northern England (University of York online postgraduate programme): a personal review

Ken Madrell, Masters Student, Open University

The University of York online postgraduate programme is probably the most interesting and exciting course I have ever studied and far exceeded my expectations. Before commencing the programme, I had developed some theoretical knowledge of geology through Level 2 and Level 3 courses with the Open University but anyone with a background in geography or science would find the course content easy to access and understand.

Each year is divided into 3 online modules of 10 weeks duration, with the final week designated for assignment writing. Each week participants receive a programme of study and suggestions for further reading. The articles are easy to download from the course reading list. Whilst it is recommended that you spend about 15 hours a week, I found this varied according to what was being studied and your own personal choices. For example, I am not keen on structural geology so I read the weekly programme and only one or two of the supporting papers, much less than 15 hours work! However, I



A view of Thornton Force one of the sites visited on the Ingleton Waterfalls Walk, part of the Thornton and Twisleton Glens SSSI. There is an unconformity surface between the horizontally bedded Carboniferous Limestone Supergroup and the underlying Ordovician age Ingleton Group. Photo by Ken Madrell

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Yes, you can see fossils like this! A photograph showing a large gastropod found in the lagoonal limestone facies at Betton Farm Quarries SSSI, East Ayton, near Scarborough. Photo by Ken Madrell

was very interested in the Triassic Period and also oceanic anoxic events, so in those weeks I spent more than 15 hours.

At the end of each module there is an assessment to complete, relating to the topics covered in that module; this ranges from: i) a short (1000-word) informal article plus a longer (3000-word) technical report, to ii) one single 4000-word scientific report. These should not be daunting – nor should they drive the learning programme, unless of course you are wanting to acquire a high mark in the diploma, perhaps for career purposes or to lead on to further studies at master's level.

In Year 1 the course began with a residential week based at the University of York, where course participants worked together on rock identification and took part in trips visiting Ingleton and the Whitby coastline. On the visit to Ingleton we visited the Hanson Aggregates active Ingleton Quarry where we saw some of the oldest rocks in England, dating back to the Ordovician Period, or perhaps earlier. This was followed by an afternoon walk along the River Twiss where we looked at the Carboniferous Limestone Supergroup and the older Ordovician rocks, known as the Ingleton Group (within Thorton and Twisleton Glens SSSI). These rocks, and the unconformable junction between them, are beautifully exposed at Thornton Force. The second visit was to the Whitby coastline where we walked along the shoreline between Whitby town and Saltwick Bay (Whitby-Saltwick SSSI). We saw examples of Jurassic-age rocks in which changes in their colour and texture illustrated changes from marine to terrestrial environments, and from anoxic to oxic marine conditions. Many fossils were discovered on the shoreline, as was the famous Whitby Jet, all of which are testament to one of the most dramatic environmental changes in the Mesozoic world, the Toarcian Oceanic Anoxic Event, when extreme warming caused major perturbations to life in the seas.

In Year 2, a second residential week was held in week 3. On one of the days we visited sites in north-east Yorkshire to examine an exposure of Upper Jurassic lagoon and reef palaeoenvironment

in a small quarry at Betton Farm near Scarborough (Betton Farm Quarries SSSI). We also studied fossilised meandering river channels along the nearby coast at Burniston Bay. A second day visit was made to the British Geological Survey HQ at Keyworth, where we examined rock cores from the Permian to Triassic periods as well as exploring the range of on-site facilities including the Geological Time Walk. Back at the University of York, during one of the practical sessions we had the opportunity to examine microfossils, revealing a fascinating microscopic world normally only accessible through the internet or books.

The content of the course charts the geological history of Yorkshire and northern England from the Cambrian Period to the present day. Examples are studied from the Lake District, the Cleveland Basin and other areas in Yorkshire and wider northern England. There are also modules looking at geological skills and palaeoenvironmental analysis. The final module is on economic geology and looks at the raw materials that have supported the development of the region from the early stone-age factories of the Lake District, through the Industrial Revolution and up to the present-day developments of the new Sirius polyhalite mine in the North York Moors National Park.

Although the focus of the course is on Yorkshire and northern England, I live in the West Midlands and found its content equally applicable to my home region and other parts of the UK and Europe that I have since visited.

The future programme

Dr Annette McGrath, University of York explains that;

“Concentrating mainly upon the geological evolution of northern England, the PGDip programme will enable you to analyse and interpret key geological features, understand fundamental concepts, and integrate regional knowledge into the interpretation of larger scale Earth processes and structures.

You will assess the region’s importance in current and historical Earth science controversies and study human interactions with the rocks and landscapes of northern England from the Stone Age to the present day. Undertaking this multidisciplinary qualification will equip you with a breadth of transferable skills, including advanced research, science communication and palaeoenvironmental analysis.”

Although northern-England centric, the programme also examines elements of other significant areas of wider UK geology where relevant, for example the Chalk Group of Southern England, the Hebridean Igneous Province of Scotland and the North Sea Oil and Gas Province. You will also have the opportunity to focus and tailor your own reading and research on to your home region, to suit your personal interests, or other areas of the wider UK or world.

Further Information

Applications are currently being considered for the September 2020 intake for the online PGDip programme (now ‘The Geology of Northern England’). For information email the Postgraduate Administrator, Amanda Pauw, amanda.pauw@york.ac.uk or call 01904 328482 for further details or visit the website: <https://www.york.ac.uk/lifelonglearning/geology/>

Brown Howe Quarry board, mounted on a block of Windermere Supergroup rock, from Kirkby Moor Quarry, showing a sliver of the pink microgranite dyke rock. Photos by Audrey Brown, Cumbria GeoConservation . More details on page 38.





Earth Heritage in print

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It can be downloaded free as a pdf file from www.earthheritage.org.uk. You can also purchase a hard copy of any issue via www.geologistsassociation.org.uk/earthheritage. Subscribe to notifications of new issues at www.earthheritage.org.uk/subscribe.

We thank all those who have assisted in preparing the publication, including the voluntary geoconservation sector who are major contributors. The opinions expressed by contributors are not necessarily those of the above organisations.

Stone stacking on the Lecale coast, on of the 76 GeoWeek events that took place in 2019 (see article on page 11 for more details).

