

#### Committee

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Copy date for the next Newsletter is Wednesday 1 August

# Newsletter No. 249 June 2018

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To find out more about this photo - read on!



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For enquiries about field and geoconservation meetings please contact the Field Secretary. To submit items for the Newsletter please contact the Newsletter Editor.

#### For all other business and enquiries please contact the Honorary Secretary.

For further information see our website: <u>bcgs.info</u>, Twitter: <u>@BCGeoSoc</u> and <u>Facebook</u>.

## **Future Programme**

Indoor meetings will be held in the Abbey Room at the Dudley Archives, Tipton Road, Dudley, DY1 4SQ, 7.30 for 8.00 o'clock start unless stated otherwise.

Visitors are welcome to attend BCGS events but there will be a charge of £1.00.

Please let Andy Harrison know\* in advance if you intend to go to any of the field or geoconservation meetings. If transport is a problem for you or if you intend to drive and are willing to offer lifts, please contact Andy with at least 48 hours notice. \*For the meeting on 9 June contact Ray Pratt NOT Andy. See below for details.

Saturday 9 June (Field meeting): Palaeozoic Sites of the Black Country, led by Andrew Harrison, Ray Pratt, and Julie Schroder. Joint meeting with the Geological Society West Midlands Regional Group. Meet at 10.00 at the Lickey Hills Country Park Visitor Centre, Warren Lane, Birmingham, B45 8ER. We will start by visiting a variety of exposures in the Lickey Quartzite Formation following the 'Champions' trail, then on to visit the Rubery Cutting, Wren's Nest, Barrow Hill (if there's time) and Saltwells LNR. Due to finish around 4.30. Wear stout footwear and bring a packed lunch. Numbers limited to 20. Pre-booking essential. Register via Ray Pratt from the Geological Society WM. Text: 07867785779 or email: geostart@btinternet.com

**Saturday 21 July (Field meeting): Severn Valley Country Park, Geology and Mining Heritage, led by Andrew Harrison.** Meet at 10.30 at the Severn Valley Country Park visitor centre, Chapel Lane, Alveley, Bridgnorth, Shropshire, WV15 6NG. Parking fee: £2.20 all day. Bring stout footwear and a packed lunch. (*NB: this event replaces the trip to Nottingham's Sandstone Caverns which has had to be cancelled.*)

Saturday 18 August (*Field meeting*): Visit to Wren's Nest and the newly opened Dudley Museum and Art Gallery, led by Graham Worton. Meet at the Dudley Archives at 10.30. Bring a packed lunch and suitable footwear for indoors at the Archive and outdoors at Wren's Nest.

Saturday 1 September (*Field Meeting*): Visit to Titterstone Clee Hill, Shropshire, led by Andrew Jenkinson (Shropshire Geological Society). Joint meeting with the OUGS WM. Details TBC.

## **Procedures for Field Meetings**

#### Insurance

The Society provides public liability insurance for field meetings but personal accident cover is the responsibility of the participant. Details can be obtained from the Secretary, and further helpful information can be found in the <u>Code for Geological Field Work</u> published by the GA and available on our website. Schools and other bodies should arrange their own insurance as a matter of course.

#### Health and Safety

If you are unsure about the risks involved or your ability to participate safely, you should contact the Field Secretary. Please take note of any risk assessments or safety briefing, and make sure that you have any safety equipment specified. The Society does not provide hard hats for use of members or visitors. It is your responsibility to provide your own safety equipment (eg. hard hats, hi-viz jackets, safety boots and goggles/glasses) and to use these when you feel it is necessary or when a site owner makes it a condition of entry. Hammering is not permitted unless specific permission has been sought and granted. Leaders provide their services on a purely voluntary basis and may not be professionally qualified.

Monday 17 September (Indoor Meeting): Details TBC.

Saturday 6 October (Geoconservation Day): Portway Hill Quarry, Rowley. Details TBC.

Monday 15 October (Indoor Meeting): Details TBC.

Saturday 3 November (Geoconservation Day): Wren's Nest. Details TBC.

Monday 19 November (Indoor Meeting): Details TBC.

Saturday 1 December (Geoconservation Day): Saltwells Local Nature Reserve. Details TBC.

Monday 10 December (Indoor Meeting, 7.00 for 7.30 start): Members' Evening, details TBC.

# **Other Societies and Events**

BCGS members are normally welcome to attend meetings of other societies, but should always check first with the relevant representative. Summarised information for approximately **two months** is given in our Newsletter. Further information can be found on individual society websites.

## Mid Wales Geology Club

Sunday 10 June: Dethenydd (nr Llandinam) led by a member.

**Wednesday 20 June: Building Stones of Montgomeryshire.** Speaker: Dr. John Davies (Welsh Stone Forum).

Wednesday 18 July, evening field trip: Aberedw Rocks (south of Builth).

Further information: Tony Thorp tel. 01686 624820 and 622517 <u>tonydolfor@gmail.com</u> Web: <u>http://midwalesgeology.org.uk</u> Talks at 7.30 at Plas Dolerw, Milford Road, Newtown.

## Woolhope Naturalists' Field Club - Geology Section

**Saturday 30 June: Meet Lawrence Banks** at 10.30 - 11.00 for coffee/tea in Hergest Gardens and visit a local quarry. Also to see the private collection.

Tuesday 10 July: Geology - Footsteps of William Smith - further details to follow. Led by Paul Olver.

Non-members of the Club pay £1 extra. Bookings must be made via the Field Secretary Sue Olver on 01432 761693, when more details of the meeting will be given. Email: <u>susanolver@hotmail.com</u> or visit: <u>http://www.woolhopeclub.org.uk/Programme.html</u>

## Warwickshire Geological Conservation Group

Wednesday 20 June at 7.00: Wolstonian Clay Pit, Burton Hastings. Led by Brian Ellis, Ian Fenwick.

**Saturday 21 July at 11.00: Ecton Copper Mine,** Manifold Valley between Hulme End and Wardlow. Led by Ecton Educational Trust staff. Trip to be confirmed.

For more details visit: <u>http://www.wgcg.co.uk/</u> or email: <u>WarwickshireGCG@gmail.com</u>. There is a charge of £2.00 for non-members.

## East Midlands Geological Society

Saturday 16 June at 2.00: Holmebank Chert Mine, Bakewell. Led by Paul Chandler of the PDMHS.

Saturday/Sunday 14-15 July at 10.30: Malvern Precambrian inlier – Late Precambrian to Permian sediments and intrusions. Led by Paul Olver.

Non-members are welcome. Further info: <u>www.emgs.org.uk</u> or email: <u>secretary@emgs.org.uk</u>

## North Staffordshire Group of the Geologists' Association

Wednesday 13 June at 6.00, evening walk: Alderley Edge. Led by Eileen Fraser.

Saturday 7 July: Wren's Nest. Led by Graham Worton (BCGS).

For enquiries: Steve Alcock, Longfields, Park Lane, Cheddleton, Leek, Staffs, ST13 7JS. Tel: 01538360431 or 07711 501028. Email: <a href="mailto:steves261@aol.com">steves261@aol.com</a>More info: <a href="mailto:www.esci.keele.ac.uk/nsgga/">www.esci.keele.ac.uk/nsgga/</a>

## Teme Valley Geological Society

**Saturday 30 June: Meet Lawrence Banks** at 10.30 - 11.00 for coffee/tea in Hergest Gardens and visit a local quarry as well as see the private collection. Joint meeting with the Woolhope Club.

Contact John Nicklin on 01886 888318 or visit: <u>http://www.geo-village.eu/</u> Non-members £3.

## **Geological Society, West Midlands Regional Group**

**Saturday 9 June: Palaeozoic Sites of the Black Country**, led by Andrew Harrison, Ray Pratt, and Julie Schroder. Joint meeting with BCGS. See above for more details.

**Tuesday 12 June at 6.00 for 6.30: Reflections of a retired Hydrogeologist on the use and management of the Permo-Triassic sandstones of north-west England**. Speaker Keith Seymour. Venue: The Birmingham & Midland Institute, 9 Margaret St, B3 3BS.

For further details and to register your interest in attending, please contact the Group Secretary at: <u>geolsoc\_wmrg@live.co.uk</u>

## The Geologists' Association Annual Conference 2018 - The Geology of 'Mordor'

Exploring the incredible geology and mineral wealth of the Black Country, that powered the 'workshop of the world' and inspired iconic art and literature.

#### **Provisional Programme:**

**Friday 19 October:** Lapworth Museum of Geology, University of Birmingham Pre-registration & behind-the-scenes visit to the Lapworth Museum

Informal social gathering at local pub

Saturday 20 October: Talks relating to the world-class geological & cultural heritage of the region Topics/speakers to date: Keynote: People and rocks in the landscape of 'Mordor' Graham Worton: The Black Country UNESCO Global Geopark Speaker (tbc): BGS and the geology of the region Colin Knipe: Mining and Industry in the Black Country

Ben Evans: Conserving Geoheritage in the Coalfields/Urban Area

Conference Dinner details to be confirmed

**Sunday 21 October:** Range of excursions to include: The limestone geology and fossils of the Black Country The Coal Measures geology of the Black Country Coalfield The Building Stones of Birmingham City Centre



For further information and registration: <u>www.geologistsassociation.org.uk</u> or email: <u>conference@geologistsassociation.org.uk</u>

## Abberley and Malvern Hills Geopark - Geofest

The 2018 Abberley and Malvern Hills Geofest is running from 26 May to 2 September with the usual variety of events and exhibitions. Click here to view or download the <u>Geofest programme</u>. For further information go to: <u>http://geopark.org.uk/</u>

### Herefordshire & Worcestershire Earth Heritage Trust

**Saturday 16 June, 9.30 - 1.00: Herefordshire Walking Festival – 'Voyages in Deep Time' at Black Hill.** This walk introduces a free new smartphone app called 'Voyages in Deep Time' which will help you discover past environments and landscapes in the Olchon Valley and Cats Back. For further information and to book on this walk, visit: <u>www.walkingfestival.com</u>.

**Sunday 17 June, 10.00 - 3.30: Herefordshire Walking Festival – Geology and Landscape of the Wye Gorge** with Moira Jenkins of the Earth Heritage Trust. Enjoy the spectacular scenery of the Wye Gorge. For further information and to book on this walk, visit: <u>www.walkingfestival.com</u>.

**Saturday 23 June, 12.30 - 4.00: Herefordshire Walking Festival – 'Voyages in Deep Time' at The Doward**. This walk introduces a free new smartphone app called 'Voyages in Deep Time' which will help you discover past environments and landscapes in the Wye Valley. For further information and to book on this walk, visit: <u>www.walkingfestival.com</u>.

Saturday 30 June, 10.00 - 5.00: Science in the Park at Malvern Priory Park, Great Malvern, WR14 3HB. H&WEHT and their 'Voyages in Deep Time' project team will have a stand featuring a large variety of fossils, a Dinosaur Detective Trail, dig-a-treasure, and they will demonstrate their 'Voyages in Deep Time' app, as well as selling geology-related merchandise. All are welcome.

For further information contact Herefordshire & Worcestershire Earth Heritage Trust, Geological Records Centre, University of Worcester, Henwick Grove, Worcester, WR2 6AJ. www.EarthHeritageTrust.org Telephone: 01905 855184 Email: <u>eht@worc.ac.uk</u>

## **Open University Geological Society**

**Symposium 2018 'Music of the Earth', 10 – 12 August** at St John's Campus, Worcester University.

Geology of the Worcester area, the Malvern Hills, and Martley.

Including speakers from the Earth Heritage Trust, BGS, OUGS and local universities.

Gala dinner followed by Ceilidh.

Half day local field trips on Saturday.

Sunday Evening: socialising in the bar with a quiz. Monday: Self drive trips to various sites and other events.

For more details contact: <a href="mailto:symposium2018@ougs.org">symposium2018@ougs.org</a>



## Vacancy – Meetings Secretary

Our former Meetings Secretary, Roy Starkey, stood down at the AGM in March. If you are interested in taking on this role, and shaping the future programme of talks, please contact any member of the Committee. Contact details above (p.2) and on our website at <u>http://bcgs.info/pub/contact-us/</u>

#### We urgently need someone to come forward to take on this role!

### **Possible BCGS Excursion to Dorset**

Graham Worton recently led a trip round the Wren's Nest for The Dorset Geologist's Association Group. As a result, a reciprocal visit to Dorset for BCGS has been suggested.

- Would you, our members, be interested?
- Would you like a weekend away, or perhaps just one overnight stay?
- Have you any particular sites in mind?

Andy needs some positive responses if it is to be worthwhile organising this trip. It's a very long time since BCGS had an overnight excursion. Please respond with suggestions and let's try and make this happen! Contact Andy Harrison, Field Secretary, <u>fieldsecretary@bcgs.info</u> (Ed.)

# **Field Meeting Report**

**Sunday 7 April: Forest of Dean, Soudley Valley and Bixslade Valley.** Led by John Moseley, Gloucestershire Geoconservation Trust (GGT).

Heavy rain fell as we met John at Soudley Village Hall at 10.30. However, this soon cleared to give a dry and cloudy day with a light breeze and some sunshine. Once gathered, we moved a short distance to the Dean Heritage Centre (Soudley, Forest of Dean GL14 2UB). Here, John introduced the day's programme, and the geological background to the Forest of Dean.

We spent the morning examining cuttings along approximately 1km of the Soudley Valley Trail that runs parallel to the B4227 (Upper Soudley to Ruspidge Road). The trail follows a former 19th century mineral railway that once serviced local coal and ironstone mining, plus limestone and sandstone quarrying industries in the Forest of Dean.

The cutting exposures contain a rock sequence that starts with Devonian Lower and Upper Old Red Sandstone (ORS) strata and progresses into Lower Carboniferous Limestone strata. At the start of the trail are Devonian Lower ORS rocks, belonging to the Brownstone Group. These rocks comprise repeating mudstone-sandstone sequences, or cyclothems, which contain ripples, desiccation cracks and animal burrows. They are believed to have been deposited from constantly changing braided streams, flowing over a low-lying flood plain.



Devonian Old Red Sandstone strata at the start of the Soudley Trail

Continuing northwards along the trail, we examined

two rock units representing the Upper ORS. Just beyond the Brownstone Group rocks, the first unit we encountered was a coarse-grained sandstone with abundant quartz pebbles. This unit, identified as the Quartz Conglomerate (formerly known as the Huntsham Hill Conglomerate Formation) sits unconformably above the Brownstone Group and was historically used for grindstones. The unconformity represents missing Middle Devonian strata.

Approximately 300m further on, the second unit we encountered included regular thinly bedded fine and medium grained sandstone layers with occasional thin mudstone partings. This unit, the Tintern Sandstone Group (formerly the Tintern Sandstone Formation) also exhibited channelling, graded and cross-bedding indicating deposition from ancient water courses. ►

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Heading northwards another 50m, the mudstone partings became more numerous as the cyclic mudstone-sandstone character returned, as seen previously within the Brownstone Group strata. These rocks were mostly unfossiliferous and cemented with lime or dolomite. They have been interpreted as the gradational, diachronous boundary separating the uppermost Devonian Tintern Sandstone from the lowermost Carboniferous Lower Limestone Shale.

Further north the exposure ended at a sealed tunnel exit (Blue Rock Tunnel), to the north of which the trail opened out into an area of trees. A set of wooden steps led eastwards up a steep, tree-covered slope and into a quarry known as the Blue Rock Quarry. Poor underfoot conditions meant that we did not enter the quarry. However, John described what could be seen and showed us samples of the rocks therein. Lower Limestone Shale exposures on the quarry's southern edge comprise calcareous sandstone and mudstone layers interbedded with crinoidal, dolomitized limestone. These layers indicate deposition under complex shoreline conditions fluctuating between shallow shelf and lagoonal



Examining Pennant Sandstone at the Mine Train Quarry

environments.

Within the quarry, the Lower Limestone Shale progresses into pale yellow, slightly fossiliferous finegrained dolomitized limestone rocks, which have been chemically altered by percolating magnesiumrich fluids. These rocks belong to the Lower Dolomite.

Situated on the western side of the B4227, our next location was the Perseverance Road Cutting. Here we examined middle Carboniferous Limestone rocks belonging to the Crease and Whitehead Limestone. The older Crease Limestone sits directly above the

Lower Dolomite and comprises orange red-brown, iron-rich dolomitized limestone. Unconsolidated pockets of silt and sand found within this stratum have been interpreted as later Triassic cave or wadi deposits. The younger Whitehead Limestone, seen in the right hand side of the quarry, sits unconformably above the Crease Limestone and comprises lighter coloured thickly bedded limestones.

From Perseverance Quarry we headed back along the Soudley Trail to the Dean Heritage Centre for lunch. Our afternoon session involved driving approximately 6km west, through the forest to the Cannop Ponds and a walk up the Bixslade Valley. The ponds themselves sit within a depression marking the Cannop Fault Belt.

Along the Bixslade Valley, we followed an old tramway (dating back to the early days of mining using horse and cart), to the closed Mine Train Quarry. From the entrance we viewed gently dipping thinly and massively bedded rocks belonging to the Pennant Sandstone Group that lie within the late Carboniferous Upper Coal Measures. These sandstones were grey, medium to coarse grained and contain carbonised plant remains. Haematite and goethite mineralisation had stained them reddish brown. Once again these rocks were deposited in fluvial channels crossing a low-lying flood plain.

Regionally, the underlying Carboniferous Limestone and Devonian rocks have been strongly folded into a syncline with a steep easterly limb. The rock sequence seen along the Soudley Trail forms a traverse through this eastern limb. The more resistant Devonian rocks ring the Forest of Dean as a ridge of high ground. The Middle Carboniferous rocks seen further north in England are missing from the Forest. The Upper Coal Measures strata form a shallow basin sitting unconformably on top of the Lower Carboniferous and Devonian Strata. ►

The numerous structures and features seen within the Forest of Dean, hint at a complex tectonic history. The unconformity between the Brownstone Group and the overlying Quartz Conglomerate, coincides with the closing lapetus Ocean and associated Caledonian uplift. The Tintern Sandstone-Lower Limestone Shale boundary has been interpreted as a steady marine transgression, either due to the land sinking or sea level rising at the end of the Devonian. The Crease and Whitehead Limestone unconformity resulted from a minor, unidentified tectonic event during the Lower Carboniferous. Folded Devonian and Lower Carboniferous strata, and missing Middle Carboniferous strata are associated with Late Carboniferous (Hercynian) tectonic collision and uplift. Tertiary tectonic compression and uplift, associated with the Alpine Orogeny, exacerbated folding of the Devonian and Lower Carboniferous and folding of the Upper Carboniferous strata.

Iron mineralisation within the Crease Limestone was due to downward percolating iron-rich groundwater during the Triassic. Iron-bearing minerals such as pyrite within the overlying coal measures strata provided the iron source. However, this does not account for the mineralization seen in the Pennant Sandstone.

I would like to thank John for another extremely interesting field visit and we look forward to our next outing with the GGT. More information about the Soudley Trail can be found in the GGT, Rural Geology Guide for Soudley Valley, Forest of Dean. See their website for more information: <u>http://www.glosgeotrust.org.uk/</u>

**Thursday 3 May: Evening Tour of Birmingham's Building Stones.** Joint trip with the Geological Society, West Midlands Regional Group. Led by Julie Schroder.

Although this was a Geological Society West Midlands Regional Group event, members of the BCGS were invited as well. As members will be aware, Julie and John Schroder have been working to produce three leaflets covering the building stones of central Birmingham, based on the detailed trails by Dr Ruth Siddall of University College London, which are already available on our website. The completion of the leaflets has not been helped by current and ongoing building works.

Around 18 participants met at 6.15 next to the Victoria Statue in Victoria Square, where Julie gave an introduction to the evening. Using the detailed web versions of the 3 trails, the route covered most of Trail 1 and the start of Trail 3.

Our first stop was the Town Hall on the west side of Victoria Square. Opening in 1834, this building is clad with Penmon Marble, from the Loggerheads Limestone Formation of the Lower Carboniferous (Asbian) Clwyd Limestone Group. Where the surface is clean, rugose corals (*Dibunophyllum sp.* and



Examining the Penmon Marble of the Town Hall

*Palaeosmilia sp.*), colonial corals (*Syringopora sp.*) and brachiopods (*Daviesiella llangollensis*) are prominent. Bioturbabtion and stylolites are also common in this stone.

Due to Chamberlain Square being under reconstruction, our next stop was the Birmingham Museum and Art Gallery and Council House building. Constructed between 1874 and 1885, their exotic exteriors are built from various Upper Carboniferous Sandstones, including Coxbench Stone from Horsley Castle, Derbyshire; Wrexham Stone (or Cefn Stone), from Ruabon, Denbighshire; and Darley Dale Stone (or Halldale Stone) from Halldale Quarry, Darley Dale, Derbyshire. Inside the Museum, an impressive **>** 

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range of Devonian Devon Marbles have been used to line the main entrance, the stairs and in various places within the museum interior.

Within Victoria Square, sculptures such as 'The River' and 'Youth' are constructed of Upper Carboniferous Watts Cliffe Sandstone from Elton, Derbyshire. Darley Dale Sandstone has been used for the associated 'Guardians' and 'Object (Variations)' sculptures. Upper Carboniferous Sandstone has been used in Victoria House, which also exhibits door columns and soffits of grey granite, believed to be Late Caledonian Bessbrook Granite from the Newry Granodiorite complex of County Armagh, Ireland. Waterloo House



Standing back to admire the Council House

on the eastern edge of Victoria Square is faced with dark red brown 'Dakota Mahogany', a 2.7 billion year old granite from Millbank, South Dakota, USA. The building's entrance doorstep on Waterloo Street is paved with 'Baltic Brown', a 1.5 billion year old Rapakivi Granite from eastern Finland that contains distinctive pink potassic feldspar ovoids.

Continuing along Waterloo Street, the entrance to the upper storey offices of New Oxford House has door surrounds faced with 'Bird's Eye Marble'. This is a Lower Carboniferous Limestone, packed with crinoid ossicles, from Cromford, Derbyshire. The building is also faced in Jurassic Portland Stone from the Isle of Portland, Dorset which is common to many Birmingham buildings and comes in many varieties. The variety seen here is a pale grey stone containing oyster shells. The entrance surrounds to the ground floor retail outlets either side of the main entrance, (currently 'Adam's Restaurant' to the left, and 'Pieminister' to the right), are faced with a green serpentinite breccia known as 'Verde Alpi', from the Piedmont Zone of the French and Italian Alps. These serpentinites represent slivers of ocean crust obducted onto land when the Tethys Ocean closed during the early Tertiary, Alpine Orogeny.

Following Waterloo Street round to Colmore Row we passed the building currently home to 'Nosh & Quaff', with its facing of Portland Stone above the pearlescent dark blue of Larvikite from Norway. On Colmore Row we first stopped at No.122-124, the Java Lounge Coffee Shop to admire the decorative black and white Frosterley Marble, used in the door surrounds. With its finger size rugose corals



Dibunophyllum bipartum

(Dibunophyllum bipartum), in a dark bituminous matrix, this limestone is part of the Great Limestone Member, guarried at the Harehope and Broadwood Quarries, near Frosterley, County Durham. Inside the coffee shop are examples of Connemara Marble slabs in buff limestone Connemara frames. Marble comes from County Galway, Ireland, and represents Dalradian sediments that were metamorphosed during the Caledonian Orogeny. ►



Java Lounge Coffee Shop

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Shap Granite from Cumbria

The buildings along Colmore Row support a great variety of stones. Starting with No.125 (Starbucks), Giallo Cecilia, a garnet bearing metagranite clads the lower part of the building; Giallo Dorata, another Giallo granite from Brazil, and Bathstone, (a Jurassic oolitic limestone) clad No.115; pink Peterhead Granite and pale grey Dalbeattie Granite clad the Scottish Union and National Insurance Company Building (No.110); Larvikite and Whitbed Portland Stone clad No.98; Coxbench and Darley Dale Sandstone form Nos.85 - 89; Bathstone is used for

the Royal Bank of Scotland (Nos.79-83); Portland Stone and Dancing Cairns Granite (from Scotland) are used at No.84; and Shap Granite from Cumbria is used for the pillars either side of the doorways of No.55 and the former Grand Hotel (now Gusto Restaurant).

The Cathedral Church of Saint Philip in Cathedral Square was originally constructed of Arden Sandstone from Rowington, Warwickshire. However, since this rapidly decayed, many buff to white coloured sandstones, including Darley Dale Sandstone, Mansfield Stone, Hollington Stone, and Dunhouse Stone, have been used to repair the Cathedral. Other notable features around the Cathedral include the sandstone paving slabs from India which exhibit Liesegang rings; Peterhead Granite used in the Crimean War Memorial; Portland Stone, Bird's Eye Marble and Carrara Marble used in the Burnaby Obelisk; and the Penmon Marble monument to John Heap and William Badger who were killed during construction of the Town Hall.

To the south of Temple Row, on the southern side of Cathedral Square (and from the first part of Building Stone Trail 3), we saw examples of the 'Baltic Brown' variety of Rapikivi Granite, and Tivoli Travertine facing Lloyds Bank (No.43). The Travertine originates from quarries at Bagni de Tivoli near Rome, Italy, and is of Pleistocene age. Cladding the CBRE Building (No.55) and easy to see down Needless Alley is another variety of Portland Stone, known as Fancy Beach Whitbed. This is packed with leached out fossil oysters (*Liostrea sp.*), bivalves (*Trigonia sp.*), gastropods (*Ampullospira ceres* and *Aptyxiella portlandica*) and algal debris. The entrance facade is clad with 1.8 billion year old Blaubrun Granite, from Sweden.



Fancy Beach Whitbed

Our final building was the Allied Irish Bank, which is clad with Norwegian 'Blue Pearl' Larvikite above the first floor. Sardinian and Cornish granites have been used to face the door surrounds. The brownish Sardinian granite was quarried from the Buddoso Pluton, located northeast of Sardinia. Both granites were intruded during the Variscan Orogeny, around 300 million years ago.

Our guided tour finished around 8.00, and whilst some of the group headed home, the remainder of us adjourned to the Old Joint Stock for some refreshment.

I would like to thank Julie for a very interesting evening and hope that the ongoing building works do not interfere with the trails too much. Hopefully we can run the other trails in the future. For more information about the trails visit the BCGS website (<u>http://bcgs.info/pub/local-geology/building-stone-trails/</u>).  $\blacksquare$ 

# **BCGS & GDPR**

I expect you all know what 'BCGS' stands for and, unless you have been on an extended field trip and incommunicado, you will have seen 'GDPR' even though you may not know that it stands for 'General Data Protection Regulation'.

I spoke to someone at the Information Commissioner's Office who advised me about what BCGS needed to do in order to comply with the new regulation, which came into force on 25 May. As a result of this we have made a few changes. We now have a Privacy Policy which can be found on our website, but I include it below for those without internet access. The spreadsheet where we keep details of members and others who receive our Newsletter, is now password protected. Out of date copies have been deleted. We were advised that we would not need to register with the Information Commissioner's Office if we were a 'not for profit' society, and if this was in our constitution. So we voted to add this clause at a short Extraordinary General Meeting at the beginning of the last indoor meeting (16 April). Our constitution can now be found on our website: <a href="http://bcgs.info/pub/the-society/the-constitution/">http://bcgs.info/pub/the-society/the-constitution/</a> The only other change is that we will not now be able to advertise in the Newsletter. Hopefully, we are now conforming legally and can carry on much as before!

John Schroder

## **BCGS Privacy Notice**

The information that we collect about you is your name, address, telephone number, email address, and any organisation that you may represent.

It is held on a spreadsheet which is only available to members of the BCGS Committee.

We need this information to be able to communicate with you and send to you details of our meetings, Newsletter and any other BCGS business.

This is the only way we will use your personal data and it will not be shared.

If you stop being a member of the Society we will delete your personal details within a year.

If you no longer consent to us holding your personal data we will delete your personal details within a month.

If you wish to see your personal data or have your data removed from our records, please contact the webmaster, <u>webmaster@bcgs.info</u>, or any member of the Committee.

# 'Rocks & Landforms - view from Bilberry Hill' A new geological information panel for the Lickey Hills

On Saturday 12 May, the Herefordshire and Worcestershire Earth Heritage Trust (H&WEHT) held its AGM in the Lickey Hills school room, with a walk led by the Lickey Hills Geo-Champions scheduled for the afternoon. The Champions had spruced up Warren Lane and Barnt Green Road guarries in advance of the event, and aimed to follow the usual Champions Trail, including some of the new discoveries made by the group and visiting geologists in the years since the Champions group was formed in 2011. But in the event, there were far more surprises in store for our guests!

The Champions project left the Lickey Hills with three information panels for display in the Visitor Centre, and three in Barnt Green Road Quarry. These provide a lot of information and are still very much appreciated, but the Champions group soon lamented that there was no interpretation board on the main Bilberry Hill ridge. An opportunity arose in late 2015 when the EHT received Heritage Lottery funding for a project entitled 'Voyages in Deep Time'. Four sites were chosen to be researched for use in geological teaching apps for youngsters. Fortunately, the Lickey Hills were amongst the chosen sites, and a small financial contribution from the Lickey Champions group ensured a 'spin-off' project to create a new information panel. (See front cover photo, Ed.)

With expert input from those directly involved in the project, plus two years of hard work from members of the Champions group, the panel was completed and ready for installation only a few days before the AGM. Throughout the whole process the Lickey Hills Ranger Team were fully supportive, and it was thanks to a heroic effort on their part that the panel was installed in a prime location near the car park on Bilberry Hill ridge – just in the nick of time!



During the afternoon walk on 12 May, the EHT's outgoing Chairman, Sue Hay, was on hand to officiate with a

Sue Hay unveils the new panel

Ultimately there will be different apps aimed at different levels: one designed for 10 - 14 year olds in the form of a game, and another aimed at A level geology students. The junior app was just about ready for a test, so Beth came armed with tablets

ourselves reading about the geology to the accompaniment of a soundtrack relevant to the palaeoenvironment, answering questions to gain points, and taking evasive action in the face of

hazards to avoid losing points - or worse!

ceremonial unveiling of the panel. But there was yet more to come on this very special occasion!

One of the purposes of the new information board was to promote the 'Voyager' app with its Lickey 'voyages'. We were lucky to have with us for the occasion two of the main players in the 'Voyages in Deep Time' project team – Mike Brooks who created the apps (and the art-work for the panel), and Beth Andrews who is the outreach manager for the project.



Lickey Hills Geo-Champions with Mike Brooks

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Beth demonstrates the 'Voyager' app

The Lickey Champions and Rangers are proud of the new information panel, which they hope will be enjoyed by visitors to the Lickey Hills for many years to come. They are also delighted that the Lickeys were chosen for the development of the app, a wonderful teaching tool which has already added a new dimension to the promotion of geology in the Lickey Hills. You can download the Voyager app from Google Play Store or Apple App Store, and download the Lickey voyages from within the app. For more information on the Voyages in Deep Time project and the app please visit <u>www.deeptime.voyage</u> or email <u>e.andrews@worc.ac.uk</u>.

Come to the Lickey Hills! Read the information panel, try out the app, follow the 'Champions Trail' and just immerse yourselves in the amazing geological story stored in the rocks and the surrounding landscape of the Lickey Hills. You can start with our field trip on 9 June - and don't be deceived by the title 'Palaeozoic sites of the Black Country'! The day starts in the Lickey Hills with the oldest Palaeozoic rocks in the West Midlands.

Julie Schroder (photos by Keith Woolford)

# Mike's Musings No. 15 'Geo-Rates' - the speed of things in geology

My last musing dwelt on the subject of 'sudden' disasters. Set against such geological principles as Lyell's 'Uniformitarianism', Hutton's notion of the 'endlessness' of geological time ("no vestige of a beginning, no prospect of an end") and Darwin's vision of gradual biological evolution, the idea of anything geological being 'sudden' would seem to be something of a contradiction. But it doesn't require a great deal of insight to recognise that many geological processes are indeed extremely rapid.

I forget who first made the observation that warfare consists of long periods of inactivity punctuated by short bursts when all hell breaks loose. This notion (but in reverse) reminds me of Rossini's amusing description of a Wagner opera as having some wonderful moments but terrible quarters of an hour! Either way around, this dichotomy is a more realistic understanding of geological activity.

Whether in the realm of disaster - be it a volcanic eruption, tsunami or earthquake - or even in regard to the evolutionary process, there are long periods during which nothing much appears to be happening apparent stasis - ('the calm before the storm' comes to mind), followed by much shorter periods of rapid activity or change.

So, where does all this lead? Well, it puts me in mind of an article in the Journal of the Geological Society of London (N.J. Price, 1975, pp.553-575) in which the whole spectrum of geological deformation was put under the spotlight. Being a technical article, it approaches the question by considering the time taken to develop 10% strain (an arbitrary figure) in rocks subjected to a wide range of geological processes. Glossing over ►



Richard Wagner, Vanity Fair, 1877 Wikimedia Commons

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the difficulties in determining actual strain rates (which the author fully recognises and explains in greater detail), he arrives at the practical, and intuitive, conclusion that geology involves a continuum from very fast to very slow activity. He also points out that some, perhaps all, processes, are multiphase, such that the final outcome is reached by a series of events which may each vary greatly in their duration.

At the very slow end of the spectrum we have processes such as subsidence and uplift in a tectonic sense, whereby sediments are carried to great depths, lithified in the process, and then brought back to the surface by erosion of overlying strata ('inversion'). These require 10's or even 100's of millions of years to complete. Sedimentation rates are reckoned in millimetres per year. ('Sedimentology is the opiate of the masses' was a phrase coined by a fellow scholar in my university days, who as far as I know never made it as a stand-up comedian!) Supercontinent cycles, some now believe, operate on a similar time scale, from accretion to break-up to reassembly in different form, with a recurrence rate of about 500 million years, give or take. Sea-floor spreading and subduction rates are similarly measured in centimetres per year.

Isostatic readjustment of landmasses to the release from melting ice sheets after an 'ice age' is an analogous process measured again in 10's of millions <sup>4</sup> of years – but here it is easier to imagine that the process is ongoing since we are familiar with the idea <sup>5</sup> of ice caps waxing and waning, with changes in sealevel at all scales. We have to view the whole process in the round; a full cycle from the development of an ice sheet, to its melting and beyond, as the uplift lags behind the disappearance of the ice.



Schematic illustration of the Lewis overthrust fault in northern Montana. Wikimedia Commons

Mountain building (or 'orogenesis'), nowadays seen as part of the plate tectonic cycle when two continental plates collide, is shown to be a slightly faster process, measured in perhaps just a few millions to tens of millions of years. We can relate this to the rate of another geological process, that of folding, since crustal shortening, essentially involving compression, is the driving factor in both events (folding is just one part of the broader process of building mountain chains).

Folding also stands in contrast to faulting. The fundamental difference is that faulting involves deformation beyond the elastic limit. The rocks have been strained to such an extent that they can no longer absorb the deformation by behaving as an elastic substance. Instead of flexing they reach 'breaking point'. Factors that control this contrast in behaviour include temperature, pressure, and the physical properties of the rocks themselves. A simpler way of looking at this difference is that folding involves ductile behaviour whilst faulting involves brittle behaviour. The ductile-brittle transition is also related to the rate at which strain is applied (or strain-rate), which brings us back to the time dimension. Faulting (or brittle failure) occurs at high strain rates, and is therefore a faster process. Under compression, it represents the culmination of a period of applied pressure that first produces folds, and is generally reckoned in minutes rather than millennia.

Lying somewhere between folding and faulting in terms of 'geo-rates' is the rather commonplace geological process of magmatic intrusion. This involves the injection of molten material into 'solid' rock. I use the term 'solid' advisedly, because as we can see with the process of folding, solid rocks are not 'solid' in the everyday sense, but can deform by bending, buckling and generally 'giving way' to forces applied slowly, or over long time periods. The viscosity of the magma is obviously one important controlling factor, which in turn depends on chemistry, temperature and pressure. The other main ▶

factor is the strength of the rock mass being intruded - which is seldom homogeneous (so intrusions will always find the weak spots).

A simplified theoretical mathematical approach has shown that it is possible to estimate the time it takes for a certain thickness of magma to cool sufficiently to effectively set 'solid'. This is expressed as cooling to half the initial temperature difference between the magma and the enclosing rock mass. This somewhat approximate approach is nevertheless sufficient to give a realistic idea of the 'geo-rate' involved. Thus, a one centimetre thin sheet of magma takes only about 40 seconds to cool sufficiently to 'set solid' (or become effectively immobile). A 10 centimetre sheet takes just over an hour to do likewise. Typically, it takes just hours or days for small intrusions like minor sills and dykes to be emplaced to the point of 'setting solid'.

Literal application of the same theory to thicker and thicker intrusions suggests that medium sized bodies (10 - 100 metres thick) take up to about a hundred years to cool while larger masses (100 - 1000 metres thick), such as laccoliths, require perhaps a few thousand years to cool. Larger batholiths several kilometres in size might take a few million years to set solid. On a cautionary note, it may be that the basic equations are too simplistic and fall down for larger or deeper bodies of magma, where other factors may be involved (geothermal gradient for instance), so treat some of these figures as very rough estimates only.



Lava from fissure 8 advances on Kahukai Street, Kīlauea, Hawaii, May 2018. U.S. Geological Survey

At the faster end of the spectrum we return to the realm of the disaster scenarios - processes that are all too readily perceptible to mere mortals. It doesn't require mathematical equations to recognise that volcanic eruptions, when in full flow, are very short term processes reckoned in minutes, hours or days. Of course there is more to a single event than the eruption itself, with activity underground bringing the magma to the surface through intricate plumbing systems, but volcanoes are generally considered active for relatively short periods in geological terms – perhaps thousands of years only.

Likewise, earthquakes involve the gradual build up of stress in rocks, but are fundamentally related to faulting which we have already described as rapid events measured in minutes. Seismic activity might be the precursor to a tsunami. These again may spread, taking hours to travel across an ocean but just minutes to wreak their havoc upon landfall.

But the fastest 'geo-rates' are those associated with the truly catastrophic – an event mankind hasn't yet witnessed at it's most terrifying – the arrival of a major meteorite strike. These are capable of utter devastation in microseconds, effectively instantaneous.

What all these examples of 'geo-rates' reveals is the fact, probably intuitive, that nature operates on all scales, and at all times, and that geological processes are not only rapid and destructive, but can also be very, very slow - and at times quite constructive. All that is needed is a lot of time. This is one of the first things the student of geology comes to terms with as they learn to see the world around them in a different, less anthropocentric, way.