



*The
Black
Country
Geological
Society*

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**Copy date for the
next Newsletter is
Friday 1 August**

Newsletter No. 225

June 2014

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<p>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: www.bcgs.info</p>		

Future Programme

**Lecture meetings are held at Dudley Museum & Art Gallery,
St James's Road, Dudley, DY1 1HU. Tel. 01384 815575.
7.30 for 8 o'clock start unless stated otherwise.**

**Please let Andy Harrison know in advance if you intend to go to any of the field 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.**

Sunday 15 June (Field Meeting): Lickey Hills, led by the Lickey Hills Geo-Champions.

Meet at 10.30 at the Lickey Hills Country Park Visitor Centre, Warren Lane, Rednal, Birmingham, B45 8ER. Following our recent involvement in geo-conservation work in the Lickey Hills, this will be a chance to gain a better understanding of the geological formations of the Lickey Hills and their context within the wider landscape. In the morning we'll follow the Champions Trail (approx 1.5 miles). In the afternoon we will explore other sites of geological interest in the Lickey Hills area. Trip ends 4.00 - 4.30. Lunch at the Visitor Centre, snacks available, packed lunch advisable. Sensible footwear. Hard hats for close contact at quarry face, but not essential otherwise. A small number will be available at the VC. Please contact the Field Secretary (details above) to show your interest in attending.

Sunday 13 July (Field Meeting): Snailbeach and the Stiperstones, led by Andrew Jenkinson

(Shropshire Geological Society). Joint meeting with the Woolhope Naturalists' Field Club, Geology Section. Meet at the Bog Visitors Centre (grid ref OS 356979) for a 10.30 start. The morning will be based around the Bog centre and involve a walk of about 5km. Separate walk (about 3km) at Snailbeach in the afternoon, going by car perhaps via Shelve, Roman Gravel and Hope. Lunch at the Bog Centre (cakes and drinks available, but not savouries). **Places restricted to 10.** Please contact the Field Secretary (details above) to show your interest in attending.

Saturday 16 August (Field Meeting): The Geology of Worcester, led by Andy Harrison.

Meet at 10.30 outside the Guildhall on the High Street (NGR: 385006, 254780). The day will begin with a look at the geological setting and building stones of Worcester and a circular walk of the City Centre. After lunch we will visit Worcester Cathedral, last resting place of Prince Arthur, Henry VII's eldest son.

Saturday 6 September (Geo-conservation Day): Rowley Quarry, led by Paul Stephenson.

Meet at St Brades Close at 10.30 for an 11.00 start. Directions: From Birmingham New Road (A4123) turn left on to Tower Road if coming from Birmingham, right if coming from Wolverhampton. Just after Bury Hill park, turn left onto St Brades Close. Wear old work clothes, waterproofs and stout footwear. Please bring gloves and garden tools; loppers, secateurs, forks and spades if you have them. Also bring lunch. Finish at 14.30.

Monday 22 September (Indoor Meeting): Forensic Geology (title tbc). **Speaker: Dr Haydon Bailey FGS**, Senior Vice President of the Geologists' Association.

Sunday 5 October and 2 November (Geo-conservation Days): Saltwells Nature Reserve (SSSI) and Doulton's Clay Pit, led by Alan Preece. Meet at the Nature Reserve carpark (NGR: 393424, 286899) on Saltwells Lane for 10.00. We will be joined by the Saltwells Volunteer Group for scrub clearance within Doulton's Claypit. Wear old work clothes, waterproofs and stout footwear or wellies. Please bring gloves and garden tools; loppers, secateurs, forks and spades if you have them. Either bring packed lunch or hot food can be acquired from the Saltwells Inn adjacent to the car park. Finish at 14.30.

Monday 20 October (Indoor Meeting): 'The Island of Rum, Diary of a 60 Million Year Old Magma Chamber'. Speaker: Dr Brian O'Driscoll, Keele University.

Monday 17 November (Indoor Meeting): 'The Galapagos - geology, fauna and flora'. Speaker: Dr Les Riley, Consultant Stratigrapher.

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. 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 seldom necessary. It is the responsibility of the hammerer to ensure that other people are at a safe distance before doing so.

Leaders provide their services on a purely voluntary basis and may not be professionally qualified.

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 the **next two months** is given in our Newsletter. Further information can be found on individual Society web sites.

Fossil Family Fun Day 2014

Saturday 30 August, 10.00 - 4.00 at Dudley Museum & Art Gallery.

In response to changes within the local authority and the re-scheduling of the International Festival of Glass to 2015 it has been necessary to move the Rock & Fossil Festival to 2016. This is a longer time than the organisers would like so they have decided to host this one day special event at Dudley Museum & Art Gallery in 2014.

Admission is free, and there will be a range of family activities including a family prize draw.

Newsletter by email

If you are a member who receives a printed newsletter then you may prefer to see it in colour rather than black and white. If you send us your email address you can receive it as a colour pdf and this will save the BCGS the cost of printing and postage.

Teme Valley Geological Society

Saturday 5 July: Charnwood Forest, leader Dr Mike Howe. Contact Janet: 01886 821061.

Saturday 9 August: GeoFest Walk Day, 09.45 - 14.00. Contact John Nicklin: 02033 717647.

£3 non-members. For more details visit: <http://www.geo-village.eu/> or contact Janet Maxwell-Stewart, 01886 821061

Woolhope Naturalists' Field Club - Geology Section

Sunday 13 July: Stiperstones, led by Andrew Jenkinson. A morning walk of about 5 km with a separate 3km afternoon walk. Limited numbers, this trip must be prebooked. (Joint with BCGS: see above.)

Guests are welcome, but must take day membership of the Club: £2.00. Further information: Sue Hay on 01432 357138, email svh.gabbros@btinternet.com or visit their web site: www.woolhopeclub.org.uk/Geology_Section/default.htm

Shropshire Geological Society

Thursday 10 July: Hampton Loade, led by Andrew Jenkinson. To look at the shaping of the mid-Severn Valley. Part of the Abberley and Malvern Hills Geopark Geofest. Book to reserve a place and obtain joining instructions from Andrew Jenkinson; email: andrew@scenesetters.co.uk telephone: 01938 820 764.

Saturday 12 July: Haughmond Abbey, led by David Pannett. To look at the shaping of the landscape and the building stones. Afternoon meeting joint with Shropshire Archaeological Society. Book to reserve a place and obtain joining instructions from David Pannett; email: jessicapannett@hotmail.co.uk telephone: 01743 850 773

Anyone wishing to attend should telephone or email the co-ordinator for the meeting you wish to attend. A nominal charge is levied for attendance by non-members. Further info at: www.shropshiregeology.org.uk/

Manchester Geological Association

Saturday 14 June: Macclesfield Building Stones, led by Jane Michael, 10.00 - 13.00. This is a half-day walk round Macclesfield based on the Cheshire East leaflet 'A Geological trail round Macclesfield'. The walk is approximately 3km (2 miles).

For further information about outdoor meetings go to: <http://www.mangeolassoc.org.uk/> or please contact Jane Michael by email: outdoors@mangeolassoc.org.uk Visitors are always welcome.

Mid Wales Geology Club

Sunday 29 June: Abberley Hills. Geological Walk. Leader from Herefordshire & Worcestershire Earth Heritage Trust.

Further information: Tony Thorp (Ed. newsletter & Hon. Sec): Tel. 01686 624820 and 622517 jathorp@uku.co.uk Web site: <http://midwalesgeology.org.uk>

Warwickshire Geological Conservation Group

Saturday 14 June: Aust Cliff and Portishead, led by Jon Radley. Meet at 11.00 at the Boars Head, Aust, BS35 4AX.

Wednesday 16 July: Stoney Cove & Sapcote Church. Meet for a prompt start at 7.00 pm at Stoney Cove Diving Centre LE9 4DW. Leaders: Brian Ellis and John Crossling. South Leicestershire diorites, Triassic Sediments & paleo-features plus varied building stones in Sapcote churches.

For more details visit: <http://www.wgcg.co.uk/> or contact Ian Fenwick swift@ianfenwick.f2s.com or 01926-512531. There is a charge of £2.00 for non-members.

East Midlands Geological Society

Wednesday 18 June, 6.30: Evening walk around the National Stone Centre. Leader: Albert Benghiat.

Sunday 6 July, 10.30: Day trip to the Bonsall Area. Leader: Colin Bagshaw.

Wednesday 16 July, 2.00: Afternoon trip to Dorket Head brickworks and quarry. Leader: Keith Ambrose.

Any non-members attending field excursions will have to pay a temporary membership fee of £2.00 and should register with the secretary, Mrs Janet Slatter. email: secretary@emgs.org.uk
For more details visit: www.emgs.org.uk

GeoFest 2014

Through the summer months the Abberley and Malvern Hills Geopark partners (which include the Herefordshire and Worcestershire Earth Heritage Trust) are running a variety of geology related events. Below is a selected brief summary of 'GeoFest' events. For full details of these and lots more events view the calendar or download a GeoFest 2014 programme at: <http://geopark.org.uk/>

Booking required for all events. Unless otherwise stated: 01905 855184 or eh@worc.ac.uk

Geofest Guided 'Geology and Landscape' or 'Building Stones' walks:

Sunday 18 June: 'Chase End Hill', Southern Malvern Hills, 10.00 - 1.00. Booking: email richard@renewton.plus.com tel: 01684 565626 or beth@glosgeotrust.org.uk tel: 01452 864438

Thursday 19 June: 'Building stones of Bromyard', 10.30 - 1.00. Book: www.walkingfestival.com

Saturday 21 June: 'Raggedstone Hill', Southern Malvern Hills, 10.00 - 1.00.

Sunday 29 June: 'Building Stones & History', Priory Gatehouse, Malvern, 10.00 - 12.00.

Saturday 5 July: 'Circumnavigate the Malvern Hills GeoCentre', Upper Colwall, 10.00 - 1.00.

Saturday 5 July: 'Wribbenhall by train to Arley', 10.30 - 5.00. Meet at Bewdley train station.

Thursday 10 July: 'Walk along Geopark Way', 10.30 - 4.30. Meet at Hampton Loade car park.

Booking: 01938 820764 / andrew@scenesetters.co.uk

Sunday 20 July: 'Bromyard Downs and Bringsty Common', 10.00 - 3.30.

Saturday 9 August: 'Martley Geo Walks', 10.00 - 1.00 & 2.00 - 6.00. Meet at Crown Pub car park.

Booking: 02033 717647 / martleypfo@gmail.com

Sunday 24 August: 'The Severn Valley', 10.00 - 1.00. Meet at the Danery Inn, near Bridgnorth.

Booking: 01938 820764 / andrew@scenesetters.co.uk

Geofest Exhibitions at Bewdley Museum:

17 May - 22 June: 'From the Mountains to the Sea'. Work by textile artist Georgina Jacobs based on geological locations in the British Isles.

28 June - 3 August: Exhibition 'Ruskin Yesterday and Today - Drawing on Nature'.

Other Geofest Events:

Wednesday 30 July: Family Event - 'Fun with Fossils', 10.00 - 12.00 and 1.30 - 3.30. Severn Valley Country Park, Visitor Centre. Booking: 01746 781192.

Thursday 12 June: Illustrated Talk - 'Minerals of the Malvern Hills', 7.30 - 8.30 at the Malvern Hills GeoCentre, Walwyn Road, Upper Colwall. Speaker: Adrian Wyatt.

Saturday 9 August: 'Hands-on Rocks and Minerals', an 'Ask the Experts' Session, 2.00 - 4.00 at the Malvern Hills GeoCentre, Walwyn Road, Upper Colwall.

Saturday 16 August: 'Hands-On Illustrated Talk - Fossil Collecting', 2.00 - 4.00 at the Malvern Hills GeoCentre, Walwyn Road, Upper Colwall. Speaker: Dr. Mark O'Dell and colleagues.

The Old Red Sandstone: is it Old, is it Red, and is it all Sandstone?

Symposium: Thursday 2 - Saturday 4 October, Brecon

Venue: The Elim Church conference Centre, Canal Road, Brecon, Powys.

A three day symposium to stimulate interest in this facies and explore the latest research, comprising a day of lectures, a day of field excursions and a public open-day of interest to palaeontologists, stratigraphers, sedimentologists and structural geologists.

Thursday 2 October: Day of lectures 10.00 - 17.00, Conference Dinner

Friday 3 October: Field meetings to local sites

Saturday 4 October: 'Geofest' public open day

The day of lectures will cover many aspects of Old Red Sandstone geology. There are already a number of confirmed speakers including some from Australia and France. It is hoped that it will be possible to publish the proceedings of the symposium in due course.

Two field excursions by coach will be on offer to areas around Brecon to look at various aspects of Old Red Sandstone geology.

The public open day on the Saturday is aimed at being a festival of geology, bringing geology to the attention of all. Local geological groups and other organisations will be putting on displays, public talks, hands-on activities and building stone walks around the town.

To express an interest in attending the meeting and to put your name on the mailing list please contact Dr John Davies, Fforest Fawr Geopark, Brecon or email sion_cwm_hir@hotmail.com

What Lies beneath our feet - Photographic contest 2014

The West Midlands Regional Group of the Geological Society and the Black Country Geological Society are hosting a geological Photo Contest under the theme 'What Lies Beneath Your Feet' which is open to individual interpretation.

All entries will be displayed at an exhibition at Dudley Museum & Art Gallery. The top 3 entries will be chosen by an independent judging panel.

First prize: £200 Second prize: £100 Third prize: £50

Deadline 31 August 2014

The contest is open to all with postcodes starting B, CV, DY, HR, ST, SY, TF, WR, WS and WV.

This is a reminder - for full details see Newsletter 223, February 2014 pp 8 & 9.

Field Meeting Reports

Saturday 12 April: Barrow Hill and Barr Beacon. Led by Andrew Harrison, BCGS Field Secretary.

This was a joint event with the Warwickshire Geological Conservation Group (WGCG), who came by coach and were met on Vicarage Lane, next to the Barrow Hill Nature Reserve at 10.30. The weather was fine and clear if a little windy. During our visit we took in East Quarry and the view over the Tansey Green Clay Pit, before going on to Barr Beacon and Pinfold Lane Quarry after lunch. Together these sites provide an interesting insight into the geological history of the Black Country between the end of the Carboniferous and the Triassic.

From the Barrow Hill summit, at 150m above sea level we had a clear view of the nature reserve and the surrounding landscape. Comprising low lying ground and numerous bumps, the surrounding landscape is a product of the underlying mixture of Palaeozoic geology including:

- **South** (beyond Russells Hall Hospital): Netherpton, the Clent and Wychbury Hills (Permo-Carboniferous Clent Breccia); the Malvern Hills (Precambrian granites / volcanics and Silurian Wenlock Limestone); Abberley Hill (Silurian Wenlock Limestone).
- **West:** the Clee Hills (Devonian Old Red Sandstone and Carboniferous Coal Measures).
- **North:** the Long Mynd and the Wrekin (Precambrian / Cambrian volcanics); Cooper's Bank, Baggeridge, Sedgeley and Dudley (Carboniferous Lower and Middle Coal Measures).
- **East:** the Rowley Hills (Carboniferous Dolerite).

Barrow Hill itself consists of a body of dolerite that was intruded into the surrounding local strata, the Etruria Marl (Upper Coal Measures), approximately 300Ma. Dark grey crystalline dolerite exposures and rubble are seen in the East Quarry along with columnar jointing, mixing with the Etruria Marl, calcite veining resulting from hydrothermal mineralisation, and gas bubbles.

Erroneously known as 'Dudley's Volcano' the rock strata of Barrow Hill represent a vertical vent on the flanks of a volcano that has long since been eroded away. This dolerite intrusion is one of several such intrusions that occurred between 315Ma and 300Ma, including the Rowley Hills, Pouk Hill and numerous smaller intrusions. The volcano's outpourings of ash are seen at the Tansey Green Clay Pit. Here, beside the spoils left behind from coal mining, a dark grey layer of ash is seen strongly contrasting against the red brown Etruria Marl.

The remains of in-situ silicified conifers have been discovered towards the base of this ash layer. These represent an ancient forest growing on the flanks of the volcano that was smothered during an eruption of ash. The conifers were exposed during former quarry activities, but buried again to preserve them. Examples of these trees can be seen in the Dudley Museum and Art Gallery.

Generally the Etruria Marl is described as comprising purple and red brown marl with green grits, and conglomerates representing alluvial deposits laid down under relatively low energy conditions. The Marl was quarried from Tansey Green Clay Pit until the end of the 1990s and was used for making house bricks.

After Barrow Hill we made our way across the Black Country to Barr Beacon where we paused for lunch. Afterwards our exploration of Black Country Geology continued from the summit of Barr Beacon, a north south trending ridge located between Walsall in the west, and Streetly to the east. The Barr Beacon Ridge represents the highest topographical feature on the eastern side of the Black Country, reaching a height of 225m above sea level. Second in height only to Turner's Hill at Rowley Regis, the Ridge provides excellent views over Birmingham and the Black Country. ►



Pinfold Lane Quarry, Barr Beacon

Like Barrow Hill, the Barr Beacon Ridge and surrounding landscape are a result of the different underlying geological strata. Dominant low lying ground to the west of the Ridge, towards Walsall, is underlain by red clays and mudstones belonging to the Late Carboniferous Enville Formation. Further to the west the Enville Formation gives way to Bunter Sandstone and Silurian Limestone.

The geology of the Barr Beacon Ridge itself is best seen in Pinfold Lane Quarry in the Barr Beacon Nature Reserve. A muddy path through thick tree cover from Beacon Road hides the spectacle of the Ridge, which is revealed upon entering the quarry. The eastern quarry wall shows extensive exposures of red and yellow bedded sandstone, capped with a thick bed of gravels and cobbles with occasional red sandstone bands.

The lower sandstone unit represents the Hopwas Breccia, the lowest stratum of the Permo-Triassic Sherwood Sandstone Group, formerly known as the Lower Mottled Sandstone. This also includes the Bridgnorth Sandstone. Closer inspection reveals cross bedding, thin layers of sub-angular clasts, or breccia (quartzite and chert), and fine red brown laminated mudstone. It is believed that the Breccia was deposited within shallow water conditions or temporary lakes on an arid terrestrial landscape. Stratigraphically the Hopwas Breccia sits unconformably over the Enville Formation.



The Hopwas Breccia

Unconformably overlying the Hopwas Breccia is the Kidderminster Conglomerate, formerly known as the Bunter Pebble Beds, and this provides the protective cap forming the Barr Beacon Ridge. The thick beds of conglomerate comprise well rounded, hard, pink-grey quartzite pebbles and layers of impersistent red brown sandstone. The pebbles are often scarred with whitish spots or pitting known as solution spots, which result from the close compaction of the pebbles at depth.

The Kidderminster Conglomerate represents desert fans and valley infill deposits associated with a torrential river, which, given the size of the pebbles, probably flowed at approximately 4 metres per second. Towards

the east the Ridge dips eastwards and the Kidderminster Conglomerate gives way to the Bromsgrove Sandstone and various glacial deposits, forming a low lying landscape where the border of Birmingham meets Warwickshire.

During the Carboniferous a landmass known as the Wales-Brabant Massif dominated much of Wales, the Irish Sea, Central England and East Anglia. The island comprised St Georges Land (Wales / Irish Sea) in the west and the Midland Barrier, or Mercian Highlands, (Central England and East Anglia) in the east.

To the north lay a shallow tropical marine basin known as the Pennine Basin, beyond which lay the continent of Laurentia. The Pennine Basin stretched eastwards across Europe to Russia and opened to the southwest into the Rheic Ocean. Shallow tropical deltas separated the southern shore of the Wales-Brabant Massif from the Hercynian continent further south. The growth of the proto-Pacific Ocean (Panthalassa) during the Devonian and Early Carboniferous caused the closure of the Rheic Ocean during Late Carboniferous times.

During the late Carboniferous the Black Country lay on the northern shores of the Wales-Brabant Massif with rivers draining the Mercian Highlands to the south into subsiding marginal basins to the north. The basins comprised shallow tropical deltas and forested swamps edging the shoreline, into which sand, clay, vegetation and limestone was deposited. Over time these became the Lower and Middle Coal Measures. Towards the end of the Carboniferous, compressional tectonic forces resulting from the closing Rheic Ocean, led to uplifting of the previously subsiding marginal basins. The earlier swamps and deltas were replaced with periodic waterlogged alluvial plains, which eventually became a well drained flood plain where the Etruria Marl was deposited.

Associated with these tectonic forces were episodes of repeated mountain building, erosion, rifting and volcanic activity. Consequently the existing Coal Measures strata were intruded with bodies of magma that gave rise to such volcanic features as Barrow Hill and Rowley Regis. ►

The final closure of the Rheic Ocean caused further uplift north of the Wales-Brabant Massif through the Permian and Triassic. This resulted in an arid landscape with rivers draining northwards off the eroding Mercian Highlands to the south. Over this landscape a variety of geological processes, (including cliff erosion, and fluvial and lacustrine deposition), acted to produce such strata as the Hopwas Breccia and Enville Formation, between approximately 248Ma to 241Ma.

During the Triassic a large network of rivers drained northwards into a vast low lying desert plain with deltaic lakes covering Cheshire and the north Midlands. The Budleighensis River dominated the Midlands. It flowed northwards from Northern France bringing with it material that was deposited as delta fans, recognised today as the Kidderminster Conglomerate. With time these deposits were covered over and buried with later Mesozoic and Tertiary strata. Later tectonic forces and erosion have acted to uncover and sculpt the landscape into that seen today as the hills and low lands of the Midlands Region.

We finished the visit around 16.00 and the WGCG members boarded their bus to return to the later Triassic and Jurassic lands of Warwickshire. I would like to thank the WGCG for their attendance and, as a conservation group themselves, for their ideas about further works that could be undertaken at the Barrow Hill and Barr Beacon sites.

Andy Harrison

Saturday 10 May: Visit to the Oxford University Museum of Natural History. Led by Professor Paul Smith, Museum Director.

The idea for this field visit was first conceived in 2012. However, repairs to the leaking museum roof prevented the visit from happening until these works were complete. Members may remember Paul giving the Society a talk in April 2013 on 'Sirius Passet and the Cambrian Explosion'. Previously Director of the Lapworth Museum and head of the School of Geography, Earth & Environmental Sciences at Birmingham University, Paul took up the post of Director at the Oxford University Museum (OUM) in 2012.

The day started warm and sunny when we met on the front lawn of the Museum. At 10.00 we assembled in Paul's office for tea and coffee and an introduction to the Museum from Paul.

The Museum came about from the foresight and determination of one man, Henry Acland (Reader in Anatomy at Christ Church College in 1845). Acland believed that every educated man should learn something of the sciences and campaigned for a new museum to house research and teaching facilities, whilst bringing together collections that were dispersed across the University. Four acres at the south end of University Parks were initially purchased from Merton College in December 1853, with an additional four acres coming a year later.

The Museum opened in 1860 on the back of the advances made in science and medicine during the 1850s and has remained a centre for learning and teaching. During the 19th Century Oxford was very much a city of clerics and so the Museum was designed to be a 'Cathedral of Science'. Now a Grade 1 listed building the Museum's design is based on Victorian neo-Gothic architecture undertaken by the Pre-Raphaelites, from the influential ideas of leading Oxford art critic John Ruskin. Irish architects [Thomas Newenham Deane](#) and [Benjamin Woodward](#) designed the building, which is built of oolitic limestone from Headington Quarry. The first Keeper of the Museum was John Phillips, the nephew of William Smith, the recognised 'Father of Geology'.



Oxford University Museum of Natural History

A vast Central Court dominates the main public area of the Museum with a two storey colonnaded walkway around the perimeter containing thirty columns. Each column is made of a different building stone, such as granite, limestone, peridotite and serpentinite from all over the country and capped with a decorative corbel. Twenty eight statues and busts around the Central Court, including Darwin, ►

Linnaeus, Newton, Galileo, Priestley, Bacon, Davy and Aristotle, pay homage to the worlds of science, engineering and philosophy. Overhead the newly restored iron and glass roof covers the Central Court allowing light to flood in and the temperature to rise somewhat. These materials had been commonly used for greenhouses and galleries since the mid-1840's, however the first version of the roof was unable to support its own weight and had to be dismantled before completion. Cast iron columns support the roof, which are decorated with wrought iron spandrels representing the branches of sycamore, walnut and palm. Early gas light fittings have been kept and fitted with more modern LED lighting to improve the Museum's lighting.

Museum Collections



Megalosaurus jaws

The Museum is dedicated to zoology and geology, mostly palaeontology, with specimens on display throughout the Central Court and colonnaded walkways. The Central Court is inundated with cases and information, the skeletons and replicas of mammals, birds and Dinosaurs, including (from Oxfordshire): *Eustreptospondylus oxoniensis*, *Camptosaurus prestwichii*, *Megalosaurus bucklandii*, and *Cetiosaurus oxoniensis* and (from further afield): *Edmontosaurus annectens*, *Triceratops horridus*, *Struthiomimus sedens*, *Pachycephalosaurus Wyomingensis*, *Bambiraptor feinbergum*, *Utahraptor ostrommaysorum*, *Iguanodon bernissartensis* and *Tyrannosaurus rex*.

Other displays include the Oxford Dodo, which along with numerous other exhibits influenced the writings of one Charles Lutwidge Dodgson, better known as Lewis Carroll, who spent much time at the Museum. Other notable names on display include Professor William Buckland - founder of scientific teaching in Oxford, creator of the Museum's core geological collection and the first person to describe scientifically a dinosaur, the *Megalosaurus*. Robert Plot, Professor of Chemistry and first keeper of the Ashmolean Museum is known for writing the *Natural History of Oxfordshire* (1677) and *Staffordshire* (1686). It was Plot who first recognised fossil bones for what they were from the femur of a *Megalosaurus*, discovered at Cornwell Quarry near Chipping Norton in 1676. Plot's assistant Edward Lhwyd, who later succeeded him as keeper of the Ashmolean is also on display as the first person to document the Museum's collections in 1699.

Beneath the colonnaded walkways, cabinets provide a public insight into the worlds of insects, biodiversity, minerals and meteorites and the geology of Oxfordshire.

The Geology Of Oxfordshire

Oxfordshire geology comprises a northwest to southeast progression through the Mesozoic and into the Cainozoic. The county's oldest rocks, of Triassic age, are found within the northwest. Towards the south and east the rocks become progressively younger passing through Jurassic strata: (the Lias, Inferior Oolite, Cornbrash and Great Oolite, Oxford Clay, Corallian, Kimmeridge Clay, Portland and Purbeck Beds); Cretaceous strata: (Whitchurch Sands, Lower Greensand, Gault and Upper Greensand and Chalk); before finally progressing into Lower Tertiary strata.

The strata strike northeast to southwest across the county and dip towards the southeast, with Oxford itself sitting on the Oxford Clay. They represent relatively warm climate and fluctuating sea levels that teemed with life as can be seen from the abundant marine and terrestrial fossil fauna assemblages entombed within.

Our Museum Tour

For our visit to the Museum Paul treated us to a look behind the scenes at the research and collections that the public do not get to see. Before commencing our adventure through darkened corridors, private doorways and up and down numerous stairwells, we visited the Wytham Room, which is also open to the public. Inside is a display devoted to Wytham Woods, a SSSI given to the University in 1943 and the site of many classic ecological studies. ►

Next we walked through the Entomology research laboratories and up the tower that dominates the front of the Museum where various insect collections of Frederick William Hope and Charles Darwin are housed. The top of the tower leads to the Huxley Room, originally the Science Library, which today is used for storage and has a false floor splitting it into two levels. It was here on 30 June 1860 that the 'Great Debate' between Thomas Henry Huxley and Samuel Wilberforce took place over Darwin's latest book 'On the Origin of Species' and the Theory of Evolution.

We continued our tour with a look at specimens of crustacea collected by Darwin during his voyage on the Beagle and the oldest natural history collection in the world, which belonged to John Tradescant. This collection includes the mummified head and foot of a Dodo representing the most complete remains of these birds, and of great importance to science. Some of the collection was originally housed at the Ashmolean Museum before coming to the OUM. Before lunch we were given a brief tour of the invertebrate and vertebrate stores where jar upon jar of preserved mammals, reptiles, birds and marine life are stored and researched.

After lunch in the new Museum cafe we reconvened our tour in the Central Court. Our next stop was an archive of fossils where Paul showed us samples from the Stonesfield Slate. Ideal as a construction material, the Stonesfield Slate is mid-Jurassic in age and a type of oolitic limestone, in which many fossil remains have been discovered, including the first Megalosaurus bones that were interpreted by Plot and Buckland. Other animals include flying reptiles and early mammals.

Next we went to the Museum archive, which holds correspondence, papers, maps and photographs relating to the development of natural history as a science. Here we saw the Jones' 'Icones' of butterflies and a life mask of Louis Agassiz. We also saw the first geological maps and sections drawn by William Smith in 1815 and drawings / paintings of fossils, discovered by Mary Anning, undertaken by William Buckland. Our final stop was to the Mesozoic vertebrate stores where the first dinosaurs and marine reptile bones to be discovered by the likes of Mary Anning, Buckland and Conybeare are stored.



William Smith's Map

Back in the Central Court, Paul ended the tour at around 16.00 and told us that we had only visited around a third of the storerooms and archives that the Museum holds. However, smaller groups of members have been invited back to explore through the remaining specimens the Museum has to offer including the minerals collection.

I would like to thank Paul for an extremely interesting, enjoyable visit and for me a trip down memory lane. I also look forward to taking Paul up on his offer of further visits in the future. ■

Andy Harrison

The Black Country Geopark Project - Progress Report

There has been considerable progress with the Black Country's bid to become a Global Geopark since we published Graham Worton's report in Newsletter 220, August 2013. The following is a summary of Graham's recent up-date for the Geopark partners. This is followed by an extract from last August's executive briefing note highlighting features which illustrate the wealth of our geological and cultural heritage. Ed.

Background

An initial statement and an overview outlining the Black Country's case to become a global geopark was sent to the UK Global Geoparks Forum (UKGGF) in late 2013 for initial comment. This was received well and identified some areas for the Black Country to work on prior to a formal submission in the window of opportunity between 1 October and 1 December this year. ►

These included: embedded branding, a formal marketing and communications plan, website, management structure clarification, evidence of financial stability, examples of projects and further information on planned actions and geosites and essentially demonstrating that we are already functioning well in most of the areas that a geopark will ultimately operate in.

In response to this we have focussed on a number of key elements since January 2014.

Work following the initial comments from UKGGF in late 2013

In January 2014 a small project team (comprising Graham Worton, Clare Marshall, Nicola Havers and Vikki Marshall - all from Dudley MBC acting as the lead authority on this initiative) was established to begin formalising the application and preparing the marketing and communications elements of the project.

Developing a Black Country Geopark Brand

Working with partners including other geoparks teams, the members of the Birmingham and Black Country Geodiversity Partnership, Marketing Birmingham etc., key messages were established and a brand was developed that was based on those discussions.



The proposed logo features Black Coal and a Red Heart (coal being the mineral shared by all boroughs and directly linking to the industrial and cultural heritage of the area, and the heart representing being in the centre of England and the warmth of the Black Country folk).

A Black Country Geopark Project Website

One of the key issues raised has been about effective communication. The UKGGF were keen to see our web presence so that they could see how we are progressing and get a flavour of how the Black Country will present itself to the rest of the global community. We realised from research and discussions with other geoparks that this should be an image rich, simple navigation style. We wanted the images to be very high quality and such that they help everyone to see the Black Country in a new and curious light, challenging stereotypes and long-held perceptions about this place.

Dudley established a small budget and extended the team to involve ICT and web expertise from both Dudley and the Black Country Consortium. A first suite of new and quite different images of some aspects of the area were obtained using a professional photographer and a website was designed and published to the web. This progressed from learning based on what we felt were best features of other tourism and geopark websites in order to show the Black Country at its best. A Black Country Geopark powerpoint presentation has been put together and rehearsed and is ready to use wherever any of the partners or stakeholders groups or wider interested parties would like to hear about us.

(The Black Country Geopark project website is at: <http://www.blackcountrygeopark.org.uk/> Ed.)

Presentation in Shetland 1- 3 May 2014

In February 2014, the UKGGF invited us to Shetland to present our case and demonstrate our progress on our bid to the full UKGGF teams, representatives of national conservation agencies, UNESCO and others. ►

On 1 May Graham Worton travelled to Shetland to present the case for a Black Country Geopark to the UKGGF. Their support is needed in writing to allow us to go forward to full application via UNESCO and was essential to demonstrate our readiness. It was a meeting held in two separate sessions, one closed to existing geoparks the other a full open session with prospective geoparks and scrutineers. There were informal questions by other teams throughout the days and evenings of the gathering.

The Decision - and Next Steps

Our preparation and teamwork in the build up to this meeting definitely paid off. The presentation was slick and finished exactly on time. After a short meeting with the UKGGF Chair and Vice Chair and UNESCO representative, they told us that the Black Country was in their opinion strong enough to go forward with a full application.

The next step requires all the other geoparks in the UK to see a copy of our draft final bid so that they can pass comment and write a formal letter of support from the UKGGF. They will then pass this forward to the UK office of UNESCO who will then, in turn, check it and add their own letter of support, then pass it forward to the Global Network. They would want to see a draft of our application in 8 weeks so they have time to do this before the window of opportunity for 2014.

Once we have submitted the final application dossier in the autumn things will go quiet while the global network assesses it. If they are satisfied that on paper it meets the criteria they will then want to visit the Black Country to ensure that things are as we say they are on the ground. This will be in May-June 2015. It will be our responsibility to pay for this scrutiny visit and look after the visitors while they are here. After that, if they are happy, they will invite us to present the Black Country Global Geopark project to the full assembly in Rokua Geopark, Finland in September 2015, and hopefully we will then become a global geopark and global heritage destination. ■

Graham Worton, 20 May 2014

Illustrative points showing the quality and diversity of our Geology & Cultural Heritage

(from a Geopark Proposal - executive briefing note, August 2013)

- Geological sites which cover **6 major geological time periods**, and **440 million years of Earth History**
- Wrens Nest established as **Britain's first National Nature Reserve for solid geology in 1956**
- Two extensive **geological lagerstätte** - The Silurian Limestone Fossils and the Coseley plant and arthropod fossils
- **Hundreds of scientific and popular publications including monographs and treatise**
- **Abraham Darby**, often referred to as the 'father of the Industrial Revolution', **was born on what is now Wren's Nest National Nature Reserve, Dudley in 1678**
- Direct influences on the history of the science of geology through works of many famous geoscientists including **Sir Roderick Murchison** who founded the Silurian System in 1839 (65% of his fossil evidence coming from the limestones of Dudley)
- **Tansey Green Clay pit** - site of the **Dudley Volcano** and the **world's oldest known anatomically preserved conifers**
- The Newcomen 'Atmospheric' Engine, **the world's first successful commercial steam engine**, was erected in the Black Country in the early 1700's
- **Charles Lapworth** (founder of the Ordovician System) associations with Dudley Museum Geological galleries
- **John Johnson Shaw** inventor of the modern seismograph in West Bromwich ►

- **Castle Hill** - the world's oldest stratigraphic geological map, Metallum Martis, 1665
- **Coal Mining Heritage Features** - Cobbs Engine House, Warrens Hall Park on the Sandwell/Dudley border
- **Canal Heritage** across much of the Black Country including tunnels and trips into limestone mines
- **Industrial Heritage Museums:** Black Country Museum, Dudley; Red House Glass Cone, Dudley; Leather Museum, Walsall; Lock Museum, Willenhall; Galton Valley Visitor Centre, Sandwell
- **Beautiful Geoart** in many parts of the Black Country
- **Evidence of many earlier civilisations and nomadic hunters of the ice ages** (e.g. 400,000 year old hand axe found at Wollescote near Stourbridge) ■

Graham Worton, August 2013

Yellowstone's Helium

Yellowstone National park sits on a volcanic hotspot and is famous for its geysers and hot springs, produced by water and a mixture of gases being heated by the magma and forced to the surface. Amongst the mixture of gases is helium, which occurs in two isotopic forms: helium-4 (two protons and two neutrons in its nucleus) and helium-3 (two protons and one neutron). Most helium-4 originates in the earth's crust from the radioactive decay of crust minerals containing uranium and/or thorium. When their nuclei undergo spontaneous radioactive decay they emit energetic (high speed) alpha particles, each of which comprise two protons and two neutrons and carry a charge of +2. On losing energy (slowing down) each alpha particle acquires two electrons from its environment and becomes a (neutral) helium-4 atom. The isotopes of helium do not exhibit radioactivity.

Terrestrially, helium is very rare with an atmospheric content of about 0.00052% by volume and most of that comprises the '4' isotope. Helium-3 is very scarce indeed (about 10000 times less abundant than helium-4), and has been found to come from deep within the earth from where it is forced to the surface by ancient volcanic activity. Some helium-3 is produced by nuclear reactions, but the majority appears to be primordial and probably originated in the 'big bang'.



*Grand Canyon of Yellowstone,
photo by Scott Catron,
Wikimedia Commons*

It has been estimated that around 60 tons of helium are released per year from the Park which is approximately 36000 cubic metres of the pure gas under room temperature and pressure conditions. Researchers have discovered that the proportion of helium-4 compared with the '3' isotope was very much higher than expected. Also, helium-4 is being released and subsequently lost to outer space, at a rate that is several orders of magnitude faster than is generated in the crust by alpha emissions. The conclusion is that the gas could have been accumulating underground in rocks, for possibly 2.5 billion years. Volcanic activity in the Park region began about two million years ago and helium has been venting all this time but has only recently been noticed.

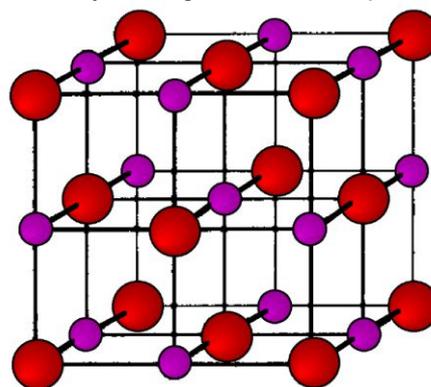
In spite of the rarity of helium it is very doubtful that it will be harvested. The gas is released over a huge area, so concentration and collection would not be easy, making it commercially uneconomic. The area is also a protected one and permission is most unlikely to be granted. ■

Pete Stamper

Geobabble

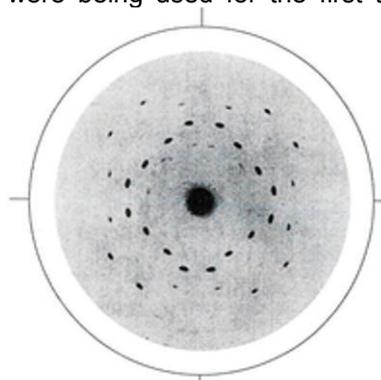
It is interesting to speculate as to the topics that most interest BCGS members, and that information might influence the aspects of geology that appear in Geobabble. Fossils must feature at, or near the top of the list as we are in one of the most famous localities in the world; and then there are the heavyweight subjects that interest nearly everyone: volcanoes, earthquakes and plate tectonics. However, put your hand up if you are fascinated by x-ray crystallography, or indeed any form of crystallography; not many I would assume. So it might be a bit risky writing about this topic for Geobabble.

We would all recognise the 'ball and rod' model of the Mineral Halite, or salt, with the Sodium ions bonded to Chlorine ions in a cubic configuration. If you show this diagram to students alongside a cubic crystal of the mineral, you can very easily relate the two, but how do you know this is the atomic structure? Can you see it under a microscope? This is where x-ray crystallography comes in.



Halite

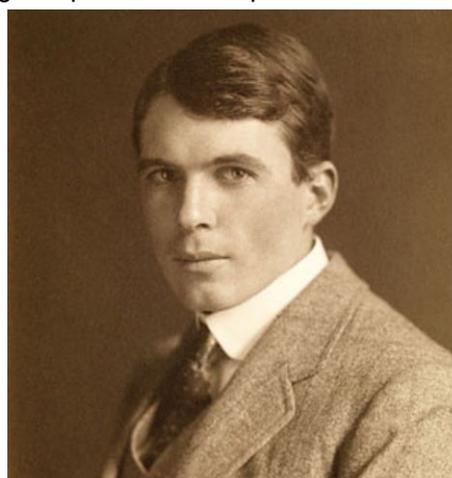
Advances in physical science are constantly being developed and used, particularly in medicine. One of the most recent examples is the use of CT scanning, so vital in modern medical diagnosis. However, the other sciences quickly pick up the techniques and try them in their own areas. CT scans are now common in many areas of geology, mostly palaeontology, and we are all familiar with the rotating, 3D images of fossils. In 1912 X-rays were being used for the first time in medicine, as the rays had a very useful property of passing through human tissue, but not bone, and you can take a picture.



Max Laue 1912

But what if you x-rayed a crystal? Max von Laue fired a single x-ray at a salt crystal in 1912 and came up with a mysterious circular pattern of dots, as illustrated. This diffraction pattern posed a complex puzzle as the science world struggled to interpret it, but this was finally achieved by William Lawrence Bragg in 1913. He saw that the dots were the reflections from atoms that were arranged in layers. Each layer reflected the x-ray, but also allowed the rays to go through to be reflected by the layer below, but the reflected rays may interfere with each other giving complex diffraction patterns.

I have, like many of you I am sure, a mental list of 'geological heroes', and I am going to add to it Lawrence Bragg. When he realised that x-rays could be used to see the arrangement of atoms inside crystals, (he was only 22 years old) he created the new science of x-ray crystallography. He was helped by his father W.H. Bragg, Professor of Physics at Leeds University, who in 1913 designed and made the x-ray spectrometer which could be used to investigate many different crystals. As Lawrence was only a research student, many thought that W.H. was mainly instrumental in discovering x-ray crystallography. This upset Lawrence and made for a difficult relationship between father and son at times.



Lawrence Bragg

In 1915 they shared a Nobel Prize, the only father and son ever to receive the award. Lawrence was only 25, the youngest winner of that award, and heard the news while serving in the trenches. Although x-ray crystallography is essential for geologists and mineralogists, there have been far more vital investigations in other areas of science, and there have been twenty nine Nobel Prizes related to this technique. It is fitting that before Lawrence Bragg died in 1971 he saw x-ray diffraction used to discover the structure of DNA. ■

Bill Groves

Members' Forum

White Island, New Zealand

Earlier this year I had a wonderful trip to New Zealand. Over the 39 days of the trip there were only a very few with rain so sightseeing was mainly done against a blue sky.

One of the highlights was a boat trip to White Island, NZ's most active marine volcano, 30 miles off the coast in the Bay of Plenty at the northern end of the Taupo-Rotorua volcanic fault line. The collapse of the SE crater wall in 1914 produced a debris avalanche that buried buildings and all of the miners extracting sulphur. This



brought that operation to an end but allows good access to the crater. The boat trip was exciting, a very fast, hard ride against the waves, scale 2 on the wave height scale - only 2?! - seemed more, passing a pod of 5 false killer whales on the way.

Gases dissolved in the magma escape and rise towards the surface where they heat and mix with the ground water beneath the crater floor. This produces fumaroles and the white steam and gas usually seen above the island. Our hard hats protected us against falling debris and our gas masks reduced breathing problems, but we could have done with goggles against the acidic cloud from these fumaroles.



Smaller fumaroles come surrounded by bright yellow and white crystal deposits that re-form in new and bizarre shapes each day. White Island is a desolate, other-worldly landscape; a dangerous place with little lakes of acid mud, hot streams and whiffs of toxic fumes but what an exciting place to visit. Do it if you get the chance! (See also the photo on the front page.) ■

Barbara Richards

See also Newsletter 218, April 2013 p.12 for an item on White Island by Alan Clewlow, and Newsletter 221, October 2013 for John Schroder's 'Geology in Motion' 2nd prize photo of the White Island crater.

Please send material for the next Newsletter to:

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