Newsletter No. 237

June 2016

The Black Country Geological Society

Copy date for the next Newsletter is Monday 1 August

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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: bcgs.info		

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 from January 2016.

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.

Saturday 11 June *(Field meeting):* Oxford University Museum of Natural History, led by Prof. Paul Smith (Director). Meet at the Museum for 10.00. Look at mineralogy, fossil and living vertebrates and archives. Bring packed lunch or use museum cafe. Look at the two temporary exhibitions. Maximum number of places is 30. Please contact field secretary to confirm attendance.

Saturday 16 July *(Field meeting):* Burton Dassett Hills and Cross Hands Quarry, led by John Crossling (joint trip with the Warwickshire Geological Conservation Group). Meet at 10.00, Beacon Car Park, Burton Dasset Hills: SP 394 522. View Jurassic Marlstone Rock Bed, Inferior/Great Oolite, Lias Shales. At 12.00, travel to Cross Hands Quarry (SE of Moreton in the Marsh): SP 270 289. Lunch at 'Greedy Goose' pub (junction of A44/A436, near the quarry), or bring a packed lunch. Cross Hands Quarry is notable for the echinoids (Clypeus) - the 'Chedworth Buns' of William Smith's upbringing. Potential for fossil hunting. Finish approx. 16.00.

Saturday 20 August *(Field meeting):* Wren's Nest, led by Graham Worton. Meet at 10.00 by parking on the Harty Building of the old Mons Hill college site which you get to along the access road that leads into the new development adjacent to the Caves Pub on Wrens Hill Road. We will aim to be finished at around 12.30. We will wander around the reserve to re-examine the classic localities and update the science that we now know about the rocks here. It will provide an opportunity to collect from a couple of locations and discuss what we find in different places and what the palaeontological evidence tells us about the conditions in which these rocks were formed and deposited.

Saturday 10 September *(Field meeting):* Brown Clee Hill, Shropshire, jointly with the Shropshire Geological Society. Details TBC.

Monday 19 September ***(Indoor meeting):*** **Rachel Cornah** will be speaking about her experience of working in metal mining around the world, mainly focussing on Australia. Details TBC.

Monday 17 October ***(Indoor meeting):*** **Update on the Black Country Global Geopark. Speaker: Graham Worton.**

Monday 14 November ***(Indoor meeting):*** **Optical Mineralogy. Speaker: Frank Wells.**

Monday 12 December ***(Indoor meeting):*** **Members' Evening.**

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 Code for Geological Field Work 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.

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 web sites.

Mid Wales Geology Club

Wednesday 15 June: 'Cyprus Geology: a snapshot'. Speaker: Dr. Chris Simpson.

Saturday 25 June: Llanelwedd working quarry, Builth Wells. Led by Hanson Quarry staff.

Wednesday 20 July, 6.30-8.30: Clywedog Dam nr Llanidloes: geological walk. Led by club members.

Further information: Tony Thorp (Ed. newsletter & Hon. Sec): Tel. 01686 624820 and 622517 tonydolfor@gmail.com Web site: http://midwalesgeology.org.uk Unless otherwise stated, meetings start at 7.15 (tea/coffee & biscuits) with talks at 7.30 at Plas Dolerw, Milford Road, Newtown.

Warwickshire Geological Conservation Group

Saturday 16 July: Burton Dassett Hills and Cross Hands Quarry. Led by John Crossling. A joint whole day trip with the Black Country Geological Society (details above).

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.

North Staffordshire Group of the Geologists' Association

Wednesday 15 June at 7.00: Walk Around Buxton (joint with EMGS). Led by Albert Benghiat.

Saturday 23 July, 10.30: Day Trip to Brassington Area (joint with EMGS). Led by Jim Riding (BGS).

Non-members pay £2 to cover temporary membership giving them insurance cover. A field fee of £2 per head is normally charged for members and non-members to cover the leader's expenses. For field trip enquiries: Steve Alcock, Longfields, Park Lane, Cheddleton, Leek, Staffs, ST13 7JS. Tel: 01538 360431 or 07711 501028. Email: steves261@aol.com Further info: www.esci.keele.ac.uk/nsgga/

Shropshire Geological Society

Saturday 11 June: Afternoon Rockhop: Nescliffe Hall - from desert dunes to country park. Led by David Pannett. To reserve a place and obtain joining instructions email: jessicapannett@hotmail.co.uk telephone: 01743 850773.

Wednesday 13 July: Evening Rockhop: Corndon and Hyssington ice age scars. Led by David Pannett. To reserve a place and obtain joining instructions: as for 11 June above.

Thursday 21 July: Day meeting: South East Shropshire Churches. Led by Mary Steer. To reserve a place and obtain joining instructions email: eric.steer1@btopenworld.com telephone: 01743 235047.

Some events have an attendance charge, indicated where known. An additional daily membership charge of £3 is levied for attendance by those who are not existing Members of the Shropshire Geological Society. The Rockhops are primarily intended for members who are beginners to geology. Further info at: www.shropshiregeology.org.uk/

Teme Valley Geological Society

Saturday 25 June 5.30/6.00: An evening with Worcester Male Voice choir in the unique quarry garden of Scar Cottage and a talk (with much tasting, all inclusive) on vineyards and climate change by Prof. RC Selley of Imperial College. Bring your own picnic. Cost £12.00.

Contact John Nicklin on 01886 888318. For more details visit: http://www.geo-village.eu/

Manchester Geological Association

Sunday 19 June: Upper Goyt to Shining Tor. Led by Paul Aplin.

Thursday 23 June: Penmaenmawr Dolerites. Led by Peter del Strother and Jennifer Rhodes.

Wednesday 20 July: Mam Tor. Led by Cathy Hollis.

Contact Penny Heyworth: email outdoors@mangeolassoc.org.uk For further information about meetings go to: http://www.mangeolassoc.org.uk/ Visitors are always welcome.

East Midlands Geological Society

Wednesday 15 June at 7.00: Buxton Springs Walk (joint with NSGGA). Town walk to inspect the natural springs around Buxton. About 4km, mostly on pavement and road. Led by Albert Benghiat.

Wednesday 29 June at 6.30: The Shepshed Area. This fieldtrip will examine a variety of rocks ranging over 600 million years from the Precambrian to the Quaternary. Led by Keith Ambrose.

Saturday 23 July at 10.30: The Brassington Area (joint with NSGGA). Day field trip to examine the Brassington Formation of Miocene age in the high peak of Derbyshire. Led by Jim Riding (BGS).

Non-members are welcome. Further info at: www.emgs.org.uk or email: secretary@emgs.org.uk

Geological Society, West Midlands Regional Group

Tuesday 14 June at 6.30: Contaminated Land Exposure Assessment Tool (CLEA). Speaker: Professor Paul Nathanail (The University of Nottingham). Venue: Atkins (The Axis) Birmingham.

Refreshments from 6.00. Meeting starts at 6.30. For further details and to register your interest in attending, please contact the Group Secretary at: geolsoc_wmrg@live.co.uk

GeoFest 2016

'GeoFest' is a three-month long celebration of the geology, landscape and associated heritage of the Abberley and Malvern Hills Geopark. Events are hosted and run by the members of the Geopark Forum. Through the months of June, July and August there will be guided walks, talks, children's activities, tours and exhibitions and 'Ask the Expert' sessions.

To view or download the full programme go to: http://geopark.org.uk/pub/category/geofest-2/ For more information email: amhg@outlook.com or phone: 07547 481440 or visit: www.Geopark.org.uk

Lapworth Museum of Geology reopens on Friday 10 June

The Lapworth Museum at the University of Birmingham has been closed since December 2014. Following a £2.7m redevelopment it now incorporates three exciting themed galleries, a dedicated education room, new collection stores and a range of facilities to enhance the visitor experience.

Editorial

The 'Members' Forum' section which regularly appears at the end of the Newsletter has inspired some interesting items recently. In the last issue, Paul Truelove sought an answer to a question about 'Birds, Diaphragms and Dinosaurs'. Sadly there has been no response to date. Surely one of our readers can throw some light on this - perhaps for the next newsletter? We have two very different Members' Forum items this time. Adrian Wyatt resurrects our Society's on-going interest in glacial erratics, taking the subject to Bromsgrove with another question (responses will be welcome!). The other item, from new member Peter Purewal, raises a timely issue about the possibility of BCGS joining the modern age with a presence on Social Media. We would greatly value your comments and suggestions on this subject.

In these pages we like to report the geological experiences of our members from their travels around the globe, and over the years you have entertained and informed us with fascinating insights and spectacular photos. In this issue we are pleased to include an account from our Field Secretary, Andy Harrison, from his recent holiday in Costa Rica. So please bear this in mind. Wherever the summer holidays take you - close to home or far away, let us hear about your travels. ■

Julie Schroder

Museum and Geopark - news from our Chairman

Dudley Museum and Art Gallery

In the April Newsletter we reported the decision to close the Dudley Museum and Art Gallery. This was part of the overall response to central budgetary cuts, and was approved at the full council sitting in March. The local elections in May have established a situation where no overall control exists by any party. It is therefore possible that the decision will be reviewed, but this remains uncertain. In the meantime the team at DMAG is preparing for closure within the time period leading up to 31 March 2017. At this moment the main possibility for future hosting of geological displays and the geopark headquarters is the new Dudley Archives building adjacent to the Black Country Living Museum. If, how and when this will take place is still to be agreed.

The Black Country UNESCO Global Geopark Project

In October 2015 UNESCO formally adopted the Global Geoparks Network into its own work programme and the Black Country's application was submitted in November 2015, making ours the first geopark application to go through the formal, new UNESCO process. It is some time since we last reported the on-going efforts to bring this application to fruition, and why it is so important for the Black Country. We hope that the sentiments expressed in this rather lengthy quote from the final section of the application dossier will help to focus minds more clearly, as the remaining 'hoops' in the process are negotiated:

"Here we have a legacy of truly amazing world class heritage and unique geological features to be cherished and to feel proud of, but they are often too hidden in our urban landscape and unknown to all but the specialist. This makes them vulnerable to neglect and loss, and their value is not realised. Also here, like arguably nowhere else in the geopark network, these things exist as much through human endeavour as natural processes and they represent a significant human cost in their ►

creation. In the present day they are often the only remaining echoes of those industries. Huge industrial closures in recent decades gave rise to large areas of unsightly dereliction. This has created in many minds a terrible perception of the landscape here and leaves us with a particular and urgent need to improve our quality of environment, to recognise our special heritage before it is lost, and to make best use of it to create new and sustainable opportunities for the future. The loss of industry in many parts of the Black Country brought with it a loss of wellbeing and purpose, and this has created a negative legacy of deprived, lower self-esteem communities who now often believe there is nothing good left and that things are always better elsewhere. This has manifested itself as an ongoing problem of outward migration of our talented young people, our skilled workers, and our wealthier individuals.

It's a situation we simply have to change. We need the tools to re-focus on the good and special things that we have here that make this a unique and wonderful place to be. There is still huge pride here, but we are not communicating well about the landscape and how special the area is. It's arguably this lack of self-belief and the widespread ignorance of how special the area is and of the opportunities that still exist here that are stifling confidence in change, and holding the Black Country back from what it needs to move on. This place deserves a world stage; it's amazing. Change is happening and the geopark accolade will be a key catalyst in this process. Put simply, we need our local people to reconnect with the Black Country landscapes and become personally involved in making this a really vibrant and different place to be and a wonderful place to visit and explore."

The Black Country UNESCO Global Geopark proposes 45 sites (geosites) that together tell the full landscape story of the Black Country's 256 square kilometre territory. Out of hundreds of potential geological and cultural assets the selected ones were chosen to provide best access to the Black Country's internationally, nationally, and regionally important geological, and related cultural heritage, for visitors, groups and local communities alike.

Geosite information panel at Saltwells Nature Reserve

UNESCO carried out a provisional desk-based review, and have now assigned two international experts to visit the geopark itself. This visit will be undertaken by Prof. Jin Xiaochi of the Chinese Academy of Geosciences in Beijing, and Prof. Jari Nenonen of the Finland Geological Survey, between 20 and 24 June 2016. They will then submit an assessment report to UNESCO in Paris and we will formally present our case at the Global Geopark Network Conference in September of this year. A decision will be made and after the UNESCO Committee AGM meeting in spring 2017 we will be told the result. In terms of these challenging times within the heritage and culture sector, and given the weighting that people and organisations place on international designations when prioritising funding etc. there is a lot resting on this work. There will be further up-dates as and when we have news on this important project.

To see a map of the chosen geopark sites and to view or download the full application dossier go to: http://www.blackcountrygeopark.org.uk/sites-to-see/ ■

Graham Worton

Field Meeting Report

Saturday 23 April: Churnet Valley, North Staffordshire. Led by Prof. Ian Stimpson (Keele University).

The Churnet Valley is situated approximately 4.5 km north of Cheadle and 14.5 km east of Stoke-on-Trent. The valley itself is one of several roughly north-south trending, steep sided and flat bottomed valleys, which cut into an older, flat plateau type landscape. Through it flows the River Churnet and the parallel Caldon Canal, which links Stoke-on-Trent to the Trent and Mersey Canal at Etruria in the west. The River Churnet flows towards the south-east and intersects the River Dove.

We met Professor Stimpson at Froghall Wharf, at the southern end of the valley at 10.30 for an introduction to the day. After a cold and frosty start the day turned into one of sunshine with a light wind, but became cloudy later in the afternoon. The aim of the day was to walk the northern end of the Churnet Valley Geotrail, produced by Professor Stimpson and the Staffordshire RIGS Group. Starting at Froghall Wharf the trail heads north along the Froghall 'Green Walk', and through the steep sided valley of Whieldon's Wood. The trail then climbs eastwards out of the valley, towards the village of Foxt, before heading south and eastwards crossing fields and the Shirley Brook. From the south side of Shirley Brook our route left the trail (which continued southwards towards Whiston village), to follow a former tramway back to Froghall Wharf.

The Caldon Canal, Froghall Wharf

Geology

The geology of the Churnet Valley and surrounding area has been instrumental in shaping the local landscape and its industrial heritage. The bedrock geology underlying the local area comprises Upper Carboniferous, Bolsovian Stage (Westphalian C) Coal Measures, and Namurian Gritstone strata. For the morning, the first half of our route crossed Coal Measures strata, which included the Froghall Ironstone and Woodhead Hill Sandstone. In the afternoon, the second half of our route crossed interbedded mudstone and gritstone strata, which included the Chatsworth Grit, Roaches Grit and Morridge Formation Mudstone. Limestone strata of the Lower Carboniferous underlie the gritstone strata and are exposed approximately five kilometres east of the Churnet Valley, at Caldon Low. A north-south trending fault separates the gritstone strata to the east from the Coal Measures to the west, which have been downthrown by approximately 300m.

The gritstone strata represent deposition of coarse sandy sediments within deltas situated at the mouths of rivers draining southwards from the remains of the Caledonian highlands to the north. The Coal Measures strata represent shallow coastal deltas, associated with the Staffordshire Basin, around 314Ma when the area was situated at more equatorial latitudes. At this time the southern continent of Gondwana was situated over the South Pole and covered with ice sheets. Cyclic advancing and retreating of the ice caps resulted in fluctuating sea levels that influenced the deposition of sediments within the deltas. During periods of low sea level terrestrially derived sediments (sands, muds and vegetation) were deposited, and periodically the deltas would dry sufficiently to allow layers of soil to form. During periods of high sea levels the deltas would flood and marine sediments washed in. This resulted in the sequences of inter-bedded mudstone, sandstone, thin coal beds, seatearth, ironstone and marine bands, which characterise the Coal Measures strata. ►

With the onset of the Variscan Orogeny at the end of the Carboniferous, these strata were uplifted and the upper-most units of the Carboniferous eroded. During the Mesozoic, these strata were buried beneath the sandstone, limestone and mudstone sequences that characterise this era. The Tertiary saw the area uplifted once again and eventually, during the last Ice Age, erosion from glacial meltwaters shaped the current landscape. Numerous north-south and east-west trending faults also cross the area, which are testament to the tectonic forces this area has endured in the past.

Industrial Heritage

Today the wooded and undulating landscape through which the Geotrail passes hides an industrial heritage of canals, tramways, mining and mineral extraction. Froghall Wharf is situated at the eastern end of the Caldon Canal, which runs for 18 miles westwards to Etruria in Stoke-on-Trent, and includes a stack of seventeen locks and the 69m long Froghall Tunnel. The former Uttoxeter Canal once joined the Caldon Canal close to Froghall Wharf; however this was later infilled to provide a route for the Churnet Valley Railway, which arrived in 1849. Heading eastwards away from Froghall Wharf the route of a former tramway leads to limestone quarries at Caldon Low. The tramway was reconstructed four times, with ever increasing amounts of engineering to make it smoother and able to carry heavier loads. The engineering works included construction of retaining walls and the infilling of a valley.

Limestone was transported from the Caldon Low quarries along the tramway using tubs, to Froghall Wharf where it was burnt in limekilns to produce slaked lime. Most of the lime was transported to Stoke via the Caldon Canal, where it was used as a flux in iron smelting. A by-product of the limestone was chert, which was also transported to Stoke, where Pottery manufacturers used it in bone china. The area is pock-marked with depressions from old mine workings and heaps of colliery spoil. Coal production and coppicing of trees for charcoal provided important fuel sources. Ironstone was mined to provide ochre for the dyeing industry, and copper for products such as telegraphic cables.

The Geotrail

Locality 1 of the trail is Froghall Wharf, now a picnic area, where the remains of the Caldon Canal, the former tramway incline and the lime kilns can be seen. Following the Froghall 'Green Walk' north the trail follows the line of the Froghall Ironstone through Whieldon's Wood. At the time of our visit the valley floor was carpeted with early spring flowers, including lesser celandine, wood anemone and bluebells. In the valley the trail passed the entrances of several former family run bell pits, old mine shafts and a stream which cut through old mine spoil at Locality 2. At Locality 3, an exposure of the Woodhead Hill Sandstone was visible in a stream. At Locality 4 the trail passed an outfall draining a mine situated within the Crabtree Coal, stained orange from iron-rich mine water.

Coal Measures between Localities 1 & 2, sandstone seat earth with iron carbonate (Siderite) nodules

Heading eastwards, away from Whieldon's Wood and past more mine workings, a break in slope at Locality 5 marked the position of the north-south trending fault that separated the Gritstone strata (Rough Rock sandstones), from the downthrown Coal Measures mudstones in the west. From Locality 5 we headed for the village of Foxt, where we were due to have lunch at the 'Fox & Goose' pub. However, the pub was unfortunately closed for refurbishment. The views from the pub provided a good panorama of the surrounding landscape, its plateau-like appearance and the deep river valleys cut into it. ►

After lunch we followed the Geotrail eastwards along the upper edge of a valley to an exposure of the Chatsworth Grit at Locality 6. The coarse grained, red-brown and cross-bedded nature of this sandstone is evidence of its northern origins during the Namurian. We continued south-east and downhill into the valley of Shirley Brook, over mudstone strata to Locality 7, where exposures of the Roaches Grit were visible. These rocks are better exposed at the Roaches, hence the name, and once again show evidence of their northern origins.

Discussing the Origins of the Chatsworth Grit

Continuing across Shirley Brook we also saw evidence of the first tramway used to transport limestone from Caldon Low to Froghill Wharf. Two east-west trending faults bound the Shirley Brook Valley, which again hint at the tectonic history of the area. Continuing southwards into the next valley, and Locality 8, we viewed exposures of the Namurian mudstones that occur between the beds of gritstone, and these are the dominant Carboniferous rock type of the area. Unlike the gritstones, the mudstone strata have not been traditionally named. Locally they were called the Morridge Formation and today are better known as the Bowland Formation. Dark grey in colour, these mudstones are organic-rich and known to be a source of hydrocarbons, which is of interest to companies wanting to extract shale gas through the controversial process of fracking. Of course the rocks we saw, being at surface, were long devoid of any hydrocarbon potential.

Climbing out of the valley to Locality 9, we walked along the cutting of the former tramway through high exposures of fractured Chatsworth grit. In places the sandstone was bleached, which it is believed is a result of contact with hydrothermal fluids. Continuing along the trail it wasn't long before we reached a fork, at Locality 10. Here we left the trail and headed westwards, along the former tramline, back to Froghall Wharf.

We ended our walk around 4.00 at Froghall Wharf. I would like to thank Ian for a very interesting visit and enjoyable walk.

A copy of the Churnet Valley Geotrail leaflet can be downloaded from the Geoconservation Staffordshire website at http://srigs.staffs-ecology.org.uk ■

Andy Harrison

Geology in Action - Costa Rica, May 2016

For our holiday this year my girlfriend and I undertook a two week trip in May around Costa Rica, looking at wildlife and viewing first hand some interesting geology.

Costa Rica is situated towards the southern end of a thin isthmus of land, Central America, and is located between Nicaragua to the north and Panama to the south. It is situated on the eastern edge of the Pacific 'Ring of Fire', at tropical latitudes, between approximately 8° and 10° north of the equator. Approximately 400km long and 100km to 150km wide, Costa Rica has around 1,300 km of coastline with the Pacific Ocean to the west and the Caribbean Sea to the east. ►

Volcan Arenal from La Fortuna

Two northwest-southeast trending staggered mountain ranges, made up of four volcanic cordilleras, run the length of the country dividing it in two. The ranges include from northwest to southeast: Cordillera de Guanacaste, Cordillera de Tilaran, Cordillera Central and finally Cordillera de Talamanca. Many of the volcanoes making up the cordilleras are recorded as extinct, however several are listed as dormant or active. The six most recently active volcanoes include Poas Volcano (2,708m), Irazu Volcano (3,432), Volcan Arenal (1,670m) and Turrialba (3,328m), in the Central Cordillera, and Rincon de la Vieja Volcano (1,916m) and Tenorio Volcano (1,916m) both in the Guanacaste Cordillera.

Volcano Turrialba is the most recent volcano to erupt and was reported as erupting during our visit, on 3 May 2016. Since out return home it has reportedly erupted again covering the local region, including Costa Rica's capital - San José - in ash, which has also disrupted air traffic.

Geology

The geological history of Costa Rica and the Central American isthmus, started at the time of the breakup of Pangaea around 180Ma. At this time North and South America formed two separate continental landmasses, between which the Pacific Plate was beginning to be subducted beneath the Caribbean Plate. The result was uplifting of chunks of ocean floor known as ophiolites. Around 50Ma early submarine volcanoes started to form along the line of the subduction zone. Successive layers of accumulating volcanic ash and lava eventually caused the volcanic peaks to rise above sea level, resulting in a volcanic archipelago that lasted from approximately 40Ma to 3Ma.

Over the millennia accumulating continuous eruptions caused lava and sediments to fill in the gaps between the volcanoes. Consequently, around 3Ma a land bridge formed linking North and South America, i.e. the Central American isthmus. This land bridge subsequently allowed the migration of animals and plants between North and South America. The result was to make the countries of Central America, such as Costa Rica, some of the richest and most diverse places for wildlife on the planet. Although at equatorial latitudes, some of the volcanic peaks of Costa Rica, i.e. Volcan Chiripo, are high enough to have supported glaciers during the last Ice Age.

Therefore, the geology of Costa Rica generally comprises deeply buried and metamorphosed oceanic basement rocks overlain with younger volcanic rocks and more recent sedimentary deposits. The southern Cordillera de Talamanca represents the uplifted core of an early volcanic chain, now eroded to expose the intrusive rocks of the former magma chamber.

La Fortuna and Volcan Arenal

We arrived at La Fortuna on day six of our trip. The most striking thing about the place was the looming presence of Volcan Arenal, Costa Rica's most famous volcano, to the west. According to the town elders it was once called El Bario and known by the locals as La Fortuna because of the area's rich fertile soils that produced abundant crops all year round. However, another story goes that the town's name came about after it survived the last eruption of its brooding neighbour. ►

End of the Trail, Arenal Volcano

The area was settled by local farmers around five hundred years ago probably because they recognised the potential of the area. At the time little notice was given to the large mountain dominating the skyline - nothing being known about volcanology at the time. However, on Monday 29 July 1968, at 07.30, all that changed.

Seen from La Fortuna, the volcano looks like a single peak, which indeed it was prior to 1968. However, on the morning of 29 July the mountain violently exploded into life after a vertical row of three vents opened up on its northwest flank. The two lowest vents erupted the most violently sending pyroclastic flows westward at approximately 120km per hour. The eruptions continued unabated for several days, burying over 15 square kilometres of land with rocks, lava and ash. With time the two lower vents became plugged and stopped erupting, leaving the third and highest vent to gently release lava and ash. Over the years these steady eruptions built up the western side of the volcano into a second peak, situated immediately adjacent to the first and older peak. Steadily effusing lava flows were visible on the volcano summit up until 2010 when this giant finally went to sleep and stopped erupting. Today all that can be seen are occasional plumes of venting gas and water vapour issuing from the summit. It is illegal to go up the volcano, but this doesn't stop the locals.

In the path of the 1968 eruption were the villages Tabácon (the closest), Pueblo Nuevo and San Luis. Tabácon was totally wiped out with the death of 87 people and the destruction of 232 square kilometres of land. Pueblo Nuevo and San Luis were partly destroyed, which played right into the hands of local government, who at the time had been trying to get the two villages relocated to make way for a new hydroelectric scheme.

The eruption of Volcan Arenal was used as an excuse to move the remaining villagers, claiming that the area was not safe. In the 1970s the villagers were moved to a new location, further west and a new town built called New Arenal. The remains of Pueblo Nuevo and San Luis were flooded and today lie beneath the waters of Lake Arenal, which opened in 1979. This vast reservoir, covering 85 square kilometres, supplies over fifty percent of Costa Rica's hydroelectric power. Other than its wildlife the country is well known for being one-hundred percent energy efficient, with 85% from hydroelectric power, 15% geothermal and 5% from solar/wind.

Along the main road from Lake Arenal to La Fortuna, to the north of the volcano, numerous hotels have been erected. Each originally advertised the best views in comfort of the lava flows on the volcano's flanks. Since the lava stopped flowing, the hotels branched out into hot baths and springs to relax in, with pool-side bars. Whilst some of the water comes directly from the hot springs other hotels source their water from boreholes sunk down into geothermal strata. We had a chance to sample the hot baths at one hotel, Hotel Los Lagos, for an evening with good views of the volcano, but it was a shame not to see any lava flows. ►


Hotel Los Lagos Hot Baths

On our second day in La Fortuna we went on a guided walk of the Arenal National Park, situated at the foot of the volcano. It was striking how quickly the vegetation had recolonised the area since the 1968 eruptions. Walking over red weathered volcanic soil we eventually arrived at a view point of black pitted, broken lava flows and andesitic rock debris, remnants of the pyroclastic and lava flows. Black hand-painted signs with yellow lettering warned us not to go any further, but we could view the grey frozen remains of lava flows on the volcano's flanks. A major export from Costa Rica comes from the andesitic rocks in the form of silica, for silica gel, used in packaging to keep goods, in particular electrical goods, dry.

Our tour leader for this mentioned that they undertake tours covering many of Central America's volcanoes, some of them active. Apart from the wildlife and pre-Spanish culture, the volcanoes are another good excuse to visit this part of the world again. ■

Andy Harrison

Obituary: Albert Ludford 1913 - 2016

A Black Country geologist inspired by the Wren's Nest and his tutor - Fred Shotton

In Newsletter 199 (http://bcgs.info/pub/wp-content/uploads/newsletters/BCGS_Newsletter199.pdf), I wrote an item about Albert Ludford after an introduction by his nephew, Ian Ludford. Following Albert's death earlier this year Ian entrusted me with some books, specimens and personal geological papers from Albert's collection, to be disposed of in a fitting manner. Some of these have been donated to the Lapworth Museum, and those of you who were at the last indoor meeting will remember that Albert's books were offered to you in exchange for 'donations' to BCGS funds. I'm delighted to say that this raised £55.00 for Society funds, and there will be more items on offer at the next indoor meeting (19 September).

The following obituary appeared in the May 2016 issue of the Geological Society's 'Geoscientist' magazine and is reproduced here by kind permission of the Editor of Geoscientist, and Ian Ludford, who sent it to me. Ed.

Albert Ludford

Born in Willenhall near Wolverhampton, Albert attended Wednesbury Boys High School. Although chemistry was his initial preference he graduated in 1934 with a good honours BSc in Geology & Geography from Birmingham University, having been awarded the Panton Geological Prize. He taught at a local primary school following completion of a teaching diploma.

A strong mutual interest in geology developed with Ellen Seagar (Nellie), whom he married in1940, continued through the Midland Group of the Geologists' Association which he joined in 1938. Albert carried out researches in his spare time; firstly into local industrial mineral deposits and then into the Carboniferous stratigraphy of the Pennines in Staffordshire and south-west Derbyshire. Both involved a lot of walking and bicycling. ►

Royal Artillery

In 1940, he was commissioned in the Royal Artillery and initially served as a battery commander in England, Orkney and Nigeria. Then Albert was seconded as a geologist to the Inter-Services Topographical Department and was involved in the preparation of overlays for soil types in north Germany for tank runs and made visits to Norway, Sweden, Thailand, Singapore and Burma for other projects (detailed in the publications of Ted Rose & co-authors). He was demobbed in 1947 with the rank of Captain.

Albert transferred to the Wolverhampton Municipal High School where he taught geography but introduced geology. Also, he was a geology lecturer for the extra-mural department of Birmingham University.

He was awarded the MSc in 1945 for his work on the Carboniferous stratigraphy of the Weaver Hills, which was subsequently published in QJGS *(Quarterly Journal of the Geological Society).* Two fossils are named after him as a consequence of his researches: a Ludlovian Leptaenid brachiopod Ludfordina pixis and a Carboniferous goniatite Pronorites ludfordi. His Carboniferous researches were extended into Dovedale for the award of a London University PhD in 1972.

In 1955 he was appointed a Lecturer at Luton & South Bedfordshire College of Further Education (now the University of Bedfordshire). Geological resources at Luton for the External London BSc were considerably enhanced through the advent of Norman D'Cruz in 1960. Later, with a rapid increase in undergraduates, further staff appointments were made.

CNAA

At his retirement in 1976, Albert was Principal Lecturer in charge of five geology staff and Deputy Head of the Science Department. Additionally he was a member of the Geology Board of the Council for National Academic Awards and an Examiner for London University External BSc. Nellie and he retired to Malvern where he continued his interests through the local RIGS group. In 2013 he was awarded a University of Bedfordshire honorary DSc.

Encouraged by Albert and Norman the Luton geology section maintained high standards of degree-level teaching that provided a good foundation for the establishment of a university. Albert will be best remembered for championing the interests of students and as a stimulating teacher with great thoughtfulness, consideration and patience. He lived to be the Geological Society's oldest Fellow, a position he held for many years. ■

By Gordon Taylor with help from Norman D'Cruz and Ian Ludford.

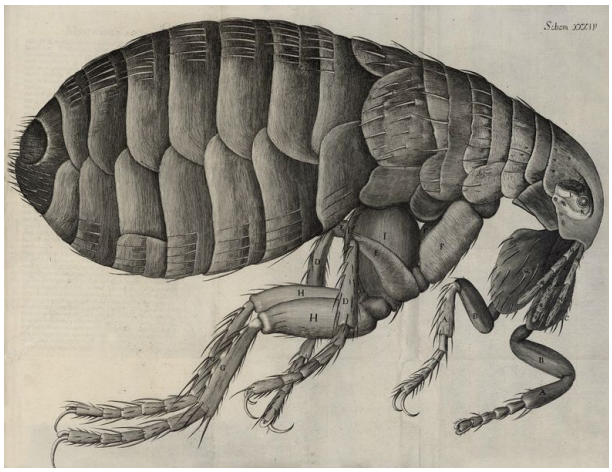
Mike's Musings No.3 - On The History of Microscopy

The evening lecture on microfossils *(Monday 18 April)* informed us, among many other things, that Hinde made a study of scolecodonts back in the 1880's. This surprised me at the time as I had fallen into the trap of imagining that nothing so tiny could be usefully examined at that date.

A clearer realisation began to dawn on me when, firstly, we were told that scolecodonts could actually range in size from just a fraction of a millimetre (100 microns or so) to several millimetres; and secondly when I remembered the illustrations of Robert Hooke's miniscule creatures in his work 'Micrographia', a seminal work in the study of things under the microscope, dating much further back to 1665. ►

But by now my interest in the subject of the history of microscopy had been aroused, and at risk of straying too far from the realm of geology for this 'musing', I'd like to share this history as gleaned from several sites on the wonderful web.

The first chapter begins in the 2nd century BC, with Claudius Ptolemy's (yes - **the** Ptolemy, of 'geographical' renown) observation that water bends light (which is why our arm or leg appears to have been broken when immersed at an angle into our baths). He correctly deduced the principle of light refraction when passing from one medium to another.



Robert Hooke's drawing of a flea

Around a couple of centuries later, the Romans discovered the way to manufacture artificial glass, and noted that in some situations glass was able to make an object look larger than it really was i.e. the principle of magnification. Glass globes filled with water did the job even more impressively.

By the end of the 13th century (a bit of a jump, I know, but we have to take the so-called 'Dark Ages' into account), skilled craftsmen were able to construct spectacles after a fashion, by which time the concept of the 'lens' (derived from the Latin for 'lentil') was fairly well established in practical terms.

The next step was the understanding that magnification could be advanced by combining two, and subsequently more than two, lenses to create the world's first microscopes. This was first achieved in the late 1590's/early 1600's, producing magnifications of x6 to x10, albeit with rather blurred images. A popular item to view under such enlargement were small insects, and these early microscopes were often referred to as 'flea-glasses' as a result. Compound microscopes became more refined by the 1620's when Galileo put them to good scientific use (also developed were telescopes, which have the lenses differently arranged to bring distant objects closer rather than to enlarge nearby objects).

Towards the end of the 1600's, glass grinding and polishing was achieving more sophisticated lenses such that even a single simple lens could achieve magnifications of x50 (commonplace) and x270 (for specialist instruments). The latter were the workmanship of Anton von Leeuwenhoek. He produced lenses capable of superior resolution and coined the term 'animalcules' for what we now know to be bacteria. His contemporary, Robert Hooke, to whom I have already alluded, was the first to publish a dedicated scientific study of the microscopic world ('Micrographia').

Since Leeuwenhoek's time a compound three-lens design has become standard in most optical microscopes and the main improvements have since come from advances in the application of optical theory in overcoming the problems of chromatic defects, an understanding of which really began with Newton's 'Opticks' of 1704. In due course designs overcame problems such as chromatic (1730's) and spherical (1830's) aberration in lenses, and improved methods of light gathering by immersing lenses in oil or water (1870's).

All these advances meant that by the time Hinde sat down to examine his scolecodonts, the best microscopes had a magnification of some x1250 to x1500, and a resolution of 200 or so nanometres or comfortably less than a micron. This more or less represented the theoretical limit one could possibly achieve using a light optic system, a limit imposed by the wavelength of the visible spectrum. ►

An instrument called an ultramicroscope, developed by Zsigmondy in 1903, uses the scattering of light rays rather than simple reflection to increase resolution down to a few nanometres, but it is only with using shorter wavelength parts of the electromagnetic spectrum that still further reduction in resolution has been made possible, with X-ray microscopes developed in the 1940's and 1950's.

The whole field of electron microscopy, begun in the early 1930's with both transmission and scanning electron microscopy (TEM and SEM), increased both magnification and resolution still further, but neither became commercially viable until the 1950's. Thereafter a whole range of techniques with different applications were developed, in particular through the 1980's. Today we have reached the position where scanning tunnelling electron microscopes (STEM) are capable of 3-D images with a resolution of 0.01 nanometres - a thousand times better than can ever be achieved by optical means. All we need now are even smaller microfossils, commensurate with such capabilities! ■

Mike Allen

Members' Forum

Time to Tweet?

Before we ponder the above question, a short biography on myself. I graduated from Aston University in 1977 with a degree in geology, however my career went in a totally different direction. I have recently retired from West Midlands Ambulance Service after nearly 38 years and decided to pick up my interest in the rocks by joining the Black Country Geological Society at the end of last year. During my career with the Ambulance Service, I worked as a Paramedic, Instructor and latterly in Leadership and Organisational Development. Over the last 2-3 years we had made extensive use of social media, both from the Press and Communications Department and in my immediate team.

However, I have noticed that the Society does not have a presence on social media. On the website it states that it 'sets out to raise the profile of geological awareness in the West Midlands and to document and conserve local geological sites.' I would suggest to the Committee and Members that this would be greatly assisted by the use of Twitter which would appeal to a wider audience.

What is Social Media?

Social media initially began as a tool for personal communication and included platforms such as Facebook, blogging, Flickr, Twitter and YouTube. More recently, social media has seen an explosion in its use by organisations and other professional-focused tools have come on to the scene including LinkedIn and email newsletter software such as MailChimp.

This fast growth has created an opportunity for organisations to deliver information directly to people who want to receive it, without having to purchase advertising, hope for media coverage, etc.

If we decide to use Twitter as part of our Society's approach to communication, we can provide a guide to help you use it to build and strengthen the reputation of both the Society and its area of work. It will provide you with tips on what kind of content to tweet and even how to do so.

In short, Twitter can help us amplify our message by reaching target audiences more easily and quickly than by only using traditional communications methods. It also provides an opportunity to reach audiences that we normally wouldn't have had access to, or were traditionally included in targeted communications. ►

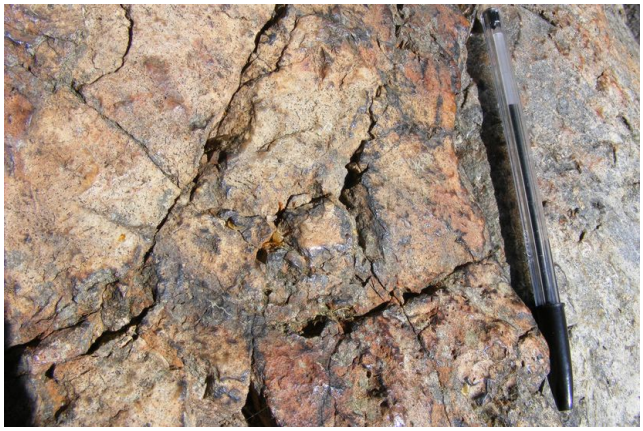
Twitter is an effective tool to help the Society to engage with members; disseminate important and timely news and resources to large audiences; increase awareness of issues; build and strengthen networks. For example, we can use Twitter to:

1. Grow and engage the Society's networks
2. Advance the Society's aims and vision
3. Increase awareness of the Society's work
4. Celebrate the achievements of the Society.

Setting up an account for the Society is relatively easy and with access granted to members posting to Twitter will not be the responsibility of a few. ■

Peter Purewal

Bromsgrove Glacial Erratics - two questions



Views of erratic on left hand side *Views of erratic on right hand side*

See front page photo for the overview of the entrance to the Bromsgrove cemetery.

A pair of Bromsgrove erratics keeping well! Two erratics stand either side of the entrance to the Bromsgrove cemetery, opposite St John's church. Apparently, they were moved from Bromsgrove High Street where, according to John Humphreys, MDS, FLS, in his 1902 lecture, they were seen opposite the old weighing machine. Does anyone know the glaciations after which they were deposited and the possible place of origin? Arenig quartzite has been found nearby. ■

Adrian Wyatt