Newsletter No. 242
April 2017

Contents:

Copy date for the next Newsletter is Thursday 1 June

To find out more about this photo - read on!

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For enquiries about field and geoconservation meetings please contact the Field Secretary. To submit items for the Newsletter please contact the Newsletter Editor. **For all other business and enquiries please contact the Honorary Secretary.** For further information see our website: bcgs.info and Twitter account: @BCGeoSoc		

Future Programme

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

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

Please let Andy Harrison know in advance if you intend to go to any of the field or geoconservation meetings. If transport is a problem for you or if you intend to drive and are willing to offer lifts, please contact Andy with at least 48 hours notice.

Saturday 22 April *(Field meeting):* Mortimer Forest, Herefordshire/Shropshire Border, led by Paul Olver of the Woolhope Naturalists' Field Club. (This is a joint meeting with the Woolhope Naturalists' Field Club, Geology Section, and OUGS WM branch.) Meet at 9.30 at the Forestry Commission car park at High Vinnals: GR 474 732 (south side of Ludlow - Wigmore road 3.5 miles from Ludlow). OS Landranger Map No. 137 (Church Stretton & Ludlow). Aim: to study the various Middle and Upper Silurian strata exposed within the well-known Mortimer Forest Trail west of Ludlow. These were laid down in a clear, warm, shallow sea stretching across the W. Midlands between what is now Charnwood Forest and a deeper ocean basin to the west. This is now occupied by the thick, folded and highly cleaved successions of mid-Wales. Conditions encouraged diversity of inarticulates, and examples of trilobites, brachiopods, nautiloids and corals may be found. The sea later became shallower and muddier, and thus less conducive to coral reef formation. The later Silurian rocks reveal good examples of zonal graptolites, orthoconic nautiloids and selected brachiopods. Lunch at a pub in Wigmore (or bring packed lunch). The Ludlow Anticline can be viewed from the nearby castle mound. This is the location of the Ice Age Lake Wigmore whose boundaries can easily be picked out from the viewpoint. Finally, we will return to the Mortimer Trail to examine further Silurian exposures. A study guide for the day will be provided.

Monday 24 April *(Indoor meeting):* 'A Teacher's View of Glacial Geology'. Speaker: David Pannett (Shropshire Geological Society).

Saturday 20 May *(Field meeting):* Return to the Brymbo Fossil Forest, Wrexham, led by Gary Brown, Brymbo Heritage Group. (This is a joint meeting with the Woolhope Naturalists' Field Club, Geology Section and North Staffordshire Group of the Geologists' Association.) Meet at the new Brymbo Heritage Centre (www.brymboheritage.co.uk) for 10.00 (approx. GR: SJ 295 536). Directions: ***Please read these carefully and look at the Brymbo website. SatNav and digimaps may not have caught up with recent road developments.*** Take A483 for Wrexham, exit at J4 to go west on A525, signed Brymbo, Coedpoeth. Take second right towards Brymbo (1st right is just after the lights) on B5101 (Heritage Way). After approx. 1.5 miles take second exit at roundabout onto Pheonix Drive (B5101), then straight on at the next two roundabouts. At the fourth roundabout the Brymbo Heritage Centre is the first exit to the left. Brymbo Heritage Centre is located approx. 200 yards south of Brymbo Enterprise Centre postcode: LL11 5BT (Blast Road, Brymbo).

Things have moved on since our last visits in 2007 and 2009, to house this amazingly preserved fossil forest from the Late Carboniferous Coal Measures. With help from the Prince's Regeneration Trust a plan has been put in place for the iron works, colliery and the fossil forest, which now has its own visitor centre. The morning will mostly concern the fossil forest. Lunch at the neighbouring cafe or bring a packed lunch. Afternoon session from 1.15 will focus on the iron works and colliery and the plans for their restoration. Finish around 3.30.

Saturday 17 June *(Field meeting):* The newly refurbished Lapworth Museum, led by Jon Clatworthy (Museum director). Meet at 10.30 in the museum for refreshments and an introduction to the history of the Lapworth redevelopment. Followed by a tour of the galleries, new stores and archive. Bring a packed lunch. Finish around 15.00. Members then free to look around the museum. Doors close at 17.00.

Saturday 22 July *(Field meeting):* Huntley Quarry Reserve and Hobbs Quarry, Gloucestershire, led by John Moseley, Geowarden for the Gloucestershire Geology Trust. This is a joint meeting with the Lickey Hills Geo-Champions. Meet at 10.30 at the Huntley Country Garden Centre, Ross Road, Huntley, Gloucestershire, GL19 3EY - next to the church. At Huntley we will see exposures of the Huntley Quarry Beds (Late Ordovician - very early Silurian volcaniclastics) and Late Triassic red beds. We will also examine the Blaisdon Fault and associated structures, mass movements and mineralisation. Lunch will be at either one of the two local pubs or at the cafe in the garden centre, or bring a packed lunch. In the afternoon we will visit Hobbs Quarry, located 3km from Huntley Quarry to see Gloucestershire's equivalent of the Wenlock Limestone with very impressive bioherms and a chance to do some fossil hunting. Finish around 3.30.

Saturday 12 August *(Field meeting):* Wren's Nest, led by Graham Worton. Details tbc.

Saturday 16 September *(Geo-conservation Day):* Wren's Nest. Details tbc.

Monday 18 September *(Indoor meeting):* 'On the move in pursuit of 'black gold' - highlights from three decades of international oil and gas exploration'. Speaker: Graham Hickman. Graham Hickman, a long time member of BCGS, graduated from Leicester University with a degree in Geology and Geophysics. He joined BP Exploration in 1981 and has followed an international career in oil and gas exploration. This has involved his living and working overseas in Egypt, Trinidad, Oman and Texas. While based in London he has worked on projects in Angola, China, Vietnam, Colombia, Ecuador, Peru, Switzerland and Denmark. He will describe the challenges and highlights from his international career and the challenges facing the industry.

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.

Sunday 1 October *(Field meeting):* The South Malverns, led by John Payne. Joint field visit with the Open University Geological Society, West Midlands branch. Details tbc.

Monday 16 October *(Indoor meeting):* 'The Corsi Collection of decorative stones: where geology meets the arts.' Speaker: Monica Price, Head of Earth Collections, Oxford University Museum of Natural History, and known to many members as a result of visits to OUMNH. Monica has made a special study of the Corsi collection and has developed an excellent website documenting its contents and history: http://www.oum.ox.ac.uk/corsi/

Monday 20 November *(Indoor meeting):* 'Cave Development.' Speaker: Tony Waltham.
Tony's wealth of experience exploring cave systems across the world, coupled with his geological training and engineering geology expertise have led him to a deep understanding of the formation of caves. Tony's engaging and enthusiastic style, coupled with a lifetime's experience underground combine to make an unforgettable evening.

Monday 11 December *(Indoor meeting):* Members' Evening.

Other Societies and Events

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

Manchester Geological Association

Sunday 9 April: Congleton Edge and Mow Cop. Leader Eileen Fraser.

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

Mid Wales Geology Club

Wednesday 19 April: 'Rocks and Minerals in Art: an illustrated talk'. Guest Speaker: Sue Purcell.

Sunday 23 April: (Field trip) Lapworth Museum, Birmingham.

Sunday 14 May: (Field trip) Llangranog coastal section, Cardigan Bay. Leader: Keith Nicholls.

Wednesday 17 May: 'From Heaven to Hell: a tale of two valleys'. Guest Speaker: John Rodgers.

Further information: Tony Thorp (Ed. newsletter & Hon. Sec): Tel. 01686 624820 and 622517 tonydolfor@gmail.com Website: 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.

Lectures at the University of Birmingham

Wednesday 12 April, 5.00 - 6.00: The Keith Palmer Lecture & Reception hosted by Prof. Alice Roberts: 'Why Dinosaurs Matter'. Speaker: Professor Ken Lacovara. Free. Booking essential. http://www.birmingham.ac.uk/alumni/events/items/Keith-Palmer-Lecture-Series.aspx

Postponed Lapworth lecture: 'History of the Moon'. Speaker: Dr Katherine Joy (University of Manchester). This lecture was scheduled for Monday 13 March but had to be postponed. It was announced that it would be re-scheduled for the summer term. Check the Lapworth website below.

Lectures at 5.00 in lecture theatre WG5, Aston Webb (R4), University of Birmingham. All are welcome to attend and there is no admission charge. For further information phone: 0121 414 7294.
web: http://www.birmingham.ac.uk/facilities/lapworth-museum/events/lectures.aspx
email: lapworth@contacts.bham.ac.uk

Lickey Hills Geo-Champions

Monday 17 April, 11.00 - 12.30: Lickey Hills 'Champions Trail' Easter Guided Walk. Free public walk (approx. 1½ miles), to visit Warren Lane and Barnt Green Road quarries in the Ordovician Lickey Quartzite and to consider this formation within the context of the wider landscape. Meet at the Lickey Hills Visitor Centre, Warren Lane, Birmingham, B45 8ER. Suitable for all the family. No booking required. Wear strong shoes. For a flyer and more information go to the Champions website: http://ehtchampions.org.uk/ch/calendar/

Woolhope Naturalists' Field Club - Geology Section

Saturday 22 April: Mortimer Forest Herefordshire/Shropshire border. Joint meeting with BCGS, see above for details.

Saturday 20 May: Return to Brymbo Fossil Forest, Wrexham. Joint with BCGS, see above for details.

Guests are welcome with day membership of the Club: £2.00. Contact Sue Hay on 01432 357138, email: svh.gabbros@btinternet.com or visit: www.woolhopeclub.org.uk/Geology_Section/default.htm

North Staffordshire Group of the Geologists' Association

Saturday 20 May: Brymbo Fossil Forest. Joint meeting with BCGS, see above for details.

For field trip enquiries: Steve Alcock, Longfields, Park Lane, Cheddleton, Leek, Staffs, ST13 7JS. Tel: 01538 360431 or 07711 501028. Email: steves261@aol.com More info: www.esci.keele.ac.uk/nsgga/

Warwickshire Geological Conservation Group

Wednesday 19 April: 'New insights into old fossils: the Ediacaran biotas of Charnwood Forest and Newfoundland'. Speaker Dr. Phil Wilby (British Geological Survey, Keyworth).

Friday 12 - Sunday 14 May: Buxton Weekend. Residential Field Trip to the Peak District, based in Buxton. *N.B. This trip was advertised by BCGS member Mike Allen at the BCGS AGM. There are still places available but hurry! Please contact Julie Harrald directly by Friday 7 April if you are interested on 01509 558211 or JulieHarrald@googlemail.com*

Wednesday 24 May: (Field trip) Kenilworth cutting / Finham gorge.

Doors open at 7.00 for coffee before a 7.30 start at St Francis Church Hall, 110 Warwick Road, Kenilworth CV8 1HL. For more details visit: http://www.wgcg.co.uk/ or email: WarwickshireGCG@gmail.com. There is a charge of £2.00 for non-members.

East Midlands Geological Society

Wednesday 3 May, 2.00: Charnwood Rocks: an exhibition. Organised by the Russell Society. Leader: Frank Ince of the Russell Society. Exhibition of rocks, minerals and fossils from the Charnwood area to celebrate the 60th anniversary of the first academically verified report of the Late Precambrian fossil in Charnwood Forest. Meet outside the Charnwood Museum, Granby Street, Loughborough, LE11 3DU.

Thursday 25 May, 2.00: Sedgwick Museum visit, Cambridge. Leader: Tim Colman. Welcome and short introduction from the museum staff. Meeting: Sedgwick Museum entrance, Downing Street, Cambridge CB2 3EQ. If you are coming by car it is probably best to use the Madingley Road Park and Ride CB3 0EX (just off the A14) to St Andrew's Street – close to the museum in Downing Street.

Saturday 3 June, 2.00: Creswell Crags - Permian Dolomitic Limestone with sedimentary features and Prehistoric habitation. Leader: tba. We will examine the well exposed Cadeby Formation dolomitic limestones in the gorge formed during Pleistocene glaciation. Free access to the crags and VC. 'Life in the Ice Age' tour, which includes entry to the caves, has been provisionally booked for the group. This is an additional £7.50. When booking for the general Crags please indicate whether you would like to go on the caves tour with the additional cost (payable on the day). Meeting place: Creswell Crags car park (MR SK 538 744) £3 car park charge.

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

Abberley and Malvern Hills Geopark - Geofest

The 2017 Abberley and Malvern Hills Geofest will run from 27 May to 3 September with the usual variety of events and exhibitions, and will include, at Bewdley Museum, 'Lines in the Landscape' featuring craft activities based on geology, and from 22 July, 'Stunning Landscapes from space - How Satellites see the Geopark'. The full programme will be on the Abberley and Malvern Hills Geopark web site in May: http://geopark.org.uk/

Editorial

Following the AGM there are usually some changes on the Committee, and this year is no exception. In the last issue we announced the departure of our Vice Chairman, Peter Twigg and Honorary Secretary, Linda Tonkin. Peter will soon be moving to Painswick in Gloucestershire to be nearer to his family, and we wish him well in his new life. Linda's much-valued service as our Honorary Secretary has come to an end, but she will not be leaving us, and once again we offer thanks to both for their loyal service.

Looking to the future, we are delighted to welcome Robyn Amos to the Committee to take on the role of Honorary Secretary, and to Andy Harrison, who will take on the role of Vice Chairman in addition to his on-going responsibilities as Field and Geoconservation Meetings Secretary. Last, but certainly not least, we welcome Dave Burgess as a new member of the committee. Many of you will remember the talk given by Dave's daughter, Rachel Cornah last September, focussing on her experiences in the mining industry in Australia.

Following Roy Starkey's recent appointment as Meetings Secretary, and Pete Purewal in charge of Social Media, and with newly elected Robyn Amos as Hon Secretary, we can feel confident that BCGS is not standing still. There are lots of new ideas in the air, and as always, we invite you, our members, to make your contributions. Now you can express your feelings not only through these pages but by twitter. If you have a twitter account, please join the host of followers - and add your tweets! With or without a twitter account you can follow our twitter feed on our website.

In his Chairman's Report, Graham Worton made brief mention of the on-going transfer of the Dudley Museum geological (and other) collections to the Dudley Archives, and confirmed that this will also become the Headquarters of the proposed Black Country Geopark. This seems fitting for us, as we have already come to appreciate the Dudley Archives as our home for BCGS meetings. As we go to print there is still no further news on the Geopark bid.

The Birmingham Building Stones trails are now complete in their web based versions. In time for the February issue we had installed the 3rd trail from Ruth Siddall in its pdf format. Since then, we have completed a slightly revised version of this trail which we think makes it easier to navigate around the labyrinth of the Bullring and Grand Central shopping centres. This is now available on our website here. We look forward to your feedback and suggestions, and hope that these web versions of the 3 trails can evolve along with the ever-changing developments in the heart of Birmingham.

Finally, I am pleased to be able to give some details (below) of Roy Starkey's recent award. I can't be credited with 'announcing' this news, as Pete Purewal was straight on the case with a tweet immediately after the event! ■

Julie Schroder

Marsh Mineralogy Award for Roy Starkey

We are proud to announce that our Meetings Secretary, Roy Starkey has been awarded the prestigious Marsh Award for Mineralogy, 2016. The award ceremony took place on 6 February 2017 at the Natural History Museum, and we offer Roy our sincere congratulations. The awards for Palaeontology and Mineralogy are presented in partnership with the Natural History Museum. They are the creation of Brian Marsh OBE, chairman of the Marsh Christian Trust, who wanted a vehicle to recognise 'unsung heroes who have made a major contribution to the promotion of palaeontology or mineralogy in the UK and abroad' [1]. In honour of Roy's achievement, and to publicise the work of the Trust, below is the full report from the Trust's website, which you can also read here: Marsh Christian Trust website. The photo is by Mary Starkey.

Roy Starkey receiving the Marsh Award for Mineralogy from Brian Marsh OBE

"The Marsh Award for Mineralogy aims to recognise living individuals (or groups of individuals) - based in the UK - who have made a significant contribution to the field of mineralogy. The purpose of the Marsh Award for Mineralogy is to recognise those who have contributed significant work to the field, yet whose efforts have not necessarily been widely recognised to date. Those nominated for the award can be of either amateur or professional status. The Award was presented for the first time in 2017, and recognised a winner's work from 2016. The 2016 winner is Roy Starkey.

Roy is an amateur mineralogist and has dedicated his life to his passion for British topographic mineralogy and in support of others who seek the same aims. Roy was instrumental in the formation of the British Micromount Society (BMS) in 1981 and membership levels remain high, with Roy continuing to take an active role as their President, regularly hosting the meetings of the West Midlands Branch at his home.

Over the years, Roy has donated specimens of British minerals which he has collected to nearly every major museum in Britain, including the Natural History Museum, the Royal Scottish Museum and the Oxford University Museum of Natural History. He is also a great believer in encouraging others to have an interest in the science of mineralogy and has never once sought to sell specimens for profit, rather he would prefer to provide them for free for others enjoyment.

Roy is well-known for his broad range of talks to a number of mineralogy societies and he freely provides information to academics and collectors alike about the many localities he has visited – giving useful tips on where best to find specimens, after having spent many days and lots of resources to find them himself.

Roy's first book, 'Crystal Mountains - Minerals of the Cairngorms', was published in 2014 and is a culmination of over 25 years of fieldwork and research in a historically important mineral-producing region. He is currently engaged in research for his second book, 'The Minerals of the English Midlands', which is due for publication in 2018. As part of this, he has photographed specimens from all the major museums in Britain, and the high quality photographs have been provided freely to the institutions, as an accurate and useful record of specimens." ■

1. British Mineralogy web site: https://britishmineralogy.com/wordpress/?page_id=441

Annual General Meeting Report

The 2017 AGM was held on Monday 20 March at 7.30 followed by a talk on the 'Volcanoes of Costa Rica' by Andy Harrison. Below is a summary of the AGM reports, taken from the minutes of the AGM.

Treasurer's Report

The Treasurer circulated the audited financial statement for 2016. There was little change from the previous year and the accounts remained in a healthy state. There was a slight fall in membership subscriptions. Sales/donations income came from items donated for sale, and from members donating a proportion of sales of their own geological specimens, books, etc. Increased expenditure was due to increases in subscriptions for 'Down To Earth' magazine, and the cost of refreshments for the Members' Evening was slightly higher. The Society had also given a donation towards the cost of the plaque for the Northfield Great Stone. The Treasurer pointed out that the Society holds a building society account in reserve, for one-off items of expenditure, such as donations. The main item of expenditure was room hire for the indoor meetings. A question was raised about expenditure for insurance. The Society is legally obliged to have public liability insurance, which covers field and indoor meetings. The Society takes out insurance through the Geologists' Association policy for affiliated groups. The Treasurer and Committee extended their thanks to Davena Dyball for auditing the accounts.

Chairman's Report

The Report was circulated to the meeting and the Chairman summarised the main points. 2016 had seen a series of indoor meetings of varied and interesting content, good field meetings and a very active programme of geoconservation days. He noted that 2016 had also been a year of considerable change, particular the closure of Dudley Museum and Art Gallery. The Museum and the headquarters of the proposed Geopark would be moving to Dudley Archives. He was proud that the Society had campaigned for the preservation and maintenance of the geology collection, which in turn had kept the Museum open. The Museum, and its collection, formed a major part of the bid for a Black Country Geopark. The outcome of the bid was due to be announced in Spring 2017. The Chairman thanked all the Committee for their support, especially those involved in publicising the Society - the newsletter, website and twitter account. He encouraged members to send in more photographs for the archive.

Election of Officers

All members of the Committee had offered themselves for re-election, with the exception of the Vice Chairman and Hon Secretary. The Chairman thanked the Vice Chairman and the Hon Secretary and made a presentation to each of them in appreciation of their contribution to the Society and to the Committee. It was also agreed that the Committee Members be elected as follows:

Chairman: Graham Worton; Hon Secretary: Robyn Amos; Treasurer: Alan Clewlow;
Vice Chairman and Field & Geoconservation Meetings Secretary: Andy Harrison;
Meetings Secretary: Roy Starkey; Newsletter Editor: Julie Schroder; Webmaster: John Schroder;
Social Media: Peter Purewal; Other members: Bob Bucki; Christopher Broughton; Dave Burgess.

Davena Dyball was asked, and agreed to audit the accounts for next year's AGM. ■

Linda Tonkin, Julie Schroder

Geoconservation Days

Saturday 4 February: Rubery Cutting

It was and remained a cool and partly cloudy day with plenty of sunshine. BCGS members met with members of the Lickey Hills Geo-Champions beneath the A38 fly-over, opposite the cutting at 10.30. Steve Hinton (Senior Ranger, Lickey Hills CP) was our supervisor for the day, which we spent continuing to clear vegetation and soil from the main area of rock exposure. Ongoing clearance work has maintained the visibility of the unconformity between the Lickey Quartzite and overlying Rubery Sandstone at this exposure. Further along the A38 to the east of the cutting, the boundary between the Rubery Sandstone and overlying sedimentary Carboniferous strata are indicated on geological maps. Potentially, future work could involve finding the boundary further along the road.

Saturday 18 February: Wren's Nest Nature Reserve, Dudley

Members of BCGS and the 'Friends of Wren's Nest' group met Head Warden Ian Beech around 10.30 at the Warden's station off Mons Hill Road. Ian's second in command, Rob Earnshaw had already taken tools to where we would be working. The weather was cool and foggy with a light wind.

We spent the day in Marsh's Quarry, situated at the foot of the 'Ripples Through Time' steps and adjacent to main patch reef/ripple bed exposures. Ian provided a brief health and safety talk regarding hand tools before we started. Like the Seven Sisters, Marsh's Quarry succumbed to local council heavy handedness in the 1960s when explosives were used in an attempt to make the area safe.

Marsh's Quarry after clearance work

The day's work generally involved clearing scrub and removing small trees from the quarry, which were stockpiled ready for chipping the following week. It is surprising how the unmanaged vegetation hides areas of the reserve from public view, and when we had finished much of the quarry had been opened up.

Recently the wardens have been working hard to clear new areas of the reserve, in particular around the Cherry Hole, the Seven Sisters caverns and the grasslands on top of Mons Hill. Opening these areas allows wild flowers (including orchids) to return, and according to Ian, the same spots have been revisited many times to remove vegetation, especially fast growing and invasive ash and hazel.

Ian is hoping to produce new interpretation panels and leaflets about the Wren's Nest in connection with the Geopark bid, for which the reserve is a flagship site. There will be plenty of opportunity for BCGS members to return and help out at Wren's Nest in the future and as usual the wardens are only too grateful for our assistance. ►

Saturday 4 March: Portway Hill Quarry, Rowley

We met on St Brades Close as usual for 10.30. It was a fine day with relatively clear skies, cloudy spells and a wind that was cold when the sun went in. Once again Tom Hartland-Smith from the BBC Wildlife Trust acted as our supervisor.

Spheroidal weathering

Since our last session in December, Tom had been supervising working parties from the Wildlife Trust and Friends of Rowley Hills group to remove vegetation and excavate more of the dolerite exposure. The bramble and scrub in front of the rock face has been brought under control to make way for wild flowers and other rare plants. Our day was spent excavating and clearing further areas of vegetation and soil from the base of the exposure. Work over recent months has formed the ground at the front of the main exposure into a terraced, level platform. The result has been to provide a better view of the spheroidally weathered columns that form the exposure and the mysterious continuous band that splits it horizontally.

For the benefit of new volunteers, Tom explained how the site had been turned from farmland and into a dolerite quarry before being land-filled to its current profile. He also explained that after the landfill was finished the area had been sold to a single buyer who partitioned the land into plots for development into housing. The Wildlife Trust had purchased one of these plots to create the Portway Hill Nature Reserve.

Volunteers ready for action in Portway Hill Quarry

Unfortunately, the site is situated within public open space and open on all sides which makes managing anti-social behaviour difficult. Although the volume of motorbike activity appears to have reduced, kids still vandalise the summit plaque. Using lumps of dolerite or glass bottles they use the cairn as target practice from the top of the exposure. Tom was saying that he constantly has to clean up glass, which is a peril for people with dogs walking through the site.

Being early spring, the Reserve's flora was beginning to re-awaken. Gorse was in bloom with its yellow flowers ready to attract the attention of the rare green hairstreak butterfly once again. Due to the nature of the colliery spoil and blast furnace slag used as landfill, no trees grow on the reserve itself and the ground is unsuitable for rabbits to dig burrows. However, the nutrient-poor soils and the exposures make good habitats for several scarce and unique plant species including bee orchids, hare's foot clover, ox-eye daisy and various vetches.

I would like to thank Steve, Ian and Tom for the opportunities to help over the past few months and look forward to offering more assistance at the start of the next season of conservation work in the autumn. ■

Andy Harrison

The Wieliczka Salt Mine, Poland

The spectacular salt mine of Wieliczka, in Poland was brought to my attention whilst watching a holiday programme several years ago. On a visit to Poland in September I finally had the opportunity to visit this site. Situated between the east-west trending ridges of the Wieliczka foothills to the south, and Bogucice Sands to the north, the town of Wieliczka is located approximately 13km south-east of Krakow, South Poland.

Origins and History of the Wieliczka Salt Mine

Throughout history, as with the rest of Poland, the Celts, Slavs, the Swedes, Hungarians, Germans and Russians have all occupied the town, which has seen its own share of economic growth and decline, plague, destruction, uprising and changes of power.

Archaeological evidence indicates that salt has been associated with Wieliczka since the Mid-Neolithic period (3,500 BC) when it was exploited as brine from salt springs. This lasted until the Middle Ages when the brine became too depleted and the mining of salt by hand commenced. Originally, salt was transported through the mine and brought to the surface using horse power, which was later replaced with steam power and eventually electricity. Salt extraction would eventually cease in 1996 as a result of low salt prices and flooding.

Salt extraction reached its peak between the seventeenth and nineteenth centuries and up until 1772, the mine was the property of the Duke of Krakow and later the King of Poland. After 1772, the mine became known as 'the Salina' and fell under the administration of the Austrian authorities until the Polish state regained independence in 1918.

In 1976 the Wieliczka mine was put on the list of Polish National Historic Monuments and in 1978 became a UNESCO World Heritage Site.

Wieliczka Salt Mine, Janowice Chamber

Geology

The salt deposits underlying Wieliczka and its sister mine at Bochnia (the Wieliczka–Bochnia area) formed during the Mid-Miocene Period, approximately 13.5Ma. At the time the area held a series of shallow salt rich lakes known as the Pre-Carpathian Sink, where salt deposited from evaporating lake water became buried beneath washed-in sedimentary deposits. Later, tectonic activity associated with the formation of the Carpathian Mountains to the south, resulted in thrusting and folding of these deposits.

The Middle Miocene (Badenian) sequence of rocks underlying the region comprise four separate strata. The uppermost stratum, (the Grabowiec Beds - Late Badenian), consist of undisturbed sands and sandstones which overlie the second stratum (the Chodenice Beds), a sequence of marly clays, siltstones and sandstones. The third stratum (Wieliczka Beds) is composed of interbedded layers of clays and evaporite deposits, including rock salt and anhydrite. These beds provided the salt that was exploited in both the Wieliczka and Bochnia Mines, and comprise an upper blocky stratum overlying a lower more stratified stratum. Underlying the Wieliczka Beds is a sequence of terrigenous, argillaceous and clastic sediments (the fourth stratum - Skawina Beds). ►

The Triassic salt deposits, associated with the Mercia Mudstone Group in the UK and found across America and Russia, also cover approximately one third of Poland. However, these deposits have no association with the salt deposits found at the Wieliczka or Bochnia mines.

The Tourist Route

The Wieliczka mine was already a popular tourist attraction in the fifteenth century, however, the main tourist period occurred during the eighteenth and nineteenth centuries. Today the mine attracts approximately 1.2 million visitors annually from all around the world and is often referred to as the 'Underground Salt Cathedral of Poland'.

The mine is a complex labyrinth of tunnels, chambers and chapels, some 287km long and reaching 327m depth. Visitors come to admire these spaces, and the magnificent hand carved figures along the long established 'Tourist Route', which visits the most historic parts of the mine. The Tourist Route comprises 22 chambers and around 2km of galleries and tunnels that cover three floors, and it descends to 135m below ground level. Along the way historical examples of the mine workings and evolution of the mining methods used between the seventeenth and twentieth centuries can be viewed. Tours last around three hours and start with the descent of the 64m Antonia Shaft via a spiral wooden staircase, of approximately one hundred steps, to floor one.

The tunnels, chambers and chapels are kept open with the help of wooden battens and props, many of which are original and have been down there for over two hundred years. Preservation of the wood and the salt is due to the unique climate conditions of the mine, which along with the ventilation have to be carefully monitored and adjusted to prevent any degradation.

Airflow is carefully regulated via a system of large doors that seal the corridors like the bulkheads of air locks. However, slight changes in atmospheric conditions in the mine cannot be totally avoided and on the walls and ceilings the evidence of slight humidity variations can be seen. Long dangling salt stalactites, referred to as ‘spaghetti’ hang from the ceiling and clumpy masses of white crystals, referred to as ‘cauliflower’, encrust the walls.

Wieliczka Salt Mine, Nicholas Copernicus

The 'Nicholas Copernicus', 'Janowice' and 'Sielec' Chambers are just three spaces that the tour passes through. The Nicholas Copernicus Chamber contains an immense figure of the great astronomer carved from green salt. The Janowice Chamber contains six life size figures that tell the story of the discovery of rock salt at Wieliczka. The Sielec Chamber holds a collection of figures and transport devices that illustrate the passage of salt through the mine, using carts prior to being hauled to the surface.

The Burned (Spalone) Chamber provided an introduction to the hazards associated with the mine. Salt carved figures hold aloft torches on long poles that were used to explode pockets of accumulating methane gas, released from the ground as the salt was excavated. In the 1800s the introduction of the safety lamp, invented by Sir Humphrey Davy, put an end to this practice. Other hazards in the mine included groundwater, which would result in flooding and destabilising of the mine, and fire, which would destroy the wooden props. ►

As Christians, the miners excavated chapels in the rock salt producing new ones as they went. The impressive St Kinga's Chapel looks more like a ballroom complete with illuminating salt chandeliers *(see front cover photo).* This chapel was started in 1896 and contains carvings of the Pope, various saints and altars. On the walls are reproductions of paintings, such as 'The Last Supper' - carved from the salt.

The rock salt is generally grey in colour and resembles unpolished granite, which makes taking photographs difficult. In some locations it can also be red, green or blue in colour. Large pools of salty brine also sit within the bottom of some chambers, such as the Erazm Baracz Chamber.

Tours end in the Stanislaw Staszic Chamber, which rises to an impressive 36m in height and is where souvenirs, such as rock salt lamps and books, can be bought on the way out. The mine is exited via the Danilowicz Shaft, located adjacent to the Antonia Shaft, which was sunk between 1635 and 1640 during the Austrian administration. This shaft was originally used to haul salt to the surface before becoming a communication shaft for mine officials, and later an exit for visitors.

The mines are well worth a visit and make for a great Polish highlight along with the magnificent cities and other tourists attractions. ■

Andy Harrison

Mike's Musings No. 8 - a Surfeit of Minerals

It all began as a happy accident. Passing through central Sweden last summer, I chanced upon the Långban Mine, set in the heart of Sweden's central mining district. This region is as celebrated by the Swedes as our own Peak District, Pennine or Leadhills orefields are by the British; a region which has been extensively exploited since the Middle Ages.

What really caught my eye was the claim that Långban was '...one of the places in the world that has the greatest abundance (meaning variety) of minerals' and '...no other place on earth has so many', with about 300 different minerals recorded, including some 70 'type species' (i.e. minerals first described from here). This seemed to be an impressive claim, but was it justified, or was there an element of exaggeration? And, if true, what gives rise to such variety.

General view of the Långban site

The issue of 'type species' is probably a bit of a red herring. So much here depends on priority, which in turn is often nothing more than an accident of history - those locations that just happened to be studied first. Few minerals are unique to just one, or a very few, locations, and might therefore just as easily have been first described somewhere else. The fact that over 320 'type species' have been described from the Kola Peninsula alone, by far the greatest concentration of such, merely reflects the fact that this area was quick off the mark in being mineralogically investigated.

The answer to the first question was easy to establish. The mineral fanciers amongst you will no doubt be familiar with the 'mindat' websites... all you ever wanted to know about mineralogical Meccas. Sure enough, their website on Långban duly lists 296 minerals known from this region, of which 72 are given as 'type locality'. So, we can't accuse the Swedish tourist literature of inflating the figures, though there is a little exaggeration with the final statement, as we shall see. The fact that I'd never heard of the place is clearly down to pure ignorance. ►

Still, it begged the question how this compares with some of the more widely celebrated mineral locations around the world. Investigating further 'mindat' sites, I discovered that there are around 5,100 minerals whose names are formally recognised by an august body set up to arbitrate on such matters.

Looking at 'mindat' sites country by country shows that it isn't just the large territories which have most minerals. Whilst USA and Russia occupy the two top slots, Germany, Italy, Japan, France and the Czech Republic all make the top ten (along with Canada, Australia and China). The UK follows closely in 12th position; very respectable for our relatively tiny dominions. Sweden and Norway are 14th and 16th respectively, above such giants as Kazakhstan, Brazil and Argentina. Sri Lanka, well known for all the lovely gemstones it contributes to world markets, apparently only has a meagre 84 minerals to its name. Even Madagascar, which is widely celebrated for its great mineral diversity, has only 343 mineral species listed. (I am presuming, in all this, that we can accept 'mindat' sites as reflecting reality!)

One of the flooded shafts at Långban

Note, incidentally, that mineral variety is not necessarily the same as being the most mineral rich or economically important. The vast majority of the mineral species that make up these most varied 'mining fields' consist of minerals that are extremely rare, hardly anyone has ever heard of, and in many cases are of no economic importance or significance. They serve only to excite the mineral collecting fraternity, and demonstrate the endless ways in which different chemical elements can combine to produce new compounds!

Homing in on smaller geographical entities, we find that Långban is, in fact, 10th in terms of mineral species abundance for what might be reasonably regarded as geologically discrete 'mining fields'. Though a fair degree of subjectivity is involved in defining such areas, and they vary considerably in areal extent, from several 1000 sq. km. (* in the list that follows) to around 100 sq. km. Individual mines are smaller still. Allowing for flexibility in deciding what to include as a 'mining field', by any reasonable measure, Långban must merit a top 20 position.

So where are the 'big hitters'? The following table gives the top global 'mining fields' as I have somewhat arbitrarily designated them.

Mining Field	**Mineral species**	**Genetic Associations / Environment**
Khibiny (Kola Region)	517	alkaline igneous complex
*Minas Gerais (Brazil)	516	iron ore / pegmatite
Clara Mine (Germany)	414	granite-hydrothermal (Cu-Pb-Ag)
Mont St. Hilaire (Canada)	401	alkaline igneous complex
Lovozero (Kola Region)	383	alkaline igneous complex
*San Bernadino (California)	377	granite-hydrothermal (Cu-Pb-Ag-W-Au)
Jachymov (Czech Rep.)	346	granite-hydrothermal (Ag-Ni-Co-Bi-U)
Broken Hill (Australia)	325	'VMS' exhalative volcanism (Pb-Zn-Ag)
Schneeberg (Germany)	303	granite-hydrothermal (Ag-Ni-Co-Bi-U)
Långban (Sweden)	296	pegmatite / skarn (Fe-Mn)
Tsumeb (Namibia)	288	hydrothermal-karst pipe (Cu-Pb-Zn-Ag-Ge-Cd)
Ilimaussaq (Greenland)	232	alkaline igneous complex
Sterling Mine (New Jersey)	227	'VMS' exhalative volcanism (Zn-Fe-As) ►

What appears to emerge from all this is that the greatest variety of minerals appears to occur in association with those strangest of magmatic environments... alkaline igneous complexes, often with related carbonatites ('magmatic limestones'). As an aside, it is often the case that areas with sedimentary carbonate deposits (limestones and dolomites) host a considerable variety of minerals - Långban and Tsumeb being two 'big hitter' examples. Both these magma types are unusual in being deficient in silica, and commonly interact with host rocks to produce strange hybrid rocks and minerals. Other examples not listed include the Kovdor mine in the Kola region, the Alnö complex in Sweden and the Fen complex in Norway. They are all found in ancient cratonic areas which have been subjected to crustal weakening with the development (to varying degrees) of continental rifts.

Also of importance are two other geological environments: acid (granitic) intrusions and associated hydrothermal mineralisation; and volcanic-massive sulphides ('VMS') associated with mid-ocean rift zones and their associated 'gossans' (alteration products due to later oxidation/weathering).

The perhaps unsurprising overall conclusion is that all this mineralogical exuberance developed in the most tectonically active regions of the earth: at past 'active' boundaries where the plates were either being wrenched apart (zones of rifting, both mid-ocean and mid-continent) or where there was active subduction, with deep seated melts producing enhanced magmatic activity. Continental collision zones (orogens, or mountain belts) feature far less prominently.

Note that none of the areas listed are geologically active any more; who knows which of today's dynamic regions will be added to the list in the geological future! ■

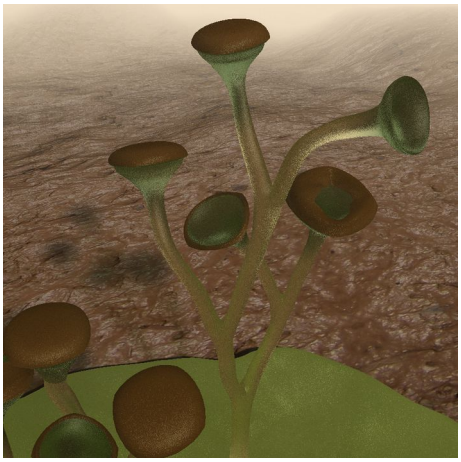
Mike Allen

Members' Forum

On a recent visit to the Wren's Nest I observed the rare carbonised plant fossil *Cooksonia sp* on the Nodular Member. It has the characteristic 'Y' shaped branching, but is a very delicate carbonised fossil fragment. It's remarkable to know this insignificant little plant was the first with a vascular system and ultimately evolved into the land plants we see today. ■

Steven Birch

Cooksonia sp on the Nodular Member, Wren's Nest



Cooksonia pertoni
Wikimedia Commons