



Newsletter No. 254

April 2019

Contents:

Future Programme	2
BCGS trip to Dorset	4
Other Societies and Events	5
Editorial	8
Securing our Website	8
Annual General Meeting Report	9
The Diary of Richard Prosser (aged 11)	10
BCGS Geoconservation Season	12
Mike's Musings No.20:	
Silicates: the Overlooked Minerals?	14

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To find out more about this photo - read on!



Copy date for the
next Newsletter is
Saturday 1 June

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

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.

Monday 15 April (Indoor Meeting): 'Europe's Lost World: The Rediscovery of Doggerland'. **Speaker: Professor Vince Gaffney MBE FSA, Anniversary Chair in Landscape Archaeology, University of Bradford.** 8,500 years ago the area that now forms the southern North Sea was dry land. By 5,500 BC the entire area had disappeared beneath the sea as a consequence of rising sea levels. The 'North Sea Palaeolandscape Project' has mapped 23,000 km² of this 'lost world' using seismic data collected for mineral exploration. In mapping this exceptional landscape the project has begun to provide an insight into the historic impact of the last great phase of global warming experienced by modern man and to assess the significance of the massive loss of European land that occurred as a consequence of climate change.

Saturday 11 May (Field Meeting): Martley Geo-Village, led by John Nicklin (Teme Valley Geological Society). Meet at 10.30 at Martley Memorial Hall for light refreshments and a pop-up display. Recognised as a Geo-Village, Martley has distinctive geology within its bounds spanning the Palaeozoic and lower Mesozoic. Includes rocks belonging to the Precambrian Malverns Complex, Martley Quartzite, Silurian and Carboniferous mudstones, siltstones and sandstones, Triassic sandstones, and Quaternary sand deposits. By car and/or on foot we will explore local geological sites, finishing around 4.00. Please bring a packed lunch.

Tuesday 21 May (Evening Field Meeting): Building Stones of Birmingham from Centenary Square to Brindley Place, led by Julie Schroder. (Joint meeting for BCGS and the Geological Society WM branch). Meet at 6.00 at the Hall of Memory (eastern end of Centenary Square, close to the Library of Birmingham). Following the two evening Building Stones walks last year, this walk concludes the series of 3 based on the Building Stones Trails created for BCGS by Ruth Siddall. The walk will closely follow the web-based version of Birmingham Building Stones Trail No. 2, which you can find here: bcgs.info/pub/local-geology/building-stone-trails/ There is also a pdf which you can download or print, but the web version has maps, additional photos, plus further information and definitions. **Booking required, numbers limited to 20. Please contact Andy Harrison (Field Secretary) to reserve your place:** Text or phone: 07973 330706 or email: fieldsecretary@bcgs.info

Saturday 15 June (Field Meeting): Lydney Cliffs, Gloucestershire, led by John Moseley (Gloucestershire Geoconservation Trust). Meet at 10.30 at Lydney Docks. Good parking at east end of Harbour Road, GR647013. Views of River Severn and south to Aust Cliffs, walk along low cliff to access Lydney Cliff section (caution required!), to examine Pridolian sequences. Lunch in Lydney, or at Parkend, 2 miles north of Lydney. Afternoon: possible underground visit to Hopewell Colliery or Clearwell iron ore caves, or a Carboniferous limestone locality. Finish around 4.00. Bring a packed lunch or there may be an opportunity to buy lunch in Lydney or at the Forest of Dean VC.

Sunday 28 July (Field Meeting): Nottingham's Sandstone Caves, led by Tony Waltham. Postponed from last year. Details TBC.

Saturday 17 August (Field Meeting): Walk round Castle Hill, led by Ian Beech (Wren's Nest Warden) and Graham Worton. Details TBC.

Monday 16 September (Indoor Meeting): 'How and why Earth's land ice cover is changing'. Speaker: Dr Nicholas Barrand (Lecturer in Geosciences, University of Birmingham). The talk will explore the impact of these changes on global sea levels and downstream systems, utilising airborne and satellite remote sensing tools.

Monday 21 October (Indoor Meeting): 'A Geological Grand Tour of the Solar System'. Speaker: Andrew Lound. A Tour of the solar system taking us on a journey from the sun to the far outreaches of the solar system, along the way visiting planets, moons, asteroids and comets. Illustrated with the very latest images and supplemented by music.

Monday 18 November (Indoor Meeting): 'Minerals of the English Midlands'. Speaker: Roy Starkey. This talk explores the rich mineralogical heritage of the area, setting this into a regional, historical and economic context, and tracing the development of mineral exploitation from earliest times to the present day. Mineral specimens from the area are recognised as being significant on a global scale, and are to be found in all major mineral collections, both within the UK and abroad.

Monday 16 December (Indoor Meeting, 7.00 for 7.30 start): Members' Evening and Christmas Social. This is our annual chance for members to share their geological experiences in a sociable atmosphere with a Christmas buffet provided by the Society.

Contributions needed from you!

We need a few of you to volunteer to do a short presentation - on any topic with geological connections; or perhaps bring some of your specimens for admiration, discussion and identification. Please contact Keith Elder if you can contribute to this event: meetingsecretary@bcgs.info

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.

BCGS trip to Dorset

Friday 13 to Monday 16 September 2019

(Please note the change of date)

The Dorset Geologists' Association Group has kindly agreed to host a weekend visit for BCGS to the Dorset South Coast. For various reasons the date had to be changed, and the trip is now fixed for **Friday 13 to Monday 16 September**, with attendees making their own way down. Monday will be optional for those attendees wishing to travel back on the Sunday. Accommodation has been reserved for **20 places**, which are steadily filling. Members wishing to organise their own accommodation should let the Field Secretary (Andy Harrison) know in advance.

We plan to visit the West Dorset and Purbeck Heritage Coasts, including Chesil Beach, Isle of Portland, Durdle Door, Lulworth Cove, Kimmeridge and possibly Studland Bay and Old Harry Rocks. Please get in touch with ideas for other places to visit for what promises to be a very interesting weekend.



Please contact Andy Harrison as soon as possible to express your interest in attending this field visit and to be included on the register. Please also indicate whether you would like to be booked into the hotel or will sort your own accommodation.

fieldsecretary@bcgs.info, mobile 07973 330706, tel: 01746 781 033

Perton Spring Festival **Saturday 18 May 10.00 – 4.00**

Perton Spring Festival returns for its 13th year on Saturday 18 May at Perton Library, Severn Drive, Wolverhampton, WV6 7QU, from 10.00 to 4.00.

Over 20 organisations and projects are participating in 2019, and for the first time they welcome the World Owl Trust who will be joined by owls from the Animal Zone at Rodbaston College. The Lapworth Museum and BCGS will also be represented.

The Spring Festival aims to engage people with what's best about our local environment, from the fossils, geology and archaeology beneath our feet, to how owls, bats and dragonflies use their amazing powers of flight to command the air, to the invertebrates, fish and amphibians that tell us whether our river is healthy. Meet South Staffordshire's honey bees and beekeepers, Perton's guerrilla gardeners and the people from Wrottesley Park who work to improve Perton's green environment with trees, bulbs and wild flowers. Meet the local Badger campaigners and the wonderful Joan Lockley who rescues local hedgehogs.

Lots to do for children and families. Refreshments are available. Perton Spring Festival is a free community event organised by Wild About Perton in collaboration with Perton Library and South Staffordshire Council.

We need your help on the BCGS stand!

**If you can spare some time on the day, or would like further information, please contact
Keith Elder, meetingsecretary@bcgs.info tel: 07477075899**

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.

North Staffordshire Group of the Geologists' Association

Saturday 27 April at 10.30: Mam Tor & Treak Cliff Cavern.

For 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/

Lapworth Museum Events - Keith Palmer Lecture

Wednesday 15 May at 6.00: 'Plumbing the Depths of the Kimmeridge Clay'. Speaker: Dr Steve Etches MBE, with the evening hosted by Professor Alice Roberts, Professor of Public Engagement in Science, University of Birmingham. **Registration for this event is essential.** Venue: Wodensborough Ormiston Academy, Hydes Road, Wednesbury, West Midlands, WS10 0DR. For more information and to register, visit the [Lapworth website](#).

Warwickshire Geological Conservation Group

Wednesday 10 April: Warwick Town Walk and Warwick Museum. Led by Jon Radley.

Wednesday 17 April: 'The Geology of Norway'. Speaker: Chris Darmon (editor 'Down to Earth' magazine & proprietor of 'Geosupplies').



The following events are organised as part of 'GeoWeek in Warwickshire with WGCG 5-12 May 2019'. 'Geoweek' is a new initiative by the British Geological Survey. See: <https://www.bgs.ac.uk/geoweek/>

Sunday 5 May, 10.30 - 4.00: 'Walk 600 million years in 20 minutes at the Brandon Marsh GeoWall'. A geological timeline wall walk. Meet at Brandon Marsh, Warwickshire Wildlife Trust Visitor Centre.

Tuesday 7 May, 11.30 - 4.00: 'Upton House Reveals its Secret Hidden in the Stones'. A geological tour of Upton House and gardens – at various times during the day.

Tuesday 7 May: 'Rock solid evidence that Jurassic Park came to Banbury'. A guided geological tour of Banbury town centre. Meet at the Town Hall for 7.00. No need to book ahead. (approx 1 hour).

Thursday 9 May: Kenilworth Rocks! Meet 'The Stones'. A guided walk of 'The Building Stones of Old Kenilworth'. Meet 2.00, Abbey Fields Car Park – 2 hours parking free with ticket (approx 1½ hours).

Sunday 12 May: 'Gold in them thar hills? Yes! Fool's Gold!' Why are the Burton Dassett Hills there? What's in them? Who dug? When? Why? Are they magnetic? What's that tower for? Meet 10.30 at the car park near the Tower (approx 1-2 hours). All-day parking £2.

Venue for talks: Kenilworth Senior Citizens Club. There is a charge of £2.00 for non-members. For more details visit: <http://www.wgcg.co.uk/> or email: WarwickshireGCG@gmail.com. Meetings start at 7.30 with tea/coffee and biscuits available beforehand from 7.00.

Manchester Geological Association

Thursday 2 May: Ecton Copper Mines. Joint with GeoLancashire.

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

East Midlands Geological Society

Saturday 13 April: 'Derbyshire Blue John Revisited'. Speakers: Dr Tony Waltham and Dr Noel Worley.

Meetings are at 6.00 in the Geography Dept. of Nottingham University, Sir Clive Granger Building. Non-members are welcome. Further info: www.emgs.org.uk or email: secretary@emgs.org.uk

Geological Society, West Midlands Regional Group

Tuesday 9 April: 'Damara geology - from geosyncline to plate tectonics'. Speaker: Nick Watson (Wardell Armstrong LLP).

Tuesday 14 May: 'Continuous Gas Monitoring'. Speaker: Simon Talbot (GGS).

Tuesday 21 May: Building Stones of Birmingham from Centenary Square to Brindley Place. Led by Julie Schroder. Joint BCGS/GeolSoc WM. Evening field trip. See BCGS programme (above, p.3) for details.

Venue for talks: The Birmingham & Midland Institute, 9 Margaret St, B3 3BS, 6.00 for 6.30. For further details please contact the Group Secretary at: geolsoc_wmrg@live.co.uk

Shropshire Geological Society

Wednesday 24 April at 2.00: Grinshill. Leader: Martin Carruthers.

Saturday 18 May at 10.00: The Bog. Leader: Martin Carruthers. Joint meeting with the Shropshire Wildlife Trust.

Booking to reserve a place and obtain joining instructions from Martin Carruthers; email: SGS.Treasurer@hotmail.com; telephone: 01939 233 144. A nominal charge is levied for attendance by non-Members. Further info: www.shropshiregeology.org.uk/

Woolhope Naturalists' Field Club - Geology Section

Thursday 16 May: David Whitehead will lead a walk to investigate the routes of the planned Hereford Southern Relief Road and the Western Bypass.

Saturday 1 June: A visit to the Woolhope Dome led by Rowland Eustace.

Non-members of the Club pay £2. Contact Sue Olver on 01432 761693.
Email: susanolver@hotmail.com or visit: <http://www.woolhopeclub.org.uk/Programme.html>

Mid Wales Geology Club

Wednesday 17 April: FISH - 'The Fossils in Shropshire Project'. Speaker: Daniel Lockett.

Sunday 28 April: Aberedw Rocks. Led by Dick Waters.

Wednesday 15 May: 'Long-term Thinning of the Antarctic Ice-sheet'. Speaker: Prof. Neil Glasser.

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

Teme Valley Geological Society

Monday 29 April: 'Hunting for Traces of Ancient Earthquakes'. Speaker: Dr Lucy Campbell, University of Plymouth.

Monday 13 May: 'Geologies of the Imagination'. Speaker: Dr Will Tattersdill.

Talks are held at 7.30 in the Martley Memorial Hall, on the B4197 by the Sports Ground, Martley. For field trip details and further information contact John Nicklin on 01886 888318 or visit: <http://www.geo-village.eu/> Non-members £3.

Editorial

A full programme of field trips beckons us all to dust off our walking boots for trips to Martley, (Worcestershire), Lydney Cliffs (Gloucestershire), sandstone caves (around Nottingham) and, closer to home, the last of the 3 Birmingham Building Stones walks and a walk round Castle Hill (Dudley). Then we finish with the crowning glory of the field trip season - our long weekend visit to Dorset in September. Hurry to reserve your place! (See p.4 for details).

Indoors, we have one more talk to look forward to this season - an intriguing insight into the post-glacial world of the North Sea around Doggerland. After that there are three events where BCGS will have some representation. Firstly, there is the Perton Science Festival on 18 May where we need some help! (See p.5 for details). Then there is the Black Country Festival in July, and the International Festival of Glass in Stourbridge over the August Bank Holiday weekend. Look out for more details of these events in the next Issue of our Newsletter.

In the meantime please do support your Society in the programme which your representatives have arranged for us all. If transport presents a problem for the more distant trips, please remember to contact Andy. We will always try to help with lifts if we can. Enjoy your summer - and don't forget to tell us about any excursions, holidays or anything geological which might inspire you on your travels. ■

Julie Schroder

Securing our Website

A few years ago Google decided to rank secure sites above insecure ones, and encouraged website owners to move to a more secure position. Many browsers now warn you if you are visiting an insecure site so we thought it would be best to investigate securing our website. When an SSL/TLS certificate is installed on a web server, it enables an encrypted connection between the web server and the browser and also authenticates the identity of the certificate's holder. I found that we could get this certificate free, enabling us to use the HTTPS protocol. This is just the HTTP protocol that we have been using up to now but adding SSL/TLS security. Transport Layer Security (TLS) is the successor to SSL and is a cryptographic protocol that enables secure communications over the Internet. This is what makes the site secure and gives a padlock on each page that you visit.

Now, if anyone uses our website, their transactions over the internet should be safe. It also has the added bonus of making our BCGS email addresses more secure when Committee members login to their Society email addresses using webmail. Have a look at the secure site: <https://bcgs.info>. ■

John Schroder, Webmaster

Annual General Meeting Report

The 2019 AGM was held on Monday 18 March. Below is a summary of the reports and election of officers.

Treasurer's Report

The Treasurer circulated the audited financial statement for 2018. There was a slight reduction in membership subscriptions compared to the previous year; however, the accounts remained in a healthy state. A cost for catering from the Members' Evening was incurred as this had been moved into 2018 after being cancelled due to snow in December 2017. It was pointed out that falling subscriptions had resulted in a slight deficit that was eating into the Society's reserves. A question was then raised as to whether membership costs should be increased. However, it was decided to keep membership costs as they were for the time being. 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. 2018 had been another busy year and 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 after Roy Starkey stood down as Indoor Meetings Secretary, Alan Clewlow continued in the interim until Keith Elder took over, bringing with him energy and ideas for developing the programme in new directions.

The Chairman thanked all the Committee for their support, especially those involved in publicising the Society – the newsletter, website, and social media accounts. He encouraged members to take a more active role in attending field events and getting involved in and shaping the BCGS programme for 2019.

The Black Country UNESCO Global Geopark bid was reported as entering the final submission stages prior to going through the scrutineering process. It was noted that during 2019, BCGS will be involved in events such as the Black Country Festival (July) and the International Festival of Glass (August Bank Holiday).

Election of Officers

Members of the Committee had offered themselves for re-election and it was 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: Keith Elder; Newsletter Editor: Julie Schroder; Webmaster: John Schroder;
Social Media: Peter Purewal, Christopher Broughton, Robyn Amos;
Other member: Bob Bucki.

It was agreed that Davena Dyball be asked to audit the accounts for next year's AGM. ■

Andy Harrison and John Schroder

A Tour to the North of England from 27 August to 18 September 1849 The Diary of Richard Bissell Prosser

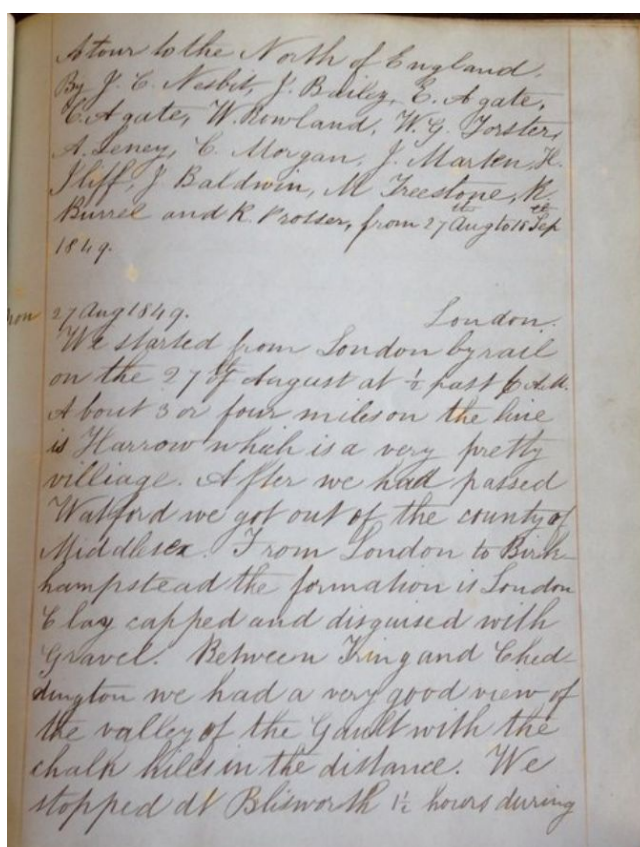
Anyone who hasn't come across this fascinating account of an 1849 tour of the midlands and the north might find it interesting. It describes an extensive tour by a group of schoolboys and their teachers, visiting geological features, museums, exhibitions and numerous factories to see a range of industrial processes in operation. The account, by schoolboy Richard Bissell Prosser (no relation of mine, as far as I know) can be read at [*https://prossertheengineer.com/images/PDF/A_Tour_to_the_North.pdf](https://prossertheengineer.com/images/PDF/A_Tour_to_the_North.pdf) (Copyright © 2016, John & Susan Darby). Most importantly, the itinerary includes both Birmingham and Dudley, with mention of a lecture from a certain geologist called Murchison.

In short, on 27 August 1849, two days after his eleventh birthday, Richard Bissell Prosser and eleven other pupils from a boarding school in Kennington, London, embarked on a three week tour of the 'North of England'. The tour, led by an enlightened master, one John Collis Nesbit (1818 - 1862) a scientist specialising in agricultural chemistry, was to be an intensive formative experience, which must have been remembered by the boys for the rest of their lives.

The carefully planned 'tour' commenced in the Derbyshire Peak District where the group spent their first week lodging in Matlock. On long walks the boys studied the local geology, collected fossils and visited several mines. On 4 September the party left Matlock journeying north by carriage to Castleton where it stayed two nights in this village in the High Peaks of Derbyshire; again mines were visited as well as spectacular caves. The next destination was Manchester where a week was spent touring numerous manufactories. On 13 September, the group took an omnibus to the Liverpool and Manchester Railway Station and then travelled by train to Liverpool. They then travelled by train to Birmingham, where after visiting 'the exposition', they were taken to King's Norton,

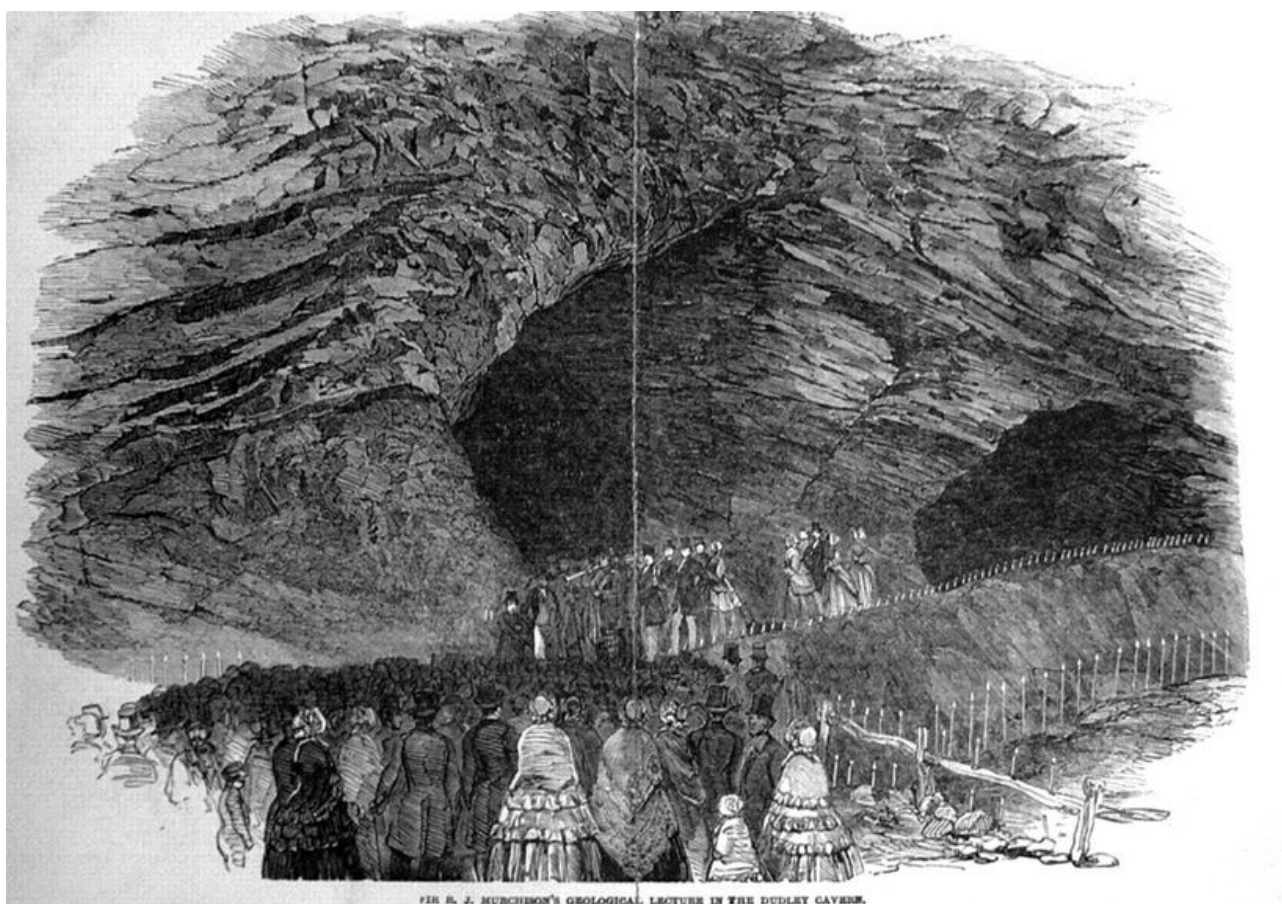
where the Prosser family home, High House, was situated. The 'exposition' was almost certainly the 1849 Exhibition of the Manufactures of Birmingham and the Midland Counties that was held in the grounds of Bingley House on Broad Street. The twelve boys and the two school masters stayed with the Prosser family at High House for the next four nights; their time there spent going on an outing to Dudley and visiting yet more manufacturers, including a works owned by Richard Prosser (young Richard's father) which made tubes, and a paper mill owned by the father of another pupil. On 18 September the adventure ended and the boys returned by train from Birmingham to London, but not before they had toured Birmingham's Town Hall and the Philosophical Institution.

Richard Bissell Prosser's diary entries, included in the PDF link above, includes the following entry about Dudley and Birmingham: ►



Saturday 15 Sept King's Norton.

'We got into an omnibus and proceeded towards Dudley; we did not go through the town of Birmingham but only on the outskirts of it; on approaching towards Dudley the district was very smoky and there were great many coal pits about; when we arrived at Dudley we put up the omnibus at an inn and walked to the castle which is now in ruins but the gateway is in a tolerable state of preservation; we then walked to the cavern there was a great crush to get in, and it was splendidly illuminated, Sir Roderick Murchison F.G.S. had gathered together a number of people in a wide place in the cavern and was giving them a lecture on the Geology of the neighbourhood of Dudley, three of us having missed J. C. Nesbit came out with Mr Prosser and Miss Potter and ordered dinner to be brought up to the castle which when we had finished we took a cab to the Wren's Nest to try to find the others and on our way we met J. C. Nesbit.'



Sir R.I. Murchison's lecture in the Dudley Caverns, 15th September 1849. (From the Illustrated London News)

In short, this is a fascinating account of industrial activity in the 'north' (including Birmingham) at this time in history, providing an insight to the importance of geology and the industrial activities taking place in Birmingham and the Black Country at this time. ■

Dr Colin Prosser, Natural England

*<https://prossertheengineer.com/> is the web address for the full web site, with other stories about RBP the elder. Ed.

BCGS Geoconservation Season October 2018 to March 2019

The 2018-2019 geoconservation season saw BCGS members actively involved with vegetation and exposure clearance at Wren's Nest, Saltwells Local Nature Reserve (LNR), the Lickey Hills Country Park and Barrow Hill LNR. The season should have started with a session at Portway Hill, Rowley on Saturday 6th October; however, the visit was cancelled due to bad weather.

Wren's Nest - Saturday 3 November 2018 and Saturday 16 February 2019

Members visited Wren's Nest on two occasions this season. Both sessions concentrated on two trench sections running along the Reserve's eastern edge. Reserve wardens Ian Beech and Rob Earnshaw coordinated the works and provided tea and biscuits for refreshments on both days. Conditions were cool and gloomy during our November visit, but fine weather accompanied our February session.



The Wardens have found that the visiting public appear to prefer the Reserve's more established and open parts rather than the eastern edge, which had become largely neglected and overgrown with trees and undergrowth. Recently, the wardens have been focusing on opening up this area. This has revealed hidden exposures, encouraging floral and faunal diversity whilst providing an attractive area for visitors.

The first visit concentrated on the inner trench where the Lower Quarried Member had been removed. Exposures forming the western trench wall revealed the Transition Beds, grading into the underlying Coalbrookdale Formation. Forming the eastern wall was the overlying Nodular Member. Having been largely overgrown, dark, and largely ignored, this location has not been picked over for fossils. Members had an opportunity to do some fossil hunting during the session and discovered some very interesting brachiopod and coral examples. These included a rare square rugose coral, *Goniophyllum pyramidale*, located within the Transition Beds on the western side of the trench.

For the second (February 2019) visit, members concentrated on a section of the outer trench where the Upper Quarried Limestone had been removed. Since our November visit the Reserve wardens had continued to clear the inner trench revealing good exposures and further interesting fossil finds. A short perpendicular cut connecting the inner and outer trenches reveals a good exposure through the Nodular Member, which is exposed within the western wall of the outer trench. A low lying heavily overgrown bund relating to the poorly exposed Lower Elton Member forms the trench's eastern wall. The exposed Nodular Member limestone layers revealed another interesting array of largely untouched fossils including corals, bryozoans, crinoid platelets, brachiopods and other molluscs including *Tentaculites ornatus*. ►



Square rugose coral, *Goniophyllum pyramidale*

Saltwells LNR (Doulton's Claypit) – Saturday 1 December 2018

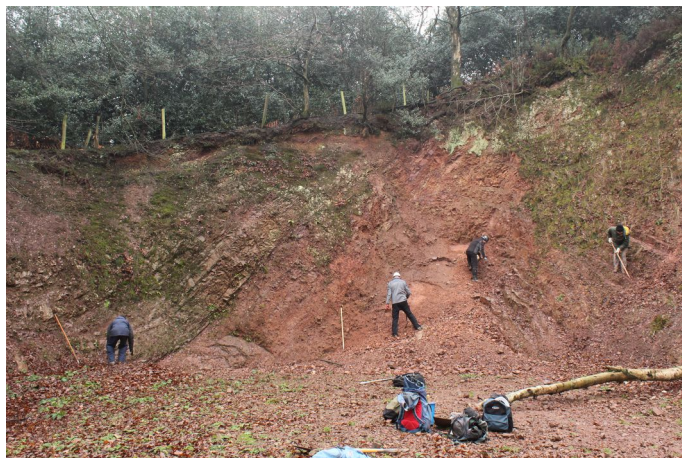
The day started gloomy, but soon brightened up. Members aided Tom Weaver, the Reserve's warden, clearing saplings, scrub and soil from the Coal Measures exposures in the base of Doulton's Claypit. Mostly exposed was a uniformly layered, cross-bedded fluvial sandstone that also contained interbedded mudstone and shale layers with ironstone concretions. The wardens and associated friends' groups have been working hard to open up Doulton's Claypit to create new wildlife habitats, including heathland, woodland, wetlands and ponds to improve the



location's biodiversity. New paths cut their way through the Claypit bottom, revealing a stark contrast between the new and ancient environments. Conservation works are proving very successful. Numerous birds, insect and floral species have been spotted including the hybrid Common Spotted/Southern Marsh orchids, for which the Claypit is well known.

The Lickey Hills Country Park (Barnt Green Road Quarry) – Sunday 20 January 2019

BCGS members joined the Lickey Hills Geo-Champions to start 2019 with a clearance session in the Barnt Green Road Quarry. We met at 10.30 at the Lickey Hills Visitor Centre, Warren Lane and after collecting tools made our way to the Quarry.



Cold, calm and gloomy conditions accompanied our endeavours in the quarry, which involved cleaning the exposures first cleared in 2010 using a long reach excavator and high-pressure hoses. Since then, the Lickey Hills Geo-Champions with help from various conservation groups have battled hard to keep the exposures clear of vegetation, plus soil and scree washed down from further up the rock faces. However, this is an ongoing battle. The Lickey Quartzite layers show heavy folding, fracturing, faulting and inter-bedding with clay

layers. Over the years the Lickey Hills team have attempted to interpret what is going on within these rocks, but many questions still remain unanswered.

Barrow Hill LNR (East Quarry) – Saturday 2 March 2019

The 2018-2019 geoconservation season ended with a well-needed return to Dudley's own volcano at Barrow Hill LNR. Members met at 10.30 on Vicarage Lane outside St. Mark's Church and were subjected to cloudy conditions with clear spells throughout the day.

Efforts focussed on clearing saplings and scrub from the East Quarry's left-hand arm, the north face of which contains dolerite exposures with vertical columnar joints resulting from thermal shrinking. ►

The southern face contains dolerite tongues that have intruded into the Etruria Marl, baking it to give a terracotta appearance. The published Barrow Hill Volcano leaflet describes a dark purple or pale reaction zone defining the actual dolerite/marl contact. The original Etruria Marl is believed to have been wet and waterlogged, thus rapidly cooling the intruding hot doleritic magma. Evidence for this is seen from the relatively limited extent to which the Etruria Marl was altered. In places the dolerite churned up the Etruria Marl, giving the exposure a rubbly appearance. The exposure also contains thermal joints that formed whilst the dolerite cooled, and these have been infilled with churned up rubble. Rising hydrothermal fluids later deposited white calcite to form veins running through the infilling rubble.



Rubble and calcite filled crack

Blooming flowers, blossom and budding flora hinting at approaching spring, brought our conservation season to a close; emerging vegetation acting as a reminder that the clearance work in places such as Barrow Hill is ongoing and needs to be managed in order to protect these sites. ■

Andy Harrison

Mike's Musings No. 20

Silicates: the Overlooked Minerals? Part 1

Ask most people to name half a dozen minerals and it's quite probable that conspicuous by their absence will be any mention (*quartz* excepted) of members of a rather important group commonly referred to as the '**rock-forming minerals**'. As this name suggests, they are quite fundamental to our everyday existence: they literally support us, and feed into many of the things that we build or manufacture.

My suspicion is that most people would first think of things like *calcite*, *pyrites* or *fluorspar* (and, OK, probably *quartz* as well) when asked that question, completely overlooking the fact that the Earth's crust is composed primarily of oxygen (47%) and silica (28%). These are, of course, precisely the elements of which *quartz* (or sand!) is composed, and indeed the other abundant silicate minerals that form the greater part of 'our solid Earth'. (See *front cover for examples of Mike's vast and colourful sand collection! Ed.*)

When I was a student, the 'must-have' mineralogy text-books were Rutley's 'Elements of Mineralogy' and the fairly modest single volume of 'Introduction to the Rock Forming Minerals' by Deer, Howie and Zussman. The former has since gone through a couple of new editions with minor revisions whilst the latter has expanded to five volumes (all of which now come in two, or even three, parts), and occupies half a shelf in my local university library. ►

Most Abundant Elements of Earth's Crust	Approximate % by weight
O	46.6
Si	27.7
Al	8.1
Fe	5.0
Ca	3.6
Na	2.8
K	2.6
Mg	1.5

From Wikipedia

Whether they are still an essential read for the modern undergraduate I doubt (how could you absorb so much detail, and why would you want to anyway!). But it makes the point that the **'rock-formers'** are of such importance that much work has obviously been done on them to expand these volumes to such a degree.

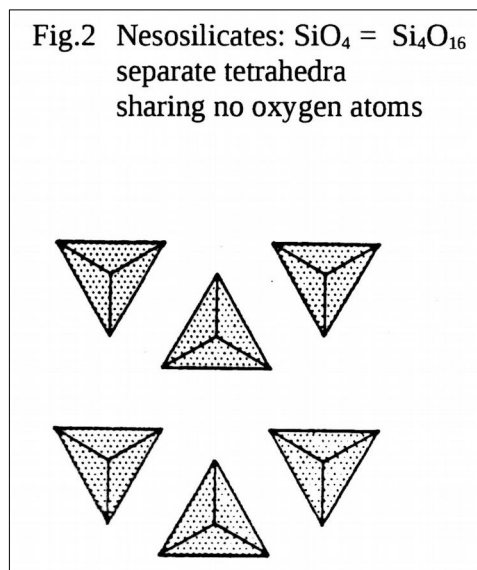
Whilst much of the detail is of purely academic interest, the basic stuff is not without some general interest. These **'rock-formers'** can be broadly divided into five groups based on a particular feature of their fundamental atomic structures. I can see many people switching off here and picking up the local newspaper or a good novel for some light relief, but bear with me a little further and I hope to show that the mention of atomic structure isn't half as daunting, or indeed boring, as it might sound. However, I can't pretend that things won't get a little complicated.

It is well known that carbon and hydrogen can bond in different ways to produce a whole galaxy of organic compounds. In particular, carbon is especially adept at forming multiple bonds (polymerization), with repeat patterns of C-H units. Silicon can behave in a similar fashion, but to a far lesser extent, when combining with oxygen. This forms the basis of the different silicate structures seen amongst the **'rock-formers'**, in which the basic ratio of Si:O (silicon to oxygen) atoms varies from one group to the next.

The way in which silicon and oxygen (or indeed any other) atoms 'fit together' is largely controlled by their respective sizes. It happens that silicon and oxygen fit together most conveniently by arranging 4 oxygen atoms at the four corners of a regular tetrahedron (**Fig.1**: think of those pyramid-like tea-bags some brands manufacture, with the silicon atom at the centre of 'the bag').

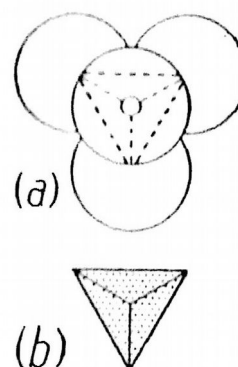
With that shape in mind, it is easy to see that the Si:O ratio is 1:4 (or 4:16 - expressing the ratio as if there were 4 silicon atoms makes comparisons between mineral groups clearer, as will become apparent).

To test your patience further, the nomenclature presented in Deer, Howie and Zussman's volumes is different from that used in another famous textbook from my university days: 'The Principles of Physical Geology' by Arthur Holmes (the 'bible' for geology students).



Anyway, the simplest starting point is to consider **'orthosilicate'** (ortho = upright) minerals with a structural basis of entirely separate (SiO_4) tetrahedral units (**Fig.1**). Happily there are two familiar mineral families that are built in this way, *olivine* and *garnet*. Deer, Howie and Zussman volume 1A spends 333 pages on *olivine*, with 52 pages listing over 1600 references (so much for 'simple')! *Zircon* and *topaz* are two further members of these **'nesosilicates'**, as Holmes calls them (**Fig.2**). The prefix 'neso' comes from the Greek: 'an island' referring to the fact that the separate tetrahedral units are bound together by **other** atoms, and are not directly linked to each other - **there is no sharing of oxygen atoms** between tetrahedra. ►

**Fig.1 a) Basic tetrahedron - SiO_4 (atoms roughly to scale)
b) Diagrammatic representation as used in other figures**

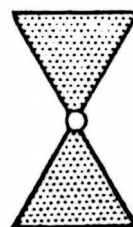


That last thought is the key to where the discussion now proceeds.

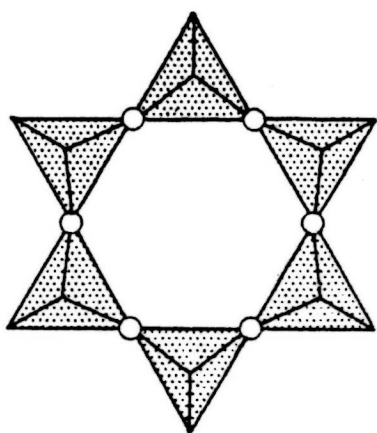
Let us now consider two adjacent tetrahedra, producing Deer, Howie and Zussman's group of '**disilicates**' (di = two). In these, **one of the oxygen atoms is shared**, so we can see that the base unit transforms from SiO_4 to $\text{SiO}_{3.5}$ (or Si_4O_{16} to Si_4O_{14}). There are no common minerals with such a 'double-tetrahedron' structure (**Fig.3**), but they do exist (e.g. *melilite*). Holmes refers to them as the '**sorosilicates**' (soros = a group).

There are also minerals that 'mix and match' between structural units, containing both single and double tetrahedral units. *Epidote* is an example of this fusion between '**neso-**' and '**soro-**' silicates, though the Si:O ratio doesn't quite fit the numerical trend that will be established as we look at further groups. Perhaps lumping them all into a single group (the **orthosilicates**) has some advantage!

**Fig.3 Sorosilicates: $\text{Si}_2\text{O}_7 = \text{Si}_4\text{O}_{14}$
pair of tetrahedra
sharing 1 oxygen atom**



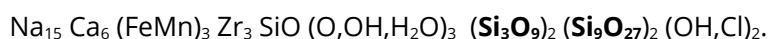
**Fig.4 Cyclosilicates: $\text{Si}_6\text{O}_{18} = \text{Si}_4\text{O}_{12}$
ring of 6 (or 3,4,9 etc.) tetrahedra
each sharing 1 oxygen atom**



Next, it won't surprise you to find that in some minerals **two oxygen atoms are shared** between adjacent tetrahedra. But there are three ways in which this can be achieved. One way involves linking tetrahedra to build up rings of either 3, 4, 6 (**Fig.4**) or larger multiples of tetrahedra. This gives us Deer, Howie and Zussman's '**ring-silicates**', which Holmes refers to as '**cyclosilicates**' (cyclos = a circle). The best known examples are *beryl* (including the varieties *emerald* and *aquamarine*) and *tourmaline* with 6 tetrahedra, and *axinite* with 4 tetrahedra. In these cases each silicon atom is always linked to 3 oxygen atoms, with the base unit stated as SiO_3 (or Si_4O_{12}).

To ensure that you look forward to the second part of this article, I'll leave you with nature in mischievous mood in producing the mineral *eudialyte*. This once again mixes things up, with rings

of both 3 and 9 tetrahedra, having a formula (one of many versions!) to stretch the mind to breaking point. One does wonder how such formulae are worked out, but here goes!



Other versions allow for further minor constituents such as fluorine, titanium, niobium, and various rare earth elements. On the plus side, *eudialyte* is remarkable for its strikingly deep crimson-red-pink colour, in contrast to the many silicate minerals that are either colourless or just 'boringly' white. ■

Mike Allen

Reference: Figures 1-4 from '*The Principles of Geology*' by Arthur Holmes, 1944.
Part 2 will follow in the next issue of the Newsletter. Ed.