



# Newsletter No. 296

## April 2026

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To find out more, read on!

Copy date for the  
next Newsletter is  
Monday 1 June



<p><b>Mark Jeffs</b> <b>Honorary Secretary,</b></p> <p><a href="mailto:honsec@bcgs.info">honsec@bcgs.info</a></p>	<p><b>Andy Harrison,</b> <b>Field Secretary,</b></p> <p>☎ 07973 330706</p> <p><a href="mailto:fieldsecretary@bcgs.info">fieldsecretary@bcgs.info</a></p>	<p><b>Julie Schroder,</b> <b>Newsletter Editor,</b></p> <p>42 Billesley Lane, Moseley, Birmingham, B13 9QS.</p> <p>☎ 0121 449 2407</p> <p><a href="mailto:newsletter@bcgs.info">newsletter@bcgs.info</a></p>
<p>For enquiries about field and geoconservation meetings please contact the Field Secretary.  <b>Please notify Andy Harrison in advance if you will be attending these events.</b>          To submit items for the Newsletter please contact the Newsletter Editor.  <b>For all other business and enquiries please contact the Honorary Secretary.</b>          For more information see our website: <a href="http://bcgs.info">bcgs.info</a>, <a href="#">YouTube</a>, Twitter: <a href="#">@BCGeoSoc</a> and <a href="#">Facebook</a>.</p>		

## Future Programme

**Indoor meetings are now held in the Lamp Tavern, 116 High St, Dudley, DY1 1QT  
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.*

**Saturday 11 April (Field Meeting): Visit to the Ercall Quarries, Shropshire.** Leader: David C Smith (SGS). Park and meet at the Wrekin Forest Glen Car Park at 10.15 for a 10.30 start. Grid ref: SJ638092. Nearest PC: TF6 5AL. Parking charges apply (£4 all day). Alternative parking up the road at the Buckatree Hotel, grid ref: SJ640097. Or park on the roadside. Directions: from the M54, Junction 7, take the Holyhead Road (B5061) south towards the Wrekin (signposted less than a mile). Turn right at T-junction. The car park is immediately on the left. We will spend the day looking at the Wrekin Quartzite and unconformities with the underlying Precambrian Uriconian Volcanics within the Ercall Quarry Nature Reserve. Lunch will be at the Buckatree Hotel. Either have food from the hotel or bring a packed lunch. Wear suitable outdoor clothing for the weather conditions. We will aim to finish this trip around 3.30-4.00.

**Monday 20 April (Indoor Meeting): 'How geology made the Potteries'.** Speaker: Bernard Besly (*Retired Independent Consultant - Keele, Staffordshire*). Geology played an important part in the industrial and urban development of North Staffordshire. Workable clays occurring with hot burning, long-flame coal gave the early potters a unique set of resources. But why did this happen in North Staffordshire? What is so special about the clay? What is 'long-flame coal' and why was it important for the pottery industry? Did any other geological circumstances lead to dominance of the Stoke area? This talk intends to address some of these questions with reference to the wider geological history and context. (*For biographical details and the full talk abstract, see the Programme of Events on the website.*)

**Perton Library Science Fair -  
Saturday 9 May, 10.00 – 3.00  
Severn Drive, Perton, WV6 7QU**

BCGS will have a stand at the Science Fair and we will be promoting ourselves in the usual way with free leaflets, specimens to look at and a display. We've been asked to highlight the local glacial erratics, so the display will be featuring our recent involvement with the Birmingham Glacial Erratics project, and our more recent activities at Wightwick Manor and The Mount Hotel.

Come and visit our stand and enjoy the Science Fair – and don't miss the

**Perton Glacial Erratic Boulder**

The Perton erratic boulder has been put to good use as an RAF War Memorial and is only a few hundred metres away from Perton library, at the far corner of the Perton Centre car park off Severn Street (*see website for map*).

**Saturday 9 May (Geoconservation Morning): Smestow Valley.** Leaders: Smestow Valley Local Nature Reserve Wardens and Friends of Smestow Valley. Meet at Smestow Valley Local Nature Reserve, Meadow View Terrace, Wolverhampton WV6 8NX (Grid ref: SO 891 999), 9.45 for a 10.00 start. This event is for members of BCGS and the 'Friends of Smestow Local Nature Reserve' to undertake some clearance work of rock faces in the quarries and walk the Reserve whilst discussing future geoconservation possibilities at the site. Wear suitable outdoor clothing for the weather and vegetation conditions. Please bring thick gloves and loppers / cutting tools / long arm clippers. The Friends and Wardens can provide some hand tools. We will aim to finish this session around 12.30. Either bring a packed lunch or you can purchase lunch locally.

**NB:** This activity clashes with the Perton Library Science Fair which is just 4 miles away. After the morning's geoconservation session, why not visit the Science Fair in the afternoon? (*It closes at 3.00.*)

**Saturday 13 June (Field Meeting): Dudley Museum and Archive.** Leader Graham Worton. Details TBC.

**Sunday 5 July (Field Meeting): Burton Dassett, Warwickshire.** Leader Ray Pratt. Joint event with the Warwickshire Geological Conservation Group. Details TBC.

**Saturday 25 July (Field Meeting): Bewdley Museum and Bewdley.** Leaders Liz Cowley and Andrew Harrison. Details TBC.

## Other Societies and Events

### Lapworth Lecture

**Monday 11 May from 5.30 to 6.30: 'A journey to ancient Antarctica'.** Speaker: Dr Saurav Dutta. Dr. Dutta will present the latest findings and explore how geochemical records from fossil shells are revealing the pace and magnitude of climate change during the Eocene-Oligocene transition 34 million years ago.

Venue: Lecture Theatre WG12, (Aston Webb Dome & Semi-Circle, University of Birmingham, Edgbaston, Birmingham, B15 2TT). The lecture is free to attend and open to everyone, and is available to attend in-person on campus or on Zoom. For more information: <https://www.birmingham.ac.uk/facilities/lapworth-museum/events>

### Mid Wales Geology Club

**Wednesday 15 April: 'Oily Olivine'.** Speaker: Roy McGurn.

**Wednesday 20 May: 'The Geology of Antarctica: a personal Journey'.** Guest Speaker: James Cresswell.

Further information: Web: <http://midwalesgeology.org.uk> lectures start at 7.15 and are a hybrid of in-person meetings at Plas Dolerw, Newtown, SY16 2EH and via Zoom. Those wishing to join a meeting remotely should contact the secretary, Chris Simpson, at [christopher\\_s@btinternet.com](mailto:christopher_s@btinternet.com)

### Teme Valley Geological Society

**Monday 27 April 7.30: 'Ledbury Railway Cutting and the Passage Beds'.** Speaker: Rosie Watkins.

Talks take place in Martley Memorial Hall at 7.30 and some take place on Zoom. Non-members £3. For further information email: [enquire@geo-village.org](mailto:enquire@geo-village.org) or visit: <https://geo-village.org/>

### Shropshire Geological Society

**Wednesday 13 May: 'Geology of the Mantle'.** Speaker: Prof Johan Lissenberg (University of Cardiff).

Meetings commence at 7.00 for 7.15. Lectures are now being held in hybrid form, in-person at the The Methodist Centre, Lansdowne Rd, Bayston Hill, Shrewsbury SY3 0HZ, and on Zoom. If you wish to attend please contact Albert Benghiat: 07710 421 581, email: [SGS.chair@hotmail.com](mailto:SGS.chair@hotmail.com)  
Further information: <https://shropshiregeology.org.uk/>

## Warwickshire Geological Conservation Group

**Thursday 16 April: 'Geoconservation'**. Speaker: Dr Colin Prosser (Colin recently left Natural England after 37 years working in geoconservation).

**Thursday 14 May: 'The Geology of Shropshire'**. Speaker: Martin Whiteley. A Zoom only event.

**Sunday 24 May at 10.30 until 1.00: Solihull Urban Geology Trail.** Led by Ray Pratt.

For lectures please join us in person if you can, or register to attend virtually via Zoom 7.30 – 9.00. St Francis Of Assisi RC Church, 110 Warwick Rd, Kenilworth, CV8 1HL. There is a charge of £2.00 for non-members. For more information visit: <https://www.wgcg.co.uk/> or email: [WarwickshireGCG@gmail.com](mailto:WarwickshireGCG@gmail.com).

## North Staffordshire Group of the Geologists' Association

**Sunday 26 April at 10.00: 'Lathkill Dale, Derbyshire'** led by Prof. Vanessa Banks (BGS). Joint trip with EMGS. Start at Alport Bridge (River Lathkill near Youlgreave). After looking at the Alport tufa, we will follow the valley upstream to Over Haddon, exploring the interplay between bedrock and superficial geology, mining and hydrology. After a lunch stop in Over Haddon, we will return to Alport, considering the role of hydrology in landscape incision. Parking, toilets and pub facilities in Over Haddon and Youlgreave. Limited parking at Alport. Bring warm, waterproof clothing and walking boots.

If you would like to attend this field excursion contact our field secretary Steve Alcock for registration details: [steves261@aol.com](mailto:steves261@aol.com). Tel.07711 501028. 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 more info. go to: <https://nsgga.org/>

## East Midlands Geological Society

**Saturday 11 April at 6.00: 'Hunting dinosaurs from space'**. Speaker: Professor David Martill. This talk discusses the nature of the Cretaceous age Kem Kem Group of Morocco, famed for its assemblage of dinosaur remains, and how it has been possible to prospect for its fossils using space age technology that was unavailable just two decades ago.

**Sunday 26 April at 10.00: Lathkill Dale, Derbyshire** led by Prof. Vanessa Banks (BGS). Joint trip with NSGGA, please see above for details.

Lectures are from 6.00 to 7.00, and are normally held in the School of Geography Sir Clive Granger Building on the Nottingham University Park campus. Non-members are welcome at all of our lectures and attendance is free of charge. Please note that payment is now required for car parking in the Main University Visitors Car Park on Saturday evenings. Further info: [www.emgs.org.uk](http://www.emgs.org.uk)

## Editorial

It's a long time since we had a stand at an external event, so our presence at the forthcoming Perton Library Science Fair is definitely something to look forward to. The original request was for a display about glacial erratics, and this will be the main feature - but we have lots more to offer! We will have the usual BCGS display materials with samples to show to visitors, and free leaflets to hand out. We have a small group of volunteers now, but if anyone else wants to help, please contact the Honorary Secretary at the address above.

We have one more indoor meeting this season, on the subject of the Geology of the Potteries, to be presented by Bernard Besly. Once again I'd like to thank our treasurer, Alan Clewlow for his continuing efforts to fulfil the role of Meetings Secretary and bring us such an interesting and varied programme of indoor meetings, though he has expressed a wish for someone else to take on this job. Please think about this – could you take on this role? We'd love to have a few more people on the committee if the Society is to continue to thrive!

We hope as many of you as possible will be supporting our programme of events through the summer months, with some close to home and some further afield though still within the Midlands (*see the Programme of Events above*).

Enjoy the Newsletter and the summer programme – and please get in touch with me if you have any items of geological interest for the Newsletter: [newsletter@bcgs.info](mailto:newsletter@bcgs.info) ■

*Julie Schroder*

## Field Meeting Report

**Saturday 30 August 2025: Smestow Valley Local Nature Reserve (LNR),**

**Saturday 14 February 2026: Smestow Valley Local Nature Reserve (LNR) plus Wightwick Manor and The Mount, Tettenhall.**

### **Smestow Valley**

#### **Background to the Smestow Valley Local Nature Reserve (LNR)**

The Smestow Valley Local Nature Reserve (LNR) is a pioneering Lottery funded project, set up by Wolverhampton City Council, to 'Explore, Enhance, Protect and Promote Smestow Valley'. Currently in the design phase, the reserve is looked after by a team of wardens headed by Catherine Perry, Project Manager, and Jordan Ferguson, Conservation Officer. The project's aim has been to promote the reserve's natural history and industrial heritage to the wider public with the aid and support of a local Friends Group, the Wildlife Trust and the nearby Wildlife Activity Centre.

Located off Henwood Road (B4161), the LNR is situated approximately 3km west of Wolverhampton City Centre. Roughly triangular in plan and approximately 4.5km long, the LNR stretches from Newbridge in the north-east, to Castlecroft in the south-west and covers around 52 hectares (120 acres). Access is gained from Henwood Road at the Newbridge end, via a car park and small array of commercial businesses that include the Cupcake Lane Café, situated within the former Wombourne Railway station waiting rooms. ►

Along the LNR's northern boundary flows the Smestow Brook on its way southwards to intersect with the River Stour at Prestwood, near Kinver. Adjacent, and almost parallel, to the brook is the Staffordshire and Worcestershire Canal. An embankment that historically carried the South Staffordshire Railway runs along the LNR's southern boundary and today forms a walking and cycle path that stretches from Castlecroft towards Himley, via Wombourne (part of the long-distance National Cycle Route 81).

Within its north-east half, between Newbridge and Compton, the LNR is restricted to a narrow strip of land, but fans out to include more ground in the south-west, between Compton and Castlecroft. It lies within a relatively flat, low-lying landscape forming the Smestow Brook floodplain at around 100m Above Ordnance Datum (100m AOD). To the north-west, beyond Henwood Road (and its continuation, Bridgnorth Road, A454), the ground rises very sharply towards Tettenhall and Tettenhall Wood to around 140m AOD at the Tettenhall Ridge. South-west of the brook and canal, the landscape rises more gently towards Finchfield, Merridale and Bradmore at around 140m AOD.



*Smestow Valley, rising more gently to the south*

### History of the Smestow Valley

In Roman times the local area was an important and strategic location and a fortified Roman settlement has been recorded not far away at Greensforge. The area was cleared and used for agriculture during Anglo-Saxon times and from the Middle Ages became an important centre for producing iron. An information board, located within the Meadows forming the southern part of the LNR, proudly boasts this as the site of the Battle of Tettenhall. The battle took place in August 910, when combined Anglo-Saxon (Mercian and Wessex) forces defeated a Northumbrian Viking army returning from sacking Bridgnorth. Not only was the battle a major turning point in English history, but it is also believed, amongst other things, to have inspired Tolkien and for his literary creation of the 'Hobbits'.



*Staffordshire and Worcestershire Canal in the LNR*

Prior to the Industrial Revolution, many iron mills became established around the lower parts of the Smestow Brook and River Stour. The water was used for cooling and powering machinery. Charcoal was sourced from the nearby Kinver and Wyre Forests. Its iron heritage is what led to the brook's name, *Smetheslall* or *Smethestalle*, meaning 'Place of Smiths', which has Anglo-Saxon origins but was not written down until the 14th Century.

Iron production was thriving when James Brindley built the Staffordshire and Worcestershire Canal, around 1771, to connect the River Severn with the Trent to the north. The South Staffordshire railway came along in 1847 and connected Dudley to Lichfield via Walsall. Both transport routes cross over each other through the LNR and despite various pressures and competition bringing about their disuse, today they survive as recreational boating, ►

walking and cycling routes. Historical maps, dated from around 1900, show that the southern end of the LNR was historically quarried for sand and the resultant pits later used for landfill. The sand from the LNR quarries was used as moulding sand for casting the iron.

### Geology of the Smestow Valley

Published British Geological Survey (BGS) information shows the former quarries as artificial 'Made Ground'. This ground also follows the route of the railway northwards through the LNR and is associated with the former railway embankment. Historical BGS borehole records show that within the former quarries, the 'Made Ground' reaches over 8m in thickness. Superficial Devensian glacial till (formerly known as boulder clay) covers much of the LNR and the underlying bedrock is shown as sandstone strata belonging to the Wildmoor Sandstone Member (252Ma to 247Ma). This dates from the early Triassic Period, and formed from fluvial and aeolian processes under hot and semi-arid conditions. It was this stratum that was historically worked for moulding sand for casting iron.



*Helsby Sandstone blocks in a wall*

Immediately to the north, underlying the Tettenhall Ridge, are sandstone strata belonging to the later Triassic 'Helsby Sandstone Formation' (formerly known as the Bromsgrove Sandstone Formation or the Keuper Sandstone). This is from the Anisian Age (247Ma to 241Ma), and this stratum lies unconformably over the Wildmoor Sandstone Member, and comprises 'fine- to medium-grained, locally micaceous, cross-bedded and flat-bedded sandstones', deposited under fluvial and aeolian conditions.

Local topography and geology have heavily influenced the layout of the LNR, the course of the Smestow Brook, the Staffordshire and Worcestershire Canal, the South Staffordshire Railway and the area's history. To the north-east, beyond the LNR, the landscape remains confined as a narrow strip up to Aldersley and Dunstall Park. This narrow strip contains a valley which forms an important topographical feature. It is a glacial meltwater channel carved into the former Triassic landscape following glacial retreat at the end of the last (Devensian) Ice Age. As the Ice retreated it left behind the superficial gravelly and sandy clay-rich glacial till deposits which contain boulders, or glacial erratics, derived mostly from the Lake District and Scotland. It was through these deposits, into the bedrock beneath, that the course of the Smestow Brook was carved before being slightly modified by human activity in the 18th, 19th and 20th centuries. Today, the Smestow Valley LNR forms a diverse landscape of meadows, scrub, woodland, wetlands and waterways with a rich biodiversity of plants and animals, all influenced by the lie of the land and underlying geodiversity.

### BCGS visits to the Smestow Valley LNR

BCGS members undertook their first visit to the reserve on Saturday 30 August 2025 and a second on 14 February 2026. The aim of the first visit was to become acquainted with the LNR's wardens and various volunteers, and the second visit was to meet members of the Friends Group. Both visits involved a walk starting from the LNR entrance, at the Cupcake Café, and proceeding southwards along the Staffordshire and Worcestershire Canal. Part way along at Warren Truss Bridge (locally known as the 'Meccano Bridge') we switched to the former South Staffordshire Railway walking/cycle path and continued to Compton Locks. Beyond the locks, we followed various paths and trails through the ►

meadows and woodlands that form the southern end of the LNR, before returning via the former South Staffordshire Railway path to the Cupcake Café.

These visits provided an important opportunity for BCGS members to help the Wardens and Friends Group, by identifying and providing information about known geological features within the LNR. The visits also aimed to identify potential opportunities for BCGS to aid with future conservation works.



*The 'Meccano Bridge'*

The first geological feature on our walk was situated on a canal bridge close to the LNR entrance. Here, there are two examples of Devensian glacial erratics transported from either Ennerdale/ Eskdale, in the



*Glacial boulder on the bridge*

Lake District, or Scotland around 17,000 years ago. Research has shown that during the Devensian ice advance, glacial ice from the north indirectly passed through the Irish Sea and dredged up seabed material along the way. This is evidenced by the presence of turrillid gastropod shells found within the glacial till.

A short way along the canal towpath, we came across a small section of wall comprising sandstone blocks that were likely to have been sourced from nearby quarries working the Helsby Sandstone Formation. Further along the canal, just before the 'Meccano Bridge', was an example of where the Smestow Brook had been canalised, its banks built up with rubble comprising concrete, brick and dolerite which was likely to have been sourced from the Rowley Hills.

The LNR spreads out to the south-east of Compton lock. The landscape is relatively flat and low-lying forming the Smestow Brook floodplain and steadily rises towards the south-west in an expanse of meadows and woodland. Looking at historical maps, the meadows located immediately south of the brook identify where the main infilled quarry workings were located. Woodland pockets running centrally through the LNR contain some exposures of glacial deposits and some unworked Wildmoor Sandstone outcrops from the former quarries. Higher flat ground, forming the reserve's south-east corner, is underlain with glacial till and reportedly contains two ponds and more examples of glacial erratics that have yet to be closely examined.



*Wildmoor Sandstone Formation outcrop*

A conservation event, with the wardens and Friends Group, has been organised for 9 May (*see programme above*) when we hope to undertake some exposure clearance within the former quarries, and further explore the reserve for geological features. As a developing project, the LNR and surrounding area have a lot to offer regarding Triassic and glacial geology, potentially offering great opportunities for the involvement of BCGS members. ►

## Glacial Erratics at Wightwick Manor and The Mount Hotel

Following our visit to the Smestow Valley LNR in the morning of 14 February, we moved on to Wightwick Manor where Julie Schroder showed us around the collection of glacial erratics. She has recently been involved with the National Trust team and other BCGS members in cleaning the erratics and learning more about their history. The afternoon finished with a visit to see the newly re-discovered erratics at The Mount Hotel in Tettenhall. The Society last visited Wightwick Manor in March 2010 (*see Newsletter 201, June 2010 and you can read more on the recent work with the glacial erratics at the Wightwick Manor and The Mount in Newsletters 293 and 294, October and December 2025*).

The Mount and Wightwick Manor both belonged to members of the Mander family, who played a significant role in Wolverhampton's history for many generations. Today, Wightwick Manor is a National Trust property, and The Mount is a hotel. The recent research revealed that the boulders had been moved from a former 'bouldery' at The Mount, which had a large collection of glacial erratics established by the owner, Charles Benjamin Mander in the late 1800s. Wightwick Manor was built in the 1880s after the death of Charles B. Mander by Sir Geoffrey Mander's father, Theodore (who belonged to a different branch of the Mander family) and Sir Geoffrey inherited it following his father's death in 1900. It was when The Mount was sold in 1952 that Sir Geoffrey acquired the erratic collection for display at Wightwick Manor.



*Wightwick Manor's arc of erratic boulders*

Our first stop was within the orchard, in the north-west part of Wightwick Manor grounds, to look at the arc of 19 glacial erratics set out by Sir Geoffrey Mander in 1957. These boulders include granite, microgranite, epidotised porphyritic andesite, andesitic tuff, granophyres, epidotised andesitic tuff, Criffel granite and greywacke most of which have been identified as originating from Ennerdale and Eskdale in the Lake District, and Mount Criffel, Galloway, Scotland, in the case of the Criffel Granite. Each boulder has its own identifying plaque. Unfortunately, years of neglect had resulted in the plaques getting moved around and the boulders needed cleaning. With permission sought and granted, Julie was involved with members of BCGS in the cleaning session last year, under the watchful eye of the National Trust team, and Graham was on hand to ensure that the right plaque was placed with the correct boulder.



*The erratic boundary wall at Wightwick Manor*

After looking at the boulders, we went to look at the boundary wall in the north-west corner above the orchard. The walls comprise rounded cobbles and boulders of various lithologies, including limestone and sandstone, but also some that looked distinctly like glacial boulders similar to the granite, granophyre and tuffs seen in the arc of 19 erratic boulders. ►



*Glacial boulders at The Mount Hotel*

From Wightwick Manor, we continued on to The Mount Hotel where, in the hotel's western grounds, stands a very tall, multi-limbed conifer tree. At the conifer's base there are several very large granite and granophyre boulders that most likely represent all that is left of the former bouldery established by C.B. Mander. Hotel staff had recently removed some fallen branches from the tree and given the boulders a good clean, nicely showing off their features. According to the hotel, married couples holding receptions at the venue like to use the boulders in their wedding photos.

Both visits to Smestow Valley LNR, finished shortly after midday and our visit to Wightwick Manor and The Mount finished around 4.00pm. We look forward to holding more events discovering features within the Smestow Valley and around the Perton and Tettenhall areas in the future. I would like to thank the Smestow Valley LNR wardens, the Smestow Valley Friends Group, Julie and staff at Wightwick Manor and The Mount for their time and we hope to see members in May for our geoconservation visit to Smestow Valley. ■

*Andy Harrison*

## Droitwich Spa Heritage Centre Reopens

*Some BCGS members may remember a field visit to Droitwich in May 2015 to learn more about the geology and the salt industry. The trip was led by Andy Harrison, and you can read his report in Newsletter 232, August 2015. We thank Roy Starkey for this news item about the recent reopening of the Droitwich Spa Heritage Centre.*

I was delighted to be invited to attend the grand opening of the newly refurbished Droitwich Spa Heritage Centre this morning (20 March 2026). The gardens looked amazing, the sun shone and everyone had a great time.

Nestled in a beautifully preserved black and white building in the heart of Droitwich Spa the Heritage Centre celebrates the remarkable story of one of England's most significant salt-producing towns. Whether you're a curious local, a visiting family, or a history enthusiast, you are sure to enjoy a visit to this small local museum with a BIG story.



*Droitwich Spa Heritage Centre*

The museum brings to life over 2,000 years of local history and the industry that shaped the town - salt. Through interactive displays, archaeological finds and multimedia exhibits, visitors can explore how natural brine springs beneath the town made Droitwich one of the most important salt-producing centres in Britain. The exhibition traces the story of salt production from prehistoric and Roman times through the Saxon and Medieval periods to the Victorian age, when the town developed into a famous spa destination. ►

Inside the museum you can see remarkable artefacts uncovered during local excavations, including Roman pottery, coins and even part of a wooden barrel used for storing brine.

Officiating at the opening were: Mayor - Councillor Mrs Chris Bowden; Consort to the Mayor - Councillor Eric Bowden; Deputy Lieutenant (representative of His Majesty The King) - Charles Moyle JP; local MP Nigel Huddleston - Shadow Secretary of State for Culture, Media and Sport of the United Kingdom; and our hosts for the event, Rebecca Butler and Catherine Finn - joint Heritage Managers.



*Inside the Droitwich Spa Heritage Centre*

This brief report aims to capture the atmosphere and encourage anyone living in the West Midlands or travelling through the area to plan a visit. ■

*Roy Starkey*

## Beware of Montmorillonite!

There is an old adage that says one should never purchase a property built on a flood plain or cliff edge but now we should perhaps add to this list: "never buy property built above a deposit of montmorillonite".

First described and named after its place of discovery in 1847, montmorillonite is surprisingly common in fluvio-glacial deposits across Canada, Scandinavia and Russia. Thought to be formed from the breakdown of basic igneous rocks in alkaline conditions, it carries the generalised formula  $(OH)_4Al_4Si_8O_{20} \cdot nH_2O$ . Minerals in this group are characteristically built up from layers of silicon and aluminium atoms with their attendant oxygen atoms arranged like a sandwich. They have a platy or flaky habit and due to the absence of significant salts which would induce an electro-static effect, these very pure forms of clay have the property of being thixotropic, i.e. they can change very quickly from one state into another as a result of sudden shock or shaking and then return to a semi-solid state when left at rest.

Accumulating in lakes and ice-dammed water bodies enables these deposits to develop undisturbed and in some abundance. Spectacular failures of such clays involving the destruction of properties and buildings have been recorded at Surte in Sweden (1950), Nicolet in Quebec (1955) and even the destructive effect of the Great Alaskan Earthquake (1964) around Anchorage may well also have been exacerbated by soil liquefaction involving montmorillonite.

Nearer to home montmorillonites are also closely associated with bentonites, both being a product of the weathering of volcanic ashes and the Wren's Nest in ►



*Surte, Sweden 1950. The landslide has split the house in two! Wikimedia Commons*

Dudley is known to contain at least 15 bentonite layers. They are also a common occurrence throughout the upper Much Wenlock Limestone Formation of the Welsh Borders. No known recording of a failure of these bentonites could be found, however there have been reports of the failure of beds during quarrying operations in the Woolhope Dome area.

Thanks go to Desmond Bagley for my introduction to montmorillonite as one of his villains in his novel 'Landslide' (1967). These fascinating members of the smectite group of minerals are certainly worthy of further study as they also encompass kaolinite, but that's another story. ■

Mike Williams

**Erratum.** We apologise for a formatting error which caused the loss of some text in Mike's Musing No. 61, Newsletter 295. P19, para. 2, line 3 should read: "...rocks known as **Charnockites**, which are characterised by extremely anhydrous compositions associated with 'dry' areas of continental shield..." Ed. ■

## Mike's Musings No. 62

### More spheroidal objects – Nodules or Concretions?

I return to the theme of 'spheroidal objects' (cf. 'Towie Balls', Newsletter 290, April 2025, Musing No. 56 and 'Pebble Shape' Newsletter 279, June 2023, Musing No. 45) to consider the subject of **nodules** (Latin: *nodus* = a knot) and **concretions** (Latin *con* = together, *crescere* = to grow), which, in truth, are seldom that 'spheroidal', but, unlike the previous subjects, are a very common feature amongst sedimentary rocks.



Fig. 1. Cambrian Alum Shales (Norway) streamlined around a siliceous concretion

The first matter to clarify is where the difference between the two lies. This distinction seems to be an area of much confusion or contradiction in the literature, but we can begin with the general consensus that both **nodules** and **concretions** are structures that form during diagenesis (Greek: *dia* = through, *genesis* = origin / creation) i.e. concerned with physical, chemical or biological changes within 'soft' sediment while being transformed into 'hard' rock. This allows for such objects to consist of either organic or inorganic material, but this probably isn't the best criterion on which to make a distinction.



Fig. 2. 'Ghostly' bedding preserved in Concretionary Magnesian Limestone, Cleaton Park Quarry, Tyneside

In most cases I have come across, the bedding structure *curves around* the object, indicating that it developed early on while the sediment was still 'plastic' or able to 'flow' around the harder body (Fig. 1). In some cases a 'ghostly' trace of the bedding is preserved *running through* the object, suggesting that development began, or at least continued, during later stages of the diagenetic process (Figs. 2 and 3). This should not be confused with post-diagenetic differential sculpting of sedimentary rock in ►



Fig. 3. Bedding running through a large 'dogger' concretion from the Collyweston Slate (cf. Fig. 10)

which alternate layers have slightly variable resistance to erosion (Fig. 4).

Definitions provided by geological dictionaries are often fairly vacuous, and suggest that nobody has ever thought to offer a rigorous description of either of these terms. One of the better efforts defines **concretions** as "more or less spherical, or irregular masses... which consist of material of different nature from the surrounding rock brought together [presumably] by percolating waters", which gets us started. Another source adds that they are "lumps formed within a rock by materials rearranging themselves about a centre", which offers more insight into the process involved. A third source suggests

(quite correctly, but unhelpfully) that the terms **nodule** and **concretion** are used synonymously, which I don't care much for – why have two separate words for the same thing and waste the opportunity to identify a fundamental difference?

I believe it is both valid, and useful, to draw a distinction between the two, and many texts seem to agree; but this is where confusion arises as they present varying ideas on where the distinction lies. Thus, one guide to sedimentary structures considers that "if a distinction is made, **nodules** occur as irregular masses, while **concretions** are spherical or ellipsoidal..." while another such book posits that "**concretions** are often rounded, though they may take on many irregular shapes. The smaller, rounded **concretions** are often called **nodules**"! Another source appears to echo this, regarding **nodules** as "small rounded lumps". Is the shape of the object of such importance that it is raised to the point of defining the difference?



Fig. 4. Differential weathering of harder and softer layers in Nubian Sandstone, not concretionary

Further observations on the nature of these features include that:

- they can be highly variable in size (many metres to just a few millimetres)
- they may follow the stratification of the rock and be arranged in rows, with gaps or joined in groups
- they usually stand out, being harder due to their stronger cementation
- they are often found in isolation, having been eroded out from their sedimentary host

But none of these generalisations provides a justifiable reason for defining the difference.

In addition:

- they may have a similar, or highly contrasting, chemical composition to the host material.
- they may have a colour and texture similar to, or contrasting with, their host. ►

These statements seem to offer more fertile ground on which to base a distinction, and one suggestion is that **nodules** show a greater contrast with their host, either chemically or physically. I think we can take the distinction a little further and take into consideration the process involved, and suggest that **concretions** develop by mineral precipitation *around* a point of nucleation, while **nodules** form by *replacement* of some part of a sedimentary deposit.

One of the sources already referred to suggests that "*most concretions have doubtless formed by growth outwards from a nucleus*" and suggest that this should be implicit, but goes on to say that "*nothing is implied in the term as to whether the object was formed contemporaneously with the containing rock or subsequently*". This would at least agree with the earlier observation that the timing of formation may be at any point during the diagenetic process, **but** would further allow the object to form after full consolidation of the rock mass. This, in my mind, may be carrying things a bit too far, and could be seen to include processes associated more traditionally with a much later episode of mineralisation. The question of timing may therefore, again, not be the best criterion for separating the two objects, so I would suggest that we return to the suggestion above, that the process involved is the more useful and fundamental criterion on which to form a distinction.



Fig. 5. A pot-pourri selection of 'septarian concretions'

So, to recapitulate, I suggest that **concretions** form by mineral re-precipitation radiating from a point of nucleation while **nodules** develop by replacing part of a host material with contrasting mineral matter. A 'Wikipedia' article states this in slightly different language: "*There is an important distinction to be drawn between concretions and nodules. Concretions are formed from mineral precipitation around some kind of nucleus while a nodule is a replacement body*".

In both cases it is necessary that the original deposit consists of two (or more) different chemical materials, the object resulting from a separation, or rearrangement, of these contrasting substances. Therefore, there is no need to introduce new material as is normally implied by the process of mineralisation. The size, shape, colour, arrangement or timing are of less significance. Whether this distinction appeals to you or not, we may as well consider a variety of examples.



Fig. 6. *Dactylioceras* sp. ammonite: commonly preserved in concretions, including a smaller 'part and counterpart' pair

Perhaps the best known type are **septarian concretions** (or just 'septaria'). These objects are characterised by having a radial pattern of internal cracks believed to form either by shrinkage or by expansion of gases released by the decay of organic matter, and which sometimes taper towards the margin of the concretion. These may be secondarily infilled with crystal linings creating an attractive contrast to both the rest of the concretion and the host material (Fig. 5). You may also be familiar with the extraordinarily large examples of septaria known as the **Moeraki Boulders** found in Palaeocene mudstones on New Zealand's South Island (see front cover photo). ►



Fig. 7. 'Dogger' concretions (diam. ~1.5m.) in Millstone Grit near Hathersage



Fig. 10. Coalescent 'doggers', Duddington Quarry, near Stamford (cf. Fig. 3)



Fig. 11. 'Marleka' concretion, Stensö, southern Sweden (Wikimedia Commons)

Perhaps the most bizarre concretionary structures in Britain are the well-known **Cannonball Limestones** of Roker Beach, North-East England (Fig. 13). These are the best known amongst a host of such concretionary structures developed in the Magnesian Limestone formations of Permian age, ►

Another common form of **concretion** is the type found in formations like the various Lias shales in Yorkshire. These are often large and ellipsoidal, with flattening in the bedding, and are strongly cemented by a carbonate species (usually calcite, ankerite or siderite) or an iron oxide (pale limonite or darker goethite). Smaller ones enclose beautifully preserved ammonites which served as a trigger-point for precipitation of the 'cement' (Fig. 6). Larger examples are often referred to as **'doggers'**, and may occur in other formations such as the Millstone Grit (Fig. 7), Kimmeridgian limestones (Figs. 8 and 9) or the Collyweston Slate (Fig. 10).



Fig. 8. 'Doggers' in Kimmeridgian sandy limestones, (diam. ~1.8m.) N. France



Fig. 9. As Fig. 8: concretionary 'inter-growths' after weathering out of cliff

Similar in chemical composition are the so-called **Marleka** 'fairy stones', which are smaller, more discoidal, having concentric grooves suggestive of incremental growths (Fig. 11) like tree-rings. They are apparently quite common in Quaternary clays in Quebec (Canada) and Östergötland (Sweden), but I have yet to see them for myself. Other flattish concretions reveal a concentric internal



Fig. 12. Ironstone concretion with concentric layering: Weald Clay, Surrey



Fig. 13. 'Cannonball Limestone' concretionary bed, Roker beach, Sunderland (individual concretions ~ 5-25cm diameter)

which also boast a crazy array of internal features (Fig. 14) that perhaps warrant a musing of their own!

Limestones are well known as playing host to siliceous bodies, the best known being the familiar **flints** in the Chalk

(which, again, could occupy a musing all to themselves). These take different forms: either tabular flints formed parallel to the bedding or lining inclined fractures, joints or fault planes (Fig. 15), or irregular flints which may again form on bedding planes (Fig. 16) but may also be more transgressive as in large **paramoudra flints** (Fig. 17). All such bodies generally form by segregation from an original mixed silica-carbonate sedimentary deposit, and are best regarded as **nodules**. The same applies to the **chert** masses best known in the Carboniferous Limestone as far as British stratigraphy is concerned. Figure 18 shows part of a colonial coral which has been replaced by chert at a late stage during diagenesis.



Fig. 14. Internal structures in 'Cannonball Limestone', Carley Hill, Sunderland



Fig. 15. 'Tabular flints' infilling sub-vertical joints in 'Upper' Chalk, near Brighton

Another form of **nodules** in Chalk are the familiar pyrite or marcasite masses, usually well rounded but occasionally taking on other shapes (Fig. 19). Other iron minerals also



Fig. 16. 'Nodular flint' seam, Seven Sisters Flint Band, 'Upper' Chalk, Birling Gap, Sussex

occur as **nodules** in different lithologies such as the Nubian Sandstone in the Sahara desert, where I have come across them taking on far more irregular forms weathered out from outcrops (Fig. 20). ►

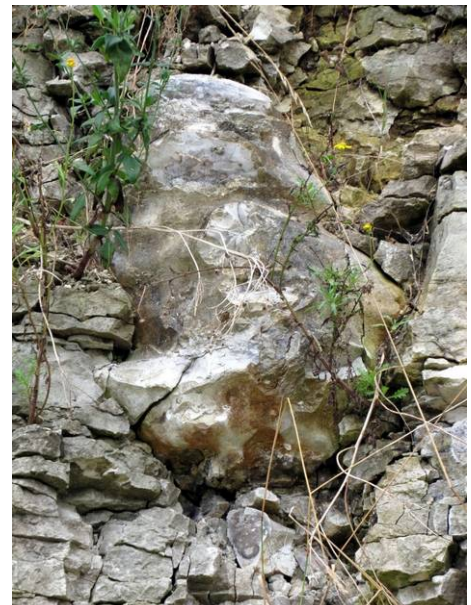


Fig. 17. Large 'paramoudra flint' 'Middle' Chalk, near Scunthorpe



Fig. 18. Chert nodule (darker 'core') replacing limestone in colonial coral, Peak District



Fig. 19. Nodules of pyrite (or marcasite?) from the Chalk (radiating structure: Cap Gris Nez; framboidal: Folkestone; mamillated: London Clay, Sheppey)



Fig. 20. 'Ironstone' nodules, mainly irregular, weathered from Nubian Sandstone, Egypt

Not all **nodules** form as part of a rock mass. It has long been well known that some areas of the deep ocean floor are strewn with metal-rich spheroidal bodies commonly referred to as **manganese nodules**, although they also contain iron, cobalt, nickel, zinc and other valuable metals. They are not much to look at (Fig. 21) but with an estimated total mass of half a trillion tons, they could provide a vast economic resource for the future, albeit with likely serious damage to marine ecosystems!

This is a far from exhaustive treatment of this subject. I haven't elaborated on any biologically mediated examples such as oolites and pisoliths, algal oncolites or rhizocretions ('root nodules'). As a

final flourish I leave you with a tongue-in-cheek thought, previously mentioned in one of my 'Geological Howler' Musings (Newsletter 261, June 2020, Musing No.27), pointing out that "the largest **concretions** occur round Burton Bradstock"! (Fig. 22!) ■

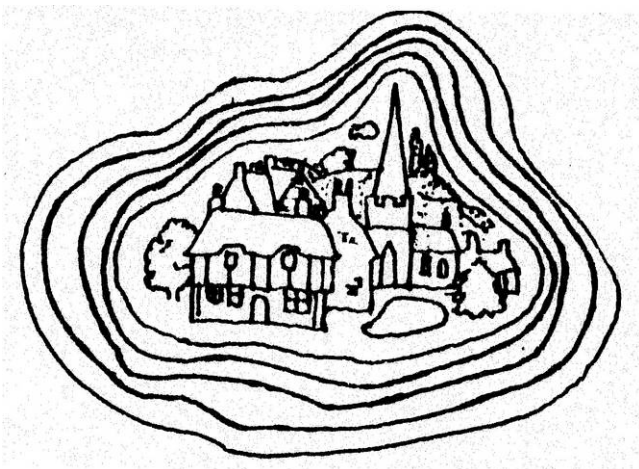


Fig. 22. "The largest concretions occur round Burton Bradstock"!

Mike Allen



Fig. 21. Part of 'manganese nodule' from floor of the Pacific Ocean, near Marquesas Islands