Newsletter No. 272
April 2022

Contents:

To find out more about this photo - read on!

Copy date for the next Newsletter is Wednesday 1 June

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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 more information see our website: bcgs.info, YouTube, Twitter: @BCGeoSoc and Facebook.		

Future Programme

Indoor meetings are normally 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. The same timing applies to online 'Zoom' meetings.

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

Saturday 23 April *(Field Meeting):* Brampton Bryan Park, Northwest Herefordshire, led by John Moseley. Meet at 10.00 at Aardvark Books, The Bookery, Manor Farm, Brampton Bryan, Bucknell, Herefordshire, SY7 0DH, (grid ref: SO370722). We will drive to Brampton Bryan Park to view the landscape and relate it to the underlying geology, which includes Longmyndian sandstones and conglomerates, and Eltonian shales. The trip will also include the Upper Pedwardine, the Llandovery/Tremadocian unconformity, and the boulder bed and channelling at the Eltonian/Leintwardinian contact in Lingen. We will aim to finish around 4.00 to 4.30.

NB - the meeting below has had to be re-scheduled to Tuesday 26 April at the usual time.

Tuesday 26 April *(Indoor Meeting):* 'All the world's a stage: Geodiversity - a natural setting for a natural world'. Speaker: Dr Jonathan Larwood, Natural England. This talk will look at Geodiversity as the foundation – a stage – for the natural world and a vital component of the diverse landscapes with which we're all familiar. The talk will explore the relationship between geodiversity, habitats and species, consider the importance of understanding that relationship and the mutual benefit that an integrated approach to managing geodiversity and biodiversity brings for nature recovery. A number of Black Country case studies will be referenced in the talk including the Wren's Nest and Saltwells National Nature Reserves.

Saturday 7 May *(Field Meeting):* Dudley Museum at the Archives and Wren's Nest National Nature Reserve, led by Graham Worton. Joint Field trip with the WGCG. Meet at 10.00 at the Archives building, Tipton Road, Dudley, DY1 4SQ, (grid ref: SO950912) for a tour of displays, followed by a field visit to Wren's Nest NNR to look at recent works and to discuss future plans. Finish at 4.00.

Wednesday 15 June *(Evening Field Meeting):* The Building Stones and Landscapes of Dudley Town Centre Geosite, led by Graham Worton. Meet at 6.30 outside the Old Dudley Museum in St James Road, Dudley, DY1 1AH, (grid ref: SO943903). An evening walk around the town centre to discover the geological and architectural heritage of the town. (Ample free parking is available after 6.00 on roads around the museum.) This is to be followed by a social in a town centre pub.

Wednesday 6 July *(Evening Field Meeting):* The Geology and Landscapes of Barr Beacon Local Nature Reserve Geosite, led by Graham Worton. Meet at 7.00 at the Beacon car park (grid ref: SP060967). An evening walk to examine the geology and its effects on the landscapes of the Barr Beacon area of Walsall. Graham will also explain the recent works and new interpretation installed as part of the 2022 'Purple Horizons Nature recovery project' with Natural England.

Thursday 4 August *(Evening Field Meeting):* The Geology, mining heritage and landscapes of Himley Hall and Baggeridge Country Park, led by Graham Worton. Meet at 6.30 at Himley Hall car park, DY3 4LA, (grid ref: SO889915). An evening walk to examine the geology and its effects on the landscape of the historic hall that was also the home to the last deep coal mine of the Black Country (Baggeridge Colliery).

Wednesday 7 September *(Evening Field Meeting):* The Geology of the Rowley Hills Geosite, Sandwell, led by Graham Worton. Meet at 6.30 in the lay-by roadside parking on Darby's Hill Road, B69 1SG, (grid ref: SO967892). This evening walk will take in the views, look at exposures of the famous 'Rowley Ragstone' at the Blue Rock Quarry Geosite, and some millennium Geoart installations.

Monday 26 – Friday 30 September: BCGS visit to the Dingle Peninsula. Field trips led by Ken Higgs. For more information see Newsletter 271, Feb 2022, p.4. Contact Alan Clewlow, email: treasurer@bcgs.info

Other Societies and Events

Shropshire Geological Society

Wednesday 13 April: AGM followed by **'Adventures Under The Microscope 2'.** Speaker: Martin Carruthers.

Wednesday 11 May: 'Blowing Hot and Cold - The Story of Earth's Climate Change'. Speaker: Mark Woods, BGS.

Lectures are being held using Zoom and commence at 7.15 for 7.30. Further info: http://www.shropshiregeology.org.uk/SGS/SGSEvents.htm

Geological Society, West Midlands Regional Group

Tuesday 12 April: 'Diversity in Geoscience'. Speaker: Lisa Pinney, The Coal Authority.

Saturday 23 April at 10.00: Brampton Bryan Park, north-west Herefordshire. Joint field visit with BCGS. Led by John Moseley (Gloucestershire Geoconservation Trust). Meet at Aardvark Books, Brampton Bryan. GR37007222. Post code: SY7 0DH.

Saturday 7 May at 10.00: Dudley Museum at the Archives and Wren's Nest National Nature Reserve. Joint field visit with BCGS. Led by Graham Worton, BCGS. Meet at the Archives Building, Tipton Road, Dudley, SO950912 DY1 4SQ.

Tuesday 10 May: 'Earthquakes without Frontiers'. Speaker: Professor James Jackson, University of Cambridge.

Lectures are being held using Zoom and commence at 6.00 for 6.30. For further details please contact the Group Secretary at: geolsoc_wmrg@live.co.uk Click here for website.

Warwickshire Geological Conservation Group

Wednesday 20 April: 'Jurassic Brain Teasers'. Speaker: Stephan Lautenschlager.

Saturday 7 May, 10.00 - 4.00: Field Outing to Dudley Archives & Wren's Nest.

Venue for talks: Kenilworth Methodist Church. 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.

Teme Valley Geological Society

Monday 25 April: Sedgwick's 'Great Dislocation' revisited: the Dent Fault, NW England. Speaker: Dr. Nigel Woodcock, Cambridge University.

Talks are held at 7.30 in the Martley Memorial Hall, on the B4197 by the Sports Ground, Martley. Non-members £3. For field trip details and further information contact John Nicklin on 01886 888318 or visit: https://geo-village.eu/ These talks may also be available by Zoom as well as in person.

Woolhope Naturalists' Field Club - Geology Section

Tuesday 26 April: A walk on North Hill Malvern with Dr John Payne.

Non-members of the Club pay £2. Visit: https://www.woolhopeclub.org.uk/meetings or contact Sue Olver on 01432 761693, email: susanolver@hotmail.com

Mid Wales Geology Club

Wednesday 20 April: 'Landscape Evolution of south-west Wales'. Speaker: Peter Kokelaar.

Wednesday 18 May: 'Anglesey GeoMôn Geopark'. Speaker: Cynthia Burek.

Further information: Tony Thorp tel. 01686 624820 and 622517 tonydolfor@gmail.com
Web: http://midwalesgeology.org.uk lectures start at 7.15 via Zoom.

Editorial

It was a time for celebration when we returned to the Museum and Archives for our March meeting - the first time since February 2020. The AGM was followed by a buffet and a talk by Graham to bring us up to date with recent activities and future plans for the Black Country Geopark.

We are delighted to announce the appointment of our new Honorary Secretary, Mark Jeffs, who got to work immediately with his summary of the AGM for this issue of the Newsletter. Mark introduces himself on p.7. We welcome him to the committee, and look forward to the restoration of normal secretarial activities. Please note the change of address for contacting the secretary: honsec@bcgs.info This is because the previous address was being targetted with a lot of junk mail.

We have one more indoor meeting, now re-arranged for **Tuesday 26 April (see p.2)**. This is the last one organised by Keith Elder as we announced in the February issue. Once again, we send our thanks to Keith for all his hard work. Then comes the summer season with field trips nearby and further afield, including our trip to Dingle led by Ken Higgs at the end of September. This is now confirmed, and there may still be a few places left – so hurry! See our programme of events above, or the full page item in the last Newsletter *(Issue 271 p.4)* for more details. You can refresh your memory about the Dingle Peninsula by viewing again the excellent Zoom talk which Ken gave to the Society in March 2021: https://www.youtube.com/watch?v=_hz5fEGqnnw&t=302s

I am pleased to report that the Building Stones of Birmingham leaflets have been flying off the display stands, especially in Birmingham Public Library, and we now have very few copies left. The leaflets are also available in pdf format from our website: https://bcgs.info/pub/local-geology/building-stone-trails/

The erratics project is progressing well, with several members of BCGS enrolled as volunteers. You can read about recent activities, events and future plans in the article below (p.10).

There's a lot to look forward to through the summer months. Remember that this is your newsletter, and we want to hear from you with any items of geological interest. Please share them with us! ■

Julie Schroder

BCGS Committee: vacancy for a Meetings Secretary

We urgently need a new Meetings Secretary. If you can help, or would like more information about the work entailed, please don't be shy to put your name forward! Please use this email address: honsec@bcgs.info

Annual General Meeting

The 2022 AGM was held at Dudley Museum and Archives on Monday 21 March. Below are summaries of the Treasurer's and Chairman's reports and election of officers.

Chairman's Report

The Chairman's report was produced by Graham Worton. The report was distributed to members in attendance. Graham Worton summarised the key points of the report.

Graham reflected upon a year of continued restrictions of the Society's activities and celebrated the work of the committee, especially Keith Elder for a varied and successful programme of events. Graham thanked Andy Harrison and the members for a recent return to geoconservation work at the Wren's Nest and Saltwells National Nature Reserves. Graham reported that in 2021 the Society extended the term of the BCGS Poet in Residence, Robert Francis. The report is optimistic for the future of the Black Country Geological Society's activities, including involvement in the UNESCO Black Country Geopark.

No questions followed and acceptance of the report was proposed by Jon Amos and seconded by Bob Bucki.

Treasurer's Report

The Treasurer's report was produced by Alan Clewlow. The report was distributed to members in attendance along with the audited accounts. John Schroder delivered the report's key point summary in Alan's absence. The report shows a healthy surplus in 2021 due to low expenditure. There was also a slight growth in membership.

No questions followed and acceptance of the report was proposed by Pete Purewal and seconded by Mike Allen.

Election of Officers

The Chairman opened all committee posts for nominations. Mark Jeffs offered to take the vacant post of Honorary Secretary. With no other nominations, Mark Jeffs to be appointed to the position of Honorary Secretary was proposed by Graham Worton and seconded by John Schroder.

The Chairman asked if any incumbent committee members wished to step down from their duties. Keith Elder stepped down leaving the position of Meetings Secretary vacant. Thanks were given by Graham Worton on behalf of the Society for Keith's work.

The Chairman asked all incumbent committee members if they would stand again for another term and they agreed. All incumbent committee members to serve another year was proposed by Jon Amos and seconded by Mike Allen.

5. Election of Auditor

Davena Dyball to serve another year as auditor for the Society was proposed by Graham Worton and seconded by Alan Richardson. ►

6. Any other business

The Chairman opened the floor to any other business. Nothing was raised and the Chairman made closing remarks thanking the committee for the hard work over the course of the last year and throughout COVID-19 restrictions. The Chairman also noted the Society's 50th anniversary year in 2025.

The meeting concluded at 8.00pm and was followed by refreshments and a talk by Graham Worton entitled 'The Black Country Geopark: Recent Developments and Future Plans'. ■

Mark Jeffs, Honorary Secretary

Introducing Mark - our new Honorary Secretary

Mark at the Wren's Nest

Greetings fellow Black Country Geological Society Members. My name is Mark Jeffs and at the last AGM I became the Society's new Honorary Secretary. I think a quick introduction is in order as I am still a relatively new face in the Society.

Some of you may recognise me as Graham's volunteer. I have now been volunteering with Graham Worton and the Dudley Museum Service for over 10 years, helping with the Dudley geological collection, geological conservation and research projects. I received a Masters degree in Geology from the University of Birmingham in 2016 and currently work at the Red House Glass Cone in Wordsley, a UNESCO Black Country Geopark geosite. *(See 'Matt's Maps' below - coincidentally relevant! Ed.)*

I have always found geology fascinating and through my formal education and voluntary work I have never stopped learning and experiencing the joy of discovery. That's what this Society offers to me: a place to continue to learn and experience geology. I hope I can help to maintain the success of the Society. Please feel free to contact me on the new Honorary Secretary email address: honsec@bcgs.info. I look forward to hearing from you. ■

Mark Jeffs, Honorary Secretary

Geoconservation Days, Spring 2022

Spring 2022 has heralded a return to geoconservation works after a two-year absence due to the pandemic. Our return has seen BCGS members undertake works at Wren's Nest National Nature Reserve (NNR) and Saltwells NNR. At both reserves, the pandemic has kept the wardens busy without their volunteers, undertaking site maintenance and controlling lockdown crowds who insisted on camping, lighting fires and dropping litter, which in turn has upset local residents on adjacent estates. Eased restrictions have finally given the reserve wardens the opportunity to welcome back volunteer groups. ►

Saturday 5 February (Geoconservation Day): Wren's Nest NNR.

Under cold and overcast skies with strong winds, BCGS members met with Wren's Nest NNR wardens (Ian Beech and Rob Earnshaw) at the Mons Hill Warden's base for a 10.30 start.

Ash dieback

We spent the day in the quarry below the reef mounds where ash saplings and undergrowth had taken over after three years without management. A common tree species on the reserve, ash provides a valuable habitat for wildlife and is unfortunately under attack from the Chalara fungus (*Hymenoscyphus fraxineus*), better known as ash dieback. In winter the fungus' impact can be seen as peeling bark and dark diamond-shaped lesions where branches meet the tree trunk. Leaves discoloured to black and shedding early make the disease's presence more obvious during the summer months. These symptoms result from the Chalara fungus, which overwinters in leaf litter, penetrating into a tree and blocking the tubes that carry nutrients through the plant. Whilst a tree can fight back, year-on-year infection will eventually kill it. After seeing examples of infected trees, it was not difficult to identify others amongst the saplings we were removing.

During the pandemic, the wardens have been hard at work on the Mons Hill summit where the wide and flat terraces behind the former college have been managed to improve their conservation value. The terraces were created to provide soldiers in the First World War with target ranges where they could train. Today hedgerows and trees divide the terraces into individual meadows, important for wild flowers. To help tackle flooding downstream, several interconnecting ditches and pools have been cut into the underlying Coalbrookdale Formation to capture and hold back surface water on the hill summit. To aid with this, tree trunks have been placed in streams to create leaky dams that help slow down the rate of flow into downstream water courses. The result has been to form a valuable wetland habitat that has already attracted the attention of many birds, such as two passing snipe.

Public attendance during lockdown soared as people sort solace in the Reserve's green space. To help with litter, and conservation work such as tree planting, the wardens have sought help from local ►

Wren's Nest before clearance...

...and after clearance

school children and residents living on the newly built Mons Hill estate. This includes street names such as Fossil View, Calymene Mews and Silurian Mews.

In recent years, the wardens' hard work and local community involvement have massively reduced antisocial behaviour on the Reserve. Improving access, and vegetation clearance to open up blind spots, have helped with a cultural shift and a decline in the problems associated with bored children, motorbikes, arson, litter and vandalism seen 20 years ago. Increased environmental awareness and the pandemic have also potentially played a part in improving anti-social behaviour. Many more people now use the Reserve to relax, walk the dog or explore the fossil seabed.

Sunday 6 March (Geoconservation Day): Saltwells NNR.

The weather was cold and sunny when we met Head Warden, Alan Preece, along with members of the Friends of Saltwells Nature Reserve, at the new Warden's' base adjacent to the main Saltwells car park.

The Friends Group at a tub line exposure

Much has happened at the Reserve during the pandemic. Notably, the site became a National Nature Reserve in October 2020 to celebrate its world class geology, which it combines with a rich industrial heritage and biodiversity. The Warden's base is a new addition since our last visit. It provides office space, a workshop, and an education and meeting facility. As with Wren's Nest, the Saltwells wardens have been busy during the pandemic undertaking maintenance and controlling the public.

The day's activities focussed along the old tub line between Highbridge Road and Brewin's cutting. Historically, this part of the tub line section was widened to provide a space where tubs could be stacked and their passage through the tunnel beneath Highbridge Road managed. Until recently, this area was very overgrown, making a dark and rather uninviting path to walk down. Therefore, the wardens have been busy thinning out the trees and removing undergrowth to bring in light and open the area up to increase wildflower and bird numbers. Now the route is a more pleasant space to walk through.

The work has also involved making three large cuts into the side slope to provide exposures that reveal yellow and reddish-brown sandstone layers belonging to the Downton Castle Sandstone Formation. This stratum sits on the very late Silurian/early Devonian Boundary and was formed from rivers flowing over low-lying floodplains. The exposure furthest along from Highbridge Road shows heavily fractured sandstone up against dark-coloured dolerite. This appears also to have intruded along the sandstone bedding. The dolerite body is thought to be the same as that seen at Brewin's cutting and is late Carboniferous in age. ►

Brewin's Cutting

Dividing into several groups, we were spaced out along the tramway/tub line at each new exposure and also at Brewin's cutting. At the exposures the work included clearing the sandstone layers and moving scree to form level platforms from which the rock faces could be easily observed. At Brewin's cutting we cleared moss, soil and undergrowth to better expose the Silurian beds and the contact with the intruding dolerite.

As seen with Wren's Nest opening up spaces such as this has helped with reducing antisocial behaviour on the Reserve. Visitor numbers during lockdown also brought similar problems as those encountered at Wren's Nest and upset local residents along Saltwells Lane who found themselves blocked in due to car numbers. As with Wren's Nest, the wardens try to keep the locals happy as they never know when they may require their help.

On both days, we finished work around 2.30 before packing up. I would like to thank Ian, Rob and Alan for their time and we look forward to seeing them again in the autumn. ■

Andy Harrison

Birmingham's Erratic Boulders: Heritage of the Ice Age

Glacial Boulder Trail 1 - The Roland Kedge Trail

With an eye on the looming launch dates for each of the seven Glacial Boulder Trails, the most recent focus of the team has been to prepare for the first launch - 'The Roland Kedge Trail' - on 23 April. You've all had an invitation to this, which sadly clashes with our Herefordshire field trip, but for anyone who is not going to Brampton Bryan, please come along to the Great Stone Inn to join the celebration. You may remember that BCGS supported Roland in his drive to get an information plaque installed beside the Great Stone. This was achieved in 2016, and reported in Newsletter 240, December 2016. Roland was also responsible for finding and publicising many of the other boulders on this trail, and hence its name. This includes the one on the front cover: boulder no.5, in Shenley Fields Park.

Roland Kedge at the elusive Erratic Boulder no.3

An erratic restored to view in Garland Way

Our growing volunteer team sprang into action with trail-testing and proof reading the trail before publication. This gave rise to some welcome comments and suggestions, plus some excellent new photos for our expanding erratic photo archive. There was one new discovery as well! One particular boulder - no.3 in Trail 1 - proved to be so well hidden that no-one found it! It needed a visit with Roland and a bit of TLC to reveal it to the world again. The Trail 1 leaflet is already on the Erratics project website: https://erraticsproject.org and the free paper copies will be available from the launch day. ►

Clearance and Erratic finds

Illey Valley – oak tree with built-in erratic!

A particularly fine boulder at Garland Way on Trail 1 had become entirely engulfed by foliage over many years (see photo above). Enquiry revealed that the project volunteers would not be permitted to deal with the offending bushes, but shortly after the enquiry we were pleased to find that Bournville Village Trust had dealt with the problem, at least to reveal the erratic boulder partially cleared, but still behind a fence. We regard this as 'work in progress'.

The route of the Illey Valley Trail (4b) was embryonic in my last report, but a team of dedicated 'Illey rock-hounds' have spoken to local farmers, explored the muddy fields and paths, and now we have a definitive route for the 'Illey Wilderness Trail', with some new finds to add to the database. One of these was found in a hedgerow, partly engulfed by the growth of a magnificent old oak tree (see photo). The Illey Valley area is beset with boundary confusion, including Birmingham, Bromsgrove, Frankley and Dudley MBC. There are some access problems, but we hope to have these sorted out before the launch later in the year. This is one of the best areas for rock-hunting as there has been less man-made disturbance, so there's more chance of finding erratics - especially close to waterways.

Masefield Square - seven erratics

Glacial Boulder Trail 3

Trail 3 is due to be launched on 14 May (a date for your diaries). This is before Trail 2, for practical reasons, and work is well under way to produce the Trail 3 leaflet and make the necessary preparations. The trail is centred on Kings Norton and Masefield Square, and trail testing is underway. Recent clearance at Masefield Square has uncovered another small boulder previously hidden under the hedge (see far left of photo), and pressure washing has revealed the distinctive features of the isolated boulder at the front of the photo. It is a porphyry from a different part of the Arenig mountains, showing prominent feldspar crystals.

Volunteering

With our volunteer Co-ordinator, Zoe Jackson, now well established, I'm pleased to say that more BCGS members have come forward to join the Erratic volunteer team - but there is still plenty for volunteers to do, so visit the project website and have a look at the 'Volunteering Opportunities' Handbook' or contact Zoe directly on: z.jackson@worc.ac.uk ■

Julie Schroder (BCGS rep on the Erratics Project steering group)

News from our Poet in Residence

Over the last few months I've been collaborating with local film maker, Paul Stringer, on a short film that covers some of the ideas, places and poems from my residency with the Society. The final edits got done a few weeks ago and we've submitted the film to Wolverhampton Film Festival. We're hoping the local theme and content will put us in a good position for selection and if we are it'll be screened ►

over the weekend 29 April - 1 May. I'll keep my fingers crossed! I'd be very happy to do something for the Society's online content or real life events on the back of this, but it will have to be a little later in the year because the film festival requests first showing as part of the rules.

I've also just completed another essay on my work for an edited collection on Micro Travel. The book will focus on the restricted mobility put on us during the Covid-19 lock-downs and the way different types of journeying allows for a greater awareness of ecological concerns. My chapter shouts out about the Geopark as a place to rediscover our 'earthness' and how travelling with a geological lens reconfigures our alertness to nature in the most profound ways.

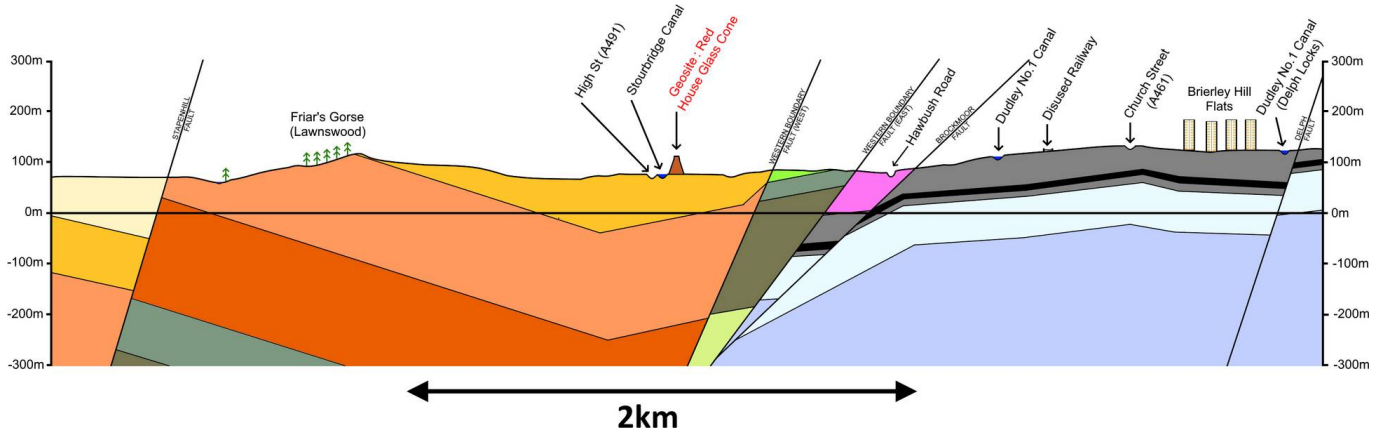
Finally, my colleague, Ben Colbert, and I are currently putting together plans to broaden the scope of the work I've done over the last two years, with a view of building poetic links between the Black Country Geopark and some of the others in the UK. We're hoping to use one English, one Welsh, one Scottish and one Northern Irish geopark, put a poet in residence in each and run a series of walks, talks and events. We're going for an Arts and Humanities Research Council grant, around £150k. I had this idea on the back of Graham's talk that celebrated the one year anniversary of the Geopark's UNESCO status *(see our YouTube recording).* In this, Graham discussed how part of the remit is to connect and collaborate with the different geoparks, to encourage new ways of communicating their wonders and getting new audiences involved in the parks and the earth sciences. I think this could be a basis for setting down the pathways for this new idea. To achieve this we'll need to demonstrate that we have support from BCGS, other local and national societies and the other Geoparks.

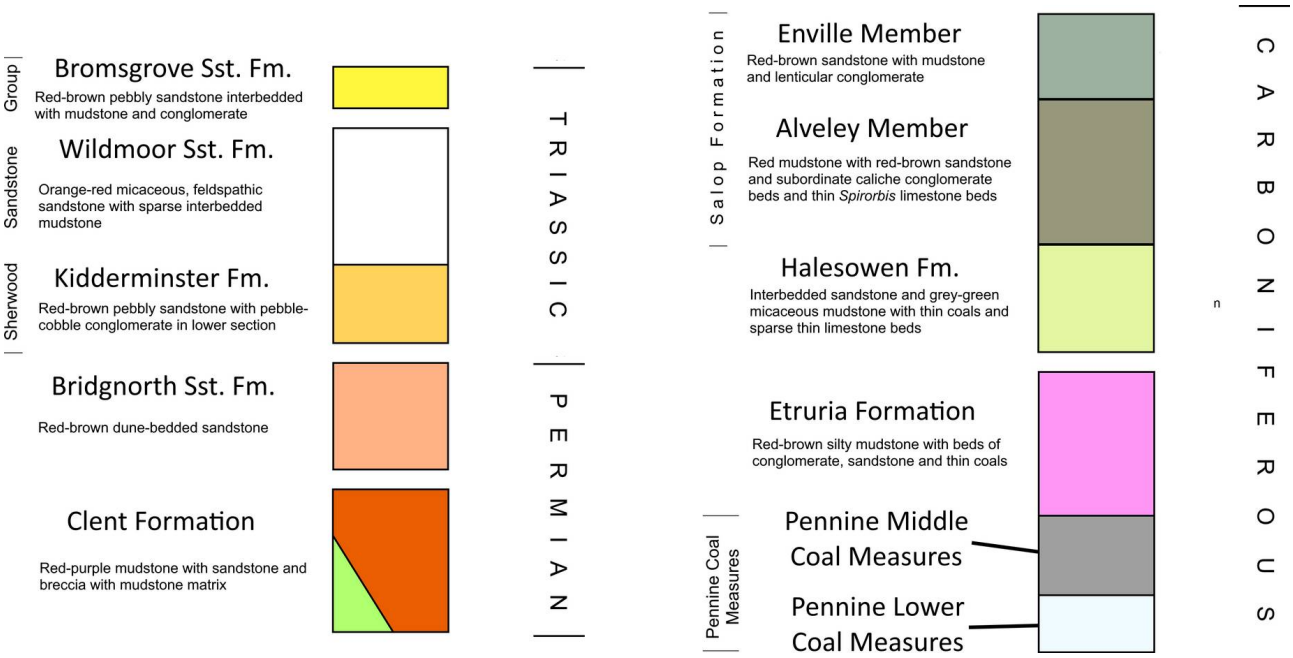
With that in mind, I wondered if I could get an initial thumbs up from you guys and some contacts for other people who might offer similar support? By support, what I really mean is something like a letter of support to the effect that BCGS is keen to be involved and could offer offer support in the form of refreshments, space for meetings and events etc. ■

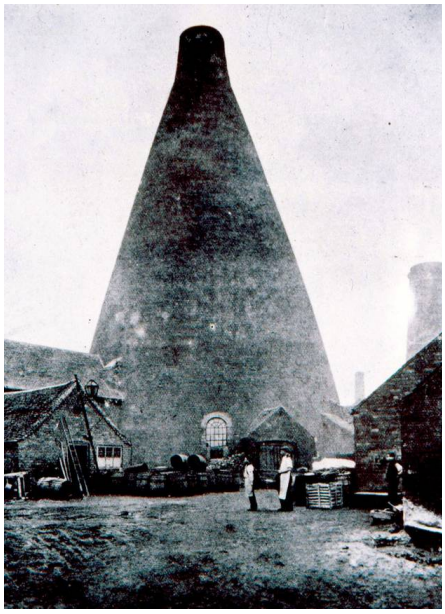
R.M. Francis

I'm sure we would all want to support Rob in this enterprise with a letter from one of our officials, and the willingness to help out as necessary. If you'd like to offer your personal support for Rob or have any ideas how we might be able to support him, please let Rob know via my email address (above). Ed.

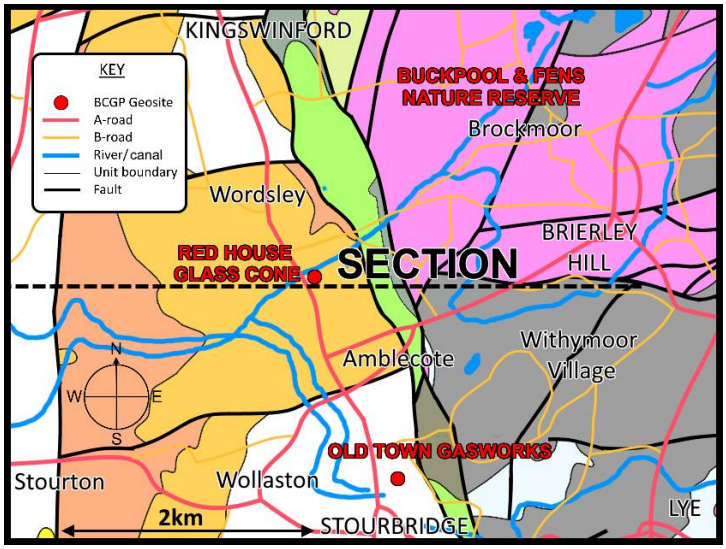
Matt's Maps No. 7 - Red House Glass Cone







Early 20th century photograph of the Red House Glass Cone, courtesy of Dudley Museums Service.



There were two things I used to look forward to on the bus ride between my adolescent home in Kingswinford and my college in Stourbridge. The first was that the double decker was prone to leap clear of Stream Road on the steep Wordsley canal bridge, promptly thudding down to earth in a sort of National Express-West Midlands roller coaster experience. The second was the timeless sight of Red House Glass Cone proudly rising to dominate the local skyline.

Though no rock exposures are visible here, the Cone is one of our region's geosites and is inextricably linked to the natural resources and geological history that surround it. The Cone, completed around 1790, is the last survivor of more than a dozen glass cones that dotted the Stourbridge landscape along the 'Crystal Mile' from the 17th to 20th centuries. Many authors have written at length about the Stourbridge glassmaking industry, which was globally renowned through industrial times. The case here, as with so many other places, is that the story of manufacturing sits atop a much more ancient geological story. ►

Oil painting by Emily Jane Hodgetts of the interior of a glass cone as it would have appeared around 1820, reproduced here courtesy of the Dudley Museums Service.

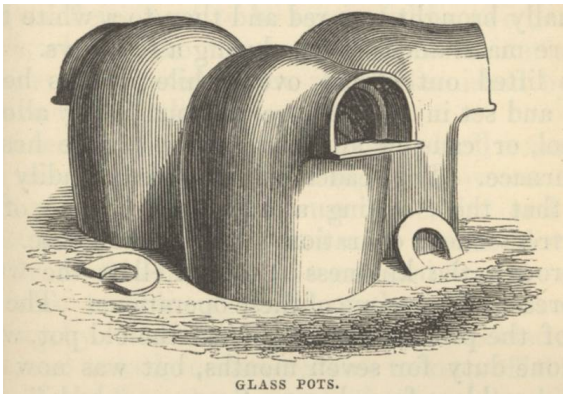
The geology underlying the Glass Cone is very similar to that discussed in Matt's Maps No.3 *(see the June 2021 Newsletter),* so I won't go into huge detail here. The Crystal Mile (including the Cone) sits on a Permo-Triassic bedrock of sandstones laid down in the arid interior of the supercontinent Pangaea around 250 million years ago. Uphill to the east, across the coalfield defining Western Boundary Fault, significantly older Carboniferous rocks are thrown up to the surface, exposing a rich mineral tapestry of coals, clays, iron ores and limestones that came to define the Black Country.

Victorian glassmaking required a few things. Firstly, raw materials for the glass. Primarily this means silica sand, which is melted down and sculpted at high temperatures. In the latter decades of Stourbridge glassmaking the silica sand was brought in from areas such as Cornwall. It seems plausible that some of the nearby sand-rich fluvioglacial deposits, laid down by rivers at the end of the last ice age, could have been the raw material for the earliest glassmakers. Purer sands than those found in the local area were required as the industry matured, and the building of canals in the late 18th century permitted the transport of raw materials at a pace unimaginable only a generation before.

The second thing glassmaking requires is somewhere to make the glass. The cone design is almost as old as the wider Stourbridge glassmaking industry and these structures could accommodate scores of workers. Each work team would work in a 'glass pot'. Numerous pots would be lined up around the outside of a single large furnace in the centre of the cone. These pots were made from fireclay – an unreactive material that can withstand even the extreme temperatures needed to melt silica.

Fireclay is a geologically fascinating resource that is closely associated with coal. Coal is the compacted remains of ancient forests, primarily those that existed during the Carboniferous period. Fireclay, also known as 'seatearth', is the preserved remains of the soils out of which those coal forests grew. As you might expect, they are typically found directly underneath coal seams, and those in the Amblecote area were particularly pure in clay minerals such as kaolinite. The purity of fireclay in the Amblecote area, and the existing large-scale coal mining efforts that produced fireclay as a by-product, were together the main factors in establishing Stourbridge as a global centre of glassmaking. The following is a quote from 17th century historian Robert Plot, writing c.1686:

"The most preferable clay of any is that of Amblecote, of a dark blewish colour, whereof they make the best pots for the glasshouses of any in England... The goodness of which clay, and cheapness of coal hereabouts, no doubt has drawn the glasshouses, both for vessels and broad glass, into these parts..." ►



Glass pots made from Amblecote fireclay. Similar pots would be arranged around the circumference of a furnace in the centre of the Cone, and glass fired inside them. Image from an 1841 manufacturing guidebook and reproduced here courtesy of Birmingham Libraries.

Lastly, the third vital ingredient you need for glassmaking is a source of energy to generate immense heat for melting sand. Fuel was never in short supply for industrial Black Country folk. There is written evidence of coal mining near Stourbridge as early as 1291, and I needn't describe in detail here the legacy of coal mining in this region. Many local pits extracted both fireclay and coal in the same locations, whilst others (particularly in the Victorian era) took only the fireclay. The largest glassmaking companies of the 19th century owned not only glassworks, but also fireclay and coal mines.

Red House Glass Cone as seen from the east on the Stourbridge Canal.

A final consideration as to how the glassworks ended up in Stourbridge is the location of the town itself. Prior to the late 18th century, exporting any glassware from here would have been hugely hazardous, owing to the lack of a viable waterway connecting it to the outside world. The River Stour was briefly made navigable between 1667-70 before those engineering works were destroyed by flooding. The last piece in the puzzle is surely the opening of the Stourbridge canal in 1779, connecting both the industrial heartlands to the east and the River Severn (via the Staffordshire & Worcestershire Canal) to the west. Barges could now easily transport raw materials to the Crystal Mile and delicate glass products could be safely exported around the country, to the port cities and from there across the seas to the rest of the world. Through a combination of geological good fortune and engineering ingenuity, Stourbridge would thrive as a glassmaking centre for centuries to come.

This cross section is one of three that I created for the 2019 International Festival of Glass in Stourbridge – an annual event co-hosted in the Cone. After a two-year hiatus, the festival will be returning in August 2022. I can thoroughly recommend it to anyone interested in the craft and/or history of glassmaking. Similarly, the new Stourbridge Glass Museum (located directly opposite the Glass Cone) will be opening to the public on 9 April, meaning Dudley Borough's glass collections will be on public display for the first time in 7 years. ■

Matthew Sutton

References and further reading

- Emily Hodgett's oil painting is owned by the Dudley Museums Service. The image and further context can be found at the following link:

https://artuk.org/discover/artworks/glassmaking-scene-inside-the-richardson-glass-cone-c-1820-52472

- Glass pots image from The Useful Arts and Manufacturers of Great Britain, Vol.1 (1846).

- 'The Stourbridge Fire Clay', by George Harrison, in (p133): 'The Resources, Productions and Industrial History of Birmingham and the Midland Hardware District (1865)', edited by Samuel Timmins. This chapter was an invaluable source of information for me when writing this article, and is available for free online:

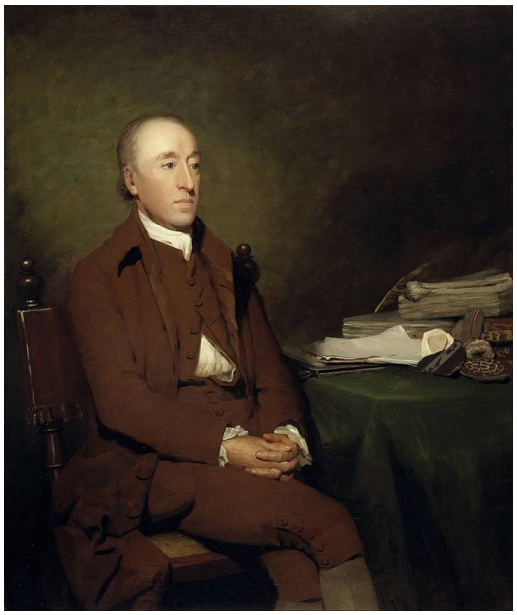
https://babel.hathitrust.org/cgi/pt?id=nyp.33433087549881&view=1up&seq=153&skin=2021

- British Geological Survey factsheet on the economic geology of British fireclays.

https://www2.bgs.ac.uk/mineralsuk/download/planning_factsheets/mpf_fireclay.pdf

Mike's Musings No. 38 - Igneous Rocks: Fiery Origins

I imagine nobody reading this will be surprised when I define an igneous rock as one that began life from a molten state. You may however be surprised to read that this was not always believed to be the case. Whilst the science of geology was in its infancy, there was an opposing view that igneous rocks (indeed most rocks) were formed by precipitation from seawater that once covered the whole of the Earth's surface. This was an extremely influential idea in the late 18th century, promulgated by Abraham Gottlob Werner, a leading German professor at the Freiberg Mining Academy. Those supporting this theory were known as the **'Neptunists'**, in opposition to the **'Vulcanists'** (or **'Plutonists'**), of whom a certain James Hutton was a leading light, and whose now more orthodox ideas won the day, becoming mainstream thinking by the 1820's.



James Hutton, painting by Henry Raeburn
Wikimedia Commons

Nowadays it seems obvious that the defining primary crystalline nature of igneous rocks arises from their formation from a molten state, and it is all too easy to scoff at what now appear to be rather silly ideas. We should not forget that science often progresses by way of false notions, blind alleys and serendipitous discoveries, any and all of which have helped to steer a course towards a better understanding of the world around us.

The name we give to this molten material is **magma** while it is present at depth, or **lava** once it reaches the Earth's surface. In either case, when cooling takes place, igneous rocks are the result. **Magma** is mostly generated in the Earth's mantle, with a lesser proportion deriving from crustal melts. It is generally considered that the Earth's crust (especially the continental crust) developed by **magmatic segregation** from the mantle. In this sense the first rocks formed on Earth were igneous, so all igneous rocks (including ones of extra-terrestrial origin!) might therefore be regarded as being of **primary** origin, even when they have been re-cycled. All other rocks are regarded as secondary, or **derived**, and will be the subject of future 'Musings'.

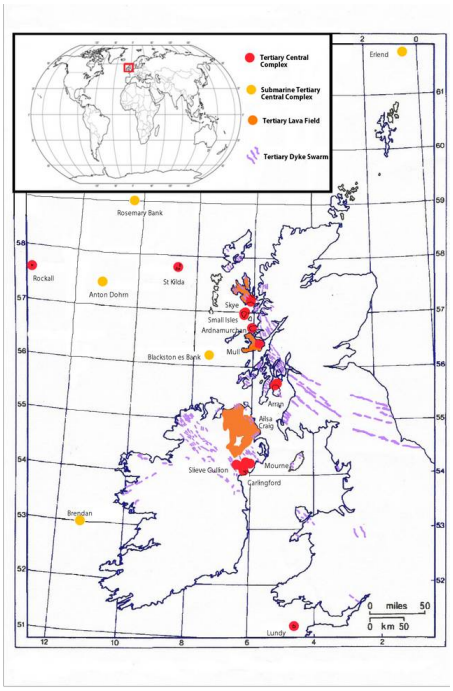
Magma is simply a 'chemical soup' containing, potentially, all the naturally occurring chemical elements (from hydrogen, the lightest, through to uranium, the heaviest). With 92 elements being available (perhaps discounting one or two that barely exist in a natural state) it is clear that an infinite variety of magmatic compositions is possible, but it is possible to simplify matters by focussing on the more abundant elements.

Regular readers may recall *(Musing No. 31, Newsletter 265, February 2021)*, that I described using coloured Smarties in classroom demonstrations to represent the eight main constituent elements that make up around 99% of the vast majority of **crustal magmas**. Using appropriate proportions of colours one can simulate a parent magma of any composition and show how this changes as you remove constituents entering specific minerals that crystallise out according to a generalised order of formation during the cooling process. This order is mainly determined by their descending melting points although other factors are also at play. ►

This basic process is known as **chemical fractionation**, (or **magmatic differentiation**) and results in magmas evolving towards a more acidic composition as it is the more basic constituents that get used at higher temperatures (the terms **acidic** and **basic** will be explained below). When most of the magma has solidified, only the more volatile constituents remain, including aqueous phases (known as **hydrothermal fluids**) which hold many of the other 'trace elements' present in just the tiniest amounts, and are generally reckoned in parts per million. This residual magma is much more mobile ('runny') and enriched in **ore-producing** elements (especially transition metals) that result in late-stage **mineralisation** of igneous masses and their surrounding host rocks.

As a general principle we may argue that rocks with more-or-less identical compositions have a common parent magma, a principle that helps us to understand the bewildering array of igneous rocks that exist, and bring some sort of order to differences in the nature of their formation. This '**principle of consanguinity**' allows us to draw conclusions about the relationship between different igneous bodies on both a broad scale or a more specific scale. We may extend this to suggest that rocks derived from the same parent magma **(comagmatic)** will share many chemical and mineralogical features. This will enable us to identify **igneous provinces** which developed in both a restricted geographical area and also during a relatively limited interval of time.

For any such comparisons we must first establish some kind of framework by which to compare or contrast different igneous rocks. This leads to the subject of their classification. (It is a basic human instinct to want to classify things in order to better understand them: we call this taxonomy, about which I have written before, notably Musing No.16, Newsletter 250, August 2018, and elsewhere.)



British Tertiary Volcanic Province, Wikimedia Commons

We classify igneous rocks in several different ways according to needs. The most fundamental is in terms of their general **chemical composition**, best expressed in terms of their **silica content**:

acidic	>66%	(sometimes also referred to as 'felsic' or 'sialic')
intermediate	52-66%	
basic	45-52%	(sometimes also referred to as 'mafic' or 'simatic')
ultrabasic	<45%	

Note that the term acidic has nothing to do with a chemist's understanding of 'acidity', although this terminology was originally based on the **Neptunist** idea that silica rich rocks were precipitated from waters rich in hydrosilicic acid (H_4SiO_4).

A better basis for this method, if not the terminology, lies in the fact that the Earth's crust and mantle are largely composed of silicate minerals, with oxygen and silicon being overwhelmingly the most abundant constituent elements (around 47% and 28% respectively in the crust, 45% and 22% in the mantle). A few odd rocks with very low, or no, silica content aren't ideally served by a system intended to focus on this parameter, although they are technically part of the ultrabasic category. The carbonatites (magmatic limestones) are a particular case in hand. ►

Silica content may be combined with other parameters to focus on particular issues or get round particular problems. For instance, volcanic rocks are often so fine-grained that a purely chemical approach is preferable to other criteria considered below. The so-called **TAS classification** plots 'total alkalis' **(TA)** (sodium and potassium) against the silica content **(S)**, producing a considerably more useful array of rock types for advanced investigations *(figure 1).*

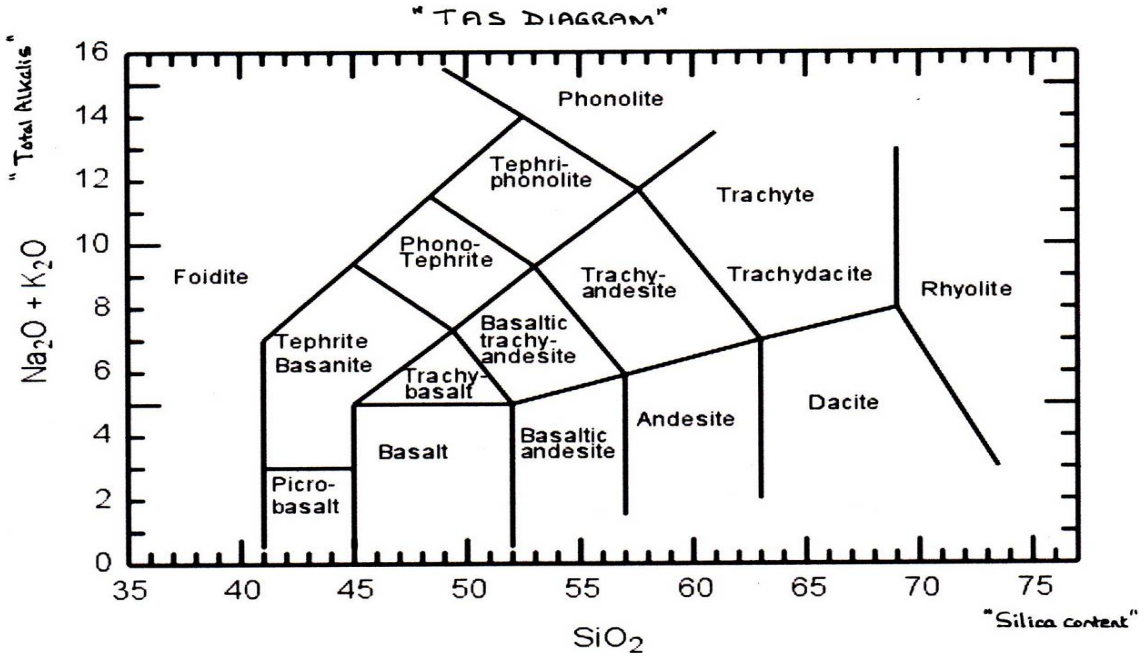


Figure 1

A different approach to classification which is more practical and visual, primarily for use in the field, considers the **physical appearance** and **texture** of a rock. Of importance are factors such as general colour (pale or dark) and crystal size (coarse or fine) and crystal shape (angular or rounded). Other features like the presence of gas bubbles, conspicuous crystal colour or degree of alteration of individual minerals may also be considered. This approach is useful in differentiating between the two principal divisions of igneous rock: those formed at depth (from **magma: plutonic / intrusive**) and those formed at the surface (from **lava: volcanic / extrusive**).

In the latter case a complication arises in that lava erupted into the atmosphere will fall as particles that result in rocks described as **volcaniclastic**, which have some of the characters of secondary sedimentary rocks, a subject to which I shall return in future. Such 'hybrid' rocks highlight the problem of creating unduly simplistic divisions between different rock types (or anything else for that matter). All too often differences grade seamlessly from one state to another!

Yet another means of classification is based on **mineralogical composition**. The most widely used is the **QAPF diagram**, a double-ternary diamond-shaped graph with quartz (Q), alkali-feldspar (A), plagioclase-feldspar (P) and feldspathoid (F) at its four corners. This is usually presented separately for plutonic or volcanic rocks alone: together things get rather cumbersome! *(figure 2).*

These chemical, mineralogical or physical approaches to classification serve mainly to describe the different rock types resulting from igneous origins. It enables us to differentiate between, say, a granite or a gabbro (acid or basic plutonic / coarse grained); between a basalt or a rhyolite (acid or basic volcanic / fine grained), but this alone is of little more than academic value. ►

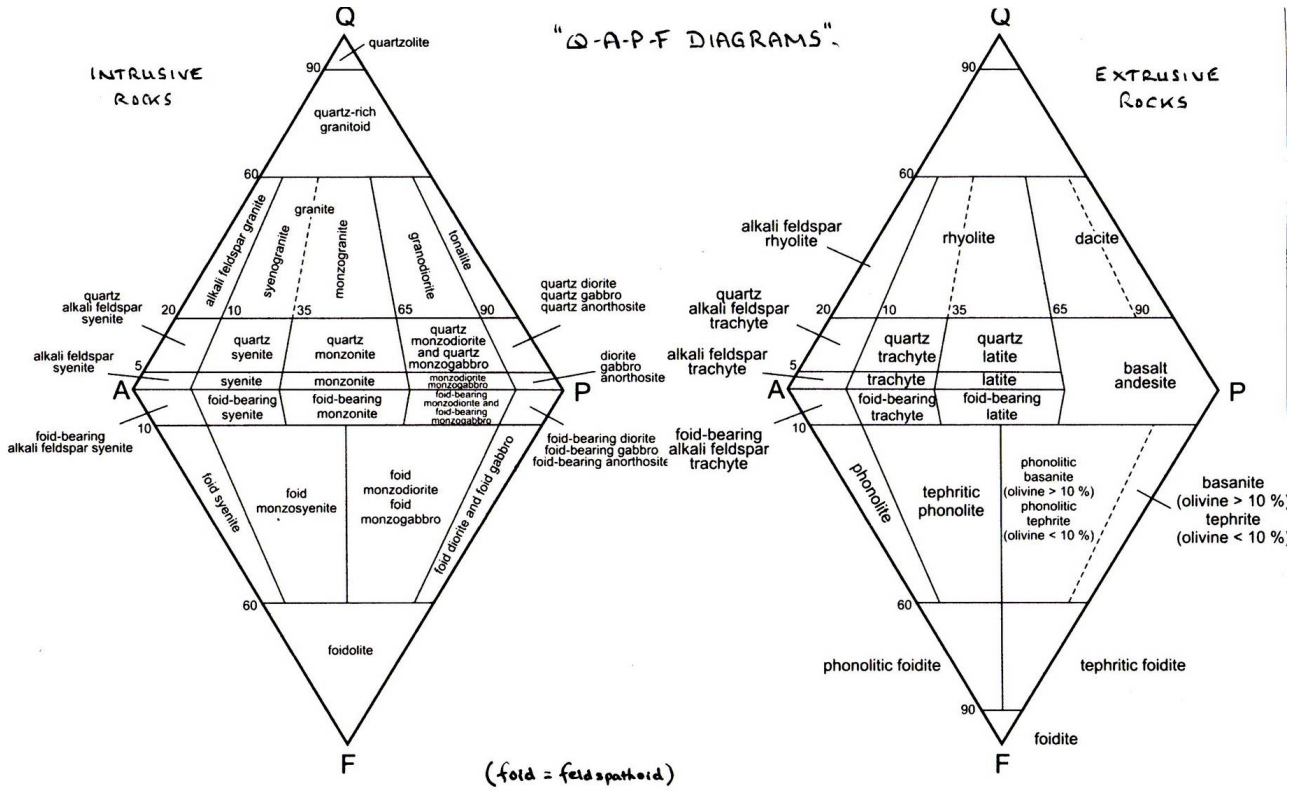


Figure 2

Carrying things a step further we can try to demonstrate further utility of classification schemes to throw light on the specific environments in which different igneous rocks are formed. This involves the recognition of different igneous **suites**, which adds further complications (and jargon), but is worth the effort! ►

ignsuite	----------> FRACTIONATION ----------> SEQUENCE ---------->			
	KOMATIITE SUITE	**THOLEIITE SUITE**	**CALCALKALINE SUITE**	**ALKALINE SUITE**
SILICA SATURATION	Over-Saturated	Over-Saturated	Over-Saturated (56-61% silica)	Under-Saturated (<51% silica)
IRON ENRICHMENT	Low Fe High Mg, Ni, Cr	Fe Enriched	Not Fe-enriched	Fe poor
ALKALI INDEX (ratio Ca:Na+K)	>1	>1	1	<1
Typical Rocks	Gabbro Peridotite ultrabasic lavas: Basalt, Andesite	High Fe Basalt	intermediate rocks: Diorite, Monzonite Plagiogranite Rhyolite	Alkali Basalt Alkali Granite Syenite Sodalites
Tectonic Environment	(exclusively) Archaean rifts	Rift Sites fore-arc basins Large Igneous Flood Provinces	Subduction Zones Volcanic Arcs	many situations: back-arc basins rifts, hotspots, volcanic arcs

Figure 3

Four main igneous suites are recognised: Komatiite, Tholeiite, Calcalkaline and Alkaline. These follow a progression in the degree of **chemical fractionation** (referred to previously). The concept of **silica saturation** is related to whether or not there is sufficient silica present in a magma to yield free quartz, and is broadly similar to the previously mentioned parameter of **silica content**, whilst the notion of **iron enrichment** and **alkali index** are reasonably self explanatory.

The resultant diagram *(figure 3, above)* goes further to show the typical rocks associated with each suite, but more usefully shows the typical plate tectonic environment with which each are usually associated. The value this brings is that it provides a sound basis for interpreting the geological history of an area, and, together with the magnetic record preserved mainly within igneous rocks, underpins much of the work that has gone into resolving the motions of tectonic plates through geological time.

So far we have relied on the major constituents of igneous rocks (chemical or mineralogical) to provide the main framework for investigating their differences. However, with the advent of the technological means to measure the minute amounts of every element present in rocks (almost to the extent of counting every atom!) many further specific methods have been described where minor constituents have proved of great value. I will give just one example.

Pearce and Cann (1973) introduced a means of discriminating between different plate tectonic environments using certain immobile elements, notably by means of a ternary plot of titanium, zircon and yttrium contents. This was based on analysing many samples from known present day locations and identifying a reasonably clear division of plots between **within-plate, island arc** and **ocean floor** samples. This template *(figure 4)* has since been applied with further refinements to identifying the likely association of many specimens from the ancient rock record. This, and other **Pearce Discriminants**, have been of particular value in differentiating between granitic intrusions: the so-called S, I, A and M types of granite associated with different tectonic environments.

The ultimate application of 'trace-element' and mineralogical analysis appears to have been reached with the 'fingerprinting' of rocks to identify specific sources from which building materials were obtained in ancient (archaeological) times. A well publicised example of this deals with the source of the 'blue stones' used in the construction of Stonehenge, but has also been used to help identify the provenance of granites and other igneous rocks used in some of the great buildings of classical times. The same principle, often extended to employ chemical isotopes, has been used to throw light on purely geological (though often esoteric!) problems.

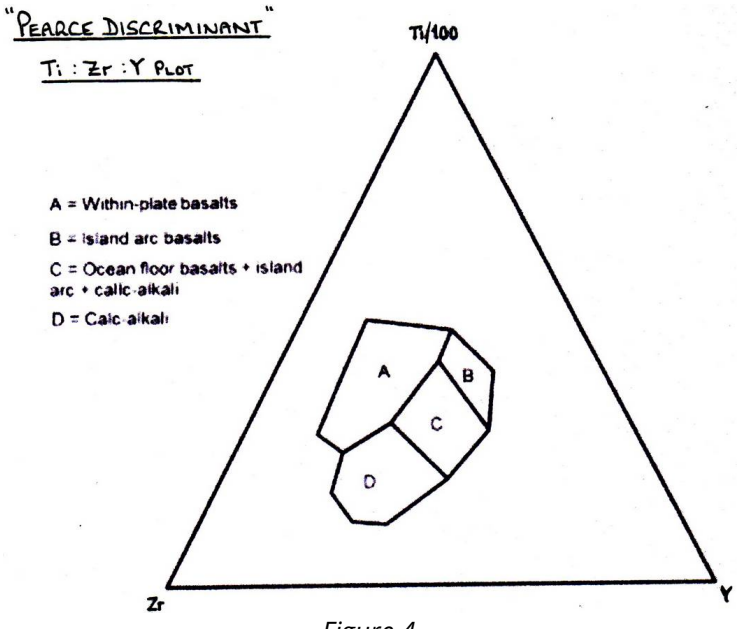


Figure 4

Such methods are not, of course, restricted to the igneous fraternity. So, who knows where future sophistication may lead us in uncovering the origins of igneous (and other) rocks. ■

Mike Allen