Newsletter No. 261
June 2020

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To find out more about this photo - read on!

Copy date for the next Newsletter is Saturday 1 August

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

Future Programme

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

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

Covid-19 Possible Alternative Arrangements for Talks

As you will know, many community events such as the BCGS talks, the AGM in March and the April talk were cancelled because of the COVID-19 lockdown. We all hope that by the time the BCGS autumn talks programme begins again on Monday 21 September we are able to meet at the Dudley Archives. But if that is not possible, we are hoping to be able to hold our meetings on-line using the video-conferencing platform 'Zoom'. Many organisations have been using software such as Zoom to keep in touch during the lockdown.

This software is free and easy to download and has proved not too difficult to use. You may have used it yourselves to talk to friends and relatives during the lockdown.

If we are not able to go ahead with talks at the Dudley Archive in September **please let us know if you would be unable to join us online.** By August, we hope to let you know one way or the other about the September meeting and if necessary, will give more details about 'Zoom' in the August Newsletter. We will keep you informed of any further developments.

Please contact the Meetings Secretary for further information.

Keith Elder, **BCGS Meeting Secretary**
☎ **07477075899** keith.elder@hotmail.co.uk

Monday 21 September *(Indoor Meeting, 7.00 for 7.30 start):* AGM *(postponed from 16 March)* followed by **'Glacial Change and its impact on sea levels'. Speaker: Dr Lucy Clarke (Senior Lecturer in Physical Geography, School of Natural and Social Sciences, University of Gloucestershire).** Lucy will describe and discuss some of the glacial change research she undertook in Antarctica and the impact of glacial change on sea levels.

Monday 19 October *(Indoor Meeting):* 'The Bob King Mineral Collection'. Speaker: Tom Cotterell, National Museum of Wales.

Monday 16 November *(Indoor Meeting):* 'Saltwells and Wren's Nest - Dudley's SSSIs for Geology'. Speakers: Alan Preece (Saltwells Warden) and Ian Beech, (Wren's Nest Warden). Details TBC.

Monday 14 December *(Christmas Meeting):* Talks by young geologists *(postponed from 16 March):*
1. 'Phytoplankton and the response of ocean ecosystems to ancient and future climate change'. Speaker: Matt Sutton, (University of Oxford).
2. 'Planetary Science'. Speaker: Connor King (BSc graduate from Plymouth University).
Full details for this meeting TBC.

Monday 18 January *(Indoor Meeting):* 'Geology in Paradise'. Speaker: Graham Hickman.

Other Societies and Events

Covid-19 Cancellations

Many societies have cancelled their meetings for the foreseeable future. Some are running virtual on-line meetings. Below is a list of the societies whose events we normally promote in this Newsletter. Please check websites for further information.

Geological Society of London – Public Lectures 2020

Tuesday 23 June, 2.30 – 3.30 *(Virtual lecture via Zoom):* **'Strategies in times of crisis - lessons from past marine ecosystems'.** Speaker: Professor Daniela Schmidt, Professor for Palaeobiology at the School of Earth Sciences at the University of Bristol. This lecture is free, but booking is essential. For more information and booking instructions go to: https://www.geolsoc.org.uk/
Registration for this virtual lecture is open now via Eventbrite.

Geological Society, West Midlands Regional Group: **Holding Zoom meetings -** www.geolsoc.org.uk/
Warwickshire Geological Conservation Group: http://www.wgcg.co.uk/
North Staffordshire Group of the Geologist's Association https://nsgga.org/
Teme Valley Geological Society: http://www.geo-village.eu/
Woolhope Naturalists' Field Club - Geology Section https://www.woolhopeclub.org.uk/meetings
Lapworth Lectures: http://www.birmingham.ac.uk/facilities/lapworth-museum/events/lectures.aspx
Shropshire Geological Society: www.shropshiregeology.org.uk/
Manchester Geological Association http://www.mangeolassoc.org.uk/

Mid Wales Geology Club: http://midwalesgeology.org.uk/
East Midlands Geological Society: http://www.emgs.org.uk/
Herefordshire & Worcestershire Earth Heritage Trust: http://www.earthheritagetrust.org/
Abberley & Malvern Hills Geopark: http://geopark.org.uk/

Editorial

In spite of the lockdown, we do have some news to report, and some excellent articles to inform and amuse in lieu of all those cancelled events and holidays which make our diaries look rather empty, way into the distant future. In fact this is the ultimate bumper issue so far - weighing in at 20 pages!

First comes the very sad news of the death of BCGS founder member Alan Cutler, whose contributions to geological conservation at a local level and nationwide are simply countless. In 2017 Alan received the award of MBE for his voluntary services to geoconservation, and this was reported by Andy Harrison in Newsletter 241, February 2017. Graham Worton, our Chairman and long-term friend and colleague of Alan's gives a fitting tribute below.

Then there is some good news. BCGS now has a Poet in Residence! This follows from the poem by Robert Francis which we published in the last Newsletter. He has recently received the news that his funding application for the project 'Chain Coral Chorus' has been successful. *(See the April Newsletter issue 260 for more details.)* He will be exploring the Black Country Geosites through the medium of poetry and this funding will open up opportunities for working in liaison with our Society. We congratulate Rob, and look forward to meeting him when circumstances permit, and to some geo-poetical collaborations in the future. This will be a whole new dimension for our Society. Below, (p.8) Rob (using his preferred title and pen name, R.W. Francis) describes his new role, rounding off with another poem, 'Coalescence'.

I hear in the news that Covid-19 is inspiring people to get writing. Publishers are receiving unprecedented numbers of new manuscripts! So how about it? Those of you who have a geo-story to tell but have never put pen to paper (or fingers to keyboard) now is surely the time! Please get your thinking caps on and get writing! We'd love to hear from you.

Julie Schroder

Chairman's Tribute to Alan Cutler MBE

It is with great sadness that I must report that we recently lost Alan Cutler, one of the founders of this Society. He was a very knowledgeable, kind, and dedicated part of our Society and he will be greatly missed by those who worked closely with him. He had an enormous impact on the world of local geology and its conservation. He was Black Country through and through and grew up in the hey-day of thriving Black Country industry. His pride in the area, and its amazing heritage and the desire to preserve it for future generations shone throughout his life.

Some of you will have known Alan. If you did you'll probably remember a gentle, quietly spoken guy with a cheeky smile and a twinkle in his eye. You probably won't know a great deal of his story, about his role in the creation of this Society and his impact on the whole field of local geological conservation. You probably won't know because he was a very modest man who never boasted about his contributions, and usually worked quietly influencing and persuading in the background. ►

Alan wasn't formally trained as a geologist. He studied Physics at Birmingham University in the late 1960's and then settled into the local metals industry after graduation. He was however inspired to establish an amateur local geological society - the BCGS back in 1975, while furthering his own education at night classes in geology. From then on his impact on the subject as a passionate advocate and campaigner grew, leading to local and eventually national recognition.

When I recently asked him about the motivation for his part in the creation of, and service to, this Society over all those years, he told me that he had become fascinated by the subject and was driven by the fact that he was witnessing rapid loss of geological sites from the area as redevelopment of the landscape swept them away, which disturbed him. He also lamented the poor storage of geological collections in local museums that had come from those sites. He deeply felt the loss of their amenity for science, education and inspiration. Rather than most, however, he decided to do something about it and began to act and do what he could to make a positive change.

He founded the Black Country Geological Society (BCGS) with a few like-minded friends to do just that and halt this ongoing loss. He loved the historical aspects of geology (he was closely involved with HOGG – The History of Geology Group of the Geological Society of London). This I think gave him a strong vision for the Society which was based on those earlier geological societies of Dudley where amateurs made a difference and contributed much to knowledge. *(For more on the history go to our website: https://bcgs.info/pub/the-society/history/ Ed).* This vision became a reality for the current BCGS through the endeavours of Alan and the early officers of the Society in the 1970s. Alan was its foremost champion and was its chairman from 1975 to 2000. From the outset the BCGS was set up to be an amateur society with practical, rather than strictly academic ambitions. Its first activities were to intervene at the local museums to salvage local geological collections, to campaign and lobby for the protection of local geological sites, and to hold public lectures and field excursions about local geology ensuring that emerging generations were still connected to their landscape and its heritage.

In 1985, Alan influenced a really important moment for local geology. He was instrumental in bringing the Geological Curators Group (affiliated to the Geological Society of London) to Dudley for its AGM that year. This was an incredibly important meeting that resulted in the establishment of the post of Keeper of Geology in Dudley Museum in 1987, with Colin Reid becoming the first keeper of geology since the 1800's. This achievement has proved to be absolutely pivotal in the development of local geology in the whole of the Black Country. The new presence of a full-time geologist drew together interested parties and provided an important central, recognised, geological 'hub' location for the region for the first time. This had a major impact by offering a point of contact during the working week with contact time that could create and maintain a local geological network of schools, engineers, planners, families and individuals that together would create award winning geological galleries, and host and run nationally renowned geological events and festivals attended by thousands of local families and enthusiasts. Alan co-authored the 'Geological field guide to the Wrens Nest National Nature Reserve' with Colin Reid and Peter Oliver in June 1990 which has been reprinted and updated a number of times and is probably one of the most well-read and regularly used geological field guides ever! ►

In 1993 Alan was one of the invited speakers at the Malvern International Conference 'Geological and Landscape Conservation'. He spoke about the important geological conservation work of the BCGS as one of the few regional geological societies at that time doing and developing geoconservation practice. His paper, published by the Geological Society in the proceedings volume in 1994, put the BCGS on the international map.

That work developed contacts and led to many new and profile raising initiatives in the next decades. These created the circumstances in which we could formalise a geodiversity partnership with an action plan and greater capacity to do good things - and ultimately to develop the Black Country UNESCO Global Geopark bid. This bid uses the international importance of the geological heritage. It will improve the quality of the local environment, will help to improve the lives of the 1.1 million people who live and work here, increase visitors to the area, create jobs and raise local pride. It would simply not have happened without the BCGS.

For me personally, as Alan's close colleague in various geological endeavours, I witnessed him at work and through writing various things together we shared our thought processes too. Alan had fantastic natural skills in negotiation and persuasion. He was a passionate local heritage champion who had an engaging and humble manner that inspired collaboration and trust. He had training in graphic design, conference organisation and exhibition work, so he knew how to present a concept. In fact all of the early branding for the BCGS, the promotional and exhibition materials for the Society, the typing and printing of the Society's one and only journal 'The Black Country Geologist Volume 1' *(on-line here: https://bcgs.info/, Ed.)* were all drafted by, organised and delivered by Alan and his contacts and by involving his own resources.

It is obvious to me having worked so closely with him for many years (almost 40 years - blimey!), that in his inbuilt 'calling' concerning the urgent need for conservation of local geological sites, Alan found his greatest sense of geological purpose. It's where he placed most of his passion, skills and time on behalf of the Society. He gave up a large amount of his free time and personal resource to be our representative at a wide range of meetings, conferences and committees. His dogged determination to get geology explicitly referred to in planning policy (as for example are archaeology and biodiversity), in nature conservation documents, and considered in funding programmes for nature conservation, was amazing. This drove some people on the receiving end of his gentle insistence crazy, no doubt, but he earned huge respect because of that commitment and consistency. I think he will always be remembered for that tenacity on the part of geology and geoconservation. The very few times I ever saw Alan annoyed were in connection with his frustrations about having to continually repeat and remind teams and individuals about geology and geoconservation in nature conservation circles despite the clear expression of geology and landscape in the clauses in nature conservation law itself!

He didn't just influence causes and organisations though, he massively influenced individuals like me too. I first met Alan in 1979 when the BCGS organised an evening class at Dudley Library about minerals and mineral deposits and, encouraged by members of the Society to join the BCGS, I soon found myself working alongside Alan on the committee. There, I first got to understand the importance of what this Society does and the vision that Alan and his fellow members had. In those days I learned and absorbed everything like a sponge and also realised the plight of geological sites and collections ►

because of them. They lit that fire in me too and I guess informally 'mentored' me. Alan without doubt strongly influenced me with his knowledge, joy for the subject and zeal as an agent to counter the threats to local geological sites, something he never lost and now because of him, neither will I.

In those decades I had the privilege of sharing many days with him doing things like site surveys (in some very odd and messy backwaters of the Black Country at times), or attending meetings all over the UK, doing presentations on Black Country Geodiversity, being part of all sorts of geological events and celebrations (and even organised a few with him). We put together grant applications, we wrote geological leaflets and did promotional events like rock and fossil festivals. In more recent times we sat together on committees and in partnerships representing all the angles for geological heritage, we wrote geological policy for guidance documents and schemed the Black Country UNESCO Global Geopark. He was so generous in spirit and shared so much of his time and knowledge with me. He even had me and others dressing up as historic geological characters on more than one occasion... he still is the best Sir Roderick Murchison re-enactor that I've ever witnessed!

His great reputation gave him other opportunities to be involved in geological things he cared so much about. That vocation for geoconservation saw him employed in more recent times as a geological conservation advisor with Natural England for a spell. That reputation for knowledge, commitment and gentle thoughtfulness also saw him chair Geodiversity and Biodiversity, and local sites forums. He became treasurer of UKRIGS / GeoConservation UK and a valued board member of the strategic partnership known as the Local Nature Partnership for Birmingham and the Black Country. He was my confidante in the UNESCO Global Geopark bid. He was involved in so many things that we often joked at the introductions part at the start of partnership meetings that Alan had to 'abbreviate' his list of affiliations so that we could make sure that the meeting finished on time!

He was rightfully awarded the MBE in 2017 for his tremendous and mostly voluntary contributions to geology and conservation – which he typically and modestly described in a local newspaper as 'a rather pleasant hobby'.

For the last few years he had a very difficult time with illness, but throughout he maintained incredible commitment and dignity, and as always that cheeky smile and passion for what he was doing.

Alan & Graham at the Murchison speech re-enactment, 2006

He was of course much more than this. He loved his family more than anything and was very proud of them. He also loved his connections with his former school, King Edward's School/College in Stourbridge where he was a governor and committee member of the Old Edwardians Club. The club was a place he loved to spend time and where he was probably particularly appreciated for his passion and knowledge for wine and port! His wife told me that she sometimes came second to all these things because he loved them so much, and that he really loved his life. I believe he did.

Perhaps then the best tribute I can give is that his was a life very well-lived. He gave a great example in his conduct and had a positive impact on so many others. He left the place better and with more opportunities than he found it. I am truly thankful for the time that he shared with me on geological adventures. His influence will carry forward and continue to influence so many things. He was my friend and he will be very sadly missed. ■

Graham Worton, Chairman

R.M. Francis - BCGS Poet in Residence

Below, in his own words, Robert Francis introduces himself and gives an insight into his new role as our 'Poet in Residence', using his preferred title and pen name, R.M. Francis. We congratulate him and look forward to this new partnership. Ed.

R. M. Francis lives in Wren's Nest Dudley and is one of the Creative Writing Lecturers at the University of Wolverhampton, where he completed his PhD. He's the author of five poetry pamphlet collections. In March 2020 his debut novel, Bella, was published with Wild Pressed Books, and later in the year, Subsidence, his collection of poems, will be released with Smokestack Books. In 2019 he was the inaugural David Bradshaw Writer in Residence at the University of Oxford.

Poet in Residence

R. M. Francis is the Black Country Geological Society's first ever Poet in Residence! He was recently successful in obtaining a place on the University of Wolverhampton's Early Career Research Award Scheme (ERAS), for a creative writing project that explores the geological heritage of the Black Country. This residency has been enabled by this fantastic support.

I'm absolutely delighted and very excited to be Poet in Residence for the Black Country Geological Society. In this 12 month role (from July 2020) I'll be exploring the geosites of the region, and writing a series of geopoems inspired by and set in these wonderful places. These poems will be creative responses to the environment and will explore how the geological make-up of the land impacts, connects and clashes with the much overlooked cultures of the Black Country. This work will be enhanced by the important geological research and work of the BCGS; together we'll be furthering the messages of geo-conservation; introducing new comers to geology and the region's rich history.

The Black Country is famous for its role in the Industrial Revolution; its industrial heritage forged unique and important communities and cultures; this, in many ways was connected to the grounds that gave life to these cultures - the fossil rich grounds dating back to the Silurian era. My creative work will re-figure our relationship with the local environment; both in its surfaces and depths, the building materials and the forces that create them. This project will consider these issues in an overlooked region, famed for its 'dark satanic mills' in the Industrial Revolution, considering this in conjunction with conservation, ecology, sustainability, and new ways of experiencing place in the anthropocene.

My working title for these poems is Chain Coral Chorus, and it will be the first Black Country Geopoetry project. Geopoetics are a variety of experimental writing practices that draw on geological method and language, and consider human life, culture and society in a deep time context. Canadian Poet, Don McKay referred to it as 'the place where materialism and mysticism, those ancient enemies, finally come together, have a conversation in which each hearkens to the other, then go out for a drink'. In this way, the poet's notebook and the geologist's field journal fuse. ►

I'll be working with The Black Country Geological Society to engage the public in these new ways of considering poetry and place. As such, alongside the poems I'll be running a series of walks, talks, readings and workshops throughout the year. You can also keep up with my explorations, thoughts and writing by following my BCGS Poet's Blog, and regular updates in the two-monthly newsletter, which again will consider all these concerns about poetry of place and to celebrate Black Country Geology.

Keep your eye on the BCGS Programme of Events for the upcoming information on these creative workshops, walks and talks.

Following from 'Through Filth' printed in the April Newsletter, here is another poem that explores some of the ways geology and the study of earth sciences intersect with our everyday experience of place and the natural world. This poem plays with the ideas of geological fusion and suspension loads, using this as a metaphor for how a return to being conscious of our ecological heritage results in an awareness of all of our mutual interdependence and inescapable connectedness. ■

Coalescence

Just spring -
the last leaves
left from autumn's
mulching leak
into pig iron grounds.
Greywacke, Fireclay, Ironstone
sit turbid at Netherton Spa
where dog walkers and rambling clubs
and pinfold teens and locked in pensioners
sense the spectral gravity beneath feet.
It seems to whine at the flytipped waste. It
takes it into itself. And the buds from Bramble,
Damson, wipe rheum from eyes between quickflash
of bluebell, snowdrop. Rheum drips in Dalton caverns
as in weeping elms and human pores:
this land leaves them colloidal. *We suspend.*

R. M. Francis, BCGS Poet in Residence

Find out more about R. M. Francis here https://rmfrancis.weebly.com/
and connect with him on Twitter @RMFrancis
Find out more about the University of Wolverhampton ERAS here:
https://www.wlv.ac.uk/research/the-doctoral-college/early-researcher-award-scheme-eras/

Volcanic Experiences trip to La Palma

Part 1 – The Geological Background and History

'Volcanic Experiences' is a small company running trips to volcanic areas around the world. It is run by Alan Clewlow (our Treasurer), who accompanies all the tours. This is his account of a recent trip to La Palma in February / March just in time before Covid-19 put a stop to all such adventures. Part 1 describes the geological setting. Part 2 will be a day by day account of the tour, and will be in the August Newsletter. Ed.

We were extremely fortunate to be able to undertake, at the end of February, a geological tour to La Palma, one of the lesser known, but for many, the most beautiful and spectacular of the Canary Islands. This was at a time when the Coronavirus pandemic had started to spread into Western Europe, but as no cases had reached the island at that time, flights were operating normally. Had the trip been planned for two weeks later, we would have run into major problems in being able to get around, and would possibly have been trapped on the island for an extended stay.

As it was, we were blessed with fine weather throughout the week of our stay, being based at the Sol La Palma hotel on the south-western coast of the island, which experiences around 300 days of sunshine per year. The tour covered most parts of the island, which is entirely volcanic in origin, and exposes rocks from its early beginnings as a submarine sea-mount, to a crater and lava flows formed by its most recent eruption in 1971.

General Geology of the Canary Islands and tectonic setting

The Canary Islands form a cluster in the Atlantic Ocean, around 100 km west from the African Coast. There are seven larger inhabited islands together with a number of smaller ones. The islands rise from the ocean floor, which lies at a depth of 3000-4000m below sea level, making Mount Teide on Tenerife, the third highest peak on the planet, at a true height of over 7000m.

View of Tenerife (left) and La Gomera (right) from the 'Route of the Volcanoes', La Palma. The peak of Teide on Tenerife can just be made out

The Canary islands have a lot in common with the Hawaiian islands. They both consist of a series of volcanic peaks composed largely of basalt. The chemistry of the magma which formed them is similar, and both sets of islands are thought to lie on 'hotspots' above an upwelling mantle plume, where heat rising through the upper mantle has been able to partially melt the peridotite forming the asthenosphere, to create large volumes of basaltic magma. Due to movement of the overlying African Plate up to the present time, it is thought that the mantle plume now lies in a position close to El Hierro (the island lying due south of La Palma), with the oldest islands Fuerteventura and Lanzarote lying furthest east, nearer the African mainland, and the youngest islands, La Palma and El Hierro furthest west. The oldest rocks on Fuerteventura date back to 22 million years, while those on El Hierro date back only to 1.2 million years. La Palma started to form around 2 million years ago. ►

There are some significant differences between the Hawaiian islands and the Canaries. Firstly, unlike Hawaii, where the volcanoes on all but one of the islands are extinct, most of the Canary Islands still have active volcanoes which have erupted in historic times (La Gomera is the exception). The main explanation for this difference is that the African Plate in this region is moving only very slowly over the hotspot, so none of the islands is very far away from it. Secondly, although mainly basaltic in composition, the magma erupted in the Canaries does have a much more varied chemical composition, including those of an alkaline (Na and K-rich) and silica rich nature. This means that magmas are sometimes viscous and explosive when being erupted. It also produces a third difference in character compared to Hawaiian volcanoes - those in the Canaries tend to have steeper slope angles of around 15-20° compared to the 5° typical of Hawaiian volcanoes. The reasons for the differences are likely to be due to variations in the supply rate of magma from the underlying mantle. In Hawaii, volumes are so large that magma does not have the time to reside for any great length of time in magma chambers, so its composition is more constant. In the Canaries, however, magma supply rates are much lower, being just enough to keep magma chambers molten, while allowing time for magma to undergo fractional crystallization.

Geological Evolution of Canarian Volcanoes

As mentioned previously, the origin of volcanoes such as those which have formed the Canaries lies in the existence of a hot-spot above a mantle plume. Magma forms in the upper mantle due to partial melting of the peridotite which exists there. Mantle peridotite is ultrabasic in character, with a generally low silica percentage of around 40%. It has high iron and magnesium content and is dominated by minerals such as olivine and pyroxene. The magma produced by the partial melting is slightly richer in silica (typically around 45-50%) and is generally described as basic. This is what is erupted at the surface to form large quantities of basalt rock, which largely make up the islands. Over time, however, the nature of the material being erupted changes, as does the character of eruptions and the features produced. Three distinct phases can be recognized in the Canaries: **Seamount** (Submarine) stage; **Shield-building** stage; **Post-Shield** stage.

The Seamount stage

During this phase, which occurs as the plate above approaches the hot-spot, eruptions of alkali-basalt (sodium-rich) occur on the sea-floor, perhaps 4 km below the surface, creating an active sea-mount. The great pressures exerted by the weight of sea-water above ensure that any gas contained within the erupting lavas remains dissolved, so eruptions are generally effusive and quiet, forming so-called 'pillow lavas' as lava in contact with the ocean water chills to form a skin and the pillow inflates beneath it before breaking away to allow another pillow to form. The seamount also includes associated intrusive rocks (dykes and larger coarse-grained intrusions of gabbro). Although formed below sea-level, uplift and deep rapid erosion have exposed these rocks on a number of islands, but most notably on La Palma.

The Shield-building stage

This stage occurs when the volcano lies directly over the hot-spot. It may account for 95-98% of each volcano's volume. Both La Palma and El Hierro are believed to be at this stage of their development. La Palma has been in this stage for the past 2 million years. Large quantities of ***tholeitic*** basalt are produced. The silica content averages about 50%, with relatively high amounts of iron, magnesium and calcium, but very little sodium. This tends to be hot and fluid, but for reasons explained previously, ►

volumes are not so great as in Hawaiian volcanoes, and there may also be eruptions of more viscous silica-rich material, so slope angles can be steep. The early period of this stage takes place under water. Outpourings of lava build up, with crustal thickening as the great mass of the material causes settling into the mantle below. Eventually, however, the volcano breaches the surface and eruptions continue, both above and below sea-level. Without the weight of a huge volume of water above to contain the pressure, gases are released as lavas erupt, so at this stage, there may be 'fire-fountains' created by the vigorous emission of gas and lava. More explosive eruptions, creating ash and cinder cones are also common. Slope failure (lateral collapse) due to gravity on the seaward side of large volcanoes appears to be a common occurrence, many extending inland and producing collapse-scars up to 20km across and 2 km deep.

Post-Shield stage

The end of the shield-building stage produced large scale collapse calderas on a number of the Canarian volcanoes (most notably Mount Teide on Tenerife). There then tends to occur a period of inactivity lasting several million years, during which time there may be intense erosion of the landscape. Eventually, there then follows renewed activity, often quite vigorous, but with low magma production rates compared to the shield building stage. It is believed that Lanzarote, Fuerteventura, Tenerife and Gran Canaria are all in this stage of their development.

The Volcanoes of La Palma

In simple terms, these can be categorized as follows:

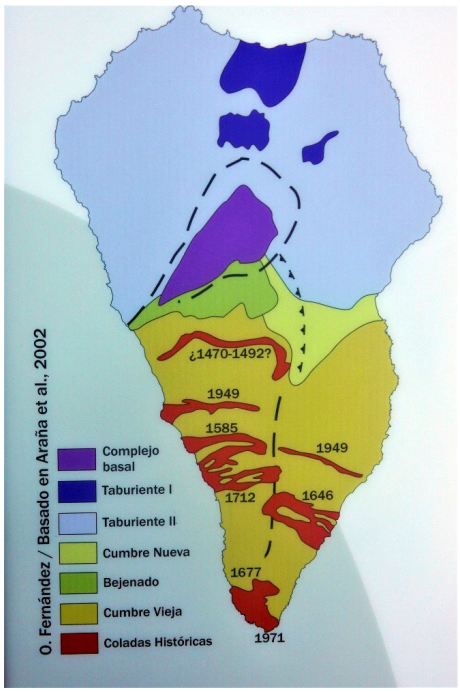
1. The submarine volcano, Pliocene in age with rocks formed during the sea-mount stage. This is now exposed due to regional uplift and erosion within the Caldera de Taburiente in the lower part of the Barranco de Las Angustias.

2. The Garafia Volcano (extinct). Sometimes referred to as 'Taburiente I', this is the oldest subaerial volcano on the island, at 1.7-1.2 million years old, found in the northern part of the island but completely covered by lavas and other deposits from the younger, much larger, Taburiente volcano. There are isolated exposures in the north, where erosion to form deep barrancos has stripped away overlying material.

3. The Taburiente volcano (extinct). Sometimes referred to as the 'Northern shield' volcano. This massive volcano dominates the northern part of the island and forms its highest peaks. At its centre lies the huge Caldera de Taburiente. The volcano was active for 800,000 years, from 1.2-0.4 million years ago, continuing to see eruptions up to 90,000 years after Bejenado (below) ceased erupting.

4. The Bejenado volcano (extinct). A smaller, younger volcano which developed within the Caldera de Taburiente. Age 0.56-0.49 million years.

5. The Cumbre Vieja volcano (active). This is the most active of all Canary Islands volcanoes, most recently erupting in 1971. It forms all the southern half of the island, with eruptions occurring from a series of cones running along a N-S ridge, which has formed along one of the main rift lines of the island. The volcano has been active for 120,000 years, and has erupted six times in the past 500 years. ►



A simple geological map of the island is shown on the left:

NB. The key in the diagram (left) may be a little confusing. 'Complejo basal' is the submarine volcano, 'Taburiente I' is the Garafia volcano, 'Taburiente II' is what is usually regarded as the Taburiente (Northern Shield) volcano. 'Cumbre Nueva' is the name given to the build-up of lavas on a rift zone of the Taburiente volcano in its later stages of eruption, as the centre of activity shifted to the south. ■

Alan Clewlow

Part 2, an illustrated report of the week's tour of La Palma, will appear in the August Newsletter. Ed.

Holiday Visit to Mount Vesuvius, Italy

Mount Vesuvius, Monte Vesuvio in Italian, is located within Italy's Campania region on the south-west coast overlooking the Bay of Naples. Central Naples, the region's capital, is approximately 13km from the volcano's current peak with the city's eastern outskirts ending about 2km from its flanks. Around 24 population centres, or communes, surround the volcano on all sides and house approximately 800,000 people. These include Portici, Ercolano and Torre del Greco that follow the coastline south from Naples, around 6km west of the volcano's summit. About 9km south of Vesuvius is the historic Roman city of Pompeii. *(See front cover photo, which shows Vesuvius from Pompeii.)*

The existing mountain peak sits at a lofty 1,131m above sea level. The casual observer looking from a distance would see the mountain has two peaks, to the north and south, the southern peak representing the more recent and current summit. To the more trained eye, following the northern peak's flanks, it is apparent that the mountain was historically a single peak and much higher. Topographic maps and images show the southern peak looking like a typical volcano with a large central crater. The peak to the north is revealed as a crescent shaped ridge called Mount Somma and between the two peaks is a deep valley called Valle del Gigante.

Mount Somma (the old and northern peak) and Valle del Gigante

The volcano's current morphology stems from its eruptive history, and to AD 79, when it spectacularly erupted and famously destroyed the ancient Roman cities of Pompeii, Stabiae and Herculaneum. Situated immediately to the west, the Herculaneum ruins are located where Ercolano sits today. ►

Before Lockdown and Coronavirus, I was fortunate to visit this part of Italy with my partner on a week-long Exodus walking holiday to the Amalfi Coast in November 2019. We stayed in the village of Bomerano, situated on the Agerola Plains, 700m up in the Parco Regionale dei Monti Lattari and around 17km south of Naples. Very changeable weather all week altered our itinerary, that in a way worked out for the best. On the Monday, bad weather prevented our planned trip up Vesuvius. So, we visited Herculaneum and Pompeii's ruins instead. Fortunately, better weather later in the week made possible our visit to Vesuvius and a walk around the crater rim.

View of Vesuvius driving north from the hotel

We had an early pick-up from the hotel on the day and had clear views of Vesuvius as we descended into the Bay of Naples. Driving up the volcano's wooded flanks, partially burnt due to arson, our bus dropped us off at the Vesuvius National Park Visitor Centre. Situated approximately 1,000m above sea level, here we met local guide Stefano, a Mount Vesuvius expert, who would take us up to and round the crater rim. "The walk will take around two and a half hours", Stefano explained "up to Sentiero del Gran Cono at the crater rim is 900m with a stop halfway. From there, for those who want to we will continue around the crater rim and I will let you feel the mountain's hot heat".

As we started walking up Vesuvius's southern peak, Stefano explained how it was the newest peak with the crater we would visit resulting from the last eruption in 1944. Pointing to Mount Somma (meaning summit), to the north, Stefano explained how that was all that remained of the original volcano that exploded in AD 79. A mural discovered in the Pompeii ruins depicts the God of Wine, Bacchus, with a single mountain peak behind. "That is how we are sure that there was once only one peak", explained Stefano. When the volcano erupted in AD 79, not only was much of the mountain blown away, but the emptying magma chamber caused the central crater to collapse into a vast caldera. Estimated at around 2,300m high the original volcano has been reduced to about half its size and all that remains today is the crescent shaped Mount Somma. The deep valley (Valle del Gigante) between is all that remains of that original caldera.

Our ascent along the tourist route was over dark reddish-brown and black gravelly volcanic rock or scoria erupted from the volcano. Halfway up we stopped and Stefano with a big stick sketched in the path the volcano's workings. "The magma chamber is 8km below the bottom of the crater", he explained, drawing a big circle. Above he drew a triangle 'the volcano' and between the two a 'conduit', to bring the magma outside. Removing part of the triangle, Stefano demonstrated how the AD 79 eruption destroyed the earlier mountain, leaving behind Mount Somma and resulting in the ground level profile we see today. "Following AD 79, we know of around 80 effusive eruptions that occurred to build this new cone within the Pompeii eruption crater". A black line in the valley represented the last lava flows from the 1944 eruption that travelled down slope to destroy two cities - San Sebastiano and Massa di Somma, situated below the western flanks. The 1944 eruptions only killed 28 people, due to roof tops collapsing from ash building up.

Following AD 79 geologists have estimated that there were around 60 to 70 eruptions from AD 202 to 1139 and then no more for around 500 years. Then in 1631 a great explosion killed 4,000, which ►

Pyroxene crystals in the scoria

resulted in people coming to see the volcano and the start of real scientific analysis. Archaeological excavations in the 17th and 18th centuries unearthed the ruins of Pompeii and Herculaneum. After 1631 four important eruptions occurred in 1906, 1929, 1933 and the last in 1944. Looking at the rocks under our feet, Stefano explained how the red vesicular lava was rich in iron giving it that distinctive colour. The black scoria was rich in dark green pyroxene, biotite, and olivine, resulting from the cooling surface of lava flows as they were effused. The eruption also ejected molten material into the sky which quickly cooled and solidified into three main forms: ash, with a grain size less than 2mm, lapilli (<64mm) and larger bombs (>64mm). Bombs get their name as when erupted the outer surface cools forming a thin shell and leaving the interior molten. Impact with the ground breaks them, setting anything flammable alight. Around 200 types of mineral have been found on Vesuvius including rose quartz, pyrite, amethyst, native sulphur, mimetite, vesuvianite, celestine, calcite and hematite.

Tectonic Setting

Italy sits on the Eurasian-African Plate boundary with the African Plate being subducted beneath Eurasia. These movements created the Alps (Alpine Orogeny) and are causing the Adriatic Sea to close. Down Italy's spine run the Appenine mountains where earthquakes are common. Along the south-west coast volcanism dominates with each volcano having its own independent magma chamber. Vesuvius itself started forming around 25,000 years ago and sits within the Campanian Volcanic arc that also includes Campi Flegrei.

Volcano Crater

Continuing our way to Sentiero del Gran Cono and the crater rim, Stefano pointed out the local geography and landmarks, including Pompeii to the south, the harbour to the west and the ports of Portici and Torre del Greco. Lying between the two are the ruins of Herculaneum at Ercolano. To the south-west was Capri and the Sorrento peninsula and in the bay to the west a pyramid shaped peninsula called Miseno with the volcanic island of Ischia beyond.

On reaching Sentiero del Gran Cono we stopped at a viewing point looking across and down into the volcano's crater. A vast vertical wall of stratified ruddy and greyish volcanic rock formed the crater wall, in the base of which were scree covered slopes. Of particular note were two almost white layers in the crater wall. These marked the original positions of the crater floor immediately after the last eruption and later. In photos taken before 1944 the crater floor appears flat and almost at a level with the crater rim. At the centre is a steaming chimney from which the various eruptions between 1631 and 1944 occurred. Today the crater rim is around 1.5km in circumference and elliptical in plan with a minimum 450m and maximum 600m width. In comparison, the original caldera that collapsed during the AD 79 eruption has been estimated at around 10km wide. Following the last eruption, as the magma chamber emptied and the pressure subsided the crater floor dropped to the level of the second white layer. Later it dropped again to its present level, which today is 330m below the crater rim. ►

From fumaroles on crater edges white vapour clouds issued. These result from evaporated rainwater carrying carbon dioxide rich and sulphurous steam up from the magma chamber. On Vesuvius these gases reach temperatures of 60° to 95°, but according to Stefano, temperatures of 500°C have been recorded for other volcanoes. Monitoring and measuring the temperature and chemistry of these gases helps scientists watching the volcano to determine whether any renewed activity is occurring. Thermal and chemical changes indicate that new molten material is entering the magma chamber.

View of the crater from the rim

From the viewpoint, we walked along the narrow crater rim over light grey pumice and ash passing various monitoring apparatus along the way. The equipment sends data about the volcano's activity directly back to a volcano observatory run by the National Institute of Geology and Volcanology (INGV). As we reached the highest point on the crater rim Stefano stopped the group. On the side of the path was a small hole, which Stefano got everyone put their hand into. "I like to let you feel the heat of Vesuvius" said Stefano as we took turns to insert a hand.

Eruption of AD 79

Pliny the Younger documented the AD 79 eruption in letters that he sent to the Roman historian Tacitus. The eruption occurred sixteen years after a major earthquake struck the region. As we saw whilst visiting Pompeii and Herculaneum, locals had only just completed and were still undertaking repairs when Vesuvius erupted. At the time, the Roman Fleet was moored off the Miseno Peninsula out to the west. On board was Pliny the Younger who had a 'ringside seat'. His uncle, Pliny the Elder, Admiral of the Fleet, on seeing the initial explosion went closer to Castellammare and was unfortunately killed during the eruption that buried Pompeii. From Pliny the Younger's descriptions this type of eruption has been christened a Plinean Eruption (with eruption columns >25km). Smaller scale events (with eruption columns of 20km to 25km) are called sub-Plinian eruptions.

"Knowing and understanding the processes and travel directions of ashfall and lava flows is important for helping officials know who is most at risk, and those to move first should another eruption happen", said Stefano. "During the AD 79 event, half the mountain was blown away and a column of ash erupted up to 28km into the stratosphere. The main hazard occurred when the column started to cool and the ash settled. The wind direction was important as it influenced the direction in which the column collapsed. During the eruption, wind directions were towards the south and south-east, resulting in Pompeii being buried beneath 7m of ash, lapilli and pumice".

"Herculaneum", he continued, "was another story. The city was destroyed during the same eruption, but sits to the west of Vesuvius. After the column was erupted, molten magma entered the magma chamber. The initial explosion had resulted in deep seated cracks that allowed groundwater to also enter the magma chamber. Groundwater contacting hot magma resulted in steam and a second explosion, this time sideways and to the west. The second explosion resulted in a base surge, or pyroclastic flow, of rock and hot gases (around 400°C) travelling at 150 km/hr that buried Herculaneum under 20m of boiling mud". ►

View over the Bay of Naples from the crater rim

Whilst visiting Herculaneum, we were told that the city was a coastal retreat for the Roman upper classes. Pompeii too was a bustling port. The residents of Herculaneum upon seeing the original explosion had apparently attempted to escape by sea, but were pushed back into the harbour by strong waves. Consequently, they looked for shelter in the boat sheds only to be buried alive. One noticeable consequence of the eruption was that the shoreline was pushed westwards by around three to four kilometres. On visiting ancient Greek / Roman aqueducts and tunnels under Naples later in the trip, we saw how the Bay's inland area owes its existence to the build-up of volcanic deposits most probably originating from Vesuvius.

According to Stefano, another Plinian type eruption is not expected any time soon. However, there is a chance of a sub-Plinian type eruption once gases in the magma chamber have had time to accumulate. The higher the eruption column, the further volcanic bombs have a chance to travel. With a sub-Plinian eruption they will not travel as far. To help predict the next eruption, scientists need as much data as possible. This they can achieve from recording earthquakes and seismic data, steam temperature and chemistry, temperatures around the crater, soil deformation and water acidity. These are all indicators to help determine the volcano's behaviour and when / whether it might erupt again.

A 13km 'Red Zone', has been set up as an area most at risk from the next Vesuvius eruption, which currently only stretches up to the Naples outskirts. Within this zone Neapolitan officials know the directions and distances ash-falls and lava flows are likely to travel and therefore which people to move first. Time, moving large populations, resistance to change, politics and money are all human issues that need to be taken into consideration in order to protect lives against an eruption and any other natural disaster.

From the high point on the crater rim with a last look at the view, it was time to head back down to Sentiero del Gran Cono and the Vesuvius National Park visitor centre. With thanks and farewells to Stefano for a fascinating day, we boarded the bus and headed back south to Bomerano, on the Amalfi coast for a good Italian dinner and wine at the hotel. ■

Andy Harrison

Mike's Musings No. 27
Time for another laugh – more howlers

In these trying times I thought it might be appropriate to return to a more frivolous theme and hopefully raise a smile of two with another helping of those geological examination howlers I introduced in my 12th musing back in December 2017 (Newsletter No. 246). This idea was also prompted by something I read on a website whilst randomly trawling the internet recently for material on news from other geological societies, the identity of which I shall not disclose (and didn't actually make a note of anyway – so don't ask). There I spotted a reference to a supposed period of geological time referred to as the 'ore division'. ►

From the general context it didn't take me long to work out that the writer was unfamiliar with the 'stratigraphic table' and had obviously misheard someone's reference to the 'Ordovician', which shows the dangers of writing about subjects one doesn't know too much about! However, this is precisely what is demanded of many students sitting geology exams, so further misunderstandings are always likely to be the result - fortunately so for the purpose in hand!

To continue with the subject of simple misunderstandings resulting from grammatical, punctuation, mishearing or spelling typos we have the following examples*...

'Much of the area is j(J)**urassic** (sic) **and crustaceous** (double-sic!) ...'

'Geological collomb' (in fairness, some contributions might be from students for whom English may not be their mother-tongue... and anyway, who would naturally arrive at the correct spelling of 'column' from pronunciation alone!).

Similarly, one might just be forgiven for imagining that **'speciman'** is obviously the correct spelling for a single 'specimen'! Or is this one for the 'contrived' section below?

I particularly like the notion of **'Herculyean movements'** which carries with it a useful connotation of 'vastness' (Hercules and the Hercynian).

Having a bad memory for names myself, I can sympathise with the student who thought it was...

'General Hutton' who coined the phrase **'The present is the key to the past'** (mixing up *James* Hutton with Charles Lyell, of course).

And it's easy to become overawed, and hence confused, by similar sounding jargon words...

'Orogeny' (ontogeny) **recapitulates phylogeny'.**

And sometimes confusion might arise from miscomprehension, or missing the point...

'When two suites of rock lie unconformably on top of each other (?) **there is absolutely no relationship between the rocks'** (??)

'It has been postulated that Iceland is still experiencing the Tertiary Period'.

'Micas are pyroxenes'.

Student: 'It looks like sandstone to me'.
Teacher: 'Nonsense! Look at it carefully with a hand lens and you'll see it's different'.
Student: 'The only difference I can see is that it's now a lot bigger'!

Sometimes we know what they mean... but... (take a deep breath)...

'The means by which continents move apart is best illustrated by Vine and Matthews when writing on the mid-Atlantic ridge'.

Or do we?...

'Vine and Matthews saw a magnetic anomaly at every ridge throughout the world'.

Of course, students always like to mess about and come up with contrived humour that is clearly deliberate in nature...

'Glaziers are common. They move about one foot per day in Switzerland' (or perhaps a little faster, and 'backwards', in these globally warmed times!?) ►

'A breccia may be formed by desiccation (dry rot), or by frost action (cold rot), or by solution (wet rot), or by the action of the sun (hot rot). It may happen by faulting in any kind of rock (all rot)'.

'Foliage is leaves, so exfoliation is the removal of leaves by ice action. This is known as onion weathering because onion trees are very easily attacked by ice'.

And of course we cannot go a whole 'musing' without dinosaurs entering the fray!..

'A dinosaur was a herbaceous (!) **animal that got so large it was too fat to run after its prey** (!!) **and so died of starvation'.**

Whilst on other occasions the humour is presumably quite unintentional...

'Boulder clay speaks for itself'.

'Towards noon a halt was called and we lunched on some slabs of red granite'.

'A visit to an aunt in the North West not far from Carlisle revealed what I think was a dolerite dyke'.

'An intrusion of dolerite came up through the middle of the diagram' (perhaps the one not far from Carlisle!?)

Ah! The (?f)utility of geological effort...

'If a suspected criminal claimed he was in one place when he was supposed to be in another, a heavy mineral study of the clay and sand on his boots would soon prove who was right. Unfortunately, most criminals would clean their shoes'.

'Galena's relative economic importance to the everyday person is illustrated by the constant theft of lead of (sic) **many church roofs up and down the country'.**

Sometimes you can detect the stress examinees are feeling...

'Kaolin is a white powder that used to be found in Cornwall until the Romans came and took it all away. There is none in the department, it's so rare. This is very unfair I think... and the rule should be, no specimen no question in the exam'.

Vacuous, or similarly unhelpful statements, seem to crop up rather a lot...

'Metamorphic rocks can be found as heavy masses'.

'I find Moh's scale of hardness most interesting'.

'Water and gas is a lot more fluid than a solid'.

And wouldn't one just love some suggestions / theories to be true..?

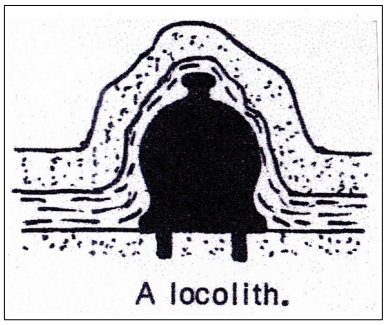
'A mammoth in amber....'

'An(other?) **example of complete preservation can be seen in Russia where a giant sloth was found intact down to the last detail... One view was that a freik** (sic) **wind was the cause. This probably had a temperature of about -300°C which would freeze and kill anything instantaneously and it must have gusted anything up to 500 m.p.h.'** (is that how Bird's Eye do their peas?) ►

'Now Mr. Holland followed the ordinary procedure of having tennis courts on the lawn at the back of his house, from which can be obtained a grand panoramic view of the Chiltern Hills, which he built for himself' (He could come and landscape my garden!)

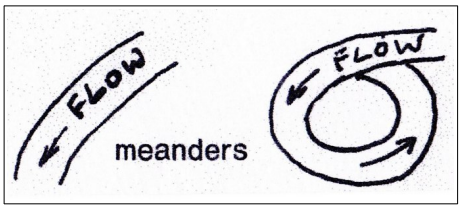
And finally (for now)... if a picture paints a thousand words...

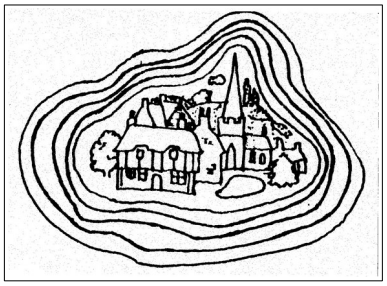
'Rocks once like this' **'can come to look like this'** (true... but how?)



I've heard of sills, dykes, batholiths and even lopoliths... but **'locoliths'**? Someone's having a laugh!

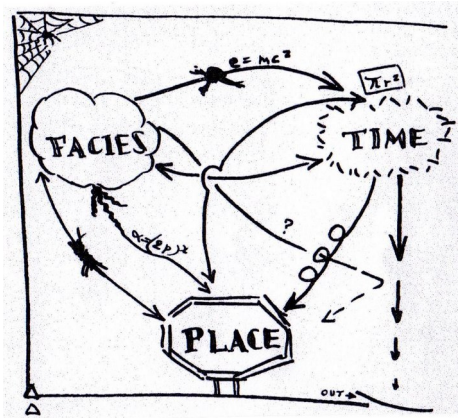
And at least one person is having trouble with their **'meanders'**





'The largest concretions occur round Burton Bradstock'
(see diagram for clarification!)

'Facies is a term used when the same rocks are deposited in different places at different times, or when different rocks are deposited in the same place at different times or when different rocks are deposited at different places at the same time...'
(see diagram for clarification!)



Well, I don't suppose this student was the first, or last, to be bamboozled by that confounded concept dreamt up to keep would-be geologists awake at night!

Keep safe, stay alert!! ■

Mike Allen

*Acknowledgement:
Taken from 'Geological Howlers', Ed. W. D. Ian Rolfe, pub: Geological Society of Glasgow, 1980.