Newsletter No. 285

June 2024

Contents:

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Copy date for the next Newsletter is Thursday 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 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.

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

Wednesday 3 July *(Evening Field Meeting):* Glacial Boulder Trail 2 'Around Bournville and Cotteridge Park'. Led by Julie Schroder. Joint meeting with Geological Society, WMRG. Meet at 6.30 on Bournville Lane, Birmingham, outside Bournville Station, SP050811. Parking available on Bournville Lane west of the railway. Learn how Louis Barrow, Cadbury's chief engineer in the early 20th century, saved numerous glacial erratic boulders found during excavation of the factory site, and created Birmingham's finest and most comprehensive collection of erratics from the Arenig Mountains in Wales. Finish around 8.30. Possible pub social afterwards (but not in 'dry' Bournville!).

Sunday 28 July *(Field Meeting):* Tardebigge, Bromsgrove. Leader Mike Allen. Meet at St. Bartholomew's Church, Tardebigge, Bromsgrove, B60 3AH (NGR: SO 9964 6914) at **1.30** for a **2.00** start. Assemble in the church car park (Church Lane, off High House Lane). A gentle circular stroll of around 2-3 hours in an area underlain by Triassic mudstones and sandstones (c.250-210 Ma), providing an opportunity to discuss the relationship between underlying geology and local landform (if any?). En route we will observe several glacial erratics, vestiges of the Anglian ice advance (c.450,000 years ago). Walking mainly on level field footpaths, towpath, tracks, a short section on a narrow road, some steeper gradients. Arrive early if you wish to have a picnic beforehand: benches with good views nearby. The Tardebigge pub is half a mile away from the church on the B4096, Hewell Lane, Redditch B97 6QL (advisable to check open times). **Please note: there are no facilities on site or throughout the planned route.** The walk includes part of the celebrated Tardebigge flight of 30 locks on the Worcester & Birmingham Canal (longest in UK) and includes several fine viewpoints (weather conditions permitting!). A separate exposure of the sandstone in a small, overgrown, roadside quarry can be included (10 minutes by car, limited parking for 3 vehicles) at the end of the walk.

Saturday 17 August *(Field Meeting):* A Geology Walk around the Severn Valley Country Park, Shropshire. Led by Andy Harrison. Joint event with the Geological Society WMRG. Meet at the Severn Valley Country Park main visitor centre: WV15 6NG (GR: SO7536 8398) ready to start at **12.00**. This meeting coincides with the Abberley and Malvern Hills Geopark's 'Geofest' – specimens and geo-craft event hosted at the Severn Valley Railway Engine House (17 - 18 August). *(See entry in 'Other Societies' below for a link to the full Geofest programme).* Learn about how this Carboniferous landscape has been shaped by Ice Age processes, human mining heritage and conservation. Aim to finish around 3.00. This is a chance to visit the Geofest event and see a fine collection of steam locomotives.

Other Societies and Events

Warwickshire Geological Conservation Group

Saturday 22 June: Saltwells, Doulton's Claypit (Black Country). Led by Andy Harrison (BCGS).

Sunday 28 July: Tardebigge reservoir circular walk (near Bromsgrove). Led by Mike Allen. Joint field trip with BCGS.

There is a charge of £2.00 for non-members. For more information visit: http://www.wgcg.co.uk/ or email: WarwickshireGCG@gmail.com.

North Staffordshire Group of the Geologists' Association

Saturday 15 June at 10.00: Day Field Trip to Ercall Quarries, Wellington. Led by Ian Stimpson.

Wednesday 17 July at 7.00: Evening Field Trip to Brown End Quarry, Waterhouses. Led by Ian Stimpson.

A field fee of £2 per head is normally charged to cover the leader's expenses. Hard hats and hi-vis jackets should be taken on all field trips. For more information: https://nsgga.org/

East Midlands Geological Society

Saturday 15 June: Day Field Trip to Ercall Quarries, Wellington. Led by Ian Stimpson. Joint field trip with NSGGA.

Wednesday 17 July: Evening Field Trip to Brown End Quarry, Waterhouses. Led by Ian Stimpson. Joint field trip with NSGGA.

Non-members are welcome and should register with the secretary. Further info: www.emgs.org.uk or email: secretary@emgs.org.uk For field trip booking instructions see: emgs.org.uk/#fieldtrips

Mid Wales Geology Club

Wednesday 19 June: 'Is Anglesey the most geologically diverse 710km² in our solar system?' Speaker: Dr Rob Crossley.

Further information: Tony Thorp tel. 01686 624820 and 622517 tonydolfor@gmail.com
Web: http://midwalesgeology.org.uk lectures start at 7.15 and are a hybrid of in person meetings at Plas Dolerw, Newtown, SY16 2EH and via Zoom. Those wishing to join a meeting remotely should contact the secretary, Chris Simpson, at christopher_s@btinternet.com

Abberley and Malvern Hills Geopark – Geofest 2024

The annual Geofest is running from 25 May to 1 September. More on the Geofest Calendar here.

For further information go to: http://geopark.org.uk/ or contact the BCGS Field Secretary, Andy Harrison (details on p.2).

Manchester Geological Association

Wednesday 17 July: Geology of Crummackdale. Led by Peter del Strother. Joint field trip with Westmorland Geological Society.

For more information: http://www.mangeolassoc.org.uk/or contact lectures@mangeolassoc.org.uk

Geological Society, West Midlands Regional Group

Tuesday 11 June: 'Contaminated Land / hydrogeology (Title TBC)'. Speaker: Dan Welch, AtkinsRéalis.

Lectures are being held at Mott MacDonald, 10 Livery St, Birmingham, B3 3NU and by Zoom. They commence with refreshments from 6.00 for a 6.30 talk. For further details and registration please contact the Group Secretary at: geolsoc_wmrg@live.co.uk Click here for website.

The Geologists' Association Annual Conference, 27-29 September

This year's Geologists' Association Conference will be hosted in Bristol at the Earth Science Department, University of Bristol and Bristol Museum & Art Gallery. Talks and field trips that celebrate the geological riches the area has to offer are being planned and will be advertised in due course.

For more info: https://geologistsassociation.org.uk/conferences/

Editorial

In this issue we bring you our programme of events, plus a report from Andy of the excellent Castleton field visit in April, the concluding part of Alan Clewlow's fascinating account of his recent geological trip to Costa Rica, an amusing snippet from Mike Williams' visit to the Knockan Crag in Assynt, and a Musing from Mike Allen on a subject close to the hearts of your editorial team – both classical musicians.

We look forward to seeing many of you on our field trips *(details above, p.3)*. If your holidays include any geological adventures, please send us your news, or reports of anything else geological which you can share with BCGS members. Please send items (with or without photos) to me *(details above, p.2).* ■

Julie Schroder

Geological Tour to Costa Rica January 2024 (part two)

What follows is the second part of an account of a trip I took in early January this year, where I arranged and led a geological tour to Costa Rica. The first part *(Newsletter 284, April 2024, p.11)* included a general background to the geology and tectonic history of Costa Rica, and a description of visits to Irazu and Poas volcanoes. This second part describes visits further to north of the country, to volcanoes in the Guancaste range: Arenal, Miravalles and Rincón de la Vieja volcanoes.

Volcan Arenal

This is the most well-known of Costa Rica's volcanoes, and up to 2011 had been one of the most active volcanoes in the world. It has the shape of a classic stratovolcano, with a perfect conical shape and steep sides. Although it naturally lies on older material, the volcano only started to develop about 4000 years ago. Over the time it has taken to build up to its existing height, it has produced numerous eruptions of lavas and pyroclastic flows. The lavas exhibit quite a range in composition, from basaltic to silica-rich dacites, although the most common have been andesitic, with an intermediate level of silica content - typical of material produced at destructive plate margins.

Arenal in 2010 during an eruption

As explained previously, the magma is generated by the subducting Cocos Plate which is at greater depth in this region (due to lying north of the Quesada Sharp Contortion). Rising magma has a considerable thickness of overlying crust to pass through in order to reach the surface and as a result, there is more scope for fractional crystallization to occur (where high-temperature silica-poor minerals may crystallize at depth and be left behind as the magma continues to rise). Also, parts of the overlying crust may be melted and incorporated into the magma by assimilation. Both of these have the effect of raising the silica content, producing magma which is viscous and has a high gas content, making explosive eruptions and pyroclastic activity much more likely. ►

Arenal in the morning sun January 2024

Up to 1968, the volcano was regarded as dormant, or even extinct. It is now known that it had previously last erupted in 1525, but as this was before settlement of Costa Rica by the Spanish, no eruption had taken place in recorded history. It was common for locals and visitors to the area to climb the flanks to get to the summit, where the 'Crater of the Finches' could be found. Huge numbers of these birds nested in the vegetation within the crater, and their morning chorus was famous.

For a few years before, fumarole activity started to develop around the summit, but it was not until 1968 that the volcano really came to life. There were several minor earthquakes in the area in May, but on July 29 there occurred 10 hours of intense seismic activity, followed by a series of huge summit explosions producing bombs of up to 10 metres diameter, which landed up to 5 kms from the crater. Three new craters formed alongside the earlier one.

The explosions released a number of pyroclastic flows, which swept down the sides of the volcano to overwhelm the villages of Pueblo Nuevo and Tabacon. Studies have estimated the temperature within the flows was around 400ºC. Vegetation was burnt away and in addition the landscape became changed as craters formed where thousands of bombs landed. The population of the whole area had to be evacuated for some time.

From 1968, eruptive activity was more or less continuous, though two of the craters formed in the 1968 explosions were obliterated. More recent activity then centred on one crater, which built up as a consequence, forming a slight ridge on the western side of the volcano near the summit. Unfortunately, the eruptions stopped around 2011, and have not occurred since.

Activity was mainly of the 'Strombolian' type, producing an explosion every few minutes, blasting lava-bombs out of the crater into the sky above it. In addition there were frequent streams of lava flowing down the upper slopes. The lava was of the viscous, blocky type (aa) and tended to stop before it got down to1000m altitude above its base. It was typical for the volcano to create about 6 flows per year, and each lasted for several weeks. There were also sporadic pyroclastic flows (most notably in 1975) on the western side towards the Tabacon valley, but none of these created any casualties.

The summit area of Arenal, January 2024
The picture also includes a sloth in the tree-top

During its extended period of eruption from 1968 to 2011, the volcano looked an impressive sight during the daytime, but as night fell, it became really spectacular. At times of eruption, streams of glowing active lava flows could be seen, along with the showers of incandescent lava bombs from the frequent noisy explosions, which then rolled down the slopes, darkening in colour as they descended and cooled down. ►

I witnessed this activity on the volcano's south eastern slopes in 2007, and again from the north in 2009 and 2010, but as the activity stopped in 2011, our visits since have had to be content with a view showing wisps of steam rising from fumaroles in the summit craters. This was also the case on our January visit. The best views we had were in the morning, where the sunlight picked out the summit features very clearly.

Volcan Miravalles

Miravalles is a large stratovolcano of broadly andesitic composition, with an estimated volume of 125 cubic kilometres. It is one of five cones falling within the large Guayabo (Miravalles) caldera, which has a diameter of 15 kms. The caldera itself was formed during several major explosive eruptions that produced massive pyroclastic flows of largely dacite / rhyolite composition from 1.5 to around 0.6 million years ago, in the process creating an ignimbrite plateau over 60 miles long and 13 miles wide. Following the caldera formation, volcanic cones developed in the eastern part of the caldera which overtopped much of the eastern and southern caldera rim. Growth was interrupted by a collapse which then produced a major debris avalanche towards the SW. The large steep-sided volcano sits above the town of Guayabo, which lies on the flatter, western part of the caldera floor.

Volcan Miravalles, January 2024
as seen from the roadside on its lower slopes

Volcan Miravalles has a summit altitude of 2028m. It also has a number of subsidiary cones located on its southern flanks. Many younger lava flows now cover the western and SW sides of Miravalles, which have been dated as ranging in age between 8000 and one million years.

There is no evidence of any recent volcanic activity at Miravalles apart from a minor explosion on the SW flank in 1946. High heat flow remains, however, and Miravalles is the site of the largest developed geothermal field in Costa Rica.

The main focus of our visit to the area was the hot springs and bubbling mudpools at Las Hornillas, where a number of the group took the opportunity to bathe and coat themselves in the warm mud, which supposedly has various health benefits - I remain to be convinced!

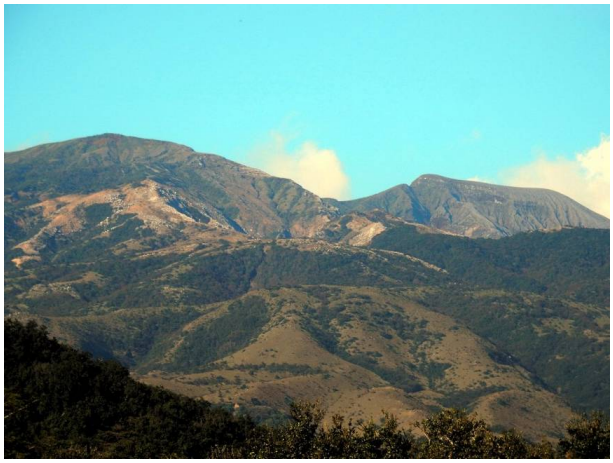
Volcan Rincón de la Vieja

This is the most northerly of the volcanoes seen on our visit to Costa Rica. Like many of the other active volcanoes in the country, the area in which it lies has been designated as a National Park. Like Arenal, it forms part of the Guancaste Range and its plate tectonic setting is similar to that of Arenal. Again, it is an andesitic stratovolcano with a tendency to produce explosive eruptions.

Its altitude is 1916 metres, and the volcano forms an elongated ridge consisting of at least nine vents, with those to the far west being the oldest and those which have erupted most recently being in the east. This suggests that activity has migrated eastwards over time. ►

Lying in a more remote part of the country, the volcano has been studied in far less detail than some of the more accessible ones nearer the capital. However, historic records do indicate that it was particularly active in the nineteenth century. In more recent times, the volcano has seen many phreatic eruptions from the summit crater, one of which is described below, although these have not produced any new lava.

Accounts record that the Rincón de la Vieja volcano erupted in February 1998. That eruption was phreatic. It produced a lahar (mudflow) which travelled down several rivers. No damage was reported, although many fish in these rivers were killed. At least 23 steam eruptions occurred throughout that day. A volcanic plume formed, reaching a height estimated at 1000 m. and around 6cm. of muddy material was deposited on the southern rim of the crater. Muddy ash fell as far as 3km to the south-west. During the eruption, blocks ejected from the volcano formed impact craters up to 300 metres from the crater rim. That eruption continued for many months.



Summit craters of Volcan Rincón de la Vieja January 2024 taken from its lower slopes

There then followed a quiet period until eruptions once more resumed in 2010. These have been ongoing since then, with eruptions in most years since that time.

The situation at the time of our visit in January 2024 was that the volcano had an eruption warning in place for minor activity to occur at any time. There had been a number of steam and gas exhalations in previous weeks and measurements of the quantity of sulphur dioxide being released was at its highest for many years. Fortunately (or perhaps a disappointment for some), there was no sign of any activity at the time we were there. We were well below the summit area, viewing the craters from some distance. The only activity we were able to witness was in the hot springs and bubbling mud pools in fumaroles located on the lower slopes. ■

Alan Clewlow

A Visit To Knockan Crag to view the Moine Thrust

Not many locations offer such easy access to the world famous Moine Thrust as Knockan Crag situated on the A835 between Ullapool and Elphin in Sutherland, north-west Scotland. A small unmanned visitor centre with car park leads to a climb of about 60m up the steep crag to an outcrop of mylonite marking the Moine Thrust plane, where metamorphosed Moine Schists overlie Cambrian sedimentary rocks, a complete reversal of the law of superposition and an enigma to all early researchers in the Northern Highlands. ►

View from Knockan looking west to the Torridonian peaks of Cùl Beag and Stac Pollaidh

Moine Thrust Plane

Our tour guide went to great lengths to explain that the elucidation of the problem by Peach and Horne et al. in 1907 was one of the great advances in the interpretation of mountain building processes. However, he did acknowledge that some years earlier a talented amateur had proposed an explanation for this enigma which was confirmed during detailed mapping by the 1907 surveyors. Now, if any of you can remember Professor Paul Smith's excellent lecture to the BCGS some years ago, it appears that the early 'talented amateur' proposer to the solution of ancient rocks apparently overlying younger strata was none other than the renowned geologist Charles Lapworth who visited Knockan and the Assynt area in 1885. By this time Lapworth had already been appointed as the first Professor of Geology at the University of Birmingham with a firmly established professional reputation.

Hopefully our suitably chastened tour guide will amend his explanation of the historical context of the interpretation of this site and the area in general, to include the contribution made by Professor Charles Lapworth well before 1907. ■

Mike Williams

References

Lapworth C, 1885, 'The highland controversy in British geology'. Nature, London. Vol 32, pp 558-559.

MRW Johnson & I Parsons, 'Geology Excursion Guide to the Assynt District of Sutherland'. Edinburgh Geological Society, 2000.

Field Meeting Report

Saturday 6 April: Castleton and the Mam Tor landslip, Derbyshire.

Led by Albert Benghiat (Shropshire Geological Society).

Conditions were sunny and mild with a light breeze and some cloud cover for our visit to Castleton. We met Albert at the Castleton visitor centre at 10.30 on a very busy Saturday morning, the final weekend of the Easter holidays.

Having previously lived in Derbyshire for a few years, Albert has helped to produce a 130 mile geological walking route, 'The Peak District Geowalk'. Our day included only a tiny portion of this trail.

Overview of Geography and Geology

Albert started with an overview of the local geography and regional geology. Generally, Castleton sits at the western end of the Hope Valley, at roughly 190m to 200m Above Ordnance Datum (m AOD), on a broad and relatively flat expanse of field-covered land. Through this land, the streams 'Odin Sitch' and 'Peakshole Water' flow eastwards towards Hope, before eventually meeting the River Noe and continuing onwards to the River Derwent. To the north, the ground rises sharply to between roughly 416m AOD and 476m AOD at Lose Hill, forming a sharp ridge, beyond which lies the Vale of Edale. The ridge continues from Lose Hill in the east, westwards past Hollins Cross to Mam Tor and a hill fort at 517m AOD, which is situated to the west of Castleton. ►

Castleton, mouth to Cave Dale

To the east, the valley floor slopes very gently into the Hope Valley. To the south the ground also rises sharply into the Peak District National Park and a rolling, expansive landscape that undulates between roughly 300m AOD and over 400m AOD. Water, ice and human activity have, over time, carved and shaped this landscape into what we see today. Along this high ground's northern edge, great and steeply dipping scars have been carved that run into Hope Valley. These scars include Cave Dale, immediately south of Castleton, and Winnats Pass, to the west. Numerous quarries, disused mines and caverns, including Speedwell, Treak Cliff and the Blue John, pepper the northern edge of this high ground and hint at the industrial heritage associated with the area that has made it into a popular tourist attraction.

Geological Setting

A look at a geology map for the area shows 'head' and alluvial deposits associated with the Odin Sitch/Peakshole Water, underlying Castleton and the immediate flat ground surrounding it. The high ground to the north, south and west are generally devoid of superficial deposits but occasional patches of head or peat are shown.

The oldest bedrock forms the high ground to the south and south-west. This is limestone belonging to the Bee Low Limestone Formation and is Lower Carboniferous (Visean) in age. The British Geological Survey GeoIndex, describes this stratum as 'pale grey, pale brownish grey to grey, fine- to medium-grained calcarenites, thick-bedded with scattered crinoid debris; mainly biosparites, but biopelsparites and pelsparites also occur'.

Underlying Castleton and forming the high ground to the north and north-west are sandstone and gritstone strata, including Mam Tor Grit. This belongs to the Millstone Grit Series which sits conformably over the Bee Low Limestone Formation. This stratum is also Lower Carboniferous (Namurian) in age.

The Bee Low Limestone sits within the lower parts of the Carboniferous Limestone series with the Monsal Dale Beds and Eyam Limestones above. Together these strata form the high ground south of Castleon that underlies the Peak District National Park and represent a domed structure known as the Derbyshire Dome. This dome structure stretches from Matlock in the east to Buxton in the west and Castleton in the north to Ashbourne in the south. The younger Millstone Grit series surrounds the Derbyshire Dome on three sides to the north, east and west. To the south around Ashbourne the structure sits unconformably beneath younger Permo-Triassic rocks. ►

Mam Tor and landslip

The Derbyshire Dome is believed to represent a series of circling reef mounds, much like those found in the present day Bahamas. Each reef mound would have comprised a central muddy limestone core, held together with algal mats, with a sloping fore reef and back reef. The fore reef would have sloped sharply downwards into relatively deeper oceanic waters on one side and into relatively shallow lagoonal waters covering the back reef behind.

Basalt intrusion exposed in Cave Dale (see p.12)

Several such features have been interpreted across what is known as 'the Pennine Basin', dating from early (Dinantian) Carboniferous times, and which resulted from the breaking up and eroding of the Devonian Old Red Sandstone continent. A northern landmass formed from the eroding remains of the Old Red Sandstone continent, including the eroding remains of the Caledonide mountain chain which bounded the Pennine Basin to the north. A smaller landmass, the Wales-London-Brabant Massif (formerly known as St Georges Land), bounded the Pennine Basin to the south.

The Pennine Basin itself was situated over the southern Odin Sitch/Peakshole Water continental shelf margins of the northern landmass. Fault-bounded blocks were formed from old Caledonian Crust intruded with granites, with subsiding basins between, within the Pennine Basin. This provided an ideal environment for shallow and deep water shelf carbonates to form, giving rise to reef-bounded lagoons such as the Derbyshire Dome. The shallow lagoons and back reefs occurred over the blocks with the fore reef sloping away into the relatively deeper basins between the blocks.

Northern slopes to the Peak District National Park and Derbyshire Dome

Clastic sediments from the eroding northern landmass accumulated on the continental shelf margins until they collapsed as turbidity flows that steadily encroached onto the flanks of the reef mounds. Under water, the flowing sediment was graded with the coarsest grains being deposited first, forming gritstones and sandstone layers, and the finer grain sizes being deposited last to form shale, or mudstone layers. These repetitive cycles, called 'cyclothems', are today seen throughout the Millstone Grit series. The organic rich shales have been matched to the Bowland Shale in Cumbria and as well as plant remains, contain brachiopod fossils and goniatites, the early relative of the ammonite. Over time, as the Pennine basin continued to subside, the Millstone Grit deposits eventually covered the Derbyshire Dome. Through the Westphalian, the Dome was buried deeper beneath coal measures strata and eventually beneath upper Carboniferous sandstone strata. ►

Our Walk

On our walk, we left the Castleton Visitor Centre car park and headed south to track up through the scar that formed Cave Dale and the Limestone Way. Our first stop was within a steep-sided deep gorge forming the mouth to Cave Dale, where what looked like very broken up, thinly-bedded limestone layers dipping back towards Castleton were exposed. These represented limestone debris deposited on the fore reef side of the reef mound as it plunged into deeper water.

Continuing upwards, along the rocky Limestone Way, which had formed a fast-flowing stream bed, the gorge opened up into limestone exposures that were more massive, thickly-bedded and very micritic in comparison to those seen previously. This quarried section revealed much purer limestone that formed the core of the reef mound, comprising carbonate muds and algal mats.

The Limestone Way continued and narrowed to another gorge as we ascended along the rocky stream. Before long, we came across a small sub-vertical, partly excavated feature in the gorge side, which was repeated in the opposite side of the gorge. This feature could also be traced up the grassy slopes beyond and represented a worked ore body, known as a 'rake', where hydrothermal fluids had deposited lead-bearing ore, galena and calcite, during deep burial in the distant past. Looking back down the gorge, Peveril Castle sat perched high above the limestone cliffs.

The Limestone Way and Peveril Castle

Eventually, the Limestone Way opened out again as we reached the grassier slopes that formed the reef mound summit. Passing through a gate, we saw a dark distinctly harder rock projecting above the ground with very familiar hexagonal columns. This basalt mass was likely to have been emplaced during volcanic activity when the reef mounds were around *(see photo above, p.10)*.

Continuing along the Limestone Way, the rocky stream gave way to a very muddy, slippery and well-trodden path that made the going slow. Leaving the Limestone Way, we passed through a gateway in a stonewall. Our next outcrop was a whitish, fine-grained limestone that represented alkaline muds deposited within the quieter lagoonal waters behind the reef mound. Looking around, the landscape gently undulated with low hills and valleys that typify limestone country and the summit plateau of the Derbyshire Dome. Small depressions hinted at subterranean streams causing localised subsidence.

Organic shales, Little Mam Tor

Heading back towards Castleton along a gentler, grassy path, we could see the gritstone ridge that included Lose Hill, Hollins Cross and Mam Tor, in the distance to the north and west. As we descended, Albert pointed out a triangular area on the hillside which on the geology map was highlighted as volcanic rocks. Little more than degraded tuff, this feature is believed to have originated from an ancient and eroded lava flow that may relate to the basalt exposure we saw earlier. ►

On returning into Hope Dale, we had lunch at Speedwell Cavern. In the afternoon, we walked up the road to the base of Mam Tor and on to Little Mam Tor *(see front cover photo).* The hummocky, broken terrain we tracked over was typical of that for a landslip. Here we saw the slip backscar and dark, almost black organic shales, with sandstone bands that formed the upper parts of a cyclothem deposited from a turbidity flow within the Pennine Basin. *(The photo on the previous page shows a loose sample of these crumbling, unstable shales. Ed.)* The fine nature of these deposits indicates that they formed in the upper parts of the cyclothem.

From Little Mam Tor, we walked back to Castleton and the visitor centre for a cup of tea before the long drive home. I would like to thank Albert for a very interesting and informative field visit that was well explained and clearly showed the geology of the local landscape. For those interested in finding out more about the Peak District Geowalk Trail and downloading the walk sections, please visit the website at: www.peakdistrictgeowalk.org. ■

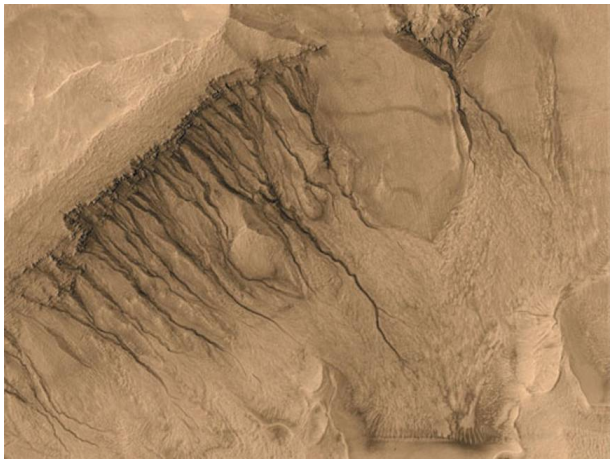
Andy Harrison

Mike's Musings No. 51

Extraterrestrial Contemplations?

The 'Planets Suite' by Gustav Holst, was one of the first compositions that captured my interest in classical music. It doesn't feature that often on concert billings, but I'm sure it's one of the most recognisable pieces in the classical repertoire. It was written during the dark days of the first world war (between 1914 and 1916 or 1917 according to different sources) and was actually inspired more by astrology than astronomy. This is why our home planet doesn't feature: it is the vantage point from which the astrological symbolism is seen, Earth having no astrological significance of its own. The state of astronomy was also very different at that time; there was little knowledge of nuclear physics, nuclear fusion was unheard of, the origin of the Universe hardly speculated upon and even less was our place in the firmament seen in its true perspective. Another absentee from the suite was Pluto, for the obvious reason that it wasn't discovered until 1930, although an extra movement was commissioned by the Hallé Orchestra and presented (as Pluto – '*The Renewer*') for its first performance in 2000. It has been seldom featured since, perhaps because in 2006 Pluto was demoted to the status of 'dwarf planet'.

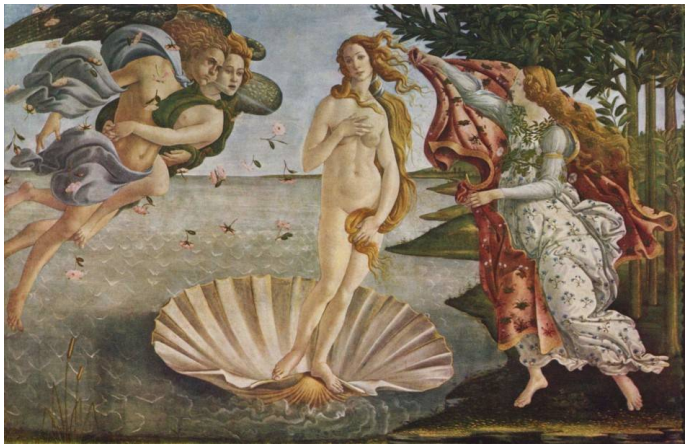
Gustav Holst.
Wikimedia Commons.



Gullies on Mars taken by the orbiting Mars Global Surveyor. Wikimedia Commons.

This piece was in part informed by a concert given by the BBC Symphony Orchestra, with a commentary by Professor Brian Cox against a backdrop of modern imagery of the planets, to mark the precise centenary of the premiere given in the Queen's Hall, London, on September 29th 1918, and to which acknowledgement is given. ►

The piece begins with Mars – 'the Red Planet' – or as Holst saw things, '*The Bringer of War*', beaten out with ostinato rhythms almost throughout. First described by Galileo in 1610, all that was known was based on some poorly defined linear markings across much of the face of the planet, identified by Schiaparelli in 1877 and thought to be canals, or possibly some kind of engineered structures. We now recognise with some assurance that water once flowed over the surface of Mars *(see image on previous page)* and could have supported some form of life some three billion years ago. Vehicles have been landed on its surface, and we have all marvelled at the images they have sent back to Earth. There is even consideration of humans visiting the planet in the foreseeable future. Mars to us today, perhaps, is more a symbol of hope and opportunity than of conflict.

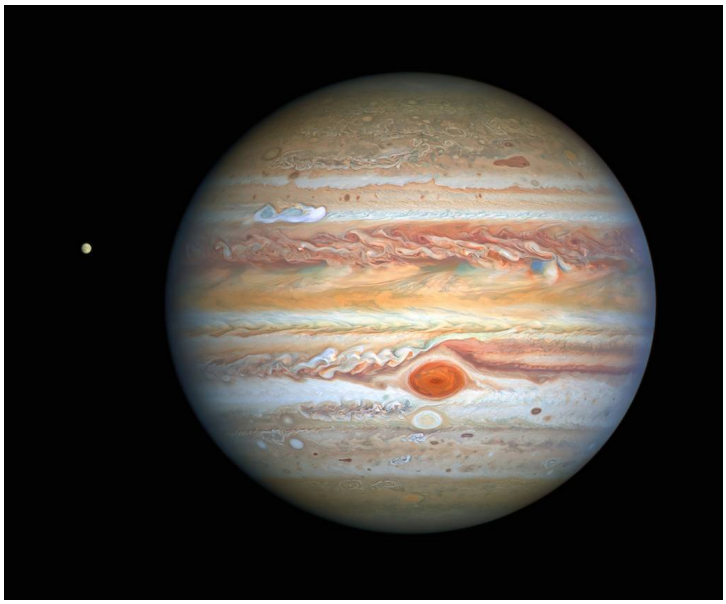


The Birth of Venus by Sandro Botticelli. Wikimedia Commons.

The aggressive crescendo of war gives way to the gentle strains of Venus, a sublime evocation of harmony and tranquillity – '*The Bringer of Peace*' indeed (and don't we need it!). Earth-like in size, the closest of our neighbours, and, because of its inferior orbit, it always appears close to the Sun in our night sky, where it shines brightest of all the planets (as either a 'morning' or an 'evening' star). These factors perhaps added to it being thought of in Holst's day as a place of comfort and capable of hosting life. Now we know otherwise: it is a scorchingly hot planet with a thick atmosphere (over ninety times the atmospheric pressure on Earth) composed largely of carbon dioxide, pumped out by more active volcanoes than on any other planet, which has led to runaway greenhouse gas conditions. Far from being an imagined tropical paradise, Venus is closer to our perception of Hell: a veritable failed world.

Mercury by Augustin Pajou. Wikimedia Commons.

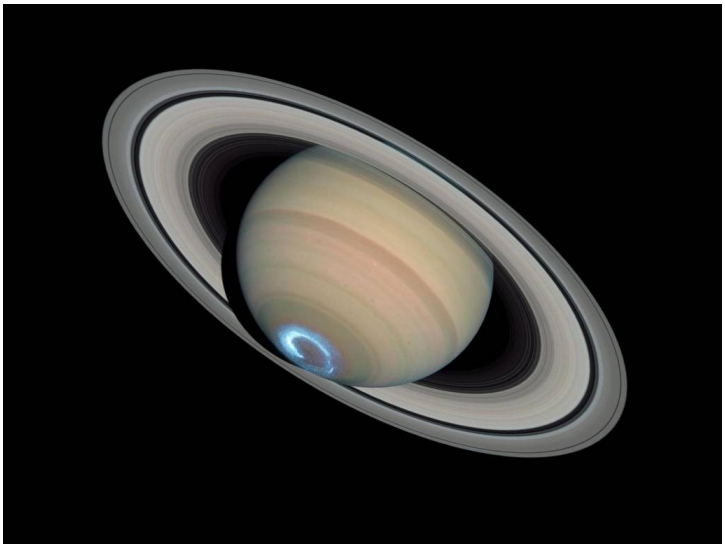
The pace picks up again with the chirpy sounds of Mercury – '*The Winged Messenger*' – hopping and skipping along in mimicry of its celebrated rapid transit across the face of our home star when viewed from Earth. It is the shortest of the movements, as befits the smallest of our neighbours, and was the last to be composed. Yet this apparent simplicity belies the fact that Mercury is difficult to reach because of its minimal gravitational attraction, which requires any earthly craft to approach relatively slowly. Known to the ancients, Mercury has long been understood to have the shortest orbital period. It also has a high orbital eccentricity which was explained when Einstein theorised on the warping of the fabric of space-time. With its close proximity to the huge relative mass of the Sun, Mercury understandably experiences this effect most in the context of our planetary system. But it remains an extreme and enigmatic object, with temperatures varying from 4300C to -1800C diurnally. Unexpectedly, it retains a high level of volatile constituents that should, by rights, have boiled away by now. Perhaps part of the 'winged messenger's' flighty character is due to having shifted its position much closer to the Sun since its 'birth', with the wider suggestion that our solar system is far from static or fixed in time. ►



Jupiter with its moon Europa, taken by the Hubble Space Telescope. Wikimedia Commons.

From the smallest to the largest of our heavenly neighbours, Holst's fourth movement concerns the majesty of Jupiter – '*The Bringer of Jollity*'. Jupiter was seen as a mini-solar system with many of its moons known in 1916, although the detail was fairly vague. Also known was the 'red spot', understood to be the focus of a huge storm within the gaseous outer layer of the planet. At two and a half times the mass of all the other planets put together, this gas giant exerts a profound gravitational effect within our solar system, second only to the sun. It may have been responsible for the breakup of a nearby inner planet, thus creating the asteroid belt. Even Galileo recognised its dominance, and used his telescopic observations of this planet to support the Copernican heliocentric model. Appropriately enough, it was NASA's Galileo mission that first orbited the planet and initiated its detailed study. Holst himself later arranged part of this movement to the patriotic lyrics 'I vow to thee my country' from a poem written a few years earlier, but perhaps lived to regret the mistaken associations this produced. Not only is Britain no longer the centre of a global empire, nor Earth the 'centre of our universe', but our true perspective, on many levels, was made plain to see when Voyager 1 captured our image (the 'Pale Blue Dot') as it departed the Solar System, revealing our insignificance and evident fragility, contrasting with any notions we might have of our self-importance. Yet, the uplifting and dynamic rhythms of this exuberant movement enable us to remain positive in the face of this reality.

The next movement has particular resonance at my time of life! Saturn – '*The Bringer of Old Age*' – opens quietly before building slowly to a climax, thereafter fading back into quiet resignation as if coming to terms with one's mortality. Saturn's celebrated ring system was believed to be unique a century ago. We now know this to be mistaken, and we also know a lot more about the delicate nature of the rings, comprising a filigree belt (just 10m thick!) of ice particles, ironically much younger than the planet itself: hardly a symbol of dotage or decay! Moreover, two of Saturn's moons appear to offer the potential for life, possibly with both surface liquid water and hydrothermal vents present, not unlike conditions imagined to have spawned life on our planet. Saturn now appears a contradiction, far from its astrological association with maturity. ►



Aurora on Saturn taken by the Hubble Space Telescope. Wikimedia Commons.

The penultimate movement concerns Uranus – '*The Magician*' – which seems quite appropriate for this strange 'up on end' world, that circles the sun with a retrograde rotation and at an almost perpendicular alignment (over 80^0 axial tilt) to its orbit. If Holst had viewed it, he would have seen a fairly uniform pale blue disc produced by an atmosphere now known to have a more layered and banded 'cloudy' structure and consisting of quite a cocktail of gases. Originally classed as a star, then briefly as a comet, only detailed observation with the aid of a telescope in 1781 confirmed it was indeed a planet. Little else was known about it in Holst's time. Today we are aware of the furious winds (500 mph at the poles) within its atmosphere and that it, too, has a faint ring system like its neighbour. This movement has been described as having the nature of 'a clumsy dance'. To my ear, its perky and frequently changing rhythms are suggestive of the waving of a magician's wand (or conductor's baton?), at times frantic like the winds, but all ends in a calm pianissimo.

Uranus and the Dance of the Stars
by Karl Friedrich Schinkel. Wikimedia Commons

So finally we arrive at Neptune – '*The Mystic*' – both the outermost planet (since Pluto's disqualification) and last movement of the suite: a world only discovered in 1846, the only planet invisible to the naked eye from Earth. It has much in common with Uranus: both are 'ice giants' out in the freezing depths of the solar system, both appear as pale blue discs (due to methane in their atmosphere absorbing the red wavelengths of sunlight) and both disturbed by supersonic winds. Even after the relatively close fly-by of the Voyager 2 probe, this distant world retains most of its secrets; mystical indeed. The orchestra maintains a pianissimo throughout and, unusual for its time, Holst introduces a human voice accompaniment by way of an offstage, wordless female chorus which gradually takes over from the quiet strains of the orchestra, in turn fading into the distant cosmos as the door between audience and chorus is closed, leaving orchestra and listeners alike alone in the silence of the auditorium. It begs the question: 'Is this music, or simply sound'?

Neptune, taken by Voyager 2. Wikimedia Commons

All of which, perhaps, leaves us reflecting upon the oft contemplated, but as yet unanswered, question: 'Are we, the human race, truly alone in the Universe'? ■

Mike Allen