Newsletter No. 286
August 2024

Contents:

To find out more about this photo - read on!

Copy date for the next Newsletter is Tuesday 1 October

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For enquiries about field and geoconservation meetings please contact the Field Secretary.
Please notify Andy Harrison in advance if you will be attending these events.
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

Change of Meeting Venue

The Dudley Archives will no longer be available for our meetings due to Council funding cuts.

Dates are fixed for the next 3 indoor meetings.
We are currently seeking an alternative venue.
Any suggestions from members will be welcome.
Please contact Alan Clewlow, Acting Meetings Secretary: treasurer@bcgs.co.uk
We will email members and update the website when we have further details.

7.30 for 8.00 o'clock start unless stated otherwise.

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

Saturday 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' event featuring specimens and geo-craft, 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. This is a chance to visit this Geofest event and see a fine collection of steam locomotives. Finish around 3.00.

Saturday 14 September *(Field Meeting):* Walk around Barrow Hill. Led by Andy Harrison. Meet at St Mark's Church, off Vicarage Lane, Brierley Hill, DY5 4JH (NGR: SO915893) for a 10.30 start. Join us for a walk around the feature known as 'The Dudley Volcano', one of the geosites within the Black Country Geopark. This will be the first in many such events to explore all 44 geosites within the Geopark and gain a good understanding of what each site has to offer. This event will be very much about member participation, so please come prepared with any stories and memories you may have of visiting this site in years gone by. Who knows what new information may be revealed. For background information have a look at the BCGS Barrow Hill leaflet here. Bring a packed lunch. We will aim to finish by 4.00.

Monday 16 September *(Indoor Meeting):* 'H.W. Hughes - a glimpse into the life & works of a Man of Coal'. Speaker: Peter Glews. Venue TBC.

Sunday 6 October *(Field Meeting):* Wren's Nest Walk on **International Geodiversity Day.** Led by Andy Harrison. Meet at 10.30 at the Warden's office, at the end of Fossil View, DY1 3SS (Grid ref: SO937921). The day will involve a walk over the reserve, one of the Black Country Geopark geosites, to celebrate the third year of International Geodiversity Day, taking in recent works undertaken with the reserve wardens. As with the Barrow Hill walk, this event will be very much about member participation, so please come prepared with any stories and memories you may have of visiting this site in years gone by. For background information have a look at Wren's Nest leaflets here. Bring a packed lunch. We will aim to finish by 4.00.

Monday 21 October *(Indoor Meeting):* 'Volcanic Tsunami Hazards - lessons from Krakatau, Hunga Tonga and beyond'. Speaker: Dr Seb Watt (University of Birmingham). **Venue TBC.**

Saturday 2 November *(Geoconservation Day):* TBC.

Monday 18 November *(Indoor Meeting):* Dr Duncan Murdoch from Oxford Natural History Museum will speak on an aspect of his work at the museum (title TBC)**. Venue TBC.**

Saturday 14 December *(Geoconservation Day):* Portway Hill, Rowley. With the Friends of Rowley Hills and the B&BC Wildlife Trust. To work at the dolerite exposure in the former quarry *(see front cover photo: dolerite sample from the Nov. 2023 session, showing 'onion skin' weathering).* Meet at St Brades Close, off Tower Road for 10.00 (Grid ref: SO974893, nearest PC: B69 1NH). Directions: from Birmingham New Road (A4123) turn left on to Tower Road if coming from Birmingham, right if coming from Wolverhampton. Just after Bury Hill park, turn left onto St Brades Close. Wear old clothes, waterproofs and strong footwear. Please bring gloves. Tools provided, or bring your own. Bring a packed lunch, hot drinks provided. Finish around 2.30.

Other Societies and Events

Woolhope Naturalists' Field Club - Geology Section

Wednesday 18 September: Landscape and geological aspects of the Hanter Hill area. Field Meeting led by Geoff Steel.

Non-members are welcome and pay £2. More info. at: https://www.woolhopeclub.org.uk/meetings

Shropshire Geological Society

Wednesday 11 September: 'Glacial geology in and around Shrewsbury'. Speaker: Prof. Peter Worsley (University of Reading).

Wednesday 9 October: 'The Greywacke'. Speaker: Nick Davidson.

Meetings commence at 7.15 for 7.30. Lectures are now being held in hybrid form, in person at the Higher Education Centre, Shrewsbury College, as well as by Zoom. If you wish to attend please contact Albert Benghiat: 07710 421 581, email: SGS.chair@hotmail.com
Further information: http://www.shropshiregeology.org.uk/SGS/SGSEvents.htm

Teme Valley Geological Society

Monday 23 September: 'Geological History of Britain and Ireland'. Speaker: Nigel Woodcock. By Zoom.

Monday 28 October: 'When the Law of Superposition does not work: What Nicolaus Steno and William Smith did not know about some carbonate successions'. Speaker: Paul Wright.

Talks take place in Martley Memorial Hall at 7.30. Non-members £3. For further information email: enquire@geo-village.org or visit: https://geo-village.eu/

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).

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.

Friday 4 October Hybrid Meeting: 'The Geology of Woodsmith Mine, Yorkshire'. Speaker: Lisa Gillespie (Anglo American).

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

Warwickshire Geological Conservation Group

Sunday 18 August at 2.00: Moorwood Cutting and an area near Nuneaton. Led by Mike Allen.

Thursday 19 September: 'Working with Dinosaurs'. Speaker: Phil Manning.

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

Manchester Geological Association

Tuesday 3 September: Building Stones of Central Manchester. Led by Peter del Strother.

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

Mid Wales Geology Club

Wednesday 21 August: 'The Geology of Islay and Jura'. Speaker: Dr Geoff Steel.

Wednesday 18 September: 'A Geology trip across two Scottish Terranes'. Speaker: Dr Chris Simpson.

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

Editorial

It is sad that in this issue we have to report that our Dudley Archive bookings for the autumn programme of talks were cancelled at short notice by Dudley Council. This is due to the on-going financial crisis which faces the Council, but has left us with the dilemma of finding an alternative venue. Members of the committee are working on it but we have not yet found a solution. If any of you can help please contact Alan Clewlow *(details in box on p.2).*

On a happier note, the summer months are a time for holidays, and for our field trips. Face-to-face confrontation with geological exposures and exhibits must surely give rise to questions, moments of insight and just sheer wonderment at the geology around us, often hidden or invisible until our eyes are opened. Such was the case on the BCGS visit in June to the BGS headquarters in Keyworth, where the eye-watering vastness of the National Repository for core sections opened our eyes to the wealth of material saved from generations of geological exploration. All this material is now available for on-going research. Then, our Birmingham Glacial Erratics trip in July opened eyes to these little known relics of the Ice Age which played a significant part in the emerging science of glaciology in the late ▶

19th century. Our most recent field visit was to the area around Tardebigge, where Mike Allen revealed some inner secrets of the Triassic, notably, for me, finding halite pseudomorphs – real local specimens to find, hold and connect with the palaeoenvironment under our feet.

Field trips are the back-bone of geological discovery and inspiration, and we would like to see more of you attending our field trips. They provide an opportunity for us to get together, get to know each other better, have an enjoyable day, and learn lots more about the subject which has brought us all together. If transport is a problem please contact Andy. Locations are quick to find on a link to Google maps on our website programme which will appear shortly after publication of the Newsletter.

Please note that we are asking you to let Andy know if you are intending to take part in any field trips or geoconservation days *(see box, top of p.2 for contact details).* It helps Andy to have advance notice of numbers. This doesn't mean you can't turn up without notice, but please try to let us know in advance.

The Newsletter is for everyone! Please share your experiences, thoughts and suggestions for the future of our Society. Send text and photos to me at the address above in whatever way suits you best - and don't forget - the next field trip is to The Severn Valley Country Park on 17 August. ■

Julie Schroder

Field Meeting Reports

Saturday 11 May: Central Malverns. Led by John Moseley, Gloucestershire Conservation Trust.

Conditions were mild and clear with wispy cirrostratus clouds drifting overhead and a light breeze, plus plentiful sunshine for our visit to the Central Malverns. Following on from our visit to North and Tank Quarries in the Northern Malverns last year, this visit provided further insight into the intricacies of the Malverns Complex.

Upper Wyche Quarry, Granite Exposure

We met John at the Earnslaw Car Park off the Wyche Road (B4218) at 10.00, where he provided a brief introduction and described the plan for the day. This included a circular route to Upper Wyche (formerly Upper Tollbar) Quarry before continuing to the Wyche Cutting and ascending up onto Perseverance Hill and back to Earnslaw Car Park. Along the way we would examine the Precambrian and metamorphic rocks forming this part of the Malvern Hills and relate this to what we had seen in the North Malverns last year.

Perseverance Hill

From the Earnslaw Car Park we crossed the busy B4218, before heading 150m south to the Upper Wyche Quarry. Here, John set the local scene of the Malverns Complex, which includes Precambrian granites and dolerites with a complex history of intrusion, metamorphism, thermal alteration, shearing and faulting. Radiometric analysis dates these rocks to around 677Ma (Uranium/Lead dating) and 681Ma (Rubidium/Strontium dating). Earlier dates, between 1,043Ma and 1,147Ma, have been recorded for rocks representing recycled crustal basement that was assimilated during magma generation. At the Upper Wyche Quarry we observed a quarried outcrop of the sheared granite with dolerite dyke intrusions. ►

Malvern complex examples in Cafe H2O

Continuing south, to the busy Wyche Cutting, John explained how this gash in the landscape had resulted from the rocks being ground up within an east to west trending fault zone. Sheared granites with dolerite intrusions, like those seen at the Upper Wyche Quarry, form the steep cutting faces and high ground north of the cutting. To the south, a large schistose diorite block, or terrain, with intruding pinkish pegmatites forms the cutting's steep faces and grassy slopes leading to the summit of Perseverance Hill.

Following a narrow pavement through the cutting, we passed into Herefordshire and visited Cafe H2O in the Malvern Hills Geo-Centre. Here, the Earth Heritage Trust have a base to promote the local Malvern Hills geology with displays and specimens. After a refreshment stop, we walked up Perseverance Hill. The views east and west into Worcestershire and Herefordshire were limited due to distant haze. On a breezy diorite outcrop, John put the Malverns complex into a more regional context and explained some of its history.


Earnslaw Quarry

Dating to the Late Neoproterozoic (Precambrian), the Malverns Complex forms the approximately 7 mile (12.5km), length of the Malvern Hills. During this time England, Wales and Southern Ireland, sitting within the Avalonian landmass, were located to the north of Gondwana, with a subduction zone and the Iapetus Ocean to the north. Subducting oceanic crust caused magma to become intruded into the Avalonia landmass. As it cooled, the magma underwent fractionation, with iron and magnesium-rich minerals like plagioclase feldspar, biotite, hornblende and pyroxene, forming first. These dense minerals settled to the intrusion base, forming medium to coarse-grained intermediate diorite rocks. Ongoing cooling and fractionation caused iron and magnesium depletion within the melt in favour of more silica-rich minerals. The result was more acidic rocks, granites and granodiorites forming the upper parts of the intrusion.


Earnshaw Quarry, phyllosilicate exposure

Extensive thrusting and faulting from various tectonic events, such as the Caledonian and Hercynian Orogenies, resulted in these rocks becoming carved into blocks and the diorites towards the base being displaced up against the more acidic rocks higher up in the intrusion. Deep burial and extensional forces allowed hydrothermal fluids to flow through fractures within these rocks forming mineral-rich veins, and it also caused dolerite emplacement as intrusive dykes. ►

From Perseverance Hill, we returned to the Earnslaw Car Park for lunch. Afterwards, John showed us the southern end of the quarry where dolerite-intruded granites are exposed once again. A complex outcrop towards the car park rear shows the granites ending at hornblendite-rich and sheared phyllosilicate rocks. The phyllosilicate has been metasomatically altered by magnesium/carbonate-rich hydrothermal waters at depth and contains thin veins of magnesium carbonate. Past the phyllosilicate shear zone the rock type changes to a biotite-rich pyroxenite, demonstrating once again the complex origins and evolution of, not just this outcrop, but the whole Malverns Complex that still poses many unanswered questions.

I would like to thank John for another very interesting field visit that, whilst helping our understanding of the Malverns, illustrates that not all questions in geology can or have been answered.

Saturday 8 June: BCGS at the BGS Open Day.

Members may recall that back in January, we had a talk from Dr Ekbal Hussein (Remote Sensing Geoscientist) from the British Geological Survey (BGS), in Keyworth, and an invitation to their June open day. Such events occur every two years and sell out quickly. June 2024 was no exception with tickets selling out within the first hour.

Tsunami demonstration

The event was open to all and well-attended by members of the public of all ages, from non-geologists to amateurs and professionals. There were displays and interactive activities to entertain the young relating to dinosaurs, geohazards, modelling landslides, gold panning, tsunamis, an enthralling toilet roll of time, and games. There was an opportunity to meet staff and researchers and to discuss their work.

BGS History

The BGS is located at six offices, with the Keyworth office being located just south of Nottingham.
Founded in 1835 with Henry Thomas de la Beche as its director, the survey started life as the Ordnance Geological Survey then moved to The Museum of Economic Geology at Craig's Court, Whitehall, London, which opened in 1841. The survey quickly established itself as a centre for undertaking geological surveys and collecting records relating to economic geology, abandoned mine working plans and mineral production statistics. The 1845 Geological Survey Act provided the survey with a legal framework designed 'to facilitate completing a geological survey of Great Britain and Ireland'. Continuing to grow and expand, the survey quickly outgrew the Craig's Court premises and in 1851 moved to the newly constructed Geological Survey and Museum of Practical Geology in Jermyn Street, London. Around the same time, the 'Government School of Mines and of Science Applied to the Arts', later the Royal School of Mines, was inaugurated. In 1872, the then Geological Museum relocated to premises in South Kensington. The survey later became the Geological Survey of Great Britain in 1905 and was eventually renamed the British Geological Survey in 1984. BGS headquarters were finally established at Keyworth in 1985 and the South Kensington Geological Museum premises given over to the Natural History Museum. ►

The BGS website advertises that, today, they are *'a world-leading geological survey and global geoscience organisation, focused on public-good science for government and research to understand earth and environmental processes'*, and act as *'the UK's premier provider of objective and authoritative geoscientific data, information and knowledge to help society to use its natural resources responsibly, manage environmental change and be resilient to environmental hazards'.*

The BCGS Visit

Through the day, the weather was cool with early clouds dispersing to give fine and sunny conditions. The event started at 10.00 and a small number of members met for 11.00 outside the main entrance.
The day included three talks in the morning that were repeated in the afternoon and included 'Geoscience for Society: A Critical Science indeed', a 'Geology Quiz' and 'Water you up to?'. Each talk lasting 20 minutes. There were also tours conducted throughout the day that included 'The Core Store Tour', 'R&D Engineering Workshop Tour', 'Virtual Reality Tour of Britain' and 'BGS Wilding and Sustainability Tour'. Each tour lasted between 20 and 45 minutes.

Those buildings open to the public were split into five zones – 1. Red, 2. Blue, 3. Green, 4. Purple and 5. Orange.

The Red Zone was located outside the main building entrance, with a gazebo, where visitors could sign in and get information for the day. An adjacent tent contained activities for kids that included panning for gold and displays about the water cycle and tsunamis. A paddling pool was also on hand to show and model how tsunami are generated and work.

'All Shook Up' Map

The Blue Zone was inside the main building, adjacent to the BGS shop selling books, guides and maps, minerals and fossils, stationery and other geologically themed products. A display entitled 'All Shook Up', included a large world map on the floor showing earthquake occurrences and sizes with an activity for creating seismic waves and illustrating how these are measured. Dr Hussein was in charge of running the display and explaining to visitors about earthquakes and how they are generated and where they occur.

A remote sensing display illustrated the different methods the BGS use to complement field observations, using satellites and drones, some of which were on display. The remote sensing methods can be used to survey soil properties, mineral surveys and ground movements, such as landslides and shrinkage / swelling activity.

Elsewhere were activities for children based around 'my pet rock', building stones and a dinosaur photo booth where families could obtain a picture of themselves alongside these 'terrible' beasts. The building stones stand focussed on worked stones from around Nottinghamshire used in locally well-known buildings and structures. Upstairs, in the Blue Zone were various stands showing different rock types, minerals and fossils. At one end was an interactive display called 'Nature's Time Machine', which was all about how climate and environments have changed through geological time. ►

The Green Zone contained a display from the Geological Survey of Northern Ireland. They were demonstrating projects in Stormont and the Giant's Causeway where geothermal energy was being utilised as a heat source. Here there was also a display introducing the public to the BGS's own online mapping database, the BGS GeoIndex. The database illustrates various data sources including geological strata and structures, boreholes, mapping information and a lot more that the Survey is continually gathering. This information provides an invaluable reference database to applied geologists and others in industry.

The Purple Zone was situated within the foyer area of an adjacent building and contained a display showing where raw minerals are sourced and illustrated how these are used today in modern technology. This zone also included a display on geohazards. Here, visitors were asked their view on a coastal scene showing a sandy beach and cliffs to see whether they would pick up on the potential risks present. The intention was to raise public awareness of geohazards and how these pose potential health and safety risks to human health.

The Orange Zone was a tented area adjacent to the Purple Zone containing interactive displays that illustrated geological mapping techniques. Layered sand in a box was used to demonstrate how borehole information is used to create geological cross-sections. A display called 'Rock Shock' was all about Electrical Resistivity Tomography (ERT). This technique fires electrical pulses into the ground and, using groundwater, can be used to survey landslips and soil suction or look for voids, old mine workings, and contamination in soils. A cheaper investigation method than drilling, ERT surveys can easily penetrate up to 30m depth or deeper at a push.

The Geological Walk

Between the zones ran the 'Geological Walk', which included numerous large boulders of varying rock types. Along the walk, staff had rolled out a toilet roll illustrating the enormity of geological 'deep' time.

The Core Store Tour

The Core Store tour started from the Orange Zone. The store is home to the National Geological Repository and includes several large, steel frame sheds crammed with floor to ceiling racking that holds pallets of core boxes. Our tour guides were Dave and Mike. All racking is controlled electronically and moved slowly, so as not to damage the core. A forklift places and extracts each core pallet from the racking. ►

Predominantly holding material from the oil and gas industry, the Core Store acts as a national facility for storing onshore and offshore rock cores and is important in many ways:

1. As a repository for storing important oil and gas well information from boreholes that are expensive and time consuming to drill.
2. Acting as an archive to prove conclusions from core interpretations.
3. Helps PhD students with their research and allows them to build on work undertaken previously.
4. It forms a cheap way of providing asset and survey data.

The first shed we visited was built in the 1980s during a big push to move the BGS out of London. The cores provide invaluable information about rock porosity and permeability, mineral and micropalaeontological information to help with oil, gas and mineral exploration and aquifer information. Despite boreholes potentially being hundreds of metres to kilometres deep, the core represents only a small part of what is recovered. The core essentially targets the area where the mineral resource in question is likely to occur. When drilling a borehole, much of the material returned is as chippings in the lubricant, or flush, which aids the drilling process. Many a geologist when starting out in the oil and gas industry will start as a 'mud logger', logging these chippings to determine when the borehole is approaching an oil/gas aquifer or other mineral ore body.

The Core Store

We were shown examples of the many other rock, mineral and fossil specimens and collections this facility also stores, including volcanic rocks collected by Charles Darwin during his journey aboard the Beagle, building stones used for reference purposes and footprint moulds from an extinct four-legged reptile taken from a German lagerstatte.

The second store we visited, the Nirex Store, was built most recently, in 2000, for the Nirex Project near Sellafield. These boreholes were drilled to help identify suitable rocks for subterranean low level nuclear waste storage. The rocks required need to have low permeability and porosity to prevent groundwater getting in or anything leaking out. The Nirex store mainly holds granitic rocks, which are ideal, but other strata being investigated include the Mercia Mudstone Group and Oxford Clay which also have the required properties.

The Core Store facility also includes viewing labs where, once taken from the racking, the core can be laid out on tables for PhD students to undertake their research. Once an oil and gas organisation has finished with their core, rather than throw it away, they will give the BGS first refusal for their collection. Once received, all core is photographed and stored on electronic databases, accessible via the BGS website. We were told that currently, only around 10% of the collection has been photographed using the most up to date techniques. The Core Store facility also contains many private geological collections. Upon receiving these, the collection has to be examined to determine what is worth keeping. ►

Like all Government bodies, the BGS suffers from lack of funding with currently around 60% of their funding coming from private means. The knock-on effect is low staff numbers and the top priority is to take care of visiting students and curating on tours. Therefore, photographing core and sorting private specimens features low on the priority list of things to do.

The open day finished at 5.00 on what had been a very interesting and informative event. On behalf of the BCGS, I would like to thank Dr Ekbal Hussein for the invitation and fellow BGS staff for their time on this very enjoyable day. ■

Andy Harrison

A Visit To Down House

The home of Charles Darwin with a link to the history of BCGS

Down House, located just south of Orpington in Kent is today in the hands of English Heritage and offers an insight into Darwin's domestic arrangements as he refined his thoughts which would lead to the publication 'On The Origin Of Species' in November 1859.

Down House

Furnished very much in the style of William Morris and the Arts & Crafts Movement the house must have provided Darwin with the calm family life wherein he could muster his thoughts and experiences gathered during the voyage of The Beagle (December 1831 to October 1836) enabling him to formulate his great theory. Free from the necessity to earn a living due to his family connection with the Wedgwood dynasty he was able to devote his energies into scientific enquiry.

Unfortunately, due to the ongoing wishes of the Darwin family, photography is not allowed inside the house. However, it is possible to visit Darwin's study and get a feel of the environment where the monumental theory had been developing in his mind *(Wikimedia Commons conveniently supplies an image, Ed)*. A number of upstairs rooms are dedicated to the story of his life and achievements and whilst perusing one of these displays I came across a section on the Darwin Medal Prize, (not to be confused with the Darwin Medal; see later explanation). First created in 1880 by the Midland Union of Natural History Societies, the award of a gold or bronze medal plus cash with a total value of £10 (about £1300 today) was to be awarded to the author from a member ►

Darwin's Study at Down House, Wikimedia Commons

society of a paper that demonstrated original research in the fields of geology, zoology or archaeology submitted for publication in the Midland Naturalist. Darwin, a subscriber to the Midland Naturalist, wrote to agree "that their wish to name the Medal after me is a very great honour, which I gladly accept".

Noted as a member of the Midland Union is the 'Dudley & Midland Geological & Scientific (Philosophical) Society & Field Club', the precursor of today's BCGS, and hence the connection to Darwin *(see BCGS website, 'History of the Society')*.

The Darwin Medal was first awarded in 1886 and continues today as an award for original biological research. **The Darwin Prize Medal** did not stand the test of time. The 'Midland Naturalist' ceased publication in 1893 and the final Darwin Prize Medal was awarded in 1895. ■

Mike Williams

References

The Midland Union of Natural History Societies: Wikipedia

T E James, Nature 141, May 1938 (via Wikipedia): 'A Discontinued Darwin Medal'

Hebridean Gems: Hoy

Yes, yes, I know where Hoy is. It's the second largest island of the Orkney archipelago, after Mainland, so I'm rather stretching a point to include it in my occasional 'Hebridean Gem' series. But I hope to convince you that it's worth seeing, even if it isn't Hebridean enough for you!

Having cleared up that geographical inexactitude, I can confirm that, like all the other Orkney isles, Hoy consists primarily of rocks of Devonian age, being part of the Old Red Sandstone 'Orcadian Province' that also extends to the north-east Scottish mainland.

But first we have to get there. This necessitates two ferry crossings: firstly to Mainland Orkney, and thence to Hoy itself. Assuming you are taking your vehicle, two options present themselves to reach Mainland. I recommend travelling outwards with Northlink from Scrabster (near John o'Groats) to Stromness, as this route passes by the west coast of Hoy, and, as Mike Williams recently pointed out in his timely article *(Newsletter No. 281, October 2023)*, offers the opportunity to see the celebrated 'Old Man of Hoy' sea-stack from an offshore perspective. Northlink also provide a longer Aberdeen to Kirkwall crossing, and Pentland Ferries will take you from Gill's Bay (also near John o'Groats) to St. Margaret's Bay on South Ronaldsay, which is a good way to return after exploring more of the Orkneys.

To reach Hoy, it is a short drive (if you've taken my recommendation) from Stromness to Houton for the short crossing to Lyness on the east coast of the island. To explore Hoy there is a single main road which winds its way from Lyness southwards around the east coast and South Walls, the latter being a tidal islet connected by a causeway, built in 1912 across the sands known as 'The Ayre'. The main road also heads in the opposite direction around the east coast to a settlement also called Hoy, on the north east of the island. An important minor side road serves the sprawl of dwellings that is Rackwick, the only point on the west coast of Hoy served by road. As far as accommodation is concerned, this is limited to a single small hotel in Lyness, B&B's, hostels, camping or self-catering cottages. I confess to just making a single day visit from Mainland, which isn't doing Hoy justice! ►

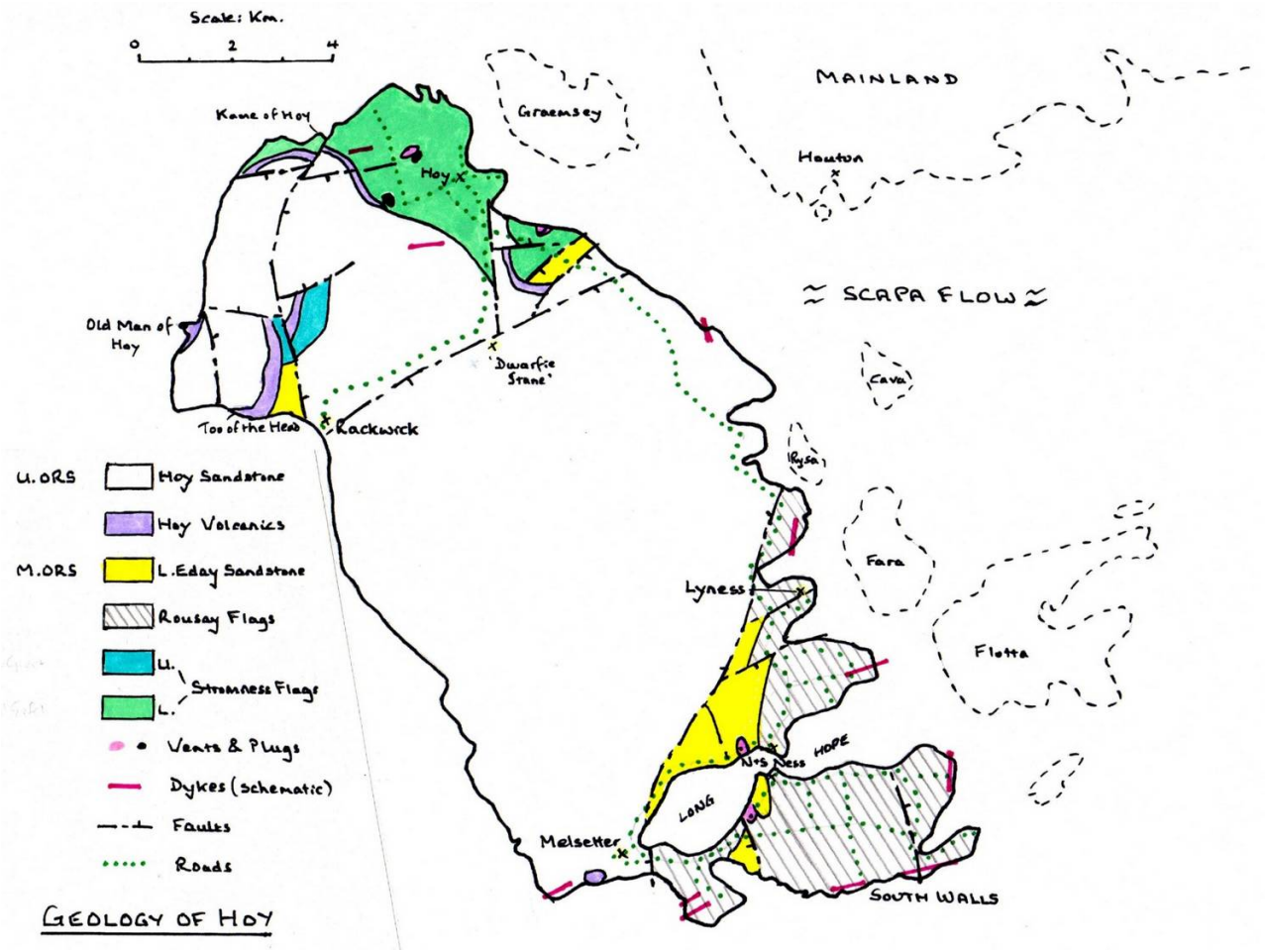


Fig. 1. Geological sketch map of Hoy

A simplified geology map (Fig. 1) instantly shows that most of the island comprises the eponymous Hoy Sandstone Formation, with various slightly older formations in the north and east. There is also one volcanic horizon with a number of small patches of vent infill, and scattered dykes complete the picture.

Stratigraphy:	*Upper Old Red Sandstone*	*Hoy Sandstone*	*3,500ft*
	(only present on Hoy)	*Hoy Volcanic Rocks*	*450ft*
		----- unconformity -----	
	Middle Old Red Sandstone	*Lower Eday Sandstone....*	
		incl. 'Passage Beds'	*800ft*
		Rousay Flags	*5,000ft*
		Upper Stromness Flags	*1,100ft*
		Sandwick Fish Bed	*10ft*
		Lower Stromness Flags	*3,500ft+*
	('Probable' Lower Old Red Sandstone is restricted to Mainland Orkney)		
		----- unconformity -----	
	(Granite / Schist Basement rocks again only seen on Mainland Orkney)		

The middle Old Red Sandstone (ORS from now on) rocks sound like a vexillologist's utopia, but the 'flags' in question refer to the well-developed property of the sandy beds to split along bedding planes conveniently spaced so as to produce good paving material, or 'flagstones'. These were deposited in ►

a single wide, shallow lake that spread across the whole of the Orkney - Caithness region. This basin was subjected to regular tectonically controlled fluctuations in sea-level, producing many 'cyclic' sedimentary sequences which had an initial lacustrine component continuously below water level and a later shallower component with periods of subaerial exposure, desiccation and fluvial influences. Such sedimentary features are, in my experience, better seen elsewhere in the Orkneys, perhaps because other features on Hoy occupied more of my attention.

Several parts of the Eday succession are absent on Hoy, either eroded during a period of uplift or never actually deposited. This has produced a marked unconformity between the middle and upper ORS rocks, but clear exposures eluded me. Hoy is the only Orkney island to have any rocks attributed to the upper ORS, their age being largely inferred by the need for a significant time interval to erode the middle ORS land surface before extrusion of the Hoy lavas, tentatively dated at around 383 (±9) million years, which could be either late mid-Devonian or upper Devonian. The Hoy sandstones seem to be devoid of all signs of life apart from some possible trace fossils. They were most probably deposited in a braided river environment. Their unyielding nature is reflected in their extensive outcrop area being generally rather featureless.

Beginning in the north-west of the island, a series of crags on the slopes of Ward Hill mark a change of character within the Hoy Sandstone. The lower beds are softer and weather more readily into sandy screes while the upper beds are more resistant, creating a step in the profile and clearer signs of bedding above them (Fig. 2). On the coast nearby at the Kame of Hoy, and more impressively still at the 'Too of the Head' near Rackwick, the Hoy Volcanics are well developed, including columnar basalts above a bed of ash, separating the middle and upper ORS, but both locations are difficult to appreciate except from offshore (see Plate VII in the Survey Memoir for the Orkneys).

Fig. 2. Ward Hill (centre) with Round Hill on the right, North Hoy

The view in Fig. 2 also includes a low, asymmetric hill, on the right (west), misleadingly named Round Hill, which is an elliptical vent infilled with basalt. A further cluster of three smaller, more circular vents nearby have a mixed infill of lava and ash, the largest of which is surmounted by a possible Pictish burial mound which rejoices in the name of 'Tuak of the Witter'! In his 'Ancient Volcanoes of Great Britain', Archibald Geikie believed these were the outlets from which the Hoy Lavas were extruded, but this explanation may not entirely suffice, as we shall see. Further vents intruding the middle ORS occur near Quoyness in the north (an agglomerate) and around Long Hope Bay in the south. The most convenient to include in a short visit may be seen by the roadside on the west shore of South Walls. This is just 75 by 40 feet in extent, and consists of a dark outcrop of monchiquitic breccia mixed with fragments of the host rock, the Rousay Flags (Fig. 3). ►

Fig. 3. Small Vent of monchiquite-breccia, South Walls, Hoy

Staying with the theme of intrusive rocks, there are plenty of small dykes scattered all around Hoy. Most are composed of monchiquite. This is a rock of the lamprophyre family that commonly forms dykes of various ages all over Scotland. The lamprophyre clan are perhaps one of the least understood groups and could form the subject of a 'Musing' on their own, but are of interest because of their similarity to kimberlites and lamproites - rocks which host many of the world's diamond fields - but don't try looking for diamonds on Hoy!

Fig. 4. Amygdaloidal olivine-basalt, near Melsetter

Curiously, only a single, thin sill has been described on Hoy (and indeed in the Orkneys), and that is barely accessible, at the foot of the cliffs on the Kame of Hoy. It consists of an even more esoteric rock type called a bostonite, rich in alkali feldspar.

Fig. 5. The Dunes near Melsetter, South Hoy

My final word on the volcanic rocks of Hoy is to reference the splendid exposure of porphyritic olivine basalts on the south coast near Melsetter. Small in extent, it includes good ropey lava tops, and is mostly vesicular with calcite-filled, often large, amygdales (Fig. 4). These would appear to be too far removed from the northern vents for Geikie's suggestion to apply here, while the contrasting composition of the southern vents suggests they, too, aren't genetically related either, so perhaps the 'Melsetter volcano' may lie offshore? Incidentally, on the way to this location you pass a small area of dunes which preserve some fine cross-sections revealing their internal structure (Fig. 5).

The road to Rackwick follows a fault-controlled valley between the heights of Ward Hill and an impressive set of crags known as the 'Dwarfie Hamars' (Fig. 6) and their less rocky neighbours the 'Stany Hamars' (Old Norse, hamarr = crag or steep cliff). These are carved from thicker bedded, more resistant upper parts of the Hoy Sandstone. Two huge blocks have fallen to the valley floor, one of which known as the 'Dwarfie Stane' (Fig. 7) has been hollowed out by human agency and is clearly a great tourist attraction. ►

Fig. 6. The Dwarfie Hamars, impressive crags of Hoy Sandstone.

Fig. 7. people crowding around the 'Dwarfie Stane'

No doubt these tourists are often on their way to, or from, the obvious highlight of the island: the 'Old Man'. A well trodden track from Rackwick rises around the slopes of Moor Fea before turning north over descending ground thereafter. The top of the 'Old Man' himself comes into view from some distance (Fig. 8). The close-up views of the famous sea stack are well worth the effort; an impressive 449 foot high pinnacle of red Hoy Sandstone borne aloft on a secure plinth of brown Hoy Lava (Figs. 9/10). Note how even and almost level the bedding is for much of the stack; only at the top is there much suggestion of any large-scale cross-bedding. It is also curious that the stack is taller than the cliffs themselves, otherwise how could it appear to be so prominent from a distance, (as in Fig. 8)? In my experience this isn't usually the case. A convenient thought on which to end. ■

Mike Allen

Fig. 8. The 'Old Man' poking his head above the horizon, to the left of another old man!

Fig. 9. The 'Old Man' of Hoy sea stack

Fig. 10. The greyish-brown Hoy Lava securing the base of the 'Old Man'

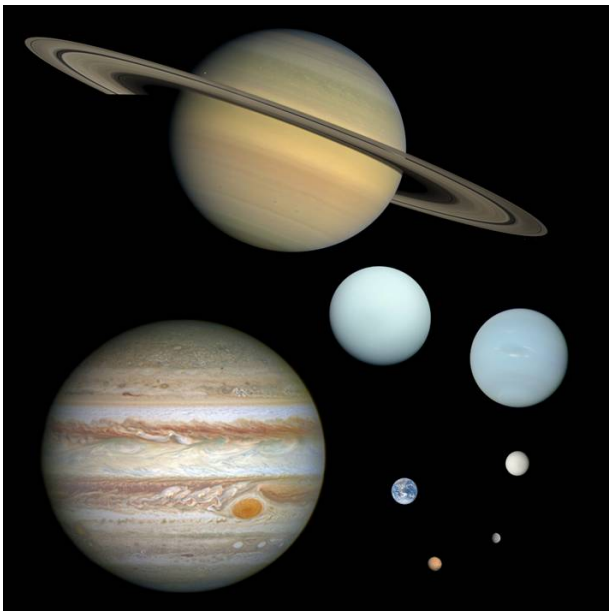
Mike's Musings No. 52

Gifts from Heaven? (Part 1)

It seems opportune after the subject of my last Musing *(Newsletter No. 285)* to return to planet Earth by way of those mysterious travellers from outer space that occasionally end their journeys with a bang, pop, fizzle or hiss in our own backyard. These range from devastating events that have scarred our planet and changed the course of life on Earth, to milder events that bring smaller cosmic messengers to our attention.

First we need to clarify some of the surrounding terminology which can be confusing or misunderstood. We are all familiar with the terms **stars**, **planets** and **moons**. These are the names we give to some of the larger objects in our heavens. Our one and only **home star** is, of course, better known as **the sun**, but trillions more exist throughout the universe, unimaginable in their numbers (even more so than the millions and billions of years geologists and astronomers glibly talk about when referring to the fourth dimension). From now on I shall remain focussed on the confines of our own solar system: the universe is just too big to cope with! ►

Planets orbit our sun and are far fewer in number (just eight are now recognised within our solar system). They are much smaller in size than the sun, the four outermost being 'gas giants', with the four innermost so-called 'rocky planets' easier to visualise, probably because we live on one them. **Moons** are bodies that orbit a planet; neither Mercury nor Venus have any moons, while Saturn has (at present) 146 known moons, and counting. Both the planets and their moons are of interest to geologists as they throw light on some aspects of Earth's early history and, to some, suggest the possibility of finding simple forms of life close to home.



The Planets, to scale, Wikimedia Commons

You may have gazed into the skies on a dark night, especially when far removed from the interference of city lights, and observed points of light trailing across the night sky. These 'shooting stars' are more correctly known as either **comets, asteroids or meteoroids**. Occasionally these objects (for they are indeed substantial bodies, and not just light sources) enter the atmosphere of larger bodies, whence they are correctly referred to as **meteors**. Most of these will burn up during their flight through the atmosphere, but roughly 1 in 20 will survive (in part at least) to collide with the surface of that body, and are referred to as **meteorites**. Generally when talking about **meteorites** we are dealing with those that land on Earth, but they may also strike other 'rocky' heavenly bodies, examples having now been recorded both on our moon and on Mars. Similarly, a **comet** (called Shoemaker-Levy 9) was also recorded breaking up with its various parts successively entering the atmosphere of Jupiter in 1994.

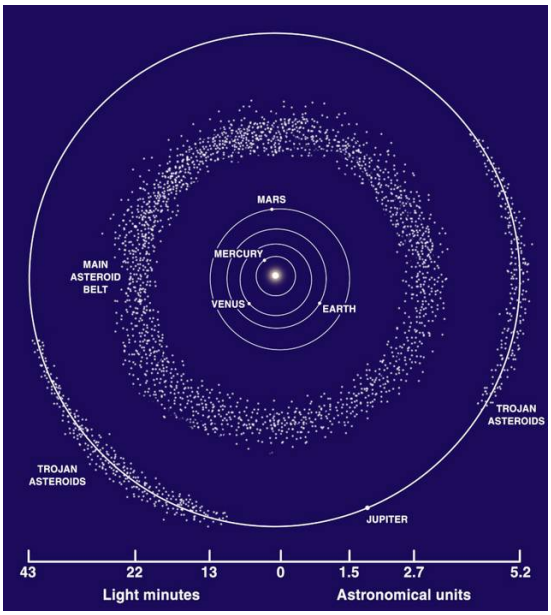
The 'gifts from heaven' I refer to in my title may include any of these categories of smaller 'space-rock'. Their one common feature is that they all orbit our sun, either directly, or indirectly (in that they orbit a planet or moon that itself orbits the sun). **Comets, asteroids or meteoroids** each have specific characteristics which define them, and they give different clues about the history of our home planet.

Comet Hale-Bopp, Wikimedia Commons

Comets are arguably the most fascinating objects in the night sky. Around 5,000 are known, and they usually have highly eccentric orbits (exceptions might in fact be better classified with the asteroids). Coming in a range of sizes (the largest known has a nuclear diameter of around 200km, so fairly small as celestial objects go), they have been referred to as 'dirty snowballs'. They differ from other objects by their higher content of volatile material, notably water ice or other frozen gases, such as carbon dioxide, carbon monoxide, methane or ammonia, surrounding a nucleus of rock and dust. When their trajectories bring them closer to the sun these volatiles evaporate releasing clouds of dust that produce a large, bright 'fireball' (or coma) with a long glowing trail of bright light (the tail) in their wake. Older comets may have lost much, or all, of their volatile constituents, whence they no longer glow and take on the appearance of a dull asteroid. ►

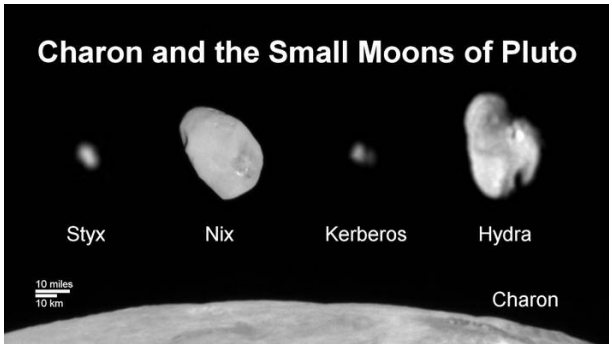
Much of their fascination arises from their periodic nature: they are divided into long-period comets (>200 years), thought to originate from the very outermost parts of the solar system and beyond, in the so-called Oort Cloud, and short-period comets (<200 years), which come from sources closer to home, just beyond the orbit of Neptune, in the so-called Kuiper Belt. It is their highly elliptical orbits which may bring them much closer to Earth at times. In many cases their orbital period has been well established such that their 'return to Earth' can be accurately predicted. Probably the best known is that named after a former Astronomer Royal, one Edmund Halley, who first demonstrated their periodicity.

Their importance to Earth's history is somewhat subjective, but it has been suggested that an abundance of cometary collisions with our infant planet may have been responsible for at least partially watering the early Earth. Some authorities have gone even further; the presence of aromatic hydrocarbons detected on some comets has given rise to speculation that shock-synthesis associated with collisions between icy comets and a rocky Earth could have produced amino-acids (the simplest building blocks of proteins) thereby bringing life to our planet from beyond (the 'Panspermia' theory); this would make all of us alien visitors!



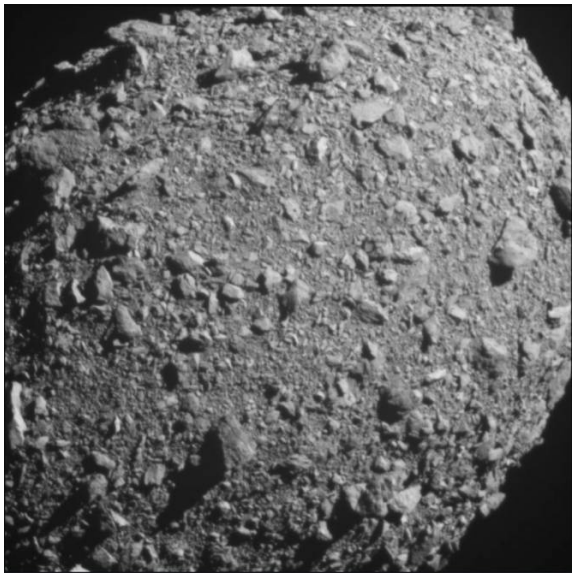
Asteroid Belt, Wikimedia Commons

Asteroids, also known as minor planets, have slightly elliptical and more stable orbits, much like the major planets. A few atypical asteroids having wildly eccentric orbits might, as mentioned earlier, simply be extinct comets that have lost their volatile constituents, and therefore their glow, thus appearing to be more 'rocky'. The term was introduced as more and more objects within the so-called **asteroid belt** were discovered. This is a zone that occupies a position between the orbits of Mars and Jupiter and contains a large number of small rocky objects that are the possible remains of another early planet which was disrupted by the huge gravitational effect of Jupiter. Ceres, the earliest asteroid to be discovered in 1801, is large enough to join Pluto (the demoted planet, discovered in 1930), and add confusion to the terminology by being granted a kind of bridging status of **dwarf planet**. A further seven or eight bodies beyond the orbit of Neptune have been added to this status since the turn of the millenium. All of these dwarves are large enough to be gravitationally rounded, most of them have their own moons, and two even have ring systems like Saturn, so a separate identity is no doubt justifiable. The terms **planetoid, meso-planet** and **quasi-planet** have also been used to describe these bodies, whilst Vesta has suffered the indignity of having been demoted from such status back to a simple asteroid.



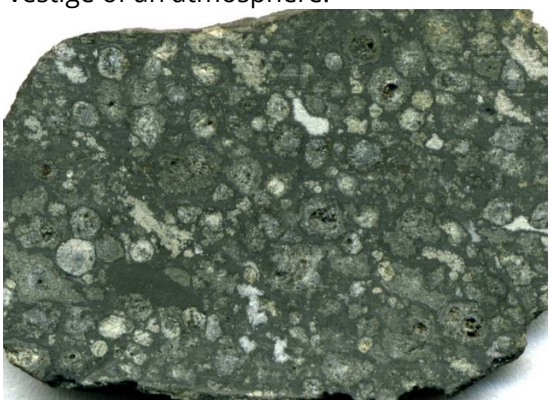
Wikimedia Commons

Incidentally, if a celestial body has its own satellites (moons), it makes it possible to determine its size and mass more accurately. In this way, when Charon (the first of its five moons to be discovered, in 1978), Pluto was found to be much smaller than first estimated. Instead of being larger than Mercury, it was now only 5% as large. This was the first nail in its coffin for maintaining 'full planetary' status, compounded by its high orbital eccentricity. ►



Dimorphos orbits the asteroid Didymos and the photo was taken by NASA's DART mission just before impact. Wikimedia Commons

Meanwhile, the size of an **asteroid** has never been formally defined, but one commonly accepted view holds that any such object less than a metre in diameter is regarded as being a **meteoroid**. It might alternatively be more helpful to regard asteroids as being specific to the asteroid belt, while meteoroids could have wider application as any random fragments of 'space-rock' left isolated during the formation of our solar system, irrespective of size. But, by this definition, roughly a million **asteroids** have been individually identified, mostly within the asteroid belt. This million adds up to only around 3% of the mass of our closest neighbour, the Moon. Altogether, it is estimated that around two million larger than 1 kilometre diameter and many millions more smaller ones make up the asteroid belt. They differ essentially from planets and dwarf planets in being too small to have a gravitational field large enough to have drawn them into an ellipsoidal shape, or to retain any vestige of an atmosphere.



Allende meteorite, carbonaceous chondrite, Wikimedia Commons

The shape of these objects varies from highly irregular to what might be described as 'sub-angular to sub-rounded' if you were adopting the descriptions given to the shapes of pebbles (Krumbein's or Pettijohn's: see Musing No.44, Newsletter No.278, April 2023), but composition is a better criterion for classification. Three main types are recognised: the most common (75%) are C-types, 17% are S-types and the remaining 8% are M-types. I shall have more to say on this subject later on when specifically discussing meteorites, which are classified in broadly the same way: suffice to say for now that compositions break down along these lines:

- C-types carbonaceous or chondritic (and therefore dark in colour)
- S-types siliceous or stony (in particular magnesium silicates)
- M (or X)-types metallic or nickel-iron (with perhaps some stony material)

Needless to say, as more objects are discovered, the variations within these classes become ever more complicated, leading to further sub-types, most of which seem to be quite rare or even unique!

Other criteria have also been applied to the classification of asteroids: one method is based on their colour, albedo (reflectivity) and spectral characteristics which are largely determined by their surface nature, and include the degree of weathering, which can provide a clue to the age of the body. Another method is based on their orbital location and includes those in the **main asteroid belt**: the so-called **'Trojans'** being those which share the same orbit as a particular planet without colliding with it; and the somewhat more significant group (from our perspective!) of **'Near Earth Asteroids'** which includes those that cross Earth's orbit and constitute a real threat of interfering with our peaceful (?) existence here on Earth! The cheerful subject of asteroid impacts will be explored in 'Gifts from Heaven - Part 2'. ■

Mike Allen