Geology Matters

The newsletter of Malvern U3A geology group
January 2017

The leader

Well here we are moving into a new year - why is time passing so quickly?! Apparently, Father Christmas has it best - because he's moving so quickly to visit every household in the (Christian?) world, he is not only getting smaller but he is also not ageing – something to do with Einstein I understand!

First many thanks to Dr Ralf Gersitter who talked to us this month on the 1815 eruption of Tambora in the Philippines and large scale volcanism in general. I think everyone who attended enjoyed his lecture which was both entertaining and informative. He disproved the theory that German's have no sense of humour! There were 88 members present which maintained the very high level of attendance so far this U3A year.

A funny story - those of you who attended our first talk of the year by Rosemary Dartnall may remember the rather complex talk she gave on her PhD research project on the Gwna Melange of Anglesey! I had the dubious pleasure of doing the write up and after a few weeks trying to make sense of the slides and audio plus a bit of extra reading I produced my best efforts. However, when shown to Rosemary, she decided that she didn't want her talk published on our website after all! She is concerned that it would mean her theories would have too wide a distribution before she completes and publishes her PhD – the geology group website?! Anyway, she has now agreed that we may distribute a somewhat reduced version of her talk directly to members. You will find it as an attachment to the email.

Calling our new members - may I just reinforce the point once again that we want you to attend our main monthly meetings – I know that at least one of you was confused on this point. The new member's sessions, good as they were, are purely an introduction to the subject to get you started so that you can better enjoy the more varied fare presented at the monthly meetings.

We have now finalised our summer programme – see Calendar for advanced warning of dates. There will be more information nearer the time.

Finally, some of you may be interested in a free Open University Future Learn course beginning in February – it's called '[The Earth in my Pocket: an Introduction to Geology]'.

All that remains is for me to hope that you had a very happy and successful Christmas and that 2017 is good to you all.

Potpourri

This being our first edition of the new year, your editor was casting around for ideas about the content, and eventually the notion of a geological travelogue distilled itself. So if you are thinking about where you might travel to this year, then here are a few ideas. There will always be other things to do, so if your spouse is a little dubious then all you have to do is tell them about all the other wonderful attractions. So here we go….

Holidays at home, so to speak

This phrase originated as a piece of government propaganda in the austere years after WW II. A strong memory is threading through barbed wire entanglements to get to the beach at Hornsea in East Yorkshire. But it is to a different stretch of the UK coastline that we go for our first recommendation, the UNESCO World Heritage site of the Giant's Causeway in Northern Ireland.

Around 50 to 60 million years ago during the Palaeogene period, Antrim was subject to intense volcanic activity, when highly fluid molten basalt intruded through chalk beds to form an extensive lava plateau. As the lava cooled rapidly, contraction occurred. While contraction in the vertical direction reduced the flow thickness (without fracturing), horizontal contraction could only be accommodated by cracking throughout the flow. The extensive fracture network produced the distinctive columns seen today. The basalts were originally part of a great volcanic plateau called the Thulean Plateau.

And if you would prefer to look at the Scottish end of the system then there is always Fingal ’s Cave on the island of Staffa which is accessible from Oban.

Et maintenant Les gorges du Verdon

Being sophisticated travellers, you’ll well understand the joys of holidaying in France. It’s a big country, but one well served with an excellent road and rail system. Avoiding the school holiday period (8th July to the 30th August) you can enjoy early summer temperatures in the 20s and very few days with rain. The local wine’s not too bad either. Make your way south to the Ardeche region and this is what you can enjoy.

The bare limestone gives way to scrub and bushes above the winter flood line. The span varies between 200m (660ft) and 1.6km (1mi) at the top of the gorge.

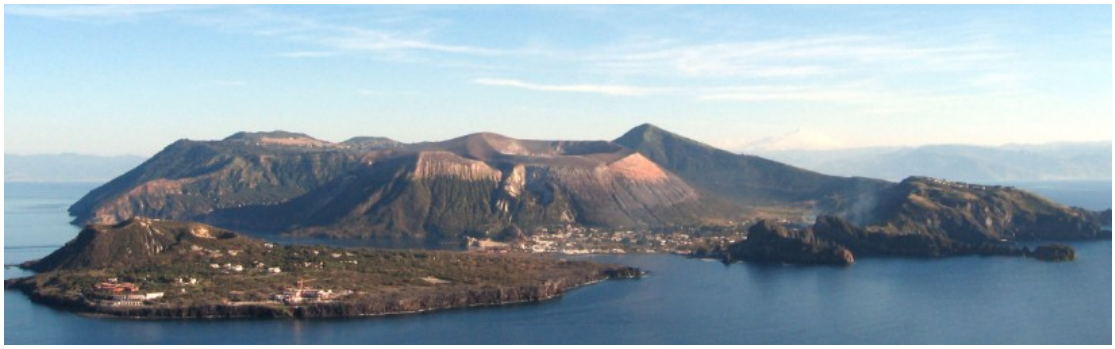
A multitude of caves opens out onto the wall of the gorge. These were created when acid from rainwater dissolved the limestone. The small amounts of carbon dioxide gas that rain collects as it falls through the air turns it into carbonic acid, which dissolves away calcium carbonate, limestone's chief constituent.

This honeycombing of the limestone has weakened the whole rock area, making it easier for the river to cut its downward path. Geologists think that, before the Verdon Gorge was formed, the river flowed through an underground cavern system. Chemical erosion slowly weakened the roof of this cavern. Eventually the roof collapsed under its own weight, opening up a great chasm. The river would have washed away the massive volume of debris generated by such a fall, leaving behind the gorge as it stands today.

Vulcano

No, that isn't a misspelling – it is a small Italian island, and it does have a volcano, in fact several. Lonely Planet describes the highlights of a visit in these terms:

> "With its visibly smoking crater and vile sulphurous fumes, Vulcano makes an indelible first impression. The island's volcanic nature has long been impressing visitors: the ancient Romans believed it to be the chimney of the fire god Vulcan's workshop and today it remains famous for its therapeutic mud baths and hot springs. The main draw card, however, remains the Fossa di Vulcano (Gran Cratere), the steaming volcano that towers over the island's north eastern shores. Vulcano's most obvious attractions – climbing the crater, strolling over to the mud baths and the black beaches at Porto di Ponente – are easily managed on a day trip from Lipari."



Pamukkale, meaning "cotton castle" in Turkish

This is our second World Heritage site recommendation, this time situated in the south west of Turkey and known since ancient times for the attractiveness of its hot springs and beautiful travertine terraces. The geo-chemistry behind this is fairly straightforward. When the water, supersaturated with calcium carbonate, reaches the surface, carbon dioxide de-gasses from it and calcium carbonate is deposited. The depositing continues until the carbon dioxide in the water balances the carbon dioxide in the air. Calcium carbonate is deposited by the water as a soft jelly, but this eventually hardens into travertine. If you would like to see some travertine locally, then you need go no further than the steps leading into Lloyds Bank on Bellevue Terrace.

And if you don't mind the jet lag .....

then New Zealand has a lot to offer. Well known for its volcanoes, high mountains and glacial scenery, it is a geological cornucopia. But to be slightly perverse, the featured site has none of the above.

These are the Moeraki boulders. They are unusually large and spherical boulders lying along a stretch of Koekohe Beach on the wave-cut Otago coast between Moeraki and Hampden. They occur scattered either as isolated, or clusters of boulders within a stretch of beach where they have been protected in a scientific reserve. The erosion by wave action of mudstone, comprising local bedrock and landslides, frequently exposes embedded isolated boulders. These boulders are grey-coloured septarian concretions, which have been

exhumed from the mudstone enclosing them and concentrated on the beach by coastal erosion.

Continuing eastwards and after yet more jet lag we find ourselves in Trumpland©

The USA has a plethora of National Parks, many of which feature really interesting geology and it's quite difficult to pick just one, but here goes. The exposed geology of the Bryce Canyon area in Utah shows a record of deposition that covers the last part of the Cretaceous Period and the first half of the Cenozoic era in that part of North America. The ancient depositional environment of the region around what is now Bryce Canyon National Park varied from the warm shallow sea in which the Dakota Sandstone and the Tropic Shale were deposited to the cool stream sand lakes that contributed sediment to the colourful Claron Formation that dominates the park's amphitheatres.

Other formations were also formed but were mostly eroded following uplift from the Laramide Orogeny which started around 70 million years ago . This event created the Rocky Mountains far to the east and helped to close the sea that covered the area. Uplift of the Colorado Plateaus and the opening of the Gulf of California by 5 mya changed the drainage of the Colorado River and its tributaries. The uplift caused the formation of vertical joints which were later preferentially eroded to form the free-standing pinnacles called hoodoos, badlands and monoliths we see today.

Rock of the month

Maggie Smith, fresh from travels to Japan has contributed this month's rock:

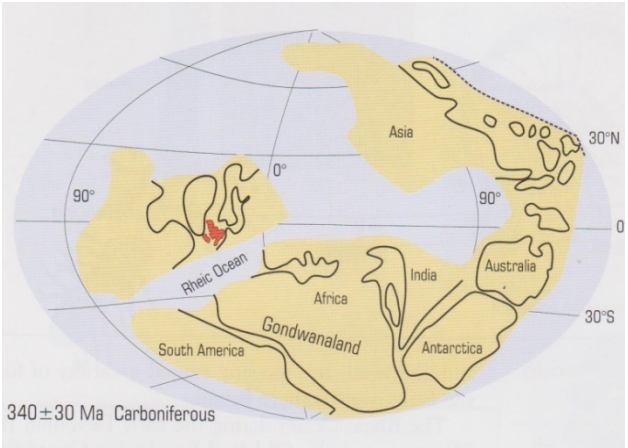
Last summer my husband and I decided to go for a short walking holiday in the Yorkshire Dales around Kettlewell. We both love this part of the country and have visited nearby Malham Cove and Gordale Scar many times. I remember two things from my first visit here back in the 1970s, an exciting first sighting of a great crested grebe on Malham Tarn and being rather surprised that limestone pavements, that I had learnt about for my geography "O" level, actually existed. Here I was hopping across the fissures between huge flat slabs of rock as the mysterious language of "clints and grikes" actually took physical shape in front of my eyes. Now, almost 50 years later and armed with three years membership of the Malvern U3A Geology Group under my belt, I hoped to discover more.

Kettlewell village lies in the picturesque Upper Wharfedale valley where dry stone walls border the ancient packhorse routes which lead up to wilder open moorland. Closer inspection of these walls, with my trusty new hand-lens, revealed that amongst the chunks of limestone there were also blocks of sandstone – something I had not expected! And later, on the track in front of me, I found a fist-sized piece of a fossil.

I now had three questions I wanted to answer;

- what geological time period did the rocks belong to
- why were both limestone and sandstone rocks present and,
- what was the fossil?

A guidebook to the Yorkshire Dales identified the rocks as belonging to the Carboniferous Period, laid down around 330 million years ago when the future UK (shown in red) was positioned near the equator, and would have had a tropical climate.

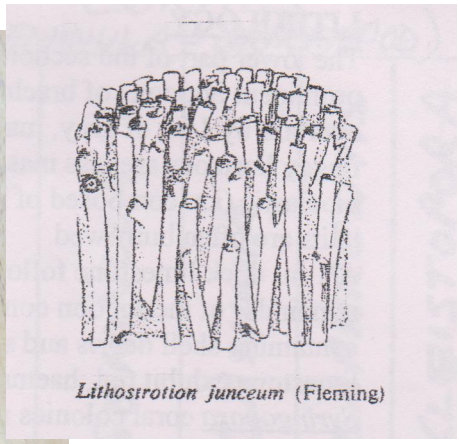


Limestone indicates a marine environment where the calcareous remains of millions of sea creatures gradually built up as they dropped to the sea floor. These were subsequently buried beneath deposits of sandstones, mudstones and shales deposited by muddy river delta systems draining into the sea. This cyclic sequence of rocks found in the Yorkshire Dales is now known as the Yoredale Series. The rock type and depth of each layer was influenced by global climatic and sea level changes.

Subsequent periods of glaciation also helped shape the landscape into that which we see today. The terracing of the hillside seen in the top picture reflects the variation in hardness of the rock types and their susceptibility to erosion.

The presence of reef deposits within the limestone layers, with fossils of marine creatures such as crinoids, corals and brachiopods, indicates that they were laid down in warm, clear, shallow waters with low sedimentation rates. This is the type of environment with similar fauna today.

A shift towards increasingly non-marine conditions is indicated where the rock sequence becomes mudstones, siltstones and the coarser sandstone material. As I was attending a fossil group class I showed my find to Paul Olver, who easily identified it as a species of rugose coral named *Lithostrotion junceum*. Rugose corals had a skeleton made of calcite (a form of calcium carbonate) that is often fossilized. Like modern corals the, now extinct, rugose corals usually lived on the sea floor or as part of a reef structure.



Some corals, including Lithostrotion, could form large colonies. Although there is no direct proof, it is inferred that these corals possessed stinging cells and tentacles to help them catch small prey.

A complex arrangement of internal radiating plates (septa) is diagnostic of rugose corals. They also always have a central rod (columella) which supports the septa running up the centre of each corallite.

I can show you these features in my fossil in a close-up photograph I took using our new microscope and camera, which as a first-time user, I am very pleased with.

magnification x 20

So, all my questions answered – job done!

Note: 'Rugose' is from the Latin word for wrinkled. These corals generally have a wrinkled surface.

Calendar

January	11	Monthly Talk: East African Rift Valley
February	8	Monthly Talk: The Anthropocene
	13	Steering Committee meeting
March	8	Monthly Talk: Geology and Tectonics in the Andes
April	5	Local field trip: Southern Malvern Hills
	12	Volcanoes of Southern Italy
May	5	South Wales (until 9th)
	10	Members' Meeting
	24	Area field trip: Lickey Hills
June	14	Local field trip: Hollybush/Raggedstone Hill
	27	Visit: BGS Open Day
July	26	Local field trip: Bromsgrove building stones (Evening)
August	30	Area field trip: Hergest ridge
September	19	Brittany (until 28th)

Who's who?

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