CHARNIA

Newsletter of the

Geology Section

Of the Leicester Literary & Philosophical Society

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SECTION C COMMITTEE 2019-2020

Cover photo: Steam vents at Storihver on the Laugavegur Trail, Iceland. See the report on Page 4.

EDITOR'S NOTES

There are two contributions from members in this issue. Roger Latham, a regular contributor, has one about fossil footprints in the US. Lyn Hancock has also produced a reminiscence about a trip to Iceland which sounds a great experience. A big thank-you to both of them and may it encourage more members to put pen to paper or finger to keyboard.

Having been to Iceland on a different venture myself, I can vouch for the attractions of the country. I have yet to get to the area that Roger describes in the US. However, I am becoming more concerned about my carbon footprint, reinforced by the growing pressure about the "climate emergency" and the increasing likelihood that our era will be recognised officially as the anthropocene in recognition of the impact that our generation is having on the earth. What does this mean for amateur geologists, or other adventurers for that matter, if our freedom to roam far and wide becomes socially unacceptable or even constrained by law or price?

The last issue in February included an item about the forthcoming AGM. This has now taken place and the new - and not so new - officers are listed on the previous page. It is a pleasure also to record that Roy Clements was also elected Life President.

Finally, please send your contributions and comments for the September edition to bdh2o@btinternet.com by the end of August. Thank you and have a good summer. Brian Waters

The Laugavegur Trail

Lyn Hancock

In May 2018 I went to Iceland with my friend Ros. We had been undergraduates at Swansea University studying Geology from 1968 to 1971. Ros had spent time in Iceland in the early 1970s whilst completing her PhD and was keen to go back.

After a three hour drive from Reykjavik over rough terrain we arrived at Landmannalauger in the Fjallabak Nature Reserve. A flat gravel plain between a glacial river and the front of the fifteenth century rhyolite lava flow hemmed in by rhyolite and obsisian mountains. We passed the hot springs but had no time to bathe. We introduced ourselves to our guide and the other members of our group and we were off. The route climbed steadily upwards through the Laugahraun lava field within the Torfajökull caldera, a huge circular volcanic complex which has been active for about 1 million years, over 15Km in diameter which has the most silicic rocks in Iceland. As we gained height we saw terrific views of the multi-coloured rhyolite mountains, which contrast with the black and brown basaltic rocks that make up most of Iceland.

We climbed up a hill by the side to the trail to get 360 degree views of the orange, red and green mountains and all the way back to Landmannalauger. We could see the peaks of Brennisteinsalda and Blanukur both still active volcanoes and examples of subglacial rhyolitic eruptions within the Torfajokull.

Carrying on along the trail we began to smell sulphur in the air as we came to the active steam vents of Storihver and watched the bubbling waters and saw steam rising upwards. We passed a scoria cone which was the remains of a lava plume where the softer rocks surrounding it had eroded away. The floor around us was strewn with glistening pieces of black obsidian looking beautiful in the sunshine. After a strenuous but very exciting day we arrived at the Hrafntinnusker (which means obsidian skerry) hut for our first night. Double bed bunks and everyone in one dormitory! Hjallti our guide provided us with excellent meals and lots of snacks.

On day 2 we began to leave the Torfajökull caldera and the rhyolite mountains and enter the darker palagonite tuff mountains - similar to basalt formed by the interaction of water and lava rapidly cooling and shattering to form volcanic glass. We were walking across black volcanic sand alternating with contrasting fields of white snow. Once we slid down an icy slope on our bottoms. We could see dramatic valleys filled with glaciers and we passed dramatic gaping ice caves. There were more thermal vents. We walked on distinctive palagonite shattered lavas like sandpaper, hyaloclastite breccia, which had been extruded under ice forming moberg (palagonite tuff) ridges and distinctive table top mountains. Ahead we could see Álftnavatn or Swan Lake, (named after the nineteenth century hunters of Whooper swans), but it never seemed to get any nearer! However we did finally get there and to the hut in its spectacular setting by the lake and surrounded by mountains.

Day 3 began with light drizzle which Hjalti told us was good as it damped down the black sand desert which we had to cross. We had only just left the hut behind when we came to our first river crossing. We sat down to take our boots off and put on our crossing footwear and were fascinated to see Hjallti's perfect coral pink toenails! The black volcanic sand desert seemed to go on forever with the trail clearly marked to avoid damaging the fragile sparse vegetation. There are experiments to try to anchor the sand with maram grass or blue lupins.

The plain was cut by the Bláfjallakvisl river in its incised gorge which thankfully we crossed by a bridge. We ate lunch by its thundering waters admiring the basalt lavas. As we neared Emstrur we left the trail to visit the 200m deep Markarflótsgljúfur gorge - a truly amazing sight. We could pick out individual lava flows piling up over each other and flowing over the redder cinder cones. The gorge was formed when volcanoes erupt melting the glaciers above and flooding the valleys - a jökulhlaup. We looped back around and ended the day at the Botnor hut.

The last day began with dramatic views of the gorges. We could see the snout of the Mýrdalsjökull glacier and Hjallti told us the ground in front was dangerous as it was unstable. We could also seethe Eyjafjallajökull icecap and the volcano which erupted through the ice in 2010. To the East the distictive Einhryningur (Unicorn Mountain) was visible for most of the day. We had to wade across the Thronga River. It was thigh deep, fast flowing and extremely cold as it was glacial melt water. The pebbly bottom seemed to shift under our feet as Ros and I slowly and carefully made our way across, arm in arm for safety. Suddenly the landscape transformed as we reached a magical birch forest and descended into the Thórsmörk valley to our final hut. We passed Skuggi, a cave formed by a lava tube. The valley is wide with a braided river threading its way through. Lower down the valley you can see where, in 2010, Eyjafjallajökull volcano melted the glacier and caused a jökulhlaup.

After the starkness of the trail the Thórsmörk valley is a paradise of wild flowers, small trees and birds. Our 55Km trek was at an end. I can highly recommend it whether you are a geologist or not.

By Lynn Hancock with help from Ros.

For those unfamiliar with this area the map shows the location of the Trail (bottom centre of the inset map of Iceland) as well as the route. Source: https://www.ultimategearlists.com/destinations/laugavegur-trail-iceland

Summer visit programme

Weekend trip to The Mendips 14th-16th June, led by Dr Martin Whiteley. You should have booked already to attend!

Winter lecture programme

The winter programme starts on Wednesday 2nd October at the usual venue.

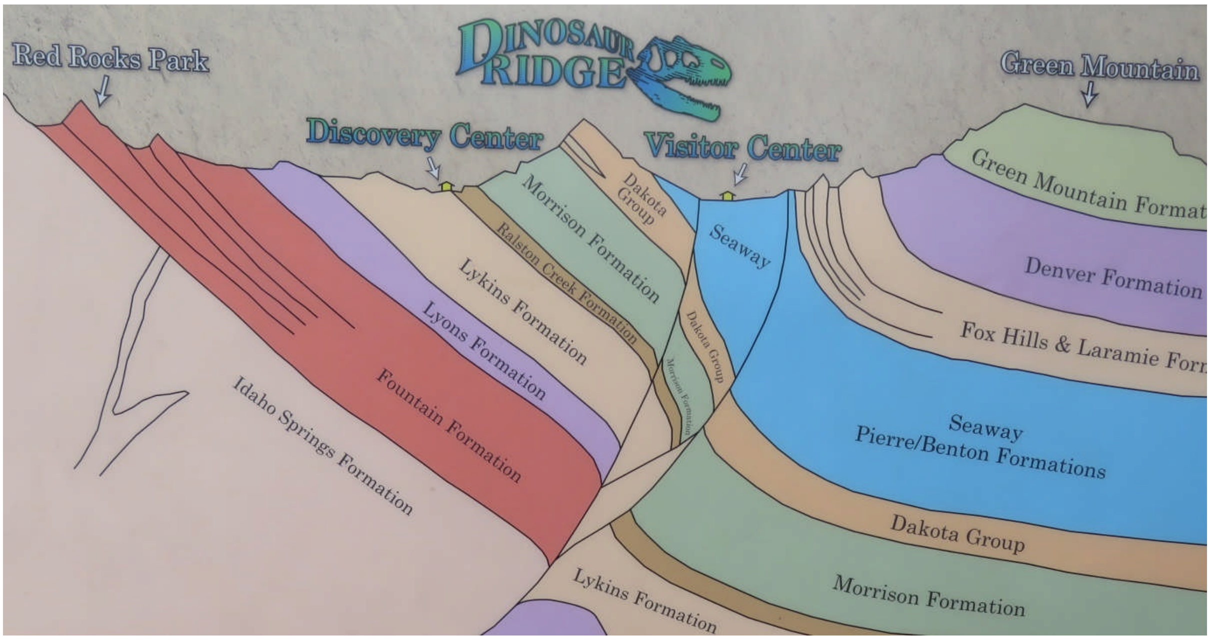
Footprints

Roger Latham

The town of Golden which lies just to the west of Denver Colorado in the USA nestles up against the front ranges of the Rockies.

The geology of the area is shown in the figure below, and consists of the first part of an eroded anticline with rocks of the early Cretaceous giving way to those of the Upper Jurassic all of which have been pushed up into a steeply sloping 60° angle. From the Dinosaur Visitor Centre to the Discovery Centre there is a walk that takes you up around the various strata from the Dakota sandstones through a low pass in the front range and into the Upper Jurassic Morrison formation.

During the early Cretaceous sea levels began to rise, and the great Plains of the USA were underwater as the Western Interior Seaway formed separating what is now the Appalachian Mountains from what is now the Rockies. As the sea level rose so the Dakota sandstones which were part of wide beach area became steadily submerged by the advancing sea.



On the walk diagonally up the hill the first thing you encounter are preserved beach ripples and as these rocks give way to the Upper Dakota sandstones so there is uncovered the dinosaur trackway. This is an area that was once close to the seashore and separated from the lush vegetation inland where sauropods and their theropod predators have left a maze of tracks and imprints which are now very plainly visible to the visitor.

Figure 2 shows the trackways.

Figure 3 explains the various movements of the animals as they crossed the muddy area leaving their marks. It's not possible to suggest that the theropods were tracking the sauropods as there is no indication that the tracks were made at the same time.

Cutting through the small gap in the full range you descend the other side of the hills into the upper Jurassic and the Morrison foundation. Here is an interesting collection of dinosaur fossils. In the equivalent strata of the Dakota sandstones on the other side of the hill can see the deep impressions made by the sauropods into the muddy substrate of the trackway with deeply bulging under prints registering in the sandstone layers. Inevitably, being the Morrison formation there are the usual jumble of dinosaur bones – mostly of sauropods, and the jumble suggests that these were the isolated bones and skeletons washed up on sandbars because of flash flooding during the upper Jurassic period.

Abstracts from 2018/2019 winter meetings

Wednesday February 27th: Reconstructing diets of pterosaurs and other extinct animals – problems and solutions using dental microwear textural analysis.

Jordan Bestwick, University of Leicester

Dietary hypotheses of extinct animals are often based on comparative, or even speculative, evidence with little means of robust testing. Using robust, quantitative techniques to infer diets of extinct animals is therefore essential for representatively reconstructing past ecosystems. One such technique involves quantitative analysis of the 3D tooth surface textures of extinct animals, known as Dental Microwear Textural Analysis (DMTA). Microwear is formed during feeding as food items create characteristic tooth surface textures that vary with diet.

This talk covers the principles, power and versatility of using DMTA to infer dietary characteristics of extinct animals. This talk also showcases DMTA research from my PhD on pterosaurs; extinct flying reptiles which lived above the heads of dinosaurs between 210–66 million years ago. DMTA is revealing pterosaurs exhibited large dietary variation, with different species potentially being fish-feeders, crunchy invertebrate consumers and opportunistic feeders. This is providing the first robust information on how these extinct animals truly fitted within their respective palaeoecosystems.

Jordan Bestwick preparing moulds of teeth.

Saturday March 9th: Annual Seminar on Geology under the sea.

About 50 people attended this year's seminar which received positive feedback from attendees for a series of very interesting talks. The numbers were similar to last year. The speaker summaries are on the web site.

The Section would like to thank IODP for their sponsorship. Speakers from Leicester University also laid on some demonstrations.

Overall the seminar made a surplus of about £280 helped by sales from the bookstall.

Next year's seminar is provisionally planned for Saturday March 8th 2020. Put the date in your diary now!

Wednesday March 13th: Late Palaeozoic Marine Anoxia: Exploring Biogeochemical Processes in the Rheic-Tethys Seaway

Dr Joe Emmings, British Geological Survey

The Mississippian Bowland Shale Formation is a highly metalliferous black shale (particularly V, Se) and a target for unconventional hydrocarbon exploration in the UK and in equivalents across Europe, including the Geverik Member (Epen Formation) and Upper Alum Shale Formation. Despite this interest, the controls on bottom water anoxia (as the key requirement for metal fixation, organic matter preservation and diagenetic pathway) are poorly constrained. In this talk I will provide a holistic perspective on the Bowland Shale, including focus on two biogeochemical aspects. Firstly, we will explore observations including sedimentology and geochemical palaeoredox proxies, in order to develop an understanding of sedimentary processes and changing basin redox conditions in response to sea level fluctuation. Critically, anoxia was likely productivity-driven. In addition, a process of switching between ferruginous and euxinic conditions in anoxic porewaters, termed 'redox oscillation', is recognised by a distinctive redox-sensitive trace element enrichment pattern, diagenetic mineral suite and organic geochemistry. This setting is partially analogous to the modern Amazon Shelf.

Secondly, we will explore a candidate record of ancient chemosynthetic microbial mats preserved in the Bowland Shale. Microbial mats are markers for compressed redox gradients at seabed, biostabilisers of sediment and are important mediators in cycling of S and C. Yet ancient examples are rare. A suite of observations suggest intermittently high redox gradients developed at seabed, and that these conditions were utilised by sulphide-oxidising mats. Therefore the Late Palaeozoic biosphere potentially included a pool of marine, benthic (chemoheterotrophic) microbial mats. Development of oscillatory redox conditions in porewaters, and eventual colonisation of seabed by candidate microbial mats, both suggest an environment that was subject to rapid accumulation of mud, reactive metals and high rates of degradation of marine organic matter. Late Palaeozoic marine anoxia was potentially coupled to generally productive and nutrient-rich water column conditions associated with the 'Phytoplankton Blackout' phenomenon.