Geology Matters

March 2018

Editorial

This month is usually the end of the more serious cold weather and we can look forward to bursting buds, flowers, nesting birds and all that the cheerfulness of spring bestows on us. We can look forward as well to the field trip programme that has been put together whilst the weather was less than clement.

This edition is not about field trips per se, but at some point researchers will have been into the field to gather the data and observations that have led to these articles which mostly feature sedimentary rocks. They range widely this month and include the near at hand Bristol Channel, the more remote Greenland and perhaps rather more accessible rocks of South America.

Wherever you travel to this coming season, please don't forget to take photographs and share them with us - they will be much appreciated.

So now, on with the geology.

Recycling, so to speak

" Muddying Greenland's melt waters" was the intriguing title of an article that caught my attention recently, so I read on. It was on a geological/global warming theme and went on to explain that satellite measurements indicate that Greenland's melt water rivers are exporting one billion tons of sediment annually, a process that is controlled by the sliding rate of glaciers. Whilst there are several factors that affect the sliding rate, the steadily increasing temperature is a highly significant one. A billion tons of sediment is a huge amount, but Greenland is a very large island and it does have a lot of glaciers. The photograph below shows the sediment flows from two glaciers in the south west of the island. You can clearly see the contrast between the northerly fjord with its slightly milky blue-green water that is loaded with sediment and the one just to the south which is dark blue and, lacking a glacier feed, is effectively free from sediment.

You can also make out light grey patches on the seaward side of both glaciers – these are the larger rock fragments that have dropped from the melting ice, whereas the very smallest fragments are sufficiently light enough to be suspended in the water for much longer periods of time, but will settle out eventually. The whitish patch to the left of the image centre is a group of icebergs.

The photograph below is a sea level picture looking eastward towards the glacial front where ice falls off into the sea. Two features here – the gravel deposited where the figure is seated, which is sufficiently large not to have moved far from where it was deposited and probably showing how much the glacier has retreated. Secondly the colour of the sediment rich water can clearly be seen.

Sermiligarssuk, south west Greenland

And just in case you would like to see a glacier 'calving' – it is a pretty spectacular event – then follow the link below.

https://www.youtube.com/watch?v=3V2UACo1qEY

Glacier ice is blue and white, whilst there is often a superficial 'dirty' appearance caused by eroded rock fragments.

Sediment nearer home

You don't have to have lived here very long before you notice that the waters of the River Severn are an impenetrable muddy brown and certainly don't have the sparkling clarity you would get in a chalk stream. Just take a look at this satellite image showing the river flowing into the Bristol Channel.

My curiosity piqued by the sediment figures for Greenland, I researched the sedimentary input into the Bristol Channel. The River Severn introduces 263 000 tonnes per annum, whilst the much smaller River Wye a quite amazing 347 000 tonnes. If we assume that the rivers have been flowing this way for the last 10 000 years, then a rough calculation suggests that they have introduced at least 5,580 000 000 tonnes of sediment. Quite a bit, and probably an understatement at that. So what happens next? And you might reasonably ask, how has the scenery changed where this vast amount of sediment originated?

Richard Edwards

During his last lecture series Richard told us about the scablands – an area of North America where, at the end of the last ice age, huge volumes of melt water were retained behind relatively weak debris

and ice walls that eventually burst and resulted in a catastrophic flood that stripped off the top layers of soil and rock, the result of which we can see in the following image.

The scablands – Potholes coulee

This is an extreme, but not unique event, and you can read more about it here

https://en.wikipedia.org/wiki/Channeled_Scablands

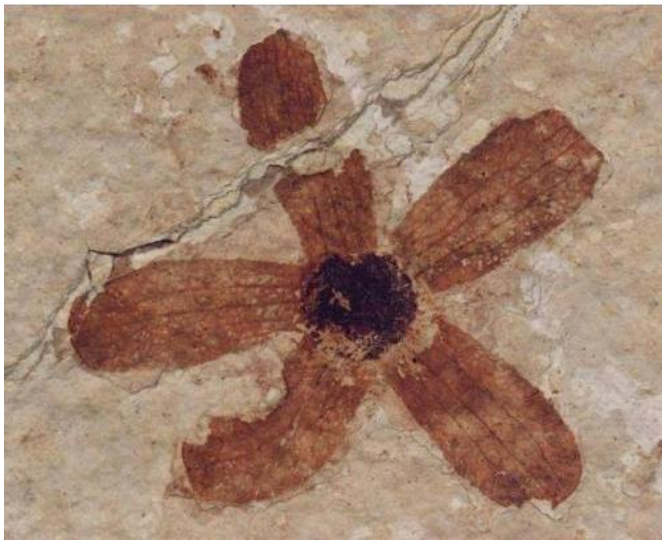
However, the eroded material didn't simply vanish – it must have been deposited somewhere.

Litho - ˈlʌɪθəʊ,ˈlɪθəʊ - the next part of the story

Petrifaction magic is a major plot element in the novels *The Lion, the Witch and the Wardrobe*, *Harry Potter and the Chamber of Secrets* but there is no
magic involved in the lithification of sediments, which is what happens next. Here we have an image of some partially lithified sandstones.

The layers in this pillar of rock are Eocene in age, about 50 million years old and are found in north eastern Utah in a location known as Fantasy Canyon. They are sandstones, deposited at the edge of lake Uinta – the ephemeral lake that also gave rise to the fossils of the Green River. These sandy layers are only partially lithified – it can take millions of years of burial, heating, and chemical interaction with groundwater to turn loose sediment into a rock. Since only part of this unit is lithified, pockets of the looser sand that get exposed to the desert setting are rapidly eroded by wind and rain, leaving the textures seen in these chaotic pillars.

And since we mention the Green River



The exceptional preservation of this Eocene (56-34 MYA) flower is due to the fine grained nature of the limestone in which it was

entombed. The specimen comes from the Green River Formation covering parts of the North American Midwest The formation is world famous for its fossil freshwater fish and the formation dates from between 53.5 and 48.5 million years ago.

Thin layers of light coloured sediment were deposited in winter from suspended particles in the lake water. The best preserved fossils are found in these varved oozes, which are made of very fine grained limey mud. The fossils are well dated due to layers of volcanic ash interleaved in the sediments that were erupted from the nearby Yellowstone caldera. The area is designated as a Lagerstette, a German word used to denote an area of exceptional preservation.

Speaking of exceptional preservation

Actinocrinites Gibsonia, a fossil crinoid and a fossil starfish from the Lower Carboniferous. It is the earliest/lowermost of two sub periods of the Carboniferous lasting from roughly 358.9 to 323.2 million years ago.

And thanks to plate tectonics

These sedimentary rocks will often find themselves resurfacing many millions of years later and many thousands of kilometres from where they formed. One such area is Jordan – which has a sedimentary landscape laid bare by the arid climate. You are invited to fly around it in this short video :

https://vimeo.com/130034654

Rocks of the month

https://en.wikipedia.org/wiki/Cerro_de_los_Siete_Colores
Hill of the 7 colours

Ausengate rainbow mountains of Peru

The different colouration is due to different environmental conditions and mineralogy when the sediment was originally deposited and subsequently diagenetically altered. Introduction of goethite or oxidized limonite will introduce a brownish coloration to sandstones. The bright yellow coloration could be due to iron sulphide as trace minerals within the pore cement. In addition, chlorite will often colour sediments varying shades of green dependent on diagenetic history and concentration.

https://en.wikipedia.org/wiki/Diagenesis

And there are fairies at the bottom of the garden

https://www.youtube.com/watch?v=dRuxw-nZoJw

There are no prizes for spotting the gaping holes in the narrative.
President Trump, this really is fake news.

You will be familiar with sod's law…

Well I was sitting in the lounge when my wife's agitated voice floated down to me "What was that?" *What do you mean? I queried.*
"Well the bed shook and the radiator creaked", came the reply.
The keen geologist in the family had not noticed the earthquake, which didn't move the lower and more stable part of the house.
Grrr.