

Diary Dates

Tuesday 6th October,
19:30 - 21:00.

At your internet device.

WEGA AGM and Zoom
Practice.

WEGA AGM and a
chance to get up to
speed with Zoom, in
preparation for next
weeks lecture.

Details on how to
connect will be sent by
email. It helps to
download Zoom in
advance. Get it [HERE](#). A
device with a camera and
a microphone would be
helpful. A microphone is
essential if you intend to
contribute.

Tuesday 13th October
19:30 - 21:00.

At your internet device.

WEGA Zoom Lecture.

Dr. Doug Robinson will
be talking about “The
Alston Block.”

Details on how to
connect will be sent by
email. It helps to
download Zoom in
advance. Get it [HERE](#). A
device with a camera and
a microphone would be
helpful. A microphone is
essential if you intend to
contribute.

Dear WEGA Members,

A lot has happened since we last met for that excellent talk by our president, Professor Brian Williams. I must confess that I have been suffering from lockdown apathy for which I apologise and time has passed so quickly, it does when you have little to do. I have been staying during lockdown with a friend at Frampton Cotterill so that we could isolate together, it made good sense, and we were lucky to have the Frome Walkway on our doorstep for our daily exercise.

Once we were allowed to travel further we have been out and about during the good weather visiting the Cotswolds, the Malborough Downs and the Mendips; mainly limestones and chalk and where it is not too difficult to be socially distant. My friend, Michael, is more interested in nature than rocks and we have



A bee orchid from our Wiltshire trip

been treated to the skylarks especially on Selsey Common where they are abundant. Also many varieties of wild orchids, damsel flies and dragonflies. The rare Duke of Burgundy butterfly and the Small

Blue butterfly were also plentiful on Selsey Common. I was fortunate to spot a bee-eater on Rodborough Common, a rare sight indeed, I wasn't sure what it was at first except it that I had never seen one before. We looked it up in on our return and from my description it could only be a bee-eater, iridescent blue/green chest, brown shoulders, yellow tan cheeks and a loud song which first brought it to my attention. Sadly when I saw it I called out to Michael to look and of course it flew away, lesson to be learned photo first then shout! I was cross because I didn't have a photo, he was cross because he didn't see it.

Until we were forced to curtail our WEGA activities we were treated to some excellent talks starting in October with Oliver Lord who gave us some insights into experimenting at high pressure and temperature to recreate conditions deep in the Earth, a topic dear to my heart. This was followed in Nov by a talk by Dr Kate Hendry titled 'Tracing the Chemical Fingerprint of Glacial Melt'. In the absence of a talk in December a number of us met for a Christmas meal at the Eastfield Inn and had a good meal in good company. In February we had our annual talks by two of the students from the university about their research, the first by Madeleine Binns titled 'Cosmochemistry and the Dawn of the Solar System' and "Life as a Geochemist and Elemental Cycling on Earth" by Danny Stubbs, both excellent talks. and of course in March our presidential address by Brian titled Continental Sedimentation where he talked about new perspectives on his beloved Old Red Sandstones. Sadly our talks in April, May and our AGM had to be cancelled as well as our proposed field trip to South Wales..

Recently we were able to have a zoom committee meeting where we started to put together a programme for next year and it was decided to hold a zoom AGM on Tuesday 6th October, I hope that you will all be set up to join us then.



And finally over a few nights this July we were lucky enough to see Comet Neowise from the back garden. I enclose a photo that I took before it flew away and another from Clevedon with the lights of South Wales



in the foreground. I have also included a bee orchid

from our Wiltshire trip. Michael, of course, with his superior equipment has some much better photos but in this instance I thought it better to use my own.

Finally I would like to wish that you all stay safe and well during these difficult times and that it won't be too long before we can meet again.

Best wishes Dr Mary Lee

A Distant Look at the Geology of the Avon Gorge

by

Graeme Churchard

The continuing lockdown has been limiting in so many ways; meetings have been cancelled, excursions postponed. But, at least, we have been able to get out and walk, sometimes with friends and relatives, often alone.

And what do I do when out walking - take photographs! Fortunately the weather was often sunny and conducive to the photographers art - even I could take half-decent photos!

As I live not very far from the Avon Gorge, many of my walks have been along the gorge. If you have driven along the Portway, you will know that it is a busy, noisy thoroughfare, often hard up against the cliffs of the gorge. It is not a place for quiet geologising.

When I started I thought I knew the geology of the gorge - Carb Limestone and a thrust fault at the bottom of Bridge Valley Road. And various ideas about

how the gorge was formed. But that is not really sufficient to write an article about it.

I had the 1:50,000 Geological survey map and then found that there was a memoir. You can get the map [HERE](#) or you can see the map [HERE](#). The memoir is no longer available from the survey but you can see a scanned copy [HERE](#). I was able to buy a second hand copy [HERE](#). My copy was originally owned by Nottingham County Library!

The field mapping started in 1939, restarted in 1943 and was complete by 1953; the memoir appeared in 1993. It soon becomes apparent that much of what was seen in the 40's and early 50's is no longer so readily accessible.

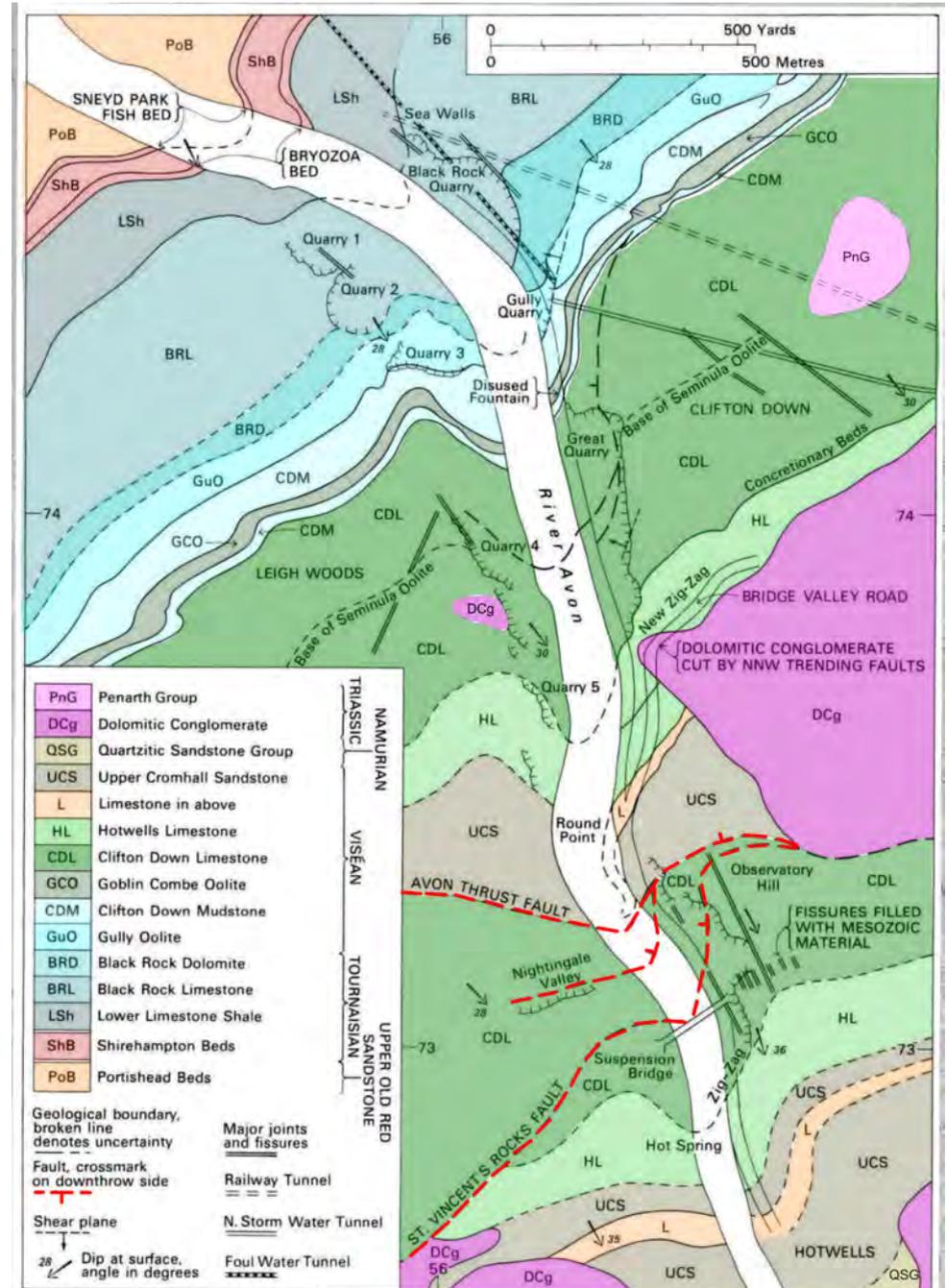
I have mentioned the traffic along the Portway. The cliff faces in the quarries are still there but have their own difficulties of access. Vegetation has taken over every surface which is not vertical.

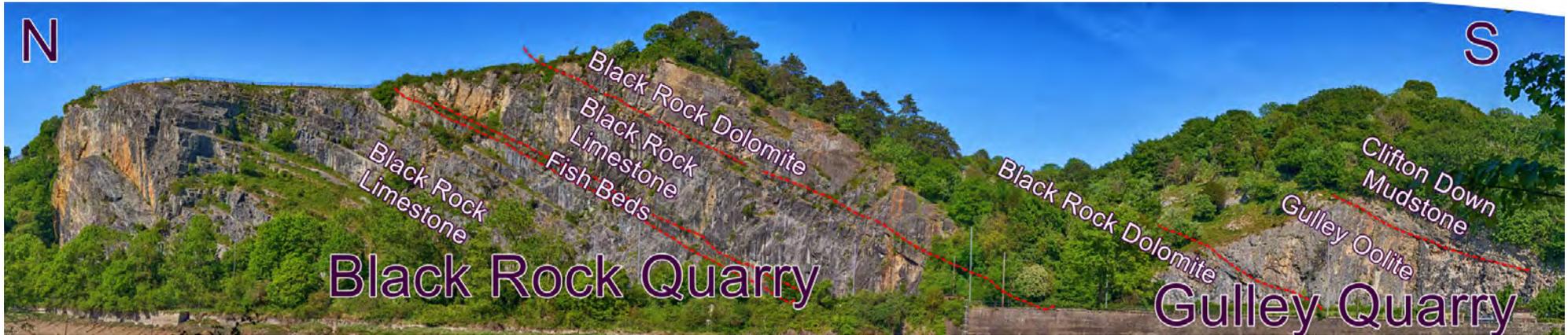
So there are no new revelations in this article. It is my attempt to get the fundamentals of gorge geology into my head. And I hope that what follows helps others who are keen on geology to answer questions I am often asked such as "What is that rock?"

On the opposite page is a geological sketch map taken from the memoir and coloured by myself. It is the easiest way of picturing the geology.

The other way is what I do in the rest of this article - put up photos of the cliffs on the east side of the gorge and superimpose the geology.

Space in the Newsletter is limited. A larger version of this is available online at <https://churchard.com/avon-gorge/>. This has more photos and talk about the details of the geology.





Black Rock and Gulley Quarries

The geology superimposed on a panorama taken from across the Avon.



The Eastern Side of the Gorge

The slope is almost impossible to enter. The geology has been taken from mapping done when the vegetation was less abundant.

The Stratigraphical Column

Stratigraphical classifications of Carboniferous Limestone

		strata in the Bristol region		
		Regional stages	Bristol and ground to north	
Carboniferous Limestone Series Dinantian	Viséan	Brigantian	Upper Cromhall Sandstone (Tanhouse Limestone)	
		Hotwells Group	Hotwells Limestone	
		Asbian	Middle Cromhall Sandstone	
	Tournaisian	Courceyan	Holkerian	Clifton Down Limestone Lower Cromhall Sandstone
			Clifton Down Group	Clifton Down Mudstone (upper) Goblin Combe Oolite Clifton Down Mudstone (lower)
			Chadian	Gully Oolite Sub-Oolite Bed
			Black Rock Group	Black Rock Dolomite Black Rock Limestone
		Lower Limestone Shale Group	Lower Limestone Shale Shirehampton Beds	



Above - The Great Quarry

Below - The Great Quarry to Bridge Valley Road

Clifton Down Limestone to Hotwells Limestone

Vegetation obscuring Hotwells Limestone





Above - Clifton Down Limestone Thrust over the Hotwells Limestone Group

As we go upstream the Upper Cromhall Sandstone comes in. The Avon Thrust disrupts the bedding of the sandstone. The older Clifton Down Limestone rides over the younger Hotwells Limestone Group.

Below - The Avon Thrust Fault

The Seminula Oolite - midway in the Clifton down Limestone Group, forms the sole of the thrust sheet. The Upper Cromhall Sandstone is shattered. Intensive rock engineering required to keep the roads safe.





Near the Suspension Bridge

Above - between the Avon and St Vincent's Rocks thrusts there are lots of minor tectonics. Upstream from the latter we are back into the regular succession. At road level the Hotwells Limestone appears at the Zig Zag path. The Clifton Rocks Railway (just off the photo on the right) is in the Hotwells Limestone.





Windsor Terrace

The terrace is built on a ridge of Upper Cromhall Sandstone and marks the upstream end of the Avon Gorge.

The Origin of the Gorge

I was told, while a student, that the gorge was superimposed drainage. An ice sheet closed Ashton Vale and the Gordano valley - the easy way to the sea - forcing the Avon to cut a new course through the Avon Gorge.

The memoir says very little about the origin of the gorge and does not commit

to any explanation. More recent publications give their opinions. Sometimes they have more than one!

The recently published (2018) book “Geological Sites of the Bristol Region”, available from Bristol City Museum, tells us on pages 28 - 31 that the Avon flowed eastwards as an extension of the Wye. Pebbles of Welsh origin have been found in East Anglian gravels.

In the Pleistocene, land loading of the Thames - Rhine Basin, caused the crust to subside. This caused the surrounding areas to flex upwards and the direction of rivers to reverse. The now westward flowing Avon was still in its original valley but started to cut down through the Mesozoic strata into the underlying Carboniferous. So the idea of superimposed drainage survives!

Page 91 of the same book mentions only one theory - ice blocking the rivers natural course through Ashton Vale and the Gordano Valley.

I will not venture an opinion about the origin of the gorge. I am just grateful that it exists and makes Bristol a spectacular place to live.

ETHELDRED BENETT 1775-1845

2015 is the bi-centenary of the publication of the world's first geology map by the man deemed the 'Father of English Geology', William Smith, but remarkably it is also the bi-centenary for a geological milestone for Etheldred Benett, a local Wiltshire woman often dubbed the 'Mother of English Geology'. Her achievement in 1815 was to produce the first annotated bed-by-bed section of the Chicks Grove Quarry near Tisbury where stone from the Purbeck and Portland beds in the Vale of Wardour is still extracted today and from where a unique range of fossils, particularly plant and reptile remains, have been found.



Miss Benett, for she never married, was born in 1776 at Pyt House near Tisbury but lived much of her life at Norton Bavant near Warminster where, as a woman of independent means, she was able to pursue her interest in collecting fossils, many of them from the Tisbury area including Chicks Grove Quarry. A relation of her eldest surviving brother John was Aylmer Bourke Lambert (1761–1842), an original fellow of the Linnean Society, a Fellow of the Royal Society and an early member of the Geological Society. He was well known as

a botanist and geologist and encouraged Etheldred and her sister Anna Maria to study natural history. Etheldred took up the newly fashionable study of fossils, while her sister took up botany.

She actually met William Smith, the Father of English Geology, and gave him a sample of a Tisbury coral. He also alluded to her in his correspondence to others as when he cited 'ladies in Wiltshire' who had 'distinguished themselves' in regards to their collections. (Torrens 2000 p60). As John Needham states in his book, 'Forests of the Dinosaurs – Wiltshire's Jurassic Finale', her work helped enable the correlation of the Cretaceous stratigraphy of the Vale of Wardour with that in Dorset. She also communicated with several other of the 'giants' of early palaeontology such as Professor William Buckland, Gideon Mantell, Edward Charlesworth, Henry de la Beche, Roderick Impey Murchison and Samuel Woodward plus George Lyell who gave us the theory of Uniformitarianism – that the processes of today are the same as those of yesteryear i.e. that 'the present is the key to the past'. She also contributed to the 'Modern History of South Wiltshire' by Sir Richard Colt Hoare. Thus, she moved in very elevated intellectual circles and was very generous in making her specimens available to others. It is important to remember that Etheldred Benett lived at a time when fossils were considered as 'sports of God' or the result of religiously significant catastrophes such as Noah's Flood, not as the result of natural processes

over a long period of time. Several of the great early collectors were members of the clergy and this must have proved an intellectual challenge in the conflict between religion and science. (This predates the so-called late nineteenth century 'Conflict Theory', now abandoned, which was epitomised by the Galileo and Darwin incidents.) Etheldred Benett was the great granddaughter of a past Archbishop of Canterbury, William Wake, (of whom she wrote a biography), but her own views on the religion/science dilemma are possibly buried in personal correspondence. It was also a time when women knew their place and scientific investigation was for men only. According to Creese and Creese (1994 p 26) many of the early 'geologists' were 'wife assistants' of the great researchers of the time, including the wives of William Buckland and Gideon Mantell mentioned above. (There were just 24 women geologists in 100 years of the nineteenth century and none with formal training appeared until around 1890 with the admission of women to higher education.) It is remarkable therefore that this independent lady, who refused to be constrained by the mores of her time, achieved so much. She was also a contemporary of that other great woman palaeontologist from Dorset, Mary Anning. Mary Anning was from a very modest background and began to sell her finds ('curiosities') to visitors to Lyme Regis where she lived. This supplemented the family income but led to her well-known discoveries of the Jurassic reptiles such as

Ichthyosaurs and Pliosaurus, far more attention grabbing than fossil sponges or bivalves which were the focus of Etheldred Benett. They died within a few years of each other but it is Mary's name that is known throughout the world, such is the draw of the dinosaur world even though she wrote barely a thing geological, unlike Etheldred Benett who published much and was in communication with several eminent geologists. The discoverer of Iguanodon, Gideon Mantell, was so impressed with the work of Etheldred that he named a Cretaceous sponge after her – *Doryderma benetti*. (The protocol is that you may name a new fossil species after a person, including yourself, but you may not name a newly discovered mineral after yourself.) The sponge came from the Upper Greensand near Warminster, close to her home. She also has her own ammonite in *Ammonites benettianus*. Her collection demonstrated that she was one of the first people to sieve for microfossils, which are now so important as indicators of possible oil deposits. She also collected specimens which, very rarely, contained evidence of soft tissue, usually destroyed in the process of fossilisation. Following her death in 1845 her collection largely went to America, bought and taken there by an Englishman and bequeathed to the Philadelphia Academy of Natural Science where the collection now resides. Ongoing modern research there into her collection brings new

evidence and ideas to light even today, about two hundred years later. Recent study of the collection that was long thought to be 'lost'; up to 1989 according to Torrens et al (2000), has given a renaissance of interest in this amazing woman. Indeed the lost examples of bivalves *Laevitrigonia gibbosa* from the Portlandian of Tisbury which, according to Torrens et al (2000 p72), 'were the first fossils ever found to have preserved most of their soft anatomy' were not re-discovered until 1992. According to Torrens et al, who have recently studied the collection, Etheldred Benett named an ammonite, a gastropod, four bivalves and twenty sponges (2000 p 70) including two genera (one rung up the taxonomic ladder from species). They go on to suggest that she might yet prove to be the first woman to have named fossil taxa, especially as many as she did.

I searched the list of Torrens et al (2000) of the many hundreds of different specimens in her collection in the hope of finding one from my own village of Dinton which lies close to Tisbury, Hindon, Chicks Grove and Chilmark where she found many specimens. I fully expected her to have visited a local quarry in the Upper Greensand (on the side of the Teffont Magna to Baverstock lane) which would have been accessible by coach. The quarry, listed in the Directory of British Fossiliferous Localities (1966 p113), has 'abundant oysters, lamellibranch and

some brachiopods'. Alas, just one specimen was derived from Dinton, an undetermined echinoid (sea urchin) from the chalk.

She was banned from becoming a member of the Geological Society on account of her gender and must have been very frustrated by the society in which she lived for in a letter to Samuel Woodward in 1836 she stated that, 'scientific people in general have a very low opinion of my sex'. (From a letter to Samuel Woodward on 12th April 1836 – Oxford Dictionary of National Biographies). Tsar Nicholas 1, after seeing part of her collection, granted her a Doctorate of Civil Law at a time when women were not admitted into higher education – no doubt believing her unusual name was that of a male! (In fairness to the Tsar, Etheldred is the male version of the name, the female equivalent of which is Etheldreda but all references to her give the male version.)

A paper by Spamer and Bogan (1993 p156-157) perhaps helps illustrate why her work had not been more widely recognised and celebrated. The paper, 'Where is *Polypothecia bennet* 1831?' recognises some of the various factors that have bedevilled her collection and her reputation: she was a woman, her collection went abroad and was therefore of less interest and less examined than local examples, she did not publish all

her finds, she named some species after others who did not always use her term so it became a 'noman nudem' (a mere name published without a description), the problems of communication of the day could lead to duplicate names for some taxa and, most importantly, the collection remained 'lost' for over one hundred years.

At last Miss Benett now receives the recognition due to a great pioneer geologist. In November 2005 her silhouette was the emblem for a conference on the role of women in the history of geology held at the Geological Society in London. Etheldred Benett is a rare female example of an enthusiastic amateur who contributed so much to the founding of the science of geology which today impacts on our everyday lives in so many ways. The local area of South Wiltshire would have been much travelled by her and very well-known as she pursued her lifelong love of fossils.

The silhouette image of Etheldred Benett is used with the permission of the Natural History Museum © Trustees.

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