Collectors, Collections and the geology of southwest Britain

Abstracts and Programme 18th September 2018

Illustration shows the Map of Cornwall, Devon and W Somerset from the first Geological Survey Memoir, *Report on the Geology of Cornwall, Devon and West Somerset* by Henry de la Beche, published in 1839 (illustration courtesy of Nineteenth Century Geological Maps, www.geolmaps.com)

Conference delegate list will be provided as a separate document to all delegates for networking purposes, where delegates have given their permission for the information to be included.

Collectors, Collections and the geology of southwest Britain

Programme 18th September 2018

09.00 Registration (poster set up, coffee available)

10.00 Keynote Speaker – Steve Etches of The Etches Collection, Kimmeridge:
'Stories from Deep Time'

10.30 Chris Duffin, Earth Science Department, Natural History Museum, London:
Charles Moore and Late Triassic vertebrates.

10.50 Matt Williams, Bath Royal Literary and Scientific Institution:
Strawberry Bank: A synopsis of the history, contents, and study of this little known Jurassic fossil site of extraordinary preservation from Somerset, England.

11.10 coffee break and poster viewing

11.40 Tom Cotterell, National Museum Wales:
Francis Basset, 1st Baron de Dunstanville and Basset, and his mineral collection.

12.00 Maurice Tucker, Bath Geological Society and Earth Sciences Department, Bristol University:
The source of stone for Roman Bath.

12.20 Owen Green and Tony Watts, Earth Sciences Department, Oxford University:
The Beacon Hill Silurian Volcano: An ancient analogue of a modern island arc?

12.40 Jan Freedman: Plymouth City Museum & Art Gallery:
Plymouth's lost Pleistocene sites.

13.00 lunch break and poster viewing

14.10 Geoffrey Warrington, School of Geography, Geology & Environment, University of Leicester:
A spore from the Bristol area: the origin of Triassic palynology in Britain.

14.30 Simon Harris, British Geological Survey:
Lost and Found – the rediscovery of the Christian Malford Lagerstätte.

14.50 Roy Starkey, Independent researcher:
"Shall I send them to you now?"– Richard Talling of Lostwithiel, the greatest Cornish mineral dealer of all time.

15.10 Mike Howe, British Geological Survey:

BGS and the Royal Geological Society of Cornwall Collections.

15.30 Coffee break and poster viewing

16.00 Karen Cook, Kansas University, US:

Reflections across the Pond: Cuvier and Brongniart's *Carte géognostique des environs de Paris* (1811) and Conybeare and De la Beche's *Map of 24 miles round the city of Bath coloured geologically* (1823).

16.20 Debbie Hutchinson, Bristol City Museums:

Mr Sanders' Map of Bristol.

16.40 Brian Rosen and Jill Darrell:

Stratigraphic solutions: fossil corals of William Smith and Arthur Vaughan from SW England.

17.00 Close of meeting and final information on fieldtrip options

17.15 end

Poster presentations

David Hill and Natalie Watson, Alfred Gillett Trust:

The Alfred Gillet Fossil Collection of Marine Reptiles from the 19thCentury Quarries of Street, Somerset.

Jan Freedman, Curator of Natural History, Plymouth Museums, Galleries, Archives:

The South West's Greatest Mineral Collectors

Graham P Hickman. Bath Geological Society:

Geology and hydrology of the Limpley Stoke valley and Somerset Coal Canal.

Deborah Hutchinson, Bristol Museum:

J.W. Tutcher (1858-1951) — Geologist and pioneer of scientific photography.

Nina Morgan and Philip Powell

The Geology of Gravestones

Keynote Address: ‘Stories from Deep Time’

Steve Etches

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An opportunity to hear Steve Etches talk about the realisation of his lifetime’s work of collecting fossils from the late Jurassic of Kimmeridge Clay and creating a permanent home for the collection in a purpose built museum in the picturesque village of Kimmeridge in Dorset. Steve will discuss his life before the Museum – how his interest in collecting fossils began and the realisation that the Kimmeridge Clay was very under collected and never recorded in a scientific manner before; how after moving to Kimmeridge from Wimborne in 1993 then led to the idea of the creation of a museum to house the ever expanding collection of fossils and the struggle to seek the support and funding to then bring the dream to fruition. Steve will also talk about some of the stunning specimens in the collection and their scientific importance and the stories behind how they were found, prepared and curated.

THE ETCHES COLLECTION

MUSEUM OF JURASSIC MARINE LIFE

Talk: Charles Moore and Late Triassic vertebrates

Christopher J. Duffin

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Charles Moore (1815-1881), a native of Ilminster (Somerset), cut his palaeontological teeth on the Jurassic strata in and around the town, amassing a large and significant collection from the Middle Lias (Toarcian) of Strawberry Bank. He moved to Bath in 1853, married well, setting up home at 6 Cambridge Place, and was able to indulge his passion for geology in true, leisured Victorian style. He collected widely, but had a particular interest in the Triassic; it was he who recognised deposits of Rhaetian age, formerly referred to as the *Avicula contorta* Beds, at the Triassic/Jurassic junction in Britain by comparing sequences which he had measured and described with those reported from the Alps. Moore was a pioneer of bulk collecting and sediment processing, an approach which he used to good effect when, in 1858, he purchased 3 tons of what transpired to be a Rhaetian fissure fill deposit in Carboniferous Limestone from Holwell in Somerset.

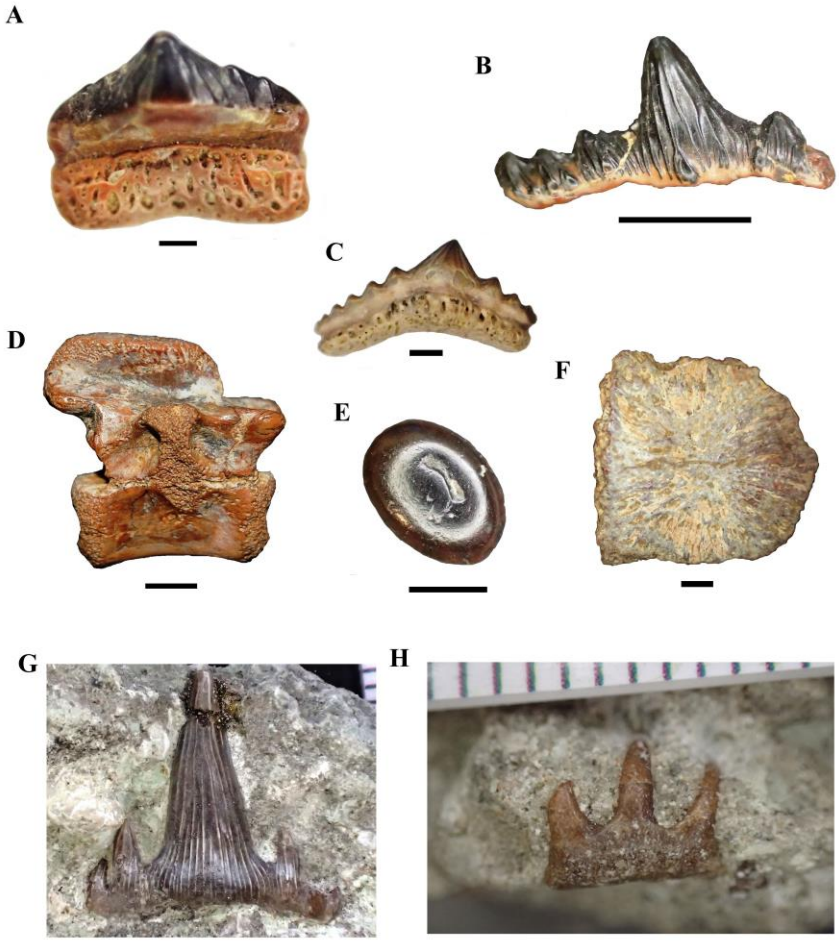

Figure 1. A-F : Shark and aquatic reptile remains from Holwell (Rhaetian, Late Triassic). A) M64,Tooth of *Lissodus minimus* in lingual view; B) M192, Tooth of *Hybodus cloacinus* in labial view; C) M183, Lateral tooth of *Synechodus rhaeticus* in lingual view; D) C28, vertebra of *Pachystropheus*

rhaeticus in lateral view; E) M193, tooth of *Psephoderma alpinum* in occlusal view; F) CD10, Osteoderm of *Psephoderma alpinum* in surface view; G-H : Shark remains from Ruishton (Carnian, Late Triassic) (Moore Collection, Bath Geology Museum). G) M4846, Tooth of *Polyacrodus krafti* in labial view; H) Hybodont cephalic spine. Scale bar = 1mm for figs. A and C, 5mm for figs. B, D, E.

His painstakingly sorted collection of isolated chondrichthyan, osteichthyan, reptile and mammal remains is still providing research material 160 years later. The Holwell vertebrate fauna includes numerous holotypes and is particularly important for its wealth of neoselachian and hybodont shark remains, lepidosaur and placodont reptile material, and mammaliamorph specimens.

In 1867, Moore reported the discovery of fossil vertebrates in arenaceous deposits excavated during the digging of the foundations of a house at Ruishton in Somerset. This low-diversity vertebrate fauna from the North Curry Sandstone Member (Carnian) contains hybodont shark, osteichthyan, amphibian and reptile remains which permit correlation with deposits of similar age from continental Europe, and are significant in marking the Carnian Pluvial Episode.

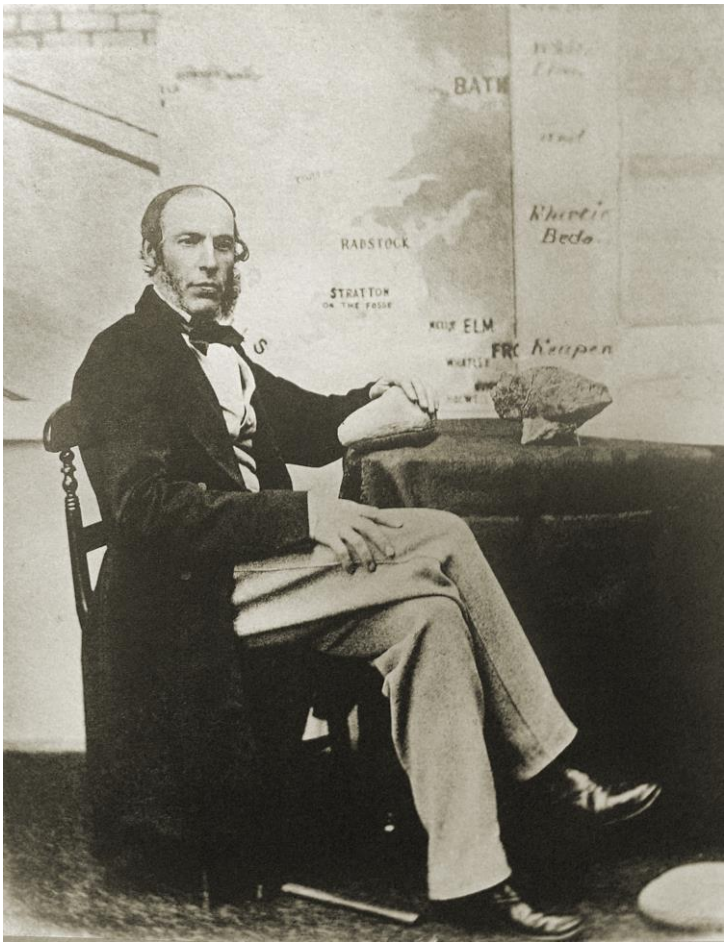

Figure 2. Photographic portrait of Charles Moore.

Talk: Strawberry Bank: A synopsis of the history, contents, and study of this little known Jurassic fossil site of extraordinary preservation from Somerset, England.

Matt Williams

Collections Manager, Bath Royal Literary and Scientific Institution
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In the 1840s the Somerset geologist Charles Moore discovered and excavated a series of remarkable fossils from Lower Jurassic limestone of Strawberry Bank, Ilminster, Somerset. A Toarcian, 183 Ma shallow marine/ coastal fauna was collected with very little compression and many delicate features including soft tissue. Moore's unique collection was noted as important by his contemporaries, but little studied until the 21st century. The precise collecting locality was forgotten and the collection was neglected during the 20th century. Over the last 12 years Matt Williams, Collections Manager at BRLSI, has worked with the Palaeobiology Research Centre at University of Bristol (led by Professor Mike Benton) to facilitate and conduct new study into these fossils. This lecture will give insight into the fossils, their study, and what further information they may yet yield about this important fossil ecosystem.

Talk: Francis Basset, 1st Baron de Dunstanville and Basset, and his mineral collection

Tom F. Cotterell

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Francis Basset (1757-1835), English nobleman and politician, is little recorded in mineralogical publications, but there is mounting evidence to show that, like his contemporaries in Cornwall, he possessed a fine mineral collection.

This is, perhaps, unsurprising when one considers that his Tehidy estate in Cornwall incorporated one of the most extensively mined parts of Britain and was bounded to the east by the estate of the famous mineral collecting Williams family at Scorrier House. To the south of Tehidy, Basset's cousin, Sir John St Aubyn, 5th Baronet (1758-1839), with whom he served as Member of Parliament for the pocket borough of Penryn and who was himself an obsessive mineral collector, lived at Clowance House. St. Aubyn spent thousands of pounds acquiring several large collections including those of William Babington and Richard Greene and Basset must surely have been influenced by this.

Prior knowledge of Francis Basset's mineralogical interests appear to be restricted to notes produced by Sir Arthur Russell in his 1952 paper on *Philip Rashleigh of Menabilly, Cornwall, and his mineral collection* cited in Wendell Wilson's *The History of Mineral Collecting 1530-1799* (1994. p. 159) in which the link to another famous Cornish mineral collector - Philip Rashleigh - was established. Francis Basset was described as the Cornish "Mineral Lord" more in reference to his mining exploits than mineral collecting.

Recent investigations have shown that Basset, under the guise of Lord de Dunstanville (a title bestowed upon him in 1796), donated a good many fine mineral specimens to the Bath Royal Literary and Scientific Institution (BRLSI). These include numerous specimens of classic Cornish minerals such as liroconite, pharmacosiderite and olivenite undoubtedly derived from the mines near St. Day owned by the Williams family.

How Basset came to acquire these specimens is not yet known, but they were most likely exchanged or given by John Williams (1753-1841), agent for the North Downs and Gwennap mines and the first member of the illustrious Williams family of mineral collectors known to have assembled a collection (see for example Smale, C.V. (2011). The Williams Mineral Collection at Caerhays Castle, Cornwall. *The Mineralogical Record.* ***42****, 211-226*). Williams had Scorrier House built in 1778 slightly to the east of Redruth and, by coincidence, just a mile northwest of what would a short time later become one of the most important mineral deposits ever discovered – Wheal Gorland. Williams' collection rapidly drew attention and by 1800 had been visited by the French Princes later crowned Louis XVIII and Charles X.

Basset, who was one of the biggest owners of land in Cornwall, possessed the famous Dolcoath Mine in Camborne which was, according to Morrison (*Cornwall's Central Mines.*

The Southern District 1810-1895, 1983), reopened in 1799 through capital provided by among others “Lord de Dunstanville of Tehidy House, the Williams family of Scorrier House and the Fox family of Falmouth”. Basset almost certainly had an interest in other mines and this association with well-known mineral collecting families would have opened up collecting opportunities for him.

In family life, Francis, who was the first son of Francis Basset and Margaret St Aubyn married Frances Susanna Coxe, daughter of John Hippisley Coxe and Mary Northleigh of Ston Easton Park, Somerset in 1780. Their only child, a daughter named Frances Bassett, died unmarried in 1855. Much research still needs to be done to determine the association with Bath but it is, perhaps, the association with the Hippisley Coxe family that is the key.

A selection of copper- and iron-arsenate, and copper oxide mineral specimens from Cornwall donated to BRLSI by Sir Francis Basset, Lord De Dunstanville, in 1826.

Talk: Source of stone for Roman Bath

Maurice Tucker

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Construction of the Roman city of Bath, Aquae Sulis, began 60-70 AD, with its famous thermal baths probably built some decades later. The majority of the city was constructed of Middle Jurassic limestone (informally referred to as Bath stone and Great Oolite) but the exact source(s) of the stone and stratigraphic horizon(s) have not been addressed before. In a project with the Roman Baths and archaeologists from the University of Bournemouth, outcrops of stone around Bath have been studied for their sedimentological features and geochemical signatures using pXRF, and comparisons made with the stone within the Roman baths complex. Much of the stone used in construction is oolitic-bioclastic grainstone, with cross-bedding, rare bioturbation, and relatively common fractures filled with calcite cement. This stone is most comparable with the Combe Down Oolite, rather than the younger Bath Oolite, which is dominantly oolitic and massive. pXRF analyses show that there are some differences between the oolites in terms of Si, Al, Fe and Mn and also for each oolite across the region when comparing samples from different quarries. In some old quarries, Lewis bolt holes have been found cut in the stone, which are identical to those on Roman blocks within the baths complex, as well as circular holes 44 mm in diameter considered to be typical of Roman chisels. However, analyses of Roman stone from the baths complex reveal huge amounts of S, Pb, Fe, Si, Al, P, As etc compared to the samples from quarries, raising issues of contamination and why. The quantity of stone required for Aquae Sulis would have been enormous, so that it is very likely many quarries provided the stone. This talk will discuss the likely sources and supply routes of stone to the Roman city.

Stone at the Roman Baths, Bath: a) the base of a Roman column with a bolt-hole cut into the top; b) a block of Roman stone with cross-bedding and burrows.

Talk: The Beacon Hill Silurian Volcano: An Ancient Analogue of a Modern Island Arc?

Tony Watts & Owen Green

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Beacon Hill in the eastern Mendip Hills, Somerset is an eroded pericline formed during the Variscan orogeny. The core rocks were first described by Charles Moore (1815-1881) in 1867 who noted a 'basaltic dyke of considerable thickness emerging from the Old Red Sandstone at East End near Stoke Lane'. Morris (1868) stated that the 'dyke' appears as 'bosses in the field' and is a dolerite and appears 'conglomeratic in places'. Moore, who was praised by Morris for his 'intimate knowledge of Somerset geology', was an avid rock collector and, interestingly, his collection now forms the 'Geological Museum' of the Bath Royal Literary and Scientific Institution.

Subsequent to these early visits, the 'dyke' became the focus of an intensive quarrying operation at Moon's Hill, east of the Stoke Lane to Waterlip road and at Sunny Hill, west of the road that continues apace today. Reynolds (1907) and Hancock (1982) later visited the quarries as well as locally excavated trenches (e.g. in Beacon Hill plantation) noting that the pericline core was, in fact, a volcanic complex which comprised andesitic lavas, tuffs, 'agglomerates' and intercalated volcanoclastic sediments. The sediments included brachiopod fragments of Silurian (Wenlock/Llandovery) age, suggesting the complex was active ~435 Ma and was older and not younger than the Devonian, as Moore and Morris had opined.

Paleogeographic reconstructions suggest the Beacon Hill Silurian Volcano was part of a ~2500 km long NE-SW trending island arc - deep-sea trench system at ~25^{o} South that marked the boundary between the subducting Rheic oceanic plate and the overthrusting Laurentia and/or Avalonia plates. Although evidence of subaerial activity has been described (Green 2008) we conclude that the 'agglomerates' are a debris flow deposit formed following one or more large-scale slope failures of a volcano flank. Brachiopods found in the deposit once inhabited the warm shallow seas that flanked the volcano before being entrained in the flow and transported downslope. The tectonic setting of Beacon Hill is therefore similar, we believe, to modern submarine arc volcanoes, such as Montserrat in the Lesser Antilles (~16^{o} North) and Monowai in the Tonga-Kermadec (~26^{o} South) arcs.

References cited:

Green, G. W. 2008. Volcanic stratigraphical architecture of the East Mendip Silurian Inlier, Somerset, UK. *Proc. Geol. Assoc.* **119**, 339-350.

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Moore, C. 1867. On abnormal conditions of secondary deposits when connected with the Somersetshire and South Wales coal-basins. *Quart. J. Geol. Soc, London*. **23**, 449-568.

Morris, J. 1868. Reports and Proceedings: Geological excursion to Bath and its neighbourhood. *Geol. Mag*. **5**, 233-236.

Reynolds, S. H. 1907. A Silurian Inlier in the Eastern Mendips. *Quart. J. Geol. Soc, London*. **63**, 217-240.

Talk: Plymouth's lost Pleistocene sites.

Jan Freedman

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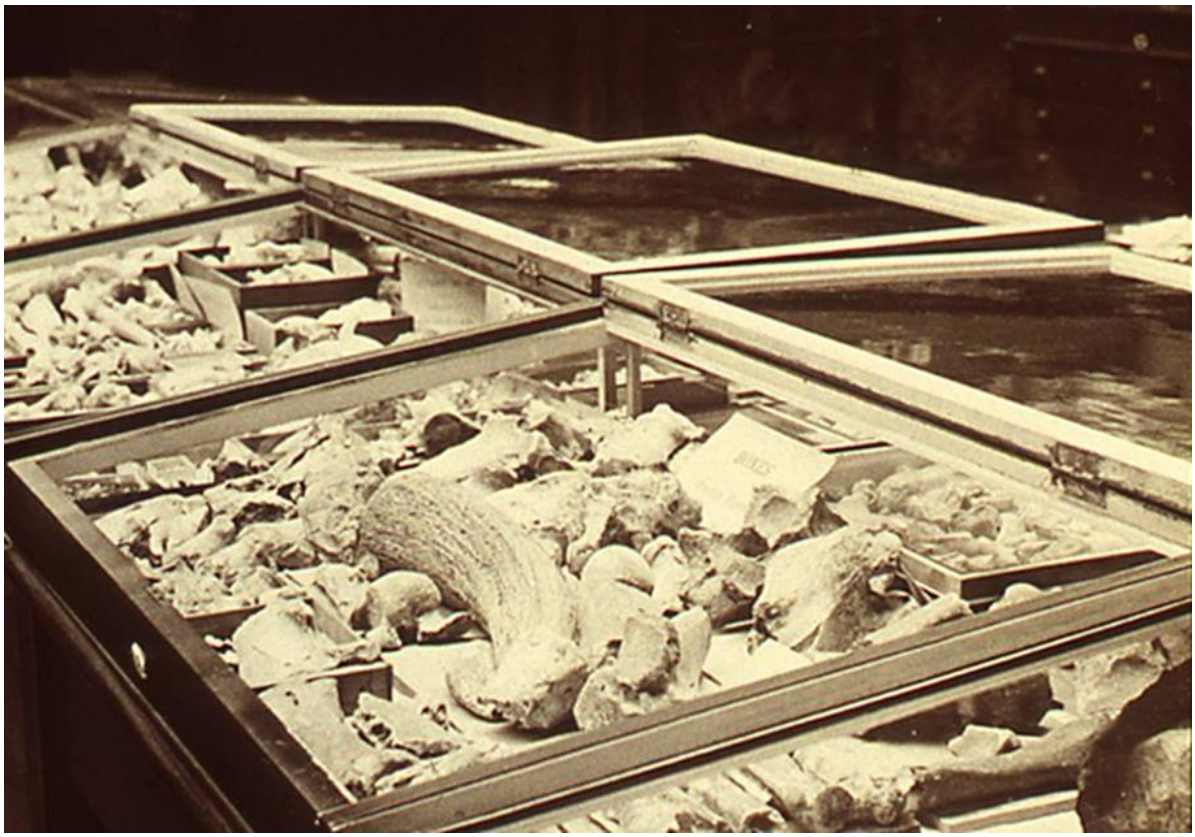
The Pleistocene of Britain is well known thanks to sites like Kent's Cavern, Devon, and Creswell Crags, Yorkshire. Recent research into Late Pleistocene extinctions are helping us understand this recent past and how animals and plants have responded to dramatic changes in climate. These are used as models to help us understand how we can protect species from our impact on the planet today.

Despite several cave sites being discovered in Plymouth, it has largely been forgotten about in the scientific literature. This talk will outline the main discoveries in Plymouth, examining the history of these excavations, the characters involved, the fauna that has been recorded, and where the collections are held today. The Devonian Plymouth Limestone houses many caves across the city, including Oreston (the first site to be scientifically described in Britain) and Cattedown Caves (almost destroyed during the Second World War). I will outline the significance of these collections relating to other sites in Britain, and how we are just beginning to work on them to highlight their importance in understanding our recent past.



Talk: A spore from the Bristol area: the origin of Triassic palynology in Britain.

Geoffrey Warrington DSc., CGeol., FGS (Snr)

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Palynology, the study of plant microfossils, has been used for dating and correlating British Triassic deposits for around 60 years. Such microfossils were first recorded in 1901, with a brief description and photographs of a spore associated with the plant *Naiadita* in specimens from Rhaetian (Late Triassic) deposits in the Bristol region, held in the Oxford University Museum of Natural History (Sollas, 1901. *Quart. J. Geol. Soc. London* **57**, 307-312).

Remains of *Naiadita*, a bryophyte, have been reported mainly from a thin bed in the Cotham Member of the upper (Lilstock) formation of the Penarth Group in and around Bristol, but are also known from scattered sites in Gloucestershire, Warwickshire and Worcestershire, and boreholes in Dorset and Oxfordshire. More detailed descriptions of the spore and the delicate remains of its parent plant, the habitat of which was interpreted as aquatic, in shallow bodies of fresh to brackish water, were given by Harris (1938. *The British Rhaetic Flora*. British Museum (Natural History)). The spore has greater geographical and stratigraphical ranges than the remains of *Naiadita*, and has been reported from Austria, Poland, Switzerland, the Middle East and N Africa, and from deposits ranging from Early to Late Triassic, but principally Carnian to Rhaetian (Late Triassic), in age. Originally referred to as 'spores of *Naiadita'*, it was formally named *Conbaculatisporites longdonensis* by Clarke (1965. *Palaeontology*, **8**, 294-321), based on material from the late Carnian Arden Sandstone Formation (Mercia Mudstone Group) at Longdon, Worcestershire. Following transfer to a new genus (*Porcellispora*) by Scheuring (1970. *Schweiz. Paläont. Abh.*, **88**, 1-119) it is now known as *Porcellispora longdonensis.* Specimens from the Cotham 'Beds' were named *Naiaditaspora harrisii* by Orbell (1973. *Bull. Geol. Surv. Gt Br.*, **44**, 1-44); this is a junior synonym of *P. longdonensis*.

Talk: Lost and Found – the rediscovery of the Christian Malford Lagerstätte

Simon Harris and Philip Wilby

Simon Harris, Collections Conservation and Digitisation Manager, British Geological Survey, Nottingham. E-mail simhar@bgs.ac.uk
Philip R. Wilby, Palaeontology Team Leader, British Geological Survey, Nottingham

In 1841, workers constructing Brunel's Great Western Railway Line from London to Bristol near the small Wiltshire village of Christian Malford stumbled upon a series of clays containing exceptionally preserved Jurassic fossils including "squid" and fish with clearly visible soft tissues. Local collectors excavated these fossils and brought them to the attention of the leading minds of the day, including Gideon A. Mantell and Richard Owen. It is possible that the exact location of the site was kept a secret, and it was soon lost in the mists of time, leaving the specimens preserved in museums around the country as the only reminder of the excavations. Unfortunately, nearly 100 years later, many of these fossils were lost in bombing raids on London and Bristol, and many of those that remain have been "improved", making them less than ideal for modern scientific study.

More recently, in 2006, Phil Wilby, a palaeontologist working for the British Geological Survey undertook to relocate the original fossil bearing beds using snippets of information gleaned from extant museum collections and the mapping expertise of the Survey. This talk chronicles the rediscovery of the site, and contrasts old and new collecting attitudes. We also provide an overview of the specimens preserved in museum collections across the UK.

Ammonites from the Oxford Clay at Christian Malford, Wiltshire

Talk: “Shall I send them to you now?” – Richard Talling of Lostwithiel, the greatest Cornish mineral dealer of all time

Roy Starkey

The Russell Society, Email: roy.starkey@gmail.com

Richard Talling was born on 18 June 1820, the fifth of 12 children of John Williams Talling and Margaret Talling of Lostwithiel, Cornwall. Listed as an apprentice shoemaker in the 1841 census, he was already developing an interest in minerals into a profession more to his liking. The earliest confirmed record of Talling’s interest in minerals is probably the donation by “R. Talling” of specimens of garnet, axinite and pyrite to the Royal Institution of Cornwall Museum in the year 1840–1841 when he would have been 21 years old, although by his own admission, by 1863 he had been “*…in the Mineral trade, more or less, for 26 years…”* (i.e. since 1837, when he was just 17).

Operating from his base in Lostwithiel, Talling was exceptionally well-placed, with many of Cornwall’s most famous mines quite close to his doorstep. Herodsfoot mine is but 7 miles from Lostwithiel and it is therefore not surprising, given Talling’s obvious tenacity and undoubted expertise in rooting out fine specimens, that it was he who cornered the market for the fabulous material mined in the mid-to-late 1800s. The specimens of bournonite and tetrahedrite, in particular, hold a special place in the history of mineralogy.

He lived through the period when the mines of Cornwall and Devon were at their maximum activity, and was in consequence able to obtain a very large proportion of the finest specimens ever produced in the two counties. He was also directly responsible for the discovery of the following new species: churchite, langite, botallackite, tavistockite, liskeardite, andrewsite, ludlamite.

Talling counted the British Museum, Henry Ludlam and John Ruskin amongst his clients and was a consummate commercial operator. Surviving correspondence provides a fascinating insight to his character and dealings, but his lasting legacy will be the thousands of fine specimens which he placed in collections. He died tragically, by his own hand on 19 December 1883 at his home, a frustrated and disappointed man who had so much more to give.

Talk: BGS and the Royal Geological Society of Cornwall Collections

Mike P.A. Howe

Chief Curator & Head, National Geological Repository, British Geological Survey
Email: mhowe@bgs.ac.uk

The Royal Geological Society of Cornwall was founded in 1814, and is the second oldest geological society in the world, after the Geological Society of London. Like most similar societies of the time, it built up collections of rocks, minerals and fossils, held first in a house in North Parade, Penzance. Then, in 1867, a new museum was built and opened nearby in St John's Hall, and this remained an important visitor attraction in Cornwall for over 130 years. Highlights of the collections included:

- Charles W. Peach collection of ca. 2200 Devon and Cornwall fossils
- Local, national and international mineral collection, including display quality specimens
- Important petrological material, including specimens collected by Humphrey Davey, Howard Fox, J. Forbes, W.A.E. Ussher, W.M. Tweedy, John Prideaux, J. Carne, J.H. Vivian, Sir Charles Lemon and Jabez Druitt.

Fluorite. Specimen RGSC M991, Black Dean, Weardale, Co Durham

In 1995, the Society received a Heritage Lottery Fund (HLF) grant of £132.6k to repair the building and improve the displays, but during the process, some of the specimens and metadata became separated. Then, in 1999, Penwith Council cancelled its annual £8000 grant, and in due course the Museum was forced to close. The building continued to deteriorate, and by 2003, the safety of the collections was under threat. The Society committee explored various options to protect the collections, and BGS was one of several organisations invited to submit proposals. In October 2004 BGS surveyed the collections and revised their offer, and in 2005, the RGSC committee invited BGS to take possession of the collections and transfer them to Keyworth.

The transfer was carried out during November 2005. Approximately 4000 kg of specimens were carefully packed and recorded, and transferred by lorry to Keyworth, with some

mineral specimens going on loan to Camborne School of Mines, and other non-localised specimens going to a local mine visitor centre. Since the transfer, BGS staff and volunteers have been cleaning, conserving and databasing the RGSC Collections.

Much of the fossil collection can now be searched through the BGS PalaeoSaurus database: http://www.bgs.ac.uk/palaeosaurus/ and the minerals through the BGS Britrocks Database: http://www.bgs.ac.uk/data/britrocks/britrocks.cfc?method=searchBritrocks.

There is also a special display of downloadable mineral images on the BGS Geoscenic image database:
http://geoscenic.bgs.ac.uk/asset-bank/action/browseItems?categoryId=1544&categoryTypeId=1.
The collection is very much open for study and research.

Talk: Reflections across the Pond? Cuvier and Brongniart's *Carte géognostique des environs de Paris* (1811) and Conybeare and De la Beche's *Map of 24 miles round the city of Bath coloured geologically* (1823)

Karen Cook

Kenneth Spencer Research Library, University of Kansas Email: kscook@ku.edu

During the early nineteenth century English and French geologists exchanged correspondence and publications, also visiting back and forth when their countries were not at war. Their mutual scientific interests were stimulated partly by the fact that the geological formations on one side of the English Channel (often called the "Pond") largely mirror those on the other side. Thus, the cities of Paris in France and Bath in England are situated in similar geology on opposite sides of the Anglo Paris Basin. Georges Cuvier and Alexandre Brongniart first reported on the results of four years of fieldwork studying and mapping the geology of the Paris region in the *Annales du Muséum d'histoire naturelle* in 1808. Their map first appeared in their *Essai sur la géographie minéralogique des environs de Paris* in 1811. It was followed by a second edition of the map and the much expanded memoir in 1822. William Daniel Conybeare and Henry Thomas De la Beche were the first to publish a geological map of Bath, although not until 1823.

A glance at the two maps reveals similar flat area colours and coarse patterns used to symbolise the geology, but is the resemblance more than superficial? This paper compares the base maps, geological classification and names, symbol design, and methods of reproduction of the two maps. While Cuvier and Brongniart's base map was specially compiled and engraved, Conybeare and De la Beche added geological information to C. Harcourt Masters' existing published map of Bath and environs. Differences in the geological classification and nomenclature reflect some geological advances made during the dozen years between the publication of the two maps. The geological area colours and patterns employed on the map of Bath closely resemble the British Library copy of Cuvier and Brongniart's map. However, the addition of geological information to C. Harcourt Masters' map of Bath was achieved by engraving geological boundary lines and area patterns on a second copper plate that was then over-printed in red on the base map. These differences lead to the conclusion that the two maps are, at most, fraternal rather than identical cartographic twins.

Talk: Mr Sanders' Map of Bristol

Deborah Hutchinson

Geology Curator, Bristol Museum & Art Gallery, Email: Debbie.hutchinson@bristol.gov.uk

William Sanders (1799-1875) was the fourth curator of the Bristol Institution (from 1857-1872), steering the Institution through financially challenging times. His major contribution to Bristol geology was as a pioneer in large-scale geological mapping, surveying the area around Bristol.

Sanders' 'Map of the Bristol Coalfield' and district was made on a scale of four inches to the mile and was started with the encouragement of H.T. De la Beche. In the 1894 'Guide to the Bristol Museum' Geology Curator Edward Wilson (1848-1898) describes how the maps were mounted on the wall for display in the museum's second purpose built building.

The maps covered an area of 720 square miles, and were constructed from Sanders' own surveys and a topographical map made by collating approximately one hundred parish maps on different scales – a huge task which he undertook from c.1835 to 1862 and were published in 1864. Bristol Museum & Art Gallery has copies of his maps as well as donated geological material.

'No single amateur has ever produced such a work on his own resources'
E.B. Tawney

Sanders was Elected a Fellow of the Geological Society of London in 1839, elected a Fellow of the Royal Society in 1864 also a founder member of the Bristol Naturalists' in 1862 and their President until his death in 1875.

Talk: Stratigraphic solutions: fossil corals of William Smith and Arthur Vaughan from SW England

Brian Roy Rosen & Jill Darrell

Department of Earth Sciences, Natural History Museum
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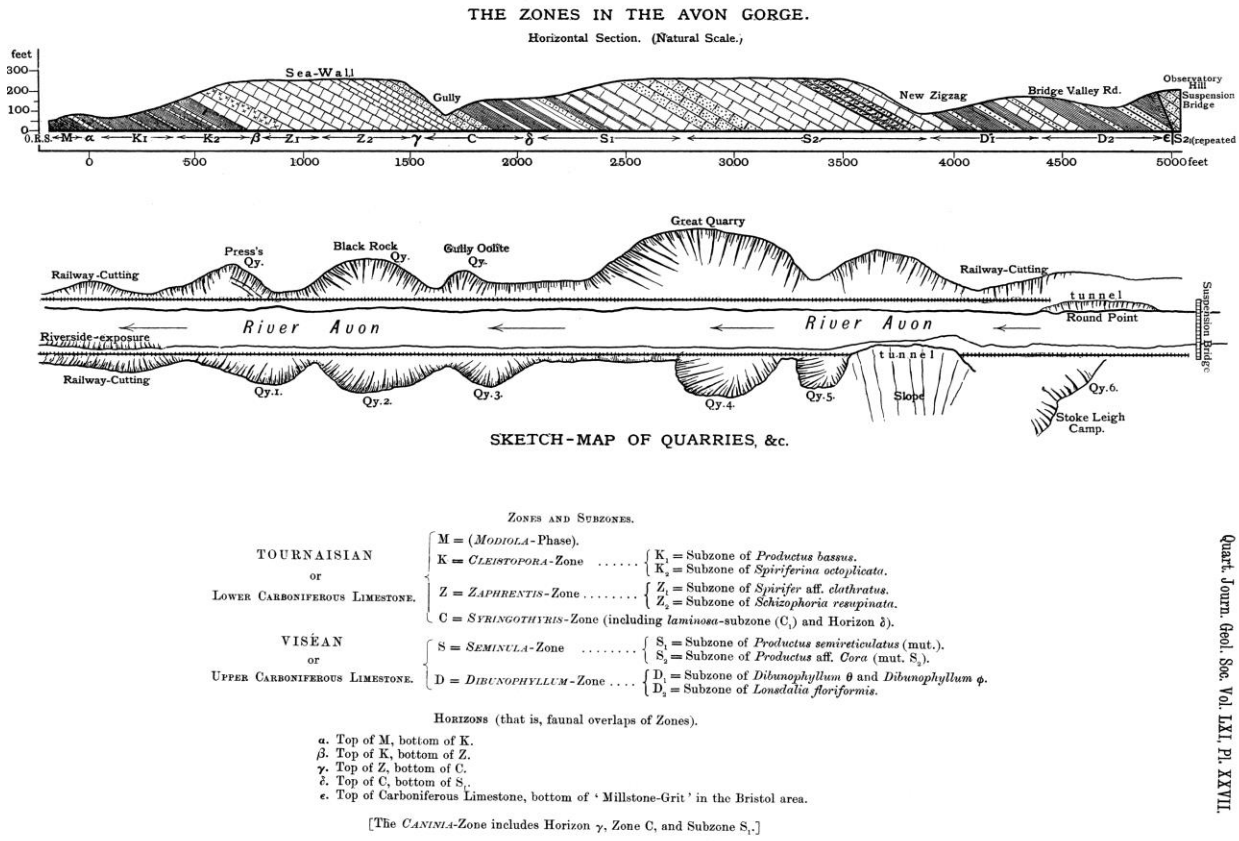
The NHM, London, holds numerous fossil collections relating to the geology of South West England. We concentrate here mostly on corals from the Carboniferous with some reference to Silurian and Jurassic. Probably of greatest historical interest in this respect are the collections of William Smith (1769-1839) and Arthur Vaughan (1868-1915).

Smith's work needs no introduction here. However, we highlight a problem already noted by others that he seems to have been confused about how to classify the pre-Jurassic limestones (all similarly coloured blue) on his various maps and geological columns. Although some have regarded these as outright errors on Smith's part, his maps and columns were a work in progress, so there were problems he had not yet elucidated and which remained unresolved when he died. Consistent with this, there are no plates of key fossils in his *Strata Identified by Organised Fossils* (1816-19) older than the Great Oolite. Aside from time and money, there was inadequate taxonomic knowledge about Palaeozoic corals (and perhaps other groups) at that time. Notably however, he left unpublished notes for various plates intended for three further, stratigraphically older, parts of his *Strata Identified*. As part of a larger project whose aim is to use Smith's specimens to publish photographic equivalents of his plates in *Strata Identified*, we have been identifying or revising his corals in the NHM. Smith's unpublished notes actually include some basic sketches of fossils which we nevertheless can match to particular specimens from SW England. By using his own notes, specimens, localities and principles, we propose a solution to his problem with the older limestones, and we present our results in this talk.

Drawing on, but developing further, the principles established by Smith nearly a century before, and even using some of the same fossil taxa, one of Vaughan's most important contributions to geology was his detailed pioneering classification of the Lower Carboniferous of the Bristol area, using (mostly) corals and brachiopods - a first step towards a classification for the Britain Isles. Even today, Vaughan's zonal corals still contribute to the recognition of the modern stages of the Lower Carboniferous (Mississippian) in Britain.

Fig. 1. One of William Smith's rugose coral specimens (NHM R1067) from his "Redland Limestone" at "Hotwells, Avon Section, Bristol", identified here as *Actinocyathus* [formerly *Lonsdaleia] floriformis* (Martin), indicating a Lower Carboniferous (Viséan) age of Brigantian. Note the characteristic strong haematitic staining.



ZONES AND SUBZONES.

TOURNAISIAN or LOWER CARBONIFEROUS LIMESTONE.

- M = (*Modiola*-Phase).
- K = *Cleistopora*-Zone ..... { K_1 = Subzone of *Productus bassus*. / K_2 = Subzone of *Spiriferina octoplicata*.
- Z = *Zaphrentis*-Zone ..... { Z_1 = Subzone of *Spirifer* aff. *clathratus*. / Z_2 = Subzone of *Schizophoria resupinata*.
- C = *Syringothyris*-Zone (including *laminosa*-subzone (C_1) and Horizon δ).

VISÉAN or UPPER CARBONIFEROUS LIMESTONE.

- S = *Seminula*-Zone ..... { S_1 = Subzone of *Productus semireticulatus* (mut.). / S_2 = Subzone of *Productus* aff. *Cora* (mut. S_2).
- D = *Dibunophyllum*-Zone .... { D_1 = Subzone of *Dibunophyllum* θ and *Dibunophyllum* φ. / D_2 = Subzone of *Lonsdalia floriformis*.

HORIZONS (that is, faunal overlaps of Zones).

α. Top of M, bottom of K.
β. Top of K, bottom of Z.
γ. Top of Z, bottom of C.
δ. Top of C, bottom of S_1.
ε. Top of Carboniferous Limestone, bottom of 'Millstone-Grit' in the Bristol area.

[The *Caninia*-Zone includes Horizon γ, Zone C, and Subzone S_1.]

Quart. Journ. Geol. Soc. Vol. LXI, Pl. XXVIII.

Fig. 2. Part of Plate 22 of Vaughan (1905) showing his famous stratigraphic scheme for the Avon Gorge, Bristol. Note that his upper division of his "*Dibunophyllum*-Zone" is "D_2 - Subzone of *Londsalia floriformis* [sic]". Smith's specimen in Fig.1 is an example of this coral. D_2 is equivalent to Brigantian.

POSTER: The Alfred Gillet Fossil Collection of Marine Reptiles from the 19th Century Quarries of Street, Somerset

David Hill and Natalie Watson

Between 1887 and 1948 these specimens, predominantly early Jurassic ichthyosaurs, were displayed in the Geological Museum in the Somerset village of Street. The Museum was housed in Crispin Hall, a civic building provided by the Clark family who ran the successful local shoe manufacturing business, the world-famous Clarks.

As well as the 18 largely complete ichthyosaurs and a partial plesiosaur there are fragmentary specimens, including a plesiosaur skull. Most were collected by Alfred Gillett (1814-1904), an ironmonger from Yeovil and a member of the Clarks family. He retired to Street in the 1860s and pursued his passion for collecting fossils. His main source was the Blue Lias limestone quarries around Street, nearly all of which were back-filled and built upon during the villages 20th century expansion. These quarries were also a source of specimens for another famous local collector, the Reverend Thomas Hawkins. A few smaller specimens in the collection were donated by Clarks family members and friends, including Dr H. Woodward, Director of the British Museum of Natural History, who officially opened the Geological Museum in 1887.

Fossil of ichthyosaur skeleton, *Ichthyosaurus communis*, found in Street, Somerset

After the closure of the Geological Museum in 1948 the specimens were left on display for a time before being placed into deep storage. Over the decades several curatorial reviews and a conservation programme were undertaken. However, apart from a temporary exhibition

at a local hotel in 1978 and a few private viewings, the collection remained largely unseen by the public. Scientific interest in the collections has recently included a review of the status of some specimens, and the identification of new species, notably by Massare and Lomax.

In 2016 the collection was gifted to the Alfred Gillett Trust, which has increased public awareness by running two pop-up exhibitions and arranging tours for groups and schools. Currently two volunteers are working on the specimens to undertake basic cleaning, following the advice of a professional conservator, and repacking the smaller specimens in museum standard materials and boxes purchased from donations made during the exhibitions. The Trust is currently developing plans which will involve greater public access to this historical and scientifically important collection.

Contacts

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Natalie Watson, Director, Alfred Gillett Trust, natalie.watson@agtrust.org.uk

Alfred Gillett Trust

Phone: 01458 444060,
Email: enquiries@agtrust.org.uk
Postal Address: The Grange, Farm Road, Street, Somerset, BA16 0BQ

Further information

https://alfredgilletttrust.org/collections/geological-collection/

POSTER: The South West's Greatest Mineral Collectors

Jan Freedman

Curator of Natural History, Plymouth Museums, Galleries, Archives
Email: jan.freedman@plymouth.gov.uk

Plymouth Museums, Galleries, Archives (PMGA) are home to over 11,000 mineral specimens. The majority of the collections are from old mining sites across Devon and Cornwall and highlight the rich geological history of this area. Four historic and contemporary collectors are held at PMGA, providing a history of collecting as far back as 1790 up to the 1980s.

Sir John St Aubyn was a prolific mineral collector and contributed a lot to early mineralogy. St Aubyn worked closely with scientists in London to help create a system of defining minerals. Sir William Serjeant collected thousands of specimens as a reference to the different ores found in the South West. The chemist Rene Gallant worked on the detailed chemistry of mineral specimens which helped with his work on meteorite impacts on Earth. More recently, the mineral dealer and collector, Richard Barstow's specimens hold the most spectacular examples of minerals across the South West.

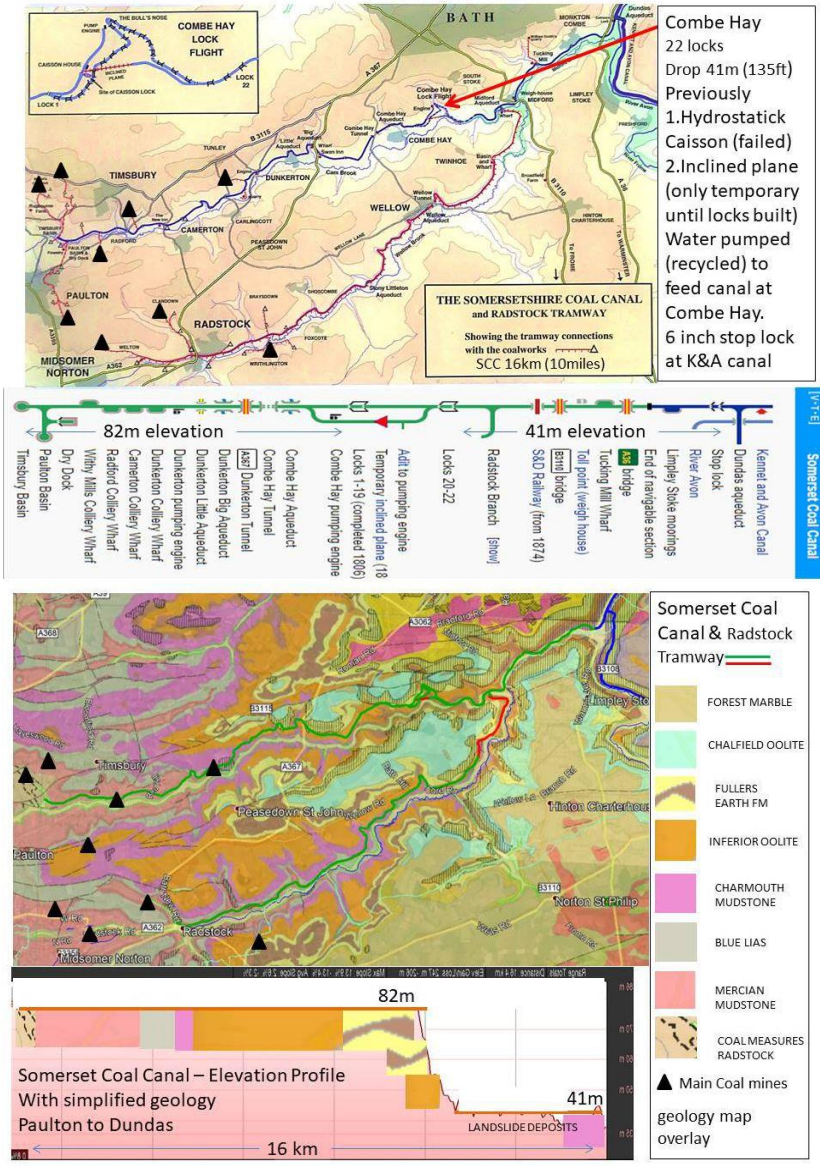
This poster will look at each of these collectors and highlight their collections, looking at the motives behind collecting, and how these collections are still relevant to scientists and the public today.

POSTER: Geology and hydrology of the Limpley Stoke valley and Somerset Coal Canal

Graham P Hickman

Bath Geological Society. Email: hickmagp@hal-pc.org

This poster, using modern geological maps and hydrology data, examines the area to the south of Bath where William Smith worked as a Surveyor on the Somerset Coal canal. The geology of the steep sided valleys is often complicated by Quaternary age landslips and cambering of competent limestones over the softer mudstones. This poster asks the question, "could Smith have made the observation he did without the exposures generated by the canal workings?"



POSTER: J.W. Tutcher (1858-1951) — Geologist and pioneer of scientific photography

Deborah Hutchinson

Geology Curator, Bristol Museum & Art Gallery, Debbie.hutchinson@bristol.gov.uk

A bootmaker by trade, Tutcher was that type of outstanding amateur geologist who devoted his limited spare time to the subject and still made a significant contribution. He was friends with Edward Wilson (1848-1898), a former Curator of Geology at Bristol Museum, which perhaps inspired him to take an interest in collecting and soon became an expert in the Jurassic fossils of the Bristol area. Alongside his palaeontological interests, Tutcher had an encyclopaedic knowledge of the stratigraphy of the region too.

Over his long life he amassed a huge collection of fossils, around 20,000 of which are now cared for at Bristol Museum & Art Gallery — all meticulously recorded with detailed data and therefore a valuable resource for modern research.

Tutcher must also be acknowledged as a pioneer of scientific photography and one of the earliest people to apply it to palaeontology. He worked closely with S.S. Buckman to produce many of the photographic plates used to illustrate *Yorkshire Type Ammonites* and produced plates for many other important geologists such as Vaughan and Arkell. A significant collection of his original glass plate negatives are cared for by Bristol Museum & Art Gallery.

Tutcher received the Lyell Fund from Geological Society of London in 1924 to mark his contribution to geology and he received an honorary M.Sc. from Bristol University in 1927. He was a member of the Bristol Naturalists' from 1901 and their President in 1931.

A modest and kind man, who pursued his interest in geology despite disability and whose important geological legacy merits attention.

POSTER: The Geology of Gravestones

Nina Morgan and Philip Powell

Oxford University Museum of Natural History
nina.morgan@cooptel.net
philip.powell@oum.ox.ac.uk

For geologists – whether amateur, student of professional – almost any urban cemetery provides a valuable opportunity to carry out scientific field work at leisure, right on the doorstep and at no cost. Because gravestones are made from a wide variety of rock types formed in a range of geological settings, cemeteries can be geological treasure-troves. A visit to a cemetery offers a wonderful introduction to geology and the other sciences, such as chemistry, physics and engineering that underpin it.

A stroll through a cemetery can reveal geological features such as minerals and crystals, fossils, sedimentary structures and flow structures in magmas that are not easy to see elsewhere. Gravestones are also useful for monitoring weathering in stone.

Although this poster is based on examples from geological trails in six cemeteries in Oxford which are documented in a new book, *The Geology of Oxford Gravestones,* the rock types and geological features illustrated can also be recognised in many other parts of Britain. We hope that this poster will encourage you to explore the geology on show in cemeteries in other areas. You'll never look at cemeteries in the same way again.

A sample of the wide variety of rock types found in Headington Municipal Cemetery, Oxford

Field trip to Haycombe Cemetery,Bath
Led by Nina Morgan

The wide range of rock types used for gravestones means that cemeteries can be geological treasure troves. For geologists – whether amateur, student or professional – almost every urban cemetery provides a valuable opportunity to learn to identify rock types, minerals and sedimentary structures as well as to carry out scientific field work at leisure, right on the doorstep, and at no cost. Other than a hand lens, no special equipment is needed.

On this field trip we will visit an area of graves that encompasses a wide range of interesting rock types and geological features. Along the way we'll highlight some of the social and historical features associated with this cemetery, including a number of war graves. We hope this trip will demonstrate how cemeteries can provide an introduction to geology that anyone can enjoy – and encourage you to get out and explore a cemetery near you!

Haycombe Cemetery opened in 1937 and is still open for burials. To find out more about its history see: https://www.batharchives.co.uk/cemeteries/haycombe-cemetery-bath

When and where:
The walk is planned to start at 10:30, but if we know you plan to arrive on the 10:01 bus from the city centre (see bus information below), we will wait for you.
Gather near the office building at the cemetery entrance (where toilets and water are available), and we will set off from there. We will return to the office building in good time to catch the 12:48 bus back to the centre of Bath

How to get there:
Haycombe Cemetery is located at 209 Whiteway Road, Bath BA2 2 RQ

You can travel to the cemetery by Bus 12 which leaves from the bus station in Dorchester Street in the centre of Bath. Take either the 9:43 bus which arrives at 10:01; or the 10:01 bus which arrives at 10:43. Buses to return to Bath leave at 12:48, 13:48 and 14:08. To download the full bus timetable see:
https://www.firstgroup.com/bristol-bath-and-west/plan-journey/timetables/?operator=3&service=12&page=1&redirect=no

For location information and directions on how to arrive by car see:
http://www.bathnes.gov.uk/services/births-marriages-and-deaths/burials-and-cremations/cemeteries/haycombe-cemetery#directions . [Ignore the bus information given there which is now out of date!]

What to bring and what to wear:
We will be walking around 2 miles, on both paved pathways and on rough ground, so be sure to wear comfortable walking shoes, and appropriate outdoor clothes for whatever the weather looks like on the day. No rock hammers allowed!! But please bring a hand lens if you have one (we have some to lend). You may also like to bring a camera.

Field trip to BROWN'S FOLLY, BATHFORD, BATH
led by Maurice Tucker, University of Bristol

JOINING INSTRUCTIONS

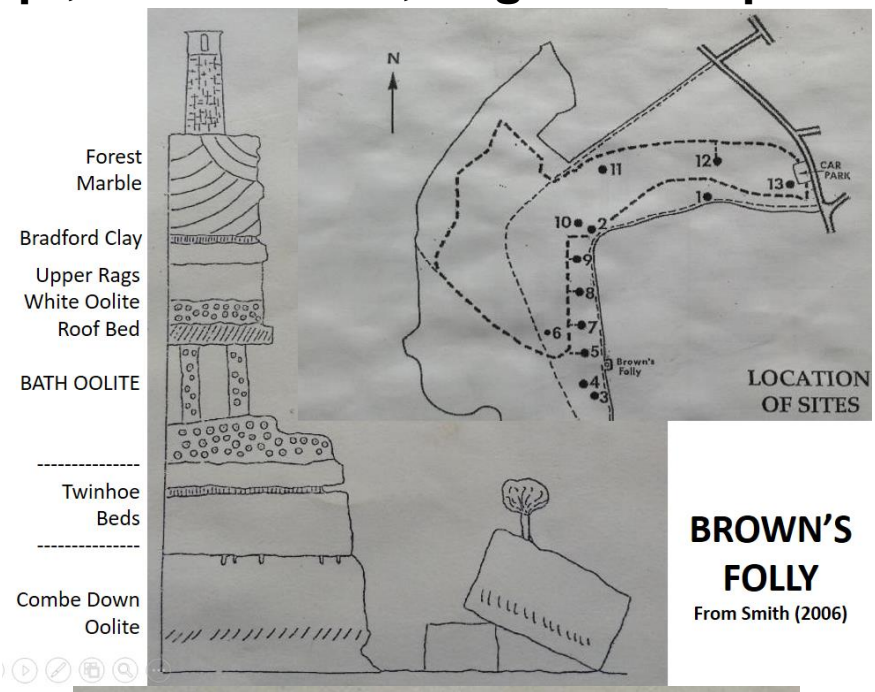
Meet at 2.30 pm at the car-park for Brown's Folly. The field trip will last around 2 hours. The walking is easy to moderate, some steps; stout shoes / trainers would be fine. Lunch could be taken before the trip starts either in Bath or at The Crown pub in Bathford, which serves light lunches.

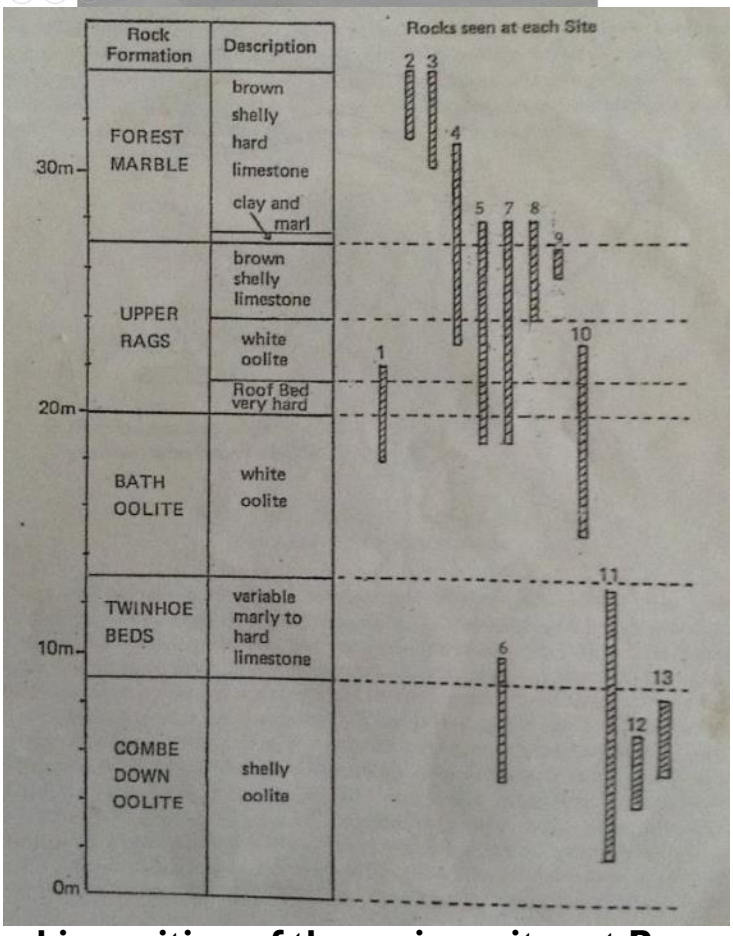
There is limited parking available at the site, so we encourage car sharing wherever possible. We will aim to compile a list of people about to offer lifts and those needing a lift as people arrive for the talks on Tuesday morning, and encourage you to find each other and make travel arrangements during the coffee/tea and poster viewing breaks.

Directions by car:

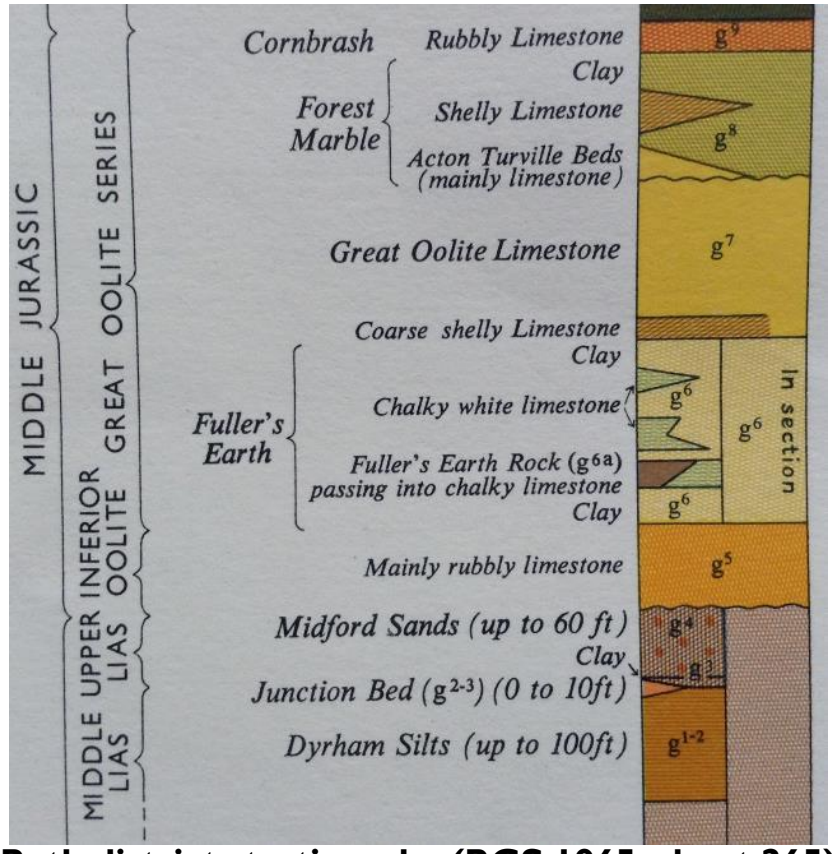
From Bath head east along the London Road (A4) to a large roundabout where take the 3rd exit; continue on the A4 towards Box and at the next roundabout take the third exit, on to the A363 towards Bradford for 200 m, then left into Bathford village, passed the Crown Inn. Heading up the hill and out of Bathford towards Kingsdown, take Prospect Place, the last road in Bathford on the right. Proceed for half a mile up a very steep hill, and the car-park for Brown's Folly is on the right near the top of the hill.

Maps, cross sections, diagrams and pictures

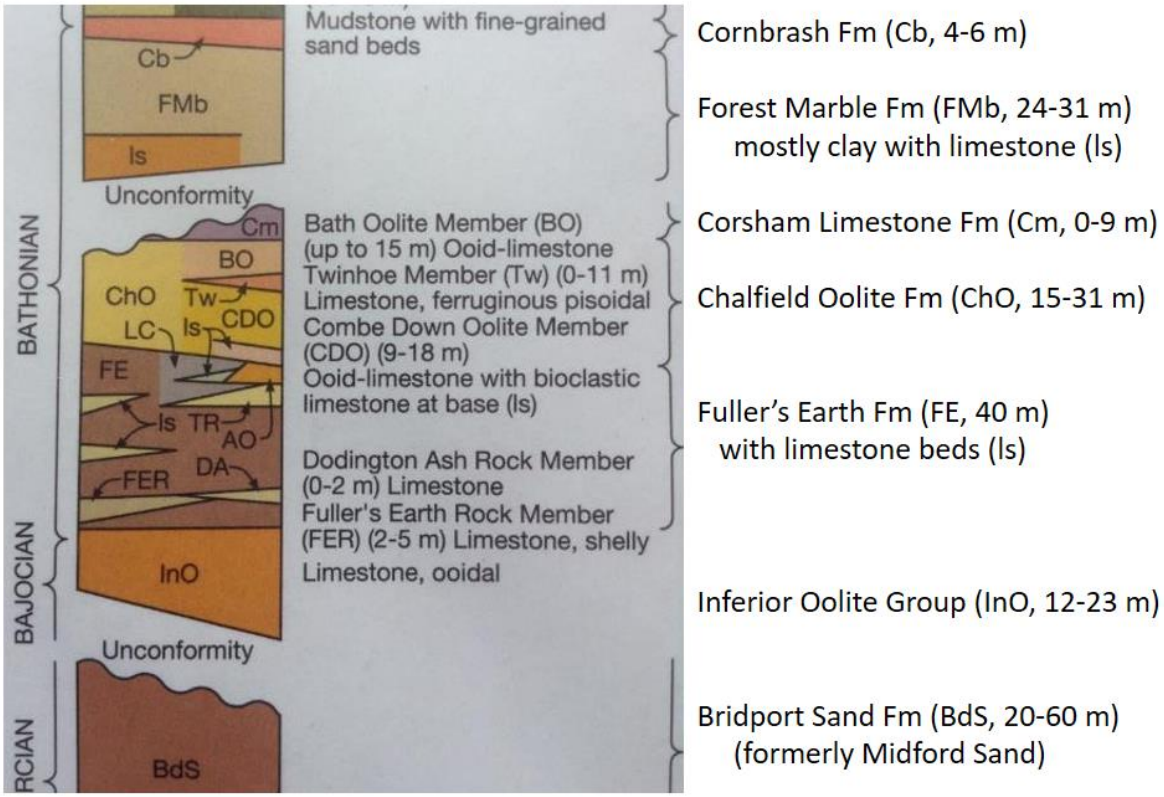




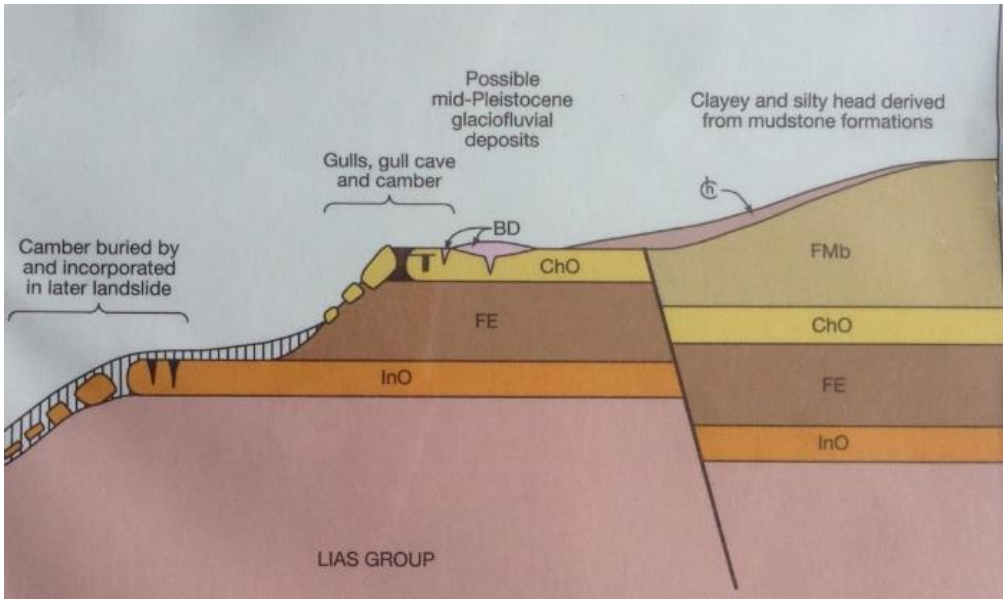
Stratigraphic position of the various sites at Brown's Folly.



Bath district stratigraphy (BGS 1965, sheet 265)

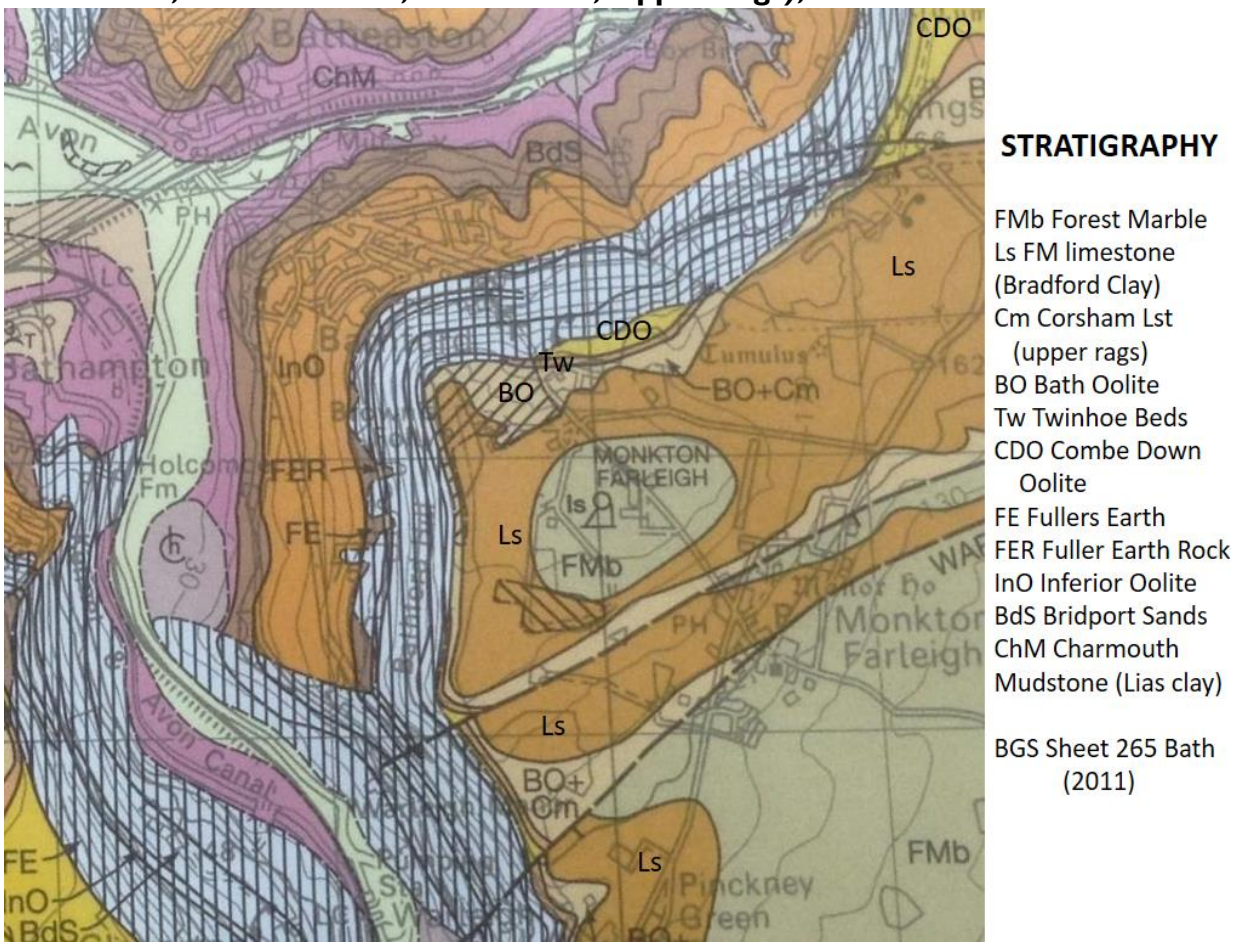


Bath district stratigraphy (BGS 2011, sheet 265)

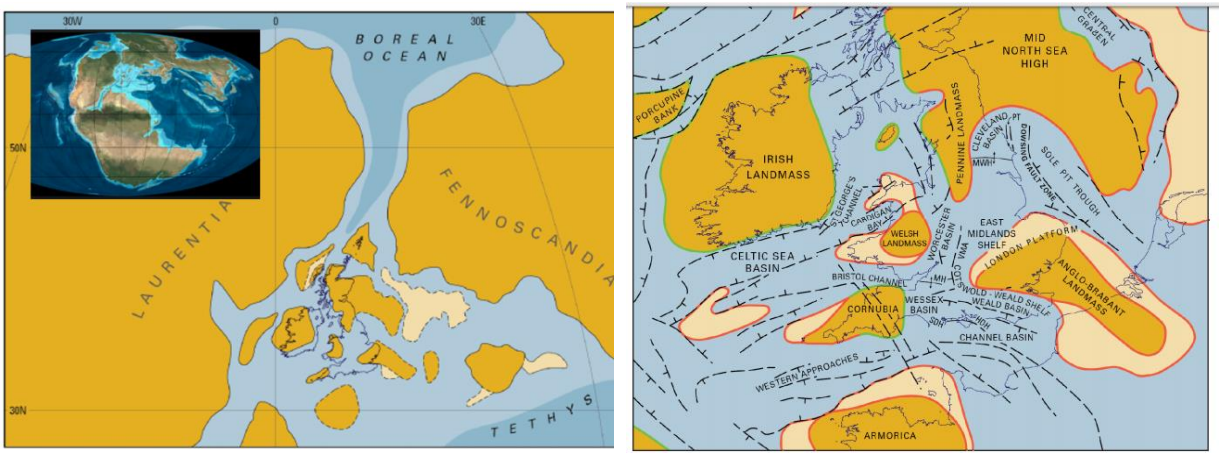


Schematic cross-section across the Bath district (BGS 2011, sheet 265)

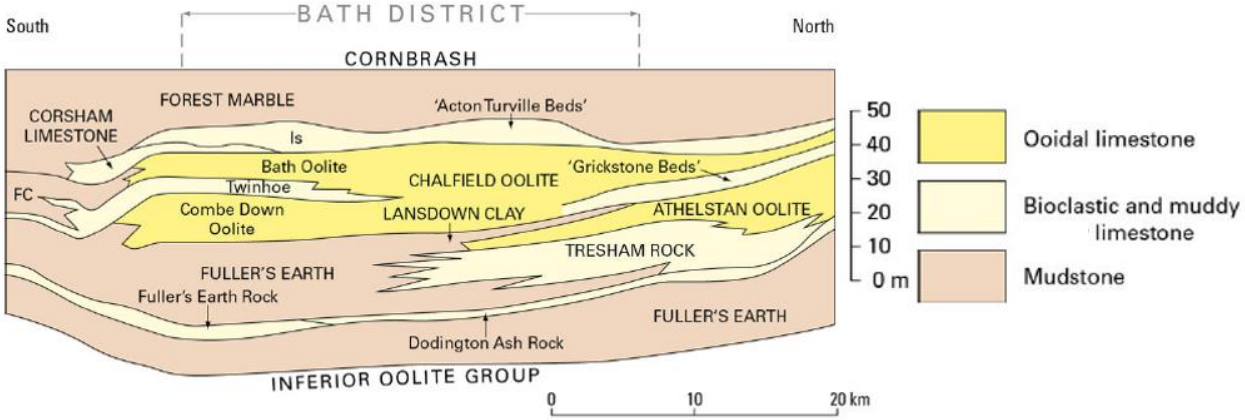
InO = Inferior Oolite, FE = Fullers Earth, ChO = Chalfield Oolite (Combe Down Oolite, Twinhoe Beds, Bath Oolite, Upper Rags), FMb = Forest Marble.



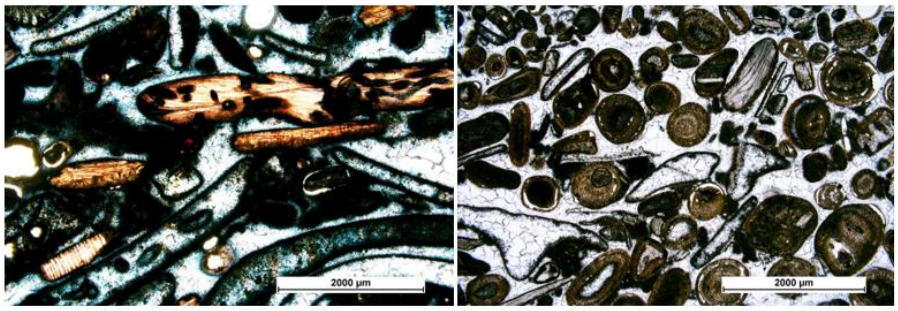
Geological map of the Brown's Folly area (BGS 2011, sheet 265)



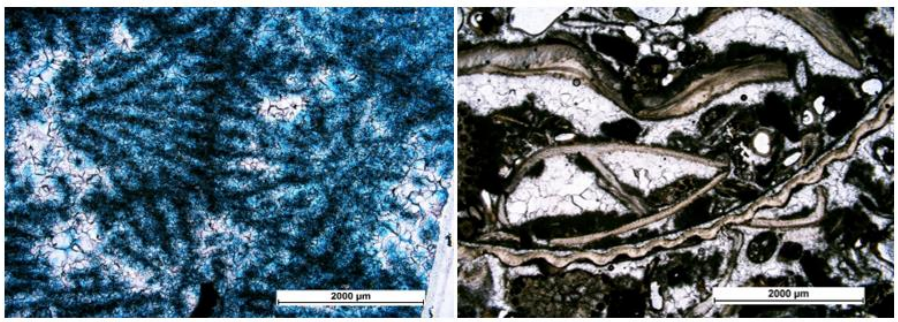
Palaeogeography for the Middle Jurassic



North-South cross-section through the Bath district (BGS 2011)

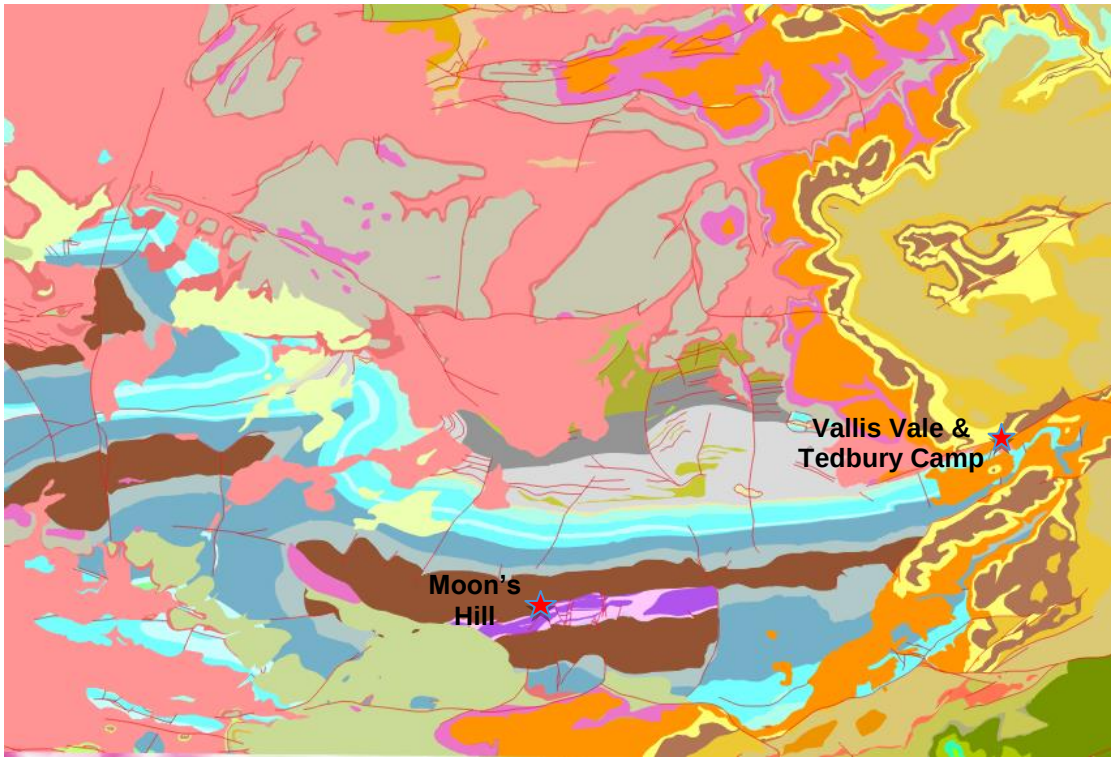


Combe Down Oolite, mostly bioclasts Bath Oolite, ooids +/- bioclasts



Coral from Roof Bed Forest Marble, bioclasts

The 'Somerset volcano' and the geology of the Beacon Hill pericline



Geological map of the Eastern Mendips. Colour key: Silurian (light mauve and purple; Devonian (brown), Carboniferous (light green, blue and light blue, light grey), Triassic (pink, dark grey), Jurassic (olive green, yellow)

Field Trip for the the History of Geology Group and Geological Curators Meeting: "Collectors, Collections and the geology of South West Britain"

19th September 2018

Leaders: Prof A. Watts and O. Green (Department of Earth Sciences, University of Oxford)

History of Geology Group

affiliated to the Geological Society (GSL)

GEOLOGICAL CURATORS GROUP GCG

Geological maps:

1 to 50,000 geological maps, Frome (sheet 281) and Wells (sheet 280).

Meeting place:

Travel from Bath to the Somerset Earth Science Centre, arriving no later than 10 am.

https://www.earthsciencecentre.org.uk/

Introduction to the geology of the Mendip Hills.

https://www.bgs.ac.uk/mendips/geology/geology.html

Farrant, A. (2008b), *A walkers' guide to the geology and landscape of eastern Mendip*. Book and map at 1:25 000 scale. British Geological Survey, Keyworth, Nottingham.

Prudden, H. https://people.bath.ac.uk/exxbgs/Somerset_Good_Rock_Guide.pdf

Field gear:

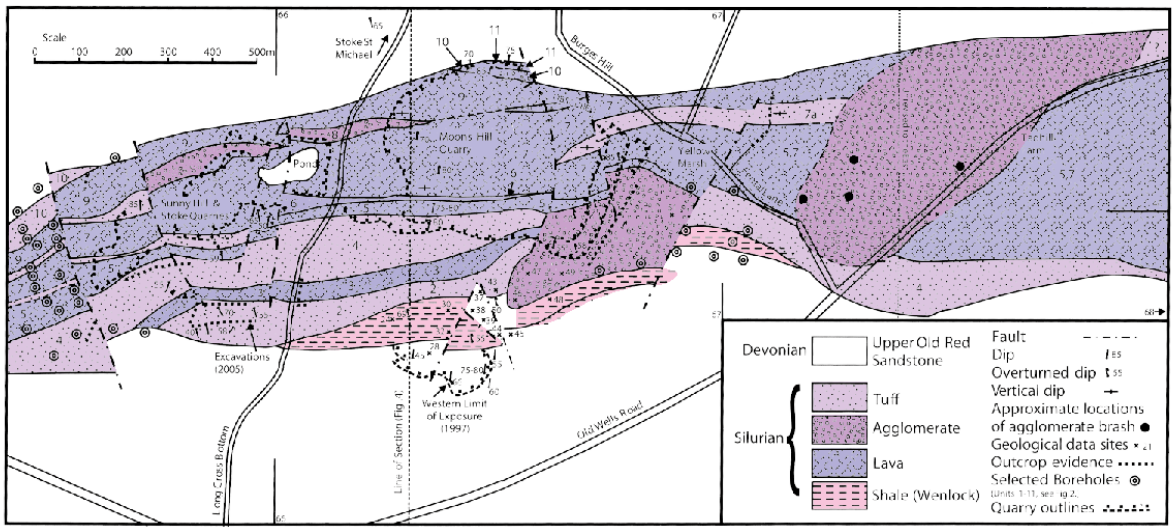
Hard hats, high-visibility jackets and sturdy shoes/boots essential.

The Mendips

The Mendip Hills form the 'fold and thrust' belt (e.g. Williams & Chapman, 1986) to the Variscan orogeny, the main deformation of which was to the southwest, in Cornwall (e.g. the "Killas" and Lizard ophiolite). The folds comprise E-W trending, northward verging, antiforms and synforms that generally increase in length and breadth from south to north. The anticlines (or periclines, e.g. Blackdown, Beacon Hill, North Hill, Penn Hill) plunge to the east and west and have been deeply eroded such that their cores comprise Devonian sediments (Silurian in the case of Beacon Hill) and the Carboniferous Limestone makes up their flanks. The synclines, such as that which forms the Radstock Basin, comprise Coal Measures that are conformable on the underlying Carboniferous Limestone. The Triassic is represented by a conglomerate (the Dolomitic conglomerate - known locally as the Pudding Stone) that infills deep valleys in the Carboniferous Limestone and Devonian sandstones suggesting uplift and erosion took place soon after folding was complete at the end of the Coal Measures. By Jurassic times, the Mendips had been reduced to one or more low lying islands. The Jurassic wave-trimmed surface is now some 100 m above sea-level suggesting a) eustatic sea-level has fallen by this amount since then, b) Mendip has undergone a further period of uplift and erosion since the Jurassic, or c) some combination of these factors.

Stop 1: Moons Hill Quarry.

Check in to the Quarry for safety briefing, and an introductory talk to the Quarry from Dr Gill Odolphie (Somerset Earth Science Centre).



Geological map of the East Mendip Silurian Inlier between grid eastings 6545 and 6800 (from Green 2008)

Left: Aerial photograph of the Moon's Hill Quarry Right: An external mould of a 'rhynchonellid' brachiopod preserved in the volcanic agglomerate.

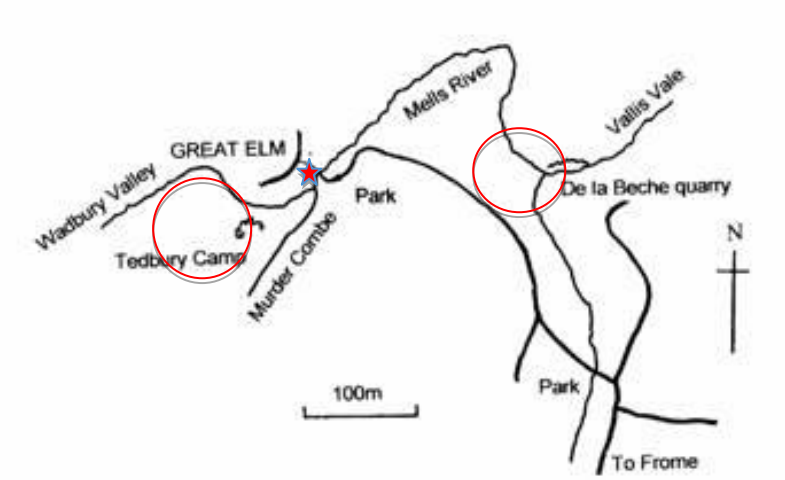
Visit the Silurian (Wenlock) volcano complex in the core of the Beacon Hill pericline. Examine the volcanic rocks, which include andesite lavas, agglomerates, ash and volcanic bombs. Fossils (brachiopod dominated fauna with reports of trilobite, gastropod and bivalve fragments) have been discovered in volcanoclastic sediments within the complex. The Old Red Sandstone (Devonian) is visible in the distance at the north and south edges of the quarry. Discuss the setting of the volcano complex, its paleogeography and its present-day analogues.

Lunch at the Earth Science Centre ~12:30 – ~1:30 pm

Stop 2: Great Elm

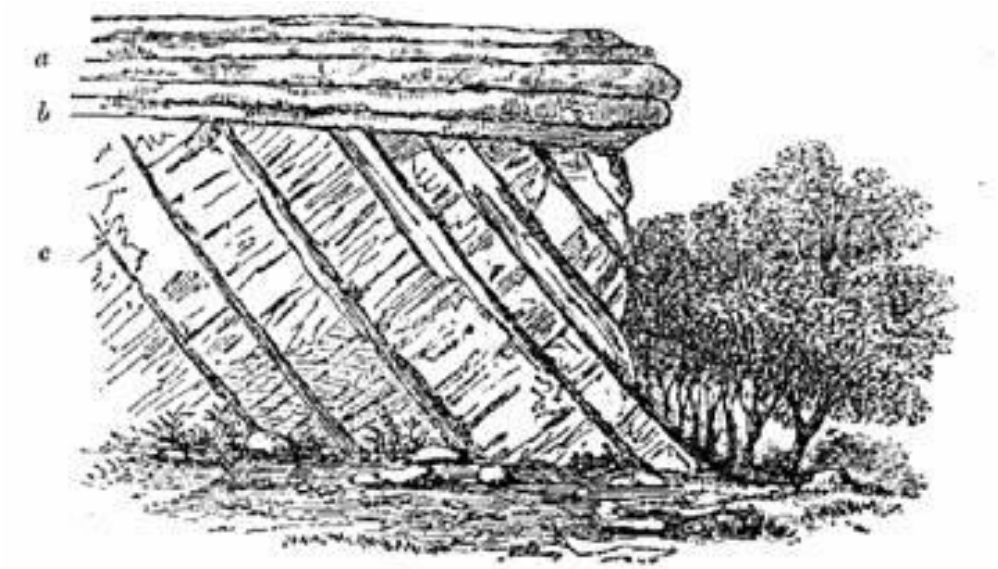
Cars only can park in the valley bottom at Great Elm where the narrow road from Great Elm to Egford crosses the Mells stream (ST 749 491). We will visit two localities:

Stop 2a. Vallis Vale – the De la Beche unconformity (ST 755 490)



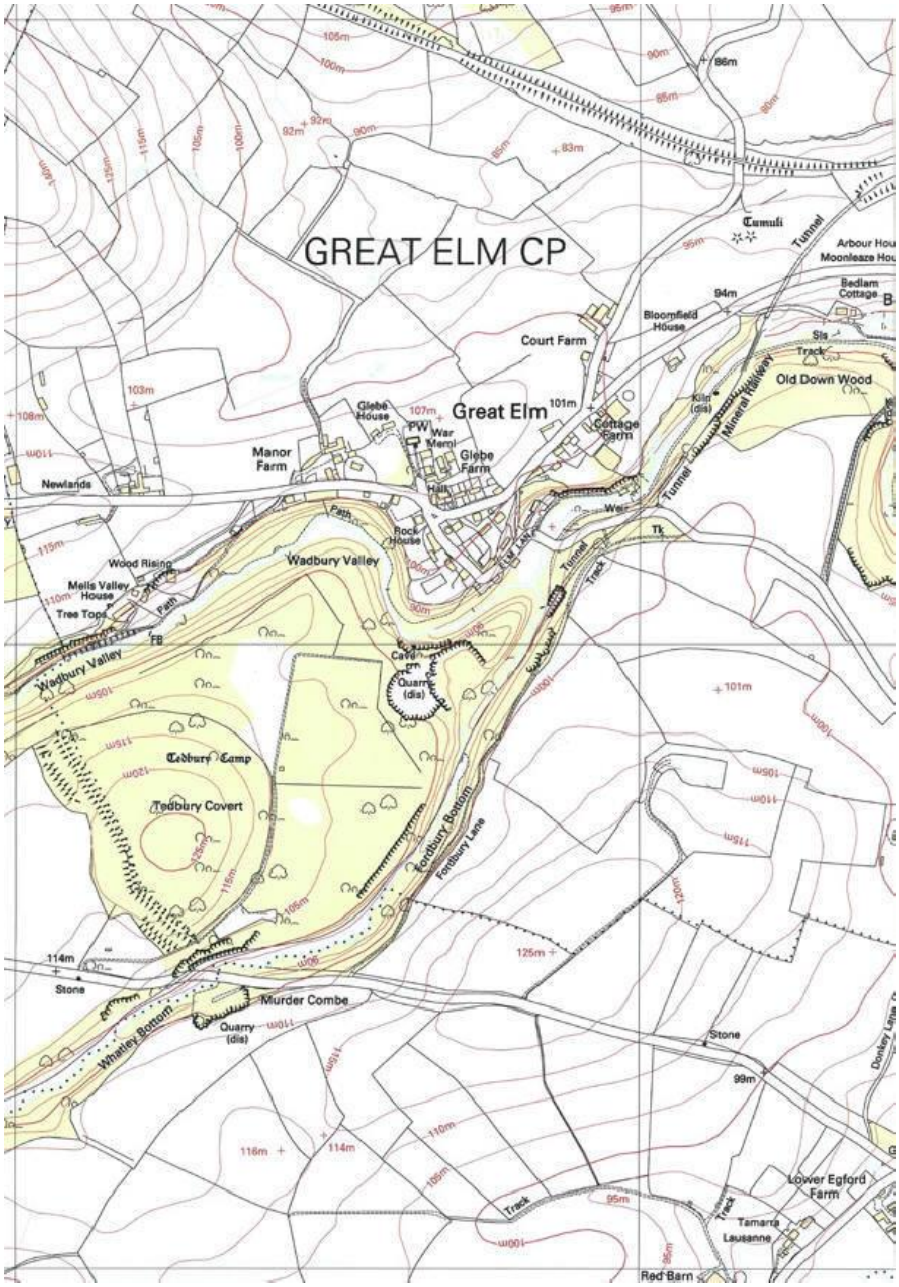
Walk (~1.5 km) back along Fordbury Water to Vallis Vale along the Mells River.

Visit the old quarry working to view the classical angular unconformity at Vallis Vale which separates horizontally-bedded Inferior Oolite above from steeply dipping Black Rock Limestone (Lower Carboniferous) below. The unconformity was first described by Conybeare and Buckland (????) and illustrated by Henry De la Beche (1796-1855) in an 1846 Memoir, the first director of the British Geological Survey, and is named in his honor. Discuss the origin of the unconformity and the evolution of the Beacon Hill pericline from Triassic to Middle Jurassic times.



a. Inferior Oolite.
b. Arenaceous parting.
c. Carboniferous Limestone.

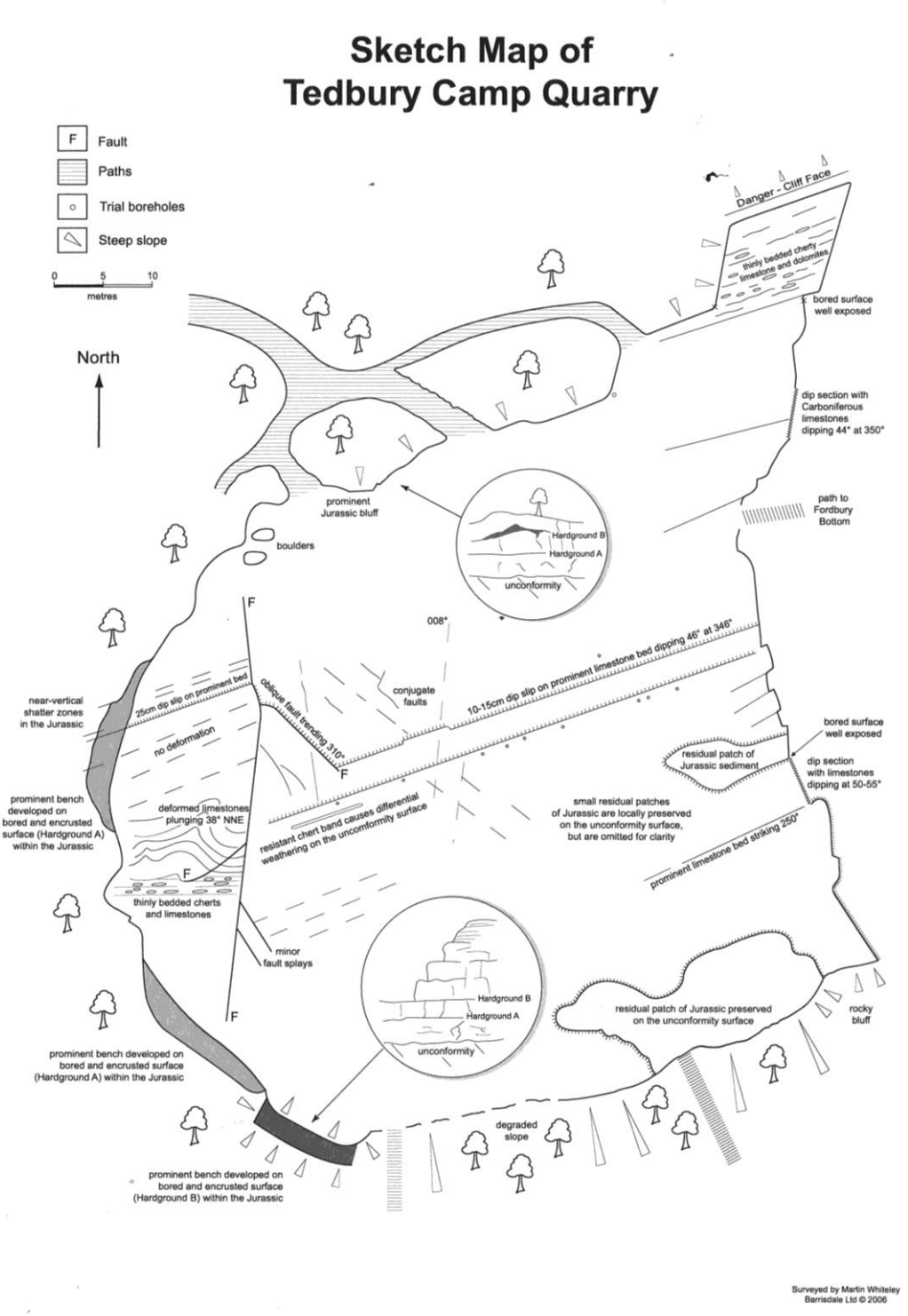
Stop 2b. Tedbury Quarry Camp (ST 746 489)



Walk SW (~0.5 km) along the Fordbury Bottom footpath close to the railway spur that links Whatley Quarry with the North Somerset railway (disused). Follow the path up the wooden steps. Keep well clear of the active railway and tunnel.

Tedbury Camp: Horizontally bedded Jurassic Inferior Oolite limestones rest upon the eroded beds of the Clifton Down Limestone Group (Lower Carboniferous) in an old quarry cleared by English Nature. Removal of the Inferior Oolite has created an intriguingly smooth surface slightly disturbed by later earth movements. Is it simple a wave-eroded surface as is usually suggested? The surface is encrusted with oysters and several generations of borings, filled with lighter-coloured sediment, while in the bedded Oolitic limestones fossil remains of corals, crinoids, echinoids and bivalves are found. Seen from above one can discern a

Variscan tear fault complex. There is an exposure of the Carboniferous Limestone at the southern edge of the quarry and these are suitable for observing bed by bed descriptions (e.g. thickness, lithology, fossil content, bedding planes and aspects of diagenesis – note the chert bands). It is also possible to compare the Inferior Oolite limestones with the Carboniferous Limestone beds remembering that the latter have suffered deep burial and the effects of the Variscan Orogeny. Discuss the origin of the paleo sea-level surface which is now ~100 meters above present-day sea-level.



Return to the car park at Fordbury Bottom, arriving at ~5.0 pm, and then to Bath.