HERTFORDSHIRE GEOLOGICAL SOCIETY
NEWSLETTER
WINTER 2019/20

Working Party Annual Field Trip to Little Heath SSSI, Potten End
Saturday 23th February 2019

We were lucky again with mild weather, although it was rather foggy first thing. However, the sun soon made an appearance and the bottom of the pit was dry. Everyone came suitably dressed in hi-viz with stout gloves [Fig. 1] and carrying various gardening tools and receptacles. We were able to remove the invasive saplings, brambles and other vegetation from the area and clean up the exposure.

After three hours work the site was transformed - see below [Figs. 2 (before) & 3 (after)]. All the vegetation was moved off site and deposited in another pit nearby with the agreement of the National Trust. The face of the exposure was cleaned by the removal of no more than one centimetre of material so that the features of the stratified sand could be clearly seen, as well as contact with the gravels above and below. Most of the group then retired to a local pub for a well earned lunch. We will be doing the same again on Saturday 22nd February 2020 so please come along and help.

Fig. 1: Working party in front of cleaned face [Photo: Nick Pierpoint]

Figs. 2 & 3: Little Heath: Before and after [Photo: Nick Pierpoint]

Geological treasure hunt: Standon to Ashwell, with 15 stops en-route. Sunday 5th May 2019

By Haydon Bailey

Trying to recall this event is difficult, as the "chase" by numerous vehicles across Hertfordshire in the pursuit of obscure, occasionally geological, facts tends to blur in the memory. However, I do recall finding myself in parts of the county previously unvisited by myself (and anyone else for that matter) and I'll try to recall some of these. There's no chance that I can remember all of it.

Approximately 30ish Hertfordshire Geological Society members met at the Standon Stone in Standon village, where our first clue was hidden in the information board text. Cars were then timed to leave at 2 minute intervals, but I suspect that the accuracy of this bit was somewhat like my memory – blurred.

We sped off, well within the speed limits, initially south westwards onto the A10 (Ermine Street) and down to Colliers End, only to discover a memorial stone in the middle of a field. This marker celebrates the two and a quarter hour hot air balloon flight made by Vincenzo Lunardi in September 1784, along with his cat and his dog. Evidently no other humans were mad enough to travel with him, which is not really surprising.

After this I start to lose track a little, although I know we stopped off at the churchyard (the first of several) at Brent Pelham where after some wandering we noted odd shaped gravestones made from Scandinavian erratics and marking the passing of a couple of Scandinavians; equally erratic ending up in Brent Pelham.

We visited the village of Braughing, scouring the churchyard and village green for clues and eventually made our way to Hare Street where lunch had been booked at The Old Swan Tea Shop. This proved as curious as the Treasure Hunt as the patroness was having difficulty in providing for a crowd of geological treasure seekers as well as the endless stream of cyclists and leather clad bikers who also frequented this quaint, if overcrowded tea room.

Post lunch the hunt was resumed north eastwards passing through the churchyard at Barkway, seeking strange sea monsters on the font. I think that was here but this is where it's become more of a blur

(sorry Mike!). Eventually by late afternoon we arrived in the village of Ashwell, which must be one of the nicest geological locations on the borders of Hertfordshire & Cambridgeshire. We located clues associated with the fauna of Ashwell Springs, the stones of the local village lock-up and the masonry bees of a thatched wall.

The tour/hunt ended in the village museum, followed by afternoon tea in the tea room opposite. It was all very civilised until, following the tallying up of the scores arising from the correct answering of all the treasure hunt clues, it was realised that we had a tie! A tie breaker question was required and this was where observations made in the village museum became crucial. "How many vertebrae are on display in the cabinets at the top of the stairs?" The current writer called out a random guess of "Four" and that was sufficient to win the day for the Sheffield Re-United team, with an appropriate prize of a lump of puddingstone.

Thanks to Mike Howgate for organising this as we had a great time and no drivers were booked for speeding..... unless you know otherwise!

Hitch Wood Chalk Pit, Hill End: An example of how past history simply increases significance.
Working party: Saturday 11th June 2019

By Haydon Bailey

The Hitch Wood Chalk Pit at Hill End (TL 197239) does not make it into "*The Cretaceous Rocks of Britain*" (Jukes–Browne, 1903) and since a major contributor to this milestone of Chalk stratigraphy and palaeontology was Hitchin resident, William Hill, then we must presume that, at the beginning of the twentieth century, the pit did not exist.

The earliest published record of Hitch Wood comes from the work of Stanley Billinghurst (1927) who was for five years a master at Hitchin Grammar School. During this time he studied the chalk from Hitch Wood, which he described as being very fossiliferous, and from it he recorded two new ammonite species, *Prionocyclus hitchinensis* and *Prionotropis cristatus.* The macrofauna from the Hitch Wood pit continued to attract palaeontological interest and between 1954 and 1964 Robert Reid recorded a number of sponges from the site, including a new form which he recorded as a new genus – *Hillendia*.

During the early 1950's the palaeontological finds from the location came to the attention of three local schoolboys at Hertford Grammar School, namely Richard Bromley, Jack Doyle and Christopher Wood. From 1954 onwards they would regularly cycle to the chalk pit in order to examine the sequence present in it and to see what fossils they might find to increase their personal collections. The story might have ended when they left school to go to university and pursue their individual geological careers; however they were all destined to return to Hitch Wood.

Richard Bromley was to first to publish on the site, which he did in 1982 with Andy Gale, in their classic paper on *The lithostratigraphy of the English Chalk Rock* (Bromley & Gale, 1982); by this time Bromley was Curator of the Institut for Historisk Geologi og Paleontologi in Copenhagen. Christopher Wood had also maintained his interests in Chalk fossils by becoming the Senior Palaeontologist in the British Geological Survey and working throughout the United Kingdom, specialising in Cretaceous macrofaunas.

Chris Wood never lost his early fascination with the Chalk of Hertfordshire and he became a dedicated member of the Hertfordshire RIGS team which produced "*A Geological Conservation Strategy for Hertfordshire*" in 2003. He was also a co-author of "*The Upper Cretaceous Chalk*" chapter in "*Hertfordshire Geology and Landscape*" (Bailey & Wood, in Catt, 2010) in which the Hitch Wood Chalk pit is described as follows:

> The small **Hill End Farm Pit (Hitch Wood Pit)** (TL 197239) is of national stratigraphic and palaeontological importance, but it has become very degraded in recent years and has lost its original SSSI status. It is the type locality of the Hitch Wood Hardground at the top of the Chalk Rock. The pebble bed associated with this hardground is extremely fossiliferous at this location and is considered to have yielded more fossils of all groups, including ammonites, bivalves and gastropods, than any other Chalk Rock locality in the county (Bromley and Gale, 1982, Gale, 1996).
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> The currently poorly exposed section of the Lewes Nodular Chalk Formation, spans the *Plesiocorys (Sternotaxis) plana* Zone and the base of the *M. cortestudinarium* Zone. It comprises the Chalk Rock (0.7 m thick excluding the overlying pebble bed) and extends to 1.6 m above the Top Rock (Hopson *et al*., 1996). The underlying beds are covered by talus and need to be exposed by trenching, but they are known to include the Reed (Caburn) Marl and probably the Southerham Marl (pers. comm., Jack Doyle).
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> The fossiliferous topmost pebble bed of the Hitch Wood Hardground provides the type locality of the siliceous sponge genus *Hillendia*, which forms part of the rich sponge fauna described by Reid (1962). The occurrence of very well preserved ammonites was first recorded by Billinghurst (1927), a local schoolmaster, who described as new species *Prionocyclus* (now *Subprionocyclus*) *hitchinensis* and *Prionotropis cristatus* (now *Subprionocyclus branneri*). These figured specimens are housed in the Natural History Museum, London, and Billinghurst's plate of these ammonites was reproduced by Bloom in Hine (1934).
>
> Many fossils from Hill End are in the Natural History Museum or held by the British Geological Survey. It has yielded 22 different ammonite species of the 24 described from the Chalk Rock, including the holotype and paratypes of *Allocrioceras strangulatum*, the holotype of *Anisoceras reidi* [now *Allocrioceras schlueteri*], the holotype of *Lewesiceras woodi*, a paratype of *Otoscaphites reidi* [now *Yezoites bladenensis*], paratypes of *Scaphites diana*, the holotype of *Scaphites kieslingwaldensis doylei* and figured specimens of the rare species *Pseudojacobites farmeryi* and *Tongoboryoceras rhodanicum* (see Wright, 1979; Kaplan *et al*., 1987; Kaplan, 1989).
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> Hopson *et al*. (1996) recorded the recovery of a non-mineralized specimen of *Micraster cortestudinarium* from immediately above the Top Rock hardground. This morphotype is typical of those noted elsewhere from high in the *M. cortestudinarium* Zone, implying considerable condensation of section at the hardground surface.

The record of the type specimen of the ammonite *Scaphites kieslingwaldensis doylei* brings us to the third member of the schoolboy triumvirate who first visited Hitch Wood in 1954. Jack Doyle maintained his geological career by becoming a school teacher in Essex, teaching Geology at A level for several decades. He continued to visit Hitch Wood and maintained the site for years with the assistance of willing sixth form students.

In 1980 a dispute arose over the ownership of the chalk pit site, as a claim was made on it by a local farmer. Jack Doyle, acting as a witness on behalf of the Hertfordshire and Middlesex Wildlife Trust, gave evidence to the Commons Commissioner. In a ruling dated 26th March 1982, the Commons Commissioner stated that:

> "I am not satisfied that any person is the owner of the land, and it will therefore remain subject to protection under Section 9 of the (Commons Registration) Act of 1965."

The site was thereby designated as Common Land and came under the management of the Hertfordshire and Middlesex Wildlife Trust.

During the 1980's the site was kept in good condition by Jack Doyle and his sixth form volunteers, and fossil collection continued on the site (see the following short write-up of Hertfordshire Geological Society's last visit to the site in 1981). However, over the following two decades the Wildlife Trust showed more interest in the butterflies, snails and rare chalk meadow plants which thrived on the site, rather than its important fossil content and the conservation of the chalk face proved difficult to maintain.

The loss of SSSI status and the publication of the 2003 *A Geological Conservation Strategy for Hertfordshire* recognised the RIGS status of the site, by both the Hertfordshire RIGS Group and the Hertfordshire Geological Society. However, despite several approaches to the Hertfordshire and Middlesex Wildlife Trust, the local geological community found it difficult to establish a working relationship with the Trust through which this important site could be conserved. During the period 2003 to 2018 the site continued to degrade and by the time the present author first visited Hill End in 2006, it was effectively completely overgrown.

In 2016 management of the Hitch Wood site past back from the Wildlife Trust to the North Hertfordshire District Council and several attempts to establish contact between the new site manager and the Hertfordshire Geological Society failed. The District Council did not have the resources to maintain a site such as Hitch Wood and they passed the responsibility for this to the Hertfordshire County Council Countryside Management Services team.

Early in 2018 Hertfordshire Countryside Management Services made contact with Hertfordshire Geological Society, asking if the Society would wish to be involved in the restoration and conservation of the Hitch Wood Chalk Pit. After two decades of neglect, the answer had to be positive.

Plans were made during 2018 for the clearance of bushes and scrub vegetation through the following winter. Hertfordshire Geological Society applied to the Geologists' Association Curry Fund for financial assistance with the excavation of the chalk section and also for the information boards to be located at the adjacent car park and by the site itself. The Curry Fund application was successful and in March 2019 a small excavator was on site to remove loose rubble from the chalk face and to excavate into the underlying Chalk Rock (Hitch Wood Hardground) section. All the material excavated from the site was piled up so that visiting geological parties and groups of local school children can collect fossils safely.

The excavation was followed rapidly by Hertfordshire conservation volunteers visiting the site to clear a large amount of scrub vegetation and to build a new set of steps into the chalk pit. During this visit Jack

Doyle was welcomed back on site to show the volunteers some of the important fossils which had been discovered there.

Fig. 4: Hill End before [Photo: Nick Pierpoint]

In June 2019, Hertfordshire Geological Society held its first conservation visit to the site during which a very large amount of overhanging vegetation was removed and the chalk face was returned to what it had been during the early 1980's [Figs. 4 (before) & 5 (after)].

The information boards for the site have been drafted, edited and completed and will be located on site by the end of 2019. With these in place a one hundred year turnaround for this site "of national stratigraphic and palaeontological importance" (Bailey & Wood, 2010) will have been completed. It is almost a century since the Hitch Wood Chalk pit was actually worked for chalk, and since that time it has yielded numerous new ammonite species, a new genus of sponge and a new name to English lithostratigraphy, the Hitch Wood Hardground. Fortunately, one of those three 1950's Hertford schoolboys, Jack Doyle, is still with us to celebrate the restoration of the Hitch Wood Chalk Pit at Hill End.

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Hertfordshire Geological Society's last visit to the site was part of a field meeting looking at the chalk stratigraphy in North Hertfordshire and South Cambridgeshire led by Chris Wood
4th October 1981

By Richard Bateman

Four exposures were examined, beginning with Hill End Farm pit, Langley. This pit was first discovered by Billinghurst and is now an SSSI. A small excavation was made by Brian Sauford & Trevor James of North Herts Museum for the visit. The pit is famous for its very fossiliferous chalk rock making the boundary of the middle and upper chalk. The succession resembles that of Kensworth; both have distinctive flint bands, although there are major stratigraphic changes to the north east. The most fossiliferous zone is the top of the chalk rock below the erosion surface and pebble bed with phosphatic and glauconitic nodules. The faunal assemblage of bivalves, gastropods and sponges can vbe traced from North America to Japan. The pit contains 28 species and subspecies of 15 genera; it is the type locality for 5 species including sponges, the uncoiled ammonite *Hyphontoceras rhoiceanum* (*H. woodsi*) and the coied ammonite *Pridnocyclis hitchinenensis*.

Few notable finds were made and it was concluded that the pit is largely worked out.

The other sites visited that day were, Morden Grange Pit, Steeple Morden, Reed Chalkpit & Barkway Chalkpit.

Fig. 5: Hill End after [Photo: Chris Hoy]

Day field trip to Peterborough, brick pits, museum and Cathedral tour. Saturday 22nd June 2019

By Lesley Exton

After an abortive attempt by Nick Pierpoint to arrange this trip for the society in 2018, put off due to Peterborough Cathedral's 900th Anniversary celebrations, he tried again this year. On a sunny Saturday morning in June a number of Hertfordshire Geological Society members met up with leaders Colin Prosser & Jonathan Larwood (with his arm in plaster) at Kings Dyke Nature Reserve, Whittlesey, just east of Peterborough.

The Nature Reserve within a former Oxford Clay pit opened in 1996 and was designed to complement the mosaic of habitats that already existed at the site. It was extended in 2008 to include ponds, a reedbed and associated habitats, as well as the retention of a geological face and a fossil collection area. It is a great example of a quarry converted into a nature reserve. By the end of 2017 over 1,500 species of insect (including 19 dragonfly and 27 butterfly) and over 300 species of plant had been identified. As

well as 158 species of birds, 28 species of mammal, 3 species of reptile and 4 species of amphibian. There was a 48-hour Bio-blitz going on that weekend to which Jonathan had agreed to add a Palaeo-blitz, so he would record any fossil species we found when we went fossil hunting a little later on.

Fig. 6: Examining the ice age boulder found in Bradey Fen Quarry [Photo: Mervyn Jones]

We started by examining an ice age boulder, near the entrance which weighs 8 tonnes and was found at the Bradey Fen Quarry in 2008 [Fig. 6]. It is a glacial erratic that was carried to that site by a glacier, most likely from the Midlands about 40,000 years ago (although an alternative theory is it came from Norway). It is igneous, poorly mixed angular and with subangular fragments, and we were challenged as to where we thought it had come from.

The brickworks are hidden from view, so you don't know they are there until you are almost on top of them [Fig 7]. Phil Parker, who runs the Kings Dyke Nature Reserve on behalf of Forterra, and who was leading the Bio-blitz, joined us and gave us a brief history of brick making in the area and the brickmaking process at Kings Dyke. Brick making has taken place in Whittlesey since the early 1900's. At one time there were eight separate brickworks operating in the area run by several different companies. Now there is just the Kings Dyke brickworks which is one of the largest in Europe. It can make 5,000,000 bricks a week which is enough to build 650 houses. Currently it is not running at full capacity, producing 3,000,000/week. They are made from Oxford Clay which contains a lot of organic material which helps the bricks to self-fire. The clay now comes from Must Farm Pit 1 km away and is dug with a dragline. Historically the clay was cut using a shale planer which is why there are a lot of steep quarry faces. The clay comes in on a covered conveyor belt to keep the moisture content at the correct level. It goes into the Pan Shed where it is ground down into pellets, these are pressed into green (raw) bricks in the

Pressing Shed. It is at this stage any patterns are pressed in. Sand is blasted onto the outside to colour of the bricks.

Fig. 7: Kings Dyke brickworks [Photo: Lesley Exton]

Up to 6-7 years ago the bricks would then have gone to the Setting Shed, but this was stopped due to manual handling regulations and they now go on another conveyor belt to the Robot Shed. However, robots don't yet have common sense, so men still have to sort out the fallen bricks. There are four sets of kilns each capable of firing bricks at 1100o C. The bricks self-fire as once it gets hot the organic material within starts to burn and produces enough heat to bake the clay into bricks. They are in the kilns for up to two weeks. The kilns are used in sequence so when one kiln is cooling down the next is heating up. Men still have to set the bricks and perform quality control, this is done by hitting two of the bricks together to see if they ring true. The bricks are then stacked in units, which are then shrink wrapped. These bricks aren't frost proof and are used for internal walls. Damaged bricks are recycled.

For many years sand martins have nested in the steep sub-face (River Nene river terrace sediments) above the clay opposite (top left of Fig. 7). However, in the last two years they have now started nesting in the wrapped bricks, so half the piles in front of us can't be used as they have baby sand martins in them.

The Fen Basin sits on the Oxford Clay which dips at 3-4 degrees eastwards. There are a series of river terraces (the River Nene and the River Welland) which document the river evolution in response to glacial advance and retreat. From the 19th century the brick industry has gradually moved from the south of Peterborough, where the Oxford Clay is near to the surface, to the east.

We then spent some time looking for fossils in the fossil hunting area which is regularly replenished with

fresh clay from the quarry and provides a safe environment to collect in [Fig. 8]. A wide range of mainly marine fossils from the Jurassic Period can be found there, belemnites, gryphaea and ammonites are the most common. Teeth or bones of pliosaurs, crocodiles and sharks have also been found. However, we only found mainly ammonites, belemnites and gryphaea. Particularly notable was the ammonite Kosmoceras which is also to be found on the logo of the Geologists' Association.

The Lower Oxford Clay, Peterborough Member was deposited when Cambridgeshire was 30o-40o north of the equator, in a relatively shallow (10s of metres) organic rich sea with an average temperature of 20 ^{o}C. Oxygen isotopes for the belemnites indicate a slightly cooler environment (c 15 ^{o}C) suggesting they may have migrated from more northerly waters.

Jonathan completed his Palaeo-blitz and then we made our way back to the car park and went our separate ways to various carparks in Peterborough and lunch. Most of us ended up at the Squires Coffee Shop at the museum which coped very well as our arrival was staggered.

Fig. 8: Hunting for fossils [Photo: Lesley Exton]

Peterborough is on the fen edge and there have been some incredible Bronze Age finds (e.g. the causeway at Flag Fen, log boats, and round houses at Must Farm). The Romans built a large town (Durobrivae) just to the west of where we were standing. The 9th legion based in Peterborough were sent to put down Boudica, but only the cavalry came back. The railway which opened in 1840 was important for the later development of Peterborough and brought in different building stones from other parts of Britain. Other industries including brickmaking and engineering are still important today.

We reconvened outside the museum at 13:30. The building itself was originally a Georgian Town House and was given to the city in the mid-19th century. It first became the city hospital (there is an operating

theatre at the top of the building) and then in 1931 reopened as the city museum. It is built of Clipsham (yellow) and Ketton (pinkish) limestones. The main geological collections on display within are those of Alan Dawn (1923-2010) of Stamford Geological Society whom the gallery is named after and who took an earlier Hertfordshire Geological Society field trip around the area. We then had time to look around the museum before moving onto our final stop, the cathedral [Fig. 9].

Fig. 9: Peterborough Cathedral [Photo: Lesley Exton]

There was a monastery Medeshansted on the site in 655AD. This was destroyed by the Viking Ivor the Boneless in 870 and was re-founded in 966AD. In 1116 it burned down and the rebuilding started in 1118, this was the 900th anniversary celebrated last year. Although it wasn't until 1238 that the church was finally consecrated. In 1496 the Presbytery roof was added. Catherine of Aragon was buried here in 1536 and in 1541 Peterborough became a cathedral. Mary Queen of Scots was buried here in 1586, but her body was later dug up and moved. Oliver Cromwell's army did some damage, and in 1822-30 there was a lot of restoration done to sort out the damage done during the Civil War. In 1880 the main tower was rebuilt. A number of building stones had been used including Barnack Limestone, Ketton Limestone, Alwalton Limestone (the font) and Collyweston Slate, for the roof. After looking at the outside of the cathedral we then went round the inside looking for examples of the stones named, and some of the more distantly travelled marbles.

Many thanks to Colin Prosser & Jonathan Larwood for a very interesting trip and for Nick for organising it.

John Catt Symposium: Hertfordshire Geology and Landscape.
The Bayfordbury Campus, University of Hertfordshire
Saturday 13th July 2019

By Haydon Bailey

Between 60 and 70 participants came together in mid-July to celebrate the work of Professor John Catt and, in particular, to acknowledge his contribution to the county in his 2010 publication *Hertfordshire Geology and Landscape*. John took up the editorship of this monumental tome from Percy Evans in 1975 and it took a further thirty five years dedication to edit it and bring it altogether in a final publication.
A collaboration of Hertfordshire Geological Society (HGS), Hertfordshire Natural History Society (HNHS), East Hertfordshire Geology Club and the Bedfordshire Geology Group members brought the various strands of this event together, which took place in the rural setting of the Bayfordbury campus. The event also saw the reprinting of *Hertfordshire Geology and Landscape* which includes a dedication to John.
Any event such as this requires a strong programme of talks and this proved to be the easiest part of the organisation as every one of the potential speakers approached immediately responded positively; this in itself is a reflection of the respect in which John Catt was held by his colleagues.
The final programme was as follows:

Haydon Bailey (HGS) & **Janet Wright** (OU/HGS)	Introduction and the Mystery of the Midlands Microcraton
Andy Farrant, M. Woods, R. Kendall, R. Vernon, J. Thompson, C. Cripps (BGS) & M. Kehinde (EA)	3D geological modelling of the Chalk for groundwater Management
Rob Sage & **Ilias Karapanos** (Affinity)	Chalk Groundwater in Hertfordshire: Our Hidden Asset Developments in understanding the flow mechanisms in the Chalk of Hertfordshire
Clive Edmonds (PBA)	Sinkhole and Crown Hole Geohazards in Hertfordshire
Clive Maton (Birkbeck/HGS) & **Tim Atkinson** (UCL)	Little Heath – a Pliocene shoreline site high on the Chilterns
Chris Green (HGS)	Great Gaddesden and the geological context and archaeological uses of Hertfordshire Puddingstone
Stewart Bryant (Herts Archaeology)	Soils and settlement: the influence of soils and geology on settlement and industry in Hertfordshire from 4000BC to AD 850
Mike Howgate (HGS)	The Ice age River Stort
John Hollis (Soil specialist), **Steve Hallett** & Ian Truckell (Cranfield University)	Hertfordshire soils: Evolution, Landscapes and Functions

Nick Pierpoint (HGS & GA President)	Observations of Stream Flow in the Hertfordshire Bourne 2013 and 2014

(Speakers marked in **bold**: Fig. 10)

The range of topics reflects the subject matter of the original Hertfordshire book and the general consensus at the close was that John would have loved to have been there. We were delighted to be joined for the day by John's wife Diana who was able to meet up with so many of John's friends and colleagues, re-establishing so many links with a lot of very friendly faces.

The following day a party from the symposium gathered on Dunstable Downs where we examined the topography, underlying geology and the local archaeology before moving onto the Kensworth Nature Reserve Site (see following write-up).

A thoroughly good day was had by all participants and we acknowledge the support of the Geologists' Association and all the contributing societies, without whom this event would have been so much more difficult to bring about.

Fig.10: Speakers at the John Catt Symposium, July 13th, 2019.

Dunstable Downs & Kensworth Pit
Sunday 14th July 2019

By Lesley Exton

On a slightly overcast morning around a dozen people gathered around the bronze model behind the Chilterns NT Centre, Dunstable Downs (TL 008198). This field trip was a repeat led by John Catt in June 2009 after a conference on the Chalk of Hertfordshire. Haydon started with an overview of the geology of the Chilterns. Beneath our feet was the top of the middle chalk (Lewis Formation). As you descend the scarp slope in front of us the sequences goes down through the Lewis, New Pit and Holywell Chalk reaching the Plienus marl, with the gault clay covering the valley below. The Plienus marl is also exposed at Totternhoe. Looking across the vale of Aylesbury the first rise we could see was the lower chalk, and the dark horizon in the distance was a Green Sand Ridge.

We then turned right and followed a path along the top of the Downs to two Medieval pillow mounds. Stewart Bryant, one of the speakers from yesterday's symposium explained these were artificial rabbit warrens thought to have been built 12th/13th century to supply Dunstable Priory with meat. One has traces of a ditch, the other a narrow bank with surrounding ditch, but the rabbits would have been allowed to roam across the Downs. They would have been looked after by a warrener. This point gave us a better view of the of the bottom of the slope where there is a rifle range and evidence of Medieval lynchets indicating the lower slopes were farmed.

Haydon then took us back to the Anglian ice age, when the ice came down and reached the Chilterns, but where did it go? This had been touched on in one of the talks the previous day for one valley. Looking north/northeast towards Royston, the ice (probably Scandinavian ice from the North Sea as well as British ice) would have come straight up the Wash. We know the ice went into the Vale of St Albans, but it doesn't seem to have got over the Chilterns. The chalk rock here was acting as a cap protecting the top of the escarpment. The ice sheet broke through to the south through the Dunstable/Luton gap, westwards at Dagenham through the Gabe Valley and at the next gap at Tring, the Bulbourne Valley. But the next valley the Chess was not breached as the drainage pattern shows a dendric arrangement. Haydon proposed that there were a series of breaches through which lobes of ice came southwards and the valleys provided melt-water channels, as the size of the streams currently in these valleys is far too small to have created them. All these valleys are based on older underlying structures in the chalk. Now beginning to pick up these structures as the area is remapped. He thinks there is an underlying fault system cutting across the Chilterns, probably Cretaceous or even older.

We then continued along the top of the Downs dropping down to Five Knolls. There are actually seven prehistoric, 2300-1700 BC burials here. Five round barrow mounds, which were excavated in the late 19th-early 20th century, but while when they were excavated is well recorded what was found isn't. Only the wealthiest would have been buried this way and these would have been bright white originally, due to the chalk. The other two are pond barrows, they are roughly circular depressions and much harder to see as they are overgrown. The first burial was the most important, though there were secondary burials and cremations added later. They were reused in Saxon times and there is also some evidence of late Roman burials and medieval gallows victims.

On the other side of the road is a golf course, there is another barrow there. This is the burial of a female with a child surrounded by 200+ Micraster echinoids. Haydon posed the question: how long would it take to collect that many?

We returned to Chilterns NT Centre for lunch, thus escaping the rain that had been threatening on our walk back. Two more joined us after lunch as we made our way to the Kensworth Nature Reserve Site (TL 011200) which had been specially cleared for us by Anne Williams and colleagues of the Bedfordshire Geology Group last month [Fig. 11]. This site and the quarry are an SSSI. Part of the agreement with the company in the 1960's/70's was that this site in the Nature Reserve was to be kept open. Here in the New Pit chalk there are only one or two levels of flints but loads of clay seams. If clay is present the silica is absorbed into the clay so isn't available to form flints. The Caburn Marl was clearly visible, and Haydon pointed out the minor faulting which is only visible when the face is clean. The majority of the marl seams are volcanogenic in origin, similar to the clays deposited on the mid-ocean ridge. During the period they were deposited the Atlantic was opening. A few fossils were found.

Some of us left at this point but the reminder to the group walked around the periphery of the quarry itself in order to see the Chalk section exposed and the solution pipes visible through approximately 50 m of chalk section, often following well defined marl seams that Haydon had talked about.

Fig 11 : Group at Kensworth Nature Reserve Site

Field trip to Derbyshire.
Thursday 19th September- Sunday 22nd September 2019

By Mike Lambert

Twenty Hertfordshire Geological Society members joined this excursion to the Peak District. Over three days, we would: visit tropical seafloors overwhelmed by volcanic lava; consider the course of converging continents; and venture underground to stand in the voids once occupied by vast mineral deposits.

For the purposes of this field-trip, we adopted a traditional sub-division of the Carboniferous into three

broad epochs: the Dinantian (early epoch of carbonate deposition); the Namurian (middle epoch of gritstones); and the Westphalian (late epoch of the coal measures).

Day 1 began at Ecton Hill, Staffordshire. Before visiting its copper mine, we went to see an impressive exposure of Dinantian rocks at nearby Apes Tor. This quarry face was mostly composed of muddy limestones and turbidites belonging to the Carboniferous Limestone Supergroup. Of particular interest was the intensely folded and faulted nature of this section, with a wave-length of around 20m [Fig. 12].

Fig 12: Apes Tor Quarry, showing folds and faults from the Hercynian Orogeny [Photo Lesley Exton]

Peter Kennett of the Ecton Hill Field Studies Association (EHFSA) provided a simple but effective demonstration of how these structures had formed. Using a small perspex box filled with alternating layers of flour and gravy powder, he applied gentle, sideways pressure to its contents. As Peter continued to compress the layers, folds and faults began to appear, closely resembling those on the quarry face [Fig. 13].

In late-Palaeozoic times, the horizontal force was provided by the Hercynian Orogeny: during which Laurasia and Gondwana converged to form the supercontinent of Pangaea. However, as Haydon observed, there was something very atypical about these folds at Apes Tor. Across Europe and in southern Britain, Hercynian fold-belts are characterised by an east-west orientation; but here the axis of fold was broadly north-south.

Fig 13. Peter demonstrating how the structures had formed. [Photo: Lesley Exton]

Copper was extracted from Ecton for around 3,500 years: starting in the Bronze Age and continuing until 1891, when the mine was finally closed. Production peaked in the late 18th century, at a time when the mine was operated by the Dukes of Devonshire and it was the site of several important innovations in mining technology.

The group was split into two, half went down the mine while the other half conducted experiments, then they swopped over. Inside the mine, Peter pointed out further examples of how the rocks had been torn and contorted during the Hercynian Orogeny. Protruding from some of the faults were surfaces that had been deeply etched by the frictional force of opposing blocks. These slickensided surfaces were identifiable by their cheese-grater texture: being extremely rough when rubbed in the direction of displacement, but relatively smooth when rubbed the opposite way. In another part of the tunnel wall, Peter stopped to show us a fine example of a thrust fault with a displacement of around 45 cm.

Later in their history, such faults and areas of structural weakness were exploited by hydrothermal currents. As hot, pressurised, acidic waters forced their way upwards, they encountered the alkalinity of the limestone and their rich mineral content was precipitated. Before such geological processes were understood, early miners knew the best ore could often be found by following the steeper strata upwards towards what they called "saddles" and which we would now describe as anticlines.

The primary metallic ores deposited at Ecton were chalcopyrite (copper iron sulphide) and galena (lead sulphide). These then gave rise to a series of secondary minerals. At one spot in the mine, everyone directed the lamps on their helmets onto a section of wall lined with green malachite and blue azurite. These copper carbonate minerals were formed above the water table, as chalcopyrite reacted with the surrounding limestone and calcite

At another point, we stopped to examine some thin bands of volcanic ash within the limestone. It was a reminder that the early Carboniferous wasn't only a period of sedimentation. However, Peter warned against the easy assumption that these volcanics might be linked to the mineralisation. A deep-seated, magmatic source has never been identified. Furthermore, the chemical profile of this Dinantian ash doesn't correspond to the suite of minerals that typify the Peak District.

In the afternoon, we walked part of the Monsal Dale trail to visit the type section of the Upper Miller's Dale Lavas. Starting from the station at Miller's Dale, we headed south, following the former railway line towards Bakewell. Along the way, we passed through several cuttings that exposed the Monsal Dale Limestone. This is slightly older than the Ecton Limestone and, having no chert and few marl seams, has a far more uniform appearance. It also lacks fossils, aside from the occasional, large productid brachiopod.

Arriving at Litton Mill, the carbonate sequence was suddenly interrupted by rocks of an obviously igneous origin. Any idea that these might be sills intruded into the limestone was quickly dispelled as we examined the rounded masses of basalt [Fig. 14]. These were clearly pillow lavas – similar to those forming in modern-day Hawaii – that had been extruded from volcanic vents either on the seabed or close to shore. Their gently rounded contours captured a moment in Carboniferous time, as they'd rapidly cooled on an equatorial seafloor, around 330 million years ago.

Fig 14: Pillow lavas at Litton Mill. [Photo: Lesley Exton]

Day 2 involved an exploration of the carbonate platform above Castleton. Our leader for the day was Lucy Manifold, who has recently completed a PhD thesis comparing carbonate sedimentology on the Derbyshire and North Wales Platforms.

In early Carboniferous times, central Britain lay close to the equator and beneath a tropical sea, bounded to the north by the Caledonian Massif and to the south by the Wales-London-Brabant Massif. Within this tropical, marine basin there were some areas of seafloor considerably higher than the rest, which provided the necessary conditions for carbonate precipitation. More precisely, these shallower areas existed above the Carbonate Compensation Depth, at which calcium carbonate re-dissolves into water. Thus, over time, these sections of seafloor slowly grew towards the water's surface and the light, supporting a rich ecosystem of corals, crinoids and molluscs, whose shells and skeletons further augmented the platform. Today, similar, steep-sided and flat-topped, carbonate platforms occur in the Yorkshire Dales, the Lake District and North Wales.

The morning began with a steep climb from Castleton, up Cave Dale, towards the top of the Derbyshire Platform. As we transected the platform margin, Lucy pointed out several mounded and massive (unbedded) structures within the limestone. These, she explained, were some of the reef-mounds/debrites – composed of small corals, bryozoans, crinoids and brachiopods – that fringe the platform's perimeter. Higher up, we saw further evidence of the platform's volcanic past, in a small outcrop of basalt that showed columnar jointing.

Reaching the platform's top, we enjoyed a more level path towards the quarry at Dirtlow Rake. This opencast mine follows the line of a horizontal fault, which has been worked for lead for the past 300-400 years. Inside the quarry, Lucy passed round a rock containing intricate bands of calcite, barytes and galena: showing how different minerals had been precipitated over time, according to fluctuations in heat, pressure and the chemical content of hydrothermal currents.

At Ecton, we'd been warned off the easy assumption that early Carboniferous vulcanism had generated the hydrothermal mineralisation. So, how were these minerals deposited? Haydon explained that current thinking points to Mesothermic (moderate depth) processes involving the mineral-rich shales that gathered in deep troughs beyond the platform's edge. Over time, these shales were buried to a depth of 3-4 km, where they experienced intense pressure and temperatures of around 150-160 °C. Under such conditions, the water content of the shales was squeezed out and forced sideways, until it found an escape route, up through the porous, fractured rocks of the carbonate platform, where its minerals were precipitated.

For day 3, we headed west and leapt forward in time, to visit the gritstones of the upper Namurian. These gritstones are composed of clastic debris, mostly eroded off a mountainous, Caledonian landmass that once stood to the north.

Our first stop was at The Roaches: an elevated outcrop of coarse gritstone whose cross-bedding reveals its deltaic origins [Fig. 15]. From this high ground, Haydon pointed out how we were on the western arm of a classic, V-shaped, synclinal ridge. Opposite us, on the eastern arm of the V, stood a corresponding outcrop of the same Roaches Grit, known as the Ramshaw Rocks.

Looking north from The Roaches, along the Goyt Trough (syncline), we could see younger gritstones (such as the Chatsworth Grit and the Rough Rock) standing proud of the softer, intervening claystones. These alternating areas of gritstone and claystone correspond to fluctuating sealevels during the Namurian: with the finer sediments having been deposited at times when the region was further from shore. We also noted how this Hercynian syncline has an atypical, north-south axis of fold, similar to that at Apes Tor.

Fig. 15: The Roaches

Our next two stops were to visit the younger, Namurian gritstone ridges that we'd seen from The Roaches. At Congleton Edge, we stood on Chatsworth Grit: close to where the northeast-southwest trending Red Rock Fault divides the Carboniferous from the Triassic of the Cheshire Plain. At Mow Cop Castle [Fig. 16], we saw an exposure of the Rough Rock: although, here the situation was complicated by subsequent faulting and folding, which had incorporated older Namurian rocks into the section.

All morning, we'd been observing Hercynian folds and faults with an atypical, north-south or northeast-southwest orientation. Haydon suggested that this phenomenon was most probably a result of the Hercynian Orogeny meeting resistance from the still potent Caledonian Massif to the northwest. Thus, the Hercynian movement had been deflected and crumpled, producing a region in which the axis of fold deviates from the norm.

Our final destination was the National Trust gardens at Biddulph Grange. We were there to see its remarkable Geological Gallery, created by James Bateman between 1856 and 1862. Bateman was a devout, fundamentalist Christian and preacher; but he was also keenly interested in the new explanations being offered by Geology. The Geological Gallery was his attempt to reconcile these two very different versions of the past: with each day of God's creation being represented by rocks and fossils from a distinct era in the geological record. Thus, Day One of the Genesis story is illustrated by rocks from the azoic, Pre-Cambrian era; through to Day Six, which shows the emergence of mammals and hominids during the Tertiary [Fig. 17].

Thanks for this wonderful field-trip go to: Haydon Bailey for the immense task of planning it all and for being our leader on days 1 and 3; Lucy Manifold for her insights into carbonate platforms and for being our leader on day 2; and Peter Kennett and Tim Colman (of the EHFSA) for enormously adding to our enjoyment and understanding of the Ecton Mines.

Fig 16: Group in front of Mop Top Castle [Photo: Frank Ogilvie]

Fig 17: The Geological Gallery at Biddulfh Grange, showing Day Five of creation and fossils from the Jurassic. The replica of an Ichthyosaur was produced with help from the Curry Fund. [Photo: Lesley Exton]

Hertfordshire RIGS Group update

By Lesley Exton

As well as the annual clear up of the Little Heath site, just outside Berkhamsted in February (see see write-up and Figs. 2 & 3) Hertfordshire Geological Society also cleared some of the vegetation at Hill End, Hitch Wood in June (see write-up and Figs. 4 & 5).

The management plans agreed last year by North Herts District Council and Hertfordshire County Council Countryside Management Service for two chalk pit sites, at Hitch Wood and at Barkway have been implemented. A small JCB, parted funded by the GA was taken into both sites in February to clear the faces and the council's volunteers have been in to clear the vegetation from the sites. Hertfordshire Geological Society also went into Hill End to clear the vegetation and expose more of the face. Hertfordshire RIGS Group is has been closely involved in the development of explanation boards for both sites.

Chairman's concluding remarks

By Haydon Bailey

Looking back I can only say that 2019 was a big and active year for Hertfordshire Geological Society, so thank you for all your help and support during the year. It's great to see so many familiar faces turning up regularly to our lecture meetings and it's also nice to be able to greet the steady stream of guests we have at our lectures too. Everyone is always very welcome.

It's difficult to select highlights from the year, but the Geological Treasure Hunt in May has to be one of them; thanks to Mike for his organisation – right down to the afternoon teas. I suspect that a considerable amount of fossil fuel was exhausted that day as we criss-crossed the county looking for gravestones and fonts, for those who didn't simply just make up the answers!

Our geoconservation efforts have also seen increased rewards over the year. Little Heath proved an ever popular location to burn off some Christmas calories in February, by stripping out last year's dead and dying vegetation. Thanks Clive for looking after this one. We also added the Hitch Wood chalk pit to our restoration sites.

This site holds a particular resonance for me, as John Catt and I had tried for numerous years to get the Hertfordshire & Middlesex Wildlife Trust to take some action over this historic fossiliferous location, to no avail. Then the Herts County Countryside Management Service contacted us as they were now managing the site on behalf of North Herts District Council. They wanted to know if we would help and the results speak for themselves. The GA Curry Fund paid for a small excavator to go on site in March and re-expose the important Hitch Wood Hardground. This was followed in mid-June by a scrub clearance ''party'' resulting in the clearest the site has been for several decades. Congratulations to all involved – it was a job well done. The information boards are now in the final stages of construction and should be in place by the year end with a solid geological section included on them and full acknowledgements for our input.

July saw our summer ‘‘event’’ come to fruition when we held the John Catt Symposium at the University of Hertfordshire Bayfordbury campus. We had a total of twelve excellent presentations ranging from the deep geology under Hertfordshire (thanks Janet) through to the distribution of soils across the county. I think John Catt would have loved to have been there and it was great to have Diana Catt in attendance all day. Thanks go to all the speakers who were so keen to be involved and to everyone who was involved in the organisation of the day, including our colleagues from East Hertfordshire Geology Club, the Bedfordshire Geology Group and the Hertfordshire Natural History Society.

It was tricky to follow this, but we certainly did when we ventured into the Peak District for our annual long weekend away. We ventured underground at Ecton Copper Mine and trekked down Millars Dale to see the lavas on the Friday and then followed this on the Saturday with a stunning hike around Castleton, visiting Cave Dale, Dirtlow Rake and Pin Dale Quarry under the able guidance of Lucy Manifold. Sunday’s weather wasn’t quite so benevolent, but it still allowed us to visit the Roaches, Congleton Edge and Mow Cop for the views and Biddulph Grange for the unique Geological Gallery originally opened to the public in 1862 by John Bateman. It is now approaching full restoration by the National Trust with financial assistance from the GA Curry Fund.

Add all these events, and more, to the stunning lecture series we’ve enjoyed, then I think we can wrap 2019 as being a ‘‘good year’’. Roll on 2020 as I’m sure that this will be as good!

Fig 18: President & Chairman at the Hertfordshire Geological Society stall at the GA Festival [Photo: Lesley Exton]