Occasional Erratics

Newsletter of the

MEDWAY FOSSIL AND MINERAL SOCIETY

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The editor of this edition of the MFMS Newsletter was Nick Baker

Cover picture

The old chalk pits, Blue Bell Hill. June 2013

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Editor's Notes

Nick Baker

Back in the spring I decided to issue a challenge. I would make it my task to produce the first edition of *Nick's Geological Journal.* Your task would be to see that this did not happen. I'm not sure at what stage, in terms of content, one could say which task had succeeded. I could assume that I had won only if I could claim 100% of the content. As that has not happened, I must congratulate the membership for another production of *Occasional Erratics*. I had set a target of c20 pages, hoping that would not be too ambitious, especially just six months after the first edition. That is still less than David's production of 30+ pages of *Flint and Fossil*, but this is twice yearly.

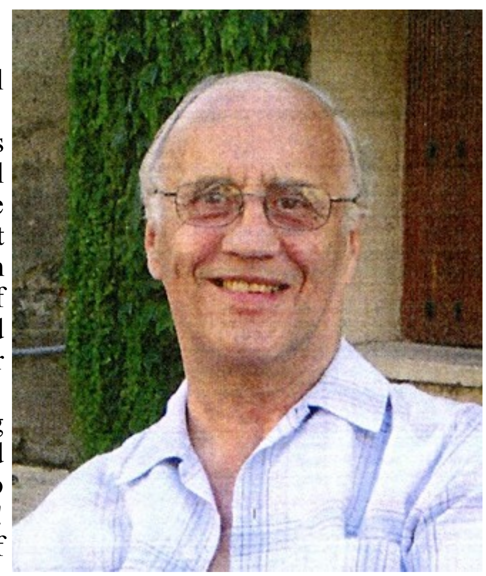
I was just loading this letter's frontispiece into place when it occurred to me that not everybody would find a picture of an old chalk pit in any way beautiful. Now, when to comes to a working pit I might agree. And it does come down to the rock type involved. Some weather gracefully and some not. Some go into retirement and mature like fine wine and some like Bree! Whether it is sand, clay, granite, or chalk, these sites will have differing modes of returning to nature. That has happened quite a lot in the past, less so now under the pressure of landfill or new developments. The pits at Blue Bell Hill, especially those higher up the slope, have been undisturbed for over a century, unlike Culand, which was used for stock car racing and as a firing range—but not at the same time!

The flora and fauna of a disused pit can be quite different to the surrounding countryside. Firstly, the exposed country rock may support a different flora to the soil and superficial deposits outside the pit. The sheltered nature of the pit can lead to climatic differences—hotter by day, but colder air trapped in the pit by night. Some deep pits may not see the sun between November and March—a factor not always accounted when considering such sites for housing developments.

All land is under pressure, now more than ever, to realise an economic value. I mentioned landfill and housing, but it is either or and not both. A landfill site cannot be built on, due to lack of compaction, but also due to the decay of the landfill and the possible questions of toxicity. Large areas around Greenhithe are now waste ground due to earlier landfill. But the Blue Bell Hill pits do not lend themselves easily to development. There has to be good access. Culand has possibilities. The tramway cutting could become a road, given that the tunnel would have to be widened, but the latter is already a habitat for protected species, such as bats. The higher pits do not have good access and their value as nature reserves is high. This leads to the question as to whether a true nature reserve should be managed at all. That could certainly be the case of such sites as Bores Hole, Cuxton, or White Pit and Lees Pits at Upper Halling. All these places provide rare habitats. So, yes, I think the Blue Bell Hill pits (and others) do have a claim as sites of natural beauty.

So, I have quite a good collection of items this time, and I've even provided a contents page. My thanks to all those who have made this precious moment possible. But, first, I must begin on a sad note

Obituary.
William Victor Marshall (Bill) 1935-2014



Firstly, we had very few photos of Bill. The one on the right is copied from a small original, but as a portrait it is Bill at his very best—which was often!

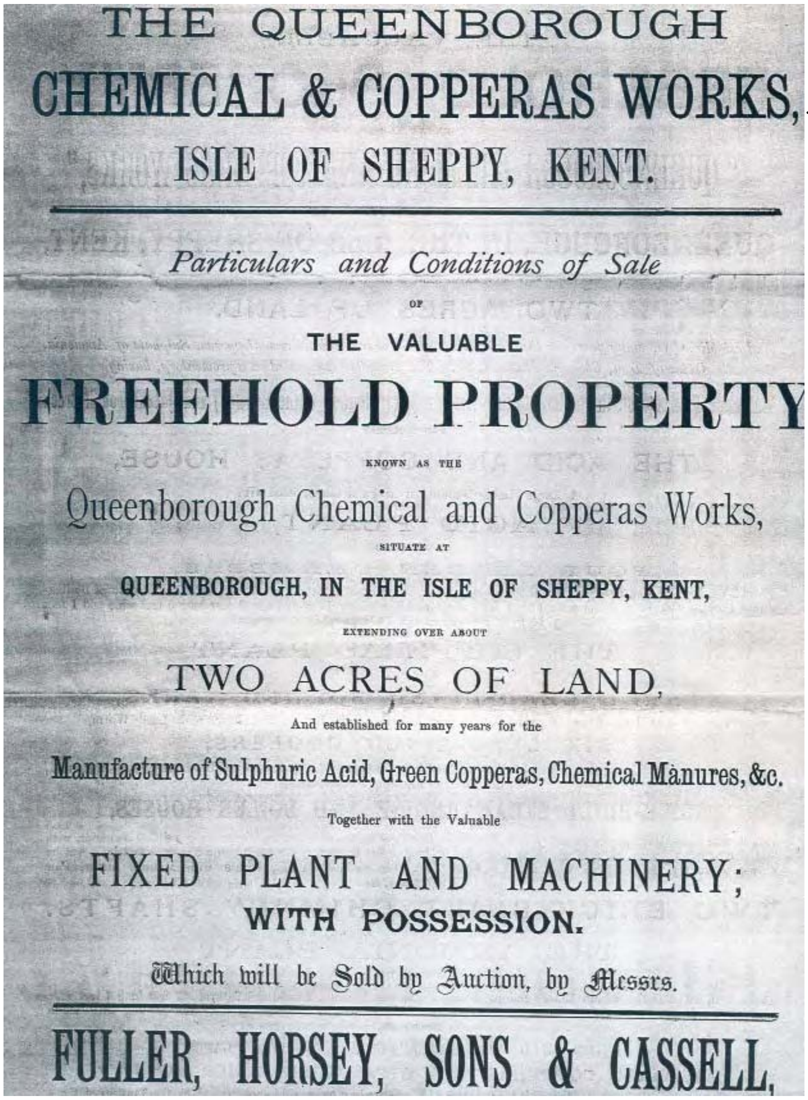
When Bill passed away in early March, it came as a shock, although perhaps less so, in so far that Bill had been very ill for some time—very few of his final meetings with us were without his oxygen bottle. Bill had been a member of the Medway Fossil and Mineral Society for quite a few years—and also of the Kent Geologists' Group, where I first met him. Bill was a much-liked member of both organisations, always with a large smile and helping hand. He was a member of the MFMS committee and always had something to add at the meetings. He helped and organised several raffles throughout the year to help with group funds. For several years his was the venue for the summer social.

I was given a list of Bill's likes and dislikes, which gives us an interesting picture. His dislikes appear to be few, relative to the likes. His dislike of baked beans and pilchards in tomato sauce (together?) comes from scout camps. Also Brussels sprouts, speed cameras, Computers, Sat Nav, cushions, however pretty! His likes show him to be a very gregarious man. Some of us have made a study of "loner". Bill never enrolled on the course. Probably never knew it existed! So, yes, happily married for 52 years, loved family and friends, scalding hot coffee, ice-cold coke and pizza (presumably not ice-cold?), reading with the children at Mierscourt School, watching rugby and grand prix with "the boys". Of his interest in geology, he always said he 'knew nothing about it'. Not quite true in his case, but it can be a good thing for the practitioner of the science to assume!

The trouble with Pyrite

By Fred Clouter

On Wednesday the 26th April 1882 the Queenborough Chemical and Copperas Works were auctioned off, heralding the demise of the copperas industry on the Isle of Sheppey. Green copperas was used to make sulphuric acid or vitriol, chemical manures and dye stuffs.



THE QUEENBOROUGH
CHEMICAL & COPPERAS WORKS,
ISLE OF SHEPPY, KENT.

Particulars and Conditions of Sale
OF
THE VALUABLE
FREEHOLD PROPERTY
KNOWN AS THE
Queenborough Chemical and Copperas Works,
SITUATE AT
QUEENBOROUGH, IN THE ISLE OF SHEPPY, KENT,
EXTENDING OVER ABOUT
TWO ACRES OF LAND,
And established for many years for the
Manufacture of Sulphuric Acid, Green Copperas, Chemical Manures, &c.
Together with the Valuable
FIXED PLANT AND MACHINERY;
WITH POSSESSION.
Which will be Sold by Auction, by Messrs.
FULLER, HORSEY, SONS & CASSELL,

'Being in Queenborough Castle in the year 1579 I found there one Mathias Falconer, A Brabander, who did in a furnace that he had erected there, trie to drawe very goode brimstone and copperas oute of a certain stone that is gathered in great plenty upon the shoure near untoe Minster on the isle'
This extract is from 'Lambard's Perambulations of Kent' and is probably the earliest known reference to a 'chemical' factory in Britain.

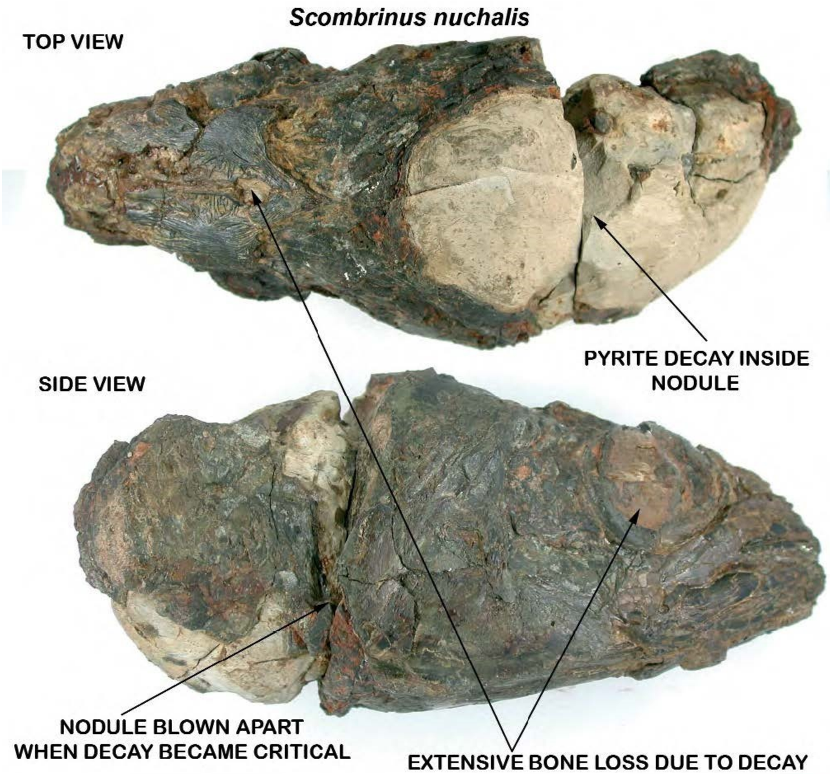
The first reference that I have that links copperas with the collection of fossils is found in the 'Life and letters of Edward Lhwyd (second Keeper of the MUSEUM ASHMOLEANUM) Oxford March 28th. 1695'. Below is an excerpt from 'A Museum of the Early seventeenth Century'
By Cyril Edward Nowill Bromhead, BA, FGS, FRGS. (Read 18Th. June, 1947) referring to the Lhwyd letter

(If you could setle a correspondent in the Isle of Shepey to save us all the Crampstones the copras-women pick up for a month or two, I would now fall about a Lithologia Britannica: and so contrive it that the first tome shall consist of onely teeth and bones of fish.)

(Shark teeth were called cramp stones as they were ground up and used as a remedy for stomach complaints)

Copperas as you will no doubt have gathered is just another word for pyrite (iron disulphide, FeS_2). The form found on Sheppey is marcasite (iron disulphide, FeS_2) and is dull green in colour when fresh, quickly deteriorating to a rusty brown when exposed on the beach for some time. Chemically identical, pyrite and marcasite are very different in behaviour. The normal gold coloured pyrite has dense molecules and tends to be more stable than the more open molecules of the marcasite stones. Fossils preserved either as pyrite casts, or containing pyrite within bone are prone to pyrite decay. Many different methods have been tried by collectors to preserve pyrite specimens over the years, all with very little long term success.

There is nothing more depressing to the fossil collector, or the museum curator who, when inspecting prized or unique specimens finds a little heap of whitish dust, an eroded data label and a discoloured box; even wooden cabinets can be severely damaged. It may be a few months, or a few years of exposure to the air, but the inevitable decomposition will take place. The chief oxidisation products are sulphuric acid and various hydrated sulphates, mainly iron. The acid will also destroy associated shell and bone material. It is now generally accepted that the decaying process is caused by a form of oxidisation and is triggered by exposure to humidity in the atmosphere. It seems that the fossils absorb moisture from the air which reacts with the pyrite and the air. In tests under humid conditions the reactions can be catastrophic. However if the water vapour is removed the reactions are slowed down and can eventually stop. The more compact forms of pyrite do not absorb moisture so readily and may only evidence decay by surface tarnishing. Various methods have been tried over the years, both by museums and individuals to stop the decay. Most have been unsuccessful. I do not believe that there is a method that can guarantee complete success but I do think that with effort the process can be slowed down. In the following paragraphs I shall attempt to describe some of the methods that I have tried with varying degrees of success



Before treatment it is important to thoroughly wash all contaminants such as clay and salts from the specimen. Salt is taken up by the specimen if it has been washed over by the tide. Wash the specimen with clean water, some wash their specimens with boiled or distilled water, but this is purely personal choice. Change the water every day. The specimen should then be dried, but do not dry the specimen artificially as this can damage fragile specimens. Have a plentiful supply of self seal plastic wallets, or plastic jewellery boxes of various sizes. It is very important that specimens are kept separate. One decaying specimen will infect others if in contact. Store your specimens in a dry atmosphere, damp outbuildings or sheds are totally unsuitable.

The chemicals used by museums are not discussed here because I don't know how to use them. If interested it is claimed that the use of Ethanolamine Thioglycollate has had some success treating decaying pyritised fossils. It is also claimed to be effective as a reagent for the removal of pyrite oxidisation products. I have not had access to this chemical so cannot comment.

Pyrite accumulations on the beach near to Barrows Brook, Isle of Sheppey, North Kent

When I first began collecting on Sheppey I avoided pyrite fossils, only collecting the larger phosphatic and calcareous ones. I then discovered Folkestone and the beautifully preserved but pyritic ammonites to be found there. Preservation became a real issue as some of the older beach collected specimens had been washed over by the sea. Because the pyrite is porous, salts had been deposited at a molecular level within the specimen. This is why washing thoroughly is so important. If the nacreous shell of the specimen is still present, the problem is, how to A, preserve the shell, and B, treat the pyrite.

Method 1. For Gault ammonites only

The shell looks fabulous when wet, but always appears whitish and powdery when dry, often falling away from the internal cast. The Folkestone ammonites need to be washed very carefully with a soft brush under softly running water to remove any remaining clay. When dry coat the shell, one side at a time with 'Sally Hanson' 'Hard as Nails' varnish. This is reinforced with nylon which helps to stabilise the shell. Allow to dry and then place the specimen in a bowl of liquid paraffin. Almost by magic over a day or two, the shell will be transformed from a creamy white to a beautiful iridescent pearly colour caused by the paraffin contained by the nylon. I have many excellent specimens up to 15 years old which show no signs of deterioration. This method works only to enhance the nacreous shell and is not useful for preserving other fossils.

Method 2. This method is more generally useful and can be used for fossils from Sheppey or Folkestone and I would expect fossils from other locations. This is my 'Heath Robinson' method, which I have been using since 1995 with mixed success. It has proved very useful for most types of pyrite fossils, but not the little seeds and carbonaceous fossils from Sheppey. (I will explain why a little further on.) My reasoning was very simple, keep the moisture away from the fossils and try to treat it at a molecular level. I searched around for a substance which could do this. I came across 'Ronseal wet rot wood hardener', a gooey resinous liquid which was thinned with acetone. Very simply, after washing, the specimens were immersed in a 20% solution which soaked through the fossil. If possible a vacuum environment will drive the liquid further in to the specimen however I didn't have one so they just stayed soaking for about a week. If the specimen came out of the solution and appeared shiny the solution was to strong so the whole process was repeated with a weaker solution. Hit and miss you might think, but not one of my little bivalves or gastropods from Sheppey have decayed in more than ten years. If used on Folkestone ammonites the shell is hardened, but the colour stays a more natural tone than the preceding method.

The woody seeds and twigs from Sheppey are very difficult to preserve. They are a mixture of carbonaceous material and pyrite and when drying the woody material shrinks while the pyrite stays the same. Consequentially the woody material flakes off as soon as drying begins. I have never successfully maintained the stability of these fossils using these methods. The Nippa palm fruit is notoriously prone to decay. I have managed to delay decay up to a couple of years by soaking the Nippa in the Ronseal liquid while it is still wet. The resins that it is made from tend to repel moisture and the acetone evaporates very quickly. When set, immediately immerse in a fairly strong solution of PVA which dries to give a flexible coating helping to stabilise the carbonaceous material. I think that making a mould and casting in acrylic resin to make a replica is the best way of keeping a reference to the seeds and woody fossils. The important thing is to keep your pyrite fossils dry, below 50% humidity. Tiny seeds can be kept in sealed containers with silica gel. As long as the silica is changed before it gets too damp the fossils may survive longer.

Nipa husk suffering from pyrite decay

Method 3 This method is essentially the same in principle as method 2 except that Paraloid is used in place of the Ronseal. Paraloid comes in the form of little plastic granules which are soluble in acetone. It can be mixed as a thin solution or as thick glue. It is clear when dry. Fossils can be immersed in the same way as with the Ronseal and it will coat the fossils at a molecular level if thin enough. It will take a little trial and error to get the consistency right. I am told that the NHM uses Paraloid in their conservation department. It is useful for many conservation purposes beside the treatment of pyrite.

(Both the above treatments are reversible by soaking in neat acetone. PVA is not suitable for use in the treatment of pyrite. Commercial products may contain other chemicals which may be harmful to the fossil.)

What to do if your specimen begins to show signs of decay

If you catch it early enough it may be possible to arrest the deterioration. The white powdery substance is very acidic and will need to be neutralised. Some rather odd techniques have been recommended in the past which involved using various disinfectants reputedly destroying the 'bacteria' and so preventing decay. I have never tested these methods so cannot say how effective they are. The method that I use involves using a strong solution of Ammonia, a very dangerous liquid so it is only recommended if you are experienced using chemicals of this kind. The idea is not a new one and I am sure that more modern techniques are less dangerous and probably more effective but I don't have access to these more scientific methods. Simply put, the ammonia converts Ferrous Sulphides to Ferrous Oxides (rust) which is much less harmful to the specimen. It does not help if the specimen is too far gone; it will most likely end up as a small heap in the jar. The specimen must be exposed to an atmosphere of 80% ammonia for several days. Do not under any circumstances immerse the specimen in the ammonia solution. The specimen must be exposed only to the fumes. The specimen will eventually turn a warm rust colour. This is not ideal, but is much better than losing the specimen. Then treat the specimen in one of the methods outlined in the previous paragraphs. Remember to isolate your pyrite fossils in either sealable plastic wallets or in individual plastic boxes.

Brychetus meulleri successfully treated for pyrite decay using the ammonia vapour technique

It is of the utmost importance that the ammonia chamber is sealed; otherwise the ammonia atmosphere will dilute in the air and be ineffective. For very small specimens I use a coffee jar with a glass lid which has a plastic seal, easily acquired from any supermarket and is ideal for the job. A small glass phial containing the ammonia is placed with the specimen and left for a few days. For larger specimens like fish skulls with pyrite within the bone structure I have used a bell jar sealed with petroleum jelly and for very large specimens a square plastic storage bin placed on glass and again sealed with petroleum jelly. The latter, a very large fish skull (Brychetus meulleri) 30cm by 35cm needed to be exposed to the ammonia for over two months but has remained stable since the treatment was completed five years ago.

I am not a conservator or a scientist so the more technical papers that I have read to do with Pyrite conservation have only been partially understood by me. However I have had some measure of success, fingers crossed, not losing any of my specimens except for some of the more woody and seed material to the dreaded disease since I began collecting in 1995. If you are advised by the well meaning to embed your specimen in clear casting resin, or to brush your specimens with hot clear candle wax or paraffin wax as has been suggested to me in the past, don't pay any attention to them, they won't work. The only sure ways to record for posterity your unique or important specimen is to either make a cast of it or to photograph it so that if the worst does happen as it is more than probable that it will, evidence of the specimen will not be lost for future generations.

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http://www.discoveret.org/kgms/feb-01/feb01-8.htm
Fossil preparation and conservation -
http://www.flmnh.ufl.edu/natsci/vertpaleo/resources/prep.htm
http://www.mineralogie.uni-wuerzburg.de/palbot/tools/preparation.html
Paraloid supplies -
http://www.conservation-by-design.co.uk/sundries/sundries20.html
http://www.archivalaids.co.uk/smx/products/paraloid/
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Exploits in Snowdonia

Anne Padfield

As part of my geology degree I had to carry out geological mapping and write a dissertation on a project area. It was suggested that I go to the Moelwyn Mountains at Tanygrisiau, near Blaenau Ffestiniog, North Wales. I had to write a risk assessment before I saw the site and assumed it would be mountainous, as the name suggested. I classed it as medium to high risk for falling from heights, rocks falling on me from above, being alone in a deserted place and falling down a hole, as it's a mining locality. My supervisor assured me it was a low risk site, so I decided to take it on.

I arrived at the location and my jaw fell open! Stood before me were several 3000 footers with sheer huge cliffs and a steep assent, covered in giant outcrops and boulders. Low risk? You've got to be joking! I re-wrote my risk assessment, and set to work to map the one square mile of mountainous terrain.

The trouble with mapping is that you need to keep walking along the same path every day, to get to the last place you mapped; and it got further and further away each time. Each time I set out I had to climb up the steep hill, so consequently I got fitter and fitter. But it was jolly hard work at first. As I anticipated the mountains were treacherous in places and much of the time I was quite alone. People mostly appeared at weekends and only ventured a short way along the better used paths, so when I was way off the beaten track I rarely saw a living soul, except for the odd animal or bird. When I did meet people, I must have presented a strange and fearsome sight with my 4lb sledge hammer and large cold chisel in each hand. If I was unfortunate enough to be injured, my cell phone didn't work in the mountains and I arranged to phone my land lady every day after descending the hill, to ensure she didn't notify the rescue services.

Nearly every morning I looked over at the gloomy hills from my digs, which were often bathed in sunshine, to see the rain and fog shrouding the site; and my heart sank. I would have to don the wet weather gear yet again. Mapping in the rain meant writing and drawing with the paperwork and my hand, inside a large plastic bag, in order to avoid reducing both map and notebook to pulp. With the addition of strong winds this wasn't an easy task. To avoid getting soaking wet feet, when walking through peat bogs, plastic carrier bags were worn over the socks. However, it didn't stop the water going over the tops of your boots, when you sank your feet into bogs that came up to your knees.

Many of the bogs and mountain pools were home to thousands of tiny froglets and tadpoles. I also once saw an adder slither away over a grassy rock ledge. There must have been fish in one of the three lakes, as I saw the odd angler. The other two lakes were utilised by the Hydro-electric Power Company at the site. Water was pumped up from the bottom lake during the night when electricity is cheap to produce, into the top lake and allowed to flow back down, to drive the hydro-electric turbines, during the day, when electricity commands a much higher price. The top lake is situated in a natural ice-formed corrie, which is partially dammed on the lowest side by an interesting geological formation, notably an igneous intrusive rhyolite sill. The gap in the sill, carved by the corrie ice, during the ice age, has been blocked with a substantial concrete dam. Pipes direct the water to the bottom lake, where the power station is situated. These are the only freshwater lakes I

know that have 'low and high water'. I had to make use of this phenomenon to map the rocks at 'low tide'.

The water in the bottom lake is confined by a fairly large impermeable granite intrusion called 'The Tanygrisiau Granite. This was easy to map as it was covered with heather and bracken, plants that likes the acidic conditions. This formation was traversed in a railway cutting by the delightful Blaenau Ffestiniog narrow gauge railway. The ride from the mountains to Porthmadog travels through beautiful scenery and the destination is an enjoyable 'day out'.

The third (fishing) lake was in a picturesque valley that came into view after climbing an inclined path, beside a stream with attractive water-falls, cascading over roche moutonees. These latter, are rocks that have been worn smooth by slowly moving glacier ice into shapes similar to 'sleeping sheep'. Once this valley opened up, a large ice smoothed, rock formation was viewed on one side. This formation had a fan shape and after examination was found to be an ignimbrite. This is the 'welded tuff' that results from a pyroclastic flow or nuee ardente. The sediments that the sill and ignimbrite have invaded are Ordovician siltstones and sandstones, with volcanic ashes, that in many areas of these mountains have been metamorphosed to slates by the mountain building episode that formed them (The Caledonian Orogeny). Subsequently, the area is riddled with slate mines, another significant hazard to add to my risk assessment. Where the siltstones and sandstones are in contact with the igneous intrusions they are contact metamorphosed to hornfels.

Working alone in the mountains for five weeks, with only the odd sheep or goat for company, can make you a bit lonely, so I was very pleased when my husband and our two dogs, visited for a few days and stayed with me in my very basic, humble cottage digs. It was a long drive from the cottage to the mountains, so Denis relieved me of this tedious task and I made the most of his company by climbing the higher rocks that I hadn't wished to map on my own. One day whilst on higher ground a dense fog descended and we could hardly see each other! Luckily I was able to use my compass and map to avoid falling over the sheer precipice I knew to be nearby.

The only two separate incidents that caused me a bit of 'grief', were temporarily losing my camouflage rucksack amongst the vegetation whilst exploring the rocks and another time stepping onto a grass tussock between two rocks, only to find it bridged a crevasse, into which my heal started to descend and I pulled a tendon when withdrawing my leg. Fortunately, this was short-lived and I was only hobbling for an hour or two. However, it has made me think more carefully about risk assessment in the work place and the things that can, and do happen. My initial thoughts on the risks in Snowdonia were pretty accurate, but it wouldn't have put me off and I wouldn't have missed doing the geological mapping for the world; but I might have found better digs.

(Edirtor's comment.
This reminds me of a visit to the Cader Idris area in August 1980. This was one of Chris Darmon's trips, although he was not the leader on that occasion. That position was filled by Graham Hall, who was warden of Kings youth Hostel, nr Cader Idris, and was quite an expert in the geology of Snowdonia. The weather was appalling. I kept a diary and each day was headed by 'rain commenced at…….' I think there was one rain-free day, with about an hour of sunshine. Transport, for some of us, was in Graham's landrover, which had mule-like qualities—no good on the flat, but could take a 30-degree slope quite well!)

Hermitage Quarry

Paul Wright

Back in September 2013, four members of the Society, led by Visit Coordinator Paul Wright, visited Hermitage Quarry near Barming. This was a prearranged visit with site owners Gallagher Aggregates Limited and as such, was the first visit by MFMS, and a visit that had a specific focus on fossils. Conditions on the ground were ideal and after the site brief by our excellent host Bill, and a cup of tea of course, we were taken to almost the lowest level in the quarry, to where some freshly blasted material was lying. A lot of material had already been removed by Gallaghers but what they had left was to be our pile! We were left to our own devices for over three hours and with all the necessary safety equipment and the very necessary hammers and chisels we began to inspect the rock.

The Lower Greensand strata, but more specifically the Hythe Beds and known locally as Kentish Ragstone, found within the Hermitage Quarry gave MFMS members the opportunity of collecting a different range of limestone fossils that complement those found in the chalk and the different clays that are regularly explored due to their extensive exposures around Kent. The Ragstone does not offer us the same opportunities to exploit like the chalk and clays because it is rarely exposed in the same way. Due to the geomorphology and land access we are effectively only left with quarry sites as our only chance of examining this rock.

Society members at Hermitage Quarry

Australoceras ammonite

The nature of fossil preservation in the Ragstone unfortunately means that it is pot luck as to what condition the exhumed fossil will be in, but you can be sure the best fossils will need a diamond saw to get them out. Ragstone is actually the hard grey limestone that occurs in bands 15-60cm thick which alternate with softer loose layers of material referred to a Hassock. Ragstone is named from the way ragged way in which it breaks and hence gives us a challenge.

The rock has long been sought after as a building material because of its attractive colouration, caused by weathering, and for its resilience to nature. Since this was one of the only a few hard rocks available to the early builders it has been heavily exploited and was very much used locally to its exposures. Later on it had wider recognition of its qualities and has been used in such notable structures as Westminster Abbey, The Tower of London, Dover Castle and Maidstone Prison! Only two quarries of some dozen originally are actively working the rock with an apparent increasing demand.

We had a very successful time in the quarry and took away many kilos of rock between us for which there was no charge! The range of fossil species found in the Ragstone is reasonably extensive and covers most of the groups; Echinoderma, Annelida, Brachiopoda, Bivalvia, Gastropoda, Nautiloidea, Ammonoidea, Arthropoda and various plant remains can all be found. We found something from nearly every group including; *Exogyra latissima,* a large bivalve similar to an oyster; *Gerville anceps,* another bivalve but elliptical and approximately 14cm in length; *Trigonia caudata*, a small bivalve with a ribbed shell; *Nautilus plicatu*s a nautiloid*, Cymatoceras* a large nautiloid; *Choloniceras* an Ammonite, *Australoceras* a large ammonite.

This was a very successful trip and another is planned for the summer this year.

The Ashdown/Wadhurst Junction at Pett and How to Locate It

Dave Talbot

The detail below may appear to be a bit of a preamble to the above discussion; however, I think it is necessary as an explanation of the immediate surroundings and the geography of the land.

Approaching Rye Town from the flats of Romney Marsh the historical town centre with its hilltop church can be easily seen. Heading into town the main road skirts around this hill, which, through gaps in the houses, sandstone rock can be seen; more of this later.

Leaving the town, toward Hastings, the land flattens out again with hills in the not too far distance. After a couple of miles the land ahead rises to another hill where the old town of Winchelsea stands. As with Rye the road skirts the hill and rises up around the outside of the town; another route would take us through and here a similar sandstone can also be seen amongst the houses of the town.

But before this a left turn guides us toward the sea and Winchelsea Beach where housing and holiday homes and caravan parks line the road. We are still heading to Hastings but are now on the back road, the scenic route, which will take us to our destination, Pett Level, see ***figure 1***.

Fig.1 – With its capping of modern sediments and trees the cliffs at Pett Level are over 25 metres high. These lower Cretaceous rocks comprise the Ashdown formation, with up to 10 metres of silty sands showing. Above these the Wadhurst Clay is nearly 15 metres thick with the Cliff End Sandstone a major part of it at 10 metres thickness.

In this view the ironstone appears as a dark line leading away from a series of small normal faults this end of the cliff; the ironstone is almost at the base of the cliffs. However, as we move along, the ironstone and therefore the junction rise up the face also.

Pett is at the western end of Winchelsea Beach with the road following the sea wall; the wall is to our left; one presumes it was built to prevent tidal highs flooding the low marshland on our right. However, this lowland is getting pinched out with higher ground swinging around towards us, again from the right, as we continue forward. As we enter the hamlet of Pett Level the hillock of Toot Rock is over to our right amongst the trees. I think one of the best views along here is the one we get as we near the end of the sea wall and the cliffs of the coastal section are seen. This is where we are headed.

Back in 1999 some of us here at the Society formed a small group to collect and collate Wealden rocks. We eventually had so much information it was decided to produce a CD-ROM of that; we called it ‘The Rock Types and Geology of the Lower Cretaceous Wealden District, see **figure 2**. In doing this grants were sought and awarded such that we could purchase maps and memoirs, even ones out of print, of the Wealden Area, from the BGS along with other equipment and goods.

Having the maps allowed us to locate various sites for specific rocks for sampling, providing they had not been closed, land -filled or built on. One of those maps was for Hastings and Dungeness Map 320/321 along with the Memoir and included reports on the cliffs here at Pett. Another map we can get also from BGS is the map of Hastings – Rye, a ‘Classical Area of British Geology’. With the memoir for the area much information on the rocks, fossils and minerals can be found.

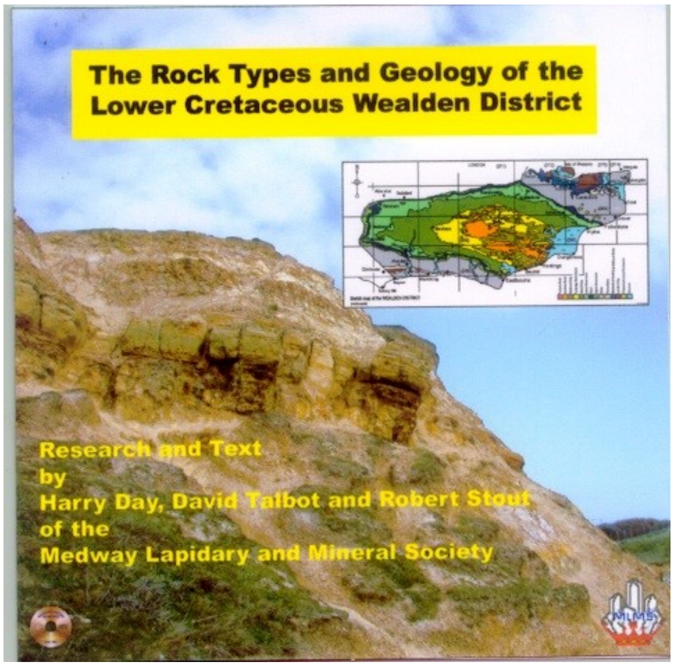

Fig.2 – Cover sleeve of CD-ROM case.

Maps and memoirs are published by the BGS and as amateurs, ourselves, and of course professionals also, these maps are the guides we use to give ourselves a start with the area we are about to visit. The authors of this memoir described the cliffs from here to Hastings and beyond in several sections and for certain cliff sections. These are well described with info on sediments, faulting, and formations; to a point.

At Cliff End there are a series of normal faults where, to the right, the Cliff End Sandstone is down to beach level. To the left, where there is little or no movement, the top of the Ashdown Formation can be seen; here we have the junction of the Ashdown and Wadhurst Clay formations. Between these two formations are the ‘Passage Beds’ of P. Allen, or what I call ‘transition beds’, the base of which is the Top Ashdown Pebble Bed, again named by Allen, c.1954. To the top of these transition beds is a layer of sideritic clay-ironstone about 120mm thick; this clay- ironstone was an important source of iron for the Wealden Iron Industry in the 18th/19th centuries, see **figure 3**; above these the previously mentioned Cliff End Sandstone at 10 metres in height. The next few metres include the Cliff End Bone Bed and various clays and silts of the Wadhurst ClayFormation. The section here is described by the BGS

The Top Ashdown Pebble Bed, unfortunately, is not clear here, as it states in the memoir. But these transition sediments are about one metre thick and the whole section is well described by the authors of the memoir, from the bottom of the section at the top of the Ashdown, to the top of it in the Wadhurst Clay. It means that by just resorting to the use of a tape measure the base of the Wadhurst can be found, all be it somewhat tentatively; the **clay-ironstone** though is the key. This lies about one metre up from the TAPB with thin shale, clay and sandstone between these two.

As we leave here and head along the cliffs toward Fairlight the cliff section is not so well described and gives some of my friend’s problems with locating this junction.

Fig.3 – Sideritic clay-ironstone is up to 120mm thick and can be found in these rocks Weald-wide.

Fig.4 – Note gentle anticlinal flexure in sedimentary layers as beds rise from the right-hand side.

Fig.5 – The head of the figure at the base of the cliff is level with the base of the 'Pale Band'; about 2 metres below the top of the Ashdown.

When the tide is out, we can only get along here when that is so, and if we walk out away from the cliffs, say 75 to 100 yards or so and look back to them, the variable shades of the strata as we look from right to left, show a distinct curve in them called an 'anticlinal flexure' by the BGS; this is more noticeable to the right than the left, the curve is more pronounced, see **figure 4**. It means that strata to the right fall to the beach as we return to Cliff End – layers become buried. It also means the beds above these buried beds get higher up the cliff the further we walk away from Cliff End due to the same strata coming out of the beach and gradually climbing upwards. By the time we have walked halfway along though the curve straight-tens out somewhat and remains about halfway up the cliff, with just a gentle fall toward Haddock's.

Of course because of its dark colouring the clay-ironstone is the one to notice here, where it is at beach level, well almost, at Cliff End, it is easily picked out as a dark line climbing up and away toward Fairlight and therefore taking the Ashdown to Wadhurst Clay junction with it, see **figure 5**.

So, having looked at the memoir for the cliff des-cription, and the position of the clay-ironstone where it lies in the base of the Wadhurst Clay, we can now start walking westward. First, note that the CES is directly above the ironstone, it is up to 10 metres thick so cannot be missed. A sandstone body in the Wadhurst Clay I hear you say. Yes, it's true as minute fossilised Ostracods of the same species are found <u>below</u> the CES, as well as above it.

The CES was once thought to be in the Ashdown but due to the above is now known to be one of three large sand bodies within the Wadhurst Clay; others being at Hogg Hill and Northiam, both to the north of here. Looking around this area we can see a short ledge which we can follow for a few metres, but look down, we are getting higher, the beach is falling away; could this be the 'anticlinal flexure' I wonder? So, we get down to the shingle beach once more, take note of the clay-ironstone and continue west toward Haddock's. As we proceed, generally, we can see the ironstone as a thin, dark line above us. There are occasional places though where it is hidden from view due to falls of soil from above; these soils seem to adhere to the transition beds where the ironstone is probably due to a narrow ledge forming below them. However it is soon seen again as we follow the cliffs, coming out from behind a recent fall or other.

As we continue the ironstone and therefore the Ash-down/Wadhurst junction, does not get much more than halfway up the cliff and is about this high at the bed we have come to know as the 'quillwort bed'

Fig.6 – Broken blocks of sandstone lay upon the 'quillwort bed' where an unconsolidated bed erodes back under tidal influence, undermining those beds above, eventually causing cliff collapse.

Here the cliff line has eroded back a fair way due to the presence of an unconsolidated bed about 1300mm thick. As this erodes the cliffs above are undercut and eventually collapse because of it; it does allow us to see the junction clearer though, **see figure 6 and 7,** giving lots of clean faces, though, and it must be said, **danger to the geologist who gets too close.**

Due to the various faults which bound this area much of the high ground is the sandstone of the Wadhurst Clay, the Cliff End Sandstone. This not only adds to the cliffs here but is most of Winchelsea, Toot Rock, Rye old town and the inland cliff line in the distance at the edge of the marsh; some of this is also the Hogg Hill Sandstone which I mentioned previously.

I hope this information and description has helped you to understand where the junction lies and therefore allows you to locate it on your next visit.

Fig.7 – Another view of the beds in fig.6 where the ironstone and the Ashdown/Wadhurst junction is about 8 metres above the foreshore.

References

R.D. Lake and E.R. Shephard-Thorn, 1987. *Geology of the country around Hastings and Dungeness*, HMSO.

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Captain Scott, Glossopteris and the Beacon Sandstone

Nick Baker

This is a short account of what has turned out to be a somewhat ill-fated talk, rather like the final outcome of the Polar Party of Captain Scott's final expedition. The object here is to describe that expedition and to describe some of the geological results. This account covers the material found by the Polar Party. There were other geological units operating as part of the expedition. An account of these (among others) is given in *South with Scott* (Evans, 1921)

The British Antarctic Expedition (*Terra Nova*) 1910-13 was Capt. Scott's second expedition, the first being 1901-04, on the *Discovery.* It was the failure of Shackleton's 1906-07 expedition, which got to within 90 miles of the South Pole, that decided Scott on his second attempt. Scott was operating on a tight budget, originally planned for two ships, but the expedition was downsized and departed with one ship, *Terra Nova*. The expedition of around 100 men established a base at Cape Evans in the summer of 1910-11. That first summer was spent establishing the base and also some depot-laying across The Great Ice Barrier to the south. The winter of 1911 was spent on final planning and other activities, including Wilson, Bowers, and Cherry-Garrard in the trip to Cape Crosier (See Appendix one).

Scott was relying on the work of Shackleton who had trail-blazed on his route to the Pole. No one had been that way before. Shackleton's achievement was remarkable, but he was careful, and never lost a single man, not even on his 1914-15 trip when his ship—*Endurance*, was crushed in the ice, and his men had to row across 80 miles of sea in the Antarctic winter. Scott tended to take risks. It was only when the expedition reached Christchurch, New Zealand, that he learned of Amundsun's intentions. Even then, Scott still saw the expedition as a scientific enterprise and not a race to the Pole, although his sponsers had favoured the latter motivation!

16 men with motor sledges, ponies and dogs left Cape Evans on November 1st 1911. It was 430 miles to the foot of the Beardmore Glacier. The motors gave out early and the ponies were quite literally worked to death and became extra meat for the dogs, before the glacier was reached. Going was heavy, with several heavy snowfalls. The Lower glacier Depot was established on December 10th. Four men returned with most of the dogs. The remaining 12 men then began to ascend the Beardmore, possibly the biggest glacier in the world—up to 40 miles wide and 124 miles long. A depot was established at Mid glacier, where four more men returned with the remaining dogs. The remaining eight men were now totally man-hauling the sledges, each weighing up to 400lbs. The ascent of the glacier was difficult. In the 124 miles it rises 9000ft. Some parts are steep and crevassed. The party was struggling amid some of the world's most amazing scenery, with the

Alexandra Range to the west and the Commonwealth Range to the east. The Upper Glacier Depot was established on Dec 21st, by which time the party had travelled 554 miles from Cape Evans. The party moved on to 87 degrees south, where a further depot was established and three men returned, leaving the famous five to go on to the Pole—Captain Scott, Dr E. A. Wilson (Scott's Chief of Scientific Staff), Lieutenant Bowers, Captain Oats, and Petty Officer Evans. The way to the Pole was now downhill, but the snow surface was bad. Then, on January 17th 1912, they reached the Pole and Amundsen's abandoned spare tent. At this moment of acute dissappointment, they were 900 miles from Cape Evans. Throughout the 18th they took several sightings with a 4-inch theodolite and finally decided on a point four miles south of Amundsen's tent. The result was the taking of several photographs of the party at the 'Pole'

And so they began their return, reaching the Upper Glacier Depot on February 7th. The party spent the following day geologising in the scree of Mount Buckley—the results of which I will return in a moment. They reached the Mid Glacier on Feb 13th. They were in a bad condition. Oats and Evens were suffering from severe frostbite. Evans could hardly use his hands and Oats' feet were frozen inside his boots. It is certain that their calorific intake had been insufficient since the start of the journey and their diet was almost devoid of essential vitamins—largely consisting of biscuit and pemmican. Wilson does not report scurvy—but in the conditions, it is likely that his judgement could no longer be relied upon. Scurvy was apparent on the bodies when they were found the following spring. Evans went into a state of total collapse, probably as a result of septicaemia (untreated frostbite will become infected) and died when the party reached the bottom of the glacier on Feb 18th.

On the Ice Barrier, temperatures were as low as –40C. Winter had come on early. Skis and sledge would no longer slide. A five mile day was now 'a good day'. Rations were cut further. Then a blizzard came, trapping them in their tent, just 11 miles from One Ton Depot and 120 from Cape Evans. From Scott's diary we know that Oats walked from the tent and was never seen again. The bodies of Scott, Wilson and Bowers were found in the tent by the search party in the following November.

When the party reached Mount Buckley on Feb 8th 1912, Wilson and Bowers spent a whole day looking at the geology of the moraine below the mountain. The Beacon Sandstone was the name given to the sediments, the type locality being at Beacon Heights, nearer the coast, by the Shackleton expedition. There was almost a thousand feet of sandstone and limestone interspersed with seams of coal. This was capped by intrusions of dolerite. (I do not know if a date has been put on the dolerite). It was Wilson who found samples of leaves of *Glossopteris* in the coal seams. These specimens and others, weighing 35lbs were added to the weight of the sledge. This fieldwork was done in a temperature of –30C. Wilson then spent the evening writing up five pages of field notes by the light of a candle, with eyes already damaged by snow blindness. The specimens were recovered by the search party in November 1912 and eventually arrived in Cambridge, where Prof A. C. Seward gave the definitive identification. It was thus assumed that the Beacon Sandstone was of 'Permo-Carboniferous' age. (The labels on the specimens in the Natural History Museum, bore that as the date, in the early 1960s).

But this raises a question. We know that much of Southern Gondwana was in a state of deep glaciation in the early Permian and was at almost the same latitude as today. This would imply that the plants at Mount Buckley would have to endure as much as six months of darkness. Even if the whole of the Beacon Sandstone was deposited during an inter-glacial (Wilson does not report glacial deposits) the plants would have to endure the darkness of an Antarctic winter. Even at very high humidities (which are doubtful) the area would, after a month or so, end up buried in freezing fog. The only conclusion is that this location was not at it's current latitude.— 86 degrees south.

Specimens of *Glossopteris* are found across a wide area of former Gondwana, - Australia, Africa, Antarctica, South America and India. The plants grew to as much as 100ft high, but this is not so for all species. The scenario for much of Southern Gondwana would be a resinous, fast-growing plant, with (in the higher latitudes) a winter die-back. Growth rings do indicate a rapid annual growth. Final plant height would depend on the possibility of regrowth on last year's growth and so the tallest species would most likely be found at the lower latitudes, and the final height would be dependant on winter temperatures.

Specimens of *Glossopteris* are abundant in the Illawarra Coal Measures of New South Wales. These are dated as the very latest Permian (Tatarian) and they are among the youngest examples of *Glossopteris.* Thus, *Glossopteris* appears to be confined to the Permian and it is conceivable that its evolution was in response to the cooling of the climate in the Carboniferous. Some 'probable' *Glossopteris* have been found in the Upper Carboniferous (Stephanian) of South America, but the precursors to *Glossopteris* are probably *Gangamopteris* (Carboniferous (Namurian-Stephanian)) (Rosler. 1978)

But what of the latitude of Mount Buckley by the late Permian? Latitude studies suggest that Gondwana, including Antarctica, had moved north about 20 degrees. Also the ice age had ended, certainly by the Tatarian stage, with few if any glaciers in Southern Gondwana. It is probably this northward movement contributed most of all to the retreat of the ice. At 70 degrees south we have to consider Northern Siberia at the present day, to be the nearest equivalent in terms of climate. So, we are looking at tundra with areas of probable deciduous forest and up to two months of winter darkness. It would seem that Wilson's finds were in the least hospitable of the *Glossopteris* environment. The trees would not be growing close together because of the low solar angle.

Temperature studies seem to suggest that *Glossopteris* did not grow in areas with a mean summer temperature of more than 15-20C —indeed evaporation from plant surfaces would suggest that they are more conditioned to wet bulb (and therefore dew point) temperatures (wet bulbs no higher than 15C). Given that equatorial forests rarely experience dew points *below* 20C, it may be no surprise that *Glossopteris* was confined (imprisoned?) in the southern hemisphere, and the catastrophic heating at the end of the Permian, triggered by Siberian volcanos, made sure that none survived into the Mesozoic.

(Ref : Evans. E. R. G. R. *South with Scott.* Collins. 1921)
(Ref : Rosler, O. *The Brazilian eogondwanic floral succession*. Bol. IG vol. 9. Sao Paulo. 1978)

(Apendix—*The Worst Journey in the World*) This was not Apsley Cherry-Garrard's description of the Polar journey but what he described as the strangest bird-nesting trip he had ever been on. This took place in the winter of 1911 and involved a journey to Cape Crozier, 67 miles from Cape Evans. Cape Crozier was the site of a huge Emperor Penguin colony. The birds lay their eggs in winter. Dr E. A. Wilson surmised that the penguins were probably a primitive bird and obtaining some embryos might shed light on bird evolution. Given that they were 40 years before the work of Crick and Watson, this might sound like a loser, but, Wilson, Birdie Bowers and Cherry-Garrard set off in total darkness on June 27th 1911, reaching the colony on July 15th, and getting back to Cape Evans on Aug 1st. The journey was 67 miles each way, through the darkness of the Antarctic winter. Temperatures as low as –61C and blizzards. At the colony they built an extra shelter of blocks of snow and basalt. At one stage the tent blew away and the roof of the shelter came off. They lay in their sleeping bags, under the groundsheet for three days. Eventually finding the tent again, they returned with the eggs to Cape Evans. The embryos gave little information but the journey gave lessons on what you should or should not do in polar travel.

(Cherry-Garrard. A. *The Worst Journey in the World*. 1922—Publisher n/k—currently published by Penguin)

Smokejacks Clay Pit. Sunday April 6th 2014

Paul Wright and myself joined a party to this site organised by Peter Austen. The pit is situated on the Surrey-West Sussex boundary, and exposes sections within the upper part of the Weald Clay (Lower Cretaceous.). Smokejacks has yielded a rich fauna and flora—dinosaurs, insects, fish, crustacea, plants etc—but not on this day. The general feeling is that the place would be more productive if it was working again. Peter showed us a crocodile tooth which had been found. Peter stated that no fish otoliths had ever been found, unlike the situation at Warnham Pit. I set out to prove him wrong and brought away some clay samples. He was right—no otoliths—just a few fish teeth and a whole lot of minute vertebrae.

Foulmead, Saturday May 14th 2014

Members of the MFMS and U3A made up a party of about 8 or 9 on a visit to Foulmead Country Park, which used to be the slag heap for Betteshanger Coal Mine. It has all been planted and there are paths for the lads to cycle. There are nature trails and a dedicated area for fossil hunters. We made our way to the fossil site and began our search. The best plan is to break up pieces of the shale. A good number of plants were found and as far as I can recall, we found *Annularia, Sphenophyllum, Asterophyllites, Calamites*, bark from *Sigillaria,* a possible seed from *Trigonocarpus,* and leaves of *Alethopteris, Mariopteris* and *Neuropteris*. The weather was good—fine and sunny—and the rain held off until it was time for us to leave. Thus ending a good day

Blue Bell Hill—Sandling 'Geo-Walk' Saturday June 7th 2014

The 'geo-walk' is an interesting alternative to the collecting trip, although a good, fine day helps a lot. The afternoon of June 7th was fine but very humid. Organised by Anne Padfield, about 10 of us gathered near Lower Bell. We set off eastward along the Pilgrim's way. Anne put forward the idea that this ancient footpath follows the outcrop of the Melbourne Rock, a hard band of chalk at the base of the Middle Chalk. Although the 'Way' cannot follow the Melbourne Rock exactly, it does appear to do so in an approximate sense, the idea being that the hard chalk provided firmer ground for foot travel, but the coverage of the ground by hill-wash needs to be considered.

Sarsen stones occur frequently across the downs and the White Horse Stone occurs right by the path. At this point we met two gents who were walking the Way from Winchester to Canterbury, and greeted us with a rendition of *'to be a pilgrim'*. The origin of Sarsen stones is still uncertain, but they are most likely the remnant of an Eocene formation that may have covered the downs. In places they are incorporated into ancient monuments—Kits Coty being the most notable in this area.

We continued on to Boarley Warren and then returned south, watching out for sightings of the first springs as we travelled from the Chalk back on to the Gault. Around Sandling we were on to Greensand country, with outcrops of Folkestone Sand. We returned north to the cars at Lower Bell and then finally went to Anne's house for refreshments.

News and Spring Roundup.

Even if you have been on a moon mission, it can't have escaped your knowledge that our Chairman has been through the wars somewhat, having broken six ribs and punctured a lung at the beginning of March. The last time I saw him he was almost fully recovered. Tony has been warning us that he plans to hand over the Chairmanship—so we need someone to take over the task, but he will be a hard act to follow. I will miss him, but I hope he will still get to come to some of our meetings.

January 14. Our first meeting of the year was a do-it-yourself evening.
January 21. This evening. It was all about tips and tricks. Tony gave a demonstration on repairing fossils and also a demonstration on a crushing device for breaking up rocks. I gave a short demo on ways of setting up boxes for displaying small (larger then micro) fossils.
January 28. Tony give his talk on the Silk Road ptI
February 5. A display of fossils from the Isle of Wight. David Rayner gave a very detailed account in terms of his collection. Fred and I discussed the nature of the Lower Chalk on the IOW.
February 12. Jennifer Jackson, the Kent Portable Finds Officer showed some pics of (mostly) Saxon finds in Kent. A discussion started on the matter of the legality of collecting. Keith Smallwood had found an ivory tusk (about a metre long) in the Pleistocene on the shore at Tankerton.
February 19. At the meeting we had reached the Devonian in our geological period themes. I took along some rocks and fossils. Tony brought along a whole lot of fish remains from the Moray Firth—Hugh Miller Country.
February 26. The theme was fossil reptiles
March 5. Anne P gave a talk on Calcite.
March 12. Tony was well enough to give his talk on the Silk Road ptII
March 19. A display of calcite.
March 26. Ann. B gave a talk on the Coast of New South Wales.
April 2. A display of mammal and bird fossils. I took along my mammoth teeth and a few other items.
April 9. Anne P. gave a talk on glaciation.
April 16. The theme was 'Chalk'. I took along some fossils and some sedimentary sections.
April 23. Tony gave a talk on geomorphology.
April 30. I took along some photos of rock thin sections, including a number demonstrating 'ferroan calcite'. Some of the members brought along their Lower Carboniferous specimens.
May 7. The subject of the evening was a question and answer session on some fossils brought in by some of the members.
May14. We watched one of Attenborough's programs—*First Life*.
May 21. Anne P. gave a further talk on geomorphology.
May 28. The theme was fossil plants.
June 4. Ann. B. The coast of New South Wales PtII
June 11. Anne P. had organised a 'building stone walk' around the old part of Rochester.
June 18. Anne P. gave a talk on the 'Fiord coast' of southern Norway.
June 25. Jennifer Jackson, the Kent Portable Finds Officer gave a talk on methods in archaeology.
July 2. Proposed—me to give a demonstration on Capt Scott, *Glossopteris* and the Beacon Sandstone.
July 9. Proposed- Theme—Upper Carboniferous
July 16. End of term party.

And for the Autumn…

Sept. 10	Recent finds.
Sept. 17	My favourite minerals
Sept. 24	Richard Forte
Oct. 1	Permian theme
Oct. 8	Gastropods display
Oct. 15	Photo evening—Natural world
Oct. 22	DVDs
Oct. 29	AGM
Nov 5	Yarwell revisited
Nov 12	Triassic theme
Nov 19	TBA
Nov 26	Geomorphology clues (II)
Dec 3	Richard Forte (III). Own up if you have Pt II
Dec 10	TBA
Dec 17	Party