Occasional Erratics

Newsletter of the

MEDWAY FOSSIL AND MINERAL SOCIETY

www.mfms.org.uk

No. 06. July 2016

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

Cover picture

The Melbourne Rock and Plenus Marks at Peter's Pit, Wouldham. May 2013.

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Editors notes.

Welcome to edition number six of *Occasional Erratics*. Well, this is the closest I have come to *Nick's Journal*. I have Gary's second report from the US and a report from Dave Talbot on Anne's field-trip to the Wealden rocks in the Tunbridge Wells area. There is also a focus on Bryozoa, usually out of sight, but not always– yet always beautiful. And we had a fossil show (not all fossils) at the Guildhall Museum, Rochester, for the second year of this event. A postponed talk gives us an insight into the *Muck Above the Chalk*—what is the true origin of the Clay-with-Flints? Anne Padfield reports on the talk on fracking, given by David Wray, back in January. We say goodbye to an old friend, and a noted geologist, and I ask a final question. We have also made a few admin amendments in the past year, including a new advertising pamphlet—the old one had, well, gone beyond its 'sell-by date' - to coin a phase!

But, what of geology? - how much does such an interest command our lives? Or perhaps even direct it in some way. Perhaps more than we would like to admit. I have taken this opportunity to tack a personal story on the back of my notes,

More Art than Science—Geology as a life-long journey

Nick Baker

The beginnings of my interest were a strange chance. My father and I were burning garden rubbish one evening in June 1960. I must have thrown a piece of granite into the fire. Several days later I was raking out the ashes and found a piece of black rock. Why did I even think about it? Not such a chance? I had obtained a copy of *The Observers Book of British Geology* (it was British in those days) a year before, and I must have been reading it just before the black rock incident. Otherwise, why would it have mattered? The chance lay in obtaining the book in the first place. The cover was a picture of a cliff of Torridon Sandstone. Something about the picture? Anyway, what struck me was the fact that the pre-history of the earth could be discerned from the rocks. Very soon I had devoured the pocket-sized book and then discovered the Natural History, Museum.

I obtained books from the museum—*The Succession of Life through Geological Time, Fossil Amphibians and Reptiles*, Regional guides such as *The Wealden District* and *London and the Thames Valley*. I would cycle into Kent and later walk from rail stations and investigate possible sites, and finding next to nothing! Blue Bell Hill was visited on several occasions, as well as Flittermouse Hole, nr Birling. But one year in I had found just two fossils. Then I discovered the Isle of Sheppey and I learned that I had to get my eyes close in—and found a whole lot of pyritised gastropods, which lasted about two years before falling apart! But I applied the new technique at the Chalk sites and things began to come forth! But my interest died literally overnight (1963). It would not be the last time. Things always died suddenly and came back very slowly. What was it? Some 'black dog days' most likely. My interest was back by 67 but I had to adopt a new method of meaningful documentation. But in 1970 there was a second break. The family had become decidedly religious. Lets just say I knew '*Oranges are not the only fruit'* before it was a book! I left home (1972) and gradually got my interest back. It was fully back by 1978. In that year I walked from Gloucester to Carmarthen examining geological sites on the route, and in the following year walked around South Shropshire. By that year I still knew no one else who shared my interest. Then, I saw an advertisement for *The Nationwide Geology Club*, run by someone called Chris Darmon. I had been a loner and Chris often had his school class with him, so it was quite an innovation. My participation was often only about one trip a year but we visited parts of Wales, Scotland, The Pennines, Shetland and Ireland (north and south).

Then in 1985, joining the Open University put me in touch with the *Open University Geological Society*. An increased exposure to igneous geology, started me on the production of rock thin sections (I produced about 200, without a rock saw). Meanwhile, back at base, I was making a study into the evolution of Micraster in the Upper Chalk. In this respect I was introduced to Dr Robert Stokes, who got me elected to the *Geologists' Association*. In Chris Darmon's group there was a gent called Jim Greenwood. I recall asking him about local geology groups and he introduced me (1991) to Eric Philp and *The Kent Geologists' Group*. There, Dr A. J. Rundle persuaded me that the collection of micro-fossils was far from difficult. That same year I got my degree from the Open University.

There was one more break (2000-2004) and it is difficult to pinpoint the cause, but there may be one main answer for this latest episode. At this time I was being flooded with information. Now, in the early years, knowledge developed slowly. It may be that I needed more time to re-adjust. It may be a personality aspect, where I need more time to adjust, but others not. Perhaps the speed did not allow periods of mystery. There are other theories which are decidedly 'alternative', which I won't begin to explain. This time, my interest came back quite fast. I knew of the MFMS/MLMS over the years but it had often been difficult to get to. In 2010 Tony was looking for future speakers. And so it was that I gave a talk (*Aspects of Chalk Stratigraphy*) in July 2010. The following September I joined and have never looked back.

The title said this was more art than science. The two seem to be separated more than they should. One said to be irrational and the other always rational. But what if science was a refined branch of art? It is said not to work from the same area of the brain and maybe there is a wide chasm separating. Maybe it directs the science but keeps Mum!

Fossil Road Show

At the Rochester Guildhall Museum, May 21st.

This was the second year of this event, facilitated by the Guildhall Museum and on behalf of The Medway Fossil and Mineral Society and Geo-Conservation Kent. A good show of geological material was on display, mostly local but also countrywide, and in that respect, representing a large part of geological time, even as far back as the Trilobites and The Age of Ancient Life'

A lot nearer to us in terms of time, there was an amazing display of fossils from the Pleistocene of the North Kent Coast. .

Outside of the Natural History Museum, this was the finest display of fossil mammal bones I think I have ever seen, including mammoth, wild ox, horse, and quite a few I cannot recall. Now, we cannot mention North Kent and not mention the London Clay, especially that on the Isle of Sheppey, and to the right we see a fine display of fossil turtles, crabs and lobsters. Kent is quite fortunate in that, as well as having two prominent clay formations, we also have some of the best coastal exposures of those formation. The other clay formation is the Gault Clay, and Folkestone is probably *the* best location for collecting fossils from that clay.

The Gault is around twice the age of the London Clay, so many of the fossils are going to be different—and we are in the realm of the Ammonites. To the right is the display and information of fossils to be found in the clay at Folkestone

For those visitors who had items for identification, you could always ask The Expert.

And for matters relating to geological sites, there is GeoConservation Kent. This is one of many allied groups who's aim is to identify and conserve geological sites at a time when the natural environment is under increasing pressure

Now, there is one individual rock formation that covers more of Kent than any other, and below is a sample of fossils that can be found in the Chalk. There was also a mineral display, and a lucky dip for the children.

And last but not least—The President (Retired Chairman) Tony Mitchell, who was on hand with a wealth of information, both of geology and natural history.

Our thanks go to all those who helped out on the day, and had the task of setting-out the specimens, (and packing away again) and most of all to Steve Nye and the museum staff for providing the space and facilities.

Focus on Bryozoa

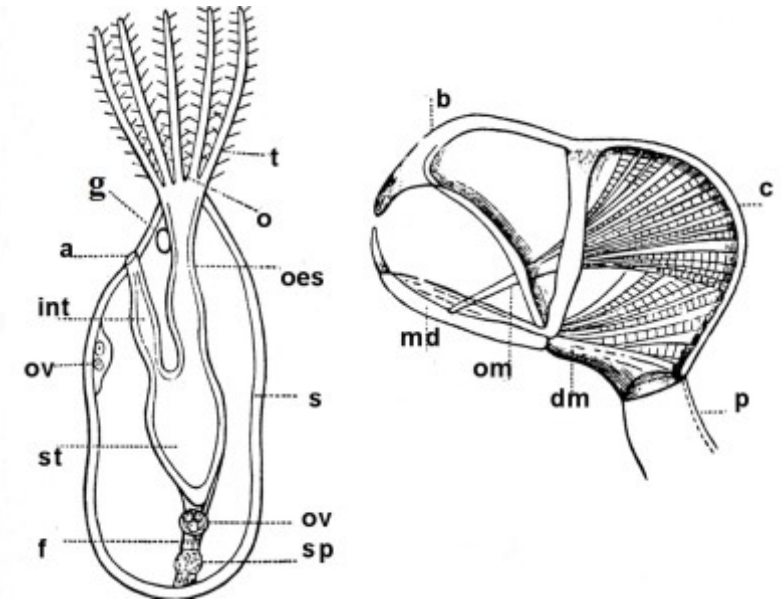
Nick Baker

Bryozoa (branched life) are not commonly found as large fossils., except perhaps in certain rock beds, such as the Coralline Crag or the Magnesian Limestone. That is not the situation at the micro level, such as certain horizons in the Chalk, where some beds are largely composed of quite beautiful and complex specimens. In discussing their structure, here is the beginners introduction, by I. O. Evans. He refers to them as *Sea Mats.*

'Many stones and shells on our beaches, and even some of the sea-weeds, appear to be partly covered with a lace-like material. This is a *Sea-mat,* a colony of tiny creatures which build cells of chitin or calcite. The cells are united in networks or separate fronds (some are easily mistaken for sea-weeds), glassy-looking while their inhabitants are alive but white after their death.

Fossil sea-mats, consisting of calcite or silica, may be found in rocks of all ages from the Silurian onwards. Like the modern type, some of them spread, in a delicate lacy crust, over fossil shells or sea-urchins. They are especially numerous in the Mountain Limestone and the Chalk, and are so abundant in the Pliocene of East Anglia that one bed of shelly sands and clays has been named after them—The Coralline Crag'.
(*The Observers Book of Geology)*

But, if you want something more informative, here is Prof. H. Woods. He refers to *Polyzoa*



s, body wall; t, tentacles; o, mouth; oes, oesophagus; st, stomach; int, intestine; a, anus; g, ganglion; f, funiculus; ov, ovary; sp, testis; b, beak; md, mandible; p, peduncle; om, occlusor muscles; dm, dicaricator muscles; c, avicularium wall.

'With the exception of the genus *Loxosoma* all the Polyzoa[1] are colonial animals, numerous individuals living in association. The colony is nearly always fixed, and may be arborescent, laminar, almost massive, or encrusting shells, stones, or plants. The entire colony is known as the *zoarium;* each individual has a sac-like form; at the upper end there is a platform or disc, the *lophophore,* on which tentacles *(t)* are placed, arranged either in a circle or in the form of a horse-shoe. In most forms the tentacles are not contractile, but are provided with cilia, which produce a current of water that conveys food to the mouth (o). The anal aperture *(a)* is near the mouth, generally below the lophophore, but in some forms within the circle of tentacles. On account of this approximation of the mouth and anus, the alimentary canal is bent into a U-shape; in it may be distinguished oesophagus *(oes),* stomach *(st),* and intestine *(int)*.

Between the alimentary canal and the body-wall is a spacious body-cavity. The nervous system consists of a single ganglion *(g)* placed on the side of the oesophagus facing the intestine. The polyzoa multiply by budding and sexually, and are generally hermaphrodite. Heart and blood-vessels are absent. The structures described above form together what is mown as the *polypide;* this is contained in the body-wall or *zooecium.* The outer layer of the zocecium, known as the *ectocyst,* generally becomes hardened by calcareous or chitinous matter, and after the death of the animal this alone remains; its surface is usually ornamented with ribs, etc. The anterior part of the polypide can be withdrawn by means of longitudinal muscles into the zooecium, just as the finger of a glove can be pulled into the hand.

Distribution of the Polyzoa

By far the larger number of the Polyzoa are marine; they occur both in shallow and deep water. The deep-water forms belong mainly to the Cheilostomata; a few Ctenostomata occur at considerable depths, but the group is characteristic of shallow water. The Cyclostomata are comparatively rare at the present day, except in the Northern seas. The extinct Trepostomata and Cryptostomata are usually associated with reef conditions.

The earliest Polyzoa occur in the Ordovician rocks. Nearly all the Palaeozoic genera are extinct; they belong mainly to the Trepostomata and Cryptostomata. The Cyclostomata are represented by a few genera in the Palaeozoic rocks, and become increasingly abundant in the Mesozoic, attaining their maximum in the Upper Cretaceous. A few Cheilostomata have been recorded from the Jurassic rocks, but the group does not become abundant until the Cretaceous period. In the Tertiary it is better represented than the Cyclostomata. Very many of the Pliocene forms belong to species which are still living.

The chief genera found in the different systems are:

Palaeozoic. *Archimedes, Ceramopora, Diplotrypa, Fenestrellina (Fenestella), Fistulipora, Hallopora, Hemitrypa, Pinnatopora, Polypora, Ptilodictya, Rhabdomeson, Thamniscus.*

Jurassic. *Berenicea,Ceriopora,Diastopora,Entalophora, Haplocccia, Idmonea, Proboscina, Spiropora, Stomatopora.*

Cretaceous. *Crisina, Diastopora, Entalophora, Heteropora, Lunulites, Membranipora, Onychocella, Pelmatopora, Proboscina, Stomatopora.*

Eocene. *Hornera, Idmonea, Membranipora.*

Pliocene. *Alveolaria, Cellepora, Cribrilina, Hornera, Lepralia, Membranipora, Theonoa.'*

(Woods, H. *Palaeontology-Invertebrate.* 8th Ed. (rep) 1963)

The Muck above The Chalk

The problems of peri-glacial (?)Pleistocene…. A proposed talk

Nick Baker

In this account we are dealing with the Pleistocene, but not that which is usually taken into account. Not Boulder Clay, or River Gravels, or Marine Pleistocene. In other words, not those whose origin has long been known and well described. What remains are those of, what have been and in some measure are still of, uncertain origin. In many cases they occupy areas some distance from the definite glacial deposits, and many are assumed to occupy former peri-glacial and tundra-type locations. Hence, the sub title of this talk. It is true that the deposits are younger than the Chalk, and are therefore above, but in some cases the deposits described are overlying older rocks (e.g. Angular Chert Drift overlying Lower Greensand) and often some distance from the Chalk, but in most cases they are associated with Chalk down land. But, just how much younger than The Chalk are these rocks? Some have suggested that the Clay-with-Flints may be as old as in Palaeocene, at least in part. Also, the rocks are difficult to categorise is terms of content, but can perhaps be more ably grouped by location. Clay-with-Flints and Plateau Gravels are often found on the downland tops, while Hillwash and Brickearths are more a feature of the slopes and lower lands. Solution pipes are quite distinct and have very variable content. Loess is often associated with Brickearth, and Sarsens with Clay-with-Flint, but not exclusively so.

Often, in geology, a rock reflects its direct origin. The rocks about to be discussed do not. Their content is often derived, from an original environment, while the whole collection of contents reflect much of the secondary environment during transport, possibly at the ends of a glacial episode, of mud, thawing snow and glacial out-wash.

But a simply explanation of formation is difficult to apply. Often we are working in absence of any contemporary fossil evidence, but, on the other hand, derived fossils often raise further questions. In the first edition of *Occasional Erratics* I tried to propose an origin for the Lenham Beds, using a theory of glacial outwash, just prior to iso-static readjustment. Information supplied to me suggested that the last glaciation produced a down-warp of up to 200 metres in southern England. However, evidence from raised beaches in other parts of the British Isles produces few, if any, examples of a raised beaches more than 45 metres above sea-level. For the Lenham Beds we would need to account for another c150 metres.

We have casts of Red Crag fossils at 200 metres OD at Netley Heath, in Surrey. There is no evidence for a 200 metre sea-level rise in the early Pleistocene, and the material at Netley Heath is definitely not *in-situ*. Interestingly, examples of Lower Greensand ironstone and sandstone can be seen only a few metres from the Netley Heath 'Crag'. All of this material, both older and younger than the Chalk, is lying on top of Chalk. In the case of the sandstone, it is similar to the sponge-rich material found in the Folkestone Beds near Ightham. While the Wealden Dome was still being eroded, beds older than the Chalk could still be at higher altitude than the Chalk on the northern slope.

I will give another example, involving a definite fossil. In the third edition of this newsletter, an account was given of the 'eolith' research carried out by Benjamin Harrison, and of the excavation of a gravel patch near Ridley, Kent. These gravels were formerly classified as 'disturbed Blackheath Beds' now Chelsfield Gravels. What is not mentioned in the article is the finding of a Gault ammonite in the gravels. It seems the Gault, most likely then at a higher altitude, was being eroded and some material was dumped on the Chalk further down the slope. We have hit a problem in descriptions. In this case a 'Plateau Gravel' becomes a Hillwash in its mode of formation. But all this still does not explain the Netley Heath 'Crag'. The deficit between the isostatic readjustment and the current altitude, might only be explained by a degree of the 'Wealden rise', still taking place at just 2Ma BP. (discuss)?

To the right is a picture of **Hillwash overlying Chalk near Lewes.** There are several grades in the coarseness of the Hillwash, while the Chalk just below shows definite frost-shattering. The limit of advance of the glaciers would be limited by a July daily maximum temperature of around 0C, meaning a yearly average of around –10C. A rise to around 5C (in the summer) would allow sufficient melting of the perma-frost, causing solufliuxion to take place on hill slopes, especially if aided by periods of rain. The absence of vegetation would lead to a very unstable environment. Much of the erosion of the Wealden 'Dome' could well have taken place at the beginning of Pleistocene inter-glacials. At Upper Halling the deposits contain a fauna of small gastropods as well as mammoth teeth and deer antler, indicating some degree of vegetation, perhaps later in the inter-glacial .

All this instability is not easily explained in the apparent uniformity of the content of Clay-with-Fints. One would expect some chalk fragments, or sandstones to be present. Its position should also be more random. It caps chalk hills, while it seems to be washed away on the slopes, almost as if it was originally one compact formation, capping the Chalk. Some researchers still see Clay-with-Flints as residue from Chalk solution. Gallios (2007) cites areas of 'decomposed' Chalk, in SW England, underlying Clay-with-Flints on a Palaeocene erosion surface. He also refers to a location in Northern Ireland where Palaeocene basalts are seen overlying Clay with flints. He gives figures for the amount of insoluble resides obtainable from the Satonian and Campanian Chalk—now eroded in SW England. I still see the ratio of flint to clay as an obstacle, but Gallios' closely-argued paper does need more attention.

To the right, the picture shows a layer of **white flints, and quartzite, above Upper Greensand, on Golden Cap, Charmouth, Dorset**. (a Chalk remnant?)

I'm leaving the subject of Clay-with-Flints here, since the subject demands more investigation and may be I shall have more material when my talk takes place. And , for us to discuss?

But, we need to look at some closely-associated aspects. This next subject is often associated with Chalk downland and Clay-with-Flints country, but is often captive of the Downwash. I speak of 'Those Damn Stones' - **Sarsens**. Here in the southeast, Sarsens are often found at the edge of fields, having been dragged off the field by the local farmers! Many of our local megaliths are composed of these boulders of quartzite. I'm thinking of Kits Coty, The Countless Stone, Coldrum, etc.

Tony Mitchell has given me some interesting photos of sarsen stones on the Wiltshire Downs. In the first photo we see the sarsens accumulated in a valley bottom, while the second picture shows a sarsen caught in the process of slipping down a slope. But the third photo is the most curious—containing plant rootlets. There is a reference in the Dartford BGS memoir (Dewey et al 1924)—referring to 'soft, pale yellow sandstone crowded with fossil leaves and stems' - the surveyors distinguished these from sarsens, but the description seems also a good one for the photo below. The stones on the Wiltshire Downs also contained flints, both whole and fragmented. So we have the remnants of a formation which is post-Chalk, and may well be of Palaeocene Age.

With sarsens, we are dealing with silcretes—quartzite type deposites, probably laid down in warm, humid conditions. So, are the sarsens an integral part of the Clay-with-Flints, or a much earlier and separate formation? I am not yet sure whether the Wiltshire material was lying within Clay-with-Flints or on bare chalk. In Kent, sarsens are often associated with Clay-with-Flints, on the downland tops, but also on lower-lying land in the hillwash.

And hillwash trails in to another formation—**Brickearth.** This is usually a brown (clay-silt) loam, formally used for brick-making. In many cases this is a form of solufluxion deposite, while in others it tends to merge with river deposits. In a small deposit of brickearth near Ightam , the author found what appeared to be wind-faceted sand grains, similar to those seen in **loess.** In Kent, the most prominent example of loess is seen in the cliff top at Pegwell Bay. But it is not certain whether this is a primary loess or one that has been water-laid.

In the talk, now scheduled for October, I hope to arrive at some definite answers, perhaps with the help of the membership present.

References

Dewey *et al.* 1924. *The Geology of the country around Dartford.*. P 89 HMSO.

Gallois R. W. 2007. *The origin of the Clay-with-Flints—The missing link. Geoscience in South West England.*

NORTH WESTERN USA FOSSIL SIGHTS #2

Gary Woodall

This is the second in a series of three articles about the fossil sights that I saw during a fly-drive holiday of Colorado and Wyoming. After leaving the Denver area we headed west towards the 'Dinosaur Diamond'. This is the area between Moab, Grand Junction, Price and Vernal. From quarries in the area a huge number of dinosaur fossils have been found and many museums have been set up. There are also numerous fossil track sites one of which is believed to contain millions of foot-prints!

We first stayed in Fruita where there is a really fantastic museum called Dinosaur Journey. It contains some fine specimens, mostly collected in the surrounding area. One really great thing was the van operated by the Museum. Given the importance of Dinosaurs to the tourist industry, the town of Fruita has numerous pieces of dinosaur-themed outdoor art. My favourite is the Velociraptor skeleton riding a bike.

Next stop a town called Dinosaur! Here the streets are named after dinosaurs so there is Stegosaurus Freeway, Brontosaurus Boulevard, Triceratops Terrace and Tyranosaurus Street. We then arrived in vernal where they too show off their devotion to dinosaurs with a cute statue at the entrance to the town.

But despite the fun side (which I love), one of the main reasons for the whole holiday was to see the Dinosaur National Monument. I have wanted to go there since I was a child, having seen photos in one of my fossil books. In 1991 when I went to the area on a Geologists' association fieldtrip, we drove within a 100 miles but didn't go there. When Judy and I did our first fly-drive in 2003 again we went close but didn't have time to visit. I was intending to return soon after, but then in 2006 the visitor centre suffered subsidence and was closed for a complete rebuild!

But it re-opened a couple of years ago and so at last I was able to go there. The site was discovered in 1909 by Earl Douglas who was prospecting for dinosaurs in the west on behalf of Pittsburgh museum. He shipped back thousands of specimens but when he discovered the site which would later become the Dinosaur National Monument, the bones were in very hard sandstone which was inclined at about 70 degrees. Luckily he had the foresight not to extract the bones but to leave them in-situ. (see photo p6)

Dinosaur Journey museum tour bus.

He then petitioned the federal government to protect the area, which it did in 1915. In the 1950's a building was built to protect the bones. Palaeontologists then worked for decades to reveal the fossils and display them in-situ.

Dinosaur quarry visitor centre.

The Wall of Bones

The wall of bones contains thousands of dinosaur fossils of several different species. Stegosaurus, Apatosaurus, Camarasaurus, Diplodaucus and Allosaurus. The rocks are of Upper Jurassic age and it is believed that the area was originally a river bend where dinosaurs who had drowned in the river were washed and preserved.

So at last I had seen it and I must say it truly is probably the most spectacular dinosaur sight in the world. I found it so much more interesting than any number of mounted skeletons.

We were now about halfway through our holiday and heading to parks such as Yellowstone, Devils Tower, Mount Rushmore and Rocky Mountain. But we were going close to several sights where Cainozoic fossils can be seen and these I shall talk about in my third and final article.

The State of 'Play' – Black Gold or Fossil Fool

Anne Padfield

On 27th January 2016, a few of our members went to see Professor David Wray's talk entitled 'Black Gold or Fossil Fool'. The talk touched on the controversial issue of 'Fracking'. A subject on which I had already formed my own opinions as a geologist, with the limited information available to me. However, with further information forthcoming in the talk, I was able to consolidate my previous thoughts.

Dave began his talk by outlining the extensive offshore oil and gas deposits of the North Sea, that have been exploited since the late 1960's and early 70's. The Northern North Sea, off the Norwegian coast, has a large rift valley with Jurassic Kimmeridge shale under the rifted sea bed. For oil and gas to form from organic material; deep burial and great age is required and the oil deposits here had these conditions at the centre of the graben.

In the Anglo-Dutch basin of the North Sea, the Groningen Gas Field is estimated to be able to keep producing until 2035. The deposits here are found in the Westphalian of the Carboniferous and up to Permian strata, with Zechstein sea evaporate deposits as cap rocks. There are currently a few onshore oil deposits in the UK, with Wytch Farm, near the Isle of Wight, operating since 1959, being the largest.

Moving onto the subject of shale gas the Professor showed us a map of the USA, where there are huge shale gas plays of various age, from Ordovician up. Iran also has very large plays. The number of drilling wells located at some of these US plays, was incredibly dense and must have been an undoubted blot on the landscape in those areas. A similar map was shown for USA oil shale, although it wasn't so dramatic. Other potential World plays are in Russia, China, Asia and Australia, on cratons where the strata are of great age and deeply buried. In Europe there are potential plays in France, Poland, Sweden, Denmark and The Ukraine.

In the UK, the main gas shale play, is the Bowland Shale, which is found under Manchester, Liverpool, Sheffield, Doncaster and the North Yorkshire Moors National Park. The Department of Energy and Climate Change Report of 2013, (Ref 1) estimates up to 64.6 trillion cubic meters of gas in place. However, the extractable amount is estimated to be circa 20% of this, but this is contestable, and others consider 10% to be the more likely extractable 'gas in place' estimate.

It is well known that 'fracking prospecting' near Blackpool in 2011, is considered to have caused two seismic events of magnitude 2.3 and 1.5, probably from slippage along pre-existing fault zones. Similar events are also associated with coal and salt extraction. Drilling was at a depth of 2.5 kilometres, where data for this depth of strata was limited and insufficient. Further seismic data after these events, revealed the faults that were the probable cause. All over the UK strata is heavily faulted, compared to the oil bearing strata in the USA, making it more difficult to interpret and predict the consequences of fracking disturbance. The seismic events in Blackpool were similar in magnitude to most natural seismic events on land in the UK, but are of course, thought to have been induced by Man's activities. In the North Sea rift the seismic events are in the order of magnitude 4.

Licenses are being sold to oil companies in the UK, to 'evaluate ', only. They grant exclusivity should oil or gas be found, but do not grant permission to extract. That has to be applied for afterwards and they may not necessarily get it. The costs of the installation and the global oil market price, will dictate activity in respect to the go ahead of oil/gas shale extraction in the UK.

In the Weald of Kent it is not gas shale extraction that is of interest, the beds are not sufficiently buried for this, but oil shale has hit the headlines recently, having been found at Horse Hill near Gatwick (Ref 2) (Prof Wray's figures updated). In a field, possibly equalling the Forties Field of the North sea in extent and estimated to contain 100 billion barrels of 'oil in place', the company UK Oil and Gas Investments (UKOG), have found oil at 2500-3000 feet deep, in the Upper Jurassic Kimmeridge clay. Mostly in the West Weald, stretching from East Grinstead to Farnham, the estimated recovery of extractable oil, however, is 3-15%, and is more likely to be the lower figure. In order to extract the oil, fracturing will be required and the company have been granted permission to test the flow rate.

Unlike in the USA, where the strata are not heavily faulted, there is a low human population density, less important environmental considerations and where the considerable density of well heads may not be such an issue, planning permission in the UK will be much more difficult to acquire. Professor Wray said there is still insufficient information about the possible consequences to the environment, of the drilling activities and their installations.

In my view the use of vast quantities of fresh water, taken from our already over-stretched aquifers and reservoirs (especially in Southern England), which is then mixed with an unknown cocktail of chemicals (drilling companies are keeping this recipe information 'top secret', which is not helpful), is not at all sustainable, or environmentally friendly.

Furthermore, once used, the waste fluids are likely to be a considerable pollutant, if not contained carefully and cannot be recovered or recycled for further use. In the USA water reserves have been severely reduced in some areas. Waste water should be carefully monitored before conclusions are reached. Additionally, compared to the US, the lack of understanding of the geological structure at depth, could be a risk factor. As Earth Scientists and as decent human beings, we are committed to reducing CO_2 emissions and hopefully slowing climate change. Warming of the Earth is believed to be an irreversible process.

Dave's underlying message was clear, we should be seeking 'Green' energy, not prospecting yet another fossil fuel. Having seen 'small scale' Site Investigation drilling in action, as an Engineering Geologist, I can add that 'Unforeseen Ground Conditions' often cause problems for drilling projects in some way, be it by causing delays, adding to costs or causing damage to equipment, either outside or inside the borehole.

Ian Sandy gave KGG a talk on drilling water wells in Africa, where he elaborated on the extent of well water extraction failure, mostly due to poor drilling practice and maintenance, due to a lack of drilling expertise in those responsible. When a well dried up, they simply sunk another borehole to compensate. The failure rate was horrendous. I hate to think of the consequences of such mistakes or mishaps, drilling for oil shale. Especially when one considers, this is not only vertical drilling, but directional drilling at oblique angles, or horizontally drilling, which is very clever, but the more complex something is, the more prone to mishaps it becomes. Although the oil itself is at depth, well below the ground-water, drilling is down from the surface, through all the strata and structure, whatever it may be. Chemically laden water is pumped down these holes and may leak out of any gaps between the surface and the deposit.

As further information becomes available and our knowledge deepens, the potential risks to the environment will become more apparent, but a culture of 'Trial and Error' drilling may be costly. With the Government pushing this through as quickly as they can, I fear that 'Oil Fever' may oust aside the 'Careful Approach'.

References

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'*Oil discovery near Gatwick airport 'significant'* By John Moylan Industry correspondent, BBC News
http:// www.bbc.co.uk/news/business-32229203

MFMS visit to Tunbridge Wells, Rusthall Common and Stonewall Park, 8th May, 2016.

Leader: Anne Padfield

Photos and text – Dave Talbot

A small group of MFMS members and friends met at Tunbridge Wells Common, near the cricket ground, to investigate outcrops of sandstone here and at Rusthall. It was a warm sunny day with a light wind and very little cloud.

We will be looking at aspects of the Lower Cretaceous, Hastings Group rocks. Around the Common there are varying amounts of Lower Tunbridge Wells Sandstone, Ardingly Sandstone, Grinstead Clay and Upper Tunbridge Wells Sandstone.

After a short introduction, Anne led us off first to the 'Bat Cave'. This has nothing to do with geology or Marvel Comics, but is still interesting for what it is. The 'cave' is an old convenience, a loo, built into the rocks some years ago. After it had become an 'in-convenience' and presumably un-useable, the entrance had been bricked up also with just a letterbox opening for said critters to come and go. An obviously ideal situation for these animals where predators are unable to get at them – two-legged ones particularly.

So, on to the rocks; Anne now led us back to the Common and our first outcrop today of Ardingly Sandstone. Wellington Rocks a rather grand name for rocks, which at first glance appear to be just lying there. Of no great height, although there could be anything up to 15 metres buried, they are today's playground for local children who clamber over them quite gleefully.

The Ardingley Sandstone has several outcrops in this west Kent/east Sussex area all very much the same with variations in height, overall size and exposure.

What we do see is a wealth of types of sedimentation in grain size and bedding. Jointing within the formation, along with gullying and cambering is also well represented. The Ardingly Sandstone is variably fine to coarse-grained with grit and pebble beds at several levels. Here, on the Common, a lot of these are seen today. Jointing can run in almost any direction according to local applied forces, but **gullying here at Wellington Rocks,** we measured a NE/SW direction. Why should that be? Isn't a gully just a wide joint? Well, it may have started off as a joint, but has evolved into a gully purely by being eroded faster than a joint. This may be due to a stream or river being able to work on one joint rather than another, taking sediment away, deepening the channel and widening the sides. A joint is the fracture that started it.

Grains are semi-angular, or semi-rounded, depending on provenance, and fine to coarse in size. In the bottom of channels there is a high degree of variation in shape and size due to the actions of river strength and mineral type on them. In other cases beds of small pebbles show quite distinctly and can be orientated in a way so as to give an idea to river flow direction. With cross-bedding, ripples and variations in bedding, we had a great deal of sediment types to see today.

We walk on toward the next exposure of rocks, **Mount Edgecombe** Rocks. These are intermittently thinly bedded with some more massive beds. They also have thin clay beds at lower levels that erode quicker and undercut the massive ones above. These are similar to, but not the same as, Wellington Rocks and the face we are looking at is much higher, about 8 metres or so. This is probably the rear wall of an old quarry, equally it may also be a fault line between the two outcrops. As I said, there is a difference. Although not too clear on the BGS map, in the memoir for the area, there is an inferred fault mentioned bringing up Lower Tunbridge Wells Sandstone here. Although the Grinstead Clay is also Lower Tunbridge Wells Sandstone, the Ardingly Sandstone is upper Lower Tunbridge Wells Sandstone, I hope that's clear? Lower Tunbridge Wells Sandstone, so my memoir says, is mainly sandy with fine grains; there is a lot of siltstone with thin beds of silty-clay. At Tunbridge Wells it is 40m thick; 34m at East Grinstead and 27m at Cuckfield. The Ardingly Sandstone is 16.8m thick at Tunbridge Wells; 18.3m at East Grinstead and 12.2m at Cuckfield.

As one travels east of Tunbridge Wells and Pembury, the Ardingly Sandstone and Grinstead Clay die out, such that the Lower Tunbridge Wells Sandstone cannot be differentiated; it therefore becomes the Tunbridge Wells Sandstone alone.

Just a little aside; as Marian and I were walking on to Mount Edgecombe she suddenly pulled me up and pointed to the ground. Out of the corner of her eye she had seen movement. I looked down and sure enough she had. A small toad was crossing the path right alongside of us, heading for the undergrowth that side of the path. It was barely 30mm long. We watched it reach the other side and safety, and disappear into the scrub.

Returning to the cars we are going on to Rusthall Common now. Due to parking problems which are quite common there, Anne suggests we take just two cars, leaving the others here. That sorted then we're off. We park above the Common and walk through the trees towards outcrops of some quite large exposures. Again these are Ardingly rocks, however, in my BGS memoir 303 and map, it is reported that there are to the east, in Denny Bottom about 500m away, Lower Tunbridge Wells Sandstone rocks. Somewhere close by is the junction with the Ardingly Sandstone, beyond these the Grinstead Clay is to the S/W, about the top of the hill. A small sliver of Upper Tunbridge Wells Sandstone completes the Hastings rocks in the area beyond that.

All very confusing, as further westward, the Grinstead Clay separates into a lower and upper Grinstead Clay with calcareous Cuckfield Stone in-between, not seen here though. What we did see, however, was a highly reddened sandstone bed, which my memoir also tells me is seen near to the top and the bottom of the Ardingly Sandstone in many places. This ferruginous and cemented layer is quite likely a junction with the local Lower Tunbridge Wells Sandstone, then?

The rocks at the Common have been given quaint names for you to remember them by; there is 'Loaf Rock', the 'Cheesewring', 'Elephant' and 'Lion'. The most famous in the area though is **'Toad Rock' (**see next page**)** due to its uncanny toad like shape; in later years this structure has had to be guarded by railings to prevent it being damaged and vandalised. There are a dozen or so other 'named' rocks to see and walks to try.

Having examined these, Anne led us across the road to a steep lane; more trees around here and further exposures of Ardingley Sandstone. This is Bull's Hollow and Quarry, which may probably have been worked over 100 years ago. As usual in this environment there is a lot of wood and leaf decay which, gives the impression that we are walking on a sponge in some places. To that end there are pockets of much wetter areas that hold water and get a little boggy. We are able though to get to many of the faces where again the various aspects of the formation can be viewed.

There is another aspect to these rocks I find quite interesting, they are relatively hard, but only on the surface. Many of these faces have had a lot of years of weathering which can enhance their strength. What happens is that a crust forms, duricrust, or hard-pan, which is a few millimetres thick. We know this because once damaged and broken, the surface underneath will just crumble away and leads to piles of sand building up below it. This crust can be cemented by silica – silcrete; calcium carbonate – calcrete; and ferrous iron, giving iron pan. Much of this hardening is done, with the rocks still underground, by groundwater, which may be oxygen-rich, carbonised or ferruginous. Once elevated and exposed and open to the elements, the hardening process is completed.

We returned to the common at Tunbridge Wells for lunch.

Our next and final visit today is a little out of the area inasmuch that it's not Tunbridge Wells. We are to visit Stonewall Park at Chiddingstone Hoath. Stonewall is a private park and garden that the owners open only twice a year to the public, with proceeds going to charity. First, when the daffodils are open and next, when the bluebells are; today it's the bluebells. The park is NW of Tunbridge Wells toward Penshurst, then west, about 8 miles total. Anne tells us she came here a couple of years ago and explains the layout. As well as daffs and blues there are also many other flowers and shrubs, including rhododendrons, many of these being in-flower. **Stonewall house** is a large country pile and sits atop the highest point in the area, overlooking pasture, woods and valleys. In the bottom of one valley a spring line flows west to east linking ornamental ponds; it joins the Medway just a few miles away near Penshurst.

On her first visit Anne was surprised to see a large outcrop of sandstone to the side of the valley above the spring line, but, not surprisingly, she knew immediately which formation she was looking at; this is another exposure of **Ardingly Sandstone** (see next page), the spring line is where the junction with the Wadhurst Clay is.

The sandstone had the same types of bedding and jointing, honeycomb weathering and grit layers. As we walked down the garden path alongside of the rocks there was an opening in them where one could stand. A handrail stopped you from falling down a hole that I realised later was probably a well to the water table in days gone by; the same water level supplying the springs in the valley today.

The geology here at Stonewall and the area in general is highly convoluted, a jigsaw puzzle of different formations of the Hastings Group. This is where my second BGS memoir and map comes in useful, '*Geology of the country around Sevenoaks and Tonbridge'*. Where our cliff face is, the fault juxtaposes Ardingley Sandstone against Lower Tunbridge Wells Sandstone, which is why Wadhurst Clay causes the spring line to form. It has been moved up against the Ardingly Sandstone. Only a few miles away, at Penshurst, rocks of the Ashdown Formation are exposed. Above us, here at Stonewall, Lower Grinstead Clay and Cuckfield Stone (*in addition*) cap the high ground. Much of this has been caused by movement on the southern limb of the Penshurst to Gilridge anticline, the cause of this being the Alpine Orogeny. These movements have occurred over the last 15 million years or so, and along with the Ice Ages, though never glaciated this far south, have been uncovered and had other formations eroded from above them, to get to where we are today.

All in all, this has been a very interesting visit to these sites today and I would like to thank Anne on behalf of the group for organising this tour.

References

Geology of the country around Tunbridge Wells, BGS Map and Memoir 303, 1972, Bristow and Bazley.

Geology of the country around Sevenoaks and Tonbridge, BGS Map and Memoir 287, 1969, Dines, Buchan, Holmes and Bristow.

The Wealden District, Gallois, 1965, Fourth Impression 1992.

OS Explorer Maps 135 Ashdown Forest and 147 Sevenoaks and Tonbridge.

Dr Raymond Casey, FRS

1917-2016

Raymond was not a member of our Medway Soc. but I mention him, none the less, since his work has influenced the activities and knowledge of many of our members. The late Mick Culleford gives a fine report on him on our website, but not all of us have access there, so…

This is by way of a shorter account. It is amazing that his name first came to my attention as long as 53 years ago, when I first read the Maidstone area memoir. His research into the ammonite zones of the Gault Clay is world famous. He gave particularly close study to the junction of the Gault with the underlying Lower Greensand, and went on to make detailed studies of that latter formation as well.

Raymond was born and grew up at Folkestone, and so the Gault was right at his back door, and he quickly discovered The Warren, at a time when it was totally open to the sea, (minus recent defences). And so Raymond discovered its wealth of fossils. At school a science teacher encouraged him to study geology. He was further encouraged by the curator of the Folkestone Museum. It was no doubt his enthusiasm and these contacts that led to a meeting with the famous Gault Clay expert, L. F. Spath. Raymond had left school with no formal qualifications, but it may have been these other factors that got him a post with the British Geological Survey (BGS) in 1939.

World War II intervened and he served in the RAF as aircrew, surviving where many thousands did not. In 1945 he returned to the BGS and also continued his studies and was awarded DSc in 1964. In the 1970s he worked with Russian scientists on the Jurassic/Cretaceous boundary—a work that continued well into the 1980s. In the 1990s he worked as an Honorary Research Fellow at the British Museum. He kept up his work and interests well into recent years, even though he was increasingly dogged by periods of ill health.

I met him once on a field trip, run by the Kent Geologists' Group, to Aylesford clay pit (1998). I had found a fragment of *Douvilleiceras mammillatum*, and showed it to Raymond. This confirmed the presence of this narrow zone at Aylesford, which had been, hitherto, in doubt. Raymond made an entry in his notebook but insisted that I keep the specimen.

Ian Burden

Ian frequently attended our meetings, and always met you with a friendly greeting and a warm smile. He is said to have been not an 'active geologist' but he certainly showed an interest in our meetings and activities. In fact, the place where we meet is really all down to him. It seems (and this is before my time) that when we had to leave our last venue, Ian, who knew the Vicar of St Peters, persuaded the Vicar to let us rent the church hall for an evening each week. So, it was all thanks to him.

He often wore a blazer with an RAF badge. This goes back to his time in the RAF (1958-73), where he served as an instrument assembler.

In his last months he became very ill and much disabled and was not able to attend our meetings.

Winter—spring roundup 2016

Jan 13
This was a do-it-yourself evening—several fossil displays, from very large specimens to micro.
Jan 20
A talk by James on the Tertiary Volcanic Area of West Scotland
Jan 27
Some members went to a talk on fracking, given by Prof Dave Wray. A few members attended the substitute program—I brought along a selection of fossil echinoids, and John Taylor brought along his laptop with digital pictures of his mineral collection.
Feb 3
Field Trip planning discussion
Feb 10
Palaeocene-Eocene Theme
Feb 17
Nodules as fossils or minerals. A lot of collections of fossil plants in nodules. And from the Chalk—fossil sponges or flint cores. Perhaps both?
Feb 24
Ann Barratt gave a talk on her last visit to Australia – in the Kimberley Area in the NW of the country.
Mar 2
Ann Padfield gave a talk on the mechanical strength of rocks
Mar 9
Dave Talbot gave another illustrated talk on Canyon Lands of SW USA
Mar 16
Tony gave a talk on sediments—how to determine their order, and age etc
Mar 23/30
Easter break
Apr 6
James gave a talk and demonstration on 'Virtual Geology' – websites on geological information
Apr 13
A county theme – Derbyshire,
Apr 20
Oligocene to Pliocene. It turned out that I had more Miocene fossils than from the other two periods,.
Apr 27
The theme was Gloucestershire
May 4
Ann gave another talk on her Australian trips
May 11
Tony gave a talk on Georgia and Armenia. He was about two minutes in before we realised he had given the talk before. None the less, he continued and was much appreciated
May 18
Anne P gave a talk on Orogenous zones

May 25
Images night (20 pics on a memory stick)
Jun 1
County Geology – Cornwall
Jun 8
Pleistocene-Holocene Theme
Jun 15
Nick gave a talk on The Geology of the Blue Bell Hill chalk Pits
Jun 22
Ann—a further talk on NW Australia
Jun 29
James—A simplified but interesting tour of the geology of Kent
Jul 6
Tony- The Country of Georgia
Jul 13
End-of-term party

Autumn 2016 Evening meetings (Provisional)

Sep	7	Welcome back	All members
Sep	14	Northumberland and Co Durham (County Theme)	All members
Sep	21	Ranscombe Farm	Steve Taylor
Sep	28	Igneous Rock	All members
Oct	5	The Muck above The Chalk	Nick
Oct	12	tba	James
Oct	19	Isle of Wight	All members
Oct	26	AGM	All members
Nov	2	Evaporites	All members
Nov	9	Cambridgeshire (County Theme)	All members
Nov	16	tba	Chris Duffin
Nov	23	Metamorphic Rocks	All members
Nov	30	20 Photos on a stick	All members
Dec	7	Q and A	Tony
Dec	14	End of Term Party	All members

Were any geological epochs ice-free? - a short comment

Nick Baker

Even in the early days of my interest in geology I would often find my self reading of times when the Earth was so warm that there were no ice-caps. Often the Jurassic and Cretaceous were the main candidates for this. But as my meteorological knowledge caught up with the geology, I began to realise that this was highly unlikely, if not impossible, even in the light of supposed geological evidence. To get to that situation you would need an iso-thermal atmosphere—that is to say that there would be no lapse of temperature with altitude. Given that the atmosphere is *warmed and cooled by the ground,* this situation would fly in the face of physics. Also, convection would be impossible—so no cumulonimbus—and 80% of rainfall today is derived from Cumulonimbus clouds. There would also be no orographic ascent or weather fronts. No changes of pressure and no wind.

If it rained at the tropics, or anywhere, for that matter, then there were ice-caps in the polar regions. A warming planet would mean a depleted ice-cap but not an eradication. Conversely, an ice age does not result in the eradication of equatorial forest, since the (thunderstorm-laden) inter-tropical convergence zone is *always* present. The forests would be reduced but never eradicated. Changes in temperature put stresses on climatic zones but they are never removed, because planetary wind circulation must always be balanced.

The problem is that ice-caps, where they are far from land leave little geological trace. Between the end of the Permian and the Miocene the south pole was never over land—hence the apparent ice-free epochs. Perhaps more research is needed in those sea areas where the polar zones formerly existed. Yet, aspects such as oxygen isotope data need to be treated with caution, and any conclusions need to be formulated with current meteorological, as well as geological, understanding.

On the final page is a copy of our new 6-sided advertising leaflet. Many thanks to the team and especially Fred for making it possible.

Members searching for fossils during a field trip to the Isle of Sheppey

Subscriptions depend on your circumstances. Details and an application form are obtainable from the Secretary:

Anne Padfield: Telephone 01634 686294
or
Tony Mitchell: Telephone: 01634 235507

email:
medwayfossilandmineralsociety@gmail.com

or contact us via our website:
www.mfms.org.uk

or why not just drop in on one of our evening meetings!
For details of the current Club Night Activities Programme and other society details, visit our web site: www.mfms.org.uk

Meetings take place at:
St. Peters Church Hall
Delce Road, Rochester, Kent
Wednesdays from 7.00 to 9.00
ME1 2EH

Medway Fossil And Mineral Society

Promoting an interest in the study of:

Fossils
Minerals
Geology

The society caters for all people interested in the Earth Sciences.

This includes the study and collection of fossils, minerals and geology in general.

Some members have a particular interest in Wealden, Gault, Chalk and London Clay.

Meetings are varied.
They include talks, lectures, workshops and displays. Displays are designed to enable everyone to take part. The subject is set well in advance and members display and introduce their material which often produces a wider discussion in the group.

The Society runs several field trips a year visiting sites including mines and quarries that are not usually accessible to individuals. Most trips are local but a few will be further afield to Wales, the West Country, Isle of Wight and rest of the UK. Through connections with other societies it may be possible to join their field trips.

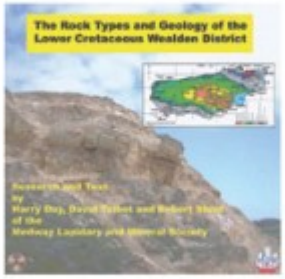
For details of the current Club Night Activities Programme and other society details, visit our web site: - www.mfms.org.uk

Other interests are the collecting and study of Ice Age fossils and flint implements found in the local area.

The combined knowledge within the membership of the society on the Kent deposits of London Clay, Gault Clay and Chalk deposits is among the best in the country.

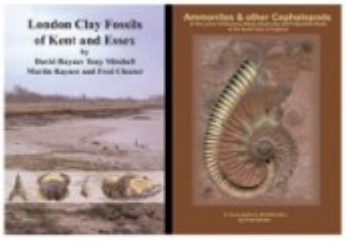
The society has put on The Fossil Road Show in Rochester and also displays in London, Kempton Park, Canterbury, Maidstone and Gillingham.

Members have researched aspects of local geology and produced a CD containing details of Wealden rocks.



Three books featuring
- Ammonites and Cephalopods of the Lower Cretaceous, of Folkestone
- London Clay Fossils of the Isle of Sheppey
- London Clay fossils of Kent & Essex

were produced by four members of the Society. Details and order forms can be found on our website - www.mfms.org.uk



Most meetings are informal which makes it easy for newcomers to get involved. The minimum age limit is eleven but juniors must be accompanied by a responsible adult member.