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

Haddock's Reverse Fault, near Fairlight, Sussex. September 2016.

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Editors notes.

Welcome to edition number seven of *Occasional Erratics*. I have Gary's third and final report from the US and a report from a field trip to Cliff End. Also a short report on the GA's Festival of Geology, also from the vantage point of myself and Tony as we ran an exhibit representing The Medway Fossil and Mineral Soc. Due to being ill, I was not able to give my talk on *The muck above the Chalk*. It has been distributed on line and on the website and so is not being included in the digital letter. Instead it is being sent in printed form with the posted letters. I have also tried to answer some recent comments. There is a Focus on Radiolaria. A round-up of the Autumn program and the next spring and summer program.

NORTH WESTERN USA FOSSIL SIGHTS #3

Gary Woodall

In this the third, and final, article of the series I will talk about some of the Cainozoic sights that we visited on our holiday to the USA. The first of these is a place from which many of you will have a fossil. This is Fossil Butte National Monument, where the famous 'Green River' fossil fish can be found. Well actually the fossils some of you may have would have come from private quarries outside the monument as to collect from there is highly illegal! the excellent visitor centre displays some truly fantastic fossils, not just of fish but plants, insects, reptiles and even birds!. The fossils were preserved in several very large lakes (50 by 20 miles) that were around in the Eocene period.

Fossil fish and birds on display at Fossil Butte.

The next place we visited where fossils could be seen was Badlands, a spectacular national park in its own right, with very impressive rock formations of the classic western badlands type. The rocks are Oligocene in age and within them many fossils of early mammals have been found. Again it is not permitted to sell fossils from the park but they can also be collected from the surrounding area. I am fortunate to have had the chance to trade with a dealer for Watchet ammonites for a couple for Oreodont skulls from these beds. As always there is an excellent visitor centre where fossils can be seen, but also has very good dioramas showing what the Oreodont animals looked like.

Diorama of the Badlands Oligocene.

Nearby Badlands, (well actually 170 miles but that is nearby in Wyoming terms!) is Agate Fossil beds National Monument. The rocks here are younger and mainly Miocene in age. Various quarries in the park have yielded many complete skeletons of mammals around at the time, the most common is Menoceras a very early Rhinoceros, which has been collected in large bone-beds. but there are also remains of huge carnivores called Daphoenodon which was a Bear-Dog. The area was also known for a spiral like structure that was occasionally dug up. Named 'devils corkscrews' their origin was unknown until the remains of a small rodent like creature, (later named Damonelix), were found at the bottom of the screw. This was then identified as the burrow of the animal and several can be seen on trails in the park.

We had now been in the USA for nearly three weeks and heading back to Denver for our flight home. However I could not leave before visiting the most recent but nevertheless one of the best sights, this is the Mammoth fossil site at Hot Springs.

Damonelix burrow.

The fossils were discovered when the town of Hot Springs was being expanded as a popular spa town and several mammoth bones turned up. Thanks again to a thoughtful developer, the area was not destroyed but carefully preserved and now displays perhaps the greatest concentration of mammoth skeletons in the world. It is thought that the place was originally a sinkhole, wherein mammoths became trapped and ultimately fossilised. Anyway, a museum building now covers the site wherein several dozen fully articulated skeletons can be seen.

Mammoth fossil site.

That concludes my series of articles on the fossil sights that Judy and I saw on our holiday to the north-west USA. The area is, however, not only good for the fossil sights that I have described but also contain some of the best national parks in America.

Geologists' Association, Festival of Geology_2016

Nick Baker

I'm not sure how it all happened, but up to November 5th, what was on my mind, and possibly Tony's, was November 5th. That was the date of the event. And so, what to bring along. A lot of specimens. Some big, some normal, and some micro….arh. Somehow, this seemed to catch Sarah Stafford's (GA Secretary) attention. And so it was—need microscopes—we brought three. So we need power supply. So bring extension leads. A lot of microslides, and also Nick's speciality—'box samples' of 'mini fossils' - the bigger stuff that appears when looking for micro. Tony also brought his rock splitter and a whole lot of bits of sandstone from the Clockhouse Pit (Lower Cretaceous) containing small fossil beetles. What about who we are—what about backboards? So I bought along some photographs, as well as some geo-strat diagram sections of Blue Bell Hill, Boxley Hill, Thanet etc. Production of micro-slides—what kit is needed for the whole process. So bring sieve, sorting trays etc, samples of stuff at different stage of production. At least I did not have to do a dummy run of it all!

The idea was for Tony to drive to my place, and then we would drive on to UCL. Tony arrived a little after 8.15 a.m. and we got to UCL at around 9:30. We had to park the car some way off. So I set up while Tony parked the car—about a mile off!

We set up our table, which took a good hour, before doors were opened at 10:30. The fossils impressed a lot of the children but I get the impression that their attention span is getting shorter and shorter. The 'Now Society' demands an instant answer. Several times one of them asked me a question, but has walked away when I got to the third word. How will they be able to put information together? There is no connectedness or unanswered mystery. Would I have got interested in geology today? – I have strong doubts! I kept my interest in that first 20 years because answers came slowly. I knew no one else. There were only a few books. When I did get to know other amateurs, it was only once or twice a year. It was the Open University that made all the difference. And the OU Geol Soc. produced a flood of people.

At the event today, there was a problem of the fact that children are rarely careful, even with their own things. Never put delicate exhibits at the front, especially those that require box-lids to be removed. Fingers have to explore but don't expect those fingers to have regard for the delicate. Magnifying glasses are picked up but often not used for their purpose and may be dropped onto glass slides! Today, there was no damage.

Then I got involved in an argument with a gent over an identification of a sea urchin. I maintained that there were two types of *Epiaster corbovis*, one from the *lata* zone of the Chalk and one from the *planus* zone. *Epiaster corbovis aff lata*, and *Epiaster corbovis aff planus*. We argued for some time. He inferred that the fossils were not found where I had found them. This got my goat and raised my blood pressure. We called it a drawer. He walked off and I had a migraine!

A message of the day, was that people don't expect fossils to be small, and was usually greeted with "Oh Wow". The fossil road shows often give the impression of the big. So perhaps an inclusion of some small is the way to continue.

Tony was much on demand, demonstrating his rock splitter. Then it was time to pack everything up. We were completed in half an hour. Tony and I finally got away. We felt it had been a good day. Due to demonstrations, the normal routes out of London were closed and the traffic often congested. We eventually got back on our inward route and got back to South Darenth at 7p.m. Tony then continued on his way to Gillingham.

Tony demonstrating the rock splitter

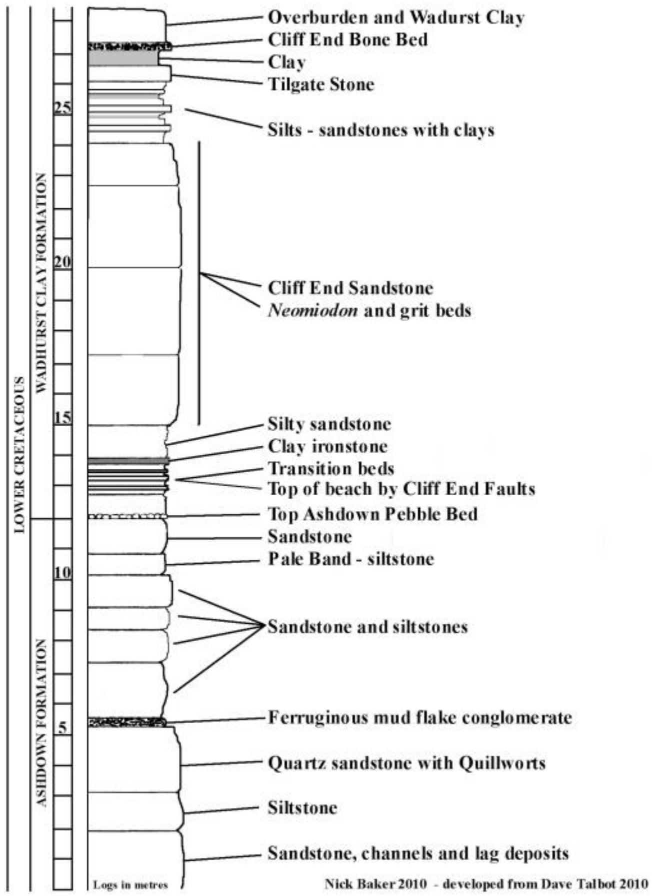
Field trip to cliff End, Winchelsea, Sussex—October 23rd 2016

(Lower Cretaceous—Hastings Beds)

Nick Baker

About 10 of us gathered at the Cliff End car park on a breezy but sunny day. Dave Talbot organised and led the trip. We then moved off towards the end of the cliff section. I will say a word about the geology in general, before going into detail later. The rocks here are quite low down in the Cretaceous system. Broadly, the Cretaceous is divided into the Wealden, Lower Greensand, Upper Greensand and Gault Clay, and Chalk. The Chalk is the Upper Cretaceous, while the other strata comprise the Lower cretaceous. The Wealden can be divided into an upper Weald Clay Group, and a lower Hastings Group.

Fig 1 Cliff End to Haddocks composite section



The latter is divided into the, Ashdown, Wadhurst Clay and Tundridge Wells Formations. Here we have the top of the Ashdown Formation and the Lower part of the Wadhurst clay Formation. Of the Ashdown, about 3 metres can be seen in the cliff, with about another 230 metres below the beach! Of the Wadhurst Clay Formation, we can see here about 16 metres out of a total of 70. A more detailed section of the cliff is shown on the left, to which I will make mention as we go along.

But, first of all, Dave reminded us of the two main hazards in the location. Firstly, the cliffs are very unstable and rock can fall at any time, evidenced by the large boulders on the beach. Spring can be the worst time, particularly after a winter of repeated freeze and thaw. Secondly is the tide. Much of the beach is below the high water mark and any traverse should be made on a falling tide. Do not wait until lowest tide before you start – the tide will be rising before you reach safety.

There is a complex of faults at the NE end of the cliff (The Cliff End Faults). The faults here have developed under tension - pulling apart - such that the right hand side has fallen with respect to the left hand side. Looking at the deposits on top of the fault we could see that it had only moved down a few meters but this doesn't show how far it may have moved laterally. What it has done is weaken the rocks such that they erode quicker than the un-faulted ones. **The photo to the left shows a good example of 'fault-drag'** – curved strata due to the tension of the fault, more commonly seen in clays and softer sandstones.

At the base of the cliff and near the top of the Ashdown is a band of pale siltstone and above this is a band of sandstone. A pebble bed, but really a line of clasts, marks the base of the Wadhurst. A metre or so above this, in what Dave calls a **transition bed (see photo right),** is an important sideritic clay-ironstone, reported by the BGS to be Weald-wide. This ironstone has been mined and quarried extensively over the years for its iron content, mainly in the 17th and 18th centuries. In laboratory tests, there was found to be >35% iron. However, richer iron bands were to be seen later.

The main member of the area is the Cliff End Sandstone (CES), which is about 9-10 metres thick. This sandstone is not the only one in the Wadhurst Clay. To the north of here there is the Hog Hill and the Northiam Sandstone. In the CES there are several shell beds of *Neomiodon* (**see right)** and, although the CES has been described as homogeneous, looking at blocks on the shore one can see many fine structures within it. There are cross beds, grit beds, and channels to name a few. By studying fallen blocks, before the sea takes them, other structures can be found, because although this rock looks quite substantial, it is easily broken down when the sea gets to it.

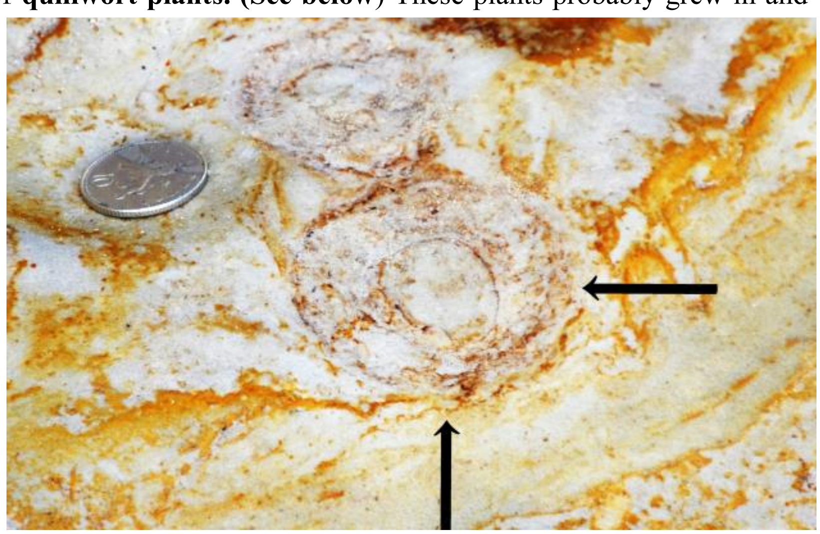
In the clay-ironstones just below the CES can be seen the **structures shown in the photo below.** These are 'shrinkage cracks' -Synaeresis, produced where a bed loses water and shrinks. Material in the bed below then comes up into the cracks.

The top of the sandstone is incised and has a rich purple colour. This is said to be due to forest fires and, again, when looking at blocks on the shore, this ash-like material can be seen, quite black in places. There also appears to be flattened plant-like material with a charcoal appearance on this top. Above the CES is a mixed layer of silts, sandstones and clays. Limestones are rare in the Hastings Group but one such is the Tilgate Stone' after the forest of the same name to the NW near Crawley and named by Mantell, the 19th century geologist.

Right at the top of the cliff is the Cliff End Bone Bed. This bone bed, over the years, has been found to be rich in small fossils, with bone, teeth, and scales from fish, early mammals, reptiles, frogs and dinosaurs amongst several other types of remains found. This bed only occurs in thin lenses so its occurrence on the beach can be a bit hit and miss. Since the bed is cemented with calcite, the fossils can only be extracted by first breaking it down with a suitable acid, such as formic or acetic. But not those such as hydrochloric, since this dissolves the phosphate in bone material. The fauna can be as little as micro size, the most common small fossils being the teeth of *Lepidotus*, but the biodiversity is low compared with other bone beds such as the early Triassic Rhaetic Bone Bed.

Having discussed the cliff sequence, it was now time to begin the traverse south-westwards towards the Haddocks Fault. Because the beds at this point are dipping to the northeast, we were now seeing older beds below the section so far described. Below the pale siltstone there is a prominent ledge in the base of the cliff, above several layers of siltstone and sandstone, comprising about 4-5 metres in thickness.

Half way to Haddocks Fault is another ironstone band with >55% iron. The clay and iron layers take up the dips and hollows in the sandstone so that in places the clay thins right out and is replaced by the ironstone. There is then a shelf of fine sandstone and within it we can find the' ghosts ' of **quillwort plants. (See below**) These plants probably grew in and around the edges of lakes and rivers in the Weald basin. Against modern examples they were likely of a similar size, growing 250 to 400mm in height, they grew from a corm -the bulbous part, they may even have been an early flowering plant; but that's just speculation. Whatever they were their remains can be seen as fine oxidised elements here in the rock. Analysis of this sandstone shows that it is an almost 100% pure quartz silica sand.



These layers often contain examples of fossil **ripple-marks (see next page**). Such features can be seen quite widely throughout the Hastings Group. Fallen boulders include examples of the Cliff End Bone Bed and Tilgate Stone.


These rocks have a fine texture to them and appear to be moulded to the shapes they have become. They also appear to have been trampled and walked on, which Dave called **'dinoturbation' (see above-right**), because quite often you can see foot-prints within them. These rocks fall out from the cliffs above, so are Wadhurst in age, from above the CES—mostly in the Tilgate Stone. Today I saw more of these footprints than on all my previous visits put together.

Finally, we arrived at **Haddock's Reverse Fault (see right**). Unlike the Cliff End fault we saw earlier which is a tensional fault, pulled apart, this fault has been caused by forcing the rock together, fracturing it causing the L/H side to move up with respect to the R/H side, the throw here is between 55 to 60 m. Whereas the cliffs to the right are Ashdown and Wadhurst, the cliffs to the left are all Ashdown and therefore older than those to the right.

This faulting and erosion shows something else also; the hard, ferruginous cover to the wall of the fault. Some years ago, Dave reported that this darkened cover did indeed cover most of the face. Now, as we could see, this was not the case. Most of this hardened protection had now been eroded and broken off. Again this was due to the westerly winds, with water and frost getting into the cracks and joints, forcing rocks to split. Once this has happened then it won't be long until the rest has spalled off; then we would see this face really start to breakdown. The dark layer on the surface of the fault formed when the fault moved -this is fault gouge or rock flour. Due to its crumbly nature, oxidised groundwater has got into it and reddened it with iron, which, in turn, hardened it also. Prior to this some burrowing creature had left its mark in the material.

At this point, in Fairlight Cove, the beach is covered with boulders of an igneous rock – Larvikite used here to help halt the otherwise rapid erosion of the cliff

Fairlight Cove West -here in the cliffs at the back we can see another distinct change in adjacent sediments -especially the colour. Though not as distinct as at Haddock's, this is Fairlight Reverse Fault, with a throw about 60 m to the NNE, so yet older sediments being forced up to the left but still Ashdown. These are the Fairlight Clays of old, a term not so much in use these days as they are a local deposit not found elsewhere, so not classed as a member. The mottled colours within the clays are termed 'cat's brain clay'. These are also subject to erosion by slumping, which is why the rock toe has been laid in the last couple of years. In the 1990's; much of this slope was creeping toward the sea.

You can find a lot of plant material out here in front of the fault where it has been suggested, though Dave hadn't looked for himself, you may also find insect wings. Fossilisation is a relatively rare occurrence even at the best of times and for animals in terrestrial deposits as here at Fairlight it is even rarer. However, they are found and there are those of us who can say 'yes, I have a piece of dinosaur'. Between here and Pett Level several large bones have been discovered in the last few years, many of which are Iguanodon; so it's always possible. The author would like to add that samples of the clay were taken for micro study and proved to be barren (2010). Dr. A Rundle of the Kent Geologists' Group also confirmed this. This is rare – clays are usually rich in microfossils. But the answer lies on the beach—siderite. The clays were often laid down in anoxic conditions. That said, a sample of clay from the 'Transition Beds' (2011) gave a small number of ostracods.

Most of the party returned at Haddock's Fault (for lunch at The Smuggler?) Dave and I remained and ate our sandwiches before making a slow return to Cliff End.

Focus on Radiolaria

In the Radiolaria the body consists of a central mass of protoplasm, enclosed in a membrane known as the *central capsule* (fig. 1,2). The intracapsular protoplasm contains one or more nuclei, and is continuous, through pores in the capsule, with a layer of protoplasm outside the capsule; this layer gives off thread-like pseudopodia, which occasionally unite.

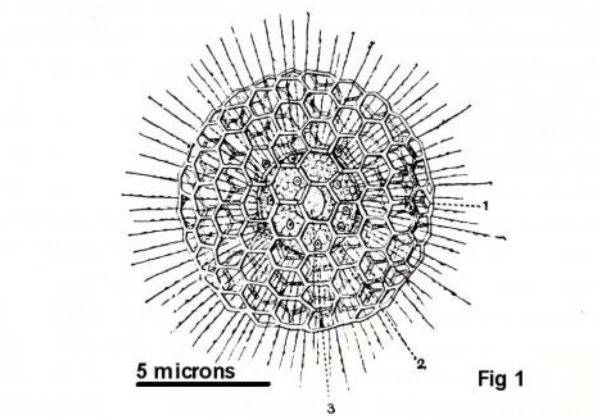
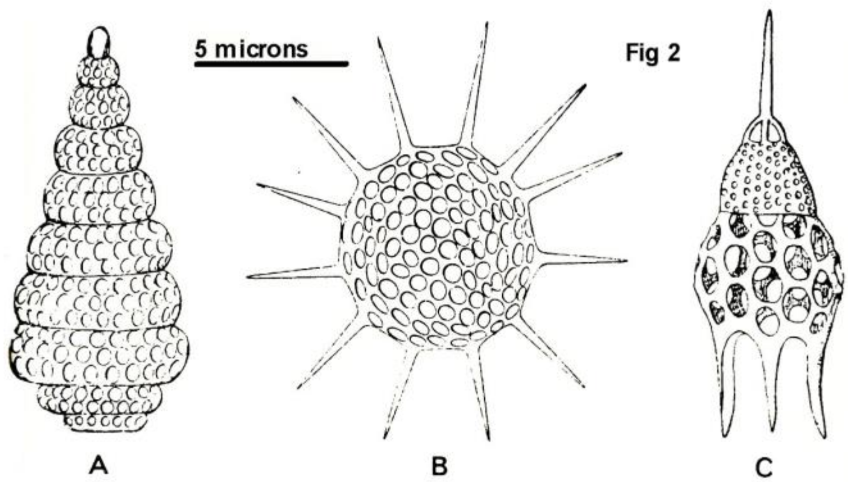


Fig. 1. *Heliosphtrra inermis.* Recent. (After Biitschli.) 1, skeleton; 2. central capsule; 3, nucleus. Pseuilopodia project from the surface.

A skeleton (fig. 1, 1) is generally present and is usually composed of silica; but in one group of Radiolaria it consists of a substance which was formerly regarded as horny in nature and termed acanthin, but is now believed to consist of strontium sulphate. The skeleton shows great diversity of form and complexity (fig. 2); it may be entirely outside the central capsule or partly within, and consists either of isolated spicules, or of a lattice-like or reticulate structure of varying shape, frequently with projecting spines.

Fig. 2. Fossil Radiolaria. A, *Lilhocampe tschernyschewi,* Devonian. B, *Trochodiscus longispinus.* Carboniferous. C, *Podocyrtis sehomburgki,* Barbados Earth (Tertiary).



The Radiolaria are all marine and mainly pelagic; the majority live between the surface and a depth of 200 fathoms, but a few forms occur in much deeper water. They have a very wide geographical distribution, being found in all climates, but show the greatest variety of forms in the seas between the tropics; they are also abundant in individuals in the Arctic seas, but the variety of forms is relatively small. In some of the deeper parts of the Pacific and Indian Oceans the empty shells of these animals settle and accumulate on the sea-bottom, forming a siliceous deposit known as 'Radiolarian ooze'. Only those Radiolaria in which the shell consists of silica are preserved as fossils.

Some bodies found in the Pre-Cambrian rocks of Brittany; have been described as Radiolaria. They are much smaller than later forms of the group, and are thought by some authors to be simply inorganic aggregations. Imperfectly preserved Radiolaria have been recorded from the Cambrian of Thuringia.

In Britain the earliest examples of the Radiolaria occur in the Ordovician rocks of the South of Scotland, where they form beds of chert; others, which are perhaps of nearly the same age, have been found in a chert from Mullion Island (off the west coast of the Lizard) and in, nearby, Cearhays Bay. A few specimens have been noticed in the Carboniferous Limestone of Flint-shire; whilst in the Carboniferous Limestone of South Wales and in the Lower Culm of Devon and Cornwall these organisms contribute largely to the formation of thick beds of siliceous rock (cherts, etc.)—some, at any rate, of these deposits appear to have been formed in shallow water. At several localities in continental Europe, Radiolaria are fairly common in the Mesozoic formations, such as the Cretaceous cherts of the Trudos Mountains of Cyprus, but in England only a few have been recorded from the Lias, the Lower Greensand, the Upper Greensand, the Cambridge Greensand, and the Chalk. In the Tertiary some have been obtained from the London Clay of Sheppey. A very important Radiolarian formation of late Tertiary age covers large areas in the Island of Barbados, and is known as the ' Barbados Earth'; it resembles very closely the modern Radiolarian ooze mentioned above, and is probably a deep-sea deposit.

Feedback—From The Muck above the Chalk

Nick Baker

On the whole, general reception of the transmitted file has been good. Questions have been raised on the time-scale of some events. One, at least, is a mis-wording of my own. I asserted that the uplift of the Weald was wholly a Pleistocene event. There is one area where we cannot escape from that possibility, and that is on the northern fringe of the Wealden Anticline, i.e. in the neighbourhood of the North Downs. The idea tries to answer the problem of Netley Heath, in Surrey, where fossils of Plio-Pleistocene Age (2 Ma BP) occur on the summit of the downs at around 200m OD.

All this assumes that the emplacement of the material took place at or near sea-level. However, there is the question of glacial outwash. For instance, the Red Crag material (and the Miocene in the case of Lenham) may have originally been entrapped by glaciation at some point to the north, and was released during a thaw as outwash. Now, given that no such material flows up-hill, there simply remains the question as how high above sea level was the base of the ice-sheet? If as much as 100m, then the North Downs have only that much more rise to accomplish during the Pleistocene. None the less, at the time of the initial deposition of the Late Tertiary material, part of the area was at or below sea-level, though not necessarily the North Down. Remember that the Miocene ironstone at Lenham is not *in situ*. Glacial outwash from the north is a possibility there, and at Netley Heath there are signs of cryoturbation in the Chalk beneath the 'Crag'. The only question is—at what elevation did the outwash occur? - bearing in mind that the Red Crag at Walton is close to sea-level.

Now, there is a question of the rates of erosion. We know, from the presence of Lower Greensand material at both Netley Heath and Lenham, that the Wealden Anticline was eroded down to the Lower Greensand by the start of the Pleistocene. (the initial rise was probably pre-Pliocene). So the rate of erosion need not be so fast as I may have indicated. However, during tundra conditions, the rate of erosion would have been negligible, and also during periods of grass-cover during the inter-glacials. That leaves us with the initial periods of freeze-thaw, when large tracts of the area would have been a sea of mud. We are talking about the removal of the Weald Clay and Lower Greensand—a thickness of c200m. The problem is we don't know the length of those periods. There were probably four or five. If those warming periods were very short we may be talking of as little as 5x100 years –40cm per year. However, I am not of the "*Grandad remembers the ice*" scenario. There is room for a much lower rates over much longer phases, probably thousands of years—also giving time for a lot of the material to disappear—but not all of it. That remnant has been the subject of the exercise.

Autumn Round-Up

September 7th When I arrived at the hall, it was found to be double-locked. The caretaker did not expect us as early as this date, but we eventually gained access. It was a multi-task sort of evening. I set up my microscope with my home-made polariser – for use with rock thin sections. James had brought in his Bresser Microscope to demonstrate same. I had also brought in a flint sponge, from a Middle Chalk sample I had got at Bluebell Hill. The specimen had very fine microstructure. At one stage two local guys came in—well tanked-up, but they seemed fascinated by our activities

September 14th The theme was Northumberland and Co. Durham. Specimens were brought—including bryozoa from the Permian Zeckstein limestone, and some fish from the Marl Slates.

September 21st Steve Taylor gave an illustrated talk on Ranscombe Farm Nature Reserve (nr Cuxton). He used a full football match in terms of time and it was a good talk, packed with data and interest.

September 28th The subject was igneous rocks. Tables of samples were set up including some micro-photos from thin sections of the samples.

October 5th. The subject was postponed, due to the projectionist being ill. I understand everybody had a 'chatty evening'

October 12th Chris Duffin came along and gave a talk on the History of Volcanology.

October 19th Due to a medical emergency at an earlier meeting at the hall, we were delayed in starting and so we all crammed into the kitchen. We were a little late but not greatly so. It was an Isle of Wight theme and we brought along a good number of fossils.

October 26th This was the evening of the AGM. All assembled and there was not so much to report, but a letter to us announced that the church authorities were increasing the rental on the hall—from £9.50 to £11 per hour. This came to light only after we had discussed the fact that we just about able to carry the former costs, but decided not to increase membership charges this year. At current rate of use, this would result in increases in rent of about £120 per annum. A slight reduction of the number of meetings will be considered

November 2nd This evening was a theme on 'evaporites'. I put the boundary to the definition on the wrong side of gypsum, and so did not bring anything – everybody else brought along mostly gypsum, and a considerable discussion developed. It was quite wide ranging and almost everybody made a contribution.

November 9th To the Medway Soc. this evening. It was a theme on Cambridgeshire. Gary was the only one who brought any fossils along. I had nothing from Cambridgeshire but later remembered that Barrington was in Cambs but I left the microfossils behind at home. What I did bring in caused quite a little curiosity – namely desiccation root tubules that I got from the hillwash above Culand pit in 93. Tony even set up the microscope to have a closer look. (see next page for picture).

November 16th The subject was cancelled due to the projectionist being ill. Steve Taylor gave the second part of his talk on Ranscombe Farm

November 23rd The theme was metamorphic rocks. Rock samples, together with thin sections were displayed.

November 30th 20 Photos on a stick. Gary—Wildlife in South Africa. Fred—French historical sites. John—Well Dressing in Derbyshire. Sarah—General Geology. Dave Talbot—General Geology.

December 7th Question and Answer

December 14th Christmas Party.

Desiccation Tubules. Plant roots growing in chalky soil—water is absorbed around the root causing calcite to deposit. Hillwash at Culand, Blue Bell Hill.

Next spring and summer program.

Jan 18	Field trip planning	Paul—and all members
Jan 25	Iceland (talk)	Tony
Feb 1	Fossil crabs	All members
Feb 8	Hampshire theme (excl IOW)	All members
Feb 15	Fracking (talk)	Anne
Feb 22	Florite	All members
Mar 1	Alternative collections	All members
Mar 8	Purnululu and the Bungle Bungles (talk)	Ann
Mar 15	Silent auction	All members
Mar 22	Echinoids	All members
Mar 29	DVD showing	All members
Apr 5	Easter break	
Apr 12	Easter break	
Apr 19	Easter break	
Apr 26	Sedimentary rocks and fossils in thin section	Nick
May 3	Sedimentary rocks display	All members
May 10	Human implements	All members
May 17	TBA - Rochester Show preparation	James
May 24	Cornwall theme	All members
May 31	Fossil fish	All members
Jun 7	20 photos on a stick	All members
Jun 14	Agates (Talk)	Ann
Jun 21	Question and answer	Tony
Jun 28	Shropshire theme	All members
Jul 5	End of term party	All members
Jul 12	Maidstone building stone walk and picnic	Anne