Occasional Erratics

Newsletter of the

MEDWAY FOSSIL AND MINERAL SOCIETY

www.mfms.org.uk

No. 16. July 2021

I am obliged to add the following, to all those members of the Medway Fossil and Mineral Society, who receive this communication by direct email or by post, under the provision of the General Data Protection Regulation (2018)

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

Cover picture

Flittermouse Hole. On the downs, north of Birling, Kent. This section is typical of the base of the Upper Chalk. ***Note, the location is part of land owned by Birling Estates.***

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Content of Additional Letters (2020-21)

Contents of Occasional Erratics. No. 16

Editor's notes.

At the time of writing, we have plans for our indoor meetings to recommence around the middle of September. That was the suggestion at a zoom meeting a few weeks back. There is now a question around rising infection and just days from responsibility being put entirely in our hands. And that responsibility affects not just ourselves but also the safety and wellbeing of our friends and relations. There will always be a risk in living with SarsCov-2, but we are now being directed to live as if the risk was suddenly minute. And I, even fully vaccinated, stills runs a high risk whatever precaution I take. It may be that rates of infection will have died down by September. We are told that we may have to live with some rate of infection. That creates a considerable dilemma for a lot of us.

I have added a 'late news' at the end of this letter

This year our zoom meetings have been as follows

Jan	6	Benjamin Harrison and Eoliths	Nick Baker
Jan	13	Brazil	Ann Barrett
Jan	20	Brazil	Ann Barrett
Jan	27	Rock cutting and thin-sectioning	Brian Lines
		Brian had some technical problems	
Feb	3	Rock cutting and thin-sectioning	Brian Lines
Feb	10	The Malverns	Brian Lines
Feb	17	Trilobites	All
Feb	24	Geomorphology I	Tony Mitchell
Mar	3	Geomorphology II	Tony Mitchell
Mar	10	Botswana I	Tony Mitchell
Mar	17	Botswana II	Tony Mitchell
Mar	24	Program Planning	All
Mar	31	?	

Apr	7	?	
Apr	14	Caves	All
Apr	21	Lithium and Lithium Mining	Anne Padfield
Apr	28	?	
May	5	Production of rock-thin sections	Brian Lines
May	12	Cephalopods	All
May	19	Fold structures	Anne Padfield
May	26	The Ordovician Age	Tony Mitchell
Jun	2	USA Dinosaur Parks	Gary Woodall
Jun	9	Diamonds and Diatremes	Anne Padfield
Jun	16	Sub-dividing the Chalk	Nick Baker
Jun	23	Fossil Fish	All
Jun	30	Plants	Tony Mitchell
Jul	7	Volcanos	Ann Barrett

In this edition of the newsletter, Gary is talking on The Everglades, and I am talking about Chalcedony and Chalk. Was not sure whether to add the latter, but not everybody saw the zoom talk and I did rush it—so here you have a static record. Sorry, print may be small in parts but there was a lot to put in. Anyway, over to Florida, with Gary.

American Parks Part 6: The Everglades

by Gary Woodall

The previous articles in this series have highlighted some of the lesser know parks in the northwest USA, we now move around 2000 miles east to the lower part of Florida where the Everglades National park can be found. The Everglades National Park and the contiguous Big Cypress National Preserve together are around 2000 square miles. They were created to protect the 'swamplands' of southern Florida in 1947. The term swamp is actually incorrect as the whole Everglades system is a gigantic river. Water from further north in Florida gradually flows south to exit in the Gulf of Mexico. The river itself is many miles wide, very shallow and covered in vegetation, hence its' nickname 'The River of Grass'.

View of Everglades from the observation tower.

By far the bulk of the everglades comprises this grassy wetland but within this are hundreds, perhaps thousands of higher 'islands' where trees, such as mahogany, can grow. The US National Park Service (NPS) has built a few access roads into the wetlands to permit visitors to experience the park and has constructed observation towers. Most of the Everglades is however completely inaccessible other than by airboat, which are banned from the park itself but can be operated in unprotected areas bordering the park. I had always wanted to ride on an airboat ever since watching the TV series 'Gentle Ben' with Dennis Weaver (AKA McCloud) as a child and more recently CSI Miami, so and I went on a ride from Everglades City.

Cypress swamp

Airboat in Mangroves

Apart from the grasslands there are two other major eco-systems, the Cypress Swamp and the Mangrove Forest. The Cypress Swamp, this time a true 'swampland' is, as the name implies, primarily in the Big Cypress National Preserve north of the Everglades. Here can be seen huge Cypress trees which have evolved to quite happily live in water. The NPS has constructed boardwalks out into the swamp to enable visitors to get amongst the trees. This is convenient as I certainly wouldn't want to walk on the ground given that there are alligators and poisonous snakes. The mangrove forests are to be found where the Everglades meet the sea and again these plants are perfectly adapted to this environment.

There is abundant wildlife in the Everglades, the most famous resident being the American Alligator which can be found throughout the park. They are found throughout Florida and virtually every body of fresh water will be home to one. They mainly eat birds, fish and small mammals which they lie in wait for then lunge at to catch, surprisingly fast. A friend of mine is a keen golfer and once when playing in Florida his ball landed beside a water hazard, he went down a small track to play it but a warden arrived shouting to get the hell out of there. When he asked why the warden said that an alligator lives in the hole! Despite this alligators are quite docile and rarely attack. In contrast American Crocodiles are much more aggressive. They can also be found in the Everglades mainly in areas of salt or brackish water. The Everglades are the only place in the world where both alligators and crocodiles can both be found. The main difference between them are that the alligators have a broad snout, crocodiles more V shaped and when their mouths are shut crocodiles teeth stick out and the lower fourth tooth sticks up above the upper lip.

Alligator.

Crocodile.

Blue Heron

Roseate Spoonbill

Anhinga

There are many other reptiles such a turtles, tortoises, lizards and of course snakes. I saw the first three but luckily didn't see any snakes! As you would expect there is abundant birdlife to be seen, including herons, storks, ibis, the very attractive roseate spoonbill and the prehistoric looking anhinga.

Large mammals are nowadays quite rare but there are still a few Florida Panthers living there and also some Black Bears, the chance of seeing one is almost nil. Smaller mammals such as deer and racoons are much more common and there is a reasonable possibility of seeing these. I was lucky enough to see a racoon from the airboat.

In coastal areas Manatees, commonly called Sea Cows, can be seen these huge mammals have few natural enemies but are endangered due to habitat loss and unfortunate encounters with boats. I didn't see any in the Everglades itself but I was lucky enough to see them in a river a few miles north of the park. Beside this river there is a power station which discharges (clean) warm water which the manatees like to swim in. It was quite sad to see that a lot of them showed the scars of encounters with motorboats.

Manatee.

When I worked for ITW-GSE their main US factory was at Tampa in Florida so every year I got to go out there for various meetings. I would always take the opportunity to stay a few days extra and see the sights of Florida of which there are many. I went to several State Parks, Cape Kennedy Space Centre and St Augustine (the oldest city in the USA). But I am proud to say that although I drove past Disney World several times I never had the inclination to visit it!

On one trip to the Everglades I did drive all the way down to Key-West, a 300 mile round trip for the day. I stopped off at a couple of sights, notably Windley Key Fossil Reef State Park. Here all the rock is a coral reef laid down in the Pleistocene. The other notable sight was the original African Queen boat from the film, somehow it ended up in the Florida Keys.

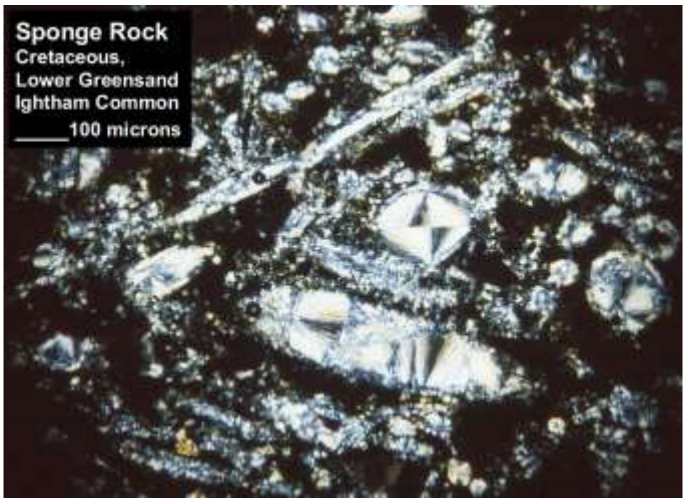
Anyway I could write quite a bit about Florida but that would depart from the theme of US National Parks. So that's it until the next edition and the next park.

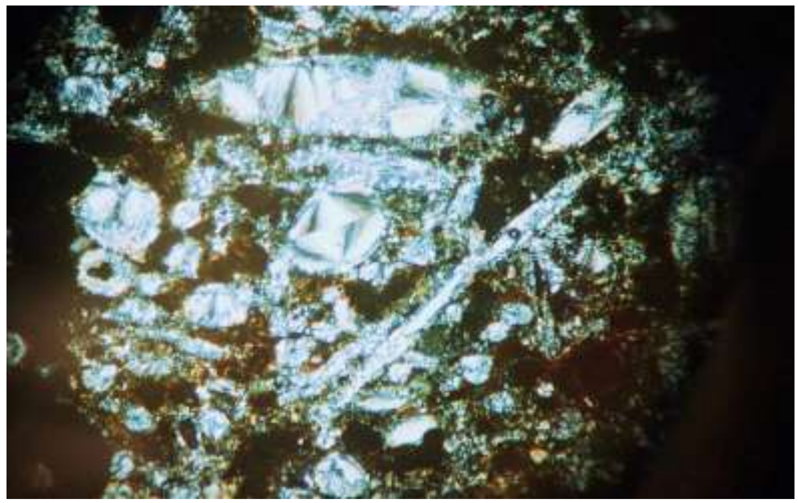
My thanks again to Gary. I calculate that (so far) Gary’s contributions would comprise a whole newsletter—if not two! The subject has reminded me of something connecting. Among my mother’s reading material was a book entitled—***A Girl of The Limberlost***, by a writer named Gene Stratton-Porter (c1912). Apparently, The Limberlost was/is a swamp area in Indiana. Subsequently it was largely destroyed by oil prospecting, but recently there have been moderately successful attempts to reinstate it, at least in part. And the story? Widowed mother hates daughter—because daughter was born on the day father was drowned in the swamp. Were it not for the daughter, mother could have been there to save him! Daughter raises money by selling butterflies (found in The Limberlost) in order to get to college, where it’s a case of boy meets girl and they live happily ever after!
Nick

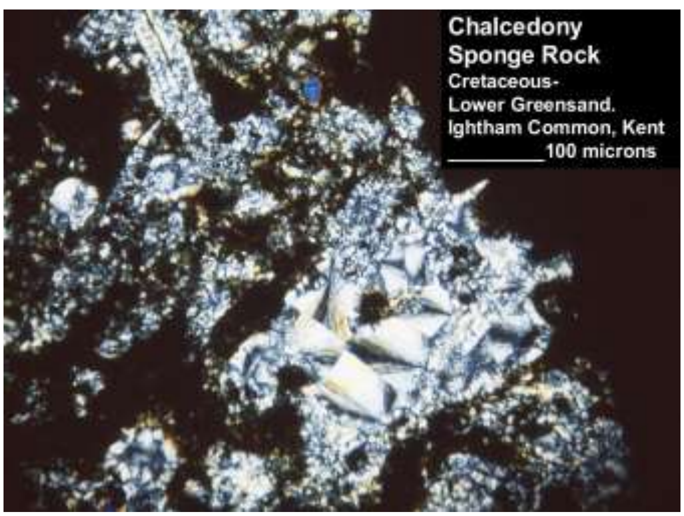
Chalcedony formation in the Folkestone Sands, Ightham Common, Kent

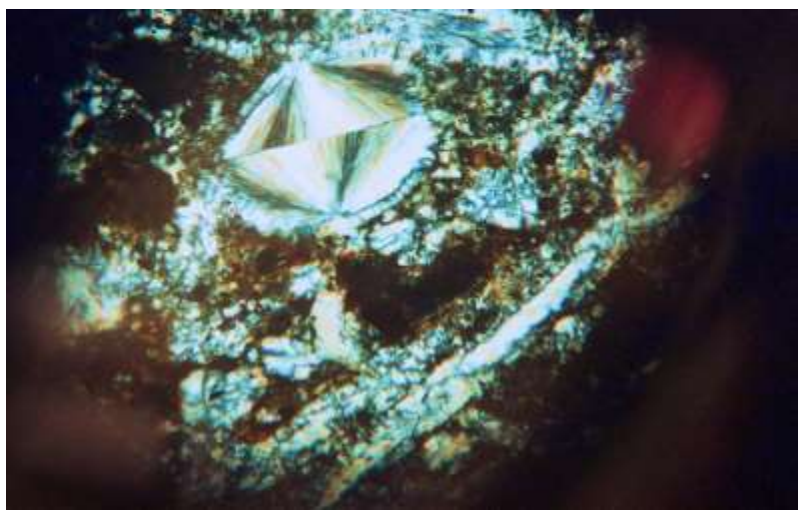
Nick Baker

That part of Ightham Common, known as Oldbury Camp, has long fascinated me. For a start, it is said to be the site of a fortified Stone Age settlement, and yet the geology appears undisturbed. It was a winter afternoon—January 21st 1961, that I cycled out from Bromley, and found my first fossil—a cast of a *Pecten* bivalve, in the local sandstone. But one can always fall into the trap (as a beginner) of so intently looking for fossils, that you don't see the rocks for the fossils. So it was over 20 years later in January 1983 that I picked up a piece of the local rock. It was curious because of its (apparently) low density. Further inspection showed that it was composed of masses of long, thin crystals, less than a millimetre in width but up to 10mm in length. The low density was due to the air between the crystals. It was not uncommon, quite a number of small boulders were lying around. But what was it? No one seemed to know—certainly not the (London) crew at the OUGS. Opinions ranged from some form of slag (from local iron smelting) to peri-glacial transport (?) The Sevenoaks memoir of the British Geological Survey mentions 'Spiculiferous sandstone' in the area in question. A this time (1986-90) I was producing rock thin-sections, mostly igneous and metamorphic, but occasionally sedimentary. I turned my attention to the mystery rock. Below are some of the results.









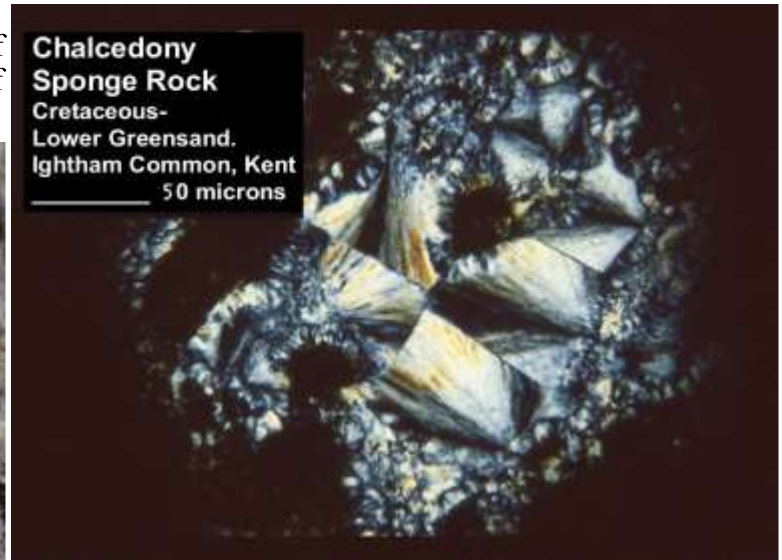
The slides show several cross-sections of the crystals, which appear to be tubes—the outer lining surrounding an infilling with chalcedony. The view is through cross polars. The tubes appear to be about 100-200 microns in diameter.

I loaned one of the slides and a sample of the rock to Richard Taylor (the rock and mineral dealer) who then referred it to a friend. The answer came back as follows.

"*The specimen consists of sponge spicules replaced by chalcedony. In some parts there are masses of Chalcedonised spicules, and in other parts the matrix itself is chalcedonised, leaving casts replacing the spicules. The latter appear as holes in the matrix, while the former are massed together in mats*".

The Folkestone Beds do not often favour fossil preservation (but some of the sponge material may well have been silicerous) - often the sediments are coarse, allowing for percolating water to dissolve any calcareous material. It seems most likely that the chalcedony is a post-depositional *infilling*. Chalcedony tends to do that rather than *replace.*

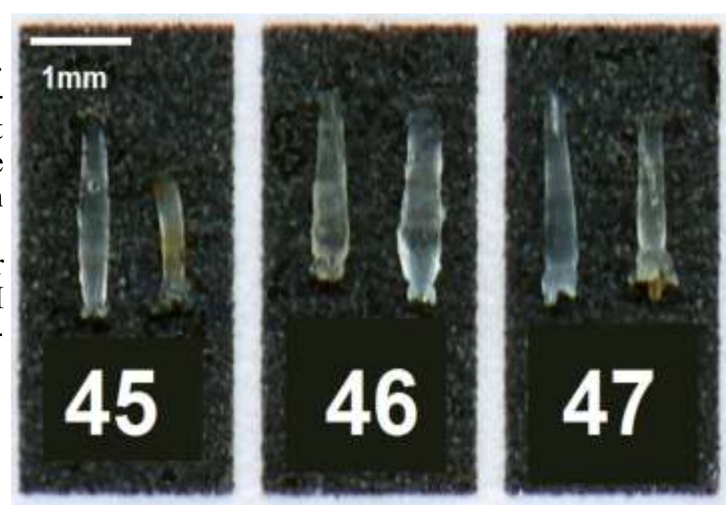
To the right is a close-up of a cross-section of one of the spicules. Below is a detail of the surface of the parent rock, showing the masses of spicules.



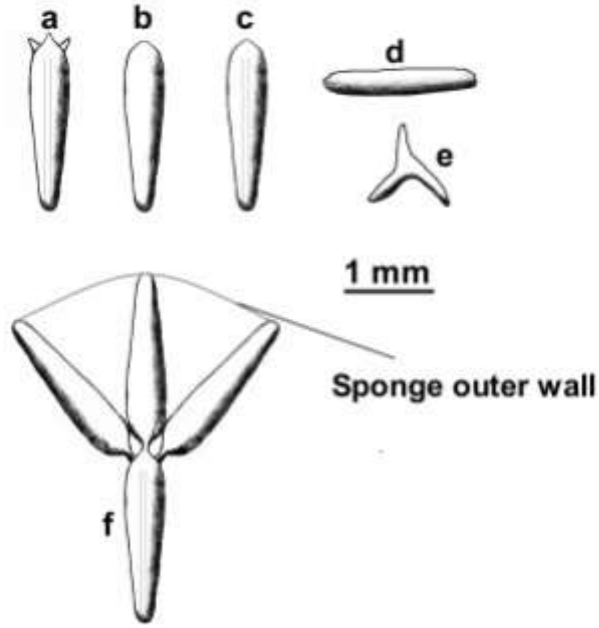
Now, fast-forward 20 years or so. On July 1st, 2011 I was walking along Seal Chart. There had been heavy thunder-storms three days before and the silt on the path had been washed into 'delta-fans' of white silt. I thought of collecting a sample and I noticed that there appeared to be elongate crystals in the silt. Later I found that I had collected another sample of sponge spicules—this time loose.

The field width in the two pictures above is about 2mm. Note that the specimen above-right appears to be splayed-out at the top. This is a common occurrence and is best shown in the picture of the mounted specimens on the right. It demonstrates the break at the junction with another spicule.

In another article in *Occasional Erratics* (number 6) December 2015 (*The White Sands of Seal Chart*) I demonstrated the relationship of the spicules in relation-ship to a complete sponge. (See following page)



Much of the material was eroded to simple elongate crystals (d), with occasional other 'sponge' material, as in (e). There was also a large amount in the form of (b) and (c), with occasional (a) where the ends had, what appeared to be, broken off 'joint segments'. There was a straight tubule apparent through many of the fragments, which appeared to branch into the small end joint segments. The material was of silica, but at the time, I was uncertain as to whether normal quartz or chalcedony.



My subsequent investigation gave the indication that the juxtaposition of the different morphology of the material indicated that they were sponge spicules from Tetraxonid sponges.

The figure (f) gives the complete structure of (a-c). The drawing shows the structure in a flat plain, but in reality you need to think of this as an inverted tripod, with the three 'supports' being attached to the outer wall of the sponge, with a separation of 120 degrees. The fourth single segment is angled into the centre of the sponge. The tubule running through the spicules is the axial canal. In living sponges this is occupied by organic matter and is the first part of the spicule to be formed, subsequently mineral matter is formed around it.

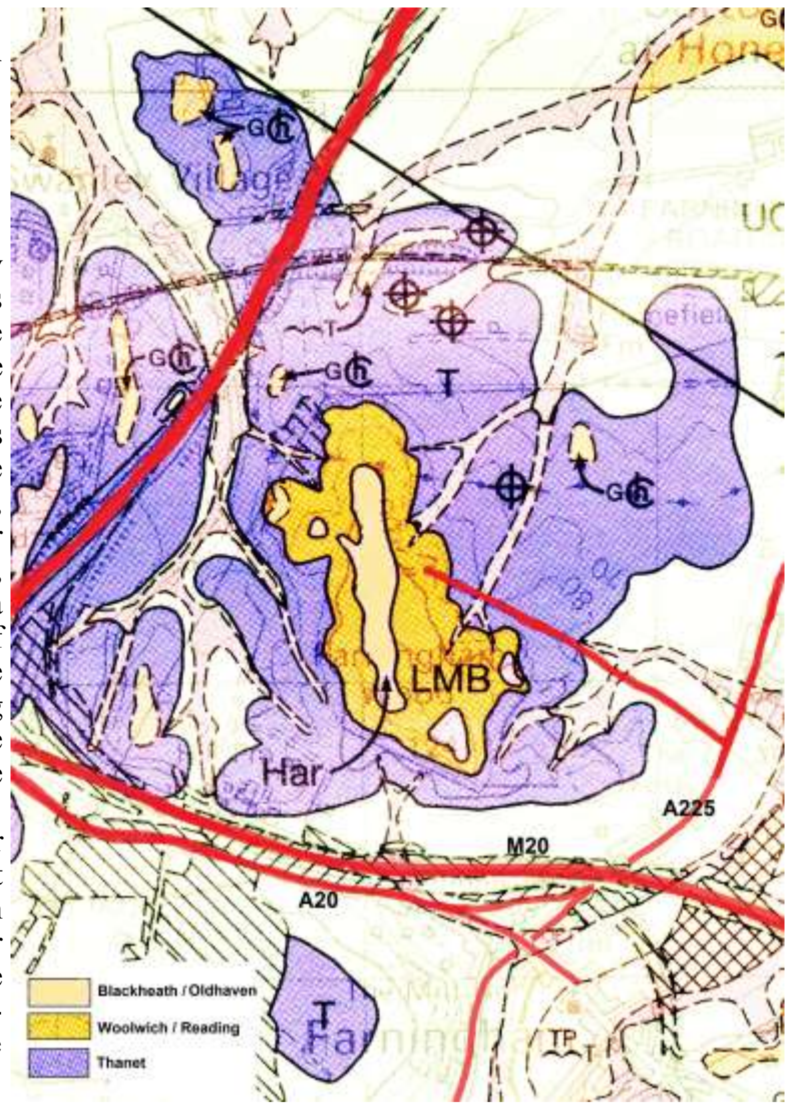
In the fossil state, and where the axial canal is visible, the outer material is generally of colloidal silica, while the canal is in filled with crypto-crystalline silica and is thus visible, especially under polarised light. But often the canal is invisible due to the whole spicule being replaced with cryptocrystalline silica.

All of this material is derived from the underlying Folkestone Sands, but given that the path was on the highest ground, the source rock must be in that vicinity and there are quarries and road banks in the area.

Some Lower Tertiary outliers in North West Kent
2. Farningham Wood

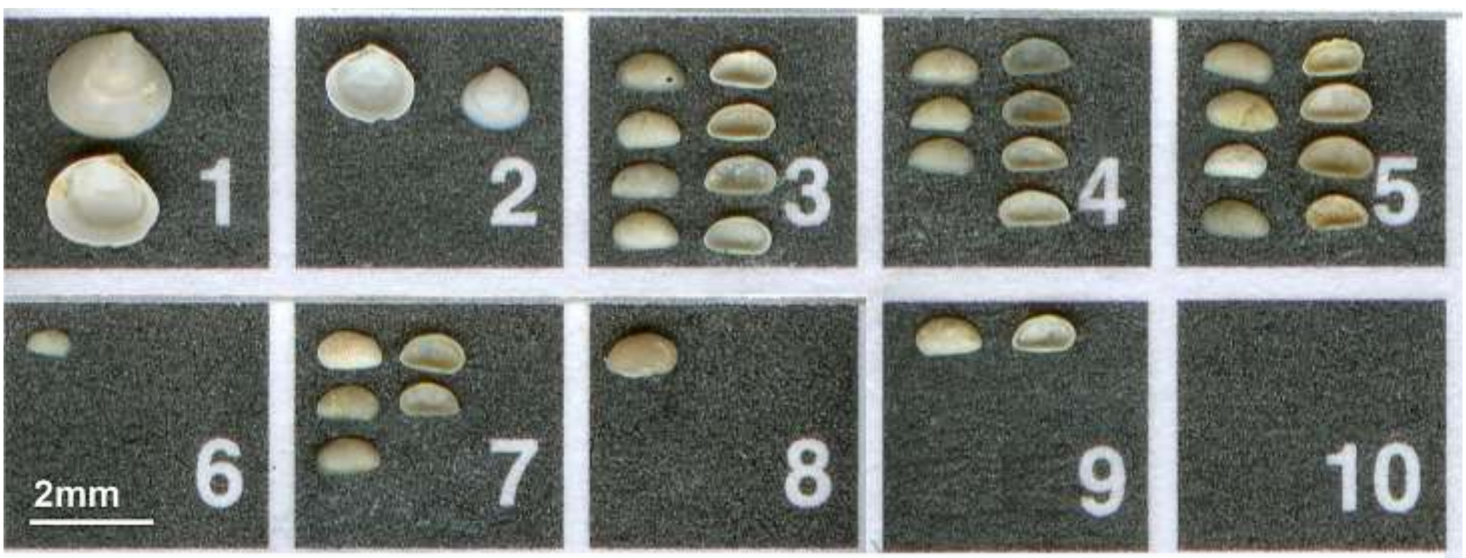
Nick Baker

I had promised this article earlier, but was delayed by events. Once again I need to explain the limits of this information. The outliers are for the most part on the dip slope of the Chalk. The earliest formation—the Thanet Sand is common as an outlier and I have omitted those instances unless fossil material is involved. I am mostly concerned here where the younger beds, such as the Woolwich and Reading, Blackheath and Oldhaven are involved. Except for Beacon Hill, near Bean, London Clay is a rarity, having been eroded first. Farningham Wood is a nature reserve on the high ground to the north of Farningham village. In addition to Geologists, the site is of considerable interest to Naturalists—having a rich flora of acid-soil species. An attempt was made to try to convert a small area to a 'moorland-style habitat. As far as I know, this did not quite succeed.



How to get there—From the M20, M25 or A20, one needs to approach Junct 3 on the M25. Exit on the A20 eastward. After about half a mile, turn left on to the A225 (road to Dartford). After a further half mile, turn left into Calfstock Lane. After a mile or so his ends with the car park at the edge of the reserve. A footpath then leads you up the ridge to the centre of the reserve. I must emphasize at this point that most of these locations are nature reserves and their keepers often see geologists as the enemy. I did extract about 500g of clay on my first visit, but this was from a large bulldozed hole produced by the local moto-cross fraternity (to produce a challenging track) at Canada Heights, at the northern end of the wood. The Canada Heights Club use that location (TQ 541687). The hole in this case broke into the Woolwich Shell Bed. The Woolwich Clays also provide a seal in retaining the water, producing the ponds on the centre of the ridge a little way to the south—a feature otherwise not expected.

About 200m to the south you can view the junct of the Woolwich and Blackheath beds. At this point silt and pebbles overlie brown silt, see photo to right. The Shell Bed is just below the silt but not visible at that point. From the Dartford memoir it is said that the Woolwich Shell Bed follows the 400ft (120m) contour around the ridge—something I have not yet tried to do. It is quite a challenge to find any large molluscs among any fragments you find but don't assume it is not worth a search. For me, looking at the micro level, things are more certain. It is a case of small molluscs, ostracods, fish otoliths, and teeth. Below is a selection of what I have found. 1-2 are small bivalves. Don't assume that small bivalves and gastropods are all juveniles. Juvenile gastropods will consist of just one 'whorl'. No, these are adults of small species.



3-9 are ostracods—small crustaceans, found in all geological periods. Their variability can be slight, but that small variation may mean another Genus, let alone species.

In the sample I collected I found one otolith—fish ear bone. See photo to the right. Their study is also highly specialised—where I have also not yet ventured! The former Chairman of the Kent Geologists' Group—Dr A. J. Rundle, has made a study of these as one of his specialities. Like the ostracods, they are common in most geological periods from the Devonian onwards. In the Tertiary they are especially common in the Blackheath/ Oldhaven, Bracklesham, and Barton Formations. Beware of pieces of strange-looking debris, especially when you find two or more identical pieces!

Sub-dividing the Chalk

Nick Baker

The question is—how to explore finer detail in a rock stratum that, at first sight, seems to be a uniform mass, and defying any further subdivision? However, any careful observation of the Chalk will indicate that it is far from uniform. There is white, apparently uniform chalk, while there is also Chalk with many flint bands, or there is Chalk with rough and nodular bedding. These first observations show that the Chalk is variable in terms of rock type—Litho-stratigraphy. Then there is fossil content. Much harder to see

Comparison of Chalk zonal schemes

	Biodivision	Mortimore *et al*	Robinson		Fossil zone	Basal marker bed
	Maastrictian				*Ostrea lunata*	Base of Sidestrand Chalk
		Portsdown			*Belemnitella mucronata*	Portsdown Marl) Fossil zones not
	Campianian	Culver			*Gonioteuthis quadrata*	Castle Hill Marls) exact to marker bed
					Offaster pilula	Friars Bay Marl (Youngest Kent Chalk)
		Newhaven			*Marsupites testudinarius*	Palm Bay Echinoid Band
Upper Chalk	Santonian			Margate	*Uintacrinus socialis*	Peake's Sponge Bed
						Barrois' Sponge Bed
		Seaford		Broadstairs	*Micraster coranguinum*	Pegwell Inoceramid Band
			Ramsgate			East Cliff Marl 2
	Coniacian				*Micraster decipiens*	Parlour Hardground
				St. Margarets	*Micraster normanniae*	South Foreland Hardground 1
		Lewes			*Holaster Planus*	Bantam Hole Flints
						Crab Bay Marl
	Turonian			Akers Steps	*Terebratulina lata*	First Flints
Middle Chalk		New Pit		Aycliff		Warren Marl 1
			Dover			Round Down Marl
		Holywell		Shakespeare	*Inoceramus labiatus*	Base of *Inoceramus labiatus* zone
					Neocardioceras juddi	Base of Melbourne Rock
			Plenus Marls	Plenus Marls	*Metoicoceras geslinianum*	Base of *Plenus* Marl
			Abbots Cliff	Capel-le-Ferne	*Calycoceras guerangeri*	Top of *jukes-brownei* zone
Lower Chalk	Cenomanian	Zig Zag Hill		Hay Cliff	*Acanthoceras jukes-brownei*	Base of *jukes-brownei* zone
				East Wear Bay	*Acanthoceras rhotomagense*	Top of Tenuis Limestone
		West Melbury	East Wear Bay		*Mantelliceras mantelli*	Top of Glauconitic Marl
				Glauconitic Marl	*Hypoturillites carcitanensis*	Base of Glauconitic Marl

This Bio– or Palaeo-Stratigraphy is variable at different levels of the Chalk and therefore varying over the history of the Chalk deposition. The first chart (above) shows the different methods used in sub-dividing the Chalk over the last 150 years or so. The first methods were litho-stratigraphic and had a three-fold division—Lower, Middle and Upper. So, the Lower Chalk, was generally grey and without flints, The Middle Chalk, white with few or no flints. And the Upper Chalk, white with generally abundant flints. This scheme allowed mapping to be generally easy and was used in most maps and text-books until the 1980s. However, field memoirs by the British Geological Survey indicate that considerable observation was made of fossil content, continuing and building on the methodology of William Smith in the early 19th Century.

Based on research in the 1970s and early 80s, Professor R. Mortimore and others attempted to fine-tune the litho-stratigraphic divisions of the Chalk—the original three divisions was converted to nine divisions (not counting the Sidestrand Chalk). The chart to the left shows the basal marker beds. Basically, the soft chalks were separated by hard nodular divisions in the lower levels. At higher levels consideration was given to the predominance of flint bands and marl seams.

Chalk zonal schemes - Mortimore *et al* (1986)

	Mortimore *et al*	Basal marker bed
Upper Chalk	Sidestrand	Base of Sidestrand Chalk
	Portsdown	Portsdown Marl
	Culver	Castle Hill Marls
	Newhaven	Peake's Sponge Bed
	Seaford	East Cliff Marl 2
	Lewes	Bantam Hole Flints
Middle Chalk		First Flints
	New Pit	Warren Marl 1
	Holywell	Base of Melbourne Rock
Lower Chalk	Zig Zag Hill	Top of Tenuis Limestone
	West Melbury	Base of Glauconitic Marl

Chalk zonal schemes - Robinson (1986)

	Robinson		Basal marker bed
Upper Chalk			Friars Bay Marl (Youngest Kent Chalk)
Upper Chalk	Ramsgate	Margate	Barrois' Sponge Bed
Upper Chalk	Ramsgate	Broadstairs	East Cliff Marl 2
Upper Chalk	Ramsgate	St. Margarets	Bantam Hole Flints Crab Bay Marl
Middle Chalk	Dover	Akers Steps	First Flints
Middle Chalk	Dover	Aycliff	Warren Marl 1
Middle Chalk	Dover	Shakespeare	Base of Melbourne Rock
Lower Chalk	Plenus Marls	Plenus Marls	Base of *Plenus* Marl
Lower Chalk	Abbots Cliff	Capel-le-Ferne	Top of *jukes-brownei* zone
Lower Chalk	Abbots Cliff	Hay Cliff	Base of *jukes-brownei* zone
Lower Chalk	East Wear Bay	East Wear Bay	Top of Glauconitic Marl
Lower Chalk	East Wear Bay	Glauconitic Marl	Base of Glauconitic Marl

The scheme of Mortimore and Co used sections in Hampshire and Sussex, these being considered to be the more complete than those in Kent. In Kent, Dr N. Robinson surveyed the North Downs Chalk. His scheme is shown above. Both the Robinson and Mortimore schemes surveyed the same Chalk features but gave them differing names, with often no cross-referencing. Robinson set out to employ the well-established names, like those applied by Rowe and Jukes-Brown.

The scheme championed by Mortimore *et al* was that adopted by the British Geological Survey, which fine-tuned the mapping schemes on a litho-stratigraphic basis. However, palaeontological research required some reference to fossil content. Given that most sedimentary rock strata in the British Isles ultimately have a zone with a contained named fossil, it would not be useful for the Chalk to be left out. Introducing fossil zones is complicating but ultimately adds to the accuracy of identifying strata. Fossils are, after all, time indicators.

Work in the identifying of fossil zones began in France in the second half of the 19th Century. The resulting, agreed, bio-divisions are set out in the table below. The names of the divisions are a Latinised version of the area name where the representative strata were studied. The first division was studied in the area of LeMans—the Roman name of which was Cenomanum. So, Cenomanian was the name applied to the division.

Chalk Biodivisions

	Biodivision	French location	Basal marker bed
Upper Chalk	Maastrictian	Maastricht	Base of Sidestrand Chalk
	Campanian	La Grand Champagne	Friars Bay Marl (Youngest Kent Chalk)
	Santonian	Saintes, Charente	Pegwell Inoceramid Band
	Coniacian	Cognac, Charente	South Foreland Hardground 1 Bantam Hole Flints
Upper Chalk / Middle Chalk	Turonian	Touraine, Cher Valley	Base of *Inoceramus labiatus* zone Base of Melbourne Rock
Lower Chalk	Cenomanian	Cenomanum (Le Mans)	Base of Glauconitic Marl

To apply these divisions into the litho-stratigraphic schemes does introduce some difficulties in certain stages. I do not agree with reaction that we should dismiss the palaeontological. I emphasise again that fossils are time indicators and that these exercises are good, applied palaeontology.

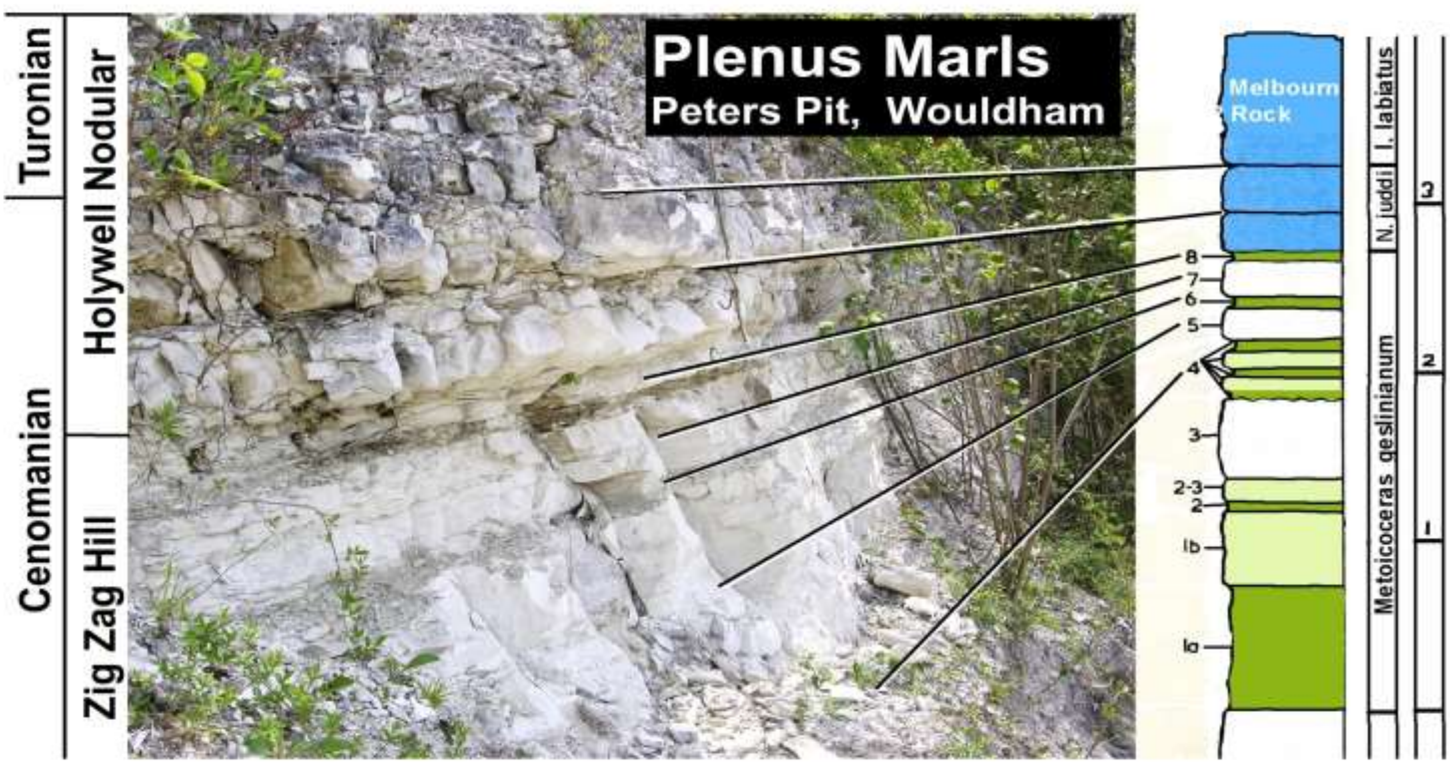
I propose that we look at some of the boundaries and see what problems are encountered.

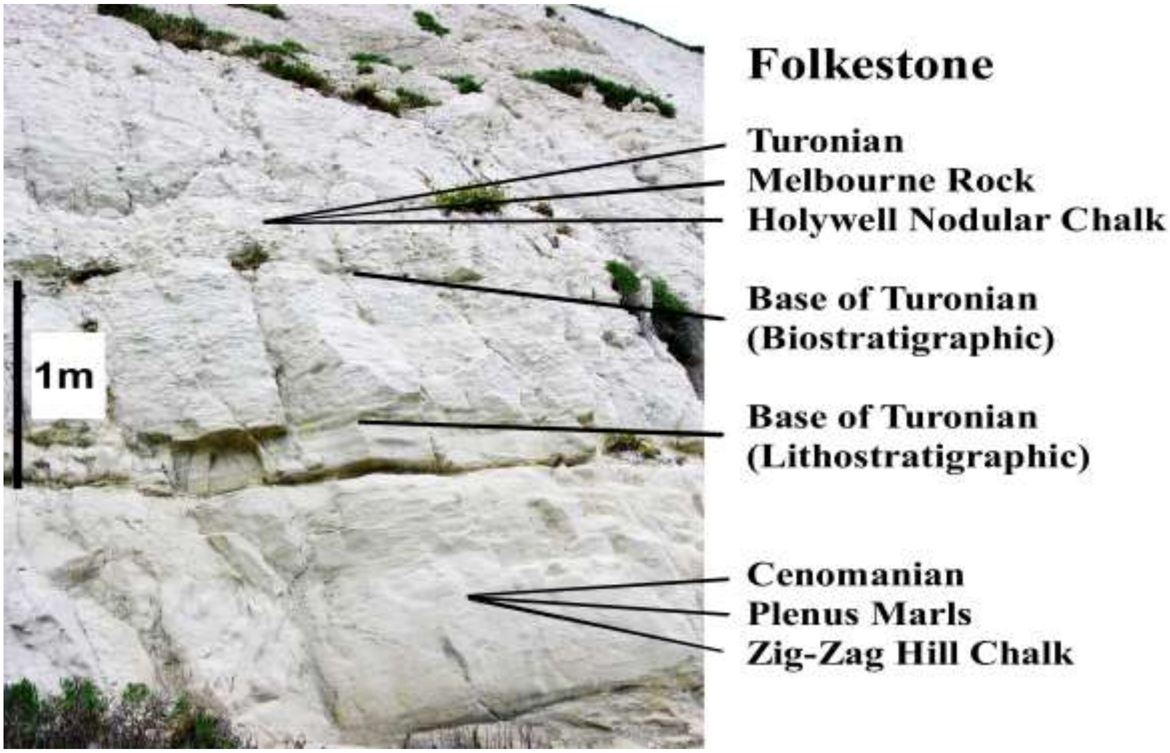
Comparison of zonal schemes within the Cenomanian

	Biodivision	Mortimore *et al*	Robinson	Fossil zone	Basal marker bed
		Holywell	Shakespeare	*Inoceramus labiatus*	Base of *Inoceramus labiatus* zone
	Cenomanian			*Neocardioceras juddi*	Base of Melbourne Rock
Lower Chalk		Zig Zag Hill	Plenus Marls	*Metoicoceras geslinianum*	Base of *Plenus* Marl
			Capel-le-Ferne	*Calycoceras guerangeri*	Top of *jukes-brownei* zone
			Hay Cliff	*Acanthoceras jukes-brownei*	Base of *jukes-brownei* zone
			East Wear Bay	*Acanthoceras rhotomagense*	Top of Tenuis Limestone
		West Melbury		*Mantelliceras mantelli*	Top of Glauconitic Marl
			Glauconitic Marl	*Hypoturillites carcitanensis*	Base of Glauconitic Marl

In the **Cenomanian,** most of the zonal boundaries coincide. The boundary of the Zig Zag Hill and West Melbury Chalk is the top of the **Tenuis Limestone**. Visible at Culand and at Folkestone. This also is the boundary of the old *Holaster subglobosus* and *Schloenbachia varians* zones. This is replaced as the junction of the *Acanthoceras rhotomagense* and *Mantelliceras mantelli* zones. I have stated in the table above that the base of Nick Robinson's Capel-le-Ferne member is the top of the *Acanthoceras jukes-brownei* zone, although in fact he places this at an *Inoceramus*-rich layer about a metre higher.

The base of the Melbourne Rock is the base of the Middle Chalk, the Holywell Nodular Chalk, and the base of the Shakespeare Cliff Member, but **not the Cenomanian-Turonian boundary**. The boundary has been subject to much dispute. The best scheme seems to be the zonal range of the ammonites *Mammites nodosoides* and *Neocardioceras juddi*. *M nodosoides* occurs across the Turonian type-area at Touraine. In Devon it is found throughout the Melbourne Rock. In Kent and Sussex it first appears about 1-2 metres above the base of the Melbourne Rock. In Devon, the Melbourne Rock is underlain by the Pinnacles Limestone—the youngest division of the Cenomanian Limestone. **The Pinnacles Limestone** contains the small ammonite, *Neocardioceras juddi*. This ammonite occurs in the lowest metre of the Melbourne Rock in Kent and Sussex. Thus, from Rawson *et al*, (Geological Society) it is concluded **the boundary of the Cenomanian occurs about a metre above the *Plenus* Marls.** Below is the section seen at Peters Pit, Wouldham, in 2013. So, the two lowest rocky layers of the Melbourne Rock/ Holywell Chalk are included in the *Neocardioceras juddi* zone of the Cenomanian. I do not know the current status of this section.



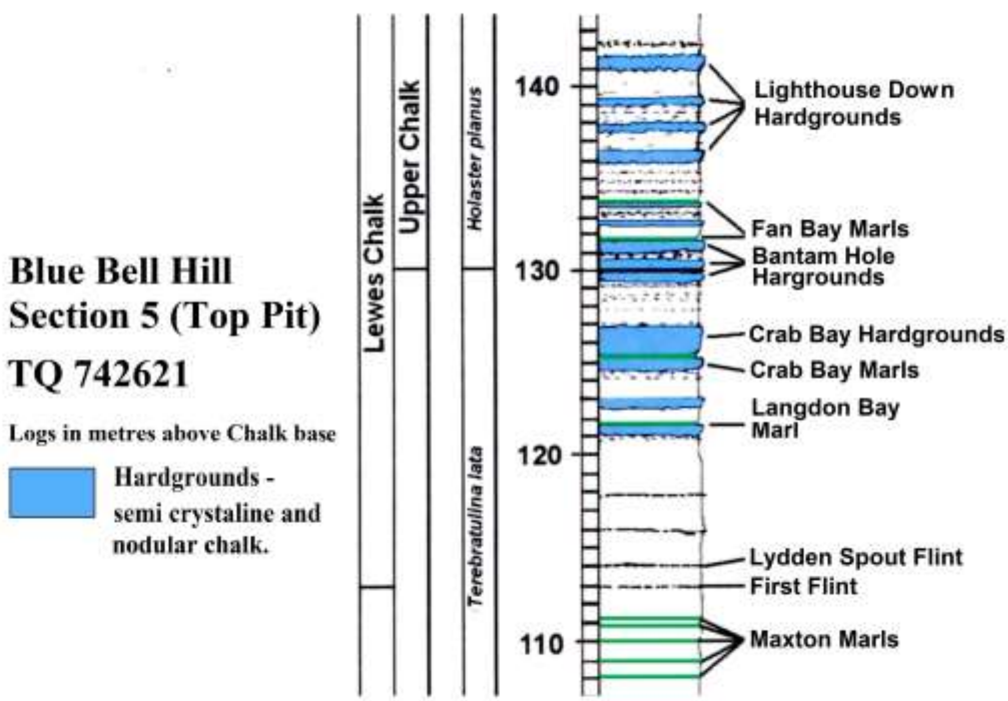


The section can be seen at Blue Bell Hill and also at Folkestone Warren—close-up from the concrete platform—see photo to the left. This is at grid-point TR267385
The section at Blue Bell Hill is not easily accessible. This is also the case for the sections between Abbots Cliff and Samphyre Hoe. The section south of Eastbourne is currently obscured by cliff falls. There are good sections above Folkestone Warren but there is danger in underground fissures

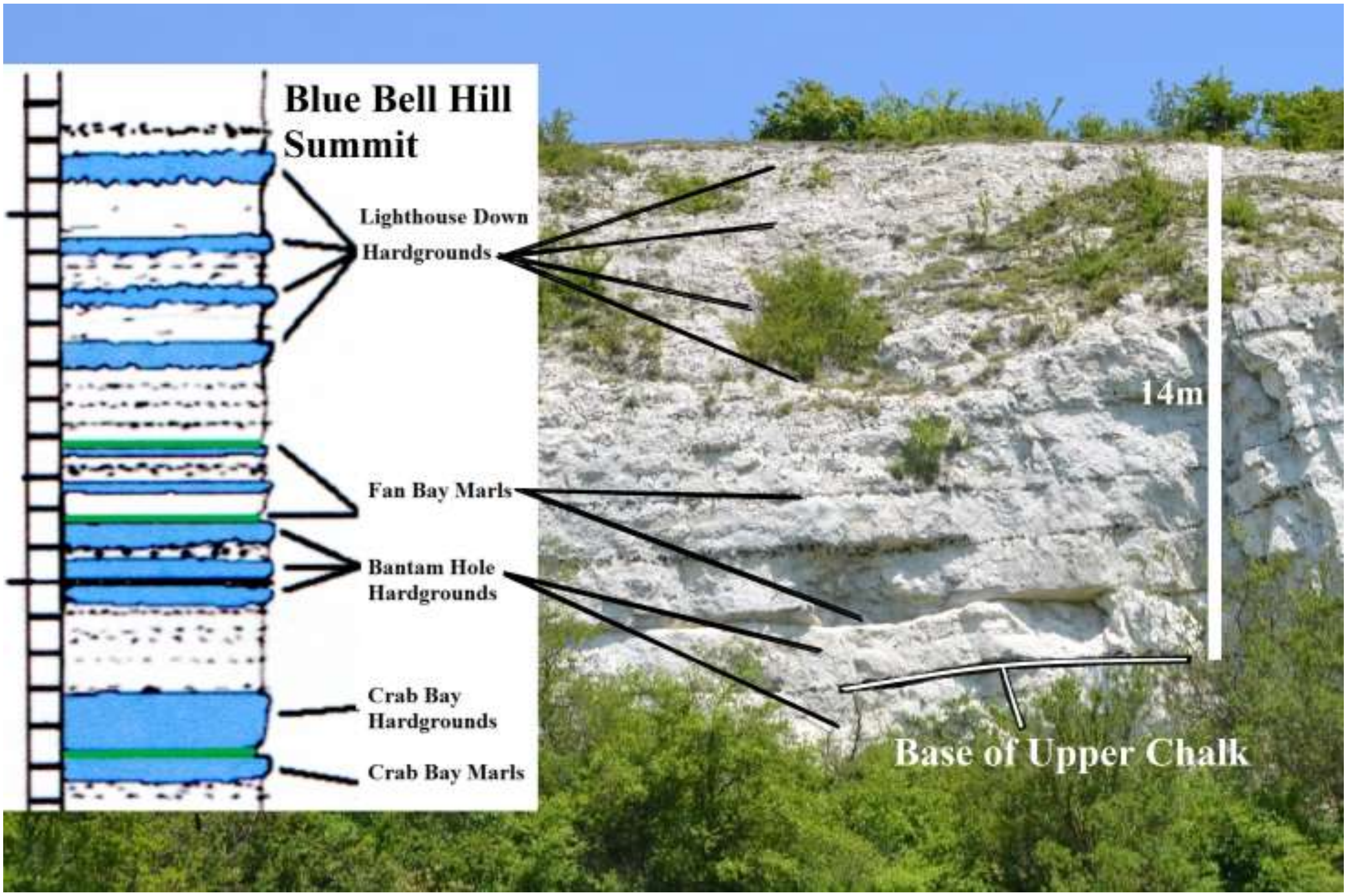
Comparison of zonal schemes within the Turonian

	Biodivision	Mortimore *et al*	Robinson	Fossil zone	Basal marker bed
Upper Chalk		Lewes	St. Margarets	*Holaster Planus*	South Foreland Hardground 1
					Bantam Hole Flints
Middle Chalk	Turonian		Akers Steps	*Terebratulina lata*	Crab Bay Marl
		New Pit	Aycliff		First Flints
					Warren Marl 1
		Holywell	Shakespeare		Round Down Marl
				Inoceramus labiatus	Base of *Inoceramus labiatus* zone

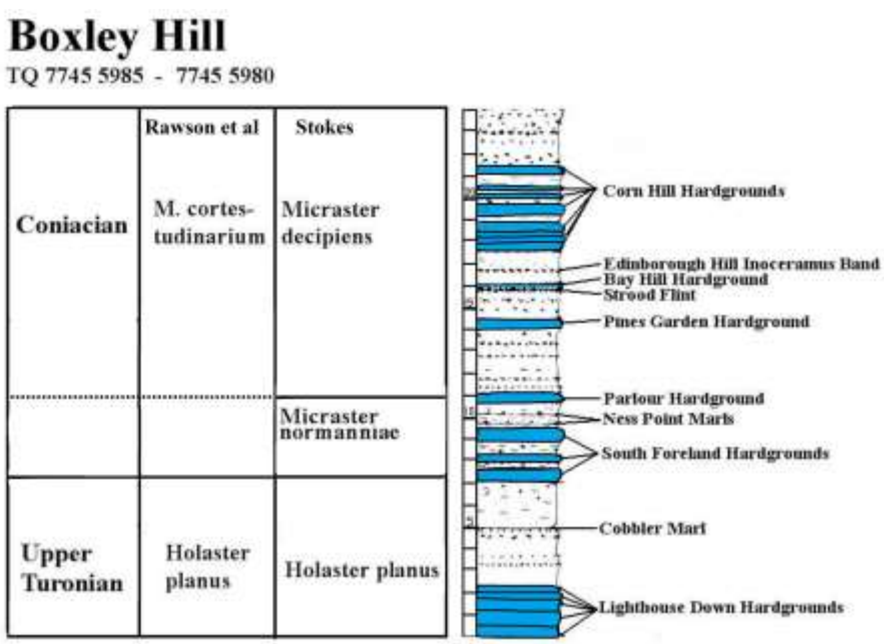
The sections within the Turonian have well-identified marker-beds.



The Holywell and Lewes Chalks are named respectively as the Holywell Nodular and Lewes Nodular Chalk. The New Pit Chalk is free of hardgrounds and flint bands. Within the Turonian is the boundary of the 'classical' Middle and Upper Chalk. It is exposed in many of the chalk pits in the Medway Valley, but is often inaccessible. We will have a look here at Blue Bell Hill. The topmost pit begins in the Holywell Nodular/ Melbourne Rock. After the New Pit interlude, the Lewes Nodular Chalk begins about 17 metres below the Bantam Hole Flints, which mark the base of the Upper Chalk. Next, you will see a photo of the topmost beds at Blue Bell Hill.

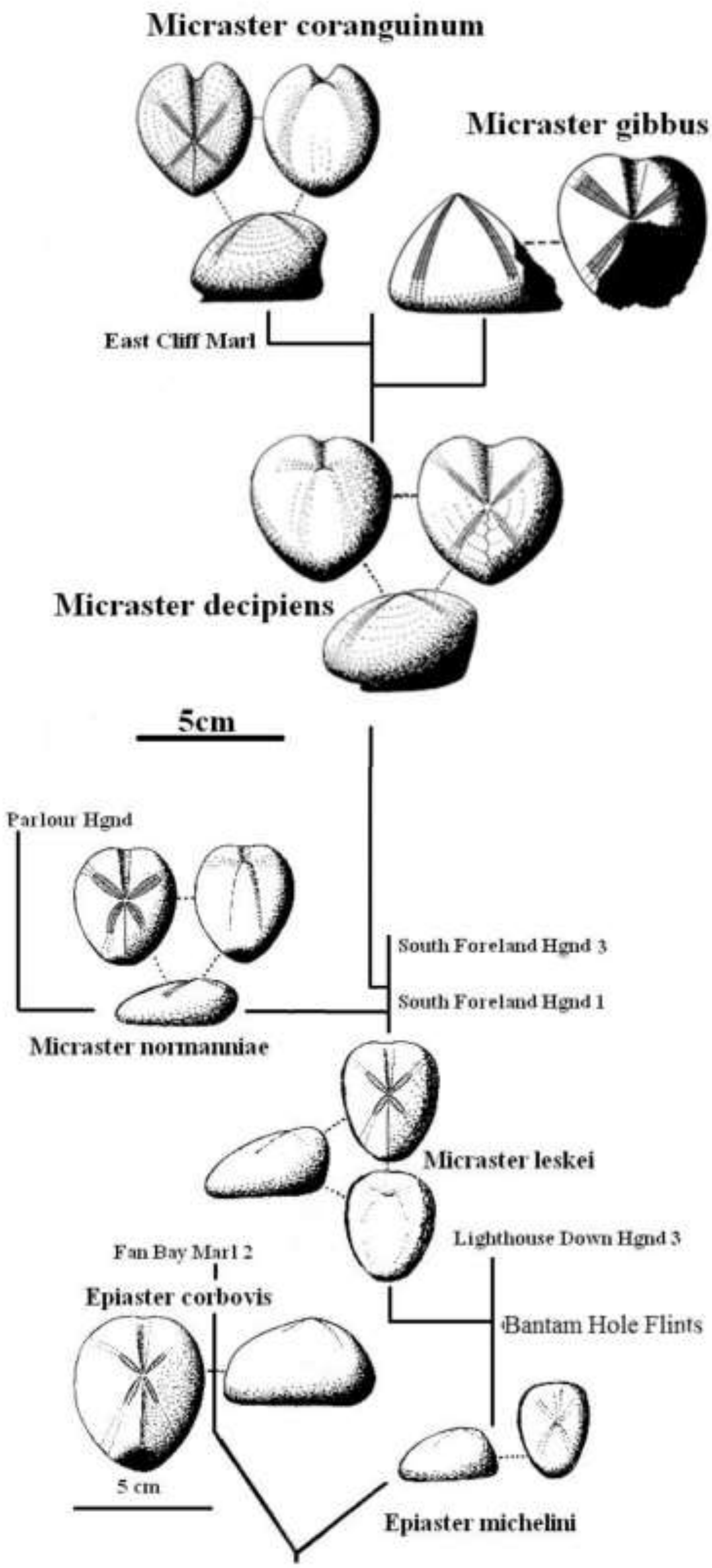


Although the Bantam Hole Flints mark the junction of *the Holaster planus* and *Terebratulina lata* zones, both of these fossils occur above and below the junction. The beds were named in full knowledge of this. The Bantam Hole Flints were chosen as the boundary with their known juxta-position with the marl seams and hardgrounds above it. Bantam Hole, Fan Bay and Lighthouse Down are located just south of St Margaret-at-Cliffe. If you want to visit the cliff section there, please note that **at high tide up to 3m of water covers the beach at the highest point—plan carefully**!



On the next page you will see a schematic diagram of the evolution of *Micraster* echinoids. At the top of the *Holaster planus* zone the early species of *Micraster—Micraster leskei*, then branched into two species: the main line into *Micraster decipiens*, and a flat form—*Micraster normanniae*. Dr R. Stokes felt that this should be considered as a new zone of *M normanniae,* which is recognised in France. He considered the *M. normanniae* zone to be part of the Turonian. Rawson *et al* of the Geological Society felt that this was insufficient to consider a whole new zone and retained **the top of the Turonian at South Foreland Hardground 1**. The author recognises the *normanniae zone* but considers it as part of the Coniacian. *M. normanniae* is not found above the Parlour Hardground—see diagram left.

Micraster evolution



Santonian	U. socialis
Santonian / Coniacian	M. coranguinum
Coniacian	M. decipiens
Coniacian	M. normanniae
Turonian	Holaster planus (Micraster leskei)
Turonian	Terebratulina lata

Nick Baker 1984

Comparison of zonal schemes within the Coniacian

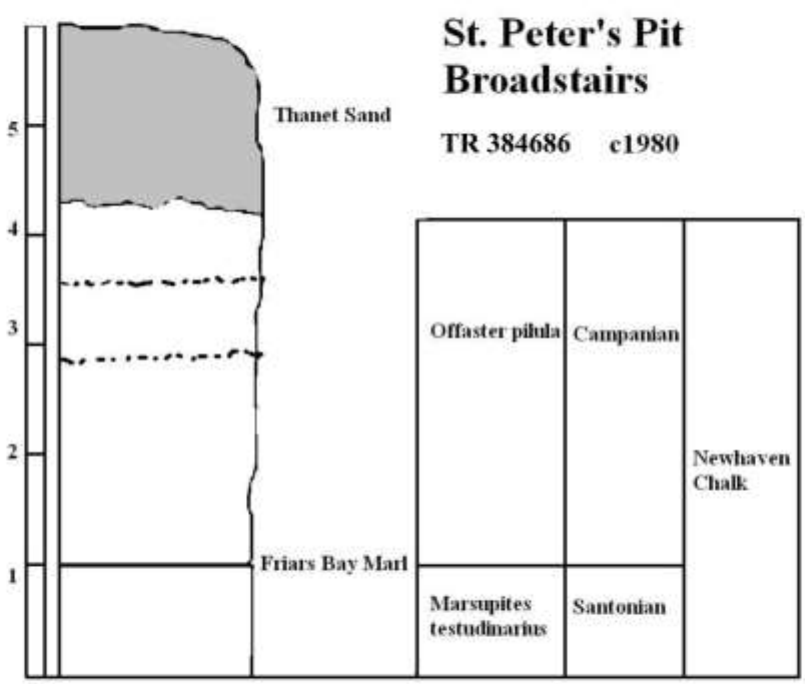
	Biodivision	Mortimore *et al*	Robinson	Fossil zone	Basal marker bed
Upper Chalk	Coniacian	Seaford	Broadstairs	*Micraster coranguinum*	Pegwell Inoceramid Band
		Lewes	St. Margarets	*Micraster decipiens*	East Cliff Marl 2
				Micraster normanniae	Parlour Hardground
				Holaster Planus	South Foreland Hardground 1
					Bantam Hole Flints

The beds comprising the Coniacian are best seen at the base of the cliffs around St Margaret's Bay. The top of the Coniacian is the Pegwell Inoceramid Band about 4km north of St Margarets. Beds marking the division of the St Margarets– Broadstairs Chalk are East Cliff Marl 2—at beach level about 2km north of St Margarets.

Comparison of zonal schemes within the Santonian

	Biodivision	Mortimore *et al*	Robinson	Fossil zone	Basal marker bed
Upper Chalk	Santonian	Newhaven	Margate	*Offaster pilula*	Friars Bay Marl (Youngest Kent Chalk)
				Marsupites testudinarius	Palm Bay Echinoid Band
				Uintacrinus socialis	Peake's Sponge Bed
		Seaford	Broadstairs	*Micraster coranguinum*	Barrois' Sponge Bed
					Pegwell Inoceramid Band
					East Cliff Marl 2

The divisions within the Santonian are decided in all cases by the fossil content. The Santonian begins with the Pegwell Inoceramid band and ends with the Friars Bay Marl. For some years there has been competition between *Micraster* and I*noceramus* in deciding the zones at this level of the chalk. The author has a lot of *Micraster* examples but very few *Inoceramus.* So the Pegwell Inoceramid Band seems to be the nearest we can get to the base of the Santonian equivalent to the (French) type area. The division ends with the Friars Bay Marl. The location used to be St Peters Pit TR384686 (Shephard-Thorn, 1988), near Broadstairs, but that may now be in-filled. This is the youngest chalk in Kent. Dr Robinson does not appear to mention the location in his memoir (Robinson 1986), but the zone is mentioned by Shephard-Thorn—see above



Thus ends my account. My knowledge of the Campanian and Maastricht Chalk is not ready for broadcast– I did not get out of Kent often enough

See next page for references

References

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Robinson. N. 1986 *Lithostratigraphy of the Chalk Group of the North Downs, southeast England*. Proc. Geol Ass 97

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End Notes

At the moment there is a file circulating regarding subject matter for September onwards. I cannot say how likely these will be for physical meetings. Certainly they can be zoom talks. Speaking personally, in spite of optimism on the part of business and Government, (with an apparent ignorance of how society actually works) the element of risk, even after double vaccination, is still too close to certainty. And I know that is the case for others. It would be difficult to act as treasurer while being absent, in the light of the level of management I had before. I have just submitted our insurance for this July onwards. I'm assuming we have the membership we had in March 2020. It might be possible to run field trip/s, with least risk. I am already set to help with an OUGS trip in early September. Regarding subs, - that will depend on what we do. Much of out commitment is the rent of the hall—so it's a case of how folks feel—so I will need some feedback in the coming weeks.

Nick Baker
Treasurer and newsletter compiler/editor
July 29th 2021