KENT GEOLOGISTS' GROUP

The Kent Group of the Geologists' Association

NEWSLETTER

No.28 – February 2022

Website: www.kgg.org.uk

Officials and Committee Members

Dr Anne Padfield, Chairperson, Tel: 01634 686294 email annepadfield@hotmail.co.uk

Treasurer, Position is currently held by Dr. Anne Padfield pending a new nominee

Grahame Godding, Secretary, M.07850 776631 email nid2657@gmail.com

Ann Barrett, Indoor Meetings Secretary, M. 07746 783398 email annbarrettgeo@gmail.com

Field Meetings Secretary, Position is currently vacant

Supporting Committee Members:-

Alison Taylor

Doreen van Seenus

Duncan Stewart – Webmaster

Nick Baker

Tony Mitchell

As always we welcome and recognize the continued support given by Dr. Adrian Rundle, Dr. Ed Jarzembowski and Peter Jeens

Cover Picture: 4th September 2021 Field Group at Boxley Church (See inside)

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THE KENT GEOLOGISTS' GROUP IS A LOCAL GROUP OF
THE GEOLOGISTS' ASSOCIATION
Burlington House, Piccadilly, London. W1J 0DU.
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Tel: 020 7434 9298

As a local group we receive details of lectures and field trips organised by the GA and other Local Groups and Affiliated Societies. Copies of the GA Magazine and the Circular with these details are on display on the Secretary's Table at Indoor Meetings.

MEMBERSHIP OF THE KENT GEOLOGISTS' GROUP

Membership is open to all who have an interest in geology, regardless of qualifications and experience. The annual subscription (which runs from January to December) is £15.00. The subscription for each Additional Member living at the same address is £2.00. There is an entrance fee of £1.00 per meeting (£3.00 for non-members) but guests and non-members are admitted free of charge for one meeting.

Membership application forms may be obtained from the Secretary or downloaded from the Kent Geologists' Group website:- www.kgg.org.uk via the "How Do I Join" page.

Editorial

Welcome to your 2022 newsletter. As always this would not be possible without your valuable input and supporting articles. Please keep them coming thank you.

I thought that I would open with a short poem. *An extract from Alfred Tennyson's In Memoriam A.H.H. Completed in 1849, just forty years after the establishment of the Geological Society – which is the world's oldest national geological group – the lines reflect the shifting world of 'deep time' as newly revealed by the Victorian geologists:

The hills are shadows, and they flow

From form to form, and nothing stands;

They melt like mist, the solid lands,

Like clouds they shape themselves and go.

*Source 'Notes from Deep Time'. A Journey Through Our Past and Future Worlds by Helen Gordon. Published by Profile Books

The KGG year 2021 was again dominated by the pandemic and Covid restrictions. Consequently our wide ranging programme of twelve meetings continued remotely using Zoom. Attendance was very good with on average between 24 and 30 people joining us on Zoom. When Covid rules were relaxed we managed to carry out three enjoyable one day local field trips and in September a week long residential field excursion to the Hartland Peninsula, Devon (see article).

A decision to return to face to face, or hybrid meetings at the United Reformed Church hall in Maidstone, Kent is constantly under review but for the time being the Zoom remote format remains for 2022 (See our 2022 Programme at the end of this newsletter).

At the beginning of the year we had 47 paid up members and by the end of the year this number had risen to 56.

In February 2021 we published the last annual newsletter (Issue #27) comprising nine fascinating articles ranging from 'The Areology of Ares (The Geology of Mars)' to 'A walk along the Medway in the Burham area' as well as a poem about 'Fracking'.

Our AGM was held on 16th March 2021 where all the above listed officials and committee members were appointed. The Minutes can be found in the Members Area of our website.

Finally, our website was expanded in the Members area with PowerPoint learning pages on 'Rock Forming Minerals' and 'Contaminated Land Remediation', another resource that we can be proud of.

Grahame Godding

Introduction

A Happy New Year to all our KGG members.
I hope you are keeping safe and well. It's been another year of Covid 19 disruption to our meeting at the United Reformed Church in Week Street. So, here is another Newsletter to keep you all enthused. I hope you like it. We would love to hear what you've been doing, so if you could send an article or picture for the next issue, that would be great. Don't forget to tune in to the monthly Zoom meetings.
All the very best to you all. Keep geologizing!

Anne Padfield (Chair)

An apocryphal story
of Channel Tunnel borehole samples and how they got to the Natural History Museum

Dr Haydon Bailey
Scientific Associate
Natural History Museum, London

In the late 1950's the Conservative government, under the leadership of Harold Macmillan gave the go ahead for the first comprehensive geological investigation of the Channel. During 1958 a large number of cored boreholes were drilled across the Channel, roughly following a potential route for a future tunnel. The cores were examined, sampled, and then stored in a quiet corner of Dover Castle.

The Channel Tunnel Study Group reported to the British and French governments in 1960, and subsequently, in 1963, a government White Paper was published which outlined the plan for twin rail tunnels to be constructed under the Channel. All was looking good for tunnel construction, but in October 1964 there was a general election in the U.K. and a Labour Government came to power with a slim majority (4) under the leadership of Harold Wilson.

This shift in power had a catastrophic impact on the progress of the Channel Tunnel project as the new government decided to scrap it as too expensive, although a marine survey which was already approved went ahead during 1964-5.

Up until this stage Dave Carter, Lecturer in Micropalaeontology at Imperial College, London, had being carrying out a limited number of micropalaeontological analyses on samples collected from the cores stored at Dover Castle. His work on this material became part of the report that had already been published (Carter, 1961). When the Labour Government took over the British Geological Survey staff asked the new government authorities what should be done with all the core they had stored at Dover Castle and the gist of the response was that "the core should be put back where it came from" i.e. in the Channel. Dave Carter heard of this response and realised that this amazing store of prime research material was about to be lost.

In haste he managed to commandeer a long wheel-based Land Rover belonging to Imperial College and set off on a whole series of journeys between South Kensington and Dover Castle. Each time he loaded the Land Rover as full as possible with Chalk cores and he surreptitiously relocated them to Imperial College. He finally completed his last return journey after two weeks of heavy driving.

Dave Carter was never a researcher who rushed into print, but at least one paper defining the foraminiferal zonation for the Lower Chalk under the Channel was published with his French counterpart (Carter & Destombes, 1972). During the late 1960's and 1970's Carter had the chalk samples processed and the residues went into his sample store, from which systematically selected samples were analysed and the foraminifera identified and counted.

Dave Carter numbered all the samples he had access to consecutively from the first day he started his research at Imperial and all his samples were given a unique number which stayed with them in perpetuity. The key to following his sample labelling system is a set of metal card index boxes and the samples are numbered from 0001 to 55,012. This predates any computerisation of databases, so everything was handwritten onto index cards.
The early part of his collection comprises mixed sample material, mainly from European, Timor & Pakistan locations and these run from 0001 – 5,065. He also left gaps in his sample number allocations for the arrival of later samples, so there are <u>not</u> 55,000 samples available. The Channel Tunnel Project (CTP) samples have index cards in four metal card index boxes and are numbered from 5,994 to 35,009. If all sample numbers were allocated this would result in a total of 28,611 CTP samples, however, as indicated, there are large gaps at the end of each borehole sample run, so the figure is more likely to fall in the range 12 – 15,000.
Nevertheless, this is a huge sample repository on which Dave Carter and his students continued to work into the 1970's. He retired during the mid '80's and sadly passed away at the age of 91 in 2013. His sample collection at this stage was buried away within Imperial College.

The Carter Collection, now housed in the Natural History Museum

In the early 2000's the last micropalaeontologist to teach at Imperial College retired, but before the departmental closure, it was arranged that all the microfossil collections at Imperial College should be transferred down the road to the Natural History Museum. At this stage a pallet load of Bisley cabinets was transferred to the NHM store in Wandsworth, where they remained untouched for just over ten years.

The present author retired from his full-time occupation as an industrial micropalaeontologist at the beginning of 2018 and duly offered his services on a voluntary basis to the Natural History Museum. The question arose – what would be the most useful project that he could undertake for the Museum? The obvious answer was – could he interpret the numbering system on the vast number of glass vials containing chalk residues which were currently sitting in Wandsworth.

This was a simple task for someone who had trained under Dave Carter in the mid-1970's (still well before computers) and had learned to use the same simple card index system for sample recording. Once the original Carter metal card index boxes had been identified and located in the NHM micropalaeontology department, it became an exercise of data transfer from handwritten cards to a digital spreadsheet format.

The work is ongoing, and somewhat delayed by the impact of Covid lockdowns, nevertheless all those chalk samples originally rescued by Dave Carter from Dover Castle are now where they belong. They are stored in the national repository for Natural History material and the digital spreadsheets will, when completed, go onto the Museum database and be accessible for anyone to access. Similarly, the sample residues are still stored safely and available for future research, all because one man had the sense to disagree the government of the time!

The Hartland Peninsula, Devon An extract from Kent Geologists' Group Week Long Field Trip September 2021

Ann Barrett

The Hartland Peninsula? This was totally unknown to us, so it was with excitement, yet some relief, that we arrived at our accommodation, having negotiated North Devon's narrow and intermittently signed B roads.

On day one, our first objective was orientation and familiarity in the locality with an introduction to the extraordinary geological history of the area as evidenced in the rocks. Just a short walk away from our comfortable residence, the Spekes Valley footpath opened up before us to reveal the picturesque stream Milford Water. As we made our way downhill, Summer seemed extended with many varieties of plants still in bloom. It was no surprise, therefore, to discover that the valley is a Site of Special Scientific Interest (SSSI), renowned for its diversity and quality of botanical species.

On the path, we came across occasional small, geometrically neat blocks of siltstone and sandstone and further observation of the valley stream bed revealed that the sedimentary rock was close to the surface. There were also layers of shale and the bedding appeared vertical. Where the valley terminated abruptly - a hanging valley - we came across the beautiful Spekes Mill Mouth waterfall with a 15m drop to the beach below. Old pictures show it to have been in several sections, but erosion of its base had created a longer drop. A vertical cross section of folded rocks clearly demonstrated how the stream had worked its way along a weaker section of the layers, creating the valley as it flowed.

It was here the rain began and stayed with us for the rest of the day. A weather event that was thankfully only repeated once more during our stay. Anne Padfield, our leader then unfolded the history of the coastline including this low tided beach, far below us. Folding being the operative word as this comprised a horizontal cross-section of a spectacular array of upended beds; the whole area being quite clearly witness to huge regional deformation.

We were looking at the Crackington formation, (approx 320mya) part of the Culm Basin begun in the deep Rheic Ocean during Devonian times and continuing into the Carboniferous era. This deep basin, thousands of metres thick was formed by the products of erosion of ancient mountains to the north in Wales. Over time, the area experienced multiple marine transgressions and regressions created rhythmic bedding of fine sediments that became shales. At times, deltas were formed and then after their submergence, the products of these deltas tumbling down steep underwater slopes forming turbidites. These interbedded coarser sandstones show fining upwards with sole casts on their undersides as ripples and grooves.

During the late Carboniferous, the basin was squeezed with the closure of the Rheic Ocean by the continent Laurasia in the north subducting under the continent Gondwana to the south. This eventually created the supercontinent Pangaea in the early Permian (approx 290mya). As the two continents collided, shortening the crust, mighty pressures forced up mountains causing spectacular fracturing and deformation. That event, the Variscan Orogeny, is also known as the Hercynian or Armorican Orogeny.
The general northerly to southerly direction of this pushing can be seen in the orientation of the folds in the strata here at the Hartland Peninsula.

Anne explained that the whole area is now a giant syncline yet containing many smaller folds and thus also paradoxically includes little anticlines. The definition of this is the rather Roman sounding 'Synclinorium'. Having digested this, we next followed the North Devon/South West coastal path noting how the folding of the rocks had a direct impact on the grassy, rolling hilly topography of the area.

St Catherine's Tor, at the northern end of the beach, displays the rare geomorphological feature of a dissected valley. The river used to run along the foot of the now half - eroded hill eventually exiting at Hartland Quay.

Further along the coastline, past a series of impressive embayments, we noticed, up ahead, a marquee and nearby, a most peculiar rock until we realised that it was artificial. We were informed that it was part of a film set which was rather ironic with so much real rock around! A rather soaked and bedraggled, yet undeterred cameraman informed us that it was for a channel 4 documentary which was all he was willing to divulge other than it was not a geological production. Really?!
On arrival at Hartland Quay we unanimously decided to return another day under more benign weather conditions. Our damp, scenic walk back to the house was quite a long one, fortunately made shorter by our discovery of an old drovers' track made all the more authentic by the slippery, muddy conditions.

Colourful greenery such as beautiful ferns and dripping leaves made the idea of a temperate rainforest spring to mind!

1 Spekes Mill Valley stream

The stream has exploited the weaker shale beds in the valley between the blocky sand and mudstones.

2 Spekes Mill Mouth Waterfall

Spekes Mill Mouth waterfall and anticlinal folding demonstrating effects of the underlying geology on the topography of the area.

3 Spekes Mill Mouth Beach

Limbs with east - west orientation at right angles to eroded folds. St Catherine’s Tor and dissected valley in the distance.

Dissolved minerals squeezed along the crack in the direction of movement.
Or small scale sole marks such as prod marks or flute casts (see ends of the crack and magnification) on the underside …or both

4 Slickenside and/or sole marks in folded greywacke beds

Our return to Hartland Quay a few days later in glorious sunshine was well worth it. Here is situated the Hartland Hotel, famous for providing a spectacular backdrop for numerous films including the 2020 adaptation of Daphne du Maurier's 'Rebecca'. The very of name of the hotel bar 'Wreckers Retreat' is ominously reminiscent of a local alternative employment to fishing.

Below the hotel, between two bays, stands a promontory of more durable rock which is the reason for the former tiny community's perched existence. On further exploration, we discovered this was due to a fabulous anticlinal fold stretching out to sea. This fold was capped by a thick, dense layer of rock which protected the whole fold and hence the promontory from erosion. Anne demonstrated how the weaker beds beneath, such as the grey shales here, were more easily folded and crumpled.

We followed the fold promontory into the next bay where, in the far distance, we saw some tiny bright yellow dots comprising one of a number geological parties spotted during the week. We later bumped into this friendly, enthusiastic group of final year students. We had been wondering how first year students would cope with the structural complexities here, as major faulting has created parasitic folds oriented in different directions.

What an inspiring place for future geologists! The high cliffs comprised a series of spectacular chevron folds and vertical beds. It was great fun following the line of parallel folds on their journey from the promontory beside the bay into the cliff and speculating which were which. We also observed the faults and downward pinching where weaker beds had given way.

On the beach, some of the beds took on a slaty appearance which suggested being on the verge of metamorphism having been subjected to deep, regional pressure. Some boulders displayed beautiful Liesegang ring markings - a sign of iron within the rocks and possible ancient iron creating surface conditions.

We saw how man had utilised the faulting and erosion of the rock to create an area by the slipway for boats to moor at high tide. No doubt they would also have been hauled up the steep slipway onto the promontory area. This quay would have been an important and unique local access to the sea in days gone by.

The theme of our two visits to the Hartland Quay area could be summarised as 'Unfolding the Folding' and by the end of the week we were all becoming quite accomplished folding detectives!

I hope that this example of a KGG adventure will encourage more folks to join one of our fun, informative and easy going field trips.


5 Folds at Hartland Quay

Looking westwards: Fold limbs parallel to the promontary. The central hinge here is made of weaker shales. To the right what appears to be a plunging hinge at right angles to the other limbs.


6 Warren Beach at Hartland Quay

Looking eastwards: Highly deformed Crackington formation of interbedded mudstones, sandstones and shales. Note chevron and pinched folds.


7 Liesegang Rings

Liesegang Rings with stress fractures in-filled with calcite

Dinosaur trackway at Fairlight

Ken Brooks

In July 2020 a rare example of a dinosaur trackway was re-discovered below the cliffs at Fairlight. The trackway had originally been seen on a joint HDGS / Geologists' Association field meeting in 2014 and subsequently included in our Journal (*HDGS Journal*, Dec. 2014, vol. 20, p. 23–25), although after six years of erosion, the casts are now very much clearer. Three aligned iguanodont foot-casts were exposed (along with two sauropod casts) on a large slab of the Lee Ness Sandstone – a unit within the Lower Ashdown Formation, known locally as the Fairlight Clay. These clays and sandstones mark the base of the Lower Cretaceous in the Hastings area, and have been dated at 145 million years old. The foot-cast rock surface measured 2.5 metres x 1.5 metres (8 ft x 5 ft) with a bedding thickness of 1.5 metres (5 ft).

Six weeks later, after waiting for the most suitable weather and tidal conditions, an attempt was made to save the iguanodont trackway. On 30th August a group of volunteers, including Phil Hadland (Hastings Museum and HDGS member), Jill Tyson (Visitor Centre, Hastings Country Park), Graham Warrick (Streamline Sales), Keith Somerville and myself, set out on the long walk along the beach to Lee Ness Point. The project would require various materials, such as silicone rubber (5 kg), polyester resin (5 kg), catalysts, hessian, fibre-glass matting, mixing containers and brushes, all of which had to be carried down the cliff path, along the shingle and over rocks (approx. one mile). On arrival we were delighted to see that the rock slab had not toppled over and that the casts were still in good condition. The first….

Fallen slab showing three iguanodont foot-casts (across centre) with two sauropod casts (bottom left and top right).

Group of volunteers carrying equipment to site.

Ken applying liquid silicone rubber to first foot-cast.

Ken and Phil Hadland hard at work.

task was to coat the foot-casts with a layer of liquid silicone rubber to protect the rock features and to allow for easy removal of the fibre-glass resin cast. However, although a 'fast action' catalyst had been added, after almost an hour the silicone showed no sign of setting – and by now the tide had turned. It may have been sea salt in the sandstone that inhibited the chemical setting process.

It seemed there was no alternative – we would have to leave the site and return on the next low tide! Unfortunately, there was also now a risk that the silicone could be washed off by the incoming tide. We then made the long journey back to the cliff path before high tide covered the beach.

The next low tide was at 4 a.m. the following morning, and as the sun rose, a smaller group of us met at Fairlight and walked westward along the beach. To our surprise, when we arrived at our destination we were greeted by a group of six seals, some swimming and some basking on an outcrop just offshore.

Thankfully, the previous day's high tide had stopped just short of the foot-cast rock, and the silicone layer had set. We immediately mixed the resin and catalyst and began to apply it with fibre-glass matting over the silicone. This would give backing support to the soft and flexible silicone rubber layer. Within an hour, the resin and fibre-glass covering was hard enough to begin its removal from the rock. This was not easy because, while preserving fine detail, the liquid silicone had penetrated the porous sandstone. For convenient transport the two-metre-long cast was cut into three sections, and by 7.30 a.m. we had returned to the cliff path.

Since then the cast has been enlarged by extending the fibre-glass around the foot-casts, and at the time of writing (early November) the mould was almost complete, with only the silicone rubber to be applied before copies can be made from it. Both the new Hastings Country Park Visitor Centre and the Shipwreck Museum, Hastings, have expressed an interest in having copies of the trackway made. Hopefully, these can be completed this year.

Almost there! Ken, Jill Tyson and Phil Hadland.

Sunrise at Fairlight.

Inquisitive seal at Lee Ness.

Seal 'banana-ing' on a rock outcrop.

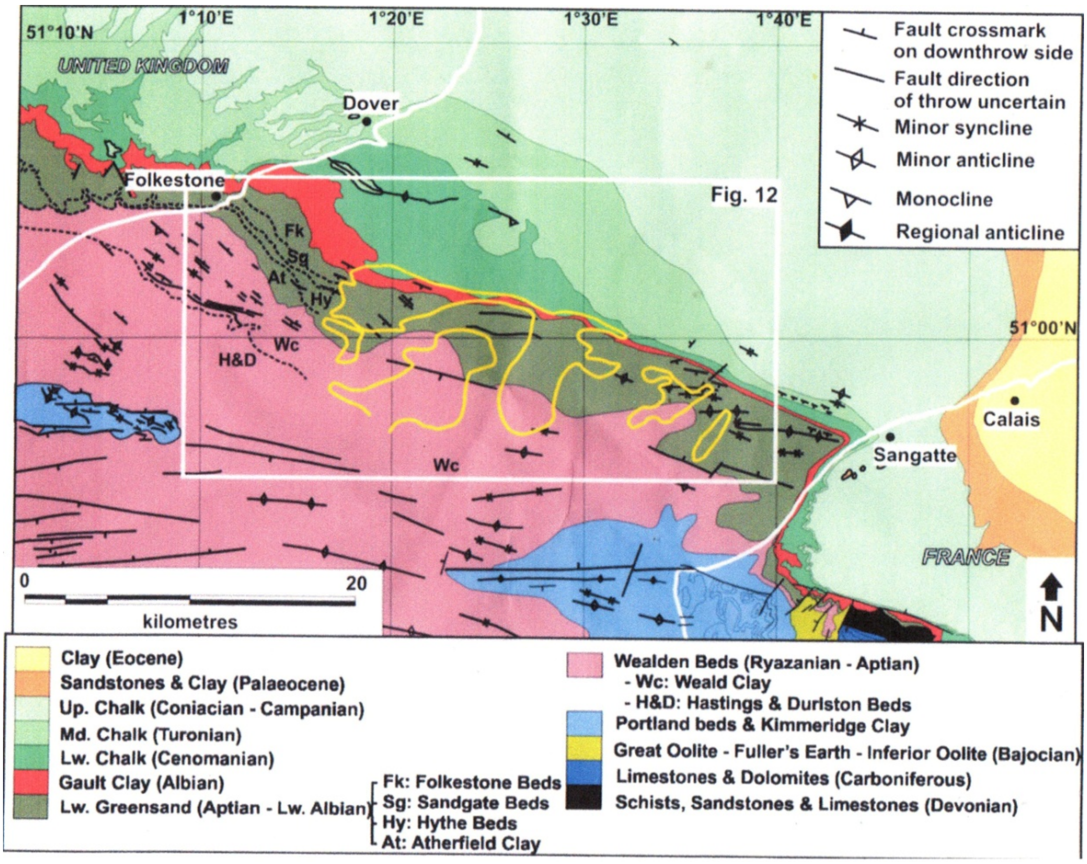
The complete fibre-glass mould.

Swimming across the Weald

Alison Taylor

We who live in South East England are fortunate that the backdrop to our lives is a major part of the Wealden Anticline, a Tertiary uplift. Following the uplift, the erosion of the different layers of sedimentary Cretaceous rock has revealed a varied landscape of concentric ovals of Chalk, Clays and Sandstones, all in quite a small area. These different rocks are well displayed in the coastlines of Kent and Sussex where the more resistant Chalk and Sandstones stand in magnificent cliffs, while the shingle ridges of flints eroded out of the Chalk are the main instruments in preventing the sea from washing inland over the low-lying softer Clays.

However, although the Wealden rocks disappear from view at the edge of the sea, they are still there, forming the seabed across the Channel until they re-appear on the other side in France. Long before the Ice Ages the anticline would have continued uninterrupted into North-East France, until such time as the drainage systems flowing north from the higher regions in Europe gradually eroded a broad shallow valley westwards towards the Atlantic Ocean in the vicinity of Devon and Cornwall. It is only the eastern tip of the anticline which now makes its presence known on the current coast of France, with the Chalk standing proud from just west of Sangatte through Cap Blanc Nez to the sand-dune coast of Wissant Bay. Here the Gault Clay emerges from beneath the Chalk and forms most of the low coast-line until, briefly, the Weald Clay and Hastings Beds give way to the Portland and Kimmeridge Clay Beds of the Jurassic which rise to form the promontory of Cap Gris Nez.



Map source courtesy of researchgate.com

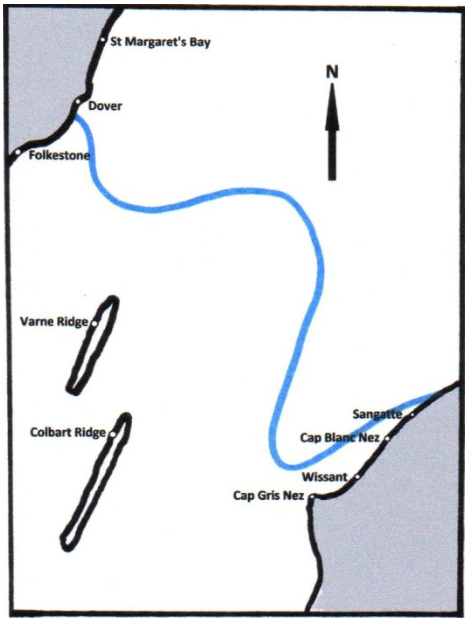
About 300,000 BP, in the Pleistocene Age, the northern hemi-sphere started to get much colder and the polar ice sheet started to move southwards, covering a large part of Britain. This was the Anglian Glacial. The freezing of the precipitation and the water in rivers and lakes prevented water from reaching the sea and so sea level gradually fell. After 50,000 years or so the climate began to warm up. The ice melted, the rivers started to run again and the sea level gradually rose. There were 3 glacial periods and between each of them the sea level rose and fell more than 100metres. This meant that over a period of about 290,000 years the shallow valley between Britain and France alternated between dry land and a long arm of the Atlantic Ocean.

Throughout all this time the Chalk extending from the North Downs across to the continent actually remained as a high ridge. It formed the watershed between rivers running west into the Atlantic Ocean and the rivers which drained into the North Sea. Exciting advancements in the study of that period have shown us how the Chalk bridge could have been weakened and then breached by the accumulation of water in the North Sea, which was unable to escape to the north during the periods of glaciation, because everything to the north was frozen. Huge torrents of water would then have been forced to roar over the Chalk bridge and plummet down into the 'Channel valley' causing a tremendous amount of erosion both on the bridge and on the valley floor. It is thought that, at the end of the last glacial period, about 10,000 BP, as the water rose again, the damage had been so great that a permanent sea channel had been formed right through the Dover Strait, joining the North Sea and the English Channel and cutting Britain off permanently from mainland Europe. Furthermore, the Storegga Slide, which was a huge displacement of material from the edge of Norway's continental shelf down into the ocean depths, is known to have caused a tremendous tsunami which overran all the North Sea coasts. It is believed that this incident in about 8,000BP was also responsible for smashing down any remains of the Chalk bridge and widening out the Dover Strait to something approaching its current width.

The process of Britain's isolation was the forerunner of huge geographical changes affecting ocean currents, the formation of shorelines, climate and of course, movement and development of plants and animals, including the history of humans on both sides of the Channel, right up to the present day.

You may have been somewhat bemused by the title of this article, but I will explain how I came to be interested in the English Channel or 'La Manche', (sleeve) as the French call it. For a significant part of his adult life, my husband's jobs were such that, they simply would not have existed had it not been for the huge changes in the geography of south–east Britain brought about by the Ice Age. My husband worked on the excavation of the Channel Tunnel (1974-5), then 8 years on the ferries from Dover to Boulogne and lastly 10 years as a Channel Swim pilot. It was this last job that really brought to my attention the interesting natural forces at work along this stretch of the sea whose existence is due to the Ice Age.

As a result of being an island nation, boat building and seamanship have been an ever important feature of man's life skills in Britain. Of course, after we were cut off from the rest of Europe, only people who could build a boat could actually cross the water to get here so this is no surprise. However, it was not until the Victorian era that there was much interest in being in the water rather than on it.



Map to indicate how the changes of tide affected Matthew Webb's swim.

In 1875 an American called Captain Paul Boyton was the first person to succeed in crossing the Channel by swimming. He wore an inflated rubber suit and used a short paddle. He also had a small sail attached to one foot! Few people nowadays would know his name but his feat inspired Captain

Matthew Webb to achieve a crossing, without any artificial assistance, from England to France later that same year. He swam from Dover to Calais in 21 hours and 45 minutes. In the following years there were many failed attempts, the 2nd successful swim not being till 1911 followed by the 3rd success in 1923. 1923 was the year that Channel swimming really took off as 2 people also succeeded in swimming from France to England. Their times were several hours better than the swim times from England to France and for many years France to England was the most popular direction to swim.

Since 1996 all swims have started in England because, in that year, the French brought in new laws in order to reduce the number of accidents between swimmers and small boats, water skiers etc. Swimmers are only allowed to be in the water up to 200 metres from the shore. Thus, nobody is allowed to start to swim the Channel from France. Special permission from the naval authorities must be obtained each year to renew the permits for Channel swimmers who have started from England, to approach and land in France. Today Channel swimming is increasingly popular and on good days there may be 10 or 12 swimmers, each with their support boat, attempting a crossing: an absolute nightmare for the coastguards trying to keep track of tankers and container ships moving up and down the Channel, ferries and smaller craft crossing at right-angles, and then vulnerable small boats with swimmers moving at a snail's pace. By 2003 there had already been close to 1,500 successful swims and by 2021 the number was over 4,000.

Dover has always been the recognised place to start to swim to France. It is the closest place to France and has in Shakespeare Beach the most suitable piece of foreshore. It is only a few hundred yards long and is a shingle beach flanked by the Chalk Shakespeare Cliff to the west and the wall of the Dover Western Dock to the east. The shingle is quite large with a lot of boulders which must have been eroded out of the nearby chalk cliff and been prevented from moving further along the coast by the harbour wall. Most swimmers arrive on their pilot boat from Folkestone or Dover. They have to jump off the boat and swim ashore in order to start from dry land as the rules dictate. The only downside is the danger of drifting across the mouth of Dover Harbour if the tide is very strong and going east.

Since the late 90s a lot of swimmers have started from Samphire Hoe, the lobe of land just to the west which has been made of millions of tons of material excavated from under the Channel in the construction of the Channel Tunnel. The access is good so it is easy for a swimmer's supporters to give them a good send off. There was some controversy when this site was first used, as to whether it really complied with the rule of starting from the shore, but nobody seems to worry about that now.

When swimmers were allowed to start from France the best landing places in England were the beaches at Dover, St Margaret's Bay or Folkestone. The choice is quite limited as the Chalk cliffs extend for a greater length on this side of the Channel than they do in France, but because there are no great irregularities in the coastline, inshore currents are not a big problem so it was relatively easy for the pilots to steer the swimmers to a suitable landing place.

The shortest distance across the Channel is 21miles, from Dover to Cap Gris Nez. At this point the coast turns sharply from a south-west trend to due south. In fact, at the point, the cliff turns through 90 degrees. This sudden change in the coastal alignment has a significant effect on the coastal stream running past it, so a landing on the point is rarely achieved. The high land which forms the cliffs at the point and to either side of it is Jurassic. This is more or less on the central axis of the Wealden Anticline and these underlying beds have been exposed here by the erosion of the overlying Wealden Beds. This has not occurred in Kent or Sussex. Although the fierce and unreliable currents render the landing around Cap Gris Nez difficult, there are several places on the south trending coast which are not too rocky to allow the boat and swimmer to reach the shore safely. Just on the east side of the point there is a café called La Sirene where the occasional landing of a Channel swimmer in the summer gives the customers an extra bit of excitement.

A much more inviting place to land is in Wissant Bay. This is a 2 to 3 mile stretch of sandy beach to the east of Cap Gris Nez: absolutely perfect for landing a tired swimmer. There are sand dunes at the back of the beach and a wild marshy area on the Gault Clay beyond. It is very different from the exposure of the Gault at the coast between Folkestone and the Warren. In Kent the narrow band of Gault Clay arrives at the coast almost at right-angles between the Chalk and the Folkestone Beds and remains as a crumbling land-slipped cliff at 100feet or so above sea level. In France, because this area is approaching the far end of the anticline, the Gault exposure runs along a similar line to the coastline and, although it is only a thin band, it comes to the surface for some distance along the shore. Wissant Beach is a popular place for a picnic on a sunny summer day and sometimes the people on the beach impede the swimmer with their enthusiasm.

From the east end of Wissent Bay the Chalk cliffs rise and, although there are not the same difficulties with currents here, as there are at Cap Gris Nez, it's difficult for the swimmer and dangerous for the boat to go close inshore among the rocks which front the Chalk cliffs. Not many swimmers land here.

To the east of Cap Blanc Nez the height of the cliffs falls rapidly giving way to a long stretch of sandy shore backed by green fields and coastal cottages. The village of Sangatte is here and further along, Calais. These are the easily eroded Eocene beds. The shoreline is sandy and unimpeded and would seem to be an ideal place to land.

The meteorological situation is the absolute determinant of whether it is possible to swim to France on any particular day. Some people use wet suits these days but the bona fide - we could say true blue – Channel swimmers can wear only a costume, a cap and goggles. The only extra that they are allowed is grease. This goes some way to helping to retain warmth but is most important to ease chafing around arms, shoulders, necks and legs. Because the sea temperature is slow to rise in the summer, few swimmers go before the end of June. Hypothermia is one of the major dangers of Channel swimming. Swimming continues throughout the summer until the end of September or the beginning of October. By then both the sea and the air temperature are getting too low. Also the nights have become very long and particularly chilly. The effect of warm sunshine on a swimmer's back is a great boost in warmth and in spirits. A long period of swimming in the dark is very demoralising.

The strength and also the direction of the wind obviously play a major role in any activity on the sea and this is of prime importance when considering a Channel swim. The perfect day would be a flat calm, but this is a rare occurrence. A big problem is the length of time that it takes to swim those 21 miles. As we know, English weather rarely stays constant all day and most swimmers will be swimming for 12 to 15 hours – sometimes for 20 hours. It is the pilot who decides whether to swim or not. Each of the pilots has a preferred source of weather information but few days are clear cut and it is often difficult to decide whether to go or not. The swimmers pay a great deal of money for the privilege of exhausting themselves in the cold waters of the English Channel, and they are not happy if the nice calm start blows up into a force 5 which will make it impossible to complete the crossing. Nor are they happy if, on a day that doesn't seem very promising, but turns out to be all right, some pilots go, but your pilot had decided against it! Force 2 or 3 are a fine forecast for a swim but a forecast of more than that not only makes for a difficult swim but is downright dangerous. The wind is usually stronger over the sea than it is over the adjacent land. Also there are significant changes in wind speed and direction near the coast as the air movement changes from a land breeze to a sea breeze in the morning and back to a land breeze again in the evening. It is certainly better to be swimming with the waves coming from behind you and a significant number of fast swims are achieved on the rare days in the summer when there is a gentle breeze from the north.

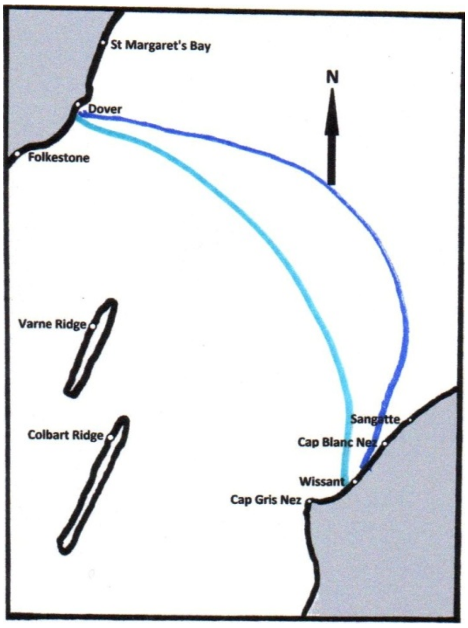
This prestigious swim is an event in which the swimmers are trying to cross the English Channel at its narrowest point. The destruction of the Chalk bridge during the latter stages of the Ice Age opened up the tides in the Atlantic Ocean to the North Sea and beyond, enabling an enormous amount of sea water to surge through this narrow bottle neck as part of the world's tidal system. At full flow, the speed of the current is 4 knots – that is 4 nautical miles per hour. Most swimmers can only maintain a speed of 2 knots. They are of course swimming across the current and not against it but the effect of the tide, especially near the French coast, is the major challenge to the pilot's skill and the swimmer's strength and endurance.

The tidal current varies in its strength according to the phases of the moon. At full moon and new moon the sun, moon and earth are aligned so there is a very strong combination of the gravitational pull on the water in world's oceans. This results in a super large hillock of water travelling around the world. As this hillock passes, the tide rises, and then falls again after it has passed. During the first and third quarters of the moon, the moon and the sun are at 90 degrees to each other in relation to the earth so the gravitational pull is nearly all from the moon with very little from the sun. This results in a much smaller hillock of water. The more extreme tides are called long tides or springs and the lesser ones are short tides or neaps. You can see on the beach how on one week the high tide will be much higher and the low tide lower, while the next week the difference between high and low tides will be much less. This is called the tidal range.

In Dover the highest high tides are 7.2 metres and the lowest high tides are 5.1 metres. This makes a big difference to the amount of water sluicing through the Dover Strait and renders a successful swim during spring tides very unlikely. The speed of the tidal current will tend to sweep the swimmer too far east or west for them ever to get to the shore. A boat with an engine can move fast enough to travel in a fairly straight line across the current in the Channel but a swimmer who can do 2 knots at most is at the mercy of the tidal flow and will inevitably be carried off course during the whole of the crossing. Without a very knowledgeable pilot they would have absolutely no chance of reaching the other side.

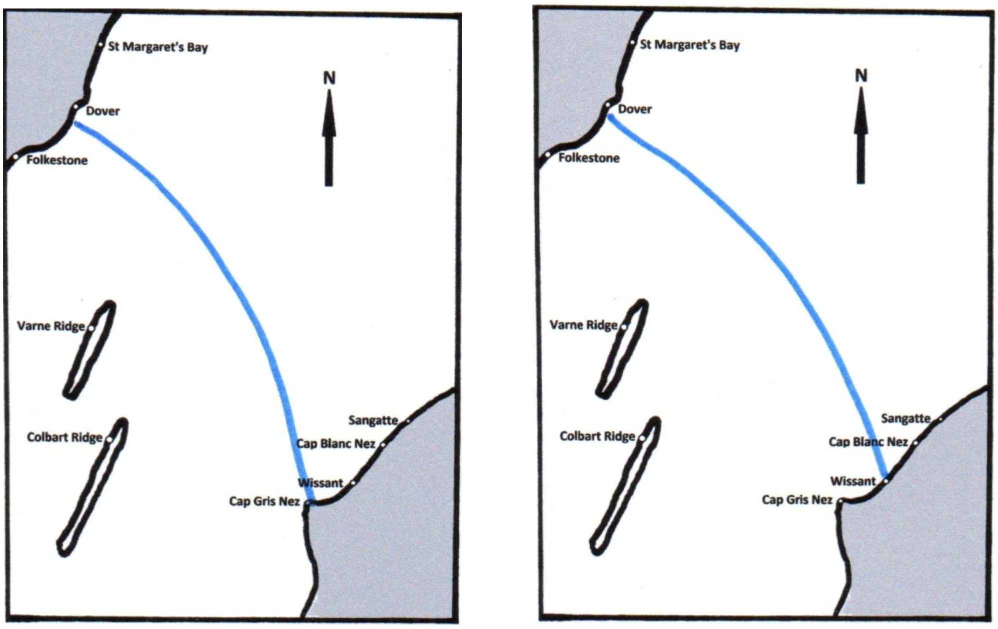
Another peculiarity of the tidal flow in the Dover Strait is that the highest part of the tide does not correspond with the change of direction of flow. In fact the tide reaches its highest point after only 1.5 hours of eastwards flow. During the remaining 4 hours of flood tide the height of the water surface is actually decreasing. There follows about 30 minutes of slack tide when the water remains more or less stationary until it begins to ebb away to the west. After about 1.5 hours of ebb the water reaches its lowest level and begins rising again, (whilst still ebbing), until it reaches its highest level at the end of another 4 hours. Then after roughly 30 minutes of slack water, the flow starts again. Each complete cycle of the tide takes just over 12 hours.

This complex but regular pattern results from a combination of factors involving tidal movements in the Channel and the North Sea, oscillation in a restricted coastal area and a backlog of water piling up at alternate ends of the Dover Strait as excess water is forced through – first to the north-east and then to the south-west. The Admiralty produces Tidal Stream Atlases for each sea area of Britain. These consist of charts showing the strength and direction of the tidal flows for each hour of the flood and ebb tides for both springs and neaps. The direction of Cap Gris Nez from Shakespeare Beach is roughly south-east , directly across the tidal flow, so every swimmer is pushed off their course to some extent, first to the east and then to the west. You can see on the diagrams the resultant curves in swimmers tracks over the ground. Both a strong tide and a slow swim speed will show in more exaggerated curves on either side of a direct course.

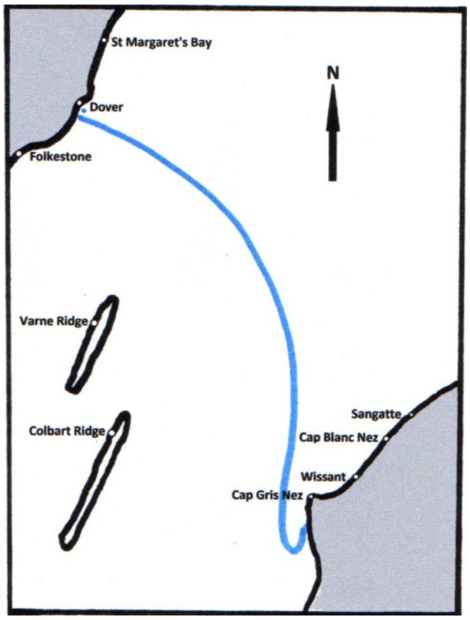


Map to indicate the effect of the tidal flow on the swimmer's course during spring tides or neap tides. Spring tides are blue and neap tides are turquoise.

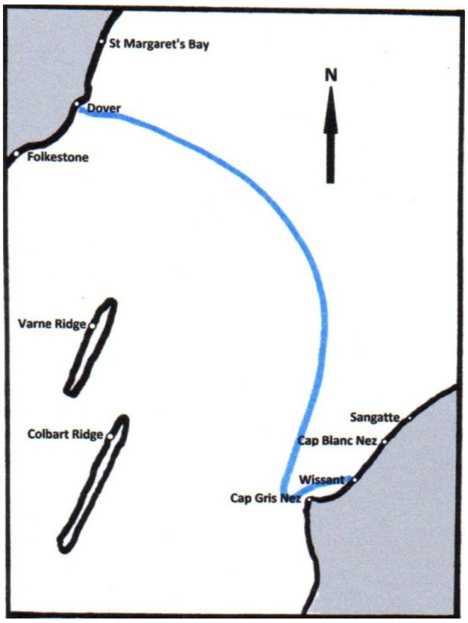
If a swimmer has enough speed to complete the crossing in 12 to 13 hours, the total effect of the tide is not too much of a problem as this time slot corresponds quite conveniently with the complete tidal cycle, so the effects of the ebb and flow will roughly cancel each other out. However, if the swimmer takes longer, then the next tide will set in and move them many miles along the coast before they can make a landfall. Most swims start around the time of high tide but the pilot will start the swim of a slow swimmer an hour or so earlier in order to try to equalise the effects of the tide. Occasionally a swim takes in excess of 20 hours, during which time the swimmer will be swept up and down twice by the tide. Just in case you fancy swimming the Channel, don't be tempted to exaggerate your swim speed when booking your pilot! He can only give you a good opportunity to succeed if you tell him the truth about the quality of your swimming!



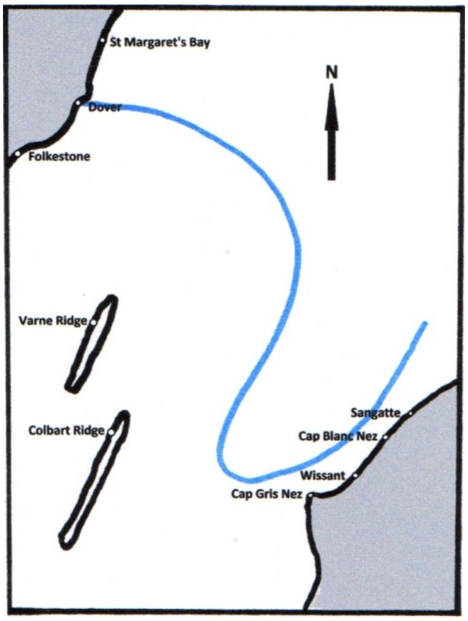
Courses of two very fast swims: 8 to 10 hours.



A good swim: 10 to 12 hours.



A slower swimmer: 12 to 15 hours.



A very slow swimmer and/or a fast tide.

Despite the pilot's careful plotting of the swim, his plans can often be sent awry by variations in the water movements. Gales in the Atlantic, or an area of unusually high or low barometric pressure can alter by as much as an hour the anticipated time of the tide's change of flow as well as its strength. The pilot must make sure that the swimmer is not swept across the entrances of Dover or Calais Harbours. These are banned areas for swimmers and any incursion into them risks the swimmer being taken out of the water. The pilot must avoid if possible, especially at low tide, the long undersea ridges of the Varne and the Colbart where the sea is often rough. (Do these feature result from the destruction of the Chalk land bridge? They both lie in the same direction of flow as the initial torrent.)

The skill of the pilot really comes to the fore when approaching the coast of France. He needs an intimate knowledge of the rocks lying under the water and of the vagaries of the myriad of local inshore currents, eddies and back washes at all stages of tide. Earlier in this article I gave a brief synopsis of the geology of the stretch of coast where landings might be considered. The reality is that the irregularity of the coastline and the frequent anomalies in the tidal cycle, not to mention the physical and psychological state of the swimmer, can combine to produce poor odds in favour of success when you are within half a mile of the land.

The southern side of Cap Gris Nez is a favoured landing place, but it only takes a slight difference in the time of the change of tide or a slackening of the swimmer's speed for the swimmer to be swept eastwards around the Cape and have to swim for several more hours before they can get out of the current and land at Wissant. For many swimmers this extension of their swim is just not physically possible and they have to go back to England disappointed. It's rare for anyone to land at the southern end of Wissant Bay, despite its nice sandy beach because the strength of the north-easterly current is too great for a swimmer to be able to overcome it and reach the shore just there. The dangerous rocks off the Chalk cliffs of Cap Blanc Nez deter landings there, so, if the swimmer can't quite manage to get into the eastern end of Wissant Bay they sometimes have to swim all the way along to Sangatte, hoping to be able to overcome the current which is trying to sweep them out through the other side of the Dover Strait and into the North Sea. But, it's not just the tide that they have to worry about on this invitingly sandy stretch of beach. The inshore approach to Calais harbour runs along this length of coastline and the cross Channel ferries pass through at speed every 10 minutes. It's a chicken run and the swimmer would be the chicken trying to cross the road!

There are plenty more dangers and difficulties involved in swimming across the Weald which don't really have any bearing on geology or geography and I for one will be just continuing to enjoy the beauty of the Weald on this side of the Channel.

As an afterthought, it's an interesting fact that, up to 2003, there are only 6 French people with their names in the Channel Swimming Association's official list of Channel swimmers. Is it because they have more sense than us?

Left. Swimmer and pace maker swimming towards west side of Cap Gris Nez.

Right. Celebrating success; Cap Blanc Nez in the background.

West side of Cap Gris Nez with coastguard's Radar Surveillance Station near point at left side of picture.

Fossils from the Oldhaven Member of the Harwich Formation, Beltinge

Philip Hadland

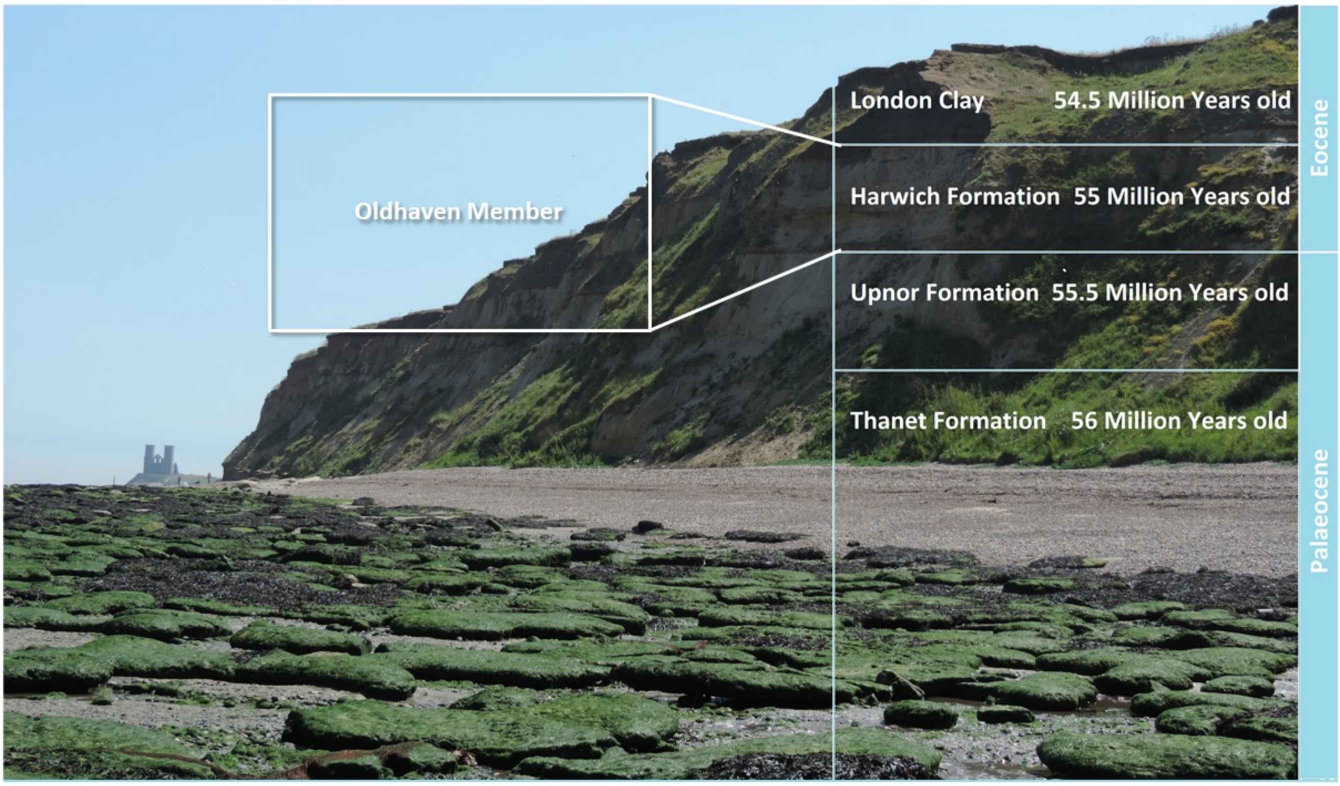
Introduction

Around 66 million years ago, the dinosaurs (except for the birds) along with 80% of all species, went extinct. Research indicates that it took around 10 million years for life to recover fully (Lowery and Fraass, 2019). So, we'd need to travel back in time 56 million years to see what things were like after the recovery.

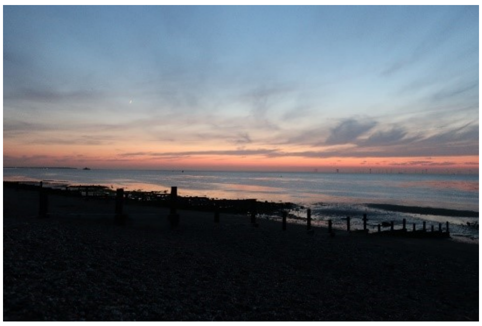
One place that you can visit that offers a glimpse of life during that time, is the coastline between Reculver and Herne Bay. The exposed geology in the area is of Ypresian age, dating from about 56 million years ago. There are a number of highly fossiliferous layers including the famous Beltinge Fish bed that is rich in fossil shark teeth.

Less well known, is the Oldhaven member of the Harwich formation. Formerly known as the Oldhaven Beds, it is somewhat overlooked, but is well worth investigating. In addition to a common shelly fauna and crinoids, it contains a diverse range of vertebrate fossils, a few of which are outlined here.

The Oldhaven Member is a shallow marine deposit, exposed in the cliffs and on the foreshore at Beltinge to the east of Herne Bay. It can be seen and explored during most low tides to the west of the 'Rand', a spit of black pebbles running almost perpendicular to the shoreline. The Rand is there due to the pebbly base of the formation. Access is via a path or slope from the car parks on Reculver Drive (post code CT6 6QF), making it very accessible. The best exposures of the Oldhaven member for collecting are actually quite close in and almost adjacent to the main shingle beach.



Above: A photo of the cliffs with Reculver Towers in the background, illustrating the relative position of the Harwich formation, of which the Oldhaven Member is part.



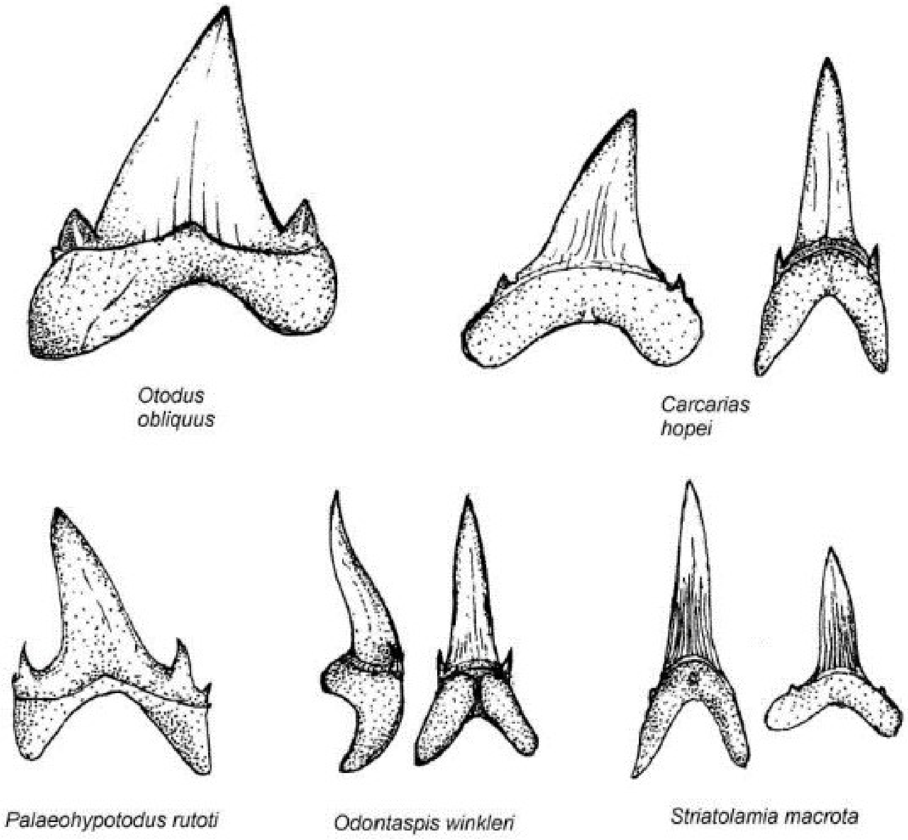
Above: a view of the main foreshore collecting area for the Oldhaven Member

Fossils

Invertebrate fossils from the Oldhaven Member include bivalves, such as *Artica morrisi*, oysters and snails. Like in the Thanet Beds, many of the bivalves can be found with the borings left behind by predatory snails. There are also crinoid stems to be found, and occasionally fossils may be encrusted with bryozoans.

Bones of vertebrates are preserved as brown or black phosphate, occasionally within ferruginous (iron rich) sandstone concretions. Shark teeth are commonly found with crowns that are usually bluish in colour. The shark teeth show up well under water and also under torchlight, so collecting in the dark can be very rewarding.

The vertebrates to be found include several species of shark teeth, in variety comparable with those found from the Beltinge Fish Bed (formerly known as the Woolwich Bottom Bed). Reptile remains you can find include bones of turtles (fairly common) and crocodiles (rare). Even bones of birds (rare) and snakes (very rare) can be found.



Above: A handy shark teeth identification guide to the most frequently found species.

The following fossils were all found by the author unless stated otherwise. Several others are on display at the Seaside Museum at the time of writing.

Above: This photo shows one of characteristic blueish preservation of the teeth in the Oldhaven member, as well as the shelly and ferruginous nature of the sediment. The dark pebbles are of flint derived from the Cretaceous chalk and are coloured by manganese oxide.

Above: Left: A fish jaw (15mm approx.). Right: Fish vertebrae are common, averaging around 1cm across.

Above: Three views of the tooth palate of the sea wrasse *Phyllodus toliapicus*. 45mm in length

Above: A limb bone from a turtle. 31mm in length.

Above: A crocodile tooth. Approx 17mm.



Above: Top: distal end of a bird humerus, found Ian Clark of Canterbury. 50 mm in length. Bottom: Coincidentally, a smaller distal humerus that I found is on display in the Seaside Museum, Herne Bay.




A snake vertebra (approx. 12mm in length)

Advice on Collecting Fossils

You don’t really need any special equipment to collect fossils at Beltinge. All you really need is a good pair of eyes, perhaps a torch for collecting in the dark, and a container (ideally with compartments for sorting finds).
One other bit of kit that can help is a pair of kneepads. With these you can crawl around on exposed areas that look promising. This allows you to get closer and spot small fossils while also saving your back!
Please follow the fossil collecting code and get in touch with a museum or expert if you find anything you cannot identify. After collection, fossils should be soaked in two or three changes of freshwater for a few days to remove any sea salt which can cause damage to them.
A useful book for identification of your finds (Rayner et al, 2010) is listed in the references and covers similar fossils from the London Clay. Always record where you find anything and label your fossils with this information. Scientifically important fossils should eventually be deposited in an accredited museum.
I hope this article inspires you to investigate this under investigated source of fossils. Good luck!

References and Useful Publications:

Christopher M. Lowery, Andrew J. Fraass. Morphospace expansion paces taxonomic diversification after end Cretaceous mass extinction. Nature Ecology & Evolution, 2019;
Local Fossil Collecting Code:
http://www.thanetcoast.org.uk/factfile/thanet-coastal-codes/fossil-code/
Handy Website Guide
https://ukfossils.co.uk/2012/01/24/herne-bay/
The BGS Lexicon of Named Rock Units: The Oldhaven
https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=OH
DOWNER Geoff. 2011: The Geology of Reculver Country Park. Published by GeoConservation Kent (formerly Kent RIGS), 53 pages, many photographs, maps and figures, in colour.
https://www.geoconservationkent.org.uk/index.php?option=com_content&view=article&id=16&Itemid=22

Useful for Fossil Identification

RAYNER David, MITCHELL Tony, RAYNER Martin, and CLOUTER Fred.: London Clay Fossils of Kent and Essex. Published by the Medway Fossil and Mineral Society, 228 pages, 1270 photographs and 265 named species.

A KGG circular walk around the Tyland Barn area

Taking in Sandling, Harbourlands and the Boxley area. To investigate the soils, land use and geomorphology of the region. Led by Dr. Anne Padfield, Chairman and Field Trip Organiser on the 4th September 2021

David Talbot

Aim

Forget all we might know about the formations and rocks along the route and use the soils and other features we found to interpret the geology below. (Most of us already knew a little about the local geology, formations, etc., what we are unsure of is where the actual junctions are).

Object

About ten members of the group met in the car parking area on the old Chatham Road near Tyland Barn where, unbeknown to us our leader today was about to test us on our powers of observation whilst walking the route. We were each handed a road and track map with place names, and selected four coloured pencils. We were told to mark the map denoting what soil or rock type we might be assessing and where we had found it. Personally I thought this was a great idea, to make us think and not just listen to what we were being told. Dr. Padfield pointed out that one essential tool of course is a compass. Without which we may never know the location and lay of the land.

On starting this report it was thought useful to make a new map of the area we had walked, the original had become rather damaged during it; Philip's Street Atlas Kent was used being the same scale as the original at 1:18 103. (On the re-drawn map between the Gault and Lower Chalk the contact is shown as a dashed sinuous line, as it is on the British Geological Survey (BGS) map; dashes are often used when contacts or extent are unclear. Dashed lines were used between the other Chalk formations for the same reason).

A copy of BGS 288 Maidstone was used for the formation positions where the walk was carried out, the scale for this at 1:50 000; the map memoir was useful for further relevant information in addition to what we were given during the walk. For the bigger picture OS 148 was also of use, scale 1:25 000. Positions of samples taken and other factors were transferred to the new map; dots for the sample points; small crosses for others. The report will be written as details are known and bring together all that the BGS map and memoir can give, the OS map, information throughout the walk and the samples looked at. All map grid references are from the TQ square which will be omitted from figures throughout the report; references are not exact, nor are formation limits. At least two other visits were carried out for photos and further observations.

Old Chatham Road, Tyland to Boarley Lane

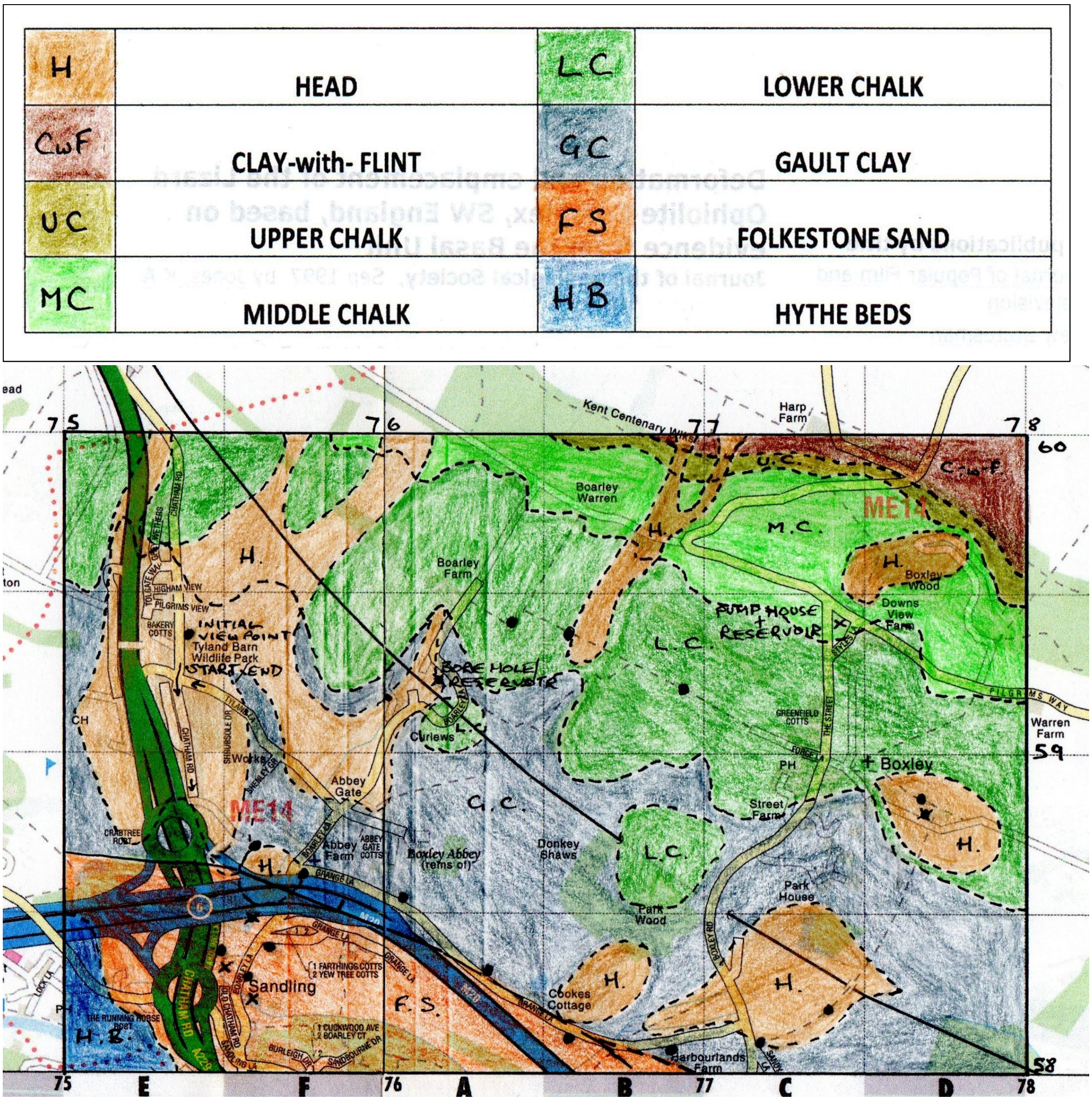
We walked up the old road a short distance to look across the fields, 754 593, to see the lie of the land, east to west roughly speaking, its use and rocks. Dr. Padfield admitted she had done her original recce during late winter and there had been very much less foliage than today, this will be a recurring theme over the walk. One of the first structures discussed was the chalk cliff face to the north, the escarpment; below us to the south is where the Medway Valley lies. With the chalk escarpment it was fairly obvious that the dip-slope was where it cannot be seen to the north from our present position. This was accepted as probably correct. Knowing a little about the formations within the basin of the Wealden area, there was probably a lack of knowledge of the position of those contacts between formations, roughly even if not exactly. *From BGS 288 map we had stopped about halfway across the Gault Clay outcrop, however in this area the map shows a large amount of Head deposits which has eroded from the upper Chalk formations in several lobes. These have merged together over a tract of country halfway to Boxley; it may have moved as far south as the present motorway; it is distinctly possible that this material covered more than it does now. Generally, compared to the thicknesses of the formations themselves, Head deposits are relatively thin.*

Walking down the old road towards the upgraded M20 junction 6 where there are still several properties, we turned left onto a short section of concrete road with trees, bushes and plants growing in some profusion. From the edge of the road, three to four metres along, water was ponding in the undergrowth, there had been no rain recently so it was soon decided this was spring water, 756 587, see map below.

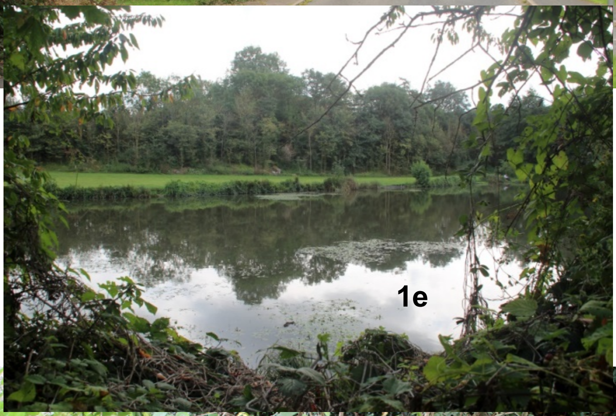
Q.1: Why is there spring water here? Is there a junction nearby? If so, which formations are involved?

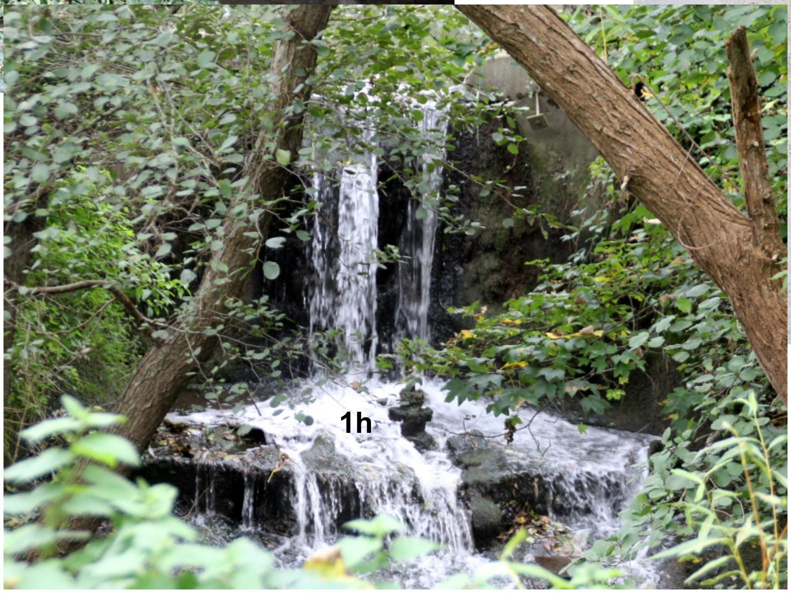
From the map and table of formations we can see that the oldest is in the SW, the Hythe Beds and the youngest to the NE is the Upper Chalk; Head which covers some of the other formations and Clay-with-Flint, on the dip-slope are even younger Recent deposits; we cannot tell at this point how each formation relates to the next. On BGS 288 map however, there is a cross-section across similar points from the NE to the SW less than a mile from the walk area. This shows how the Hythe Beds dip under the Folkestone Sands, which dips under the Gault etc, etc; this is known as a monocline. The Gault Clay is an aquiclude, it slows down or prevents the movement of water through itself, water runs across the top, as a stream, or when a water bearing formation below, an aquifer, causes water to flow from under it, ponds will form or springs will flow. There is a junction and fault nearby between the Folkestone Sands (aquifer) and the Gault Clay (aquiclude); this water was found to be running into a drain which would be taking it away from the path to prevent flooding. A culvert will take it to a sump for further removal.

Map of the walk area starting and ending at Tyland. Dots and crosses denote reference points.



Tyland Walk Scenes 1





TYLAND WALK SCENES 1

	App. Reference	Description
1a	TQ 754 593	Walk start position and view North East across scarp slope
1b	TQ 756 587	Spring from undergrowth runs into a drain here.
1c	TQ 755 585	M20 juncrtion 6 from south side.
1d	TQ 757 584	Rabbit holes in sandbank near Yew Tree Inn.
1e	TQ 756 584	Fishing Club lake nearest to motorway.
1f	TQ 756 582	Outflow from fishing lake.
1g	TQ 756 581	Stream running alongside Boarley Lane from fishing lake.
1h	TQ 754 583	Water flowing over weir from lake at lowest level to run into culvert under Running Horse roundabout to River Medway.

Boarley Lane, Sandling and the Running Horse Roundabout

Continuing on we came out onto Boarley Lane, here to our left, water could again be heard. Looking over a fence a sump was receiving water from a stream coming from the side of a garden. On investigation this sump is believed to be receiving water from the Boarley Lane stream above Tyland Lane from the GC/LC junction area; springs along Grange Lane opposite and possibly the one mentioned in the answer above. With Grange Road going off in an easterly direction we turned right and walked downhill under the junction flyover – noisy place, lots of cement. It must be added here that this motorway junction has greatly altered the layout of the roads and how they are depicted on the maps we currently have. After the building of the original Maidstone By-pass in 1960 when it was known as the A20(M), the Maidstone junctions have all been changed, in one way or another several times; the maps cannot always keep up with them, not to mention our need to replace them. So, much ground work, drainage and diversions have altered the roads around the base of this flyover at Junction 6. There are still remnants of the roads once driven but these are often dead-ends or have been rerouted. However, at the bottom of the hill it starts to rise where two closely spaced roads lead off to the left, the first road has a few cottages and an 'olde worlde' inn called the Yew Tree Inn along it. After the second road, which is a track, the road has started to level out, a tree lined bank to the left has loose soil/sand from rabbit holes, or the like, that is distinctly yellow. Taking a sample, 757 584, we are invited to work the sediment between our fingers where, although it's very fine, there is a definite granular feel to it and we decide it is fine sand with clay; sand with a thin layer of topsoil. We move on up over the brow where the road narrows and another sample from the bank is investigated, 756 583, with the same findings.

Q.2: Why have we had to go down and up and over the hill we have just walked?

As Boarley Lane dips under the motorway here a look at the geological map shows us there is a clear fault between the Folkestone Sands and the Gault Clay showing the clay is down faulted against the sand, which is reflected above also on the slip-road from Blue Bell Hill southbound onto the motorway.

Through the trees to the right we can see a lake and Dr. Padfield made a comment about the water table level and lake levels being related. I did not give the comment much thought at the time, but once starting to write this report it did, and that was that these bodies of water and some of the springs might have a common source.

<u>Sandling Area</u>

A little further on the road dips down once more where a culvert to the left side pours out a strong stream of water, it was not known initially where the water was flowing from; further investigation found it to be from the fishing lake on the opposite side, via a weir, emerging from a culvert it follows this side of the road to another weir. Here a slow moving stream also enters from the opposite direction, through a second weir. This stream comes from a large lake that hides amongst the trees to this left side of the road, 756 582. From the point where the two streams meet, another culvert runs under the road where this water feeds a lake, 755 583 on this opposite side. Over here a low block wall runs a short way along, I realised later this supported the culvert running under the road, towards an opening to a grand house, once, via a drive, the drive separates the fishing lake from this other one below it. On the opposite side of the road again, where the stream runs alongside, it appears that various stones and other debris have been coated in tufa. For this to happen there must be an input of lime-rich water, or Ca CO_3, this could only come from the chalk hills to the north, or could it?

Q.3: Why is the water table here? Where does the $CaCO_3$ come from?

The answer to the first part of this is part of the answer to Q.1, because of the Lower Greensand being a huge aquifer it can collect meteoric water from all around the region, when it comes up against the Gault Clay that acts as a barrier to infiltration and water will pond on the surface of the Folkestone Sand so forming the lakes, with an addition of stream/spring water from elsewhere upslope; it can get quite wet. Of the Lower Greensand formations the Hythe Beds is highly calcareous from the shells within it, water flowing through will collect ions of calcium and carbonate from their disintegration. The highly charged ionised water will deposit calcium carbonate once conditions are right giving tufa covered items in streams and ponds. (It has not been proved that there is tufa deposited here - DT).

From Boarley Lane to Running Horse Roundabout

We moved on, where the road was starting to rise once again, up to a left hand curve where we turned right, (this is the furthest south we shall walk today), as we followed a short section to the old Chatham Road we come to a dead end where we were able to pass through a gap in the hedge. We turned north onto the path at the bottom end of the Blue Bell Hill junction below the motorway, the Running Horse roundabout; I told you there were roads everywhere.

At this point I should say over what Formations we are walking today as, other than superficial ones, we shall not see any others. From the highest at Old Chatham Road is the Lower Chalk, next is the Gault Clay, and finally Folkestone Sand; other Formations seen but not sampled are Middle and Upper Chalk and Hythe Beds (not seen) of the Lower Greensand Group. Superficial deposits include Clay-with-Flints, Head and hillwash. The two chalks are too high, the clay-with-flints is on the dip-slope; we did not reach the Hythe Beds; there are very little or no Sandgate Beds in this area.

We walked along the path between hedgerows where again we could hear and soon see more water running over a weir. This was the opposite side of the lake we had seen from the old Boarley Road, so water was filling from one side and spilling out into another culvert this side, confused? I could just see enough through the foliage to see the water flowed away and under the A229 (new Chatham Road) towards Forstal, where it possibly flows into the Medway, which isn't far from here. (*From my own road map of the area, a stream is shown coming away from the Running Horse roundabout and flowing to the Medway).* I shall return to this shortly.

Return to Boarley Lane via Motorway Drainage Sump

The walk is now taking us towards the motorway flyover, but at a large road sign, 755 583, Dr. Padfield invited us to look at the soil around the concrete bases it stood in, because it had been positioned against a bank it meant one supporting leg was longer than the other. The two outcrops of soil had some differences in colour but the upper one had a definite sandy texture to it, the lower one less so. This could be due to landscaping during the completion of the changes to the road system, but it is on the Folkestone Sand outcrop. *(This was confirmed on BGS 288 map where the Folkestone beds outcrop runs through the area).*

We walked up to a footpath sign where we turned right alongside of the motorway flyover above us, with the lake we had seen earlier to our right. A little way along, to the left, a large grill was noted covering a culvert, 756 585, with at least three pipes entering it; the cover was securely bolted down, the culvert being quite deep. Inside there was another that appeared to be a gate valve, and there did seem to be level controls fitted, or at least level alarms; there did not appear to be an electrical drive. A piece of the covering grill had been removed for an operator to open/close it by hand if necessary; there was a square boss for a socket. This is to divert storm water away from the motorway road surface and collect at this sump.

Q.4: Where might this water flow out too?

The nearest body of water is the water table lake behind us, a fishing club has the use of it. However, storm water throughout the year and especially in winter, will be salt-laden from de-icing the motorway, so it's unlikely to be sent to the lake. It would include vehicle debris in the way of tyre rubber, brake linings dust, petrol and all manner of nasty things generally; not healthy for the fish! There are a number of Waste Water Treatment Plants around the area, so it would go to one of these.

In addition to this a short distance away, water could be heard, running into it. This water is fast flowing as if it were several strong streams. We are on the Maidstone side of the motorway, on the other side another sump was accepting spring water from elsewhere; it cannot be a coincidence that this water is coming from there.

Grange Lane to Boxley Road

We had now returned to Boarley Lane opposite the Yew Tree Inn, where we turned left walking back under the flyover and crossed over into Grange Lane and were now headed in an easterly direction along it; we were now on the coast-bound side of the motorway above us. As we moved off we could hear running water. In the verge was a circular open-grilled manhole, 757 586, smaller than the one seen previously, where water was indeed running through at quite some speed. We could not see how deep this one was, most of the grill had grown over with moss and grass, but I wondered if it was connected to the larger one, on the opposite side at the end of the footpath, where it could then run through a culvert, under the motorway directly into the fishing lake. (There is a stream shown flowing from about a halfway up Boarley Lane, 760 592, it emerges from near the junction of the Lower Chalk with the Gault Clay, it is just below the line of the Channel rail link and is shown on the area map).

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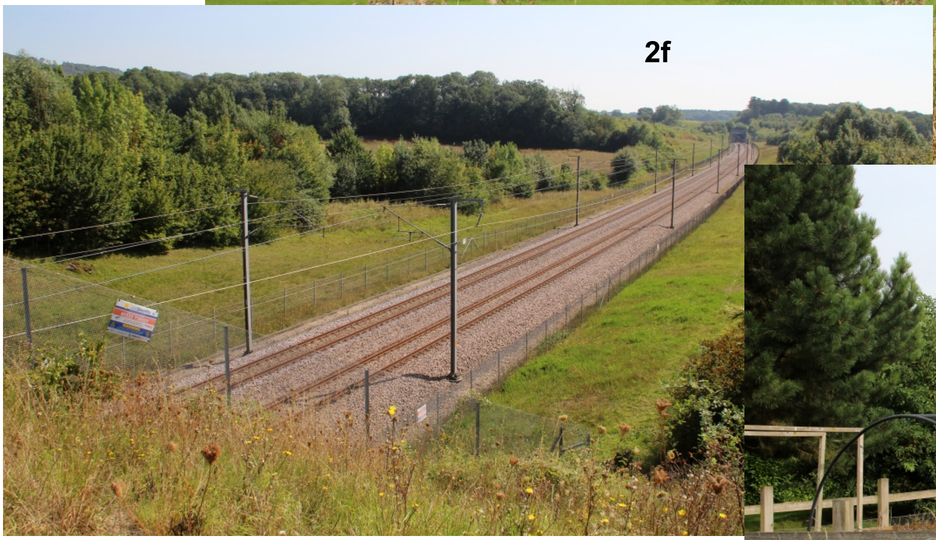

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2g

TYLAND WALK SCENES 2

	App. Reference	Description
2a	TQ 761 586	Spring flowing from hedgerow down Grange Lane.
2b	TQ 766 581	Transformer pole in Grange Lane.
2c	TQ 768 581	Ponded area in lower field level in Grange Lane.
2d	TQ 769 582	Spring flow entering culvert on the side of Grange Lane.
2e	TQ 777 587	Possible junction of Gault Clay/Lower Chalk between these fields.
2f	TQ 762 591	Channel Tunnel Rail Link (High Speed 1) looking towards Boxley Road bridge.
2g	TQ 777 588	This unusually shaped dwelling once a freshwater pumphouse.

Grange Lane

Heading along Grange Lane and on the left side, water was once again emerging from the undergrowth at the edge of the road, 761 586, another spring roughly in line with the first one we encountered near the bottom of the Old Chatham Road, (see page 1). Another factor concerning the soil here was pointed out by our leader; the tarmac was cracking about 300 mm in from its edge. This was due to the damp clay-rich soil under the road, drying out during hot weather and swelling up again when wet. This could be seen a short way on in a gateway to a field, 763 583, where the soil had been trampled over by vehicles and cattle when wet, the dry weather had caused desiccation cracks to now form, a sure sign for clay. (*We are close to the Folkestone Sand/Gault Clay contact).*

The road was now turning slowly south-eastwards but away from the M20 which was turning more south-easterly following the Folkestone Sand; we are told by Dr. Padfield, this was a deliberate move to keep the motorway away from the clay and on the firmer Folkestone Sand. We could now see grass covered open fields to the northern side of the road with small woods, a tree-line or two and small ponds, we understood this to mean more clay soil, Gault Clay. Having passed the gateway mentioned previously we now started to head up hill, trees in the hedgerow began to look more exotic and it was mentioned it could be due to landscaping and keeping road noise down; there were no soil exposures, and assumed we must still be on clay. (There were no pathways along here and had been advised to be aware of traffic movements). At the brow of the hill we could see the motorway disappearing to the southeast, at Junction 7; we continued down where there was little opportunity to sample. A transformer pole however, in the r/h bank, 766 581, stood just before the lane bottomed out, so that where soil had been disturbed sand within it could also be seen; this was taken as being close to the junction with the clay. An entrance, l/h side, with trampled, dried up mud, into a harvested field was clearly clay-based, so it appears the road must be roughly where the contact of the sand and clay is. *(On BGS 288 map the formations do indeed turn southeast from east-west which means the road here must follow the contact by the samples being investigated).*

The road again started to climb with trees overhanging from both sides giving a tunnel effect. A short way up we noticed a stream flowing down this r/h side, a bit further on we came to a point where the water came out from under the road. On the left side the stream was flowing towards us from the field alongside; another spring line then. Where the water exited from the road on the r/h side blocks had been placed to prevent the force of water from it from eroding the bank. Taking a sample from this bank at about 768 581, it was easy to detect the sandy nature of it.

Q.5: Why is the culvert/diversion here?

This has been diverted here to prevent water from ponding at the entrance of the field below. There is a fair amount of water running through it, yet there has not been rain for several days, so this is spring water. If the water was allowed to continue down the opposite side the field entrance would soon be flooded, the obvious choice was to install the pipe under the road and divert it.

Boxley Road and Channel Tunnel Rail Link (CTRL now known as High Speed 1 (HS1)) to Boxley Church via an unusual dwelling

At the top of the road we came out onto the road to Boxley, which although we would get there at some point, it would be across the next field coming up, going the longer, less dangerous way. We turned right, went a short way along and crossed over to a gate, 772 581, at the edge of a field at the end of Sandy Lane. This field had a warning sign stating there were calves in the field; we hesitated. Should we go on? Looking across the field we could see a herd of cattle, and there were young with them, but they were at the top end so we figured it was safe enough. First a check of the ground; the grass was very green, with hedges of trees and bushes around several sections. The gate area having the heaviest footfall showed signs of desiccation in the clay, there were flints amongst it and a look at the BGS map shows a large area of Head nearby; once again Gault Clay was decided on. Dr. Padfield informed us the field had been particularly boggy when she walked across here during an earlier sortie. *(You may have noticed we had crossed into Sandy Lane, yet it was decided that this field was on clay. Due to the south-easterly turn in the formations the lane crosses the Gault/Folkestone contact further along and was probably named years ago from the Folkestone Sands).* We are now heading generally north towards the exit opposite, another group coming towards us informed us there were no cattle near the gate. We got to it just as it seemed the cattle would also, but I think they were more interested in eating grass than what we were doing and stopped a short distance away.

Channel rail link area

We had reached an accommodation bridge over the Channel Rail Link, 774 582, where we were informed by group member and secretary, Grahame Godding, when the line was excavated it had to be lowered by three metres; this was one of several 'conditions' required through the area, as a *'reduction on noise, not to be lifted upon an embankment; another was to the east to run under the A249, with another to the west to climb and curve up to the new North Downs Tunnel near the Shell Garage'*. We crossed the farm access bridge where the position of an ephemeral stream was pointed out to us on our left running in-line with the railway; it runs most of the year round and floods the fileds locally during periods of wet weather. The cattle now behind us we continued up-slope on our way to Boxley. The fields are lush with green grass and wild plants so we are still on clay. Just before a field gate Grahame tells us of a spring that rises here in the winter, 776 586, again this is quite close to the Gault/Chalk contact, the grass is certainly lush enough, but nothing there today. Passing through the gate the track now narrows between fences, apparently this track can also run with water in wet weather and again one would expect that. To our left there are a number of dwellings amongst the trees which are just off the Boxley Road. To our right a new feature are grape vines, a whole field of them. We hear that grapes have to be grown in slightly alkaline soil, so clayey, but not too much, about 5.5 to 6.5 pH, with good drainage.

We can now see Boxley Church ahead and over to our left. Over to our left once more a change in the field levels, about a metre, has us wondering how this could be, as the area uppermost is almost level from top to bottom and either side of it are open green pastures; we are unable to get soil samples with fences and grass preventing it; the reference for this abrupt feature is approximately 776 587.

Q.6: Why is this break in slope here and what, if any, could the field have been used for?

From the geological map this feature is possibly the junction between the Gault Clay and Lower Chalk with a good amount of Head around the area; it would have supplied good grazing to various farm animals in the past.

Unusual Dwelling

Reaching another gate we pass through, and are soon crossing an east-west track where there are a few private dwellings, the path continues on where one of these local dwellings can be seen much clearer. We were told by Grahame - he has been a mine of information on this area - that this particular one had been a freshwater pumphouse, 777 588, but was now a private dwelling. I think it's this one *(confirmed by Grahame who tells us the old wellhead and pump mechanism are a feature of the front room)* as it has an odd shape – it is partly hexagonal, it looked six-sided from where we stood, with a conical roof of Kent Peg tiles; on top of this stands a cockerel weather vane. The rest of the building has wooden shingle walls with the same type of tiled roof; an outbuilding was similarly structured. If this is the case it would have been one of the many individual pumping stations that dotted the countryside during the late 19th C and early 20th C prior to much larger stations being built for the expanding population; locally, higher up above Boxley there is a much larger pumping station and reservoir. *(When this new station went on-line it was found that the old one, and others in the area, went dry, hence they were shut down and sold off).*

Boxley Church area

Moving on we turn a sharp corner left around this house and into another field proceeding towards Boxley Church in a westerly direction. We reached the church boundary wall which was obviously very old, being various shades of grey with lichen, but was sandy textured with black specks. Knowing that one of the local groups is the Lower Greensand and that from this, the Hythe Beds, is one of the formations that are a part, we know these blocks are Ragstone. This stone is a sandy-calcareous stone used extensively around the Maidstone area, from a 'hundred and one' quarries that are no longer in use. The black specks are glauconite so this rock formed in shallow marine conditions. Getting closer to the church now we passed through a gate in the wall into the church-yard, the church now in front of us. This also is built mainly of ragstone with some infill of flint, from the Upper Chalk in the hills above us; however, on some western corners of it, another stone has been used to replace old eroded ragstone ones.

Boxley Vineyards, Geology and return to Tyland

We continue to Boxley Road, still heading west, into Forge Lane and a track between fields of more grapevines. On bare patches of ground there are a lot of broken flints, the matrix they are in is light coloured, chalky with a little topsoil; this is Lower Chalk ground with areas of Head washed down from the Upper Chalk escarpment beyond the top of the field. Over time this Head has been worked into the fields, is of varying thickness and would require augering to get to the true bedrock. As was stated at the start most of us knew the rough position of the formation we are on, just not the actual position of that contact of one to another. From the maps we are walking across the middle of the Lower Chalk outcrop.

General Geology in the area

To our left between trees and vines the view opens up to the south where the Medway River valley lays, beyond Maidstone, the Greensand Ridge can be seen as the next high ground. In front of us and to the right The North Downs run approximately NW/SE and then appears to move off across this view. This is across the Medway Valley and is an anomaly I have often wondered about. Iit is a section of the whole Wealden area which, to the west, does run west to east from a line across the Weald from the Medway Gap, in the NE, to Lewes in the SW and beyond to Brighton on the coast of the South Downs. It is as though the whole Weald has been kinked to the southeast; I'm sure it's tectonic and due to the structure of the basement rocks. Other than that, the hillside slopes are undulating like switchbacks up and down as we are walking west and now on the return leg to Tyland. Samples of soil are looked at from 769 592, 766 594 and 764 594 mostly of a chalky nature but there are flints amongst it, of various sizes, so still an amount of hill-wash and Head.

Q.7: Why are the fields structured as they are here and does this affect grape growth?

As the group have walked along here the number of undulations have been commented on, why are there so many, what has caused them? (Sorry about the question within the answer-*DT*.). The structures formed here are mainly due to differential erosion where faulting, joints and how water finds its best route across uneven ground and freeze and thaw affects the surface. The Chalk is firmer than the Clay, so what happens to the exposed chalk will be reciprocated across the clay, hence undulations. This is also reflected in the structure of the escarpment where abutments stand proud of gullies between and these are the points where Head and hill-wash will fall and flow from as headward erosion. Grape growth is affected by the pH of the soil; an acid soil can be mixed with lime to raise the pH. The grapes here are already on an alkaline soil and as long as the pH is between 5 – 8.5, or 5.5 – 6.5 optimum, grapes should thrive in a well-drained, loamy soil.

At one quite steep slope we are asked to think about why there is a hedge line between the vines, running north to south approximately and why is there a steep slope from one field into the next. In the last twenty million years or so the beginnings of what we see today from the Alpine Orogeny commenced, hundreds of miles away. Earlier, Plate Tectonics had caused the African Plate to subduct and move north under the European Plate causing mayhem throughout the Tethys region, remnants of which we call the Mediterranean Sea today, with growth of the Alps and thrusting which affected the British Isles. In the Weald this movement caused the uplift that gave us the North and South Downs and the Low and High Weald – but that's another story. It also caused fractures, faults and joints in our region, where this may be just one of them


3a


3b

Tyland Walk Scenes 3


3c


3d


3e

3f

TYLAND WALK SCENES 3

	App. Reference	App. Reference
3a	TQ 777 586	Vineyard near Boxley Church.
3b	TQ 775 589	Boxley Church.
3c	TQ 775 589	Boxley Church wall, part flint, part ragstone and others.
3d	TQ 766 594	Undulations in fields, vineyards and along scarp base.
3e	TQ 767 593 (from)	Medway Valley and Greensand Ridge from vineyard.
3f	TQ 761 592	Boarley borehole near Rail Link.

Back to Tyland

We have made our way out to the top of Boarley Lane and are heading back to the Old Chatham Road via Tyland Lane. The lane heads downhill in a southerly direction; it also takes a quite wicked horseshoe bend and another bridge over the HS1 railway. In a field to our right, north of the line, an oldish brick building stands behind a heavily guarded gate – barbed-wire and padlocks – to prevent any intrusion, but states it's the Boarley Borehole site which is controlled by the South East Water Company. On the OS map 148 for this region there is a reservoir noted for this area, there is no sign of an open one therefore this one then is underground and enclosed.

Q.8: Could this borehole have any relationship to the ex-pumphouse over by Boxley Church?

Indeed it does. Due to the actual contact of the Lower Chalk with the Gault Clay on the BGS map being a sinuous and somewhat tenuous one it appears these two positions are close to the junction; water is probably being drawn from one of the Lower Greensand beds.

Continuing on around the 'horseshoe' we stop once more to view the rail link from the bridge over it, a train whistles by. This has obviously re-routed the old road here to accommodate the link. Looking Eastwards it was seen that the railway cutting has been constructed with shallow slopes indicating that the line runs through clay. Further on we reach a cross-road, Tyland Lane, where a short way along a small stream is pointed out which flows under the road from a point upslope away from us towards the scarp; obviously a spring line from the Gault-Lower Chalk junction a few hundred yards away; this is the one which runs to the sump this side of the motorway. We return to the cars.

It is hoped that those of you who attended this walk can follow the reasoning behind my comments and thoughts and the descriptions herein. Learning Geology is a wonderful experience, understanding it is something else. In writing the report I came up with the questions I found I was asking myself, so included them, with my answers, throughout. This report is how I understand and understood this walk. David Talbot

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The Three Chalk Arches of Kingsgate

Dr Richard Hubbard

Here Dr Hubbard reflects on the recent illustrated history of the chalk cliffs around Kingsgate. This is a companion to his excellent recent talk to us on 18th January. Please click on the link below and enjoy. For those of you who know the area please feel free to respond to his request for help with memories and anecdotes to assist him with his book.

http://kgg.org.uk/The_Three_Chalk_Arches_of_Kingsgate.pdf

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North Sea Red Chalks

A brief review of the Late Cretaceous "Oceanic Red Beds" of the North Sea offshore region' Proceedings of the Geologists' Association' (2020)

Dr Haydon Bailey

On 18th May 2021 we were treated to an evening Zoom meeting with Dr Haydon Bailey on the topic of 'Stratigraphy and Sedimentology of European Chalks'. In response to KGG member requests Dr Bailey has kindly provided us with a link to his accompanying paper. Please click on the link below and enjoy.

http://kgg.org.uk/Red_Chalk_Beds.pdf

**KGG is not responsible for the content of external websites. N.B. In this case the (external) article has been transferred to the KGG website members' area.*

A Giant Ostrich!

From the Lower Pleistocene Nihewan Formation of North China, with a Review of the Fossil Ostriches of China

Dr Eric Buffetaut and Delphine Angst

In July Dr Buffetaut gave us a fascinating evening Zoom meeting on Tertiary Dinosaurs in Southern France. The Late Cretaceous Vertebrates of the Saint-Chinian Area and their discovery. The talk alluded to Giant Ostriches so to further whet your appetite KGG members wishing to reprise their experience can learn more from this paper. Please follow the link below:

https://www.mdpi.com/1424-2818/13/2/47/htm

**KGG is not responsible for the content of external websites.*

The Geology of Herne Bay

Geoff Downer

This article is a follow-up to the Zoom talk I gave the Group in the summer of 2021 and based on two short extracts from the book: *The Geology of Reculver Country Park*. The park is situated to the east of Herne Bay sea front. The book is fully illustrated and describes the sediments found in the cliff section together with the land slips and engineering works to protect this section of coast. A walk along the seashore is included in the book with 13 stops of interest. The book was written with the layman in mind. A few copies are still available for only £4.50 including postage. Payment can be made by electronic transfer. Contact Geoff Downer for further details at carolegeoff@btinternet.com

A companion volume on the geology of the building stones in St Mary's Church and the Roman fort at Reculver called *The Stones of Reculver Country Park* is available at the same price.

The Storms of 1953

On the 31st January 1953 a combination of a low pressure weather system over the southern North Sea, strong north-westerly winds, torrential rain, a high river discharge and a high spring tide combined to create a storm surge with sea levels well over two metres above their usual height. The winter gale then further aggravated the situation by displacing water landwards causing severe flooding inland. The storm that night was reported to be the strongest to hit Herne Bay since 1897.

In the early hours of the following morning a storm surge with waves over 12 metres high excavated a large hole in the stone apron below St Mary's Church, Reculver (Figure 1). It was reported at the time that 'a number of human bones which are believed to be of considerable antiquity' were unearthed. They were later identified as the bones of a man and a woman probably once buried within the consecrated ground of the church.

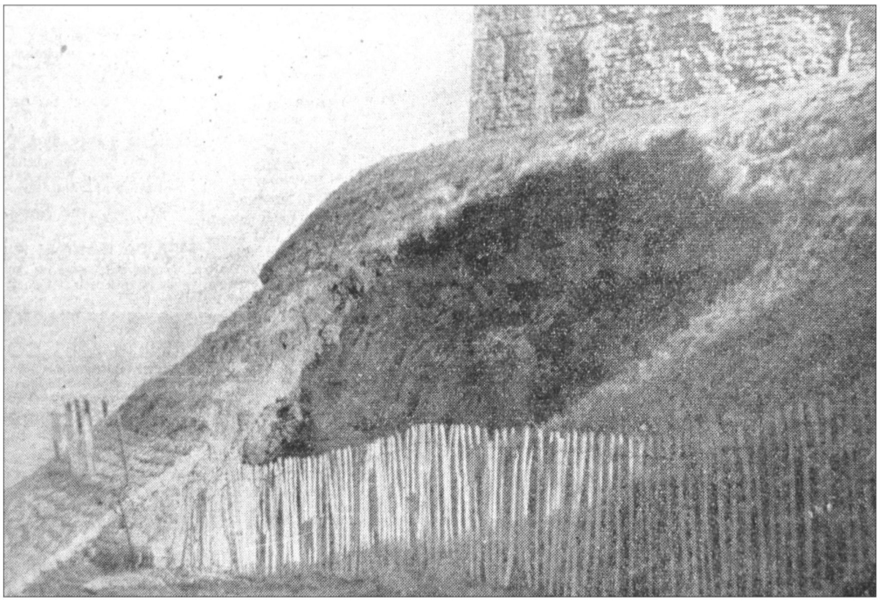

Figure 1 – Below St.Mary's Church, Reculver

To the east of Reculver there were several breaches in the Reculver - Birchington seawall, two of which were described as major. The land in the low-lying Wantsum Channel was flooded to a depth of 2.5 metres with much damage to agricultural land and loss of livestock. At each subsequent high tide, "thousands of gallons of water" were described as pouring through the seawall. As an emergency measure bags of shingle and sand were placed in the breaches with only partial success. Bulldozers were later used to erect a temporary barrier largely constructed from the debris of the former clay wall. These short term measures acted as a stopgap awaiting a much later major reconstruction of the seawall using concrete.

Meanwhile the railway service between Faversham and Birchington was severely disrupted by the flooding. Following the repair to the line to the south of Reculver, a secondary embankment parallel to the railway track on the seaward side was constructed from chalk, much of which came from a quarry at Monkton. The new embankment provided temporary protection to the line as well as to the farmland beyond, while awaiting long-term repairs to the northern seawall. Figure 2 shows a consignment of chalk being offloaded to construct the new embankment. In the background can be seen a purpose-built tower that provided illumination for night time working.

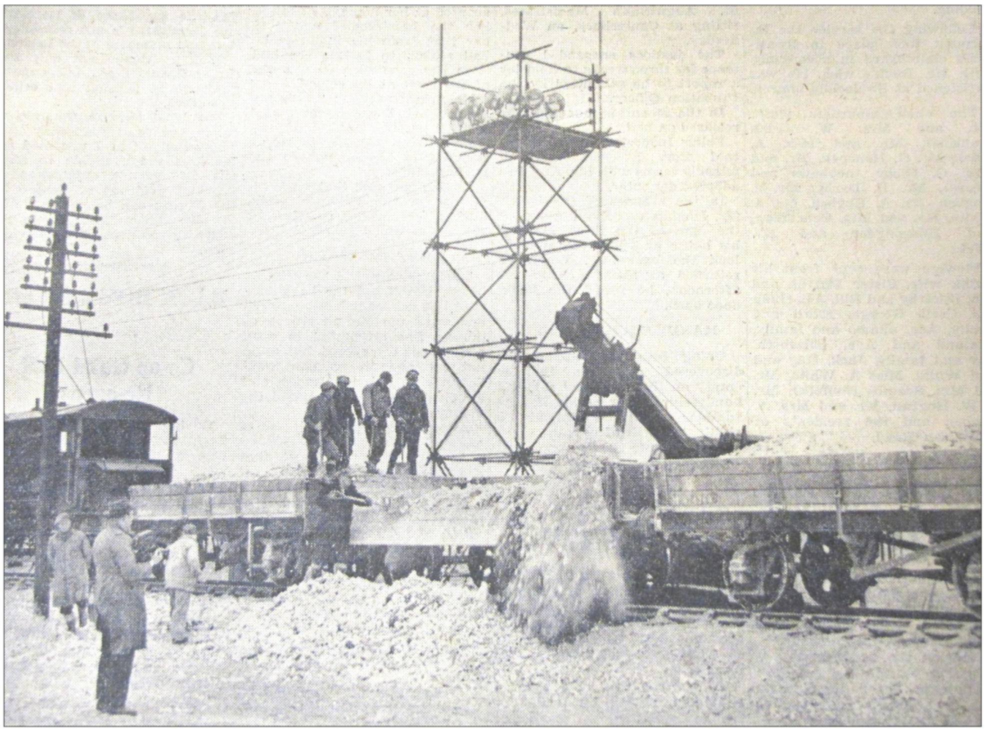

Figure 2 – Consignment of Chalk being offloaded

On the morning of 4th February 1953 some 14 metres of land belonging to the Miramar Hotel in Beltinge dropped and slid seawards on an inclined slip plane located within the London Clay Formation. This major landslip, extending to below beach level, probably arose because the base of the cliffs had been removed through beach scouring at high tide, thereby removing the weighted toe of a previous slide. In addition the cliffs were well lubricated through water saturation from both the high tide and the heavy rainfall. There had been large-scale slips recorded in the area during the previous 70 years. However, the *Herne Bay Press* described the event in 1953 as a 'monster fall' and an 'extraordinary geological phenomenon'. The entire slide caused the cliff-line to retreat up to 25 metres inland and extended in length for over 200 metres. The hotel's tea garden descended 12 metres 'just as though it had been lowered on a lift' and, remarkably, remained intact, almost without any surface cracks. Wing Commander Attwell, at the time, commented "I am only thankful the fall did not occur at a time of the year and during the day when there were people taking tea. If it had, it might have been a terrible disaster". A canyon of subsided material formed to the rear of the slide creating a steep back wall (the slip surface) marking the new cliff-line. The original cliff-face sediments (and the tea gardens) had been displaced several metres towards the foreshore, with only a slight back tilt. Over the next few days the lawned gardens were repeatedly overtopped by a series of mud slides arising from the still unstable cliff edge. Meanwhile the sea set to work removing the toe of the new slide leading to further instability and frequent localised mud flows. The Beltinge cliff-line was only stabilised in the late 1960s following surface grading and the addition of drainage facilities. Figure 3 shows a local gas engineer observed by onlookers searching for the mains pipe ruptured during the fall. The police endeavoured to keep the public away from the still-dangerous cliff face, but clearly with limited success.

Figure 3 – Gas Engineer looking for a broken main caused by this major landslip at the Miramar Hotel in Beltinge

And finally, one of the beds described in the book:

Harwich Formation (Oldhaven Beds)

Resting on the Upnor Formation are the rock units of the Thames Group, a sequence of sediments deposited in increasingly marine conditions and at increasing water depth during the early Eocene. The junction of the Lambeth Group (Upnor Formation) and the Thames Group is demarcated by an erosion surface that has removed several metres of intervening sands from the top of the Upnor Formation. Above this unconformity lies the Harwich Formation, the basal bed of which is a conglomerate comprising numerous rounded black pebbles of flint within a matrix of sand and silt. This pebble bed is a good marker horizon in the cliffs and, although neither continuous throughout East Kent nor consistent in depth, still stands out clearly in most of the visible cliff section where it is approximately 15 centimetres thick (Figure 4). The black colour of the pebbles is largely derived from the mineral manganese which provides a thin outer coat; the pebbles' interiors being much lighter in colour. Many pebbles are pitted with so-called 'chatter-marks', evidence of high energy percussive impacts caused by wave action within a beach environment. This pebble bed can be fossiliferous, although collecting from the cliff section is not recommended. The bed is much more accessible on the foreshore at low tide where fossils are frequently winnowed out of the sediment by the sea.

Figure 4 – Pebble Bed demarking the junction of the Lambeth Group (Upnor Formation) below the Thames Group

The glauconitic sands above the pebble horizon contain a fossil fauna which is indicative of brackish water conditions with frequent marine incursions. The sands are often laminated, but also show cross-stratification and have been interpreted as sediments deposited by currents in a near-shore environment. Occasional pebbles of flint within these sands also indicate a proximity to land. The beds contain a largely marine fossil fauna, with occasional freshwater specimens, interpreted as having been washed out to sea by rivers. The presence of fossilised wood and seeds are interpreted in the same way.

Localised lenses of calcareous cemented sandstones and siltstones can be seen within the less consolidated softer beds. These bear a superficial similarity to the doggers of the Thanet Sand Formation and may have formed in a similar way. On weathering these hardened blocks tend to prove less resistant than their Thanet Sand counterparts. They also lack the fine laminations of the Thanet doggers suggesting that any fine structure they once possessed was disrupted by intense bioturbation.

My thanks to the Kentish Gazette Group whose back copies of local newspapers provided the quotations and photographs for this article.

CLOSE

What a fantastic Newsletter. I hope you enjoyed it? If you've got anything we can include next time, please get in touch.
Hopefully, we will all meet again soon.
Until then, keep safe everyone.
All the best,

Anne

KENT GEOLOGISTS' GROUP PROGRAMME FOR 2022

CURRENT ZOOM MEETINGS These are held on the third Tuesday of the month. 6.50 for 7pm start.
Contact Indoor Programme Secretary: Ann Barrett.
Tel. 07746 783398 e-mail annbarrettgeo@gmail.com

INDOOR MEETINGS As Above. Zoom until further notice.

18th January	**Dr Richard Hubbard** The Chalk of Thanet, erosion and accretion. With reference to Thanet Anticline's Shifting Shorelines – 250 years of change
15th February	**Tony Mitchell** Land of the Long White Cloud
15th March	**Annual General Meeting** **Brian Lines** Minerals and the Microscope
19th April	**Nick Baker** The Muck Above the Chalk
17th May	**Lawrie Cowliff** Connecting East Kent to a wider Regional and Global Geological Story
21st June	**Dr Anne Padfield** Metamorphism
19th July	**Dr Geoff Turner** 'Forensic Geology - Murder, Mayhem, Microscopes and Minerals'
16th August	**Anthony Brook and Roger Cordiner** A Building Stone Transect of the Weald
20th September	**Heidi Tindall** Bárðarbunga Eruption 2014
18th October	**Dr Chris Duffin** The Mineraology of Art
15th November	**Anne Beecham** Wolf by the Hearth, Aurochs at the Gate
13th December NB not 20th	**Christmas Evening** **Dr Anne Padfield** The Geology of Christmas