

---

**Home Counties North Regional Group**  
**Lockdown and geology, HCNRG Special Newsletter**  
**Issue 8 – June 2020**

**Welcome from Newsletter Editor – Zuzana Lednarova**

WELCOME to the eighth edition of the Newsletter of the Home Counties North Regional Group. This newsletter was prepared as a special edition to keep you updated about our work. We have also decided to publish this newsletter to get you involved too, and so we have added a few reports from some of the members of the HCNRG. We hope you enjoy reading these articles as much as we did when we were compiling the newsletter! The articles in the newsletter are about the work-life balance during the pandemic, and some are purely about geology. As you might be aware, the petroleum industry has been hit during the pandemic due to less fuel being used as more of us working from home, and due to restrictions on travel. However, many scientists have also pointed out that the air is cleaner due to a drop in carbon emissions, due to less travel and hence less pollution. Therefore, we have also included an article previously published by the Energy Institute in 2018, which discusses the petroleum industry and climate change - both topics being widely researched within the geological sector, and also taught to our current geology students at college and university level.

<b>CONTENTS</b>	<b>PAGE</b>
<b><u>Welcome from Newsletter Editor – Zuzana Lednarova</u></b>	<b>1</b>
<b><u>Opening Words – John Wong, Chair HCNRG</u></b>	<b>3</b>
<b><u>Lockdown and Geology – Reports from HCNRG Members</u></b>	<b>4 - 21</b>
<b>1. Retired palaeontologist in Lockdown! - Dr Haydon Bailey</b>	<b>4</b>
<b>2. Engineering a Home Solution – Jacqueline Clayton</b>	<b>5</b>
<b>3. Don't baulk at the chalk, and don't let things "pasque" you bye. Geology of Therfield Heath at Royston. - Jessica Crane</b>	<b>6</b>
<b>4. Lockdown in the Chilterns - Adam Dawson</b>	<b>7</b>
<b>5. Stuck onshore but learning about the last British-Irish Ice Sheet – Zuzana Lednarova</b>	<b>10</b>
<b>6. End of the carbon war? - Dr Bryan Lovell OBE</b>	<b>11</b>
<b>7. Geological Gems of Hertfordshire and Buckinghamshire - Mick McCullough</b>	<b>14</b>
<b>8. Lockdown Geology in my back garden - Doris Southam</b>	<b>17</b>
<b>9. Book Review: The Fens by Francis Pryor - Richard Trounson</b>	<b>19</b>
<b>10. Lockdown and geology observation - John Wong</b>	<b>21</b>

---

## **Note from the Chair – John Wong**

Dear members,

Time really flies and this is the twelfth week of lockdown. I hope you are all well and safe whether you are working from home, in your office, outdoors at construction sites, or self-isolating.

No doubt many of you miss the HCNRG lectures, field meetings and workshops at this unprecedented time; I think that producing additional newsletters could help to maintain the connection of our regional group with you when there are no events at present and likely to be none in the near future, possibly for some time. It was in May, after the roll-out of the HCNRG newsletter issue 7, that I thought a special issue newsletter would be a useful exercise to maintain communication and that this should be a Members' newsletter where any member can contribute and share their experience with fellow geoscientists during the lockdown.

I was aware that this Members' Newsletter is a new concept and that members may be hesitant to contribute, so, in order to make a start, I contacted a number of members I have known for many years to ask them to assist. Dr Bryan Lovell OBE was the President of the Geological Society 2010 – 2012 and a former Chair of the HCNRG in the 90s and Dr Haydon Bailey is a past President of the Geologist's Association. Both of them kindly sent in their contributions in the first week after I sent out a general message to the group asking members to contribute articles/reports for a special issue of the HCNRG newsletter. In the days that followed, I received articles/reports from HCNRG members of different professional/amateur geoscience backgrounds – environmental law, geophysics, geotechnical investigation, hydrology, micropalaeontology, and petroleum geology.

My profound thanks go to all the authors and I hope that HCNRG members will enjoy reading this newsletter at your leisure. For the authors here is an added bonus in that you can add the CPD points for the time you have spent in writing your report/article and add your newsletter article publications to your curriculum vitae.

I plan to roll out future special Member's Newsletters bimonthly, so that we can maintain obligations of the Committee and its Chair to serve the HCNRG members at this surreal period. We would welcome future reports and articles from all of HCNRG members and look forward to maintaining HCNRG as a thriving and active community. The closing date for receiving your reports for the next newsletter issue 9 is Friday 7<sup>th</sup> August 2020.

Take care and stay safe everyone; wishing you all good health and in high spirit, and enjoy the realm of geoscience.

***John Wong***  
Chair HCNRG

## **Lockdown and Geology – Reports from HCNRG Members**

### **Retired palaeontologist in Lockdown!**

When you're retired there's no going into the office and no meetings with clients and certainly no travelling to offshore rigs, so it's almost like being in lockdown. Then you remember – we are in lockdown, so it's even quieter. So, what do I normally fill my time with? I have a whole range of geological interests, but even these are being curtailed.

My trips to the Natural History Museum are halted as the Museum is closed, so my cataloguing of the Dave Carter sample collection from the Channel Tunnel Project is on hold. This is one of those hidden gems, lost in the bowels of the museum, which goes back to the 1960's investigation of a cross Channel tunnel route halted by the Wilson government. Dave Carter got wind of a plan to dump all the cores back under the English Channel, so he collected as much material as he could before it was "lost at sea". His research on these rescued samples provided the basis for the micropalaeontological zonation used during the tunnelling of the Channel Tunnel we are now all so used to. They represent a minor fragment of our national heritage which is worth hanging on to.

More recently I have been writing up the geoconservation work Hertfordshire Geological Society (HGS) has been doing, in conjunction with the Countryside Management Team of Hertfordshire County Council, on the chalk pit at Hill End, Hitch Wood, just south of Hitchin. With financial assistance from the Geologists' Association Curry Fund, a small excavator was on site early in 2019 cleaning all the Hitch Wood Hard Ground section. Members of HGS followed up later in the summer with a vegetation clearance day. Finally, just before lockdown, the new Orientation and Information Boards (also funded by the Curry Fund) were set in place and the site is now back open to visitors and fossil collectors alike. All the chalk rubble was piled to the side of the section so that anyone can collect fossils there. It's great for kids, as well as older collectors. If you want a copy of the handout – *Hill End Fossils* drop a note to [hgs\\_localsites@btinternet.com](mailto:hgs_localsites@btinternet.com) and we'll send you one.

Throughout the whole of lockdown, infrastructure projects like HS2 have continued to grind on without raising too much public concern, despite the removal of ancient hedgerows and unexpected road closures. For the last ten years I've been a member of the *Chiltern Society* HS2 working group which by now has reached a monitoring stage, since we've long since passed the parliamentary select committee stage. This work goes on, raising issues with local MP's and basically anyone else willing to listen, even if it's only Chris Packham! Any geologists out there working on HS2 – rest assured; you're being watched!

Finally, as a complete change to normality I've become involved in home learning for my grandson. He's in Year 3 at school (age 8) so it's their turn to "do rocks and soil"! I was due to go into their class for a session on local geology as part of the GA *SchoolRocks!* initiative\*, but this has obviously been curtailed by school closure. So, the alternative was one to one online teaching via FaceTime. Week 1 was Soils; literally "gardening" for me, but it proved successful for both pupil and mentor as we both learned about the five different layers from basal bedrock up the humus on top. He went away with a plan to build his own soil profile, once I'd supplied a sufficient, socially distanced, delivery of bedrock for the first layer. The following Week 2 required a teaching session on distinguishing the 3 different types of rocks. For those of you out there who don't immediately recall these, they are sedimentary, igneous and metamorphic. I was back on to safe ground here, especially as I had access to an excellent diagram of the Rock Cycle\*\*, provided recently by a colleague for something totally different.

So, geology has continued throughout lockdown, even for an aging, retired palaeontologist. There is always online learning, but who needs that when you can still visit a few secluded chalk pits and get your hands dirty!

### ***Haydon Bailey***

\*If you want to learn more about *SchoolRocks!* visit the Geologists' Association website - <https://geologistsassociation.org.uk/>

\*\* If you'd like a copy of the Rock Cycle for your children/grandchildren/team at work/office wall drop a note to [schoolrocks@geologistsassociation.org.uk](mailto:schoolrocks@geologistsassociation.org.uk)

## **Engineering a Home Solution**

I've been working at Fairhurst for nearly three years, based in their Watford office. As part of the geotechnical team, my work has allowed for variety of different experiences both in the office and based on site. My typical week was normally working in the office, with occasional site visits to carry out site walkovers or attend a ground investigation that was designed by our team. In light of the current situation, our non-essential site visits have been put on hold as we continue to work from home. Currently I've been working on the proposed Sky Studios in Elstree which has involved design and management of the ground investigation, preparing the ground investigation report, and carrying out foundation design.

When we first received the news that all our offices would be shutting down, many of us had concerns on how this would impact our productivity as, like many other industries, the engineering sector requires continuous collaboration. There were some challenges in the beginning and adjustments that needed to be made but eventually it did become (dare I say it) ...the new normal. Short phone calls for quick queries no longer seemed inconvenient, Teams video meetings no longer felt awkward, and the option for screen sharing became heavily utilised.

While I do miss the face-to-face interactions and coffee breaks in the kitchen (not to mention the birthday treats that tended to appear in there), I've found working from home to be a refreshing and overall enjoyable experience. It's introduced a new sense of flexibility: mornings are no longer a frantic rush with my half-drunk coffee left on the counter, lunches can be put to productive use including any household chores I was too tired to do in the morning, and evenings are when I typically get my exercise – a nice long run or walk through town. I also found my productivity and focus improving over time as I got used to my new work environment.

The situation has been enlightening and has definitely put a new meaning to 'work-life balance'. It's an approach I hope my company will continue to promote in the future.

### ***Jacqueline Clayton***

## **Don't baulk at the chalk, and don't let things "pasque" you bye!**

I didn't know much about Therfield Heath until I moved to the area several years ago, before then it was simply a view from the train. Since then, it's been on my daily commute to work, and an integral part of triathlon training with the steep slopes and varied routes. I can vouch for it being known as the toughest cross-country running course in England, and a great place to exercise and wander on a walk.

Therfield Heath SSSI is designated as an example of East Anglian Chalk grassland, with the adjacent wider Royston Heath also part of a Local Nature Reserve. The site is today utilised largely as a local amenity, frequented by runners, dog walkers, cyclists, horse riders and those at Royston Golf Club. The area supports a large variety of species, with many butterflies and insects easily spotted out and about, with the Chalk providing the nutrient rich soil to which the flora and fauna have become specifically adapted. One of the rare species found here is the Pasque flower, (*Pulsatilla vulgaris*) which is also known as the "wind flower", typically blooming in April, and also seen in the area, the chalk hill blue butterfly (*Lysandra coridon*), a striking blue easily picked out against that of the grassland itself.

Therfield Heath embodies a prominent chalk ridge, noticeable by the dazzlingly white New Pit or Holywell Nodular Chalk Formations that poke through the thin soil and grass cover, with paths seen as bright white scars running across the scarp. The ridge sits proud of the local area in general, reaching over 160 maOD at its highest point, with some slopes climbing almost 100 metres within a short distance. Many hills have a 1 in 10 gradient, although some are much steeper, so being able to scramble up them is a must for any die hard cross-country runner. The steep ridge provides a beautiful view well into Hertfordshire, Cambridgeshire and Bedfordshire, even on a cloudy day, and can easily disappear and reappear mysteriously if foggy.

The steep dry valleys incised into the resistant chalk at Therfield Heath are the remnants of the end of the Anglian Ice Age, (the most recent of these events - created by the retreat of the ice sheets) carving the valleys via the large volumes of meltwater produced. These provide perfect paths and golf fairways, and are referred to as "coombes", featuring heavily in local place and building names. The nature of the quickly free-draining chalk allowed for the challenging golf course to be played during the flooding of many areas of the UK back in February 2020, with the groundwater table deep beneath.

A little further afield to the north of the SSSI, at over 160 maOD, can be found an Environment Agency former index groundwater well at Therfield Rectory, the well casing stick-up on the roadside noticed on many a bike ride, which prompted me to learn more (I'm a hydrogeologist). The borehole here is significant as water level records date back to 1883, and is one of only a handful of UK sites with continuous monitoring prior to 1900. This long record provides trend for groundwater within the Chalk in this area, pinpointing the highs and lows over the years, and warning of these events before we reach them. As the Chalk is heavily used in this area as a major public water supply, maintaining the quality and quantity of the supply is paramount, and awareness of this for our everyday lives and actions which might affect this aquifer, vital.

By utilising Therfield Heath and noticing the variety of fauna and flora whilst doing so, I've come to appreciate this area of seemingly mundane white rock, and felt the need to delve further into its history. The Chalk manages to engage on many different levels, to geologists and the Public alike, with the wide range of amenities available and broad appeal. Utilising this area for exercise has allowed me to explore it in more detail, and appreciate it from another perspective. Whilst exercising, I'll make sure to really notice all that happens on Therfield Heath, and keep learning and discovering on my doorstep.

***Jessica Crane***

## Lockdown in the Chilterns

Although in many respects, life has been on hold during lockdown, it's not been totally impossible to keep up an interest in geology.

I've been trying to use the time, both indoors and out, as productively as possible. In some ways, not being able to pursue my normal activities has actually freed up more time to follow up some of these interests. We've been particularly lucky that the weather so far has been mostly good, and lockdown rules have permitted daily exercise periods in the outdoors – even if, at times, only briefly.



*Figure 1: Puddingstone boulder overlooking Lowndes Park, Chesham*

In a recent exercise walk in the Chilterns, I came across an interesting example of a puddingstone boulder – this one in the park overlooking Chesham (see photo). This fascinating material appears in several locations throughout the Chilterns – there are similar examples in Princes Risborough town centre, in the village green at The Lee, and along the roadside on Cholesbury common. The boulders generally seem to have been placed by human activity – sometimes in the recent past, as in the case of Cholesbury, or sometimes in the more distant past as way markers. The boulders are probably Hertfordshire puddingstone and transported from their original site either manually or as a component of glacial tills. They are of especial interest today because the siliceous sarsen matrix in which the older flint pebbles are embedded is thought to have been deposited during a previous period of significant global warming – possibly the Palaeocene-Eocene Thermal Maximum (PETM) 55 million years ago. The PETM is seen by some to have many parallels with today's period of rapid climate change, and as such may offer us some clues to what might happen in the future.

Moving forward to the 21<sup>st</sup> century, the much-delayed HS2 rail project finally received “Notice to Proceed” on 15 April, right in the middle of lockdown. Since then, on my various exercise walks from home in Amersham, I've noticed a marked increase in contractor activity all along the nearby Misbourne valley. It's a major construction challenge, and although it's been dogged by controversy right from the start, the prospect of long-term work will no doubt provide welcome job security for engineering geologists right across the country. The environmental impact will of course be closely watched, though the works I've seen in my local area, particularly near Chalfont Common, Chalfont

St Giles and Amersham, so far generally seem to have been well managed and sensitively laid out.



Figure 2: HS2 works near Denham

Slotting in somewhere between the ancient PETM event and the modern HS2 project is the whole of human evolution. I'm fascinated by the history of ancient man's relationship with paleoenvironment, an interest which started when I visited the remarkable 28,000-year-old paintings in the Grottes d'Arcy in France. I wanted to learn more about the history of human beings in Britain, and especially what happened to the population during the ice ages, and as the Channel land-bridges came and went. Pre-lockdown, I was fortunate enough to be able to spend some time volunteering at the Natural History Museum in London and a colleague there introduced me to the eminent palaeontologist Prof Chris Stringer.

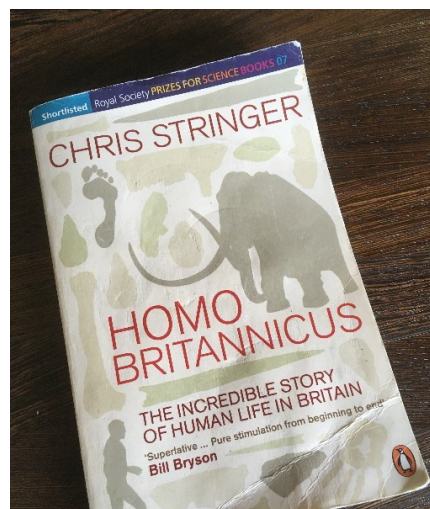


Figure 3: My well-thumbed copy of Chris Stringer's landmark book charting the hominid colonization of Britain over the last 700,000 years

I've taken the opportunity of lockdown to read his excellent book, "*Homo Britannicus*", which describes the interplay between climate, geology, geography and human evolution in Britain – exactly the area I am interested in. It's a fascinating read, highly recommended if you want to learn more about where we came from – and maybe even where we might end up going to.





*Figure 4: Recently published Government approach for the evaluation of sites for a potential Geological Disposal Facility for higher activity radioactive waste*

And finally, I like to keep up with the latest developments in UK energy policy. In my last job prior to retirement in 2016, I worked on the Government's programme to identify a potential site for the geological disposal of the UK's higher activity radioactive wastes. An essential but controversial and long-term project where both geological and societal considerations have to be carefully balanced. I was pleased to see that shortly before lockdown began, the Government had set out the approach that will be used for evaluating potential sites for a geological disposal facility, once candidate sites are identified. Geological considerations – from a safety and engineering feasibility perspective, will have a strong role to play. It's good to know that dedicated public servants are continuing to work not only to make sure that our energy supplies remain secure today, but also to ensure that the legacy from our past is dealt with safely, effectively and responsibly.

So – even though we've been in stasis for a few weeks, the world hasn't stopped turning. From my own point of view, I've found lockdown has given me the opportunity to learn more about areas of geology which I'd never had time to research properly before. I've also found, through my efforts to stay fit and healthy by taking local countryside walks, that I've come to see and appreciate see the natural world around me in greater detail than ever before. So, somewhat to my surprise, I consider myself exceptionally fortunate that I've been able to use this period of enforced inactivity in a positive way, and may even have become a slightly better person as a result.

*Adam Dawson*

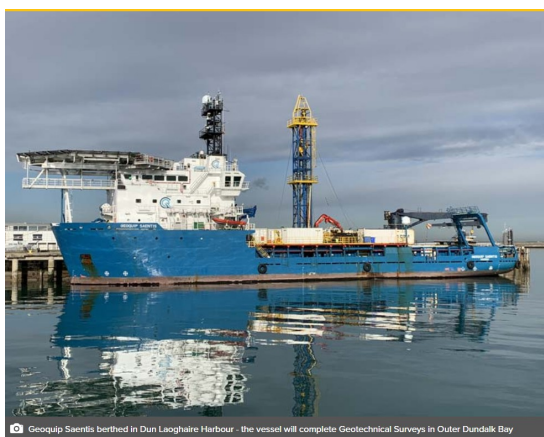
## **Stuck onshore but learning about the last British-Irish Ice Sheet**

Believe it or not, but I started a new job at a new company during the peak of the lockdown! I did receive the offer of employment from Geoquip Marine Group prior to the strict lockdown measures (which came into action on 23<sup>rd</sup> March), so was a little unsure of my future career plans. However, it all worked out well!

Once my new office reopens, I will be relocating to Bristol. In the meantime, I have been working from home and living with my family and my dog in Essex. As a new starter at a new company, I found myself facing a few uncertainties and challenges (naturally), however my new colleagues and my manager have been very supportive throughout! In addition, to keep a positive mindset whilst working from home I mix my working life with plenty of fitness and exercise (and plenty of coffee).

My normal day would include a short 30 minute walk with my dog in the mornings to get some movement, and to wake up my brain for the day's work. After all, I will be sat in the same chair until the evening. This is then followed by working until my lunch hour. My lunch break consists of 40 minutes of exercise (I used to walk into Watford town centre during my lunch breaks in Watford, which was also approximately a 20 minute walk – one way). This was much more enjoyable when the sun was shining! After work, with the addition of a 5-10km run three times a week, my dog (Biscuit) knows its his time for a walk and comes to remind me its time to finish work... and so, off we go for a minimum of a 5km walk in the fields and woods. We often walk towards Fairlop Quarry and look at the aggregates. Where I am based in Essex, here we have the superficial deposit, Boyn Hill Gravel Member overlying London Clay. I see a lot of fine to coarse, and cobbles of flint laying around in the fields too! Exciting, right?

What is more exciting, is the first project I was a part of at Geoquip Marine. With the global offshore wind capacity forecasted to grow greatly in the next couple of years, there is no better time to join an offshore geotechnical company. I was lucky enough to be given the site investigation data from the Oriel Parkwind site, which was completed only recently. This has given me a great opportunity to study the geology of Ireland, focusing on the offshore site located approximately 20km from Dundalk Bay. The area of study is located in an area with limited geological research, but I was able to find some interesting facts. The sediments encountered at the site are associated with the British and Irish Ice Sheet (BIIS), which occurred



*Figure 5: Picture taken from an online news article detailing the proposed intrusive investigation (published before the works, showing the ship Geoquip Saentis berthed in Dun Laoghaire Harbour. (<https://afloat.ie/>)*

during the last glaciation period in the Devensian. This resulted in glaciomarine sediments and glacial till overlying bedrock of the Silurian Period. As we were in an area extensively affected by structural deformation (faulting, and folding), it was no surprise that we might have also encountered a breccia. As a geotechnical engineer who has worked on residential and commercial developments onshore to date, I found this project highly exciting when comparing the data from the geotechnical laboratories across all of the geological units, comparing onshore and offshore laboratory tests, and learning about the geology of Ireland! We currently have a few ongoing projects around the coast of the United States, so I do look forward to going on site and overseeing the site works in the near future.

## **End of the Carbon War?**

I've been working on a couple of things during lockdown. One is a research project with Andy Gale of Portsmouth University on the 200-year-old mystery of the control of the high-frequency marine transgressions and regressions in the Paleogene of the Paris Basin, the evidence for which was first recorded by Lavoisier in in 1789. We have been testing the hypothesis that these transient uplifts were controlled by pulses in the convective circulation of the mantle.

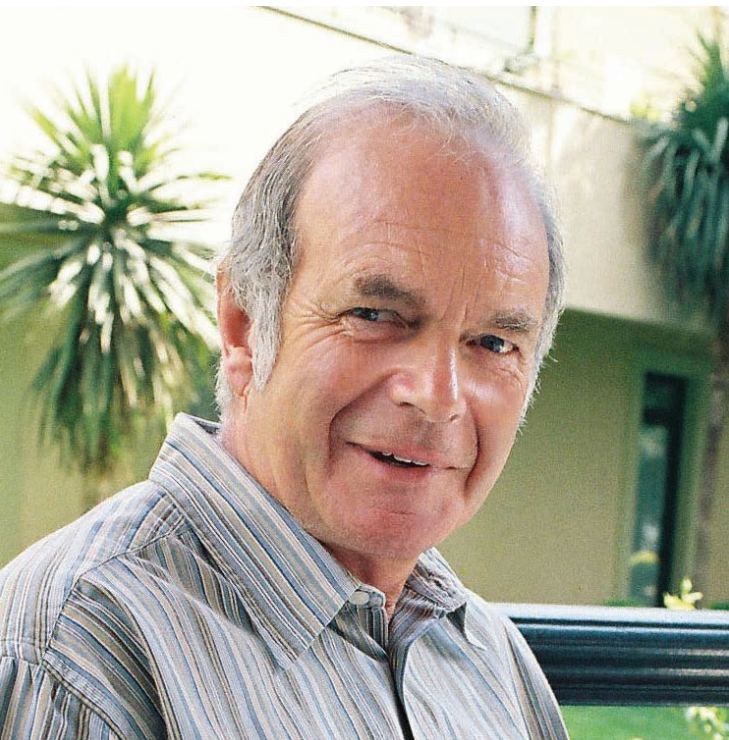
The second project is on climate change, on which I've been advising BHP in Melbourne over the last seven years. I've just looked again at the attached article published in Petroleum Review a couple of years ago, to see if the views I expressed there still apply in a post-Covid world. I am confident that my conclusions will still apply, possibly with even more force.

This article was published in the April 2018 issue of Petroleum Review, published by the Energy Institute.

***Dr Bryan Lovell OBE***

## CLIMATE CHANGE

# End of the carbon war?



**Dr Bryan Lovell OBE CGeol MEI, Senior Research Fellow in Earth Sciences, University of Cambridge\*, suggests victory is in sight in the so-called 'carbon war' in the climate change debate.**

New York City is taking BP, Chevron, ConocoPhillips, ExxonMobil and Shell to court over climate change (see [bit.ly/2p1Yscn](http://bit.ly/2p1Yscn)). This unleashing of lawyers in pursuit of billions of dollars appears to raise the prospect of a meaty battle. But is this merely a late skirmish in a long global conflict that is coming to an end?

Victory is in sight for the environmental forces, according to Jeremy Leggett, Founder/Director of Solarcentury, 'scourge of the oil companies' and 'first general of the Anti-carbon Army'. The end of the conflict that Leggett himself named in his book entitled *The carbon war* (Penguin, 1999), involves financial rather than legal forces. On 3 January 2017, Leggett wrote: '... it is rare for a report to hold the potential to change the world. But one published on 14 December 2017 did.'

## World-changing report

The new report hailed by Leggett was prepared by a Task Force on Climate-related Financial Disclosures (TCFD), chaired by Michael Bloomberg, former New York City Mayor and CEO of Bloomberg. The task force was set up in December 2015 by the G20's Financial Stability Board, chaired by Mark Carney, Governor of the Bank of England.

According to Leggett, the TCFD will give investors: '... visibility of how climate-change risk will affect individual businesses, and a roadmap for reacting to it.'

Investors appear to be using that visibility. An announcement by Bloomberg and Carney in Paris, on 12 December 2017, claims initial success for the TCFD: '237 companies with a combined market capitalisation of over \$6.3tn have publicly committed to support the TCFD. This includes over 150 financial firms, responsible for assets of over \$81.7tn.' TCFD is now leading the commercial world along the path to a low-carbon economy. If a particular company does not think this is a wise course to follow, they can bet against it – hoping their investors will share their views.

So far, so peaceful. But Leggett's claim of victory in the carbon war suggests that animosity to fossil fuels will persist given that the '...intention is for the capital markets to behave consistently with the aims of the Paris Agreement on climate change; which is to say progressively retreat from fossil fuels and increasingly favour clean-energy investments, not least renewables.'

## Too soon for obituary

Do we really have to retreat from coal, gas and oil? Many readers of *Petroleum Review* will hope not. There is indeed hope, because we know very well that the fundamental problem is not the fuels themselves, but the way we use them.

The customers of the oil companies are responsible for over 80% of emissions of carbon dioxide (CO<sub>2</sub>) resulting from use of their products. The customers could control those emissions, but only by using the skills of those same companies. Using advanced

petroleum technology, we know it is technically feasible to bury CO<sub>2</sub> safely in subsurface reservoirs, once we've made use of the carbon. Obituaries for the fossil-fuel industry are premature.

Here, I should declare my hand. I'm a geologist with a long-standing involvement with the resource industry – formerly with BP Exploration, most recently as adviser to BHP. I might perhaps be expected to be in the ranks of those who have resisted the Anti-carbon Army. I'm not in those ranks, because I trust messages from the rocks.

## Rock solid argument

Leggett named the 'carbon war' in 1999. That same year saw the publication of the first in a crucial series of studies of past changes in climate, chronicled in the geological record. This body of observational science independently supported the concern of climate scientists about human-induced climate change.

The ability to analyse past changes in climate on a near-human timescale was demonstrated in 1999 in a paper in *Nature* by Richard Norris and Ursula Rohl, in which they describe a core of 55mn-year-old rocks recovered from beneath the sea bed of the North Atlantic Ocean. These rocks contain evidence of a rapid and large input of carbon to the Earth's atmosphere, comparable in size and rapidity to that for which we are now responsible. The same rocks also contain evidence of rapid change in climate caused by that injection of carbon, creating inimical conditions for various forms of life. In a commentary published in the same issue of *Nature*, Gerald Dickens states that: '...we can now begin to view aspects of Earth's future in an entirely new light'.

For some of us, real conviction that we should be concerned about climate change came in 1999, with that new geological evidence. By then, I had retired from full-time work with BP, to pick up my research interests. Bearing the 21 October copy of *Nature*, I went to ask my Cambridge colleague Nick McCave, Professor of Geology: 'Is this as important as Dickens says?' The answer: 'Yes', it was.

McCave was one of the distinguished authors of a statement on climate change published by the Geological Society of London in 2010. Those seeking guidance on the significance of past changes in Earth's climate recorded in rocks and ice should start with this document.

In the 21st century it is no longer defensible for petroleum geologists to use, as an excuse for inaction, their reservations about the predictive models of the climate scientists. Month-by-month since 1999, the geological evidence supporting the climate scientists has grown more and more convincing. Geologists in the oil industry know from hard experience it is unwise to argue with a rock.

### Patchy oil industry response

BP and Shell expressed public concern on climate change in 1997 – a big help to Leggett and his nascent Anti-carbon Army at the Kyoto climate summit later that same year. Other majors took a different attitude concerning Kyoto, leading to a North Atlantic divide in the oil industry. The first evidence that this divide was closing came only years later, during a BP–ExxonMobil debate on climate change at the Geological Society in London in 2003.

The closing of the divide came through the power of observational science. As the geological evidence for concern on climate change built up, some oil folk previously unconvinced by the predictions of the climate scientists began to reassess their position. Some of those working in the resource industry kept up with the scientific literature on climate change and accepted its message. Others did not.

As a result, acceptance of responsibility by the fossil-fuel industry was patchy. Some companies took the lead. In other quarters, reluctance to act went as far as denial of responsibility. That

denial of responsibility is now happily becoming a thing of the past.

### Industry picks up reins

OGCI Climate Investments is an example of constructive new attitudes. A consortium of 10 major oil companies (BP, CNPC, Eni, Pemex, Reliance, Repsol, Saudi Aramco, Shell, Statoil and Total), based in 10 different countries, promised to make \$1bn of low-carbon investment over the next 10 years. The resource industry at large has begun to take appropriate responsibility for its own emissions, and for helping its customers to do the same.

In September 2015, BHP anticipated the work of Bloomberg's TCFD and led the way in publishing an analysis of its portfolio against the background of a global move towards a low-carbon economy. Other resource companies are now beginning to develop portfolios that are resilient in the face of the targets set at the December 2015 Paris climate summit.

Those targets are too demanding to allow in-fighting. Over the last 20 years, the oil industry has frequently defended its activities by reminding us that gas is a lower-carbon fuel than coal. Significant reductions in emissions have indeed been achieved in recent years in individual nations, by substituting gas for coal. But the Paris targets will not be met unless the CO<sub>2</sub> generated in the use of gas is also captured and stored. One part of the fossil fuel industry cannot save itself simply by picking on another.

Nor will the Paris targets be met at all easily without using a wide range of technologies and resources. We might in the end find that carbon capture and storage (CCS) cannot be developed safely on an appropriate scale and at a manageable cost. If so, the game is indeed up for the fossil fuel industry and hitting the Paris targets will become much more difficult.

We do know already that whatever path is followed eventually, we will need to extract from Earth the many resources we need for nuclear, solar and wind power. Geologists are preparing to cope. In June 2018, the International Union of Geological Sciences will tackle these issues at a conference in Vancouver, Canada; a preparatory meeting took place at the Geological Society in London in November 2017.

The Anti-carbon Army fought for the right basic cause – we really do need a rapid reduction in emissions of CO<sub>2</sub> from human activities. But, the wartime tactic of general assault on the resource industry has had its day.

### Responsibility and investment

The largely independent approaches of climate scientists and Earth scientists have combined this century to confirm the seriousness of human-induced climate change. Building on the strength of that rational cause for concern, Bloomberg's TCFD helps the Anti-carbon Army's long campaign. The crucial nature of that support from the TCFD has been publicly recognised by Leggett himself.

The oil companies are beginning to take appropriate responsibility on their own initiative, without necessarily waiting for encouragement from legislators and regulators. Against that background, the 'New York City versus the oil companies' legal action in 2018 begins to take on the appearance of a battle deep in the jungle, where word has not yet got through that hostilities are at an end.

I suggest that the carbon war is over. In the ensuing peace, we will rely on the skills of industry to find the resources we need – and to help its customers use those resources wisely. Through our choice of investment, we will support the companies that offer us this help. Those not willing to do so can take their chances. ●

\*Dr Bryan Lovell is Senior Research Fellow in Earth Sciences at the University of Cambridge. He was President of the Geological Society from 2010–2012. His book 'Challenged by carbon: The oil industry and climate change' was published by Cambridge University Press in 2010.



## In this month's Energy World:

- Gas – shale, pipe replacement and upstream emissions
- New technology that taps buildings for power generation
- Electric vehicles – smart charging key to unlocking benefits
- Second coming for UK solar on the way?

Energy World is the monthly sister publication to Petroleum Review, covering renewables, power generation and energy efficiency. As an EI member, you can subscribe to Energy World for £55, saving up to £305.

For more information visit [www.energyinst.org](http://www.energyinst.org)



## **Geological Gems of Hertfordshire and Buckinghamshire**

Jane Tubb in her lecture to the Home Counties North Regional Group on 29<sup>th</sup> October 2019 at the University of Hertfordshire described the Hertfordshire Puddingstone as a conglomerate of rounded, sometimes stained flint pebbles in a fine, pale, sandy matrix cemented by silica. Evidence suggests it was formed at various time through the Palaeogene. It looks like concrete but can be distinguished by the way a broken piece is seen to cut both matrix and flint pebbles, whereas concrete breaks the matrix and the pebbles are left proud of the matrix surface.

The exact origin of 'Puddingstone' rock is still problematic. It is often associated with the Plio-Pleistocene plateau drift and silcrete 'Sarsenstones' but nowhere among 'Sarsenstones' is the colour variation that you can see in 'puddingstone' evident.

Round the world Hertfordshire Pudding stone is renowned for its beauty. 'Puddingstone' is loved by lapidarists as being a fine example of a conglomerate with a wide variety of beautiful colours and the ability to retain a high polish. Though many of the flint pebbles are black-coated, some forms of the rock contain yellow, white, red, grey or green pebbles in a light grey-yellow siliceous matrix. 'Puddingstone' has been used to make Neolithic tools, hand operated Roman milling wheels used as a building stone, route and boundary markers, wheel guards, memorials and blocks used to assist horse mounting. It has also been used for brooches, pendants and handles on high quality cutlery. A piece of colourful 'puddingstone' cut and highly polished is a treasure to behold.

In rural communities 'puddingstone' has often been imbued with magical properties. Blocks of the stone can often be seen incorporated into church walls. This has been accredited to Pope Gregory I, who in 601 AD in an attempt to stop the worship of pagan icons decreed that such icons were to be included in church buildings. Thus when the buildings were consecrated the rural peasants could see that the stone was no longer pagan and magical but now Christian.

Although Hertfordshire is the renowned location for 'Puddingstone' rock, examples can also be seen in Buckinghamshire. There is thought to be a slight difference between Hertfordshire and Buckinghamshire Puddingstone in that the latter pebbles tend to be slightly coarser and in the examples seen, grain sizes within individual blocks seem more varied. On a recent HCNRG field trip to West Wycombe on 15<sup>th</sup> July 2016 instances of Buckinghamshire Puddingstone were seen. These were detailed in issue 6 of the HCNRG newsletter pp4-5, a joint report with Matthew Rust.

Examples of Buckinghamshire Puddingstone were viewed in a large block associated with 'Sarsenstone' at the rear of St Lawrence's church in West Wycombe. Just 1.5 miles down the road towards Princes Risborough at Bradenham, in front of Bradenham Manor and church is a cricket green and the parish council have kindly marked the green boundary from the road with blocks of 'Buckinghamshire Puddingstone' and at the southern end there is a number of 'Sarsenstones'.

Bradenham Manor church at the northern end of the green shows blocks of 'Puddingstone' in the outer wall. The picture below shows a block of 'puddingstone' in the church wall and a block of 'Sarsenstone' at the southern end of the green.



*Figure 6: A block of Buckinghamshire Puddingstone in the church wall at Bradenham Manor.*



*Figure 7: A block of 'Sarsenstone' at the southern end of the cricket green at Bradenham.*

At the mini-roundabout junction of New Road and Bell Road, the A 4010 in the town of Princes Risborough, on the corner by what now is the M&S Food Hall, Buckinghamshire council have installed a large piece of 'Buckingham Puddingstone' exhibiting various size pebbles and with an increased angularity. The building stone had been quarried from nearby Denner Hill just a few miles to the south-east of the town. The associated 'Sarsenstone' had been used for paving in the town.



*Figure 8: Buckinghamshire Puddingstone exhibit at Princes Risborough*

'Puddingstone in the UK is often only associated with Hertfordshire, yet the neighbouring county of Buckinghamshire also show examples with slight differences of formation. However, at present nowhere in the county can 'Buckinghamshire Puddingstone be seen at outcrop.

The presence and formation of Pudding stone, be it Buckinghamshire or Hertfordshire, is definitely Palaeogene in origin but still problematic in formation but without doubt cut and polished forms a wonderful specimen.

***Mick McCullough***



## **Lockdown Geology in my back garden (written with input from John Wong)**

**Doris Southam**

**11 June 2020**

When John Wong asked me what I was doing during lockdown, I sent him a picture of the pebbles I had collected whilst digging in my back garden. Little did I expect to receive back an almost full field trip report, or at least a comprehensive push for further investigation:

.....  
*“The pebbles which you have dug out from your garden are periglacial head deposit reworked mix pebbles from **the Pre-Anglian Glaciation Dollis Hill Gravel** and from the **Anglian glacial till deposits**. The former was originated from southern provenances as far as northern France, whereas the latter derived from provenances in the north.*

*Volcanic pebbles are from north Wales and from Cornwall, chalk and flint from the Chilterns, quartzite from the Midlands, vein quartz from south Wales, chert from the Weald Basin and also from northern France.*

***Pebbles with chatter marks** indicated they have been eroded in high energy beach environment whereas those pebbles with no chatter marks were eroded likely in a fluvial environment.*

*A few years ago, I have led a field trip to see the geology of Golders Green (your home area), we also found **Palaeolithic flint artefacts**.”*

.....  
 So how did these pebbles get into my garden? I looked up “Hampstead Heath Geology” on the internet: Sands and gravels on underlying clay. The provenance of this is put down to the Bagshot river, southwest to southeast trending, 50 million year ago, flowed in different branches at different times, across the Salisbury Plain, deposited thick river sands in the London Basin, eventually flowed into the North Sea. Some deposits can be seen on Hampstead Heath, with pebbles in horizontal layers, which record periods of flood when the river had potential to carry larger particles. Bagshot river was thought to be similar in length to the Niger, Indus, or Ganges river.

The pebbles in my garden could be washed out from the sands on the slopes of the Heath (my garden is at the bottom of the northwest side of the Heath , flint Pebbles weathered out from the chalk of the Wessex downs, other pebbles may be as far as from Dartmoor. (Hampstead Heath Geology, and Bagshot river, internet search)

But I found also another explanation: During the Anglian Glaciation (0.43Ma, MIS 20), eustatic sea level fell, the English Channel was land and Britain was connected to France. (Sediments derived from the south?)

The Thames, as the ice melted, when sea level rose, became sluggish and swampy and deposited silts and sands. Its history is preserved in a succession of terraces, eight or more, running along the Thames (Heath Extension sand digging) and even the gentlest hill in the middle of London indicates one of these terraces.

With isostatic rebound after the ice melted, did the Thames bring along all the pebbles left behind after the ice retreated, which successive pulses of the occupation of the ice sediments had laid down in fresh water sites, and estuaries? Did the Thames pick up the outwash pebbles from the southern front of the glaciers, from the northern ridges, from the Gower Peninsula, or did the Bagshot river system bring the Pebbles ?

I have not found any worked flint so far, so will continue looking in my back garden!

### Photo of Pebbles



Before identifying definitively all the pebbles, especially nos 7 and 8 (as I thought they were chalk pebbles), I was encouraged by John to perform extensive sound (pinging) tests after I have tested the hardness of the pebbles –

.....  
*“Grey area on pebble no 9 does not scratch with scissors is probably silica.*

*Pebble no 6 is quartz, it has a hardness of Mohs scale of 7.  
 Try to hit 6 with 14, then 6 with 7, 8 and 9, then record their tones.*

*Pebbles 7 and 8 scratched with scissors but not with fingernail, I still think the white surfaces of the pebbles are cortex of altered flint.*

*Both pebbles 7 and 8 have same duller tone indicate they are of **similar density**.*

*Can you test hit 10 on 9, and 10 on 13, then compare with 10 on 7 and also 10 on 8 please?*

*Pebble no 12 has undergone frost weathering, it should be slightly a touch less dense and has a tiny more duller tone when hit by 10 or 14, try it out.*

*Observation geology is all about testing, recording, compare and contrast.*

*Have fun, I await to hearing from you for your finding.”*  
 .....

### **After performing all these tests, I had to agree with John.**

#### **List of Pebbles:**

- 1, 2, 3 - Amber coloured/brown coloured flints , with faint chatter marks.
- 4 - Black coloured flint.
- 5, 11, 13, 17 - Periglacial weathering deepen and widen the grooves of the pre-existing chatter marks.
- 12 - Flint shows circular pit marks known as micro-peck marks, formed by frost pitting.
- 10, 14, 15 - Flint with pot structures: concave, or convex broken surfaces formed during permafrost conditions: during the last Ice age, water frozen deep in the ground, expanded and built up stress and shattered apart the flint pebbles to form “pot” and “pot-lid” curve surfaces.
- 6 – Quartz.
- 7, 8 - Flints show altered flint white cortex.
- 9 - Flint, grey coloured patch area with no chatter marks.

#### **Bibliography**

Hampstead Heath Geology” from Computer search

Bagshot river (computer search)

The glacial History of the British Isles during Early and Middle Pleistocene: Implications for the long term development of the British Isles, Jonathan R Lee et al, British Geological Survey, Keyworth.

*Doris Southam*

### **Book Review: The Fens by Francis Pryor**

This is not a book which is primarily about geology, but it will be of considerable interest to geologists.

It is in part the autobiography of a distinguished archaeologist, who made his reputation carrying out excavations of Bronze and Iron Age archaeology in the Fens of Lincolnshire and Cambridgeshire. The book develops into a history of the landscape in this often overlooked part of England.

In an early chapter the author avows his interest in geology, which he studied for A Level, alongside zoology and botany, at the well-known fee-paying comprehensive across the river from Windsor, which has produced so many of our political leaders.

Proceeding to Trinity College Cambridge, to read Archaeology and Anthropology, he was, by his own admission, far from a model undergraduate, spending most of his time drinking beer, chasing women, and on the river rowing off hangovers . Fortunately the resulting 2:2 did not stand in the way of an academic career. By chance when working abroad in Canada, to which he had emigrated with his first wife, he got a job as a technician assisting the Chief Archaeologist at the Royal Ontario Museum in Toronto. This led to a research project for the Museum, back in England, at Fengate on the eastern edge of Peterborough. It then emerged that he had a particular talent as a field archaeologist. The rest is the history set out in this book.

In later life, he has combined archaeology with sheep-farming in Lincolnshire. It is evident that in carrying out his archaeological researches he has made good use of the geological maxim that “The Present is the Key to the Past”. In particular, he has been able to apply his knowledge of the problems and techniques of sheep farmers to the interpretation of the remains of pre-historic settlements.

He describes a number of the archaeological investigations which he has carried out in the Fens, mainly in the Peterborough area. These include Flag Fen, the Bronze Age site, for the discovery and excavation of which he is perhaps best known. His work has revealed the highly-developed economy of the wetlands which existed in pre-historic times.

As well as giving considerable insight into archaeological techniques, the book has much to say about the geological processes which made the landscape, as well as human interventions such as the large-scale drainage projects and exploitation of gravel resources. It also describes the use of physical resources to construct notable buildings in the area, such as Ely Cathedral, and the brick-built Tattershall Castle. (The author had taken an early interest in the brick-building techniques of the 15<sup>th</sup> century, using imported bricks from the Netherlands, deployed to construct the oldest buildings at his school).

There are chapters on the social and economic evolution in recent times of the principal cities and towns in the area, Cambridge, Peterborough, Spalding and Wisbech.

He also discusses the work of the Fenland farmer poet John Clare. John Clare was a farm labourer who achieved great literary success at the time, as a poet of the local landscape who lamented the damage and destruction resulting from enclosures. Unfortunately, he suffered from poor mental health, and spent much of the later part of his life in a lunatic asylum. Interest in his work has revived in recent times, and he is now widely regarded as one of the greatest 19<sup>th</sup> century English poets. A programme devoted to him in the series "In Our Time" was recently re-broadcast on Radio 4, and can be found on the BBC website.

There is also discussion of the archaeological investigation of the Napoleonic POW camp at Norman Cross near Peterborough. Now a scheduled ancient monument, this was perhaps the first purpose-built prisoner of war camp in the modern world, which accommodated some 7000 men. It seems to have offered relatively humane conditions for such a large number of prisoners. However a number of the inmates died from typhoid and other infectious diseases, which were very much a general feature of life in those days, and were buried in the prison cemetery.

The book concludes with a look at the threats to the Fens landscape posed by climate change, storm surges, and flooding, and how the inevitable retreat might be managed.

It will appeal to many of the interests which we cultivate on our field trips, and will serve as useful background reading for members of the Group who may wish to plan an excursion to the area following the lifting of the Covid 19 lockdown.

***Richard Trounson***

This review is a slightly extended version of a review published in the December 2019 issue of the London Platform, the newsletter of the London Branch of the Open University Geological Society.

## **Lockdown and geology observation**

Working indoors away from the usual office environment and not being able to go out except for food and medicine shopping for many weeks have created many monotonous pages in my diary. When we were allowed to go out for a short period of exercise, I looked out for an ice cream van coming round but that was hoping against hope, there was no ice cream van, the street was empty and silent.

I walked to a nearby public park, strolling instead of walking, looked at the trees and tried to memorise their appearances, the different types of leaves and barks. Each time I saw that more leaves had grown, then came flowers and then fruits, so I began to take an interest in finding out more about local trees. Once a geologist, always a geologist, and I looked at the soils beneath the trees and examined the soil composition – geobotany?

When the travel restrictions eased, I went to a public park in north London and looked at the pebbles in a stream; the recently low rainfall and dry weather is a godsend for observation geology along the river banks. The water level is low, the flow is slow and river lag deposits are exposed above the water level. It was geology cherry picking time, to my amusement there were abundant pellet-size vein quartz grain in the lag deposits, which was a Eureka moment for me because quartz grains are a rarity in this part of London rivers, especially in large and concentrated amount. A lady walker stopped, kept the two metres distance and asked ‘Are you looking for fish?’ I smiled and said ‘Just looking... ..’ (I didn’t tell her that I was looking at the pebbles close up), and she replied ‘Maybe there are small fish there.’

In my view, the large amount of quartz grains can be used to determine the relative geological age of this river in comparison with the rivers immediately nearby, where quartz grain are absent.

On another visit to a different public park in London where the underlying superficial deposits are the Pre-Anglian Dollis Hill Gravel Member, pretty well sorted brown and grey coloured flint pebbles are abundant on the ground where there is no vegetation cover and also in the river bed and embankments, I was looking for evidence of glacial and peri-glacial processes, but what caught my eyes were a few isolated cobbles. Of course, I said to myself; the key to the locations of the distant provenances and the evolution of the pebbles is the cobbles (not the man-made stuff such as bricks and concrete) but not generally thought only the pebbles. With no hesitation, I picked up the cobbles and took it back with me, so that I can exam it further at my leisure.

Please add the following paragraph after the last paragraph of my article, thank you –

I have prepared two HCNRG weekday geology workshops to roll out at Burlington House when the Geology Society’s offices open either later in the year or in 2021.

The workshops are –

1. In search of the remnants of the Neoproterozoic supercontinent Rodinia in the geological cradle of the formation of the Asia continent.
2. Analysis of one group of yet to identify Cretaceous coprolites from Barrington in Cambridgeshire – predator /scavenger and faunal assemblages.

In addition, I have prepared the itinerary of a HCNRG field trip to locations near Little Brickhill in Milton Keynes Borough Buckinghamshire, to examine landslide deposits of historic times and present day slope stability, sedimentology, geoarchaeology of Iron Age and Medieval times.

I shall look forward to seeing you at the workshops and field trips in the not distance future.

***John Wong***