Home Counties North Regional Group

Newsletter - Issue No. 3 - September 2015

WELCOME to this third edition of the Newsletter of the Home Counties North Regional Group. I must start with apologies, firstly to Susan Gann for getting her name wrong in the last issue and secondly to the Group as a whole for the delay in producing this issue. This is I am afraid down partly to indolence on the part of the editor and partly to ill health and IT problems earlier this year. Because of the amount of material, it has been decided to limit this issue to events during the latter half of 2014 with the intention of reporting on 2015 events later this year.

It is pleasing to report the continuation of a successful programme of evening lecture meetings and one-day field trips, though attendance has not been as high as might have been hoped. We have again managed to get around the region, with meetings in Hatfield, Hemel Hempstead and Milton Keynes. The programme has been varied and we hope to maintain that variety in the future.

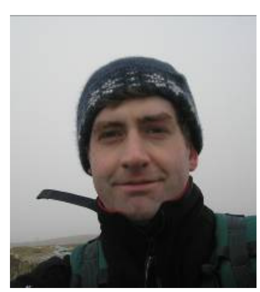
As reported in the last issue, 2 members who had expressed an interest in serving on the Committee, Susan Gann and Stuart Wagstaff were co-opted onto the Committee and our Chair, Sophy Crosby, resigned in the summer. As a result, Dave Brook volunteered to act as Chair until the AGM.

We present below only the photographs of those elected at the AGM details of whom are in Issue No. 1, together with information on the co-opted members. We will give details of co-opted members in the next Newsletter. While this Newsletter was being prepared, the Chair resigned due to the pressure of work and the position is currently vacant.

Meet Your Committee

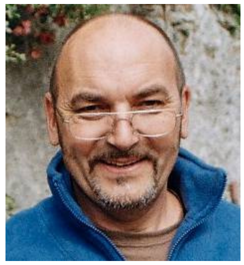
Officers

Chair – David Brook **Treasurer – Louise Cox** **Secretary – Jonathan Vetterlein**



Ordinary Members

Alistair Dewar **Seamus Lefroy-Brooks** **Jessica Macdonald** Charlotte Murray




John Wong **Sarah Smart**


Co-opted members

Susan Gann

Stuart Wagstaff studied geology and engineering geology at the University of Portsmouth [more years ago than he wish to be reminded of] and started his career as an exploration geologist. In his early years of employment, he did a fair bit of travelling looking for mineral reserves and was also involved with geophysical surveying. A recession-hit industry led him to more of an engineering path, eventually returning to the University of Surrey to undertake a Masters Degree in Geotechnical Engineering. Geotechnical engineering and site investigation has been his principal focus since and he is now Director of Soil Consultants Ltd. Mineralogy still remains a passion and he is also involved with a society for the preservation of British Minerals and always looking for opportunity to add to his collection!

Ex-Officio Members

David Jones is a member of Council, Vice-President Regional Groups and former Chair of the Southern Wales Regional Group.

Other members of Council within the region are also ex-officio members of the Committee.

Meetings of the Home Counties North Regional Group

1. Bromate Contamination of the Chalk Aquifer in Hertfordshire

5 June 2014

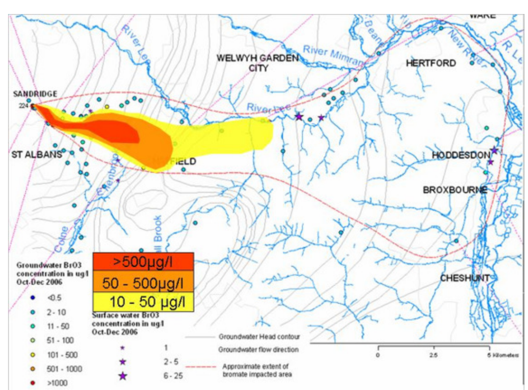
At the meeting at Affinity Water, Hatfield, 30-40 people heard Rob Sage, Asset Specialist, Water Resources, Affinity Water give his talk on **Bromate Contamination of the Chalk Aquifer in Hertfordshire.**

Affinity Water: Affinity Water is a water supply only company, that distributes water to three areas, Central (Hertfordshire and adjacent areas – 850Ml/d to 3.3 million people), East (around Colchester – 29Ml/d to 160,000 people), and Southeast (Folkestone/Dover – 43Ml/d to 160,000 people). Groundwater from the chalk aquifer makes up 60% of the water that Affinity supplies to its customers and this comes from 135 boreholes. The bromate contamination impacts part of the chalk aquifer in the Central area.

Bromate: In 2001, the Drinking Water Inspectorate introduced a 10µg/l standard for bromate ($Br0_3$). This was mainly to monitor the levels of bromate that can be produced as a by-product of some water-treatment technologies. Bromate is not found naturally and is a carcinogen which has been linked to bowel cancer. In 2000, before the standard was introduced, Affinity Water (albeit under a previous name for the company), undertook some preparatory checks on bromate levels in their chalk aquifer abstractions and found a concentration in the raw water supply (before any treatment processes have taken place) of 138µg/l at Hatfield and 7.8µg/l at another source. Hatfield was immediately taken out of supply and investigations were initiated with the Environment Agency, Health Authorities and other government bodies to identify the source and the risk posed from the contamination. Epidemiological assessments have shown that the area supplied from Hatfield has a lower than average incidence of bowel cancer. Prior to the discovery of bromate the water from Hatfield was blended with other sources so the concentrations of bromate in the tap would have been lower than in the raw water.

Source: The source of the bromate was quite quickly identified as a former chemical works in Sandridge, northeast of St. Albans. The site, which was operational from 1955 to 1980, produced and used bromated compounds and products. The site closed and the works demolished in the early 1980s and it was left undeveloped for several years before being developed for housing. Site remediation work consisted of the top 2m of topsoil being stripped off and backfilled with inert material. There is therefore no health risk to the current residents from any residual bromate contamination at the site.

Plume: In the plume the maximum concentration of bromate is >500µg/l. The initial direction of the plume is to the southeast but the direction changes towards the east in the vicinity of Nash's Farm. The plume extends to springs and abstraction boreholes along the River Lee between Chadwell and Broxbourne. There are no observation boreholes in the area of the plume that extends beneath the cover of London Clay and, to date, there is no information as to whether there is any stratification of bromate within the chalk aquifer, although it is understood that boreholes to assess this are currently being constructed.



Trends in concentration: Seasonal fluctuations linked to rainfall recharge can be identified in the data, but it is not a simple relationship and there is a lot of scatter. The concentrations of bromate rose from 2000 to 2005 and, in 2004, the concentration of bromate in the water from the other source became too high for it to be used at full capacity, even after being blended with water from elsewhere (as had been the carried out from shortly after the discovery of bromate here). Bromide concentrations are also high in the plume but there is no drinking water quality standard for bromide. There is a very strong correlation between the bromate and bromide concentrations.

Initial mitigation: The immediate closure of the Hatfield borehole resulted in a loss of 9Ml/d of supply. Affinity Water obtained temporary increases to abstraction licences at other existing sources to be able to maintain supply to their customers. Investigations were made into suitable treatment processes that could be used to treat the bromate from the raw water. These included GAC filtration and ion exchange. However none of these were found to be suitable for the high concentrations of bromate at Hatfield and the high volumes of water that would need to be treated.

In 2001, a new pipeline was constructed from Essendon to enable the water from this source to be blended. To replace the Hatfield abstraction a new source was developed and opened at Nomansland, after being granted a licence from the Environment Agency in 2007. These works resulted in over £4 million of costs to Affinity Water. However despite this, with no sign that the concentration of bromate in the plume was decreasing, there was still an ongoing potential impact to the operations of both Affinity Water and Thames Water.

Pump-and-treat remediation: In 2005 Affinity Water and Thames Water started trials at the Hatfield abstraction which involved pumping the raw water from the Affinity abstraction then dosing it with ferric chloride, to reduce the bromate to bromide and subsequent discharge into a Thames Water trunk sewer. This process worked and there was no detection of bromate in the River Colne downstream of the discharge point from the sewage works. When pumping from the Hatfield borehole was in operation, it was found that the concentrations of bromate in the down-gradient abstractions in the Lee Valley decreased. A full-scale ferrous iron dosing plant was subsequently constructed at Hatfield and a new abstraction licence for aquifer remediation issued in 2007.

The pump-and-treat system is automatically regulated by the pumping regime in the boreholes. The sewer does not however have sufficient capacity to deal with the abstracted water during periods of heavy rainfall and there can be a delay after the end of a rainfall event before the pumps can be turned on again. Although successful in lowering the concentrations of bromate down-gradient of Hatfield, the up-gradient concentrations have remained the same with no indication of a downward trend. To date around 4 tonnes of bromate has been removed from the aquifer using the pump-and-treat scheme.

Research: Affinity Water and Thames Water funded two PhD studentships at University College London that looked at the potential duration of the plume to move through the aquifer. This included water-tracing tests that built on the work that was undertaken in the 1930s in the Mimmshall Brook catchment. Bacteriophage tracer tests showed the following flow rates from North Mymms to Hatfield (3207m/d); to Essendon (2362m/d); to Arkley Hole (3206m/d) and to Amwell Marsh (2372m/d). However, the flow rates in the plume closer to the source were found to be much slower. The conceptualisation of the passage of the bromate through the aquifer is thought to be initially via matrix and tight fracture flow in the source area, which, when it reaches the significant karst system towards the southeast, is rapidly transported parallel to and in places beneath the Palaeogene cover towards the Lee Valley. This karstic flow direction appears to be different from the direction of groundwater flow that would be expected from the piezometric data. It is thought that significant karstic conduits through which the bromate passes may have been initiated during the times when the proto-Thames flowed along this alignment. It is also thought that there could be a structural control on the orientation of these conduits. In the Upper Colne Valley the thick till separating the gravels from the chalk may also have an impact on the bromate distribution from the source area.

Unknowns:

- The variations in both the bromate and bromide concentrations are not fully understood – for example there were no correlations with the dry spells in 2006 and 2012.
- Source-term – how much bromate is in the aquifer?
- Distribution of bromate with depth in the aquifer.
- Details of the flow regime are still not that well understood.
- Final solution to the problem has not been identified.

Legal position: The Environment Agency issued a remediation notice in 2005 under Part 2A of the Environmental Protection Act, 1990. It named two Appropriate Persons, Redland Minerals, who were the owners of the factory, and Crest Nicolson, who built the homes. At a public enquiry in April 2007, Affinity Water and Thames Water sought to include the pump-and-treat system as an interim Remedial Treatment Action in the revised remediation notice. Following an appeal and a Judicial Review, in March 2010 the revised remediation notice was upheld, and it included that the Appropriate Persons would have to pay for the pump-and-treat activities, in addition to the ongoing monitoring of the plume.

Conclusions:

- Tracing the source of pollution and identifying the polluter can take a long time.
- The legal process is long and complex.
- High costs can be incurred by those impacted by a pollution incident and the recovery of costs prior to the issuing of a remediation notice (in this case in 2010) is unlikely so the polluter-pays principle is not always upheld.
- Now the polluter is paying and not the customers of Affinity Water.
- Remediation of the source is still to be undertaken.
- Temporary or permanent re-location of impacted abstractions can be the most effective solution but finding new locations in areas already impacted by water stress may not be possible

Report by Jonathan Vetterlein

2. Antarctic evening and curry night

16 September 2014

At the Home Counties North Regional Group meeting at Sir Robert McAlpine in Hemel Hempstead, 26 people heard Helen Nattrass, Sir Robert McAlpine talk on **3 weeks in the Scotia Arc: a snapshot field trip in Antarctica.** After a break for curry, Dave Brook, Acting Chair of Home Counties North Regional Group spoke on **A geologist in Antarctica: reflections after 50 years.**

3 weeks on the Scotia Arc:
a snapshot field trip to Antarctica

Helen Nattrass

This presentation gave a broad-brush view of geology and wildlife seen in the Scotia Arc, which joins South America to the Antarctic Peninsula, on the 3-week cruise in 2013 to celebrate the 125th anniversary of the Geological Society of America. The GSA had advertised in *Geoscientist*, inviting Fellows of the Geological Society to join their cruise and the speaker took up the option after a previous visit to Patagonia. She flew from London via Madrid to Santiago, which was the meeting point for participants and then flew down the Andes to Punta Arenas and then to the Falkland Islands where 90 people joined the Russian cruise ship for a voyage to South Georgia, the South Shetland Islands and the Antarctic Peninsula and then to Ushaia.

The geological structure of the Scotia Arc results from the early Mesozoic break-up of Pangaea and, particularly, Gondwana. Africa, South America and parts of Antarctica are clearly linked by fossil evidence, particularly *Glossopteris*. They separated from Gondwana in the Jurassic. The result is a very complex piece of tectonics, which reflects movement between the Atlantic, Pacific and Antarctic plates. The geotectonic evolution involved accretion of sediments on continental margins, the development of subduction zones, ocean spreading volcanic and magmatic activity and metamorphism.

The cruise began in the Falkland Islands, which is located on the continental shelf of Argentina but is geologically related to Africa. At Sea Lion Island the group saw Permian limestone/siltstone with a few trace fossils. After 2 days at sea, with lectures from Ian Dalziel and other experts, they reached South Georgia.

This island drifted from the tip of South America and turned through almost 90^{o}. The ophiolite complex at Larsen Harbour comprises oceanic sediments which have been squashed and metamorphosed, closely related to the “rocas verdes” of Tierra del Fuego. South Georgia has the Early Cretaceous Cumberland Bay Formation of deformed andesitic turbidites, the Lower Cretaceous Sandebugten Formation of rhyolitic turbidites and the Larsen Harbour Complex. A landing was made at Peggoty Bluff on the south-west side of the island (the landing point for Sir Ernest Shackleton in the whale-boat *James Caird* after his 800-mile journey from Elephant Island in 1916). There was clear evidence of glacial retreat on the vast outwash plain.

Complex folding, South Georgia

Peggotty Bluff, South Georgia

At Drygalski Fjord and Larsen Harbour ocean-floor rocks comprising pillow lavas, metasediments and dykes were seen. Visits were also made to Godthul Harbour, where there was evidence of the whaling heritage, Stromness whaling station, which they were not allowed to visit because of the abundant asbestos in the decaying buildings, and Grytviken, the site of the British Consuls office and the British Antarctic Survey base, as well as the whalers' church, South Georgia Museum and Shackleton's Grave (He was buried there at the request of his widow after dying at Gritviken on the *Quest* Expedition in 1923). The group drank a toast of whisky to Shackleton's memory by his grave.

The speaker then sang her own composition, *The krill song*, which she had written while at sea on the way to the South Shetland Islands. This proved a popular ditty in the bar during the voyage, accompanied by an out-of-tune Russian piano.

They visited Elephant Island, zodiacing at Point Wild and later landing at Cape Lookout with its blue-schist metamorphic complex. It was at Point Wild that Frank Wild and the remaining crew of Endurance stayed living under 2 up-turned whaleboats and essentially feeding off seals, penguins and shellfish that they could obtain while Shackleton and 5 others sailed the *James Caird* to South Georgia and arranged their rescue after 2 unsuccessful attempts. Elephant Island was surveyed by BAS but they only mapped the edge of the island and the isolated parts they could reach from the few landing points.

There is active subduction at the South Shetland Islands with active spreading between the archipelago and the mainland of the Antarctic Peninsula. As a result, the rocks are greatly deformed, with deformation visible at outcrop, in hand specimen and at a microscopic scale. Serpentinite and dunite were examined on Gibbs Island and time was spent at Deception Island, visiting Pendulum Cove and Whalers' Bay. Deception is an active volcano with explosive volcanic activity resulting in cinders and ash deposits. The active hot springs at the beach allowed sea bathing.

Helen Nattrass at Hope Bay, Trinity Peninsula

Fossil fern, Hope Bay, Trinity Peninsula

On the Antarctic Peninsula, the turbidites and deformed sediments of the Trinity Peninsula Group were examined, with a Permo-Triassic fossil fern being found but not removed (cruise passengers are not allowed to take anything away from Antarctic except photographs). The speaker illustrated the differences between sea ice and glacier ice and explained the importance of sea ice to the world's climatic systems. Sea ice excludes NaCl, resulting in the water being much more saline. It is the combination of the high density and low temperature that drives ocean currents on which those systems depend. The southern limit of the cruise was the southern end of the Lemaire Channel. On the return they visited Port Lockroy on Wiencke Island where the former BAS base is maintained by the UK Antarctic Heritage Trust and manned through the summer to cater for tourist visitors (the *Penguin post office* featured in the BBC television programme). Returning to the South Shetland Islands, they visited Livingstone Island with its Permo-Triassic turbidites and more fossil ferns and then crossed the Drake Passage to Ushaia, which was the end of the voyage.

The speaker remained a further 2 days in Ushaia. A small group led by Ian Dalziel visited the Tierra del Fuego National Park to see deformed sediments of the Yahgan Formation (Permo-Triassic) and Jurassic deformed tuffs (Tobifera). The group also visited Estancia Haberton, the historic home of the Bridges family. On the return journey they stopped to view more of the Tobifera and also Lago

Fagnano (Kami), which is the surface expression of a large transverse fault where the movement of Antarctic sliding past Patagonia has been measured at 6.5mm/year.

A geologist in Antarctica: reflections after 50 years

David Brook

This talk presented a distinct contrast to modern geological tourism with the speaker's description of life as a geologist in Antarctica in "the old days" – not quite the heroic age of Antarctic exploration, though there was a link in that one of the speakers at the British Antarctic Survey (BAS) pre-departure conference was Sir Raymond Priestley, geologist with Shackleton's *Nimrod* Expedition 1907-09 and in the Northern party of Scott's *Terra Nova* Expedition 1910-13.

Southampton to South Georgia

In October 1965, the speaker sailed from Southampton on the *RRS Shackleton.* 5 weeks later, after a one-night stop in Montevideo, Uruguay and 4 nights in Port Stanley, Falkland Islands, which included being kitted out with Antarctic clothing, he arrived in South Georgia. The first port of call was Godthul Harbour for a brief 4-day familiarisation with the rocks of the Cumberland Bay Series and Sandebugten Series, which had previously been mapped in that area. The speaker and his general assistant then re-embarked on the *Shackleton* and moved to Stromness Bay where they were to carry out reconnaissance geological mapping of the area between Cumberland West Bay and Fortuna Bay. This entailed living in the former manager's house at Husvik whaling station for 2 months with occasional days under canvas while mapping the geology and geomorphology of this area.

South Georgia is essentially an extension of the Andes from South America with an igneous complex at the south-east end of the island. The whole of the area mapped by the speaker consisted of tightly folded volcaniclastic sediments of the Cumberland Bay Series in a greywacke – shale sequence, with abundant quartz veining. At the same latitude south as Yorkshire is north, the island is heavily glaciated with glaciers flowing down from the central mountains to the sea, though many have retreated significantly in the last 50 years.

The area being mapped was bounded to the south by the Neumayer Glacier and to the west by the Kőnig Glacier. Of particular interest was the discovery of strand lines around the shores of Gulbrandsen Lake, which was dammed by Neumayer Glacier, and a moraine-dammed lake further downstream. Gulbrandsen Lake is no longer a lake due to the retreat of its damming glacier. All around the coastline raised beaches and elevated rock platforms were also mapped.

Gulbrandsen Lake

Raised beaches at Jason Harbour

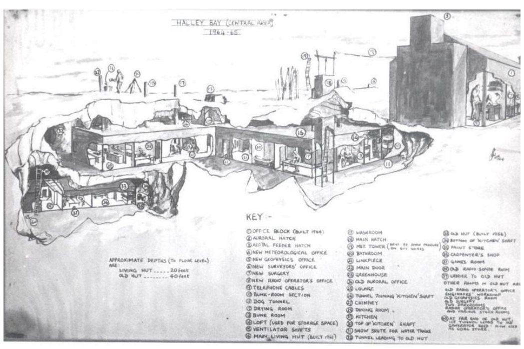
Typical overfolding

Examples of the Cumberland Bay Series sediments

During their stay at Husvik, they were occasionally visited by Japanese whalers who were occupied in the last throes of whaling at Leith whaling station before departing about halfway through the season. The local wildlife was abundant and included penguins, other sea birds, fur seals and elephant seals and reindeer descended from those introduced by Norwegian whalers in the 1920s. A lack of fear of humans was evident and close approaches were generally possible, though the speaker and his companion were dive-bombed regularly by skuas protecting their young and by Antarctic terns, as well as having to take refuge on a couple of occasions from an angry reindeer and an angry bull fur seal. Being less mobile, the elephant seals were not a problem, though it was disconcerting to be walking through head high tussock grass and to find one had almost stepped on a 4-5-ton seal.

Halley Bay, Antarctica 1966-67

The speaker was picked up in mid-January 1966 by the *MV Kista Dan* for the journey south to Halley Bay following a brief visit to the then British colony at King Edward Point. 2 weeks later after a number of false starts, unloading of one year's supplies was completed, a number of seals had been shot to feed the dogs during the winter and the *Kista Dan* departed, leaving 28 men to winter at this base.



Halley Bay central area 1964-65

Refracted ice bergs viewed from Halley Bay station

Halley Bay was established in 1956 by the Royal Society as part of the International Geophysical Year and subsequently taken over by BAS. The original base hut was rapidly buried by drifting snow and an additional living hut was added in 1961 and access was by vertical shafts. A further small office block was added in 1964 and one of the speaker's first tasks on arrival was the construction of a tunnel linking the 1964 and 1961 huts.

At Halley Bay, BAS operated scientific programmes in meteorology, ionospherics, upper atmosphere geophysics and auroral studies and physiological/medical research as well as field programmes in topographical surveying, geology and glaciology. Support staff included a diesel mechanic to operate and maintain the electricity generators, tractor mechanics, radio operators, cooks, an electrician and general assistants to support the field personnel. Communication was by short-wave radio only, with one 100-word letter per month, which was transmitted by radio and then sent on by air mail from Port Stanley. The ship visited only once per year for re-supply.

As the nearest rocks were over 200 miles away and could only be visited in the austral summer, field personnel were largely occupied during the winter in the general maintenance of the base and preparing for the forthcoming field season. The speaker thus got used to raising the outside stores of food fuel and other material and similar tasks. He did get the opportunity for an abortive autumn trip towards the Tottanfjella in an attempt to bring back a broken-down tractor that had been left behind in the summer when the other tractors returned to the base for unloading of the ship. 42 days in the field for a total distance of 260 miles, with 25 of those days not moving, mainly for reasons of the weather and snow conditions for the tractors, including one period of 19 consecutive days in one place. On returning to base it was back to base maintenance tasks, preparing the equipment (sledges and tents) for the main field season and training in driving the husky dogs.

In early October the speaker and 5 others set off with 3 dog teams to pioneer the overland route from Halley Bay to the Theron Mountains in advance of the tractor support, which first returned to the Tottanfjella to pick up and repair the broken-down tractor. Joined by the tractors, they arrived in the mountains in mid-November where the tractors laid depots and assisted with the topographical survey until departing back to base for the arrival of the relief ships. The speaker, one topographical surveyor and 2 general assistants were then in the field to continue the surveying and geological mapping of the mountains and some glaciological studies before departing in early March and arriving back on base 3 weeks later. In total, 173 days were spent in the field, of which 107 were spent in the mountains, with the total distance travelled by dog sledge being 1,231 miles.

The Theron Mountains

The Theron Mountains were discovered in 1956 by the Commonwealth Trans-Antarctic Expedition and visited briefly by that expedition's geologist, Jon Stephenson, who published brief accounts of the geomorphology and geology. They are a 120km-long NE-SW trending escarpment alongside the Bailey Ice Stream, which form the Weddell Sea end of the Trans-Antarctic Mountains, extending across the continent on the edge of the East Antarctic craton. The scarp is cut by 3 narrow glaciers and is backed by a broad undulating plateau which descends southward to the ice-cliff margin of the Slessor Glacier. While the air temperature remains below zero, running water is a significant element as the ice near the rock melts and melt streams and meltwater pools are present throughout the range. Mosses and lichens occur, largely on the dolerite rocks and Snow Petrels, Antarctic Petrels and South Polar Skuas all breed in the range.


Moraines


Meltwater

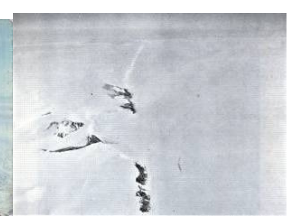

Mosses & lichens

Rising to 1,140m asl in Mt Faraway, the range is dominated by 4 major cliff sections 300-700m high with ice cliffs and occasional rock windows in between. The geology comprises continental water-laid sediments of Lower Permian age as indicated by the *Glossopteris* flora, intruded by thick dolerite sills of Jurassic age (154-169Ma).


Marø Cliffs


Lenton Bluff


Coalseam Cliffs


Marø Cliffs to Parry Point

The horizontally bedded sediments are fine-grained and range in composition from feldspathic to arkosic sandstones and siltstones with subordinate carbonaceous, quartzitic and calcareous sandstones, siltstones and mudstones. Ripple marks, slump balls, load casts and slight disconformities indicating penecontemporaneous erosion occur in several places and coals and carbonaceous shales are present throughout the succession. Many of the latter show evidence of thermal metamorphism, including hexagonal jointing in one coal immediately below a dolerite sill. The only fossils are leaf and stem impression of *Glossopteris*.



Typical sediments **Channel-fill sandstones** **Slump ball**

The sediments are intruded by sub-horizontal sills ranging from about 1m to over 200m thick with a few impersistnet dykes. At least 3 phases of intrusion are recognisable on field evidence and intrusion was accompanied by minor local tilting and faulting, by thermal metamorphism and some localised hydrothermal mineralisation. Many of the sills are olivine-bearing, including 2 sills which show layering of felsic and mafic layers. Fractionation is dominated by increase in iron and silica content with granophyric quartz-pegmatites developed in one sill. Petrographical and geochemical analyses and comparison with other Mesozoic tholeiitic rocks of the southern hemisphere indicate that the Theron Mountains include representatives of the 2 major basaltic provinces – the Karroo-Serra Geral of South Africa and South America and the Ferrar-Tasmanian of Antarctica and Australia. The distinction between the 2 provinces is considered to be linked with their relationship to the break-up of Gondwana.



Dolerites, Lenton Bluff **Hydrothermal vein** **Cross-cutting dolerites Maro Cliffs**

Halley Bay, Antarctica 1967-68

The winter of 1967 was spent completing the construction of a new base, which was required due to the pressure of ice on the existing base, and which had begun with the arrival of two relief ships, the *MV Perla Dan* and the *RRS John Biscoe.* There were now 38 people on base, including the building team, spread between the old and new bases and conditions in the 2 older huts were becoming harsh with temperatures dropping to below -20^{o}C. These huts were abandoned in early June and all moved to the new base except for the meteorologists and a few support personnel, who continued to occupy the 1964 hut.

In late September, 2 parties were involved in glaciological work on the Brunt Ice Shelf and on the grounded ice beyond the hinge zone – an area of massive crevasses where the route was carefully examined and marker flags moved when necessary each time any party crossed through it – and to reconnoitre the Dawson-Lambton Glacier named by Shackleton as he passed this coast before being trapped in the ice on his *Endurance* Expedition 1914-16.

At the end of October the speaker and his party joined with the tractor support party to journey once more to the Theron Mountians, where he spent a further 3 weeks with a dog team and one general assistant continuing his geological field work while the GA completed glaciological observations begun the previous summer. They then rejoined the tractors to assist in reconnoitring a route south to the Shackleton Range, where the new geologist was due to be working. This was unsuccessful because of heavy crevassing on the margins of the Slessor Glacier and the tractors returned to base, leaving a party of 4 with 2 dog teams to continue the reconnaissance.

The speaker departed Halley Bay in late January 1968 and sailed to Southampton via Signy Island in the South Orkney Islands, Port Stanley and Montevideo, arriving in early March.

Editor's note: I have almost certainly included in this report some things I did not actually say on the night but I felt it gave the necessary fuller picture of life as a geologist in Antarctica 50 years ago.

Report by Dave Brook

3. Sediments, sequence stratigraphy and material behaviour: why the Lambeth Group presents a challenge

23 October 2014

At the joint meeting of the Home Counties North Regional Group and the Engineering Group at Sir Robert McAlpine in Hemel Hempstead, 24 people heard Jackie Skipper (Senior geologist at GCG Consulting Group) talk on **Sediments, sequence stratigraphy and material behaviour: why the Lambeth Group presents a challenge** on the need to go back to geological first principles to understand the complex nature of the Lambeth Group sediments.

Introduction

The Lambeth Group was known as the Woolwich and Reading Beds until the mid-1980s, when Richar Ellison, Chris King and others revised the nomenclature. The Group is the dysfunctional cousin of the London Clay, which has been historically confusing and difficult when compared to its more sensible relation and difficult to classify. Brunel's Thames Tunnel was a classic example of a project that expected to meet London Clay but got the Lambeth Group instead, one of the results being 5 inundations during its construction.

The Lambeth Group occurs in the London, Hampshire, Paris, Belgian and Danish Basins. Laid down at about 55-56Ma, it overlies the Thanet Formation (Thanet Sand and Bullhead Bed) and, in its 15-18m in the London Basin, has lots of units in the Upnor, Reading and Woolwich Formations.

We need to fully understand the Lambeth group because London's expanding population means that we are now digging deeper, with higher buildings requiring deeper foundations, more tube and train tunnels, new sewer tunnels, such as the Thames Tideway, and new cable and water tunnels and gas pipelines.

Emerging issues include:

- poor classification, correlation and characterisation;
- poor recovery in site investigations;
- poor anticipation of ground conditions;
- "running" sands and gravels;
- dewatering problems;
- difficulty in excavating for piles and tunnels;
- complex faulted zones; long-term tunnel infrastructure mineralogical problem; and

- de-oxygenation.

These can lead to over- or under-conservative designs, information and data loss, communications problems between the site investigation, laboratory investigations, the designer and the contractor and complex risk management problems.

Variability in the Lambeth Group

The Lambeth Group is difficult because of its variability. There are probably about 20 different lithologies, in contrast with the London Clay, which is essentially sandy, silty clays. The Upnor Formation has 2 or 3 types of material, cross-bedded laminated sands, silty sands with clay laminae and the upper pebble beds. The Lower Reading Formation Mottled Beds have sand, silt and clay with calcretes and the Lower Shelly Beds, The Woolwich Formation has laminated beds with sand channels and the Reading Formation Upper Mottled Beds in central London have clay, silt and sand units with large sand channels. The Woolwich Formation Upper Shelly Beds also has hard beds, such as the *Paludrina* Bed. SPT values are incredibly variable compared to the London Clay and there is great variablility in permeability. 30% of the Crossrail boreholes encountered sand channels in the Upper Mottled Beds alone.

On the CTRL route from St Pancras to Barking, there was no apparent correlation along the route and an understanding of sequence stratigraphy is necessary to make sense of it. This explains how lithologies change when sea level changes. As sea level falls, terrestrial fluviatile and estuarine lithologies advance towards the basin, overlapping onto shore facies. When sea level is low enough, downcutting begins. Sea level then rises leading to marine sediments being deposited on top of other facies. This leads to complex interfingering of facies at least 3 times (Page and Skipper and the presence of the mid-Lambeth hiatus as an event horizon represents a useful surface.

The Lambeth Group was deposited in a sub-tropical environment with average sea temperatures of 17°C at latitude 40°N during a period of opening of the North Atlantic with no ice caps and volcanicity in north-west Scotland leading to ash falls in the area. Cycle 1 begins with marine conditions in the Upnor Formation and then a period of local uplift, during which the Upnor Formation is subject to continental weathering with some deposition. New sea-level rise leads to estuaries followed by more weathering as sea level falls. Variation in the Lambeth Group is due to the variable environment of deposition due to sea-level rise and fall, heterogeneous sub-tropical climate weathering and faulting at the time and afterwards.

Faulting can be difficult to see in the London Clay but Lambeth Group faults are easier to see than those in the Chalk, Thanet Formation or the London Clay. Understanding of the Lambeth Group allows interpretation of more accurate fault dating. Areas with rivers tributary to the Thames appear to be associated with complex faulting and with more sand channels in the Lambeth Group. At Bond Street Station, a 12m-deep, 300m-wide sand channel occurs in the Upper Mottled Beds with no hydraulic connection between the upper and lower parts of the Lambeth Group.

Faults are important because they may extend into the London Clay, they confuse the stratigraphy, bring unwanted lithologies into the tunnel or pile alignment, may reduce stability or strength in extreme cases and they are difficult to sample. Faulted zones may not be recovered in site investigation boreholes. As a result, design may be based on false premises. The Wimbledon, Streatham and Greenwich Faults have long been known but there are also a lot of north-east/south-west faults with complex strike-slip.

Managing the Lambeth Group

Managing the Lambeth Group requires training and an understanding of the stratigraphy, well scoped ground investigations, good communications, drilling, logging and interpretation, a good total ground model and cross-sections, site-specific testing with appropriate care of samples, geotechnical risk management and mediation of risks, eg by groundwater management.

The Crossrail project specified geological training for personnel, which started in 2002. The aims were to improve borehole logs and interpretation, supervision of site and understanding of site with better descriptions and communications standards and accurate testing. 500+ people have attended the courses, ranging from loggers to directors and contractors.

Site investigation in the Lambeth Group requires a good site investigation company with trained staff, rotary, rotary and cable percussion or sonic drilling and attention to spacing of boreholes, including being ready to do more boreholes if necessary. Core loss is possible and there is a need to monitor water-bearing layers and possibly for gas. Good supervision is required and cores should be examined from bottom up under good lighting with careful logging. Care of samples is essential since oxidation can be rapid.

Conclusion

The speaker concluded that the Lambeth Group is very variable; it requires care at every stage and the use of the best possible ground model with good intelligence and communications. Never be afraid to ask for help!

Report by Dave Brook

4. Travellers, bathers and walkers: the origins of British geological fieldwork

27 November 2014

At the Home Counties North regional Group meeting at the Open University, 17 people heard Tom Hose, a consultant in geotourism and geo-interpretation give his talk on **Travellers, bathers and walkers: the origins of British geological fieldwork.** This presented a very different perspective on how the development of field work and field guides in modern geological education and geotourism provision relied for its early development on changes in social history and cultural attitudes.

Defining geotourism as the provision of interpretation facilities and services to promote the value and societal benefits of geological and geomorphological sites and geoscience, the speaker used a time-line of major geotourism events from the late 17th century to the present day to illustrate the interplay between geology and society, with particular reference to southern England.

The British relationship with the countryside as distinctive goes back to the 1840s, the census of that time showing that over 50% of the population lived in towns. By the end of the 20th century, it was 80%. There is a long association of myths of the countryside reflecting the fact that perceptions of landscape are a mix of observation and cultural interpretation. While guide books are useful, they tell you what you should see and not what you see. These myths are also reflected in 3 artistic movements, the sublime, the picturesque and the romantic.

In the 1730s to 1750s, the preferred landscape was a controlled landscape showing a humanised scene of cultivation. Wild areas such as the Peak District or Flitwick Moors were regarded as dangerous and the haunt of footpads and other undesirables. This is reflected in 18th century naturalists and travellers diaries such as those of Celia Fiennes, who travelled in Hampshire and the Isle of Wight and Daniel Defoe, who explored the Isle of Sheppey, describing it as marshy and unhealthy ground. Travellers' interests affect the mindset and influence the experience and art galleries and tourist publications create special expectations. Special mention was made of John Glover, a painter who was financially and artistically more successful than Turner but is less well known because he moved to Australia, where he is acclaimed as the father of Australian landscape painting. His paintings are so accurate that it is possible to recreate the biodiversity from them.

Coastal tourism essentially began in the early 18th century, when the Reverend William Clarke went sun-bathing and nude sea bathing at Brighthelmstone (now Brighton), with Thomas Barber building his sea baths at Margate in 1736.

The first determined travellers were government or commercial and many early geologists had a clerical or military background. It was not easy, since lightweight camping did not develop until the 1890s and travelling was difficult. From the 17th to the mid-19th century, long-distance travel was on horseback at a speed of about 50 miles per day so Oxford and the south-east coast would be one day's journey from London, while it was 2 days to Birmingham and 6-7 days to Edinburgh. From Roman times, most transport had been by navigable rivers but the canal boom extended the range of water-borne travel at a leisurely pace of about 35 miles per day by the early 18th century. Turnpike roads were operating from the late 17th century and the development of tarmac meant coaches were able to carry 8-14 passengers at 8-10mph. Between 1750 and 1850 road journey times roughly halved. The development of railways greatly increased the speed of travel, with the Liverpool and Manchester Railway achieving speeds of 20-30mph. This opened up the countryside to a much greater extent, enabling journeys of 120+ miles per day and commuting of 30 miles or so. It also tended to break up the rigid social order.


Hillwalker, Bradbury (1884) Rev.Buckland in the field

Geotourism and health tourism really started in the late 18th century with developments such as the Sea Bathing Infirmary of John Anderson in Margate in 1791 and subsequently Clifton Baths, Margate, in the 1820s, involved excavation of the chalk cliffs and construction of sea defences. At the time boat passage was both quicker and cheaper than by land. The construction of the Royal Pavilion at Brighton began in 1787 and Brighton's indoor baths were built in 1769. Brighton became the fashionable resort. The south and south-east coast of England were favoured for visitors because of their proximity to London and the Court.

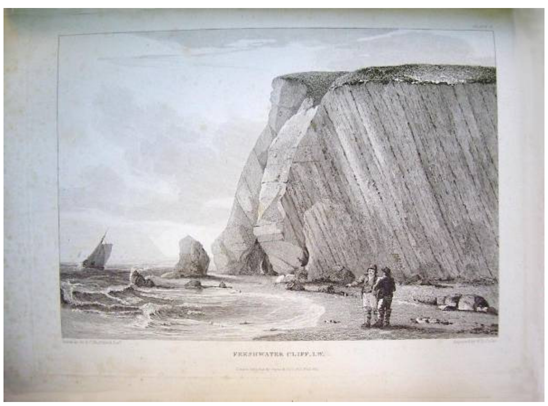
This period also saw the real birth of the guide book, although the first was published in Derbyshire in the 1670s. Cooke in 1808 published *A new picture of the Isle of Wight* and the Isle of Wight was the first to have a geological guide book by Thomas Webster, illustrator and curator of the Geological Society. The guide book was essentially a British and German invention with Murray's *Handbook for travellers* and Baedeker guides in Germany, which were the first to grade hotels, restaurants, views and sites. Libraries and museums also developed in the 19th century with the first purpose-built geology museum at the Rotunda in Scarborough.

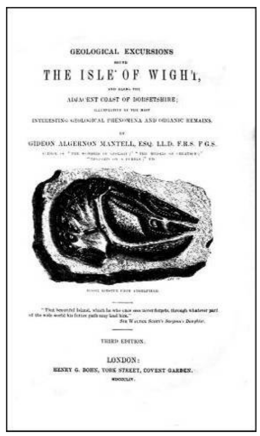
The geology attracted travellers and justified their travel. At Rottingdean, for example, tourists collected pebbles of agate and chalcedony from the beach and polished them for jewellery. Among the guide books were:

- Walford (1818) *The scientific tourist through England, Wales and Scotland*, which had a limited cover of geological phenomena and an introduction to geology;
- Higgins (1842) *Geology of the watering places*, covering Brighton, Dover, Folkestone, Hythe, Hastings, the Isle of Sheppey, Margate and Ramsgate; and
- Higgins (1842) *The book of geology*.

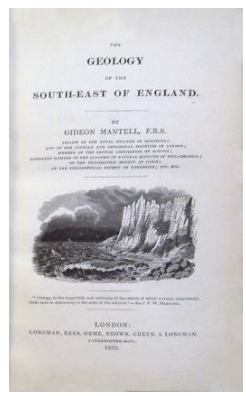
The Isle of Wight became increasingly popular in Victorian times and the south coast became the place for geological fieldwork and guides. Some notable examples are:

- Englefield (1816) *A description of the principal picturesque beauties, antiquities and geological phenomena of the Isle of Wight* with 12 geological letters by Thomas Webster;
- Gideon Mantell (1822) *Fossils of the South Downs*;
- Mantell (1827) *Illustration of the geology of Sussex*;
- Mantell (1833) *Geology of the south-east of England*, the first systematic regional geological account.





GEOLOGICAL EXCURSIONS
THE ISLE OF WIGHT,
ADJACENT COAST OF DORSETSHIRE;
INTERESTING GEOLOGICAL PHENOMENA AND ORGANIC REMAINS.
GIDEON ALGERNON MANTELL, ESQ. LL.D. F.R.S. F.G.S.
THIRD EDITION.
LONDON:
HENRY G. BOHN, YORK STREET, COVENT GARDEN.



GEOLOGY
SOUTH-EAST OF ENGLAND.
GIDEON MANTELL, F.R.S.
LONDON:
LONGMAN, REES, ORME, BROWN, GREEN, & LONGMAN.

Englefield (1816) FW Plate **Mantell 1833** **Mantell 1854 Title page**

Geological textbooks included Lyell's *Principles of geology* and De la Beche's *Geological manual* (1831), *How to observe* (1835) and *The geological observer* (1851). The Isle of Wight featured strongly with Wilkins (1861) *A concise exposition of the geology, antiquities and topography of the Isle of Wight*, Norman (1887) *A popular guide to the geology of the Isle of Wight* and Mantell (1847) *Geological excursion round the Isle of Wight and the adjacent coast of Dorsetshire*.

Conclusions

The developments mentioned above represent more than mere scientific endeavour and the question must be asked as to whether we can learn from the past. Reversing the conventional geological saying that the present is the key to the past, in terms of geological fieldwork and geoconservation, the past is the key to the present. Historical studies of geotourism and geoconservation provide the context and common interest and practitioners employ the research findings.

There are now lots of guides on how to present data and on the writing of interpretation panels, which are vital elements in present-day developments in geotourism.

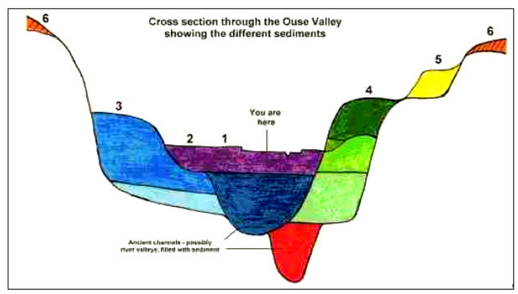
Report by Dave Brook

Field meetings

Geology, sedimentology and archaeology of Harrold-Odell Country Park and guided walk in Harrold village, Bedfordshire

2 August 2014

On Saturday 2 August, 12 people met John Wong, the field trip leader, and Richard Dowsett, the Park Ranger in the car park at the Harrold-Odell Country Park. Richard explained the geology of the Country Park using the section prepared by a PhD student several years ago. The Jurassic bedrock is completely masked by fluvio-glacial gravels of Devensian age, which are overlain by the modern valley of the River Great Ouse with its terraces. Sand and gravel were quarried from 1951 to 1979 leaving the legacy of the 2 lakes and waste was tipped alongside Kingfisher Lake from the Harrold dolls factory.



Number	Where is the evidence?	What will I find there?
1	Radwell	Post-glacial valley and sediments
2	Galley Hill	
3	Railway cutting NW of Bedford	Late Ipswichian & Early Devensian sediments
4	Stoke Golding	Mid Ice Age gravels
5	Biddenham	Early inter-glacial sediments
6	Sharnbrook Summit	Anglian ice age melt water deposits

Plan of the Harrold-Odell Country Park Cross-section through the Great Ouse valley
© Harrold-Odell Country Park, Bedfordshire County Council

Richard then led the party on a walk around the park, walking over the flood plain of the Great Ouse and stopping to look at the made ground on the shores of Kingfisher Water and then across the post-glacial river terrace, which stays dry unless flooding is severe. Across the river can be seen a terrace on the south side of the river which forms the hill on which stands Chellington Church.



Made ground, Kingfisher Water **On the flood plain of the Great Ouse** **Flood plain & terrace with Chellington Church**


River-level measurement


Former ox-bow lake


Gravels in banks of Great Ouse

Following the Great Ouse downstream, Richard pointed out the small 0.2-0.3m levée alongside the river created by sediment being deposited as the river flow slowed when overflowing the bank and the former ox-bow lake, which is now reduced to a marshy hollow. We also saw the river-level measurement stake, which is read daily and shows that about 18cm of sediment have been deposited in the last 10 years. The terrace deposits were examined in the banks of the river and we then moved into the nature reserve. Alluvial clay overlying the gravels of the terrace could be clearly seen in animal excavations in the Rabbit Warren. On the banks of Grebe Lake, further made ground deposits were examined and the terrace gravels could be seen in the cliffs on Heron Island. Richard explained that there was clear evidence of the presence of a late Iron Age and Romano-British farmstead beneath Glebe Lake between Heron Island and the Visitor Centre.


Terrace gravels the Rabbit Warren


Made Ground, Grebe Lake


Gravel cliffs, Heron Island

After a lunch break at the Visitor Centre and a short wait for the intensity of rainfall to reduce, John explained the local geology and geomorphology, using a digital terrain map to point out the clearly defined straight edge to the flood plain upstream of Harrold, where it is edged by the Blisworth Limestone (water tends to flow underground rather than as surface tributaries) in contrast to the deeply indented floodplain downstream, where tributary streams flow over the Oxford Clay. Shelly limestone and oolitic limestone of the Blisworth Limestone Formation are the predominant building stones in the village of Harrold. It thins greatly to the north, a result of the distance of sediment transport in mid-Jurassic times from the Anglo-Brabant massif.


Harrold Bridge


Harrold Causeway and flood arches over the flood plain


River terraces rising from flood plain

8 of the party then accompanied John to look at the Harrold Bridge and Causeway, which were repaired by Bedfordshire County Council in 1986-92. The bridge has 6 arches over the river Ouse,

which are all of different design due to a failure to reach agreement between the 3 parish councils (Harrold, Charlton and Chellington) which meet at the bridge. On the south bank of the river, a causeway runs parallel with the road over the flood plain, with 9 arches to allow flood water to



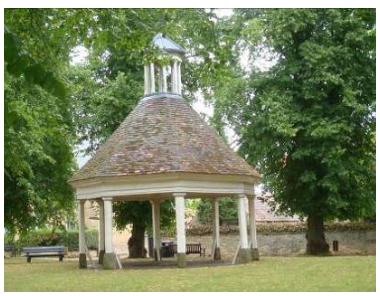
Oolitic limestone and shellly limestone with cross-bedding, outer wall of St Peters Church

Minor flooding of road

Harrold House

pass beneath. The almost ubiquitous use of Blisworth Limestone in the houses in the village was noted and we stopped at St Peters Church with its gothic spire to look at some of the sedimentary structures evident on the rubble stones and ashlars on the walls of the church. The rubble stones are predominantly a variety of Blisworth Limestone, which is pale yellow in colour and consists of closely packed shelly fragments with well developed sparite cement with the weathered surface showing cross-bedding and aligned shelly fragments. The ashlars are predominantly oolitic limestone.

At that point, a torrential downpour led to a visit to the church, which contains elements of an earlier Saxon church, though building of the present church probably began in the 12th century. It was extensively remodelled in the early 13th century with the clerestory and tower added in the 14th century.



Buttermarket

The lock-up

Oakley Arms

Finally, the rain stopped and we crossed a minor flooding of the road to the village green, which has two historical landmarks, an 18th century buttermarket and a circular lock-up or prison built in 1824. We then adjourned to the Oakley Arms for refreshment.

Report by Dave Brook

Pre-Anglian, Stanmore Gravel Formation on the roof of the eastern Barnet Plateau - stratigraphy, sedimentology and human impacts

7 September 2014

INTRODUCTION

The party of 7 met at the restaurant in the parking area, of the Trent Country Park (TQ282929) close to Cockfosters Underground station. The party doubled up in cars to reduce the problems of parking on verges at some of the points visited.

The visit was led and supervised by John Wong, who gave an initial briefing. The principal aim was to look at the Stanmore Gravel Formation. This formation consists of a string of gravel deposits sitting at the top of the remnant plateau areas on the London Clay extending from Stanmore almost to Hadley Wood at a level generally above 125m OD. These are by far the highest drift deposits in the area. On early geological maps they are often referred to as the Pebbly Gravel but since the publication of the BGS memoir No 256 for North London (Ellison et al, 2004), the new formation name has been used. After the initial briefing the party proceeded to Monken Hadley Common

Field trip party at Monken Hadley

Examining winterbourne gravels, Monken Hadley Wood

At Monken Hadley Common (TQ 255977), the Stanmore Gravel could be seen to underlie a grass-covered flat area, with lower tree-covered slopes to the south east. The break in slope marked the upper edge of the tree-covered area, where gorse was a common occurrence. In the woodland, which comprised largely oak, drainage ditches had been dug to the London Clay and in the sides of these ditches thin sandy gravelly pockets could be seen. The gravel was almost entirely flint, generally with remnants of the white cortex, or else entirely white cortex. The bed was not continuous and after some discussion it was accepted that these deposits represent soliflucted material from the gravel above.

Studying Stanmore Gravel at Hadley

Hadley Green

This site illustrated clearly the difficulty of accurately mapping the extent of the gravel.

The next stop was the pond at Monken Hadley, near the monument to the Battle of Barnet 1471. Here the sides of the pond revealed sandy gravel deposits below surface debris containing brick and plastic. The pond level, just 1.2m below the general surface level, is evidence of a high water table in the area and the necessity of the drainage ditches at the first site.

The sandy material was classified with the aid of a triangular soil distribution chart supplied by John Wong. It clearly lacked cohesion and it was not possible to obtain a “worm” from rolling the material in the hands and fingers. This indicated it to be non-plastic, with probably less than 5%

clay particles. The material felt gritty and visual examination with a hand lens, suggested the material contained no more than 25% of silt. Using the soil classification chart, this is a "sandy loam", but for engineering purposes BS5930 would classify it differently.

Lunch was spent on the green by the side of the old church in Barnet. The church was of considerable age but had undergone major restoration in the 1860s including new frontages, constructed in part from Bath freestone (Oolitic limestone) which had a warm cream colour, and partly in mortared cobbles of flint. The mortar was light grey in colour and therefore considered to have used Portland cement (OPC). Both the limestone and the flint walling reflect the age of reconstruction, ie Portland cement was not available before 1850 and the use of Bath Stone became possible immediately after Box tunnel was constructed on the GWR railway. This allowed new reserves of stone to be exploited. It could be transported from the area by rail to London and elsewhere.

After lunch the party visited the local museum and were treated to a talk on the Battle of Barnet by an associate of the library. The library also contained a wide collection of mediaeval artefacts, local pictures and a display relating to the very large Friern Barnet Hospital, which was established in 1851 as an asylum and was closed in 1993.

Afterwards the party paid a visit to the Battle of Barnet monument itself, to view the northern edge of the Stanmore Gravel. The slopes below the plateau top appear to be very marshy. As explained in the talk at the museum there is no archaeological evidence to locate the Battle of Barnet accurately, but it is known that marsh land played a significant part in the battle. The monument itself dates from 1740 and consists of a pillar of Portland Stone over a base plinth of reddish grey granite which is thought to be from Mountsorrel, Leicestershire. The monument was moved to the north to make way for a new road alignment some years ago and closer to the marshy area at the edge of the plateau. There is a local concern that if the battle site proves to be much further north than the monument itself, it will be in Potters Bar and not Barnet.

Battle of Barnet talk at Barnet Museum

On-site pebble frequency analysis, Stanmore Gravel, Arkley Nature Reserve

From the monument the party travelled to the Rowley Green nature reserve near Arkley (TQ215951). After crossing the very wet area of the reserve itself with ponds and peat deposits, the party reached an area where an infilled gravel pit exists, and where the gravels could be inspected in the sides of a large drainage ditch. A frequency analysis was undertaken using a 150mm cut out triangle supplied by John Wong to measure and count gravel particles of various sizes. The result of the frequency analysis showed a fine to coarse gravel with a few flint cobbles. The gravel was generally subrounded. As elsewhere, the gravel proved to be entirely flint but there are references in the literature to chert from the Lower Greensand of the Weald also being present. The mineralogical content suggests that the source is local to the Chalk basin of southern England. No banded quartzite, quartz or other rock types from Wales were found in this deposit as opposed to the proto-Thames gravels of the Beaconsfield area where they are common. This suggests that the age of the Stanmore Gravel must be before the diversion of the proto Thames. The nature of the deposit was further discussed. The somewhat variable base level of the Gravels indicates the possibility of them being laid down in a set of multiple channels which were flowing towards east-north-east. There is no evidence of the gravels being associated with ice sheets. The areas to the north and south of these channels must have been in the Bagshot Beds, which are far less resistant to erosion than the Stanmore Gravel. Their removal, leaving the surface of the London Clay exposed, would explain the train of Stanmore Gravel deposits across North London.

From Rowley Green the party made its last stop at the Moat Mount Open Space (TQ211941) on the east side of the A1. From the hillside above the car park, Barnet church could be seen in the distance just north of east. There were small exposures of the gravel in ditches but the shortage of time meant they were not examined in detail. The site at Arkley Windmill was also not visited.

Stanmore Gravel outcrop, Moat Mount

The age of the Stanmore Gravel is pre-glacial and the BGS memoirs indicate that there are deposits of boulder clay on it. It is, therefore, considered that it is of late Pliocene/early Pleistocene age and it may be contemporaneous with the Crag deposits of East Anglia. The type section is a borehole TQ19SE/5 (TQ15509394) sunk on Stanmore Common and recorded by Gibbard, P (1999 - The Thames Valley, its tributaries and their former courses. Pp 45-58 in Bowen, D Q [editor], *A revised correlation of Quaternary deposits in the British Isles.* London: The Geological Society) The borehole recorded a thickness of 4.5m but gravel extraction in the 19th century has left some pits deeper than this, especially to the west of A409 on Harrow Weald Common. The BGS memoirs suggest a maximum thickness of 7m.

The meeting was enjoyable and gave some new insights into the Pleistocene period of the area.

Acknowledgements are made to John Wong and Sarah Smart for their comments.

Report by Tom Powell

Behind-the-scenes palaeontology workshop. Part 3. Quaternary pleistocene (plus Puddingstones and prehistoric struck-stone flakes) at the Burymead Museum Resource Centre, Hitchin

21 October 2014

5 Members of the society met John Wong at the Burymead Museum Resource Centre in Hitchin to inspect the collections of Pleistocene material. Earlier visits had looked at the Jurassic and Cretaceous collections. We were accommodated around a small table in a room packed full of natural history exhibits, such that the palaeontology being carried out was overlooked by stuffed owls, squirrels and a variety of other animals in glass cases.

Palaeontological collections are stored in large drawers whilst many individual specimens were kept in transparent plastic boxes. All the samples could be handled and examined, many with the aid of members own hand lenses.

The Hitchin Museum is presently being closed and renovated in High Street. The Burymead Museum Resource Centre will supply exhibits for the Hitchin Museum, which is located within the Hitchin Town Hall. The Resource Centre is the responsibility of the Cultural Services Manager. Apart from supplying material for the permanent and temporary displays of the museums, it also supplies material on loan to local schools.

Some of the specimens were dated from 1934 and the total number of specimen has been estimated at 10,000. It must represent a major collection in the U.K. Unfortunately, some of the locality information was missing and this makes those individual specimens less useful for geologists.

The base of the Pleistocene was represented with specimens from the Red Crag, ie *Neptunea*, *Glycimeria, Emarginula* sp, various *Ostrea*, other bivalves and worm tubes. As expected these were often stained with red oxide. Several large shark teeth were also examined. The size had been interpreted as a large shark (*Procarcharodon auriculatus*), the same genus as the present-day great white.

The later Pleistocene specimens came mainly from Pleistocene gravel pits and included drawers of mammalian bones, which included elephant (*Mammuthus primigenius*) tusks, bear *(Ursus*), cattle (*Bos*) and deer (*Cervus*) antlers. Amongst these were the impressive collections of mammoth molars showing their unique growth patterns and tusks.

As well as the mammalian bones, there were several collections of mainly erratics including vast collection of *Gryphea sp*. (devil toenails), which might lend themselves to statistics. Other collections of erratic material comprised silicified *Porosphaera*, ferruginised wood, belemnites, silicified *Micraster sp*, a number of bits of ammonites including a complete frontal *Hildoceras* specimen and a fossil fish.

Remains from peat deposits appear to be somewhat lacking in the collections.

The opportunity was also taken to look at samples of Hertfordshire puddingstones and struck flints collected from the Frodham Hall Farm village excavated in 2008 plus other representative lithologoies from various localities.

Much was learnt from discussion within the group.

Report by Michael McCuloud & Tom Powell

Future Programme of the Home Counties North Regional Group

Your Committee are currently working to develop the programme of events for 2016, which will be of interest to members of the group. We will continue to vary the venues and if anyone knows any other venue that would be available and would suit members of the Group then please let your Committee know the details.

Field meetings

A varied programme of field meetings has been arranged for 2015 (many of which have taken place before production of this Newsletter) and John Wong has been working to develop this and looking to run more in 2016. Again, if anyone knows any suitable field trips and would be willing to lead them, please inform your Committee.

The final field trip of the year will be on Sunday 25 October on **Geology, geomorphology, palaeontology, flooding and industrial archaeology of the Pymmes Brook and its catchment are – Part 1.** It will go from the shore of Beechwood Lake in Monken Hadley Common in north London to New Southgate.

Evening meetings

On Thursday 19 November, Mark Sutton of Imperial College will be talking on **Virtual palaeontology** at Sir Robert McAlpine in Hemel Hempstead.

The Annual General Meeting of the Group will be at Sir Robert McAlpine in Hemel Hempstead on Tuesday 19 January. The AGM will be followed by a talk by David Shilston of Atkins, past president of the Geological Society, on **The Lusi mud volcano, Indonesia.**

Other events

We are also hoping to run the:

- **Schools Geology Challenge** for those schools in the region that teach courses in geology.

The winners of this event in the region will go through to the national finals at the Geological Society next year.

Your Committee, most of whom have full-time jobs and put in a great deal of effort on a voluntary basis, will continue to develop events to meet the needs of the Group and will up-date the programme on the website and keep you informed on what is happening.

Thanks are due to the speakers (who again provide their services on a voluntary basis) for presenting their talks, particularly to those who have confirmed that the reports in this Newsletter represent a reasonable summary of what they said and provided appropriate illustrations, and to those members of the Committee who have organised individual evening and field meetings and to those who provided reports on them.

If you have any comments on the content of this Newsletter or suggestions as to events the group should consider holding, please let your Committee know by e-mailing homecountiesnorthregionalgroup@gmail.net and keep checking the website http://www.geolsoc.org.uk/hcnrg.

Dave Brook

Newsletter Editor