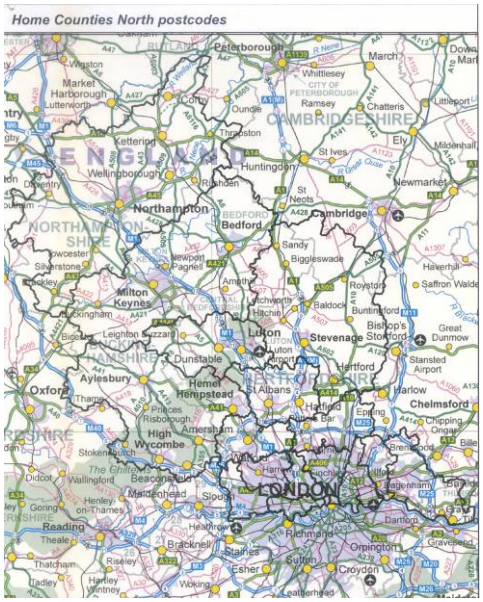
Home Counties North Regional Group

Newsletter - Issue No. 1

WELCOME to this first edition of the Newsletter of the Home Counties North Regional Group. We hope to produce this on a regular basis to keep you informed of what is happening in the region and how the group is developing. In this edition we tell you how the Regional group was re-established after a long hiatus with no discernible activity. We also give you a little information about your Committee and report on the meetings we have held to date and give you a taste of what is coming over the next few months. The picture above is of washed Stanmore Gravel, a Quaternary gravel of somewhat disputed origin, in a stream bed at Stanmore Country Park in the London Borough of Harrow.

Re-birth of the Home Counties North Regional Group

While there had been an active regional group in the northern Home Counties in the latter part of the 20th century, by the mid-1990s it had become essentially inactive. It took some years for interest to be re-established but in October 2012, Susan Marriott (the then Vice-president, Regional Groups) e-mailed around 822 fellows (of whom 142 are chartered geologists), candidate fellows and juniors within the Home Counties North post codes in the following terms:



Several Fellows have recently enquired about Regional Group activities in the Northern Home Counties. At present the nearest groups are in the Thames Valley, East Anglia and East Midlands regions, which are probably not logistically convenient for Fellows from the Northern Home Counties to attend meetings regularly. We therefore propose to set up a working party to investigate the feasibility of setting up a new Regional Group.

On 27 November 2012, Officers from Council met 9 members from the region (12 further members had expressed interest but had sent their apologies) to look at issues relating to setting up and running a Regional Group, including finances and aspects of Chartership and mentoring. While these numbers were small, it was agreed that there was sufficient interest for the Regional Group to be re-established and those present, together with others who had expressed an interest, became the *de facto* Committee.

Meet Your Committee

Officers

Sophy Crosby is the **Chair** of the **group.** A secondary-trained teacher, she has been providing

geo-education workshops and activities in collaboration with University College London Museums, for schools, community groups, & hospitals across London for the last 7 years, since completing a Geology BSc (Hons) at UCL as a mature student. She is also a keen and practicing sculptor. She became Chairperson of the HCN Regional Group after having searched for local group events with no result and discovering that her local group had disbanded. Previously, after having completed a Philosophy BA (Hons) at the University of Greenwich and PGCE at the Institute of Education, Sophy taught Geography/Study Skills on a part-time basis and also became actively involved in a variety of community groups, including becoming Chair of a local school PTA, while raising her two children. Sophy has recently formed a company with petrologist Dr Roy Gill called 'GEO-Fun – The Art & Science of Reading Rocks'. Their aim is to stimulate and promote a life-long interest in geology for all ages by providing fun, collaborative, 'hands on' activities involving a fusion of both science and art. Supported by Roy's unique and extraordinary collection of rocks mainly from around the British Isles and a VW Transporter van called the 'Rock Rover', they have already worked for the Bloomsbury Festival and have been offered a place at WOMAD next year… so watch this space!

Geoff Faro is **Secretary** of the **group.**

Louise Cox is the **Treasurer** for the group. Currently working in London but living in Hitchin, she

was keen to see the group come to life again and host meetings in the northern Home Counties area. She graduated from the University of Reading with a degree in geology and went on to specialise in contaminated land at Royal Holloway. She has been working in the contaminated land industry for over 7 years and currently works for Arup as a contaminated land consultant.

Ordinary Members

Catherine Everett joined the Geological Society in 2002 after graduating from Portsmouth

University with a Masters degree in Ground Investigation and Assessment. After gaining Chartered status in 2008 she now works as a geotechnical engineer for Sir Robert McAlpine Design Group and has the opportunity to influence a wide variety of projects from tender stage through to construction. In her spare time she enjoys her young family with her husband, daughter and two Spaniels.

Dr David Brook OBE Cgeol, FGS, FIQ has a BSc (Swansea, 1965) and a PhD (Birmingham,

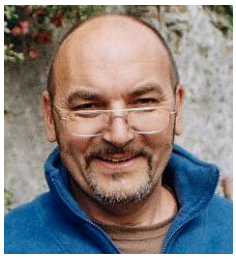
1973). He worked for British Antarctic Survey 1965-71, spending 2 months in South Georgia then 2 years at Halley Bay and 3 years writing up at Birmingham University. Dave was in the Minerals Planning Division of the Department of the Environment (and its successors) 1972-2004, with responsibility for planning aspects of land stability, environmental effects of mineral working, contaminated land, air and water pollution, sustainable drainage, flooding and coastal planning. He was awarded the OBE for services to the Office of the Deputy Prime Minister (incorporation of science and engineering in planning policy) in 2003. He has acted as a consultant since retirement. Dave chairs the London Geodiversity Partnership, is Vice-President of the Harrow & Hillingdon Geological Society and a member of the Geologists' Association, the British Geotechnical Association, the British Tunnelling and British Dams Societies.

Jessica Macdonald studied Geology at Southampton University to complement a lifelong habit of picking up rocks and reading about volcanoes and earthquakes in glossy books filled with exciting pictures. After completing her Bachelors degree in the class of 2000, she joined the Water Resources team of the local water company to undertake general environmental projects and collecting water level data to analyse. Over the next decade, she moved on to undertake visual and geophysical inspections of water abstraction boreholes. It's actually more interesting than it sounds…… Now she is less involved with the technical side of the day job she has joined the HCN committee to quench an appetite for understanding all things geologically related, especially if beer is involved

Mark Brandon (standing in for Hazel Rhymer) is an oceanographer who formerly worked for the British Antarctic Survey. He is representing the Earth Science department at the Open University.

Jonathan Vetterlein has worked for the Environment Agency for 6 years in the Groundwater, Hydrology and Contaminated Land team in North-east Thames, based in Hatfield. His work includes assessing compliance of groundwater bodies with the objectives of the Water Framework Directive, managing the groundwater quality monitoring network and dealing with the risk to groundwater from major transport projects.

Seamus Lefroy-Brooks is Chairman of the Association of Geotechnical & Geoenvironmental Specialists (AGS) and chairman-elect of the Land Forum that brings industry organisations together with government departments to discuss issues of brownfield development and sustainability. He is also one of the 12 National Experts appointed to the Defra panel to assist local authorities with the regulation of Contaminated Land. Seamus is multi-chartered as a Geologist, Civil Engineer and Environmentalist and has worked in the ground investigation sector since 1980. Through his firm, LBH WEMBLEY Geotechnical & Environmental, Seamus works as a consultant to land owners, developers and regulators alike and endeavours to bring an experienced and practical eye to the solution of all manner of ground-related problems. He has young children and a regional group holding evening meetings in or near Milton Keynes is more accessible than London.



Alistair Dewar is a Chartered Geologist who has spent 10 years working in various geotechnical roles in UK and the Middle East. He currently works for a large civil engineering contractor undertaking a variety of geotechnical design work with particular emphasis on the design of temporary works associated with the construction of deep basements. Alastair is also a Specialist Advisor for the Inland Waterway Authority.

Kevin Fielding

Co-opted Members

John Wong is a keen geoscientist on many aspects of geology. He has a BSc in Geology (University of London) and MSc in Analysis of Geoscience Data, including computer modelling (Kingston University). He also studied Masters degrees in Petroleum Geology and Geophysics at Greenwich University and Sedimentology at University of London. John has worked in the oil and gas industry as Development Geologist and Consultant Geoscientist. He is the Field Officer for the Amateur Geological Society (AGS, based in Finchley, north London) since 2007 and has

organised/led more than 60 monthly field trips for the group, including visits to many working quarries, and a behind-the-scenes visit to the Department of Energy and Climate Change. His current field trip programme for the AGS includes a series of 12-part geology field trips in the London Borough of Barnet, the next one (part 7) being in the spring of 2014. John was the Events Organiser for the Bedfordshire Geology Group from 2008 to 2010. John has a passion for vertebrate palaeontology and has presented a lecture and a hands-on workshop (with fossil specimens) on the evolution and morphology of ichthyosaurs at the Hitchin Burymead Museum Centre. geoarchaeology of Hertfordshire and medieval battlefield geology are amongst John's many leisure research interests in geology.

Charlotte Murray graduated from the University of Birmingham in the summer of 2012 with a degree in Environmental Geoscience. Since then, she has worked for Soiltechnics, a Northampton-based environmental and geotechnical consultancy. Her work is split between supervising site investigations all over the country and writing reports back in the office. In her spare time, she enjoys competing her horses at local shows.

Sarah Smart is a Chartered Geologist and Chartered Scientist with 30 years experience focused on geological materials used in construction. For many years her specialism was concrete, but currently she works as a Quality Manager for an asbestos consultancy. Sarah also has experience facilitating the geological aspects of the Key Stage 2 science curriculum, including organising field trips to identify geological and man-made materials in the built environment.

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.

Launching the Home Counties North Regional Group

The UK Stratigraphic Beer Tour
23 April & 1 May 2013

The re-established Home Counties North Regional Group of the Geological Society held two launch events on 23 April at Affinity Water, Hatfield, and on 1 May at the Open University, Milton Keynes. At both events **Hugh Mallett (Technical Director, Ground Engineering, Buro Happold)** presented his light-hearted talk – **The UK stratigraphic beer tour** - about the influence on beer of the geology around a brewery, particularly the local aquifer, from which the brewery obtains its water.

This lecture arose from a successful pitch by Hugh and a colleague to Buro Happold's internal "Dragons' den", which aims to encourage employees to develop ideas for use within the company. The pitch was to develop a talk on the relationship between geology and beer, largely for engineers and others with relatively little knowledge of geology but it has also been given as light relief to audiences including geologists. It involves tasting of 3 different beers from 3 different geologies and geological periods and scoring them for their taste on a scale ranging from 1 to 10.

The relationship between geology and beer is fundamental. For example, the hard water in Dublin is ideal for the production of stout and the evaporite-rich water in Burton-on-Trent brings out the bitterness of the hops and helps to give the beer longevity, which was needed for shipping out to India – hence the name India pale ale. Of passing interest is the fact that the St Pancras Station undercroft (now passed through on the way to Eurostar) is supported by columns at 4,47m spacing, exactly the same as in brewery warehouses. This spacing was dictated by the standard size of a barrel and the undercroft was used to store beer received from Burton before it was moved to the docks for shipping to India.

Old Empire Pale Ale produced by Marston Brewery on Triassic New Red Sandstone (now Sherwood Sandstone) 290-250 million years old – Alcohol by volume 5.7%. The brewery still uses the original Burton well discovered by Benedictine monks in the 13th century and it is still brewed in oak casks. It has a pale appearance and strong hoppy taste and the higher alcoholic strength necessary to last the 3 month journey to Bombay. It is brewed using optic malt, a subtle and pale grain that will allow other flavours to come through on the palate. Goldings and Fuggle hops are added and then it is late hopped with the American Cascade variety for extra high strength.

Geological tine - One feature, with which many non-geologists have some difficulty, is the concept of geological time and the age of the earth. Archbishop Usher of Armagh in 1645 estimated on biblical evidence that the earth was created in 6 days in 4004 BC. Hutton, Lyell and Darwin and their followers struggled with this concept as it was clear from the geological evidence they saw that much longer was needed to develop the earth as we now know it. In 1913, Arthur Holmes, while still a student at Imperial College calculated on the basis of radioactive decay that the earth was about 2,000 million years old. More recent radioactive dating based on lead isotopes puts the age of the earth, meteorites and moon rocks at 4,600 million years (MA).

To assist in visualising geological time the analogue of a 24-hour day is often used. On that basis, the earth formed at midnight and it was only at 02.40.00 (4,000MA) that there was a solid crust. The first living cells developed at 06.25.00 (3,300MA) and photosynthesis developed at 13.20.00 (2,000MA) to produce an oxygen-rich atmosphere. The Cambrian explosion of the fossil record occurred at 21.10.00 (5-600MA). At 22.05.00 (325MA) there were abundant coral seas in the Carboniferous and at 22.25.00 (225MA) there was widespread desert in the Permo-Triass. Dinosaurs were common in the Jurassic at 22.55.00 (205MA) and the first birds also appeared. At 23.10.00 (150-165MA), flowering plants appeared in the Cretaceous and at 23.40.00 (65MA) dinosaurs became extinct at the end of the Cretaceous. It was not until 23.58.00 that the first hominids developed in the Pliocene and the Pleistocene glaciation began at 23.59.12. At 23.59.59 (50,000 years) *Homo sapiens* arrived in Europe.

Bishop's Finger produced by Shepperd Neame at Faversham in Kent on the Chalk – Alcohol by volume 5.4%. This is Britain's oldest brewer (founded in 1698) and Bishop's Finger is only brewed on a Friday and only by the head brewer using antique Russian teak mash tun, water from a 200-foot deep artesian well. Kentish malt from Denne Hill Farm and east Kent Golding hops. It has been awarded Protective geographic indicator status by the European Union and is the only beer in the world that can be called a Kentish strong ale.

Geological map - William Smith was a canal engineer working in the Bath area, who noticed that the same types of fossils were associated with the same rock strata and mapped the area on that basis. He subsequently covered the country at a time when only horse-drawn (and canal) transport was available to produce the first geological map of Britain in 1815. A copy is hanging (behind a curtain to protect it from light but viewable on request) in the Geological Society.

Geology, water and beer - Brewing is a complicated process using malted barley to provide starch, brewers' yeast for fermentation and hops for flavour. As part of the research for this talk, Hugh and colleagues tested the products of 48 breweries, involving 69 beers produced on 18 rock types in 14 periods spanning the stratigraphy across the UK. Initial tasting tests in demonstrations to Buro Happold staff revealed some anomalies, such as beers that were highly marked by all but one

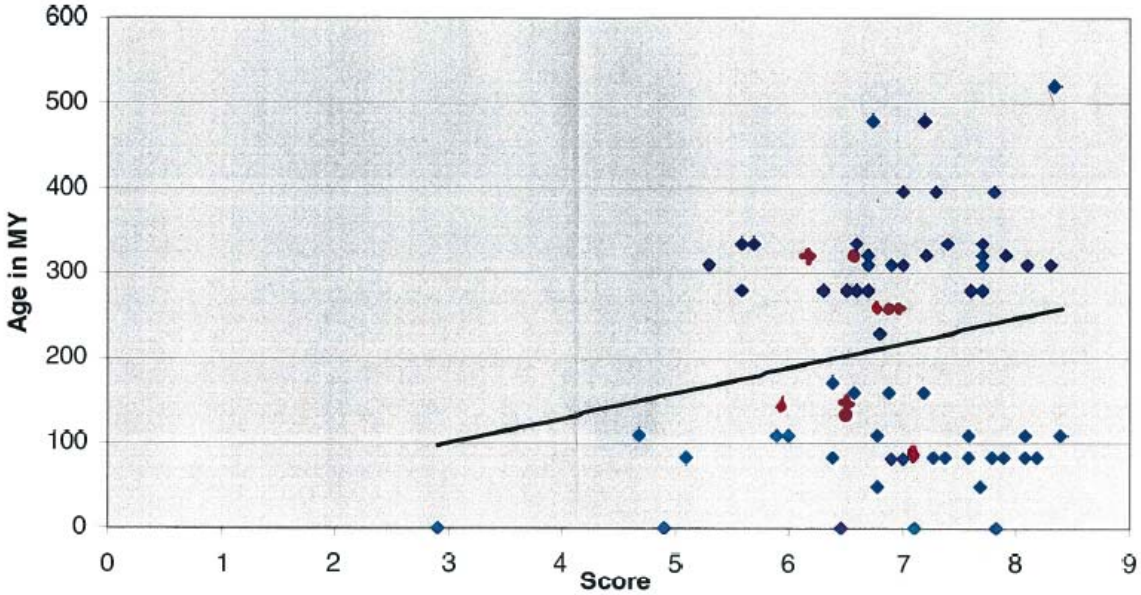
person, who gave them very low marks (he disliked beer and only drank lager!). Any average mark given may therefore be a misrepresentation because of this skewed distribution. Plotting of average scores against geological age produced a very wide scatter but asking a computer programme to put a straight line through the data suggested a slight increase in score with the age of the aquifer – very little reliance can be placed on this, however, because of the scatter.

Black Sheep Ale produced in Masham, Yorkshire, on Millstone Grit – Alcohol by volume 4.4%. This beer is made in a brewery established by Paul Theakston in 1991 after Theakston's Brewery (also in Masham) was bought by Scottish & Newcastle Breweries Ltd. It is a full flavoured premium bitter with a rich fruity aroma and a bitter-sweet malty taste followed by a long dry and bitter finish.

Conclusions – Hugh concluded that we are very fortunate in the UK to have such varied geology over a long time span in a relatively small space. He hoped that the talk had introduced some geological concepts and demonstrated the importance of groundwater as a vital resource, whose quality reflects the geology and human influence, particularly since it is very useful for making beer.

The results of the taste tests from the two talks are summarised below

Beer	Marston IPA	Shepherd Neame. Bishops Finger	Black Sheep Ale
Hatfield			
Range	3 – 10	4 - 9	3 – 9
Mean	6.65	6.57	6.21
Milton Keynes			
Range	3 - 9	4 - 9	3 - 9
Mean	6.8	6.6	6.4
Age of strata (approx. mya)	290-250	146 - 65	325



On the graph above, which illustrates the results from the talks given on this subject since developing the idea, the two Home Counties North results are shown as a red cross and a red dot

(the red diamond was BP). Hugh's overall conclusion is that geologists tend to like beer (with the exception of one Director of Buro Happold, who only liked lager and scored the beers universally low) and he needs to get some beers that people do not like so as to populate the left hand side of the graph a bit better!

Questionnaire survey at the launch events

At both launch events, a short questionnaire was distributed to obtain the preferences of those attending in terms of preferred venues and topics for meetings etc. Not including committee members, there were 43 people at the events, with 23 at Hatfield. Somewhat surprisingly, since the events were advertised on the Geological Society website and details had been e-mailed to all those in Home Counties North on the Society's database, 50% of those present became aware of the launch events by word of mouth only. 60% were members of the Geological Society, of whom 42% were Chartered Geologists with the majority of those who were not chartered, interested in becoming so. In terms of subjects for meetings, 35% were keen on geotechnics/engineering geology with contaminated land, geophysics and hard geology also being mentioned. Preferred venues were Hatfield, Hemel Hempstead and Burlington House, closely followed by Milton Keynes; other possible venues included Watford, Aylesbury, High Wycombe, Luton and Stevenage.

Meeting of the Home Counties North Regional Group
The delivery of the London 2012 Olympic Stadium
18 June 2013

At the Home Counties North Regional Group meeting at Affinity Water in Hatfield, 15 people heard **Jim Neill (Chief Engineer, Sir Robert McAlpine Ltd)** give his talk – **The delivery of the London 2012 Olympic Stadium.** While there was relatively little on the geology, an interesting talk clearly presented the design and construction of the Olympic Stadium and some of the challenges faced. The speaker was first involved in the project in 2006 and considered it one of the highlights of his career.

After describing the layout and sports venues of the Olympic Park, in the lower Lee Valley, as a whole the speaker explained what was to remain as part of the legacy of the Olympics and then concentrated on the stadium itself.

The brief was to design and construct an 80,000-seat Olympic Stadium and support delivery of the Olympic Delivery Authority's priority themes in climate change, waste management, biodiversity, inclusion and healthy living. The stadium was to be delivered 1 year before the Olympic opening ceremony (ie June 2011) and be a stadium that was capable of being demountable to 25,000 seats for legacy use.

The Contractors were Sir Robert McAlpine Ltd, the architects Populous, the engineer Buro Happold and the landscape architect Hyland Edgar Driver. Sub-contractors included Keller, Byrne Bros, Watsons, Tarmac, Ellnes, Prater, CMF, T Clarke, Imlech Meice and Seale. This was an experienced team who had previously worked together with a proven record in facilities for sport.

Key challenges were in:

- Design – the Olympic and legacy brief, a constrained site, the roof, the programme for procurement and construction;
- Town planning – 3-phase reserved matters in line with the construction programme, stakeholder engagement, CABE, LDA, Environment Agency, British Waterways etc;

- Construction – HS & E, technical, logistics and deliveries, security, co-ordination and interfaces;
- Priority themes – health & safety, sustainability, employment, equality and diversity etc
- The programme.

The stadium is in the southern part of the site, bounded on 3 sides by water and the south-west corner of the site is an area of ecological interest. 5 bridges cross the waterways, which were designed wider than is needed for the legacy to cope with flows during the Olympics. A priority was to minimise carbon emissions associated with the Olympic Park and the venues, which succeeded to the extent that they were much lower than previous Olympic stadia and lower than recent football stadia. As an illustration, the stadium used 12,500 tonnes of steel, compared to the Beijing stadium, which used about 69,000 tonnes.

The stadium was constructed in essentially 3 parts, the lower bowl with 25,000 seats (to be retained as part of the Olympic legacy), an upper tier of 55,000 seats (demountable) and the roof. A specific safety requirement was to enable people in the upper tier to evacuate to a place of safety within 8 minutes. This also required some extension to the podium level to cope with 80,000 people. The roof was also analysed for its effects on wind track conditions, the aim being to maintain winds on the track at less than 2m/sec (the limit for setting track records) as far as possible.

The site had 42 buildings on it in 2006 as well as power lines crossing it with transmission towers. It was delivered to Sir Robert McAlpine Ltd with all buildings cleared, the site flattened and all spoil removed to the "soil hospital", where $1Mm^3$ of spoil was subject to soil washing and returned to the site and re-used as fill in the Olympic Park. The area to the north was at a raised level to limit the amount of excavation required. All electric power lines had to be placed underground.

The drive was to maximise prefabrication and this to minimise on-site working and to minimise working at height. After completion of the decks, the upper one being independent of the lower one, compression trusses were fabricated and lifted in 34-tonne sections, the last one being installed in July 2009. The whole roof cable net was lifted in one go and floodlights were installed – this had to be at the right angle for high-definition television and to avoid glare. There were 44 floodlights on each 20m-high triangular unit. The fabric was installed for the roof structure and the track, infield, seating and other fittings were then completed.

The stadium was delivered 3 months ahead of programme, under budget with an exemplary safety record. For the first time in the history of the modern Olympics, an Olympic stadium was delivered without a single loss of life.

Meeting of the Home Counties North Regional Group

Tracing Visitors to our Shores

11 September 2013

At the Home Counties North Regional Group meeting at Sir Robert McAlpine in Hemel Hempstead, 23 people heard **Jane Evans (BGS)** give her talk – **Tracing visitors to our shores.** Jane has worked in isotope geochemistry at BGS since the 1980s, having spent time analysing Scottish metamorphic rocks etc. About 15 years ago, archaeologists became interested in whether some of the geological techniques being used could be of value to them, such as using isotope fingerprints to trace the origins of people, particularly strontium isotopes, which can identify the geographical range and oxygen isotopes which can indicate the climate of origin.

Isotopes have the same number of protons but a different number of neutrons. ^{18}O, for example has 2 more neutrons than ^{16}O and is heavier. Their use relies on understanding of the processes that fractionate isotopes. Stable systems are those where fractionation is by natural processes, such as evaporation of water. There are also radiogenic isotopes. ^{84}Sr, ^{86}Sr and ^{88}Sr are stable isotopes but ^{87}Sr arises from the radioactive decay of ^{87}Rb and can be used to characterise different types of land. Basalts have a Strontium isotope ratio of 0.705, older metamorphic rocks 0.710. Granites and sediments are slightly more complicated because different minerals weather at different rates. The BGS has produced a new map of biosphere variation across Britain showing typical values plants and animals would have (prior to complication by modern fertilisers and industrial pollution). Chalk has typical Strontium isotope ratio of 0.708-.709 but higher values are found in Scotland. There is also a marine coastal effect, with seawater having a constant Strontium isotope ratio of 0.7092. There is a global variation in oxygen isotope ratios from the equator to the poles. In Britain, because of the predominant westerly winds, there is a rainwater zonation in oxygen isotopes from west to east.

Archaeologist want to know:

- Were there large influxes of people in the past or was the influx mainly cultural?
- Can we identify first-generation immigrants?
- Do changes in burial rites indicate influx of newcomers?
- Can we identify locals?

Buried material can be complicated by possible diagenetic alteration. . Bone is a mixture of variably dense material with considerable organic content, which is subject to secondary alteration. Teeth are much more robust, particularly tooth enamel but it is restricted to information from childhood, when the teeth form. Experiments were carried out to test tooth enamel and dentine with soil, water, acetic acid and hydrochloric acid leaches – enamel gave the same value as the local soil, dentine was altered.

Stonehenge – **The Amesbury Archer** was excavated in 2000 and proved to be the wealthiest burial of that age in Britain. To avoid looting, it was excavated through the night and there is not a photographic record. Lots of artefacts were found including arrowheads, copper bangles, archers' wrist guards, gold hair grips, 3 metal daggers and 7 pots. The archer was a man of 35-50 years in about 2,380BC (Bronze Age). 2 teeth were analysed. Strontium isotope composition of his dentine was 0.7098 and oxygen isotope ratio 10.0±0.5, indicating a mid-European to Scandinavian climate of origin. Scandinavia was ruled out by the Strontium isotope ratio and it was concluded he was a Germanic metal worker of high status who had come into Britain. Comparing the archer with the distribution of 650 analyses of Britons with a mean of 17.71, he would be in the lower 1.5% of the British population. The artefacts were from across Europe.

Stonehenge – **The Boscombe bowmen** are in a Bronze Age multiple burial containing 3 adults and 2 children. It is very unusual to have multiple burials in Britain at this time. There were skeletal similarities suggesting they may have been a single family and 2 teeth from each individual were analysed, one pre-molar (age 6 and one 3rd molar (early teens). $^{87}Sr/^{86}Sr$ of Chalk is 0.708, as were other local burials and the children had equivalent values. For the adults, the early tooth had very high values to almost 0.714 while the later tooth had lower values at just under 0.712. For the early teeth, the nearest source would be the Hereford/Wales area. This burial provides the first evidence of child migration. There is very little match between the artefacts and where the people may have come from.

Weymouth Olympic Relief Road – In 2010, during construction of the access roads to Weymouth for the Olympics, a burial pit was found with 51 bodies, all of young men and all decapitated with a sharp blade but no evidence of clothing or artefacts. It was found near the Roman Maidencastle and was first thought to be of that era. However, carbon dating gave ages between 910AD and 1030

AD, ie the Viking period so they could be either English slaughtered by Vikings or Vikings slaughtered by the English. For example, the *Anglo-Saxon Chronicle* details the 793Ad slaughter in Lindisfarne. Tooth enamel was analysed to reveal Strontium isotope ratios of).710 -).714, with one as high as 0.721, compared with the local Weymouth average of 0.707-0.709. All were from a colder climate than Britain, with $^{18}O/^{16}O$ outside the range of British drinking water. The *Anglo-Saxon Chronicle* reports Alderman Elfric going against the Vikings with "the enemy escaped except the crew of one ship who were slain on the spot. Viking longships had 40-50 crewmen so it may have been this crew that was found.

Richard III – The body of Richard III was found under a car park in Leicester. He was the 7th surviving child in a family of 11. The primary evidence was what was in the field in that the body was found where it should be, he was flung into the grave and killed by war wounds. BGGS are analysing 2 2nd pre-molar teeth, both the enamel and the dentine since the dentine forma through time, with the enamel forming quickly by age 3 but the root continues to grow. BGS are extracting collagen and examining carbon and nitrogen isotopes, which indicate diet together with bone analysis. They expect to provide evidence of his diet, geographical origin, pollution and climate to confirm with what is know about Richard III's life. The results are awaited with interest.

Meeting of the Home Counties North Regional Group

Double Event and Curry Night

17 October 2013

At the home Counties North Regional Group meeting at Sir Robert McAlpine in Hemel Hempstead, 35-40 people heard Bill Gaskarth, Chartership Officer for the Geological Society talk about C**hartership with the Geological Society**. After a break for curry and a beer, George Tuckwell, Director Geoscience at RSK then talked on the subject of **Clandestine nuclear tests: geoscience in support of the Comprehensive Nuclear Test Ban Treaty**.

Chartership with the Geological Society

Bill Gaskarth

Fellows of the Geological Society can become Chartered Geologists (Cgeol), European Geologists (EurGeol) or Chartered Scientists (CSci). Chartership in the Society started in the 1980s as a result largely of pressure from engineering geologists who were often working alongside civil engineers and writing geological reports but they could not sign them off because they were not chartered.

Large numbers of geologists graduate each year and while they continue to be geologists and to regard themselves as geologists, a lot are working on the periphery of geoscience, eg working on water chemistry on contaminated land sites. Some of these people became concerned when their chartership application was rejected because they did not meet the geological competencies . As a result, the Society obtained a licence from the Science Council to grant chartered scientist status to those Fellows who were working on other areas of science.

Benefits of chartership

It is a mark of the achievement of a high level of competency assessed by one's peers. It is a title of equal standing with those of other chartered professionals. It is governed by an enforceable Code of Conduct. Competency is maintained through continuous professional development (CPD).

There are reciprocity agreements with the American Association of Petroleum Geologists (AAPG), which allows chartered geologists to become Certified petroleum Geologists and Geophysicists, and the American Institute of Professional Geologists, which allows attainment of CPG and CPGPhys, attained by joining the Institute with no further examination. The Society is working with the Australians and Canadians to obtain similar reciprocal agreements.

Eligibility

In order to become chartered, Fellows need a degree and a number of years of relevant professional experience, the number of years depending on the degree and accreditation. The vast majority of UK degrees are now accredited by the Society and it is working to accredit MSc degrees. An accredited first degree requires 5 years of experience and an accredited MSc requires 4 years. The Society is working with companies on the training needs and provision of mentors to help develop careers.

Criteria for Chartership

For CGeol, applicants must demonstrate that they meet the following criteria:

1. Understanding the complexities of geology and geological processes in space and time relevant to their speciality;
2. Critical evaluation of geoscience information to develop predictive models;
3. Effective communications, both orally and in writing;
4. Awareness of health and safety and environmental issues and other statutory obligations applicable to their discipline or area of work;
5. Clear understanding of the meaning and needs of professionalism including the Code of Conduct and commitment to its implementation;
6. Commitment to CPD throughout their professional career; and
7. Competence in their area of expertise and knowing the boundaries of their expertise.

For CSci, the difference is in the first 2 criteria, which are geologically slanted for CGeol. These criteria become:

1. Deal with complex scientific issues, both systematically and creatively, make sound judgements in the absence of complete data and communicate their conclusions clearly to specialist and non- specialist audiences; and
2. Use theoretical and practical methods in the analysis and solution of scientific problems

The application

Applicants for chartership should have 2 sponsors who are professionally qualified (preferably cGeol) who have known them for at least 3 years. Sponsors should comment on the breadth and depth of applicants' knowledge, the quality of their work and professional standing. Applicants should indicate their specialisation, which is needed so that the Society can assign scrutineers whose knowledge and expertise is in the same area.

The application should be accompanied by the **Professional report** describing the development of expertise, skills and competence to the level now claimed to qualify applicants to become chartered. The emphasis should be on geological competence, should refer to supporting documents to illustrate the claim of competence and each part should be signed off by the relevant line manager.

Supporting documents to a maximum of 6 should be carefully selected to demonstrate particular facets of applicants' skills, expertise and competence. They should showcase applicants' work and emphasise their work in team productions. Applicants' work that forms part of a larger volume of

work should be specifically identified. They can be reports, maps, cross-sections etc with a focus on demonstrating how applicants meet the requirements of the chartership criteria.

Confidentiality is guaranteed by the Society. All documents can be seen only by the Chartership Officer and the 2 scrutineers. Any conflicts of interest may be resolved by changing the scrutineers and major problems of confidentiality can be resolved with the Chartership Officer. If it proves impossible to submit documents because of confidentiality then employers may provide a written explanation of the work.

The applicants should take each of the 7 chartership criteria and show how they fulfil the requirements, referring to the Professional report where necessary.

A record of at least the last year's CPD is required to show an understanding of the different types of CPD and commitment to it. It is important to show a Plan-Act-Reflect cycle. CPD recording can be done on the Geological Society website or using company or personal schemes.

The interview

The interview is scheduled for 2 hours but normally lasts 1.5 hours. Applicants should make a presentation at the start highlighting how they meet the chartership criteria of not more than 15 minutes. Scutineers will then question applicants on specific points within their application to satisfy themselves that chartership is justified (or not).

The Schedule is that applicants complete the application with the advice of their sponsors and submit for a chosen interview date and venue. Scrutineers are appointed and applicants informed of them so they can check that there are no conflicts of interest.

Scrutineers must be chartered for at least 5 years or many years of experience prior to chartership and will be in the same specialisation as applicants. They are trying to find out what applicants know, not trying to fail them.

After the interview, the scrutineers report with recommendations to accept or defer. A recommendation to accept is forwarded to the Chartership and Professional Committees for ratification and then to Council for election. Applicants are informed of the decision immediately after the Council meeting. If defer is recommended, the application and scrutineers' recommendation are sent to 2 reviewers, who may or may not agree with the scrutineers. If the reviewers agree with the scrutineers, a letter is sent to the applicant explaining the reasons for the decision and offering advice. In the case of disagreement the recommendation may be overturned or another interview held with different scrutineers.

Up to 2 years following a successful application for CGeol a retrospective application may be made for CSci without the need for another interview. The Application needs to address the differences in criteria between the two and to provide CPD records for the intervening period. Conversely CGeol can be applied for following attainment of CSci.

Clandestine Nuclear Tests: Geoscience in Support of the Comprehensive Test Ban Treaty

George Tuckwell

Different aspects of geoscience will be used to enforce the Comprehensive Nuclear Test Ban Treaty (CTBT). The speaker has been working with the CTBT Organisation and its preparatory commission for when the CTBT comes into force. A short animation of underground nuclear testing illustrated the standard vertical emplacement. Tests are needed to understand the stability of the weapon being tested. Efforts to conceal underground testing may use different options.

The Treaty is a diplomatic document drawn up a number of years ago and some techniques are not included, eg position-finding is mentioned but GPS was not then in common use. Only 8 ratifications of the Treaty are needed (from the USA, Egypt, Israel, Iran, Pakistan, India, China and the Democratic People's Republic of Korea) for entry into force of the Treaty. There are still some political issues to be sorted out. For example, there is a political argument that telling people how to monitor/inspect for clandestine testing tells them how to get away with it.

There are 2 elements to the enforcement of the Treaty, global monitoring and on-site inspection by the United Nations.

Global monitoring

There is a whole line-up of global listening devices, with international monitoring stations using seismic, infrasound and hydro-acoustic techniques. Atmospheric testing is difficult to conceal so the systems are geared towards underground testing.

Seismic monitoring stations are sited in quiet areas around the globe to detect the equivalent of magnitude 2-3 up to magnitude 5 events. In the UK, the MOD operates a station at Eskdalemuir with a 10km sting of seismometers in 2 directions. The site is a good spot for wind farms and a 50km zone has been established around it, within which wind farm developers need to demonstrate that the vibrations caused will not impact on the capabilities of the monitoring station.

The aim is to distinguish between a tectonic earthquake and one caused by an explosion. The main differences are in the wave form, with an explosion having more energy up-front and the polarity of the waves – a tectonic earthquake will have push and pull waves depending on the location relative to the epicentre, while an explosion will have push waves in all directions. The success of the system was illustrated by the example of the determination of the location (and 95% confidence limits) of 3 tests carried out by the Democratic People's Republic of Korea in 2006, 2009 and 2013.

Hydro-acoustic monitoring monitors sound waves in the ocean, illustrated by the hydrophone buoy in British Indian Ocean Territory and those around Juan Fernandes Island in Chile. An explosion produces much sharper and shorter sound waves than a tectonic earthquake.

Infrasound monitors waves at frequencies lower than the human ear can detect, ie less than 20Hz, and generally uses frequencies of 0.07-4.0Hz. Infrasound waves are produced by ground to air coupling. Infrasound can also be used to warn air traffic of volcanic ash plumes.

There is also monitoring for radionuclides. For example, the station at Yellowknife, Canada, detected ^{133}xenon from the 2006 Korean test.

The International Data Centre at the United Nations in Vienna processes gigabytes of data daily

What happens if there is a suspicious event?

An on-site inspection can be triggered by:

1. Request from a state party to the Executive Council and to the Director General of the CTBT Organisation based on international monitoring station data or based on data from national technical means;
2. Director General has 2 hours to acknowledge receipt and 6 hours to communicate the request to the concerned party;
3. Concerned party has 72 hours to give an explanation, which is considered by the requesting state party;
4. If the request stands, the Executive Council has 96 hours to approve the inspection, with 30 out of 51 members needed for approval;
5. Director General issues mandate for inspection including the decision of the Executive Council on the request, the name of the state party or parties to be inspected, the location

and boundaries of the area to be inspected, the envisaged activities and equipment to be used, the travel route and point of entry into the concerned state and the names of the head of the team, its members and the proposed observer, the site-inspection team being limited to not more than 40 members.

The purpose of on-site inspection is to clarify whether a nuclear weapons explosion or other nuclear explosion has been carried out.

The time-scale is:

- Day D – Launch phase;
- D+6 – Initial period, which needs to generate sufficient information to justify continuation;
- D+25 – Continuation period, when techniques that are more intrusive can be used, eg near-surface geophysical techniques;
- D+60 – Extension, when further time and inspection can be justified by the evidence found in the continuation period;
- D+130 – Maximum time allowed for the inspection..

No sanctions are specified by the CTBT. In the case of a contravention being shown by the on-site inspection the report would need to go to the UN Security Council for a decision on what to do.

On-site inspection activities and techniques involve:

- Initial period – position-finding, measuring levels of radioactivity, environmental sampling, passive seismological monitoring, visual observation, video and still photography and multi-spectral imaging;
- Continuation period – active seismic surveys, resonance seismometry, electrical conductivity measurements, magnetic field mapping, gravity field mapping, and ground penetrating radar.

The team has to inspect an area of 1,000km^2 and has 6 days to assemble the team, 72 hours to start field activities and 25 days to justify continuation with a maximum period of 130 days for the inspection. The team is aiming to detect something with a diameter of about 50m at a depth of 0.5-1.5km. The known knowns and known unknowns are fairly straightforward because e they are known. The unknown unknowns are much more difficult. It is essential to distinguish fact, interpretation and conjecture.

Underground nuclear explosion signatures include radiation anomalies, apical voids, rubble chimney, underground activities, surface spallation (craters/retarcs), changes of soil density, displacement of water table and features such as drill-hole casing (metal), buried ferrous objects (drill pipes) shallow buried cables and construction debris.

Role of geoscientist

Visual observation is the most obvious but perhaps the hardest tool in on-site inspection. Deep tests may not form craters but there may still be surface effects from shock waves such as landslides. The presence of calcite in the rocks is helpful since it reacts with radionuclides to generate xenon. The geologists and geophysicists use their expertise to identify target sampling locations for radionuclide testing. Depending on the location, geological expertise in shield, platform, orogen, basin, large igneous province or extended crust may be required. The team is looking for things that are out of place/unusual. Gamma spectrometry can be helpful. Gas migration paths are fairly limited. Underground nuclear explosion aftershocks (down to magnitude –2) are shallower than earthquake aftershocks, decay more rapidly and may induce aftershocks in nearby faults. Magnetic field mapping and gravity mapping may help to locate tunnels and shaft. Other techniques include

frequency-domain electromagnetic conductivity, ground-penetrating radar and electrical resistivity. Drilling provides the last opportunity to detect radionuclides if the test is contained. The team has one chance to drill in one location and it needs Executive Council approval.

Aspects of on-site inspection

The on-site inspection team has finite resources, limited time, and is working under intense pressure and close scrutiny. The team is limited to less than 40 people, who must understand the phenomenology and know the signatures. The team must have properly developed search logic, synergy among the different specialisations and be efficient, justified, beyond criticism and correct. It can include global seismologists, earth physicists, geologists with expertise in structural geology, sedimentology, geochemistry, geophysics (near-surface and microseismic). They will be working in difficult environmental conditions and pressurised working conditions, probably with bad food and potentially hazardous conditions due to radionuclides and health and safety aspects.

Future Programme of the Home Counties North Regional Group

Your Committee are currently working to develop a programme of events for 2014, which will be of interest to members of the group. We will continue to vary the venues between Hemel Hempstead, Hatfield, Milton Keynes and the Geological Society

On Tuesday 21 January, we have Rory Mortimore, President of the Geologists' Association talking on **The engineering geology of Chalk: a total rock approach**. This meeting will be at the Geological Society, Burlington House, at 18.00 for 18.30.

To Be Confirmed – On Thursday 6 March, John Davies of Crossrail will be talking on **Crossrail**. This meeting will be at the Open University, Milton Keynes at 18.30 for 19.00.

The Annual General Meeting of the group will be on Tuesday 22 April at Sir Robert McAlpine Ltd, Hemel Hempstead, when you will receive reports from the Committee and have the chance to elect a Committee to replace the *de facto* Committee that was established at the initial meeting organised by Council. The AGM will be followed by a talk on **Chalk mines and solution features in Hertfordshire and the problems they cause**, by Clive Edmonds of Peter Brett Associates.

After that, we hope to hold a meeting on 12 June and then take a summer break, with the possibility of a field visit being arranged over that time. The autumn programme should comprise meetings in early September, mid-October and late November.

We will continue to up-date the programme on the website to keep you informed on what is happening.

As the compiler of this first Newsletter, I hope you enjoy reading it and if you have any comments on its content or suggestions as to events the group should consider holding, please let your Committee know by e-mailing homecountiesnorth@geolsoc.org.uk and keep checking the website http://www.geolsoc.org.uk/hcnrg.

Finally, your Committee sends Seasonal Greetings to all members of the group with best wishes for a happy and prosperous New Year.

Dave Brook

(Editor/Compiler)