



HOOKEN CLIFF FROM THE AIR © MALCOLM HART



The
Geological
Society

Annual Newsletter of the SWRG 2018

IN THIS ISSUE

Welcome

by Sarah Boulton

Welcome to the third newsletter of the SW Regional Group of the Geological Society of London. This newsletter aims to showcase some of the great events that we have organised over the last year as a reminder at the end of the year at our AGM.

This year's Frederick Sherrell award winner – Jenny Bennett – is not only an outstanding winner of this career recognition award but also the first female recipient of the award.

Jenny went to school in Totnes and Exeter, later completing an Open University degree, including many trips with the Open University Geological Society (OUGS). Jenny maintained links with the Open University, working as an Earth Sciences Tutor and Associate Lecturer for over twenty years (the last fifteen of which in the south-west). Voluntary redundancy enabled her to take a Masters degree at Cambridge, followed by a PhD at Exeter University on the 'Evolution of the River Exe during the Holocene' supervised by Professor Tony Brown.

Jenny is perhaps best known for her involvement in promoting and teaching

geology in the south west – leading field trips for many different organisations and co-organising conferences for the Devonshire Association, the Geologists' Association, the OUGS and the Ussher Society. She was Secretary of the Devon RIGS group, a committee member for SWRG, currently Secretary of the Devonshire Association, Geology Section and has just completed a term as the first female Chair of the Ussher Society. She is still looking at rivers and their behaviour, most recently using archaeological material and maps to reconstruct the past and maybe, predict the future.

Highlights of this year have included a field trip to Beer Caves, a number of evening seminars and the well-attended and very interesting Pro-Geo - once again linking with Burlington House's 'Year of Resources'. Again we worked hard to make this event inclusive with a good mix of speakers, and going forward I would like to see a greater diversity of speakers for our evening seminars.

Looking forward to next year I urge you all to get involved whether it is simply attending an event, suggesting someone you would like to see talk or volunteering to be part of the committee, it all makes a difference!



Social Media

Remember follow us on twitter @SWGeoSoc linkedin, or check online at www.geol Soc.org.uk/south_west for upcoming events, event reports and contact details for the committee.

UPCOMING EVENTS



What's coming up?

Turn to the end of the newsletter to see events planned for next year – don't forget to check the website for updates and announcements as we get more talks confirmed.

Beer Quarry Caves fieldtrip

Saturday 12th May

The Upper Greensand and Chalk of Branscombe and Beer Caves

by Prof. Malcolm Hart



Figure 1. Red Rock Gypsum Member within the Mercia Mudstone Group.

On a pleasant, but slightly cloudy, morning 26 members of the Devonshire Association (Geology Section) and the Regional Group of the Geological Society met at Branscombe Mouth. In the morning, it was planned that we would visit the Upper Greensand and Chalk exposed in The Pinnacle and nearby outcrops east of Branscombe to complement our investigations at Beer last year. To the east of Branscombe Mouth the unconformable contact between the Upper Greensand Formation and the underlying Mercia Mudstones was inspected. There is a clear hiatus, with the boundary marked by water pouring out of the overlying, porous sands. This is one of the reasons for the 1759 Hooken Cliff landslide, which is marked by the occurrence of

slipped blocks of greensand and chalk at beach level.

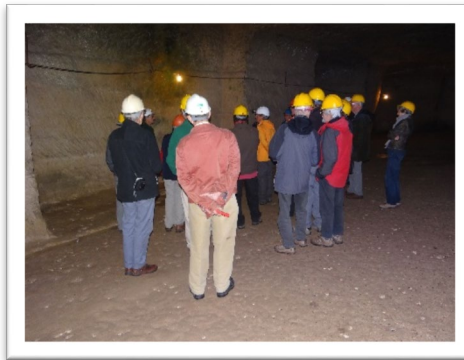


Figure 2 and 3. Beer Quarry Caves, with the party looking at the methods of stone extraction and the delicate carving of the initially soft inoceramid-rich chalk.

The aerial image, provided by Peter Cox, shows the quite dramatic 'bite' out of the Hooken Cliffs from which the landslide originated. The dip of the chalk was seen to be cliff-wards; a typical feature of rotational landslides. The group looked at the nature of the chalk succession, the flints within the chalk and the difference between them and the 'cherts' within the Upper Greensand. In the latter there was clear evidence of bedding, trace fossils and the replacement of other sandstone structures. At the base of the chert-rich Upper Greensand was a 'zone' of partially formed cherts.

A few of the group, during the lunch break, walked westwards a few hundred metres to see a small outcrop of the Red Rock Gypsum member within the Mercia Mudstones. This series of cross-cutting veins occupies a small thickness of the mudstone succession and probably represents evaporation on the edge of a playa lake.

The Beer Quarry Caves, the source of Beer Stone, has been excavated by hand from this underground quarry since Roman times and is widely used for building in Devon and nearby parts of Dorset and Somerset. The stone was used externally for the quoins and dressings of prestige buildings especially churches, and internally for fireplaces and other decorative detail. It is particularly well suited to carving and figures in internal decoration further afield including St Paul's Cathedral in London and parts of Westminster Abbey, the Tower of London, Hampton Court and Windsor Castle. During the guided tour we learnt something of the stratigraphy and lithology of the stone, its properties, the methods used for quarrying and the hard life of the quarrymen. Photography was limited as parts of the cave system are – in May – still host to overwintering populations of bats (which are protected).

Front page: Aerial view of Branscombe, Hooken Cliff and Beer Head. The Hooken Cliff landslide (1759) can be clearly seen to the east of Branscombe Mouth. Beer and Seaton are in the far distance. Image courtesy of Peter Cox.

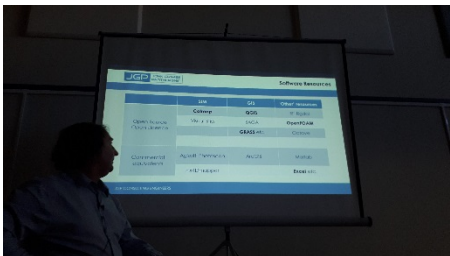
PHOTOS OF THE EVENT

**Paul Nichols**

Not only did Paul give an interesting talk on aggregate recycling he has talked about his background in the armed forces and talked about the support for services leavers and the benefits that service personnel could bring to industry.

**Cara Callingham**

Cara gave us an update on acid mine drainage and treatment.

**Rod Smith**

Back for a second year running, Rod talked about digital resources and software platforms, including an interesting case study on karst geomorphology in Wales.

This year saw another successful Pro-Geo conference with > 50 delegates attending the event held once again at the Kenn Centre. This year we decided to align the theme of the day with the Geological Society's 'Year of Resources', resulting in talks on spanning a wide range of subjects from recycling of



Lucy Crane talking about Cornish Lithium

Pro-Geo (Year of Resources in the SW)

aggregate, through to sustainable mining.

The day kicked off with Paul Nichols (Gilpin) who gave a fascinating talk on recycled aggregates. It was a real eye opener to find out how much waste material is generated when bridges and buildings are taken down and how much of this material can be responsibly recycled and reused (> 90%). The following morning talk was from Cara Callingham (Coal Authority), who gave an overview of the Wheal Jane Mine Water Treatment works.

After coffee Lucy Crane (Cornish Lithium) gave an enjoyable and insightful talk on lithium use and extraction. Much lithium around the world is extracted from brines and the hope is that the ground water in Cornwall will provide a viable source of lithium for future extraction. Interestingly this process could be self-sustaining owing to the geothermal energy that could be generated at the same time.

Dr Stefan Kapusinak rounded off the morning session by talking about underwater mining and mineral exploration. An overview of

technological advances in mining machinery was followed by a focus on the VAMOS project (Viable Alternative Mine Operating System) and EU funded project to investigate the exploitation and rehabilitation of underexplored mineral deposits.

After a bountiful lunch and a chance to network and look at the industry sponsored stands, we kicked off the final session with Rod Smith (John Grimes Partnership) standing in for James Blyth who was unfortunately ill. Nevertheless Rod did a sterling job presenting on structure from motion (SfM) and GIS digital 'resources'.

The final talk of the day was a special keynote given by Professor Karen Hudson-Edwards (University of Exeter) who spoke about the sustainability in mining.

Once again this was a great event, made possible thanks to our speakers and your involvement. We are already planning next year's event and we welcome comments on the theme for Pro-Geo 2019. See you there!

Once again the Regional Group held the annual heats for the Early Careers Geologist Award and the School's competition.

The Early Career Geologist Award 2018

This year the Early Career Geoscientist evening was hosted by The University of Plymouth in March. The event was attended by over 40 people from academic, educational and professional sectors. It was great to see geoscientists from all of these sectors getting together over a some drinks and nibbles.

We were then treated to four excellent talks by researchers from both Exeter and Plymouth universities and from local companies, based on a variety of themes:

Francesca Prando (University of Plymouth) – 'A quartz tale: ductile – brittle cyclicality in shear zones'

Abraham Audu (Camborne School of Mines) – 'Improved Understanding of Borehole Instability Mechanisms Through Development of an Enhanced Visualization-Numerical Modelling Approach'.

Sam Bolton (Cornwall Resources Ltd.) – 'Exploration and Discovery at Redmoor Mine'

Lucy Campbell (University of Plymouth) – 'Deep seismicity and rapid creep: a geological record of earthquake cycles in the lower crust'

The winner of best presentation went to Lucy Campbell who gave a very interesting talk on her postdoctoral research in Norway, with runner up going to Sam Bolton. It was noted that all talks were of a high standard especially given the career stage of the speakers.

Many thanks to all those who attended and a special thank you to all the speakers. Next year the event will be hosted by the Camborne School of Mines.

The SW Region Schools competition 2018

Early February saw Plymouth host the hotly contested heats for the National School's Geology Challenge. The afternoon started with a workshop on limestones under the microscope led by Dr Sarah Boulton prior to the main event of poster viewing and talks for the A-level students from Torquay Girls Grammar School, Torquay Boys Grammar School and St. Austell College.

This year the standard of the presentations and posters was really high and the judging was really difficult. Especially given the diverse range of topics that spanned plate tectonic theory, earthquakes and the future of Planet Earth. Everything was to play for going into the final quiz round, which saw Torquay Girls grammar school triumph for the second year running!

Well done to all our competitors!

In the evening of Wednesday 21st March 2018 a presentation on Geotechnical

Piles, Piles and More Piles!

By Jonathan King

Engineering for Electrification of the Great Western Railway was given by Jon Esser, of Atkins, Global and Richard Lethbridge of Network Rail at the Ley Arms, Kenn. The meeting was arranged by the SWRG of the Geological Society and held in conjunction with the Exeter Branch of the Institution of Civil Engineers. There was good attendance of more than 40 people about half from each organisation.

The talk gave an overview of the Great Western Electrification Programme (GWEP) from the perspective of the geotechnical discipline and also drew on some wider project challenges. They explained the GWEP aims to electrify one of Britain's oldest and busiest railways, providing greener, more

reliable journeys and improving connections across southern England and South Wales.

Around 1,000 kilometres of railway will be electrified between London and Cardiff in the biggest investment in the railways since Brunel completed the line in 1840. This mammoth task includes 15,000 piles, masts and associated wiring and 13,000 bespoke bridges and other structural designs. Many of the Grade I and Grade II listed structures along the route need to be sympathetically altered to accommodate the new overhead lines, while protecting their heritage, and also maintaining the highest safety standards for the railway. Using case studies from the GWEP the talk presented the main considerations and challenges faced by the geotechnical team, from initial design development through to detailed design and systems used for installation.

The new electrical system was designed to be compatible with Europe and involved installation of new support masts and gantries most of which were supported by piles, mainly 610mm and 762mm driven hollow section tubular steel piles 16 mm thick with a 4m allowance for corrosion during the 80 year design life. Alternative systems using augured concrete piles, micropile grillage, shallow prefabricated footings and rock bolted brackets were also used locally. The project area spanned a variety of geological bedrock types and nine ground models were developed to help specify appropriate foundations. In particular where stronger rocks such as the Forest Marble and Carboniferous Limestone were present, installation systems used pre-treatment with 800mm over-coring, and/or down hole or surface hammers before vibrating piles into place.

After the talk there was a lively discussion of both engineering and geological aspects of the project from the mixed audience illustrating the benefits of joint discipline meetings.

Glossop Lecture in the SW

This year's Glossop Award winner – Jackie Skipper - gave the regional group her Glossop medal award talk on the 17th May 2018. Her talk focussed on variability and ground hazards, with the questions 'Why should we understand ground variability? And why is it important and difficult to do so?'

Jackie used the strata of the London basin to explore these interlinked questions, and in particular with reference to the London Clay Fm., and the Lambeth Group.

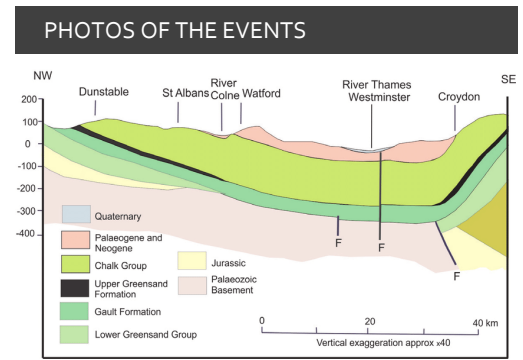
After a review of the implications of ignoring potential ground variability Jackie went on to explore the five main causes of ground variability. issues can quickly lead to even more costly mistakes: palaeoenvironment, diagenesis, faulting, erosion and anthropogenic factors (see table).

One of the most interesting parts of the talk were the case-studies, from her work in the London area.

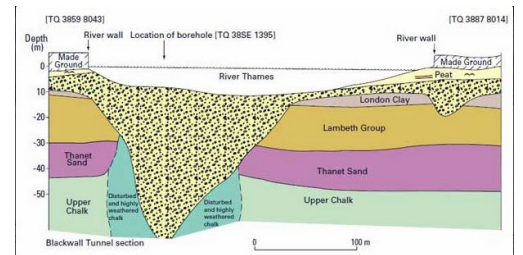
- Palaeoenvironment**
 - Assumptions around the depositional history and architecture of sedimentary successions
- Diagenesis**
 - Pedogenic oxidation and reduction to form paleosols. Engineering considerations of the redox conditions
 - Engineering considerations of the redox conditions
- Faulting**
 - Large amount of hitherto unrecognised faulting in the London basin.
 - Post London clay faulting
- Erosion**
 - Drift fill hollows with Devensian fill (~100 ka).
 - Variable fill and size causing a range of design issues.
 - Up to 500 m wide and 60 m deep.
- Anthropocene**
 - Basements, made ground, poor records.

Jackie firstly spoke at length about the Baker to Bond Street section of the Jubilee line that has suffered deformation of the tunnel. Although some notes and diagrams were present from the 1970s construction of the tunnel it was unclear how detailed and accurate these were, the 1970s construction was also using an experimental method unsuitable for the Lambeth Group. Ground investigations showed zones of high swelling and oxidation associated with faulting in the Lambeth Group, exacerbated by daily changes in temperature and high humidity. Good ground investigation allowed effective remedial work to be designed.

Also of interest with the drift filled hollows that plague the London area. All in all Jackie gave a very interesting talk that was well received by around 30 guests.



Classic view of the London Basin
Schematic cross-section with few faults (Royse et al., 2012).



Drift filled hollows
Cross-section at the Blackwall Tunnel based on site investigation boreholes, showing zone of highly weathered chalk cross-cutting the Thanet Sand and Lambeth group from Ellison et al., (2004).



Jackie Skipper with SW Regional Group chair - Sarah Boulton.

FAST FACTS

50%
OF PROJECT DELAYS ARE CAUSED BY ADVERSE GROUND CONDITIONS

80-85%
OF BUILDING FAILURES ARE THE RESULT OF ADVERSE GROUND CONDITIONS

The Geology of Mars

Dr Marcus Matthews (Emeritus lecturer at the University of Surrey) gave an interesting talk on the geology of Mars to a packed (~110 people) lecture theatre at the University of Plymouth on the 17th October, 2018.

Starting with an overview of the geology of Mars, Marcus covered such topics as the global topographic dichotomy (where crust is 40 km thick in the northern hemisphere and 70 km thick in the south), the Martian geological timescale and some basic facts on the gravity, atmospheric pressure and temperature of Mars. He also revealed a blooper from the film 'The Martian'. As atmospheric pressure is lower than on Earth, winds have less of an effect. An 100 mph wind on Mars is equivalent to an 11 mph wind on Earth! So the rocket threatened by the dust storm really was under no treat at all and certainly would not have blown away Mark Walberg!!

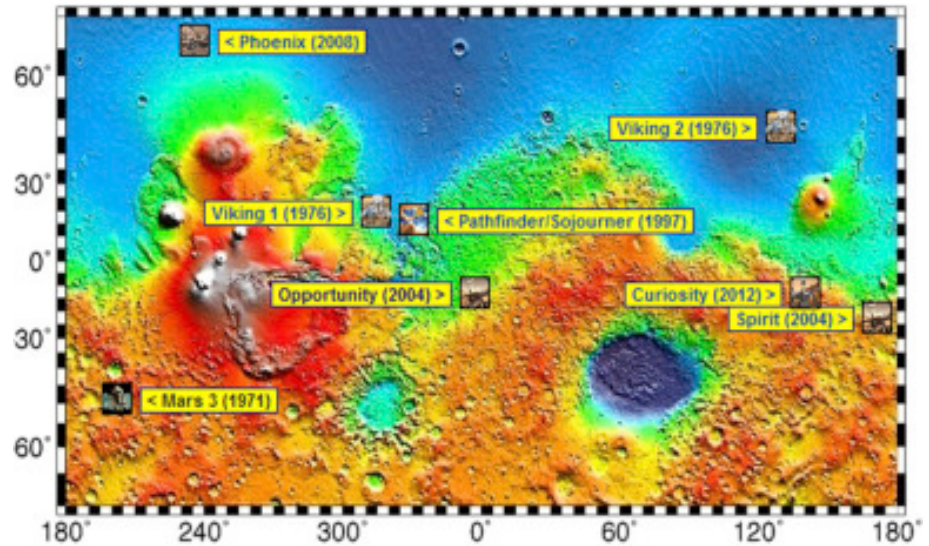
FAST FACTS

24 hrs 40 mins

THE LENGTH OF A MARTIAN DAY KNOWN AS A SOL.

3.71 ms⁻¹

ACCELERATION DUE TO GRAVITY ON THE MARTIAN SURFACE.



Martian elevation map showing the global dichotomy and the location of successful lander and rover touchdown sites (Lewinger et al., 2018).

Marcus then went on to overview a range of typical Martian geomorphic features such as craters, volcanoes, dry channels and sand dunes.

This is all relevant to his research on the engineering properties of the Martian soil – of critical importance to the function and longevity of the Martian

Marcus discussed steep including, dunes, loose soil, large obstacles, subsurface voids and duricrusts. Duricrusts present perhaps the most interesting and yet insidious danger for a Mars rover. Marcus finished his talk by giving a brief insight into the Earth-based research he and his colleagues have been undertaking to improve rover



Martian terrain as viewed by the MER Spirit Pancam (Sol 2190). Note the cracked and crumbled surface thin duricrust and the loose soil beneath (Lewinger et al., 2018).

rovers. Currently Opportunity Rover is climbing Mount Sharp, a tortuous climb. While it's twin Spirit got stuck in the sand in 2010. In order to avoid the fate of Spirit understanding the landscape hazards is vital.

performance and ability to travel across difficult terrains.

Lewinger, W., Comin, F., Matthews, M., & Saaj, C. (2018). Earth analogue testing and analysis of Martian duricrust properties. *Acta Astronautica*.

The Engineering Geology and Geomorphology of Glaciated and Periglacial terrains

Emeritus Professor Jim Griffiths (formerly University of Plymouth) has recently been involved in the development of a new Geological Society volume. Jim presented the back ground to the work at a recent seminar held at the University of Plymouth. Jim explains the rationale behind the new volume 'The 2010 Engineering Geology Forum held at the Royal Geographical Society demonstrated that the engineering geological and geotechnical understanding of glacial and

periglacial terrains was at least 20 years behind the latest academic research. One manifestation of this was the continued use of simplistic terms, such as lodgement till and ablation till, to describe the complexity of relict glacial and periglacial deposits encountered in ground investigations. Therefore, in 2012 the Engineering Group of the Geological Society set up a working party comprising experts in glacial and periglacial geomorphology, Quaternary history, engineering geology and geotechnics to establish best practice when working in former glaciated and periglacial environments. This resulted in a state-of-the-art volume published in November 2017 that was the outcome of five years of synthesis and deliberations by this Working Party. In his presentation Jim discussed the findings of the Working Party, briefly discussed the significance of the Quaternary, and the

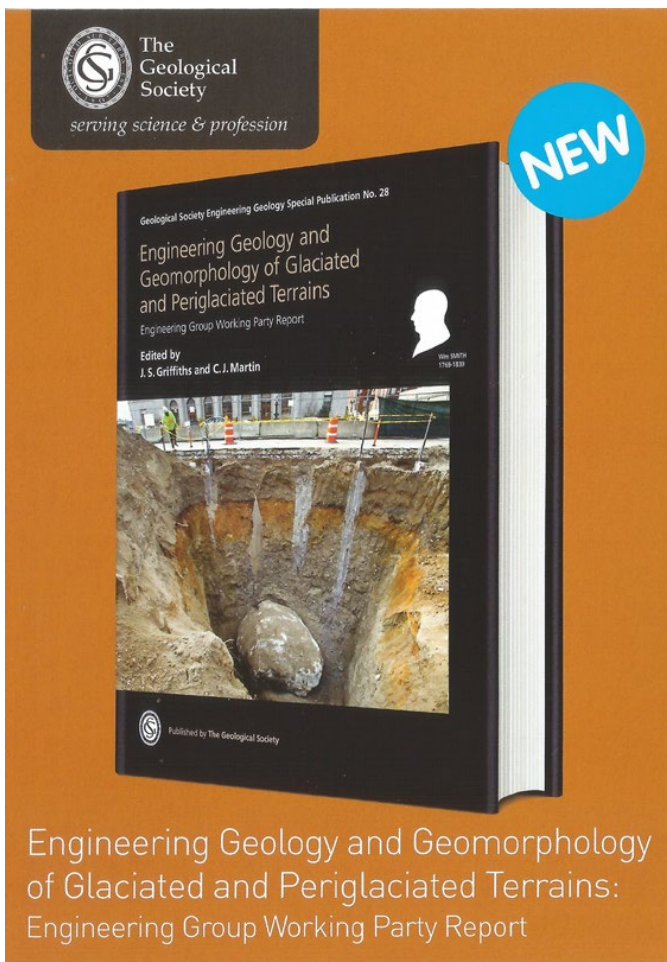
Quaternary in the UK and then spent some time explaining working group recommendations for developing and using Quaternary ground models in the reduction of engineering risk.

He spoke about conceptual, observational and analytical models, and showed examples of UK ground models. He then went on to elaborate on the problem with till classification and touched upon regional and location geohazards associated with Quaternary sediments, such as cambering and valley bulging.

He finished his talk with a quick round up of case studies where the ground engineering properties had not been fully understood leading to a variety of problems. He included the 1908 Lötschberg Tunnel Disaster, the 1967 Sevenoaks Bypass slope failure, the 1984 Carsington Dam failure and the Castle Hill Landslide complex.

A lively debate followed his talk, which was well received by the ~ 20 guests.

Thanks to Red Rock Geoscience for sponsoring the drinks and food at this evening seminar.



Engineering Geology and Geomorphology of Glaciated and Periglacial Terrains: Engineering Group Working Party Report

Schedule of Events held in 2018

Event	Date	Location	Organiser
Schools Competition	07/02/18	Fitzroy Labs, University of Plymouth	Gordon Neighbour
GeoCareers Fair	28/02/18	Roland Levinsky Building, UoP	Martin Stokes
Early Careers Evening	08/03/18	Fitzroy Labs, University of Plymouth	Sarah Boulton
John Esser and Richard Lethbridge - Piles	21/03/2018	Ley Arms, Kenn.	Laura Bacon
Brett Grist and James Blight (Cornwall Resources Ltd)	26/04/2018	Ley Arms, Kenn	Laura Bacon
Beer Caves Visit and tour	12/05/2018	Beer Devon	Malcolm Hart
Jackie Skipper	17/05/2018	University of Plymouth	Sarah Boulton
Todd Hallihan	06/06/2018	University of Plymouth	Alan White
Marcus Matthews	17/10/2018	University of Plymouth	Rod Smith
Pro-Geo	26/10/2018	Kenn Centre	All
Jim Griffiths	8/11/2018	University of Plymouth	Sarah Boulton
AGM and Frederick Sherrell Award	29/11/2018	Ley Arms, Kenn	Rod Smith

Dates for the 2019 diary!!

Event	Date	Location	Organiser
Early Careers Evening	23/01/19	Camborne School of Mines, University of Exeter	Sam Hughes
Schools Competition	06/02/19	Fitzroy Labs, University of Plymouth	Gordon Neighbour
GeoCareers Fair	27/02/19	Roland Levinsky Building, UoP	Martin Stokes
Arjan Dijkstra	Early March	University of Plymouth	Sarah Boulton
Pro-Geo	Late October	Kenn Centre	All committee
AGM and Frederick Sherrell Award	Late November	Ley Arms, Kenn	Rod Smith