

The Fellowship Magazine of the Geological Society of London

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## **Geoforensics** Laurance Donnelly and Alastair Ruffell on the Group's first decade



**MENTE ET MALLEO?** The Sedgwick's collection of geological hammers AFTER ABERFAN You respond to our coverage of the 50th anniversary **ONLINE CONFERENCING** Arjan Reesink weighs up the new trend's pros and cons



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#### Geoscientist is the Fellowship magazine of the Geological Society of London

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#### recycle



THE PRINCIPAL DUTY OF THE EXECUTIVE SECRETARY IS TO INTERPRET THE BYE-LAWS FOR THE BENEFIT OF THE TRUSTEES, AND TO OFFER PROPER GUIDANCE

## FROM THE EDITORS DESK: By your leave

he Society has advertised for an Executive Secretary (*Geoscientist* 26.10 November 2016). From the tone and content of the new advertisement, it appears that those who wrote to this magazine in protest over the unwisdom of dropping of the 'charterable geologist' requirement will be reassured. We believe that, whoever that 'ideal candidate' of whom the advertisement speaks turns out to be, he or she is surely somewhere on the Society's all-knowing and all-seeing database already.

But, while much that is vital in a senior role is hardly the stuff of a sales pitch, and therefore not likely to feature in an advert, we urge the Trustees to remember the following. First, that they govern the Society because they were elected by you, the Fellowship, and remain answerable for their decisions. And while they govern - we hope wisely - they do so under the guidance and constraint imposed by a set of rules all too easily overlooked.

I refer of course to the Society's Bye-laws, painstakingly revised by the Charter and Bye-laws Working Party under Sir John Knill at the turn of the Century, then voted on and approved by Fellows. They are your mandate to those who govern on your behalf. They lay limits on the powers of the Society's many servants, high and low, from staff to President. They specify the boundaries of power, and lay out the procedures beyond which those servants may not stray.

Any Fellow, feeling that Council has acted in breach of these Bye-laws, and having not received adequate redress via the usual channels, is within his or her right to take their grievance to the Charities Commission and even the Privy Council, in whose power it lies to revoke our ancient charter, and rebuke the Society, should the complaint be upheld.

Alas, among all the inevitable hifalutin corporate bloviation ('strategy', 'vision', 'objectives', 'leadership' etc.) it is likely to prove all too easy to overlook what is, in fact, nothing less than the principal duty of the Executive Secretary - namely, to interpret the Bye-laws for the benefit of the Trustees, and to offer proper guidance.

In other words, that delightful record should be their constant study. He or she should know the Bye-laws insideout, like Holy Writ. For they, and only they, are the rules by which Council may operate: literally, by your leave.

We trust therefore, that to avoid future difficulty as your agents the Trustees narrow their focus upon that much-anticipated 'ideal candidate', due attention will be paid to this perhaps slightly dreary, but fundamental, matter.

DR TED NIELD, EDITOR - TED.NIELD@GEOLSOC.ORG.UK 💓 @TedNield @geoscientistmag

# **SOCIETY***NEWS*

#### What your society is doing at home and abroad, in London and the regions



## Specialist Group news

Dawne Riddle has news of two possible departures and one new arrival among the Society's Specialist Groups.

At its October 2016 meeting, The Science Committee reviewed the Society's Specialist Groups and is proposing – unless there are objections from Fellows - to disband two groups that are 'seemingly dormant' – namely, the Coal Geology Group and the Borehole Research Group.

If you wish for these Specialist Groups to remain, and are keen to become involved in re-invigorating them, please contact Georgina Worrall (E: georgina.worrall@ geolsoc.org.uk) before Friday 6 January. If no objections are received, then a formal proposal for disbandment will be taken to the Society's February 2017 Council meeting for approval.

## Geological Society Discussion Group

Danny Clark-Lowes writes: The Geological Society Club, a dining club that dates back 192 years, has been transformed into a new Specialist Group of the Society – the Geological Society Discussion Group. This group will host many Discussion Dinners during the year, at a number of different venues, including Burlington House.

All Fellows of the Society are welcome to attend the meetings, at which a speaker will open a topic of current geological interest, allowing for discussion over the meal. When appropriate, dinners will be timed to coincide with meetings at the Society. The first two meetings of the 2017 programme are provisionally scheduled for 8 February and 7 March (Lyell Meeting). Please see the Society website for more details. Meetings will also continue to be advertised here in *Geoscientist*.



## LONDON LECTURE SERIES

## Waking the Giant: how a changing climate triggers earthquakes, tsunamis and volcanoes

**Speaker:** Bill McGuire **Date:** 7 December



#### Programme

 Afternoon talk: 14.30pm Tea & Coffee: 15.00 Lecture begins: 1600 Event ends.
 Evening talk: 1730 Tea & Coffee: 1800 Lecture begins: 1900 Reception.

### **Further Information**

Please visit www.geolsoc.org.uk/gsllondonlectures16. Entry to each lecture is by ticket only. To obtain a ticket please contact the Society around four weeks before the talk. Due to the popularity of this lecture series, tickets are allocated in a monthly ballot and cannot be guaranteed.

Contact: **Sarah Woodcock**, The Geological Society, Burlington House, Piccadilly, London W1J 0BG, T: +44 (0) 20 7432 0981 E: **sarah.woodcock@geolsoc.org.uk** 



## **Research Funds**

Applications are invited for the 2017 round of the Society's research funds, *writes Stephanie Jones*.

Please complete the appropriate form, which can be downloaded from the 'Society Awards and Research Grant's page at www.geolsoc.org.uk/grants. Here you will also find information about the Society funds and others administered by the Society. The average award has been about £1000.

The Research Grants Committee meets once annually. Applications must reach the Society no later than 1 February 2017 and must be supported by two Fellows of the Society who must each complete a supporting statement form. Only complete applications on the appropriate form will be considered. Please send to the 'Awards Secretary' at the Geological Society.

### The Royal Commission for the Exhibition of 1851

For reasons lost in the mists of time the President of the Society is an ex officio Commissioner of the Royal Commission for the Exhibition of 1851 – the 'Great Exhibition', as it has become known. Applications are now open for their various Awards, including Research Fellowships.

 For further information please go to: www.royalcommission1851.org/awards/

## The only way is Ethics

## Nic Bilham is the new IAPG Continental Coordinator for Europe, *writes Dawne Riddle*.

The International Association for Promoting Geoethics (IAPG) has appointed Nic Bilham as its new Continental Coordinator for Europe. Nic currently leads delivery of the Society's policy, education, media and wider communications activities, working with the Society's Council and senior staff to coordinate strategic planning and reporting.

IAPG was set up in 2012, during the 34th International Geological Congress (IGC) in Brisbane (Australia), having been conceived in April that year, during the European Geosciences Union (EGU) - General Assembly in Vienna. Geoethics describes itself as 'research and reflection on the values underpinning appropriate behaviours and practices wherever human activities interact with the Earth system'. It also deals with the ethical, social and cultural implications of geoscience education, research and practice, and with the social role and responsibility of geoscientists in conducting their activities.

Before joining the Society in 1997, Nic graduated from the

University of Cambridge with a BA in History and Philosophy of Science, and he now also holds an MSc in Science and Technology Policy from the University of Sussex. His research interests include debates around the roles scientists can and should play in policy-making, and the effective integration of specialist, stakeholder and public inputs to multi-disciplinary policy challenges such as radioactive waste management. He has been IAPG Corresponding Citizen Scientist on 'Geoscience communication'.



For more information, visit: www.geoethics.org

## FUTURE MEETINGS

Dates for meetings of Council and Ordinary General Meetings until June 2017 will be as follows:

OGMs:
 2017: 1 February; 4 April

Council:
2017: 1 February;
4 & 5 April (residential)





## Jenny Davey has the month's hottest titles from

Geological Society Publishing!

Special Publication 420: Magmatic Rifting and Active Volcanism

Edited by T.J. Wright, A. Ayele, D.J. Ferguson, T. Kidane and C. Vye-Brown

List price: £ 120 | Fellow's price: £ 60 | Other societies price: £ 72

This Special Publication presents the latest findings on magmatic rifting and active volcanism, spanning the initiation of rifting through to seafloor spreading. The contributions have a particular focus on the East African Rift, and include new results from the international Afar Rift Consortium, case studies and review articles from leading scientists in the field. **Find out more at www.geolsoc.org.uk/sp420** 

Special Publication 431: Transform Margins: Development, Controls and Petroleum Systems Edited by M. Nem ok, S. Rybár, S.T. Sinha, S.A. Hermeston and L. Ledvényiová List price: £ 120 Fellow's price: £ 60 | Other societies price: £ 72

The volume reviews current knowledge of transform margins and addresses fundamental questions for future research. Furthermore, the articles look at principal factors that influence the dynamics, kinematics and thermal regimes of continental break-up at transform margins and cover geophysics (bathymetry, seismic, gravity and magnetic studies), structural geology, sedimentology, geochemistry, plate reconstruction and thermo-mechanical numerical modelling. **Find out more www.geolsoc.org.uk/sp431** 

Recent Online First publishing highlights include: Quarterly Journal of Engineering Geology and Hydrogeology: Effect of electrode configuration on electrokinetic stabilization of soft clays by Taylan Askin and Dilek Turer http://qjegh.lyellcollection.org /content/early/2016/09/29/qjegh2015-074.abstract Geochemistry: Exploration, Environment, Analysis: Application of classical statistics and multifractals to delineate Au mineralization-related geochemical anomalies from stream sediment data: a case study in Xinghai-Zeku, Qinghai, China

by Xin Chen, Youye Zheng, Rongke Xu, Huimin Wang, Xiaojia Jiang, Hongze Yan, Pengjie Cai, and Xianzheng Guo

http://geea.lyellcollection.org/content/early/2016/09/21 /geochem2016-424.abstract

Journal of the Geological Society: Internal structure and emplacement mechanism of composite plutons: evidence from Mt Kinabalu, Borneo by Alex Burton-Johnson, Colin G. Macpherson, and Robert Hall http://jgs.lyellcollection.org/content/early/2016/09/14 /jgs2016-041.abstract

Petroleum Geoscience: Seismic imaging of Late Miocene (Messinian) evaporites from Western Mediterranean back-arc basins by M. Dal Cin, A. Del Ben, A. Mocnik, F. Accaino, R. Geletti, N. Wardell, F. Zgur, and A. Camerlenghi

http://pg.lyellcollection.org/content/early/2016/09/06 /petgeo2015-096.abstract

And...

Introduction to the thematic set: Exploring the Mediterranean – new concepts related to the Messinian salt by Juan I. Soto and Gabor Tari

http://pg.lyellcollection.org/ content/early/2016/09/06/ petgeo2016-301.extract



## Christmas & New Year Closure

The Society (London and Bath) will be closed from 16.00 on Friday 23 December, re-opening at 09.30 on Tuesday 3 January 2017. The Publishing House will also be closed on Wednesday 21 December from 12.00, and Burlington House will also close on Friday 16 December from 12.00.

# In conference!

Conferences are opportunities for sharing, questioning, networking, and absorbing the latest insights. But can we do better? **Arjan Reesink\*** investigates

he glamour of a scientific conference disappears quickly upon the realisation that people have to travel far to sit in a room and listen passively. I too have flown to Argentina and the USA to sit in a room and listen. Even at the best conferences, great talks are interbedded with a greywacke<sup>1</sup> jumble of talks that are simplified too far for scrutiny, or pitched too high for comprehension.

Educational research consistently confirms that 'doing' is better than 'listening' and, more to the point, that lecturing is rather ineffective. It is why universities are pushing for 'flipped learning' with lectures online and contact time that is practical. Conferences are controversial – are they good use of our time and money?

## Why do we do it?

Producing new knowledge is the core business of academia. Conferences help us to advertise

our latest work, test the pitch and framing of the story within a broader societal context. Conferences are opportunities to get inspired, and to be surprised and intimidated! And the best is saved for last: a beverage among

colleagues is what many

consider the most productive

part. Only after the talks are done can we seek out the people that we want to network with. Conferences are where Big Cheeses can be approached and questioned. It is the time to meet new people, and to solicit new ideas and solutions. But, is that it? Must we sit and listen passively until we fossilize?

## **Online conferencing**

I recently hosted an online conference on 'pre-vegetation river systems'<sup>2</sup>. With some sponsoring for the software (thanks to the British Sedimentological Research Group!), it was possible to bring together select speakers to present complementary views on this single topic – perspectives that would otherwise be extremely hard to assemble. The online conference reached a more global audience than usual, reached more graduate students, included hard-to-get speakers because they only needed to free up a small amount of time, and all is recorded for posterity. As with any conference, many people were unable to free up the exact time. It matters not, it's all available online.

## **Present software - better future**

Many conference drawbacks can be avoided by holding talks online: no travel costs, no paying for passive listening. Of course, we will also lose some of the most valuable aspects. Online conferences will never be able to replace real conferences. But then, they don't have to.

> If we decide as a community to hold some talks online, we can spend our time and money to escape the office and really learn: looking at rocks in the laboratory, in the invaluable BGS corestore, and in the field! Repeated Soapbox articles emphasise that fieldwork is both loved and fundamentally necessary. Doing is

better than listening, and we can do this. Let's explore this future, let's hold some talks online before we go into the world to question, verify, and scrutinize – before we go do some real Geology!

 1. Not derogatory - Greywacke is obviously a fascinating rock type.
 2. www.youtube.com/watch?v=FQ-08YEXtjQ

\*Dr Arnold Jan H Reesink FGS is Research Fellow in Earth Surface Dynamics, University of Southampton, UK & Research Fellow in Geological Storage of CO2, University of Illinois, USA



## SOAPBOX CALLING!

Soapbox is open to contributions from all Fellows. You can always write a letter to the Editor, of course: but perhaps you feel you need more space?

If you can write it entertainingly in 500 words, t the Editor would like to hear from you. Email your piece, and a self-portrait, to ted.nield@geolsoc.org.uk.

Copy can only be accepted electronically. No diagrams, tables or other illustrations please.

Pictures should be of print quality – please take photographs on the largest setting on your camera, with a plain background.

Precedence will always be given to more topical contributions. Any one contributor may not appear more often than once per volume (once every 12 months).



# **FORENSE** GEOSCIENCE GROUP - THE FIRST DECADE



# Laurance Donnelly and Alastair Ruffell\*

tell how the Specialist Group originated and has developed since its early days

Above: Real human skull on wet soil figured as crime scene. A forensic geologist may be called to provide support for a crime scene examination he Forensic Geoscience Group (FGG), is the newest of the Geological Society's 23 Specialist Groups and Joint Associations (a number destined, perhaps to go down by up to two - see p 06). It was established in December 2006 by Dr Laurance Donnelly, who served as its first Chair (2006-2011). Dr Alastair Ruffell served as the second chair (2011-2016). The post is currently held by Dr Jamie Pringle (2016). This article provides a personal account documenting the establishment of FGG and some of its main achievements.

## **Historical Overview**

Forensic geology is by no means new. According to legend, an examination of soil and rock fragments found in horses' hooves assisted Roman soldiers in locating the camp of the enemy. The documented application of geology to assist with a police investigations dates back to the middle part of the 19<sup>th</sup> Century.

Professor Christian Gottfried Ehrenberg (1795–1876), a German scientist working in Berlin, was able to assist police and identify the provenance of sand that had been used to substitute for stolen silver being transported in wooden barrels on a train in Prussia. Sir Arthur Conan Doyle and the (fictitious) work of his violin-playing, coke sniffing hero Sherlock Holmes (1887-1927), made reference to the idea that geology (soil analysis) could help investigate crime. The colour and consistency of splashes of mud on a pair of trousers helped Holmes to identify the parts of London through which a visitor to 221B Baker Street had walked.

Hans Gustav Adolf Gross (1847-1915) was an Austrian examining magistrate and professor of criminology. In 1893 he published, 'Handbuch für Untersuchungsrichter, Polizeibeamte,

## IN 1994, DR DONNELLY BEGAN SEARCHING SADDLEWORTH MOOR, IN THE PENNINES, FOR THE LAST REMAINING VICTIM OF THE MOORS MURDERS



Gendarmen' (Handbook for Magistrates, Police Officials & Military Policemen). He noted that: "Dirt on shoes can often tell us more about where the wearer of those shoes had last been than toilsome inquiries".

George Popp (1847-1915), working in Germany in 1904 on the murder of Eva Disch (who had been strangled with her own scarf) analysed nasal mucus on a handkerchief found at a crime scene. Fragments of coal, snuff, and hornblende crystals were consistent with materials found beneath the fingernails of a suspect. Popp subsequently investigated other murders using microscopic analysis (the Margaret Filbert murder, Bavaria 1908) and he noted how the stratigraphic layering of different soils on shoes could be used to build a profile of an offender's movements, placing him at a scene of crime. These cases were based on the principle formulated by the forensic

scientist, Edmund Locard (1877-1966). He developed the concept that "every contact leaves a trace" - 'Locard's Exchange Principle'.

In 1936, the Federal Bureau of Investigation (FBI) first applied soil analysis to a case (The Matson Kidnapping) to identify where a victim had been prior to his murder. The investigation of the Green River Murders in the mid-1980s also used evidence from microscopy - a serial killer was convicted of 48 murders and later confessed to dozens more. Murray & Tedrow published *'Forensic Geology'* in 1975, the first textbook to combine geology with operational cases.

In the UK, during the 1970s and 1980s, the Home Office Central Research Establishment at Aldermaston made advances in areas such as soil densitygradient examination techniques, cathodoluminescence, colour analyses and particle-size analysis. The Forensic Science Services (FSS - now closed) was set up in the early part of the 21<sup>st</sup> Century as the Natural Justice Group, and included forensic soil-science services to police forces and Government departments.

### **Renaissance**

In 1994, Dr Donnelly began searching Saddleworth Moor, in the Pennines, for the last remaining victim of the Moors Murders (ongoing). He used geological methods and strategies not conventionally used by Police. Up until this time, most police searches followed a counter-terrorism strategy, using fingertip line searches, some metal detectors and search (cadaver) dogs. This reflected the police training received from the military following the Irish Republican Army's unsuccessful attempt to assassinate the Prime Minster, Margaret Thatcher in 1984 (by planting a time-delayed bomb Mock crime scene, 2013 – set up as part of the International School Science Fair, Cornwall, UK

Forensic geologist Dr Ray Murray, with Laurance Donnelly, en route to Police HQ, Bogota, to provide advice on searching for victim grave sites

Dr Laurance Donnelly uses electromagnetic site survey equipment











in the Grand Hotel, Brighton). These types of police and military led ground searches rarely considered a detailed evaluation of the geology.

By the early 2000s it became apparent to Donnelly that even though police and law enforcement are not conventionally trained in geology – any more than geologists are familiar with police and crime-scene protocols - there were clear benefits to including geologists in certain types of criminal investigation in the UK and globally. This included searches in Northern Ireland for the 'Disappeared' associated with the IRA, being conducted by Ruffell, and (very successfully) by the Independent Commission for the Location and Identification of Victims' Remains.

Geologists supporting the police usually worked in isolation, and fellow geologists were largely unknown to eachother as they often tended to work covertly on sensitive, high-profile cases. There was, for example: no collaboration between geologists; no opportunities to discuss casework or research; no sharing of knowledge information or ideas; no encouragement to publish papers, guidance or protocols; no opportunities for career development; no incentives for the advancement of 'forensic geology' and no formal professional representation for geologists working in the field of forensic science, policing and law enforcement. This was about to change.

On 12 March 2002, a presentation entitled, 'How Forensic Geology Helps Solve Crime: Forensic Geology and The Moors Murders', was delivered by Donnelly to the All-Party Parliamentary Group for Earth Science, at Westminster Palace, House of Commons, in London. This drew attention to the applications of geology to police casework, and was followed by an invitation to ▶ Donnelly to discuss forensic geology on BBC Radio 4's 'Material World'. These events attracted interest in forensic geology from other geologists, forensic scientists, police officers, politicians and the media. In 2002, Donnelly began formulating a plan to develop a professional group on the subject. But where was this group to be focused?

In 2003, a forensic geoscience meeting was held at the Geological Society of London (GSL - see Pye & Croft, 2004). In the same year, the Centre for Australian Forensic Soil Science (CAFSS) became established after the successful application of forensic geology using largely polarising microscope and X-Ray Diffraction. In 2011 the Centre became a 'Forensic Science Centre of Specialisation', approved by Australia-New Zealand Policing Advisory Agency. Later, in Scotland, came the development of a Geoforensic GIS tool (SoilFit) and Geoforensics and Information Management for Crime Investigation (GIMI), to develop new technologies in the forensic investigations of crime scenes.

#### Establishment of FGG

Following over three years of planning and gathering support, in December 2005 Donnelly presented a proposal to GSL for a new specialist group on Forensic Geology. Approval was subsequently given by Council on 22 November 2006, for a 'Forensic Geoscience Group (FGG)'.

FGG's inaugural meeting took place at Burlington House on 18 December 2006, in time for the Society's Bicentennial in 2007. This establishment of FGG was supported by the then UK Police National Search Adviser, Commander Mark Harrison, MBE (now with the Australian Federal Police), who was working with Donnelly on Saddleworth Moor at this time. Mark subsequently commented (Police Professional, September 25, 2008, 20-22): 'Forensic geology can bring significant benefits to policing. Geologists' focus on exploration fits very well into a police and forensic environment during a criminal investigation. The expertise of a geologist would be of assistance when working anywhere in the world'.

The objective of FGG is to advance the study and understanding of forensic geoscience (also known as 'forensic geology' and 'geoforensics') - 'the application of geology to policing, law enforcement and criminal investigations'. Forensic geology may also assist with humanitarian, environmental, engineering and geotechnical investigations that may become subject to legal enquiry. Forensic geologists have also been involved in fakery and fraud cases including: minerals and mining scams (e.g. Bre-X, 1987) rare fossil sales, diamonds, gemstones and Rare Earth metal investments and the mineralogical analysis of paint to reveal art forgeries. A forensic geologist may be invited by the police or a law enforcement agent to assist with certain types of criminal activity relating to homicide, terrorism or organised crime.

### **Events & publications**

From 2006-2016 at least 227 forensic geology events have been held throughout the world. At least seven books have now been published, two GSL Special Publications, and numerous peerreviewed papers, conference proceedings, and newspaper and magazine articles. Members of FGG have been involved with many of these events and as authors, co-authors, contributors, advisors, editors or peer reviewers. 'A Guide to Forensic Geology' is currently being written.

Forensic geology has also brought together many of the Society's Specialist and Regional Groups. Numerous joint projects and collaborations have taken place with a host of commercial companies, police forces, forensic scientists, law enforcement agencies, other co-professional bodies, universities, research institutes, the media and school children.

FGG also developed the Geoforensic International Network (GIN), which brings together forensic geologists, geoscientists, police, law enforcement officers from approximately 40 countries interested in developing and promoting forensic geology.

### **IUGS**

In 2008, following the success of FGG, Donnelly was invited by International Union of Geological Sciences (IUGS) to set up an International Working Group on Forensic Geology. This was established in Uruguay and Namibia as part of the IUGS Commission on Geoscience for Environmental Management (GEM). The first Ibero-Latin American course on Forensic Geology was held in Colombia in 2009 with the Instituto Nacional de Medicina Legal y Ciencias Forense and the Federal Police in Bogota, Colombia. In 2011, IUGS promoted the Forensic Geology Working Group to the IUGS Initiative on Forensic Geology (IFG) (ongoing).



Above: Dealing with interest from the news media is another new skill that the forensic geologist may have to develop

A FORENSIC GEOLOGIST MAY BE INVITED BY POLICE OR LAW ENFORCEMENT AGENTS TO ASSIST WITH CERTAIN TYPES OF CRIMINAL ACTIVITY RELATING TO HOMICIDE, TERRORISM OR ORGANISED CRIME



### Training

FGG and IUGS-IFG have been invited to provide formal knowledge-exchange, capacity building, and training for geologists, police, law enforcement, forensic scientists and lawyers in many parts of the world - including the UK Police National Crime Agency (formerly the National Police Improvements Agency (NPIA) and Serious Organised Crime Agency (SOCA)); Russian Federal Centre of Forensic Science (RFCFS) of the Russian Ministry of Justice, in Moscow; Australian Federal Police; Brazilian Federal Police; National Research Institute of Police Science, Japan; the Carabinieri and Polizia (Italy); and the Abu Dhabi Police, Navy and Coastguard.

#### Teaching, research, outreach

FGG has encouraged and endorsed the formal teaching of forensic geology modules on BSc Geology courses (e.g. University of Leicester), MSc (e.g. Università degli Studi di Messina, Dipartimento di Scienze dell'Ambiente, Messina, Sicily) and PhD (e.g. Oxford University, University of Keele, Queen's University Belfast and both Birkbeck College and University College London). Research has also been undertaken at The Body Farm, in Knoxville, Tennessee, to understand the generation and migration of leachate and volatile organic compounds and how this can influence searches for homicide graves. FGG has supported a new human decomposition facility; the Australian Facility for Taphonomic Experimental Research (AFTER).

Forensic geology has captured the imagination of schoolchildren and university students. Numerous events have been held across the UK and globally for those aged 5-18. For instance, a mock crime-scene was established at the 2013 International School Science Fair, held in Cornwall. Following a series of lectures the children were able to conduct ground searches for (fake!) nail-bombs and weapons. Dressed in crime-scene protective suits they collected samples from a vehicle, spade and clothing and the analysis of these soils provided geological evidence and helped them to solve a fabricated crime. Forensic geology has been actively pursued by the media as this seems to have seized the public's interest, and many public lectures have been delivered.

#### **Operational support**

FGG was not set up only to support the UK Police. However, FGG committee members have been invited to enlist on the UK Police National Crime Agency, Expert Database as 'Forensic Geologists'. As such, geologists have provided advice, guidance, soil analysis and ground searches for numerous cases. Many of these were high profile, attracting national and international media interest.

Today, major crime laboratories throughout the world, public and private, conduct crime-scene investigation, including the analyses of soils and geological materials. Geologists are required to assist the police at crime scenes to collect and evaluate samples. Geological trace evidence involves analysis, interpretation, presentation and explanation of geological evidence, at a scene of crime, or from an item or object, as intelligence and as evidence.

This includes: rock fragments, natural soils and sediments, artificial (anthropogenic) man-made materials derived from geological raw materials (bricks, concrete, glass or plasterboard etc.) or microfossils. Trace evidence may be transferred onto the body, person or clothing of a victim or offender, or onto vehicles or objects from and to a crime scene. This, when interpreted by an experienced forensic geologist can help with crime reconstruction and may be admissible as physical evidence in a court.

Forensic geologists are now routinely



Geochemical surveys used as part of a search strategy to locate a burial

Ground search in progress

Car tyre and soil, analysis of which can be used to reconstruct the vehicle's movements

called upon for ground searches, applying techniques adopted from mineral exploration and geotechnical ground investigations. Such searches can be designed and implemented so as to locate homicide graves, mass graves related to genocide, weapons, firearms, improvised devices, explosives, drugs and items of value (e.g. stolen items, money, coinage, jewellery).

Ground searches may take place in urban, rural or remote locations, on land or in water (e.g. canals, rivers, lakes, reservoirs and the sea). A search may be conducted to: obtain evidence for prosecution, gain intelligence, deprive criminals of resources and opportunities to commit crime or acts of terror, locate vulnerable persons, protect potential targets and venues, search for homicide graves and associated buried items or objects.

Due to the sensitive and often high profile nature of crimes being investigated, many cases cannot be published and may only be referred to anonymously. This includes the search for missing persons, or, for example, the detection of a dismembered murder victim in northern England, following geomorphological analysis of air photos. Another victim's grave was found in a remote location following analysis of sand on a suspect's vehicle, and by the subsequent deployment of geophysics and a detectordog survey. A geological search strategy also helped the police locate the grave of a murder victim who went missing well over a decade earlier.

The UK Police National Search Adviser, National Crime Agency, commented: 'Geology in support of the search for a concealed murder victim is a relatively new and largely overlooked tool in the box'. A Major serving in the, British Army, Royal Engineers, stated: 'I have been actively involved in the world of search for 27 years and find it staggering that we (the British Army) remain oblivious to the assistance that geologists can deliver to any search task, let alone the strategy associated to it. I believe that a geologist must now be considered a critical asset to any search adviser during the planning phase of any search task'. •

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Left and right: Taking geochemical surveys

Spade with tell-tale soil traces adhering

# TOOLS OF THE OLDEST PROFESSION

## **Douglas Palmer\*** Palmer on the Sedgwick Museum's collection of 'the simplest scientific instruments'

rguably, the geological hammer is by far the oldest professional tool. And surprising as it may seem, the first to use them were our extinct hominin relatives, living on the western shore of Lake Turkana, Kenya in early Pliocene times, around 3.3 million years ago. Recent discoveries of stone artefacts<sup>1</sup> show that these 'proto-geologists' were already smart enough and had sufficient experience of rock materials - their hardness and fracture properties - to be selective in their choice of rock tools. They apparently preferred basalt and phonolite cobbles and knapped them on stone anvils with stone hammers to produce sharp-edged stone flakes. What exactly these flake tools were used for is unknown, but current thinking suggests that it may have been for cutting tough plant materials. Such well-developed cognitive abilities suggest that stone-tool use with rocky hammers, originated some considerable time before this.

Over 3.29 million years later, the geological hammer has evolved from one made of rock into a metal-headed tool; but is still used in the same basic way - albeit with a different purpose in mind. From mediaeval times, hammers diverged into a multitude of forms adapted for an increasing number of trade specialisations from the blacksmith, mason and carpenter to the jeweller, upholsterer and geologist. By the 19<sup>th</sup> Century Sheffield trade catalogues advertised around 80 different kinds of hammer.

### Collection

The Sedgwick Museum has a unique collection of geological hammers. It was originally assembled by Thomas McKenny Hughes (1832-1917), who succeeded Adam Sedgwick (1785-1873) as Woodwardian Professor of Geology in the University of Cambridge in 1873 and continues to be added to today. The collection of 41 hammers, includes those belonging to some of the pre-eminent geologists of the 19<sup>th</sup> Century, such as William Buckland (1784-1856), William Daniel Conybeare (1787-1857) and

Adam Sedgwick, as well as more recent Cambridge geologists such as Alfred Harker (1859-1939), G L 'Gertie' Elles (1872-1960), Oliver Bulman (1902-1974), H B 'Harry' Whittington (1916-2010) and R B 'Barrie' Rickards (1938-2009).

A newly published booklet (Tools of the Trade, Palmer, D 2016 - see Books & Arts, p 22), outlines the history of the geological hammer from the emergence of geology as a modern science, when pioneers, such as Robert Hooke (1635-1703) and John Woodward (1667-1728), emphasized field observation and collecting as an essential route to understanding Earth's processes, products and history. In 1665, Hooke refers to the use of a hammer in collecting fossils: 'That these Shells...have in tract of time rotted and mouldred away, and only left their impressions both on the containing and contained substances; and so left them pretty loose... so that they may be easily separated by a knock or two of a hammer.'

It is remarkable that such a simple tool as the geological hammer still has a fundamental role in the acquisition of geological information and the practice and teaching of the science. Indeed it could be argued that the geological hammer is more than just a mere tool but is also the oldest scientific instrument, albeit a very basic one. When we use a hammer to take a rock sample, we do more than just break the rock. We can also learn a lot about the nature of the rock, how tough and brittle it is, something of the nature of its component parts - the inter-relationships of the component grains and from the smell, even something of their chemistry.

## **Tool of the trade**

In the early decades of the 19<sup>th</sup> Century, as the science of geology became increasingly professionalized, the status of the geological hammer became elevated well above that of a mere 'tool of the trade'. The hammer took on a symbolic role for the profession with clubs and societies adopting it as part of their identity on logos and medals. Geologists began to see and describe themselves as 'brethren of



Above top: A pioneering female geologist Dr Gertrude Lilian Elles (1872-1960) on a Sedgwick Club field trip to Church Stretton in 1921, the year after being awarded an MBE for her war work. (Sedgwick Museum archives) Middle: Hammers to hand for geologizing in Ledbury –

Professor and Mrs McKenny Hughes and son Thomas in 1897. (Sedgwick Museum archives)

Bottom: A young Mrs McKenny Hughes (standing 4th from left) chaperones some female 'brethren of the hammer' on a Sedgwick Club field trip to North Wales in 1883. (Sedgwick Museum archives)

Left: Adam Sedgwick: 'a capital hand... for drawing large cheques upon the Bank of Time' according to Charles Darwin. Sedgwick Museum bronze statue by Onslow Ford 1901

AS THE SCIENCE OF GEOLOGY BECAME PROFESSIONALIZED, THE STATUS OF THE HAMMER TOOK ON A SYMBOLIC ROLE



▶ the hammer', as if the profession was a religious sect or quasi-masonic lodge. It helped distinguish the science and its practitioners from the other newly emerging natural sciences.

Adam Sedgwick certainly regarded himself as one of the 'brethren of the hammer': so much so that he felt obliged to apologise for the behaviour of some overly zealous geologists in the Lake District. Their activities had attracted William Wordsworth's condemnation and famous complaint against 'He who with pocket-hammer smites....' (The Excursion Book III, 1814). Sedgwick wrote that: 'One of your greatest works seems to contain a poetic ban against my brethren of the hammer, and some of them may have well deserved your censures'. The poet replied that he had put the words in the mouth of his character, the Recluse, implying that Sedgwick was being a bit too literalminded.

Sedgwick's image as one of the great 'brethren of the hammer' was finally memorialised in his over life-size bronze statue in the Sedgwick Museum. The statue was the last work of eminent sculptor Onslow Ford (1852-1901) and portrays Sedgwick in academic gown with hammer in one hand and a slab of Welsh slate (with the trilobite *Angelina sedgwicki*) in the other. A towering figure, part priest, part scholar and part field geologist, Sedgwick's somewhat intimidating gaze looks over the collections and visitors to the Museum.



#### Darwin

Sedgwick's most famous protégé, Charles Darwin frequently made reference to his geological hammer in his correspondence and not always for its intended use. A few months after setting sail on HMS Beagle, Darwin was among a ship's party that landed on St Paul's rocks in the Atlantic populated by dense colonies of seabirds. As he wrote to J M Herbert in June 1832: 'The birds by myriads were too close to shoot, we then tried stones, but at last, proh pudor!, my geological hammer was the instrument of death.' Darwin's journal adds detail '... the geological hammer... became a missile. Lend me the hammer? Asked one. No, no, replied the owner, you'll break the handle; but hardly had he said so, when overcome by the novelty of the scene, and the example of those around him, away went the hammer, with all the force of his own right-arm...'.

Just over 80 years later, on the eve of World War I, members of the University of Cambridge's Sedgwick Club were photographed on a field trip to North Wales pitching their hammers at some unseen target. No doubt students of geology still throw their hammers with or without official sanction. And, no doubt almost every geologist will have a 'story' to illustrate its use and misuse. Among the hammers in the Museum's collection that belonging to the late Colin Forbes (1922-2014) brought a vivid memory back for Nigel Woodcock.

He recalls how Colin helped out on a regular student field-course around

Sedbergh, Cumbria. Staff and students were housed in a bunk-bedded field centre in the old St Mark's vicarage at Cautley. Colin had a morning routine to rouse everyone. He suspended a gong in a central staircase well and hit it with his hammer whilst using his stentorian voice to bellow into each dormitory words from the *Rubaiyat of Omar Khayyam*: 'Awake!... for morning in the bowl of night/ Has flung the stone that puts the stars to flight'. No student, or colleague, woken in this fashion, seems to have quite forgotten the experience.

Fortunately, the making of a geologist still requires the student to sample rocks with a simple, effective and relatively inexpensive hammer and make an initial diagnosis from a freshly broken surface, even if the subsequent analysis requires multi-million pound machinery. As Darwin wrote to his cousin, the Rev. W D Fox in 1835: 'Geology is a capital science to begin, as it requires nothing but a little reading, thinking & hammering'.

*'Mente et malleo'* is still an appropriate motto for our science. ◆

**\*Douglas Palmer** is Public Programmes Coordinator for the Sedgwick Museum, Cambridge.

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Sir, The two feature articles on the Aberfan disaster in Geoscientist (Vol 26.9 October 2016) have rekindled strong memories of a defining period in my early career as a geologist.

By mid-1967, I was in post with the South Wales Geological Services, a unit formerly concerned with coal production but now rapidly expanding, taking on staff to cover tip site survey - the upgrades to the Mines and Quarries Acts were looming. Before this there had been no geological input at all into tip site selection and management. The expanded unit included four "old hands" to continue the coal production work, three new boys such as myself and a geologist acquired from the Opencast Executive to work on the tip site surveys. Only the latter had any experience of the shallow geology of the coalifield. We were fully supported by clerical and drafting staff.

The NCB has quite rightly been pilloried many times over because of the Aberfan disaster, but the purpose of this letter is to try and show that at least at grassroots level its specialist staff made great efforts to redress this shocking situation. The upcoming Acts meant that tens if not hundreds of sites both large and small needed a careful survey and report. We did our best, our efforts often not being appreciated by senior management who for one thing did not accept that geologists should express an opinion. We were firstly directed to inspect those tips threatening lives and property, and those whose collapse might interfere with the NCB's prime activity. Other sites, future, current and disused came later. We were learners at this stage and we made use of all available methods, some of which must seem very basic today:

- Surface mapping of solid outcrop and superficial deposits.
- Feature mapping (absolutely vital).
- Basic hydrogeology based on understanding lithology and structures, augmented by borehole data and piezometer readings.
- Core logging (and the liaison with drillers and consultants).
- Detailed desk studies of old surface maps and underground plans
- Air photo interpretation.
- Liaison with colliery survey and tip site staff.
- Logging of any nearby shallow drifts of roadways.

After field work and data collection we were then required to prepare a site map and report, identifying any features of significance or concern. However, we were not permitted to refer to any of these as "problems" or "threats" as we were not senior engineering staff and thus were not in a position to come to valid conclusions!

Working with colliery staff in the office or up on the mountain top was always a pleasure. Information was given freely, usually with a cup of tea, and no end of useful tips picked up. These people did more to help clear up the mess (on all scales) than is given credit for.

Field work on the tip sites led to many a long and physical day, often in all weathers, and not without its hazards in terms of deep bogs and exposure. In many ways it was the ultimate in fieldwork-based geology, and one that shaped me for the future (but perhaps it would not suit everybody today).

The NCB workforce, and the lower echelons of management I believe can in no way be blamed for the disaster. There was no background training for any event of this type or scale, even though the warning signs were there, and today would be obvious. Everybody I met was keen to learn and make sure nothing similar ever happened again. Of the higher management, I don't feel so kind, having experienced pomposity, narrow mindedness and jealousy of status. I suppose this was compounded by an alarming amount of ignorance. It is good to think that management practice is in a different world today.

In *Geoscientist's* two features there is no mention of the effect of superficial deposits on the hydrogeology, particularly the cloak of impermeable boulder clay that covered the flanks of most valleys to varying heights. This boulder clay we found to be of concern as it could displace a spring line up the hill from its position suggested by the solid geology. I believe this was a factor in the Aberfan slip.

Also worthy of mention there was an even closer template for the Aberfan slide than that of Tip 4 in 1944, occurring a year or two earlier across Mynydd Merthyr close to Penrhiwceiber in the Cynon Valley. This tip was a large linear tip that was built up across the slope to the south. In 1941 or 1942, it gave way and ran as a slurry slide down the hillside, crossing the A4059 Abercynon road near the valley floor, continuing westwards to block the railway and fill the old canal. But like Tip 4, no one was hurt, and in the darkest days of World War 2, it must have seemed an inconvenient but largely insignificant event. People's minds were focused elsewhere.



## Aberfan - worst? Yes. Deadliest? No

*Sir*, Nobody would quibble (I hope) with your description of the Aberfan 1966 disaster as the worst in British history. In terms of anguish, it certainly was, principally because of the fact that so many of the victims were so young, and all were 'non-combatants'. It is telling that, while most mining disasters are named for the mine, Aberfan is named for the village.

However, if we allow ourselves to succumb for a moment to that (to some) annoying scientific habit of defining terms and putting numbers on things, many readers might equate 'worst' with 'deadliest'. And in that grisly league table, Aberfan 1966 was by no means the 'worst'.

In 1866, the Oaks Explosion killed 388 near Barnsley, Yorkshire - England's 'worst'. In Scotland the 1877 disaster at Blantyre claimed 207. Wales suffered the greatest number of deadly accidents in Britain, and the deadliest of these (and UK record holder) was Senghennydd, where an explosion killed 439 miners in 1913. In terms of number, Aberfan comes in at about 17th 'most deadly' British mining disasters.



**R MARSH** 

*Sir,* Interesting that you link the Farnborough crash and the Aberfan tragedy in your excellent leader (*Geoscientist 26.09 October 2016*). I have a personal interest in both; a direct one for Farnborough as I was there that day, and a tangential one for Aberfan partly because it occurred on the day of my grandfather's funeral and I well recall watching the television news that evening (in black and white – Aberfan will always for me be black and white), and partly because my specialism was geotechnical engineering.

The link you make about there being no prosecutions, no persons held responsible, no resignations is of course not completely valid. In 1952 everyone was aware that prototype aircraft would crash and that air shows were places for derring-do activities by test pilots. John Derry was performing the very first supersonic 'bang' at an air show and had done this successfully on each of the previous days (Neville Duke followed the crash with just such a bang).

Anyone attending an air show knew that they might well see a crash; what was less expected was that members of the public would be killed. Yet it is true that, in that post-war period, we were much more philosophical and less likely to find blame. A better comparison would have been with the Crichel Down affair of 1954 where a catalogue of official incompetence and deceit did, indeed, lead to a ministerial resignation.

I had first been taken to Farnborough in 1951 as an eight year-old by my father, who was in the aviation industry. That year we watched from the 'hill', the best vantage point. The following year we were delayed at Waterloo and were too late for the hill – we had to sit on lower ground – but the hill was, of course, where the engine was to fall that killed so many people. I well remember asking my father, as the engines flew overhead, "what are those Daddy?". The full impact of what had happened was initially lost on me.

Without that delayed train at Waterloo, I might well not be here to correspond with you. **KEITH MONTAGUE** 

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## **Tools of the Trade**



When the legendary geologist sciencewriter (now artist) Anna Grayson was posing before the Old Man of Hoy with Ray Mears, Kate Humble and the rest of the team

for the *Radio Times* group photo marking the broadcast of *The essential guide to rocks* (BBC, 2011), the snapper paused and said 'Anna dear, can you give your 'ammer to Ray?'. She refused - and quite right too. The hammer is, as she protested, the tool of the geologist's trade.

Geologists love their hammers like musicians love their instruments. To lose a treasured hammer (as we have probably all discovered) is a hammer-blow in itself. And the hammers of the great, like the James Tubbs bow used by cellist Jaqueline Du Pré (on sale as I write this, and expected to fetch tens of thousands of pounds), are items with a mystical resonance.

The Society has a reasonable selection itself. Charles Lyell's hammer (one of them – many great geologists have owned and donated several) can be seen on display in the Lyell Room. We also boast a Buckland, two Murchisons and a Lapworth. But our collection cannot compare with the rich trove amassed over the years by Cambridge's Sedgwick Museum. This exhibition booklet is a beautiful souvenir, ensuring that the texts that one's feet had grown too tired to permit you to read properly standing up, can be digested at leisure.

Palmer discusses the purpose of the hammer – including Darwin's use of it as 'a missile' (he also used it to hunt, capturing and killing a new species of fox, while the beast was transfixed by the sight of *HMS Beagle* at anchor in the bay below). Palmer goes on to describe the history of this 'simplest of scientific instruments', and its graphical use in all those badges of the 'mente et malleo' kind, through the ages, and across the world.

He then focuses on those 'brethren of the hammer' from the University of Cambridge, which has arguably the greatest claim to being the cradle of our science within higher education. The section of portraits of geologists with their donated hammers (and one of Bulman, holding a banana) brings us up to date - including some famous men whom I myself have witnessed wielding their tools – notably, Harry Whittington and Barrie Rickards.

Indeed Barrie once appeared at my door in hall at a Pal Ass conference, holding the very hammer pictured. He then demanded to know what I was doing in his room, and why his key didn't work. Proving, perhaps, that the mente and the malleo do not always go perfectly together.

Reviewed by: Ted Nield

#### TOOLS OF THE TRADE: THE SEDGWICK MUSEUM'S HISTORICAL COLLECTION OF GEOLOGICAL HAMMERS

by DOUGLAS PALMER 2016. University of Cambridge Museums & Botanic Garden 49pp. ISBN 9780992727017. Sbk. Price: £7.50, available from the Sedgwick Museum. W: www.sedgwickmuseum.org/ index.php?page=exhibitions

## London Pavement Geology (app)



In his biography of London, the writer Peter Ackroyd notes that to touch the stones that make up the capital's

great buildings brings you into contact not only with the men and women of our near past who built the city, but allows access to a geological history that is more ancient and mysterious. For the interested 'urban geologist', the London Pavement Geology app (from the creators of the website of the same name http:// londonpavementgeology.co.uk/) is an excellent interactive guide. The app is free to download for iOS and Android, is easy to use, and it occupies only 33MB of space; this is sufficiently small to fit on most devices.

Upon opening the app, the user is presented with the Google Maps view of London. Zooming in to any part of the city reveals a forest of small pins stuck in the map at specific locations, each representing a locality at which an interesting building stone may be found. The pin-heads are colour-coded depending on rock type (igneous, metamorphic, sedimentary), fossil, or geological structure. Pressing any of the pins reveals more information about each locality, including the name of the building stone and rock type, its age, geological period, and even the quarry from which it was derived. A few illustrative photographs help point the user towards the right building.

The most impressive aspect of this app is the number of localities available. All the content is user-generated, although a large number of locations have been drawn from the years of diligent investigation and collation on the part of the app's creators. The process of adding new locations is easy, although restrictive insofar as you must be standing at the exact location if you want to submit it. New submissions are moderated before publication.

Currently, the app only covers London, which may put off geologists who are not based in the capital. However, it still acts as a useful repository of geological information as many of the building stones in London are used in other cities around the country, and the scope for future expansion to other cities is clearly apparent. For those interested in the rocks around them, London Pavement Geology is well worth downloading.

Reviewed by: Matt Loader

London Pavement Geology (v. 1.0.0) is available for iOS and Android devices

## Science and the City: The Mechanics behind the Metropolis



Science and the City is aimed at anyone interested in all aspects of the technology—past, present and under development—used in constructing and running modern cities, ranging from buildings

and water supply to cars and the internet. Although it is Laurie Winkless's first book, she brings to it some years of research in thermoelectric energy harvesting at the National Physical Laboratory plus more than a decade of experience as a science communicator with schools and universities. Her combination of serious homework with a chatty style—bolstered by interviews with an impressive variety



of urban experts-mostly works well.

The sections on underground transport and skyscrapers are the main geoscientific attraction. Focusing on London's current Crossrail project, which Winkless is thrilled to tour with its engineers, she jokes: "How do you bore a tunnel? Talk about trains!" But her detailed discussion of the planning for proposed tunnel routes, and their digging, is anything but boring. A preliminary geological survey with ground-penetrating radar can reveal buried utilities. In Mexico City it unearthed an Aztec pyramid, in Istanbul a Byzantine shipwreck.

Above a tunnel-in-progress, buildings must be constantly monitored with sensors able to detect movement of even thousandths of a millimetre, linked to an alarm at the control centre. In response, a team of grouting engineers working in vertical tunnels a few metres wide injects a cement-like substance through small-diameter pipes radiating into the ground directly beneath the threatened structures. This stabilises the area in which further sinking is predicted, compensating for the loss of soil. "It's like a filler for the wrinkled face of a city." Such prophylactic grouting has frequently saved historic buildings across the world that might otherwise have disappeared 'in the name of progress'.

As for seismic engineering, the chief engineer of the world's tallest structure, the 828-metre Burj Khalifa in Dubai, tells Winkless that "even in an area with moderate seismic activity, wind usually dominates designs." That said, huge damping pendulums inside a tall skyscraper, which move in the opposite direction to its sway, have proved useful against both high winds and earthquakes in skyscrapers and bridges in Taiwan and Japan, as Winkless notes. But in her passion for progress, she sometimes neglects tradition. Japan's first skyscraper, built in Tokyo in 1968, used a flexible steel-frame lattice apparently inspired by the flexible wooden structure of the city's 17th Century Kan'eiji Temple that enabled it to survive the Great Kanto earthquake of 1923 intact.

Reviewed by: Andrew Robinson

#### SCIENCE AND THE CITY: THE MECHANICS **BEHIND THE METROPOLIS by LAURIE** WINKLESS

Published by: Bloomsbury Sigma, 2016. ISBN 978 1 4729 1321 0 298pp, List price: £16.99

## **Exploring the Planets**



Fred Taylor, author of this entertaining but uneven memoir and erstwhile Professor of Atmospheric and Oceanic Physics at

Oxford, was at the cusp of space research for most of his career. He designed and built a lightweight radiometer there and after tedious trials it was chosen to go up in a US Nimbus satellite to investigate Earth's upper atmosphere. That started things off nicely.

Soon after, Fred moved to the Jet Propulsion Laboratories in Pasadena. After initial disappointment, he grabbed his chance and become Principal Investigator of a team that put atmospheric measuring equipment into the Pioneer space probe to Jupiter and Saturn. It launched successfully from Cape Canaveral in 1978 and brought back valuable data. Backed by that success, Fred was also appointed Principal Investigator for the Pioneer Venus Orbiter in 1979.

Then, in a surprise move Fred, 35, returned to Oxford in 1980 to become a professor and help promote Britain's space contribution. The investment climate here was not as exuberant as that in the States. Says Fred: "Britain seemed quite austere after California. It wasn't just the relative poverty and low salaries; there was a certain meanness of spirit that permeated everything. The (funding) system for university research tended to be erratic and unreliable." Nevertheless, he battled on with some notable successes and eventually, through market integration, the European Space Agency helped fund larger projects.

This memoir tracks his career. At heart, it is a testimonial to earnest endeavour. For me, his experiences in three different work environments (the US; Britain and Europe) provide much of the interest; but at times the text is laden with acronyms and unfamiliar names so it reads a little heavy. Those looking for further insights into the missions won't get much joy. That information is in previous

books. There are lighter moments. His sections about his Aston Martins (and other fast cars), some clashes with the law, and a couple of unfortunate accidents, read much more easily.

The book somewhat disjointed and the poor reproduction of his personal photos did not help. Overall, Fred's experiences during 50 years of trials and tribulations provides a useful historical record of all that is good (and bad) in space science.

Reviewed by: David Edwards

EXPLORING THE PLANETS by FRED TAYLOR. Oxford University Press 2016 ISBN: 9780199671595 (hbk) List price: £25.00 W: https://global.oup.com/ academic/product/exploring-the-planets-9780199671595?cc=gb&lang=en&

## **Tertiary Deep-Marine Reservoirs of the North Sea Region**



This excellent compilation offers a valuable overview of one of the primary play systems in the North Sea Petroleum Province. McKie et al.

have arranged the papers to offer a value-chain perspective, with a range of diverse case studies illustrating the field life cycle from mature basin exploration through development to late life production. It builds on, and is best viewed within, the extensively published regional geological framework that already exists and is widely published.

The exploration papers in the volume add to this framework and show the value of working data hard and forensically even in well-known and understood plays to unlock value in what have been marginally commercial and subtle plays containing significant stratigraphic elements to traps. Appropriately the focus of the volume is slightly

## 

weighted towards field development and production offering a diverse range of interesting and well-written case histories. Examples range from near field exploration in such as Lochranza and Arran through to mature field production cases from the Forties, Alba and Gannet fields.

The papers also show how modern thinking on deep-water depositional systems and the application of new technology (notably seismic imaging) can unlock value in complex heterolithic reservoirs, fan margin systems and in mature fields with up to 40 years' production history. The critical value of integration and the effective use of diverse data sets is also an important thread that permeates the volume.

I would commend this to any subsurface practitioners working not only the North Sea but also some of the newer areas of deep-water exploration and field development globally where much can be gleaned for these well-described and documented examples. It is also a good reference for those teaching reservoir systems or training classes covering this important area of reservoir geology. Papers are, overall, well written, and the extensive use of colour images adds a great deal to the value. Much valuable hard data and many figures enhance the text and offer an easy-to-read format as well as great reference material.

Having worked on many of these reservoir systems in the past, this offered a readable and informative update – as well as a refreshing message: that value remains in a mature play systems and late-life fields with significant production challenges. It also demonstrates the impact of well-executed petroleum geology and subsurface assessment, building on sound geological principles together with understanding of petrophysical and reservoir engineering.

#### Reviewed by: Mike Bowman

## TERTIARY DEEP-MARINE RESERVOIRS OF THE NORTH SEA REGION

T MCKIE, P T S ROSE, D W JONES & T L ARMSTRONG (eds), 2015. Geological Society Special Publication 403 ISBN: 978-1-86239-656-2, 407pp, hbk. List Price: £100.00. Fellows: £50.00. W: www.geolsoc.org.uk/SP403

## The Geology of Eigg



Originally written in 2003, this guide was sold in the island craft shop, proving popular with visitors. This revised and updated edition has been published by the Edinburgh Geological Society

in association with the Isle of Eigg Heritage Trust, with the aim of promoting the interesting geology and spectacular scenery of this small island to a wider audience.

Eigg is a unique Hebridean island where a local community buyout in 1997 led to the development of the first wind, water and solar-powered electricity grid. As the ferry approaches the island visitors' eyes are drawn by the impressive cliffs of pitchstone that form the Sgurr. The island's geology and landforms impress the most casual visitor.

'The geology of Eigg' is intended for visitors, whatever their geological knowledge or lack of it. In A5 format, it can be carried in a pocket for easy reference when out walking. This review is based on my experience using it during a family holiday.

The text is clearly written with many colour photographs and the inclusion of a glossary and stratigraphic column is helpful for the non-geologist. Part one describes the geology of Eigg and its regional setting, with individual sections reviewing the stratigraphy of the Jurassic and Cretaceous sediments, the Hebridean Igneous Province and the story of the Sgurr. A review of the 'Ice Age' and its impact on the landscape concludes the first part. Reference is also made to Hugh Miller and the Eigg plesiosaur and to Sir Archibald Geikie's theory on the formation of the Sgurr. The informative text provides sufficient detail for the casual visitor.

There follow seven excursion guides, based on the extensive network of waymarked footpaths. Clearly annotated route maps are included (which can also be purchased from the craft shop). As the island measures five by three miles, all excursions are accessible from the pier, where the café, craft shop and island shop are located.

The first four excursions introduce the visitor to the main features of the geology and landscapes of the island. They can be combined with visits to places of interest such as the 'Singing Sands' and 'Massacre Cave'. There are options to extend these routes for the interested geologist. Excursions five to seven are more strenuous, offering the opportunity to discover the remoter parts of the island.

The booklet was well used during our visit by both geologist and non-geologists and I would recommend it to anyone visiting Eigg as an excellent companion let down only by poor binding - our copy disintegrated into separate pages.

Reviewed by: Richard Wrigley

#### THE GEOLOGY OF EIGG

by JOHN D HUDSON, ANGUS D MILLER, ANN ALLWRIGHT. Edinburgh Geological Society, 2016, 2nd Edn., sbk ISBN-13: 9780904440164, 68pp. List price: £7.50 W: www.edinburghgeolsoc.org/p\_sales.html

## BOOKS FOR REVIEW

Please contact **ted.nield@geolsoc.org.uk** if you would like to supply a review. You will be invited to keep the review copy. See a full up-to-date list at **www.geolsoc.org.uk/reviews** 

- NEW! Strictly (Mining) Boardroom a practitioner's guide for next-generation directors by Allan Trench and john Sykes 294pp, sbk
- NEW! Storm, Nature and Culture by John Withington. 190 pp sbk
- NEW! Mountain, Nature and Culture by Veronica della Dora. 264pp sbp
- NEW! Ladders to Heaven how fig trees shaped our history, fed our imaginations and can enrich our future by Mike Shanahan. Unbound Press, 2016. 203pp, hbk.
- NEW! Transform Margins development, controls and petroleum systems by Nemcok et al., (eds.) 2016 Geol Soc Spec Pub #431 385pp hbk
- NEW! Magmatic Rifting and Active Volcanism by Wright et al. (eds.) 2016 Geol Soc Spec pub #420, 374pp, hbk
- Quaternary Environmental Change in S. Africa physical and human dimensions by Knight et al (eds). 2016 CUP 436pp (hbk)
- Palaeomagnetism in fold and thrust belts new perspectives Edited by Pueyo et al. 2016 Geological Society Special Publication #424. hbk
- River-dominated shelf sediments of East Asian seas. Edited by Clift et al. 2016 Geological Society Special Publication #429. hbk
- Sensing & Monitoring Technologies for Mines and Hazardous Areas by Chaulya & Prasad. 2016 Elsevier 403pp, sbk.
- Stochastic Analysts of Scaling Time Series from turbulence theory to applications by Schmitt FG and Huang Y. Cambridge UP 2016 204pp hbk
- Volcanic Geology of Sao Miguel Island (Azores Archipelago) by Gaspar et al (Eds) Geological Society Memoir #44, 2015 hbk 309pp



## ENDORSED TRAINING/CPD

COURSE	DATE	VENUE AND DETAILS
Practical Laboratory Rock Mechanics Testing for Civil and Ground Engineering	19-20 December	Venue: Burnaby Building, University of Portsmouth, PO1 3QL. Fees & discounts: see website. Contact: Pete Rowley E: peter.rowley@port.ac.uk
Geology of Scotland	26-30 January	Venue: Green Park Hotel, Clunie Bridge Rd, Pitlochry, Perthshire. Fees & discounts: see website to book online. Or contact hotel T: 01796 473248
Lapworth's Logs	2017	'Lapworth's Logs' is a series of e-courses involving practical exercises of increasing complexity. <b>Contact:</b> info@lapworthslogs.com. Lapworth's Logs is produced by Michael de Freitas and Andrew Thompson.

## DIARY OF MEETINGS 2016/2017

PLEASE NOTE THAT THERE ARE MANY MORE MEETINGS IN DECEMBER AND JANUARY, FOR WHICH WE DO NOT HAVE SPACE. ALWAYS CHECK WITH **WWW.GEOLSOC.ORG.UK/LISTINGS** 

COURSE	DATE	VENUE AND DETAILS
Engineering Group and IGS Joint Meeting	1 December	Venue: Burlington House. Time: From 1730.
Recent Work in Archeological Geophysics NSGG	6 December	Contact: Alex Booer E: engineering.group@geolsoc.org.uk Venue: Burlington House. Time: 0900-1700. Fees & discounts: see
Christmas Social: Geological Quiz and Meal Western Regional	6 December	or W: www.nsgg.org.uk/meetings/
Central Scotland: Poster and Presentation	6 December	Venue: Bristol University. Registration will be required. No details at time of going to press. Contact: westernregionalgroup@gmail.com
Central Scotland Regional, ICE Scottish Geotechnical		Venue: IET Teacher Building, Glasgow. Time: 1730. See website for details. Contact: Alistair McCay E: Alistair.Mccay@glasgow.ac.uk
Update on Eurocode 7 Yorkshire Regional	7 December	Venue: TBC. Speaker: Prof. David Norbury. Contact: Mark Lee E: yorkshireregionalgroup@gmail.com
Waking the Giant: how a changing climate triggers earthquakes, tsunamis and volcanoes. Geological Society London Lecture	7 December	Venue: Burlington House. Speaker: Bill McGuire. A London Lecture. See p06 for details.
Glossop Lecture North West Regional	8 December	Venue: Manchester University. Speaker: Tony Waltham. A reprise of his 2016 Glossop Lecture on karst. See website. Contact: geologicalsociety.northwest@gmail.com
How to get the best out of geotechnical sampling and lab testing Thames Valley Regional	14 December	Venue: Jacobs Office, 1180 Eskdale Road, Winnersh Triangle, RG41 5TU Reading. Time: 1830 for 1700. See website for details. Speaker: Dr John Powell, Geolabs. Contact: E: tvrgsecretary@gmail.com
55th AGM BSRG	18-20 December	Venue: Churchill College, Cambs. <b>Registration:</b> see website for links and Details. <b>Cost:</b> from £70. W: www.bpi.cam.ac.uk/BSBG2016 <b>F:</b> bsro2016@bpi.cam.ac.uk
January		
Quaternary engineering geology implications for glaciated and periglaciated terrains QRA, Engineering Group, Year of Risk	4-7 January	Venue: Durham University. Contact: Dave Evans E: d.j.a.evans@durham.ac.uk Dave Giles : E: dave.giles@port.ac.uk Ice Breaker at 1900. For registration see website.
Irrigating Peru Southern Wales Regional	17 January	Venue: LT 1.40 Cardiff University, Main Buliding, CF10 3AT. Speakers: Marcela Wamzer Jeiss and Sergio Solera, Mott MacDonald. Time: 1730 for 1800pm finish 1900. Contact: Simon Hughes E: swales.rg@geolsoc.org.uk
Redcliff Caves Tour Western regional	17 January	Field trip (provisional). Details unavailable at time of going to press. Advanced booking required E: westernregionalgroup@gmail.com

# **PEOPLE** NEWS

### **CAROUSEL**

All Fellows of the Society are entitled to entries in this column. Please email ted.nield@geolsoc.org.uk, quoting your Fellowsip number.

### David Vaughan



Research Professor of Mineralogy at the University of Manchester, has achieved the

rare distinction of being elected a Foreign Fellow of the Royal Society of Canada, that country's national academy. David is the leading international authority on metal sulphide minerals, key materials for the Canadian economy and natural environment, and has played a major role in establishing the field of molecular environmental science which integrates research on the mineralogical, geochemical and biological systems of the Earth's surface at the molecular scale.

### IN MEMORIAM WWW.GEOLSOC.ORG.UK/OBITUARIES

#### THE SOCIETY NOTES WITH SADNESS THE PASSING OF:

Absalom, Sydney Stuart \* Ayers-Morgan, Christopher \* Armitage, John \* Bishopp, David \* Chaloner, W G Colley, H \* Davidson, Jon Davis, Robert Vincent \* Flood, Raymond Edward \* Geddes, James D\*§ Jenner-Clarke, Hugh Clifford David \* Litten, John Robert \* Morgan, Daniel \* Piffaretti, Joseph\* Ramsden, Robert \* Smith, Robert L \* Stokes, David R \* Telfer, John \* Van der Merwe, Roelef \* Wright, Ernest \*

In the interests of recording its Fellows' work for posterity, the Society publishes obituaries online, and in *Geoscientist*. The most recent additions to the list are in shown in bold. Fellows for whom no obituarist has yet been commissioned are marked with an asterisk (\*). The symbol § indicates that biographical material has been lodged with the Society.

If you would like to contribute an obituary, please email ted.nield@geolsoc.org.uk to be commissioned. You can read the guidance for authors at **www.geolsoc.org.uk/obituaries**. To save yourself unnecessary work, please do not write anything until you have received a commissioning letter.

Deceased Fellows for whom no obituary is forthcoming have their names and dates recorded in a Roll of Honour at **www.geolsoc.org.uk/obituaries**.



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## DISTANT THUNDER

Geologist and science writer **Nina Morgan**\* samples some festive geological fare

For palaeontologists what could be more enticing than a festive meal featuring tasty samples of extinct animals? Of the recently departed, the dodo (Raphus cucullatus) might have been one possibility. But alas, the last documented sighting of a living dodo was in the 17<sup>th</sup> Century, and no one thought to pop the bird into a freezer for later consumption.

Woolly mammoths (*Mammuthus primigenius*), however, are a different kettle of fish. These extinct relatives of today's elephants flourished during the Pleistocene ice ages, around 250,000 – 4000 years ago. The first fully documented discovery of a mammoth fossil was recorded in 1799 by a hunter who came across frozen remains in permafrost along a riverbank in Siberia. Since then significant finds of frozen and mummified carcasses of

woolly mammoths have been

recorded from more than 100 sites in North America and Eurasia. As a result of their often rapid 'fossilisation', much is known about the diet and demise of individual animals.

Mammoth meals

## **Fresh-frozen fossils**

In his book, *Siberian Man and Mammoth*, E W Pfitzenmayer, a scientist who undertook expeditions to Siberia in 1901 and 1908, describes the thrill of finding and excavating the body of a woolly mammoth from its 'icy grave':

"... we found half-chewed food still in its mouth, between the back teeth and on its tongue, which was in good preservation. The food consisted of leaves and grasses, some of the latter carrying seeds. We could tell from these that the mammoth must have come to its miserable end in the autumn." This form of rapid fresh-frozen fossilisation also provided Pfitzenmayer with a unique opportunity to sample and describe mammoth meat:

"The well-preserved flesh on the upper parts of the foreleg and thigh and on the pelvis was streaked with thick layers of fat. As long as it was frozen it had a quite fresh and healthy appearance, and a dark-red colour like that of frozen reindeer or horseflesh, but was considerably coarser in fibre."

## **Dining dangerously**

It may have been accounts such as Pfitzenmayer's that inspired the members of the Explorers Club, an American-based international multidisciplinary professional society founded in 1905 to promote scientific exploration and field study, to put mammoth on the menu for its annual dinner in 1951. These annual dinners, held to honour accomplishments in exploration and hosted at the club's headquarters in New York City, are famous for their menus based on adventurous and exotic cuisine, including delicacies such as fried tarantulas and goat eyeballs.

However, right from the start, doubts as to the identity of the exotic meat served up in 1951 began to arise. In fact, the meat, said to be sourced from Alaska, was originally billed on the menu as *Megatherium*, an extinct ground sloth known only from South America. If true, that in itself would have been

remarkable. because it would have extended the species' known range to as far north as the Aleutian Islands in Alaska. But as it turned out the meat served up was neither mammoth nor Megatherium. Its true identity was

revealed in 2015

when scientists at

Yale University in Connecticut, US carried out DNA analysis on a preserved sample of the cooked flesh. The diagnosis? *Chelonia mydas*, or green sea turtle, perhaps a leftover from the turtle soup that was also on the menu that night.

A disappointing result for palaeontologists perhaps, but for the diners, it turned out to be a lucky escape. Pfitzenmayer recalled that as soon as the mammoth meat thawed, it entirely changed its appearance, and "... became flabby and grey and gave off a repulsive ammoniaical stench that pervaded everything."

Give me turkey any day! A very happy festive season to all.

Acknowledgement Sources for this vignette include: the article The **Explorers Club Once** Served Mammoth at a Meal. Or Did It? published on 3 February 2016 and available at: www.nvtimes.com/2016 /02/04/science/explorersclub-mammoth-dinner.html; Glass JR et al. (2016) Was Frozen Mammoth or Giant Ground Sloth Served for Dinner at The **Explorers Club? PLoS** ONE 11(2): available for download at: http://journals.plos.org/ plosone/article?id=10.1371/ journal.pone.0146825; Siberian Man and Mammoth by E W Pfitzenmayer, Blackie & Son Ltd, 1939; the entry for mammoths at http://www.newworld encyclopedia.org/entry/ Woolly\_mammoth; and the

Wikipedia entry for The Explorers Club.

\* Nina Morgan is a geologist and science writer based near Oxford. Her latest book, The Geology of Oxford Gravestones, is available via www.gravestonegeology.uk



WWW.GEOLSOC.ORG.UK/GEOSCIENTIST | DECEMBER 2016/JANUARY 2017 | 27

## **OBITUARY Norman John D'Cruz 1924-2016**

orman was the third and youngest son of an English mother and an Indian physician/ barrister, who died when he was three. He attended Trinity School in London.

In 1942 he commenced wartime service in the communications branch of the RAF and was trained in Somerset and Wiltshire before being transferred to the London headquarters, which was housed in the Science Museum, South Kensington. He was demobbed with the rank of instructor-sergeant in 1946.

## State scholar

Following initial part-time studies at Birkbeck College he transferred to University College London as a state scholar in 1948 to read for a degree in Geology with Zoology as a subsidiary subject graduating with a good honours BSc in 1951. He was elected a Fellow of the Society in 1950. He followed this by studying for a teaching qualification at Fitzwilliam Hall (now College), Cambridge. A spell of teaching practice at Kendal Grammar School engendered his life-long love of the Lake District.

In 1952 he was appointed as a master at Beckenham and Penge (County) Grammar School for Boys (now Langley Park School for Boys) to teach a variety of science subjects. His former Well-loved and respected teacher of geology, with a flair for crystallography and mineralogy



HE WAS AN OUTSTANDING TEACHER OF CRYSTALLOGRAPHY AND WAS RENOWNED FOR HIS AMAZING SKILLS IN DRAWING FREEHAND

students included Derek Underwood, the England and Kent cricketer, Bill Wyman, of the Rolling Stones and David Inshaw – an artist and member of the Brotherhood of Ruralists. He was appointed

Lecturer at Luton College of Technology (now the University of Bedfordshire) in 1960, proving the perfect foil for Albert Ludford. Together they considerably enhanced the geological resources at Luton for the teaching of the External London BSc. He became a recognised teacher of the University of London and was an Examiner for London University External degrees. With Albert and Gordon Taylor he took a leading role in the successful validation process of the science degree by the Council for National Academic Awards in 1972.

## Crytallography

He was an outstanding teacher of crystallography and was renowned for his amazing skills in drawing freehand complex 3D crystal structures on the blackboard, Norman's favoured medium. At the end of his lectures the blackboard was a carefully crafted colourful mural that students frequently photographed. In the field Norman embodied a picture of sartorial elegance equipped with, among other things, a deerstalker hat and umbrella.

On his retirement in 1983, Norman was a Senior Lecturer and had been (from 1974-76) acting head of the geology section. Typically, he donated the money collected in recognition of his years of service to a needy student. Afterwards he pursued his love of gardening and developed a passion for lengthy cruises especially to the Indian sub-continent and further afield. He never lost touch with geology and enjoyed frequent contact with many former colleagues and students.

Norman was quintessentially an English gentleman, generous and supportive to colleagues and students alike and possessing the characteristics of humour, patience, enthusiasm and humanity. His influence will linger for a long time.

> By Gordon Taylor with help from James MacAulay

**HELP YOUR OBITUARIST** The Society operates a scheme for Fellows to deposit biographical material. The object is to assist obituarists by providing contacts, dates and other information, and thus ensure that Fellows' lives are accorded appropriate and accurate commemoration. Please send your CV and a photograph to Ted Nield at the Society.



## ACROSS

- DOWN
- Common to banks, sedimentary basins and a (usually) clean pair of trousers. (7)
- 8 Spiny anteater (7)
- **10** Graciously accompany, like a Ford hatchback (6)
- **11** The tendency to point, like a magnetic field (8)
- **12** Melanesian archipelago (4)
- **13** Sinuously loopy as in
- watercourses (10)
- **14** Divisions to the  $10^{-3}$  (11)
- **19** Photosynthetic pigment (10)
- 22 Pre-Roman alphabet Germanic letter, proverbially hard to read (4)
- **23** Latin hole (8)
- 24 PTFE non-stick coating (6)
- 25 Hippoglossus (7)
- 26 Containing two copies of each gene (7)

- 1 Of earthquakes (7)
- Concave-up igneous intrusion (8)
- Quasi-universal unicellular/colonial phytoplankton (6)
- 4 Shutting, as in teeth and weather fronts (8)
- 5 Reflective surface (6)
- 6 Immediate the present moment (7)
- 9 Fold belt extending along the E coast of North America (11)
- **15** Obsessively or submissively fond of a wife (8)
- 16 Fine to medium grained pelite, with porphyroblasts of eg. cordierite (8)
- Sedative trichloroethanal, with which John Tyndall's wife accidentally poisoned the great man (7)
- **18** Forming a positive ion (7)
- **20** Organic acid found in rhubarb and brassicas (6)
- 21 Pertaining to rock (6)

# WIN A SPECIAL **PUBLICATION!**

The winner of the October Crossword puzzle prize draw was **Neville Taylor of Aberdeen**.

All correct solutions will be placed in the draw, and the winner's name printed in the March 2017 issue. The Editor's decision is final and no correspondence will be entered into. **Closing date - January 30.** 

The competition is open to all Fellows, Candidate Fellows and Friends of the Geological Society who are not current Society employees, officers or trustees. This exclusion does not apply to officers of joint associations, specialist or regional groups.

Please return your completed crossword to Burlington House, marking your envelope "Crossword". Do not enclose any other matter with your solution. Overseas Fellows are encouraged to scan the signed form and email it as a PDF to **ted.nield@geolsoc.org.uk** 

Name
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## **SOLUTIONS** OCTOBER

#### Across:

- 7 Neotype 8 Celebes 10 Canyon
- 11 Loophole 12 Lode 13 Exobiology
- 14 Metaphysics 19 Calcareous 22 SIMA 23
- Assesses 24 Thorax 25 Entails 26 Aridity

#### Down:

- 1 Hexapod 2 Ethylene 3 Sponge 4 Deposits
- 5 Methyl 6 Geology 9 Pleochroism 15 Aerosols
- 16 Cystoids 17 Tar Sand 18 Impacts 20 Coeval 21 Suture



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Deer, Howie and Zussman



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