

GEOSCIENTIST

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The Fellowship Magazine of the Geological Society of London

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[REVIEWS SPECIAL
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SCARP

A Scottish Carboniferous
Research Park

SHACKLETON'S GEOLOGIST

Tom Sharpe and a tale
of geological derring-do

CIRCULAR ECONOMY

Decline in coal-fired power
affects green projects

FACE ON A STAMP

A geologist who achieved
the ultimate accolade



The Geological Society

-serving science & profession

2017

YEAR OF RISK

After two successful themed years, plans are underway for 2017 – the Year of Risk!

Themed years are at the heart of the Society's science strategy, and throughout 2017 we will explore the concept of risk in the context of the geosciences, through research conferences, lectures, our education programme and other activities.

As Earth's population grows, the risks associated with a range of geohazards have intensified dramatically, particularly in the developing world. An increasing number of people are living in major earthquake zones and on the flanks of explosive volcanoes. Groundwater aquifers all over the world have been depleted or contaminated, endangering water supplies.

The environmental risks associated with extracting resources and fossil fuels must be weighed against the needs of growing economies. These issues fall within the remit of the geoscientist, and are likely to affect future generations to an even greater degree than ours; do we have the tools and mechanisms to tackle them?

The geoscience community faces a challenge; how do we engage policy makers and translate our understanding of science and hazards into risk assessment that can be understood by a range of stakeholders? As well as exploring the nature and causes of geohazards, the Year of Risk will provide an opportunity to share and debate emerging research into the science of risk, the public perception of risk and risk management. Events throughout the year will involve scientists, policy-makers, social scientists, economists, insurers, the media and modellers.

Science Committee is now inviting proposals for Geological Society conferences to take place during the Year of Risk.

Get involved!

Find out more at www.geolsoc.org.uk/risk17

To suggest a meeting topic or activity email Georgina Worrall

E: georgina.worrall@geolsoc.org.uk



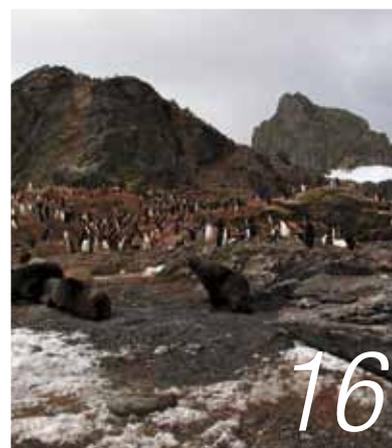
Landslide, El Salvador, 2001 @ USGS



Earthquake damage
Fukushima, Japan, 2011
© IAEA / Flickr



Coastal Erosion, Suffolk, UK, 2008
© Bob Jones / geograph.org.uk



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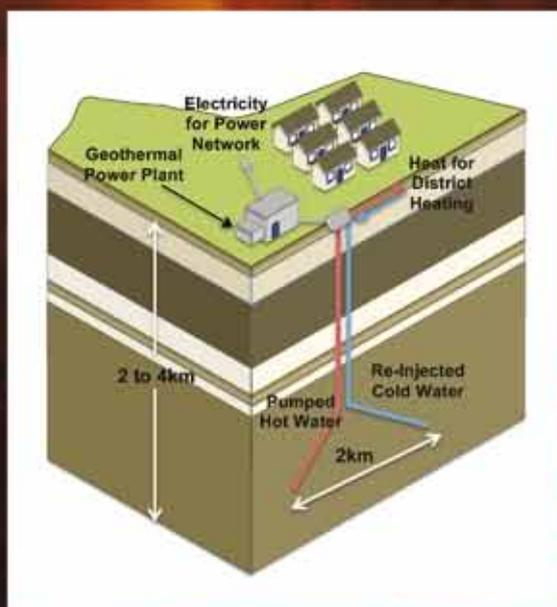
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The 5th London Geothermal Symposium

25 October 2016 · The Geological Society, Burlington House, London



Development of the UK's deep geothermal resource offers the potential to both generate secure and low carbon electricity and heat with the potential to significantly offset gas consumption currently associated with heat production. Geothermal development aligns with current government support for heat networks and has been made more feasible following the recent legislation on underground access and with the opportunity for several projects in a range of geothermal settings to apply for EU funds.

With new projects developing single well geothermal technology, interest in exploiting ultra low grade heat from abandoned mines plus several feasibility studies for the assessment of additional geothermal resources in Scotland, this event will highlight both current opportunities and future potential. There will be presentations on geothermal heat only and power generation schemes delivered by representatives from industry, government and academia. There will also be time for networking during the break and at the post conference drinks reception.

Convenors

Charlotte Adams (Durham University)

Guy Macpherson-Grant (EGS Energy)

David Townsend (Town Rock Energy)



Contact Information

For further information about this event please contact:

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“ LIKE GENTLEMEN’S RELISH, OR THE CHURCH OF ENGLAND, YOU DON’T HAVE TO HAVE SOMETHING EVERY DAY TO FEEL COMFORTED THAT IT EXISTS ”

FROM THE EDITORS DESK:

Fellow feeling

During President’s Day in June I had the honour to meet a lifelong Fellow who “hadn’t been in the building for some time”. “I was very disappointed by the changes, I’m afraid”, she added.

Thinking she must mean the refurbishments of 2006, I expressed surprise, because nobody who remembers the place in 2005 has EVER found them anything but a great improvement. “No,” she said, “I mean the Meeting Room”.

Thinking she must mean therefore the refurbishment of 1998/9, I asked: “Ah, did you prefer the demonstration bench? Some speakers do miss it, because they liked to take cover behind it...”. “No,” she said. “I miss the Parliamentary benches. Now, it just looks like any university lecture theatre!”. I had to tell her that the Meeting Room lost its historic benches in 1973, birth-year of today’s average-aged Fellow.

Many of you rarely come to Burlington House. But part of what you feel you pay for is the knowledge that you can. You have a club in town. You can, if you have a moment, pop in and browse the journals in the Library, or relax in the Fellows’ Room with a cup of coffee (sadly, the machine dispensing miniatures went some years ago, even before the still-lamented Fellow’s Bedroom).

Like Gentleman’s Relish, or the Church of England, you don’t have

to use something every day to feel comforted that it exists. Your Fellowship buys you the right. This right may be insubstantial, but in the loyalty business perception is reality, and this right is not to be discounted just because it is rarely exercised.

So, if for any reason, the Society were to remove such benefits, you might feel that you have been disobliged, betrayed - even cheated - especially if you turn up one day and find them gone.

This Society (though not our posh Council house, which cannot be commercially sublet without great legal difficulty), belongs to you – the Fellows, who are in all things sovereign. This magazine exists, independently of your elected and appointed Trustees, officers and staff, to provide scrutiny of them, and for you to use, should you feel the need, as a forum in which to criticise the things they may do in your name.

As we go to press, the President, Malcolm Brown, has written (in the Society’s email newsletter) informing Fellows that Royal Academy staff will occupy the Fellows’ Room for a ‘short term’ from 18 July, noting that use of the room by Fellows was ‘low’, that Library staff will continue to have access and that, against an unfavourable financial background, Council believes this is in ‘best interests of the Society and ... the best way to protect the Library’. What do you think?

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



Annual General Meeting report

Malcolm Brown takes the reins from outgoing President David Manning.

At the Annual General Meeting held at Burlington House on 8 June, The Annual Report 2015 was accepted, the new fees approved (see *Geoscientist May 2016 26.04 p08*) and new Trustees duly elected (see p2). Incoming President, Malcolm Brown, thanked his predecessor for all his hard work and dedication, and pledged to ensure during his term the future security of the Geological Society's tenure in Burlington House.

At a more than usually well-attended AGM, Fellows raised concerns about the future of the Fellows' Room, adjacent to the Main Library. At an earlier meeting held on 18 May, without enjoining the audience to secrecy, Executive Secretary, Sarah Fray, had informed staff that the Fellows' Room was to be sub-let to the Royal Academy for a period of 13 months beginning in June. The purpose of this was, she explained, to increase revenues from the building and rebalance the budget, which had been blown off course by external factors, including turmoil in commodities markets and falling book

sales. As a result, and as a 'planning gain' to the Society, infrastructural facilities in the Fellows' Room would be upgraded so as to provide electrical and data ports for up to 10 RA employees. This work would mean closing the Room immediately.

A week later, in a note to Fellows, distributed as item three in a Society email newsletter (dated 31 May), Ms Fray wrote: "Work is currently being undertaken in the Fellows' Room as part of an improvement to Wi-Fi and electrical facilities in the building. Fellows ... can use the Lyell Room for the coming period, with access to the computers and journals in the main library. Please forgive any untidiness or disruption caused by these works." She added: "I will be contacting Fellows shortly with further details on Fellows' use of Library facilities, including the Fellows' and Lyell Rooms."

However, the move to close and sublet the Fellows' Room had drawn unfavourable reaction from many. The Library received several written complaints about its unannounced unavailability, from users who had

travelled to London for meetings, intending to use it for that purpose.

Concerns were also expressed at the AGM about whether due process had been observed. Society Byelaws 6.25 and 6.25(i) suggest that a full Council's unanimous agreement must be obtained before any of the Society's hereditaments should be sold or 'otherwise disposed', which arguably could be seen to cover subletting. Prof Peter Styles, who as President signed the lease in 2006, pointed out that, as far as he could recall, the terms of that lease explicitly forbade sub-letting - at least without the agreement of the Landlord (the Geologist's Association's rooms being exempted, as they are a cognate organisation, are included in the Lease and do not involve payment of rent.)

David Manning assured the AGM that Officers and Council had been informed of the move to lease the Fellows' Room, but agreed that the matter should be put before the Society's Solicitor, Bristow's, and reconsidered by Council in the light of legal advice.

Ted Nield



Rain Rivers Reservoirs

28-30 September 2016 | Edinburgh Conference Centre, Heriot-Watt University, Edinburgh

The science of rain, rivers and reservoirs spans from 'clear gold' water, to 'black gold' oil. Following in the footsteps of the successful first Rain, Rivers and Reservoirs workshop in Sao Paulo, Brazil in September 2015, this workshop will bring together geoscientists and civil engineers with different backgrounds to generate new interdisciplinary approaches to key problems in our adjacent subject areas. Modern flooding, erosion and deposition, through to geological preservation of fluvial aquifers and petroleum reservoirs require linking of fluvial/flood processes to the longer term trends of climate change, regional uplift and sea level change. These subject areas are fundamentally interdisciplinary. Therefore we would particularly encourage Earth Scientists and Civil Engineers working on aspects of fluvial processes to join the meeting. Over abundance of water (flooding) and under-abundance of water (drought) are societal issues in many parts of the world that we wish to address, and we encourage world-wide case studies to be submitted. These wider perspectives add both depth and context, allowing researchers focussed on one particular aspect of fluvial expertise to contribute to solutions for ongoing global challenges.

Further information:

For further information about the conference please contact: Georgina Worrall, Conference Office, The Geological Society, Burlington House, Piccadilly, London W1J 0BG

T: 020 7434 9944 E: Georgina.Worrall@geolsoc.org.uk

Web: www.geolsoc.org.uk/rainriversreservoirs

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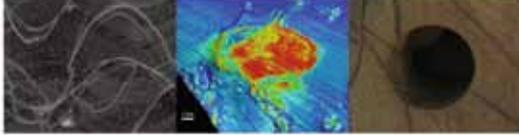
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Call for Abstracts – Deadline: 30 June 2016

Deep-water Depositional Systems: Advances and Applications

25-27 January 2017
The Geological Society, Burlington House, Piccadilly, London



Deep-water deposits continue to provide major reservoir targets for oil and gas exploration around the world as well as presenting a series of challenges within developing and producing fields. Considerable effort has been devoted to the understanding of these deposits both in terms of reservoir architecture and quality across the academic-industry interface. Progress has been made in understanding of whole-system source-to-sink relationships and controls, the mechanics of erosional and depositional processes, and the fine-scale architecture of the resultant deposits. Allied to this progress has been the advancement in characterisation techniques/technologies, which has impacted upon workflows and the ability to analyse unconsolidated as well as consolidated intervals at a greater level of refinement.

This 3-day international conference will bring academic and industry geoscientists, petrophysicists and engineers together, to share new developments in the following thematic areas:

- Depositional processes – sediment gravity flows to bottom currents
- Source to sink – deepwater systems
- Canyons and channels
- Confined slope systems – mobile substrates/structure and sedimentation
- Mass transport deposits
- Distributive systems
- Impact on exploration and production outcomes
- New techniques in reservoir characterisation and modelling

Call for Abstracts:
Please submit paper and poster contribution to abstracts@geolsoc.org.uk by 30 June 2016.

For further information please contact:
Laura Griffiths, The Geological Society, Burlington House, Piccadilly, London W1J 0BG.
Tel: +44 (0)20 7434 9944.

At the forefront of petroleum geoscience
www.geolsoc.org.uk/petroleum

FUTURE MEETINGS

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

◆ OGMs:

2016: 20 September;

24 November;

2017: 1 February; 4 April

◆ Council:

2016: 22 June;

20 & 21 September

(residential);

24 November;

2017: 1 February;

4 & 5 April (residential)



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SOCIETY NEWS

Society Awards 2017



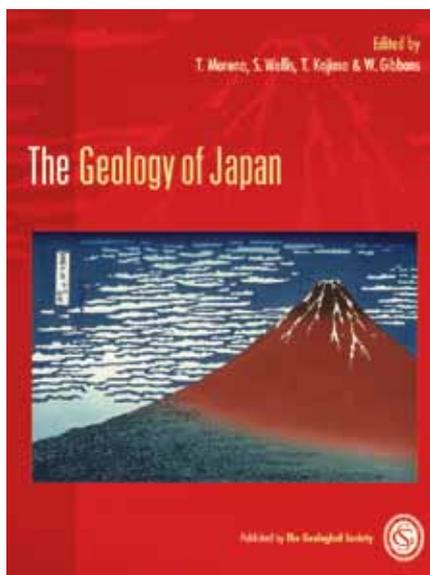
Make your nominations now, writes **Stephanie Jones**.

Fellows of the Society are invited to submit nominations to the Awards Committee for the Society Awards 2017.

Full details of how to make nominations can be found on the website at www.geolsoc.org.uk/About/Awards-Grants-and-Bursaries.

➤ Nominations must be received at the Society no later than **30 September 2016**

From the Publishing House



Anne Davenport and Jenny Davey bring you the latest news from the Society's Publishing House.

If you are completing fieldwork or going on holiday, don't forget that the GSL online bookshop stocks a range of notebooks from 'Rite in the Rain'. Each notebook is made up of a patented, environmentally responsible, all-weather writing paper that sheds water.

The GSL online bookshop also sells a range of regional geology titles and field guides, published by GSL and others – including both urban or rural locations. Walking shoes & cameras at the ready!

➤ To view the range of titles available visit www.geolsoc.org.uk/bookshop and use the 'Advance Search' function on the right hand side.



FROM THE LIBRARY

◆ Online Library catalogue

Search the online catalogue of books, journals and maps held in the Geological Society Library. Fellows and Corporate Affiliate members can now login to the Library Catalogue to renew loans, view loan history, request items and create Favourite lists.

<http://www.geolsoc.org.uk/librarycatalogue>

◆ E-Journals and e-books

Fellows of the Society can access over 100+ e-journals and e-books using Athens authentication. There is no charge to Fellows for this service. Visit

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PFA & the circular economy



Matthew Eynon* says the decline in coal-fired electricity production will have a knock-on effect on mine-works stabilisation

A It was announced recently that Aberthaw Power Station in the Vale of Glamorgan is to downgrade operations due to 'challenging market conditions'¹ and from April 2017 will only generate electricity when needed (i.e. predominantly during winter). The last few days in South Wales has also seen climate protesters occupying the coal mine at Ffos Y Fran under the #EndCoal banner².

It is obvious that huge pressures are bearing down on the coal and energy industry in the UK due to global commercial, environmental and social realities. These are unlikely to change significantly in the short term. But a major by-product from coal-fired power stations is Pulverised Fuel Ash (PFA), a key recycled aggregate in the construction industry, with large environmental and economic benefits.

Pozzolanic

Given its pozzolanic nature, PFA is used in low carbon cement, concrete and as a major component in the grout mixture used for stabilising historical coal mine-workings; typically for new developments where there is a risk of subsidence at the surface, utilising the WRAP protocol to meet the 'End of Waste' criteria³.

We have seen an increase in PFA costs through 2016 so far and, based on the forecast restriction of supply, can expect this cost increase to accelerate - as has been experienced in Scotland recently since the closure of Cockerzie power station in 2013.

What likely overall impact is restricted supply of PFA

going to have on the construction industry in South Wales and other local coalfields? Will it perhaps drive research into suitable alternatives (virgin and recycled)?

It may be that the circular economy cannot immediately provide suitable recycled aggregates; so virgin products could become necessary until materials research catches up and produces a practical reality. So, for the short-medium term at least, you can probably expect an increase in the project costs of mine-works stabilisation, until the supply and demand balance is restored.

Contracts

At my company we foresee that contract terms for mine-works stabilisation projects will become an important issue over coming months, as predicting and providing certainty on PFA costs may be challenging to those unaware of this issue. We are currently reviewing contracts for a range of live projects and implementing cost-sensitivity assessments linked to this matter.

Planning mine-works stabilisation projects during the cold months, as one possible means of addressing peaks and troughs of supply/demand, may become a reality for large or marginal sites. Some developments may become unviable through a difficult period of austerity, until land values or other commercial factors, including new aggregate sources, redress the balance.

References

1. <http://www.bbc.co.uk/news/uk-wales-36132870>
2. <http://www.theguardian.com/environment/gallery/2016/may/03/climate-protesters-occupy-uks-largest-opencast-coal-mine-in-pictures>.
3. <https://www.gov.uk/government/publications/quality-protocol-pulverised-fuel-ash-pfa-and-furnace-bottom-ash-fba>

***Matt Eynon CGeol** is a UK Registered Ground Engineering Specialist with Earth Science Partnership Ltd

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**, 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).

“ A MAJOR BY-PRODUCT FROM COAL-FIRED POWER STATIONS IS PULVERISED FUEL ASH, A KEY RECYCLED AGGREGATE WITH LARGE ENVIRONMENTAL AND ECONOMIC BENEFITS ”

Matthew Eynon

SCARP

A SCOTTISH CARBONIFEROUS RESEARCH PARK



Graham Leslie*
and **Mike Browne****
explore the
opportunities that
can be built on the
legacy of Scotland's
Opencast coal

Above: The 80-85m deep Spireslack 'canyon' can host a wide spectrum of new research in a volume of rocks where the essential stratigraphic and structural architecture is already well understood

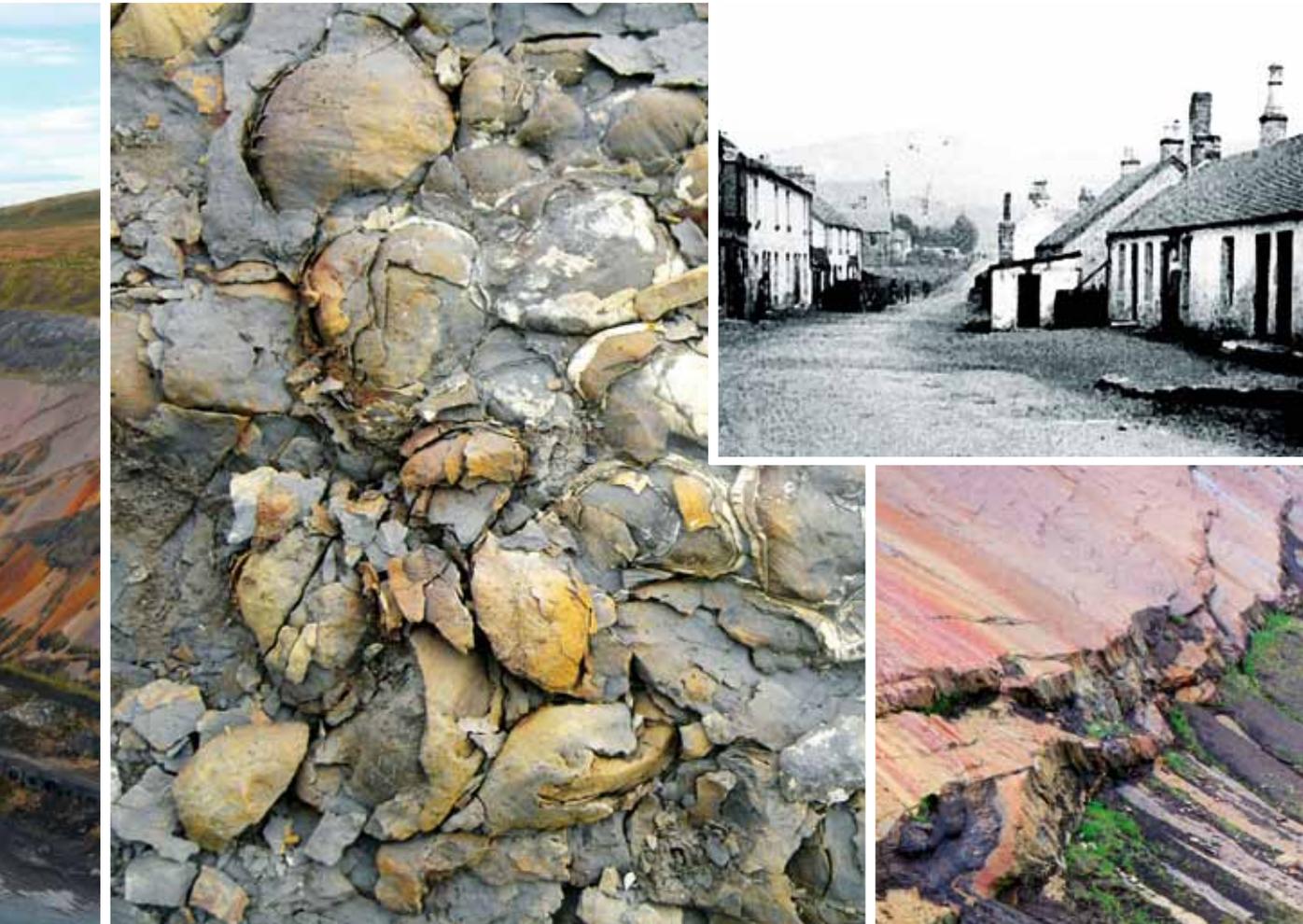
Starting from small-scale 13th Century operations, coal mining in Scotland expanded slowly until the 18th Century when, with the onset of the UK Industrial Revolution, steam engines created a near insatiable demand for fuel. Much of Scotland's industrial growth and prosperity in the late 18th to mid-20th Centuries depended upon the extensive exploitation of Central Scotland's Carboniferous coal, in concert with ironstone, oil-shale, limestone, sandstone, fireclay and mudstone (the last for brick-making).

From a peak of just under 240 million tonnes of coal produced in 1905 when Great Britain was for a time the world's largest producer, coal production and the workforce have declined dramatically. The announcement in 2015 of the final closure of Kellingy Colliery in North

Yorkshire saw an end to deep mining of coal in the UK. Although underground working ceased in Scotland in 2002, a third of UK opencast coal production took place in surface mines across Central Scotland up until 2010. Since then, weak world coal prices and other issues precipitated the financial collapse of two major operators of Scottish opencast coal sites.

A whole generation of Scots has arguably lost touch with the coal that provided employment, income, energy and a social structure for their parents, grandparents and older generations. Mining communities created a strong socialist heritage in many parts of the country; James Keir Hardie, founder of the Labour Party, lived in nearby Cumnock for much of his life. Bill Shankly, arguably Liverpool FC's most famous manager, hailed from the mining

“ BGS BELIEVES THAT SOME OF THESE FORMER MINES CAN BE DEVELOPED DURING PARTIAL RESTORATION, PROVIDING A UNIQUE OPPORTUNITY FOR PERMANENT GEO-CONSERVATION ”



Top right: Glenbuck village, East Ayrshire, c. 1920

Left: Marine limestone with abundant Productid brachiopod shells, typically 5 to 8 cm across in this view, Spireslack OSM

Bottom right: Beautifully exposed bridging relays in a branching oblique-slip fault (F on the model). The main scarp is 2.5m high and may mark a single rupture event

community that lived, worked and played in the village of Glenbuck. The local Glenbuck Cherrypickers football team achieved fame as a source of some 50 professional football players until the club was disbanded in 1931, as the local Grasshill Pit closed for the final time and underground mining ended (the young Shankly never played for the first team it seems!).

Liquidation

In April 2013, Scottish Coal went into liquidation, leaving seven ‘orphaned’ sites, all lacking the necessary funding for ‘muck shift and levelling’ restoration programmes that would have involved the opencast excavations being backfilled with waste bedrock material. In response, and at the behest of the Scottish Government, the Scottish Mines Restoration Trust (SMRT) set

out to facilitate communities and other stakeholders in bringing together viable restoration/ redevelopment plans for these orphaned opencast sites.

The British Geological Survey (BGS) believes that some of these former surface mines can be retained and re-developed during partial restoration, providing a unique opportunity for permanent geo-conservation, education and strategic national research. BGS strongly supports this initiative and will deliver the strategic geological baseline knowledge on behalf of SMRT, aiming to kick-start research and learning at these iconic locations.

Spireslack Opencast Surface Mine (OSM), situated by the now disappeared mining village of Glenbuck in East Ayrshire, and Mainhill Wood OSM, by the South Lanarkshire town of Douglas, both currently still provide stunning

and unique exposures of Scottish Carboniferous geology. The Spireslack ‘canyon’ was proposed by its operators as a local geodiversity site (LGS) as far back as October 2007, when a ‘Glenbuck Geopark’ was mooted in discussions with Strathclyde GeoConservation Group, GeoConservationUK, East Ayrshire Council and BGS.

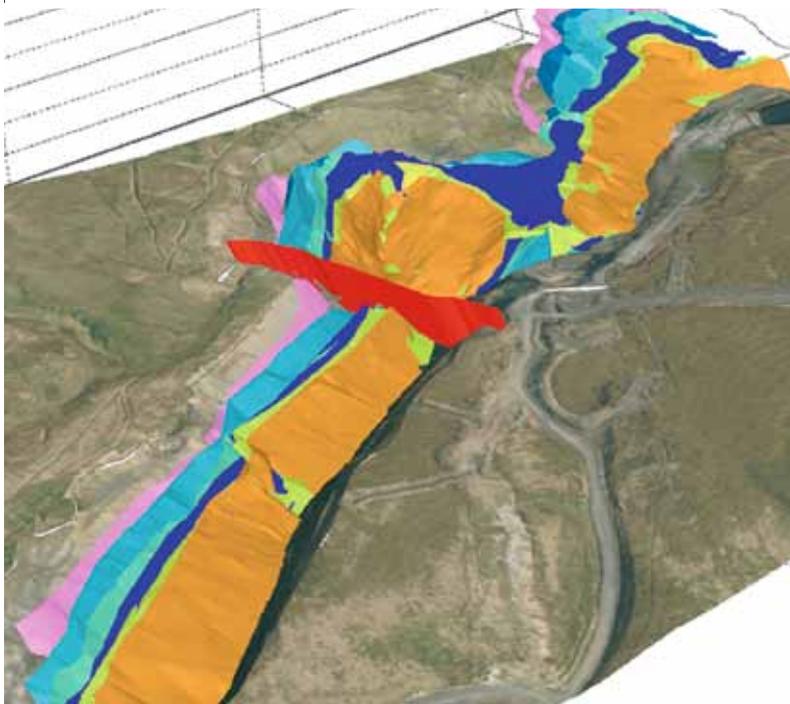
What, for some, might look like an environmental threat can be turned into a learning asset for national good. Here, we argue that a strong case can and should be made for retaining such large-scale and superb geological sections that might otherwise be lost to future generations, along with their relevant digital social geological datasets and other and industrial records. The aim therefore for the geoscience community should be to take advantage of this opportunity and now develop what is



Top:
Glenbuck
village, East
Ayrshire, c.
1920.



Middle:
Preserved
lycopoid root,
Stigmaria, c.
6 cm wide,
Mainhill Wood
OSM



Bottom:
Digital
reconstruction
of the coals
extracted from
the Spireslack
OSM; each of
the principal
coals is
coloured
separately.
Note the
tight folding
revealed NE of
the modelled
fault (red
plane).

▶ already being referred to as the Scottish Carboniferous Research Park, or SCARP.

Learning

Such former surface mines can provide a rich visitor and/or learning experience in coal geology, illuminating aspects of a former way of life in previous generations, while also supporting high quality research into Carboniferous geology. In 2014 the Geological Society and its partner organisations celebrated the unique geological heritage of the British Isles by launching a list of '100 Great Geosites' for Earth Science Week. Site categories, including those of educational, industrial and economic importance (e.g. the National Mining Museum Scotland), and those of historical & scientific importance are celebrated.

Across the UK, excavations resulting from the extraction of economic mineral resources are numerous but, perhaps surprisingly, only a handful of those are designated geosites. Spireslack and Mainhill Wood opencast surface coal mines could have been ideal for all of the three Geosite categories above, but were not available or accessible for public promotion at that time.

Spireslack

Spireslack presents a semi-continuous, almost kilometre-long, vertical high-wall section locally exposing a thickness of over 130m of Carboniferous late Viséan to early Namurian Pendleian strata, including the whole of the *Limestone Coal Formation* - one of the main coal-producing units in Central Scotland. These coal-bearing strata represent a

► typically fluvio-deltaic sedimentary facies, with the Upper and Lower Limestone formations above and below representing more marine-influenced facies with fossil-rich limestone units. At least five narrow basaltic dykes cut the section, intruded around 58-60 million years ago in the Palaeocene (just prior to Atlantic opening).

As a result of sinistral transpressive deformation in the mid- to late-Carboniferous, strata at Spireslack now dip south-eastwards at c. 30-40° across the canyon, defining one limb of a broad synclinal fold. This is revealed by the digital reconstruction of seams drawn from BGS data relating to both the opencast operations and early 20th Century underground workings. Evidence of the earlier 19th/20th Century mining practice is still visible in the high wall face where intact (but somewhat crushed) pillars or ‘stoops’ of the Muirkirk Nine Foot Coal are juxtaposed laterally with packed mine waste (in collapsed room or short wall workings).

Folding was accompanied by faulting, the effects of which are clearly seen on the south-dipping limestone pavement (Top Hosie), forming the northwest back-wall of the site where stunningly detailed exposures of bridging relays link to oblique-slip faults. Sinistral strike-slip movements dominate the fault-related deformation affecting these rocks. The scale of the high-wall section further reveals the curvilinear style of faulting that disrupts the stratigraphy.

Initial research projects are using the digitally reconstructed coal seam maps to build ‘real’ fault frameworks and stratigraphic models that can be used to test reservoir simulations or the forward modelled seismic response, all in a rock volume at Spireslack whose internal architecture is well understood.

Mainshill Wood

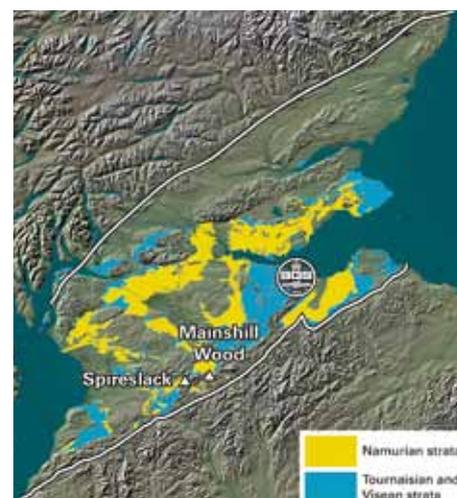
Mainshill Wood OSM presents a continuous lateral section through over 400m of Namurian strata that include the Limestone Coal Formation, the overlying *Upper Limestone Formation* and most of the Passage Formation. It is very unusual for such a thickness of Carboniferous strata to be exposed in one opencast excavation. This is because many of the strata are now arranged vertically, or nearly so - a unique feature of this site.

The section in the Limestone Coal

Formation is so disturbed by faulting and folding that arguably the most significant feature of interest for conservation is the geological structure, rather than the exposed stratigraphy; though the latter includes at least 11 locally named coal seams, many of which are not exposed at surface anywhere else in Scotland. The section in the Upper Limestone Formation exposes all of the known Carboniferous marker limestones in the Midland Valley of Scotland, namely the Index, Huntershill (Birchlaw), Lyoncross (Tibbie Pagan’s), Orchard, Calmy (Blue Tour) and Plean limestones as well as the Ellenora and Gill coals. All of these units could eventually be safely examined at close quarters given carefully designed partial restoration - an important access issue that BGS and SMRT will carefully consider as plans for these sites mature.

The section in the Passage Formation at Mainshill Wood is utterly unique and known otherwise only from the records of a few boreholes drilled to prove deep coal seams. Key features of the succession here are the three thick Manson Coal seams (c. 9m in all), and associated marine mudstones with conspicuous shells. No natural exposures of the Manson strata exist, and normally in Central Scotland the Passage Formation contains a few coal seams up to about 30cm thick. The atypical thicknesses of coal-bearing strata accommodated in the depositional basin here suggests an area of more active localised subsidence, but remote from the influence of river channels bringing in sand.

It is perhaps not surprising that if such tectonic conditions were responsible for the localised subsidence, then similar controls might continue to be reflected in the subsequent deformation that gave rise to the vertical, and intensely folded and faulted strata. Near the southern back wall of the site, Limestone Coal Formation strata define a series of complex folds and associated faults in a transpressive positive flower structure - another unique aspect of this site. The junction between the complexly folded strata and the more regularly vertical strata is clearly visible and marked by a conspicuous shear zone where the original continuity of the rock layers is virtually destroyed.



Above: Mainshill Wood and Spireslack OSMs are located in the southwest Midland Valley of Scotland. The BGS logo is located on Edinburgh

Below: Palaeocene basaltic dyke c. 3m wide, cutting Limestone Coal Formation strata; the folded sandstone at the centre-right records collapse post-mining, Spireslack OSM

“ THE SECTION AT MAINSHILL WOOD IS UTTERLY UNIQUE AND KNOWN OTHERWISE ONLY FROM A FEW BOREHOLES DRILLED TO PROVE DEEP COAL SEAMS ”

► **Environmental change**

The Carboniferous sedimentary rock types present on these sites represent cycles of environmental change, ranging from shallow tropical seas, to advancing deltas and floodplains as relative sea-level fell in coastal areas linked with development of river channels, tropical soils and tropical swamp forest. These ‘cyclic’ changes were symptomatic of sea-level changes at this time in the Carboniferous, some 330 to 315 million years ago.

Rock types readily accessible for learning and research include marine limestone with abundant visible fossil shells and trees, marine and lacustrine mudstone, burrowed siltstone and sandstone, cross-bedded and channelled sandstone, flat bedded siltstone and sandstone and rooted seat-rocks (soils), and coal. Sideritic ironstone also occurs as thin beds and nodules in the mudstone and as fist- to football-sized nodules in the rooted seat-rocks. In fact, some of the earliest mining activity in bell pits at Glenbuck exploited these ironstones for the short-lived Glenbuck Ironworks (1795 -1813).

Geology at the Spireslack and Mainshill Wood OSMs delivers unique man-made exposure on a scale

unparalleled in nature; BGS is already coming together with colleagues at Aberdeen, Edinburgh, Heriot Watt, Keele, Leeds and Strathclyde universities, and in the Geotechnical and Energy sectors, to examine and promote this hugely rich and diverse resource for learning, research and professional development. In such large sites, there is ample scope in the future for colleagues from other universities and organisations to participate as well.

Bedrock in Central Scotland is generally concealed by thick unconsolidated Quaternary deposits and hence accessible. Informative exposures of such strategically important Carboniferous strata are thus rare and limited in scope, even in the region’s various Sites of Special Scientific Interest (SSSI) and other Geodiversity sites. By exploiting the data collected during underground and surface mining operations that are now held by BGS, the geological community can conceive of a wide spectrum of internationally significant new research that can be pursued and monitored in a volume of rocks where the essential stratigraphic and structural architecture is already well constrained.

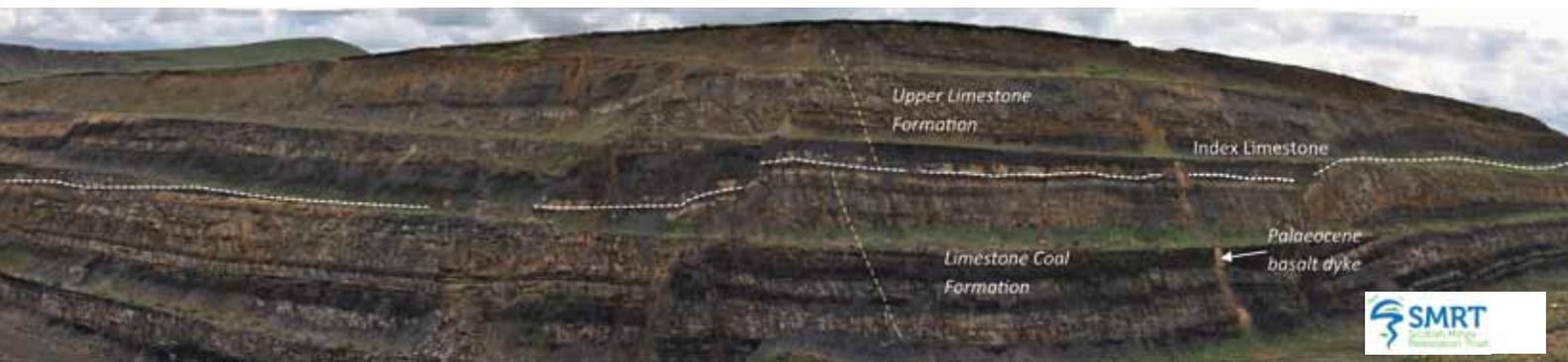
The Spireslack canyon is a window

that can help validate sub-surface interpretations deduced from state-of-the-art seismic and other geophysical methods; the geological applicability of 3D sub-surface planning methodologies and energy resource management can also be road-tested at SCARP.

Opportunity

This is a truly exciting opportunity to deliver a natural rock laboratory for university and industry training and research. Held in trust, responsibly conserved, and with safe maintained access for future generations, SCARP could provide that 3D laboratory and learning platform for Masters and undergraduate students, combined with a rich visitor experience – especially if supported by, and integrated with, local community goals and access for schools.

Such a restored landscape feature can be designed to provide diversity of managed access for geological and other fieldwork, perhaps partially addressing fieldwork and mining issues raised recently by Mike Harris (*Geoscientist* 25.6), even making fieldwork more accessible – as called for in ‘Getting Out more’ by Alison



Composite image of over 400 m of Namurian strata exposed as vertical layers in the Mainshill Wood OSM; looking WSW, the back wall section is c. 75m high. The white dotted line indicates truncation of the vertical strata by complex faulting in a transpressive flower structure to the left; the thick Manson Coal seams (M) are prominent at the right hand end of the wall

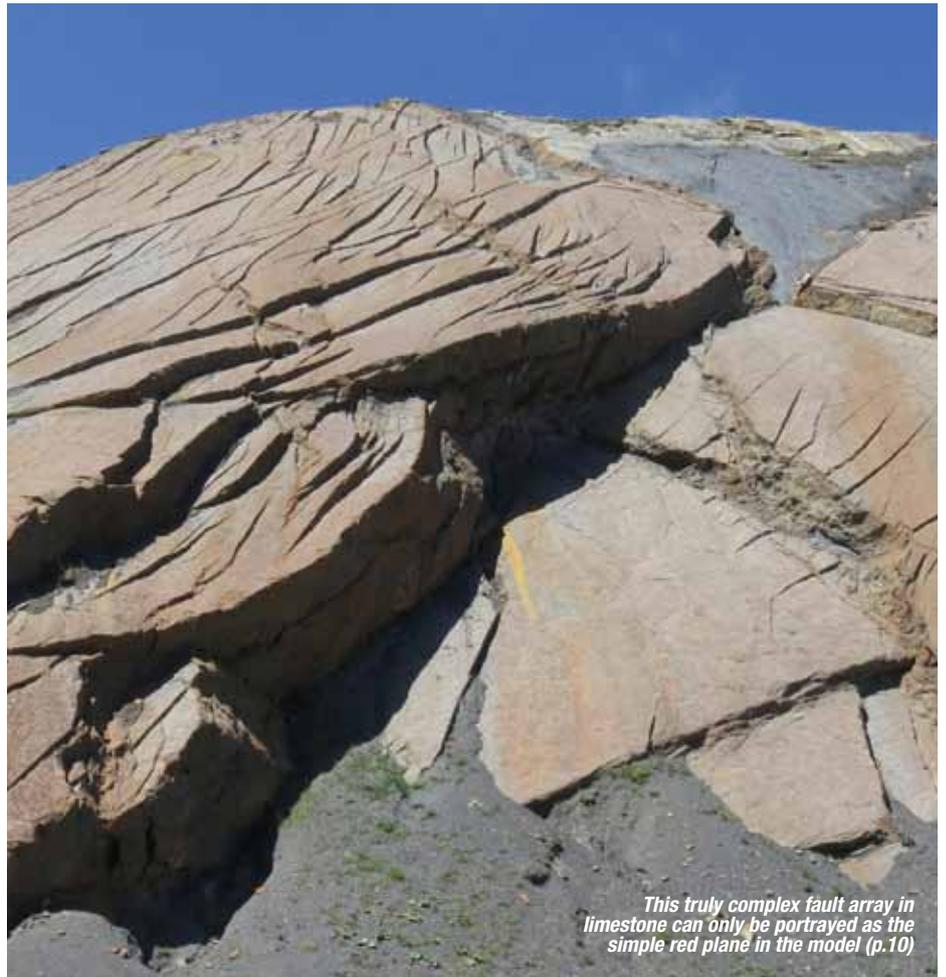
Composite image of late Viséan to early Namurian Glackmannan Group Carboniferous strata exposed in the Spireslack OSM, looking SSE across the ‘canyon’

Stokes and Christopher Aitchison (*Geoscientist* 25.4).

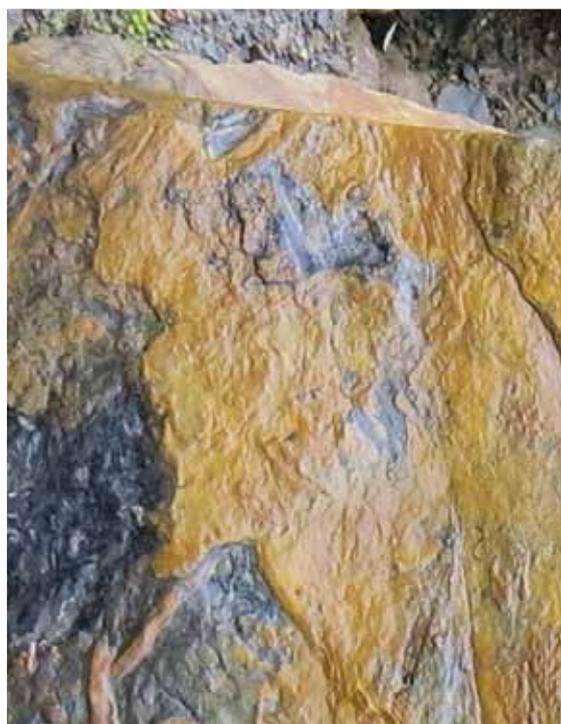
Natural, cultural and geological heritage synergy is very strong and best viewed as a complete package; opportunities to develop other complementary activities such as cycling, climbing walls, renewable energy and forestry abound. The BGS and SMRT intend to work with others to unlock more of the secrets of these sites through video footage – see www.youtube.com/watch?v=1um_V5Rheqw - and make a digital sub-surface accessible to all. ♦

***Graham Leslie:** BGS in Scotland, The Lyell Centre, Edinburgh EH14 4AP: agle@bgs.ac.uk.
****Mike Browne:** BGS in Scotland, The Lyell Centre, Edinburgh EH14 4AP & Scottish Geodiversity Forum

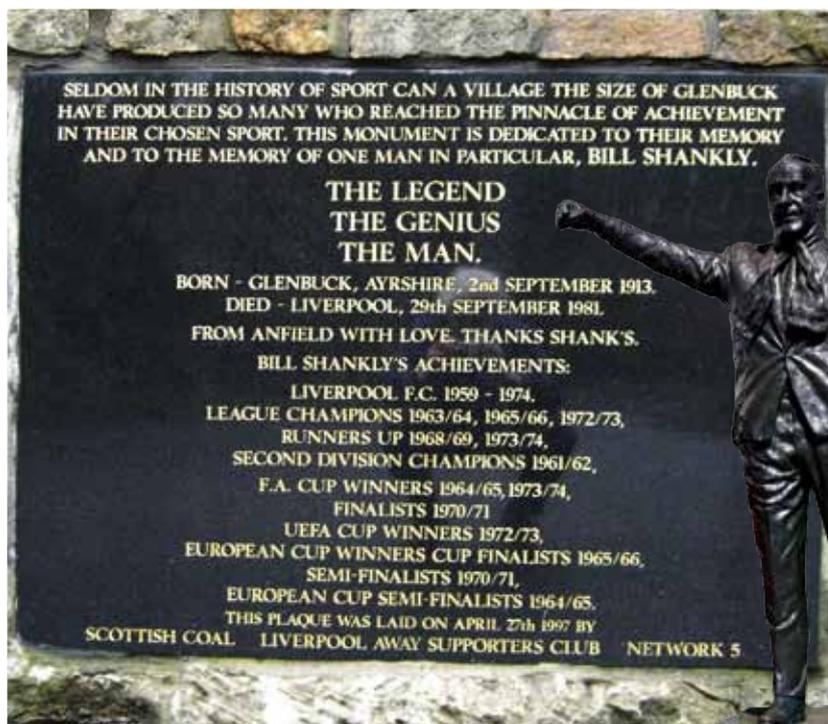
► Published with the permission of the Executive Director, British Geological Survey. Download details of the Carboniferous stratigraphic succession of Great Britain at: <http://nora.nerc.ac.uk/3235/1/RR07001.pdf>. Spireslack and Mainshill Wood are currently owned and administered by SMRT; BGS gratefully acknowledge the support of SMRT in accessing these sites to gather information in support of SCARP.



This truly complex fault array in limestone can only be portrayed as the simple red plane in the model (p.10)



Sandstone with large well preserved branching arborescent plant remains, c. 20 cm in length, Spireslack OSM

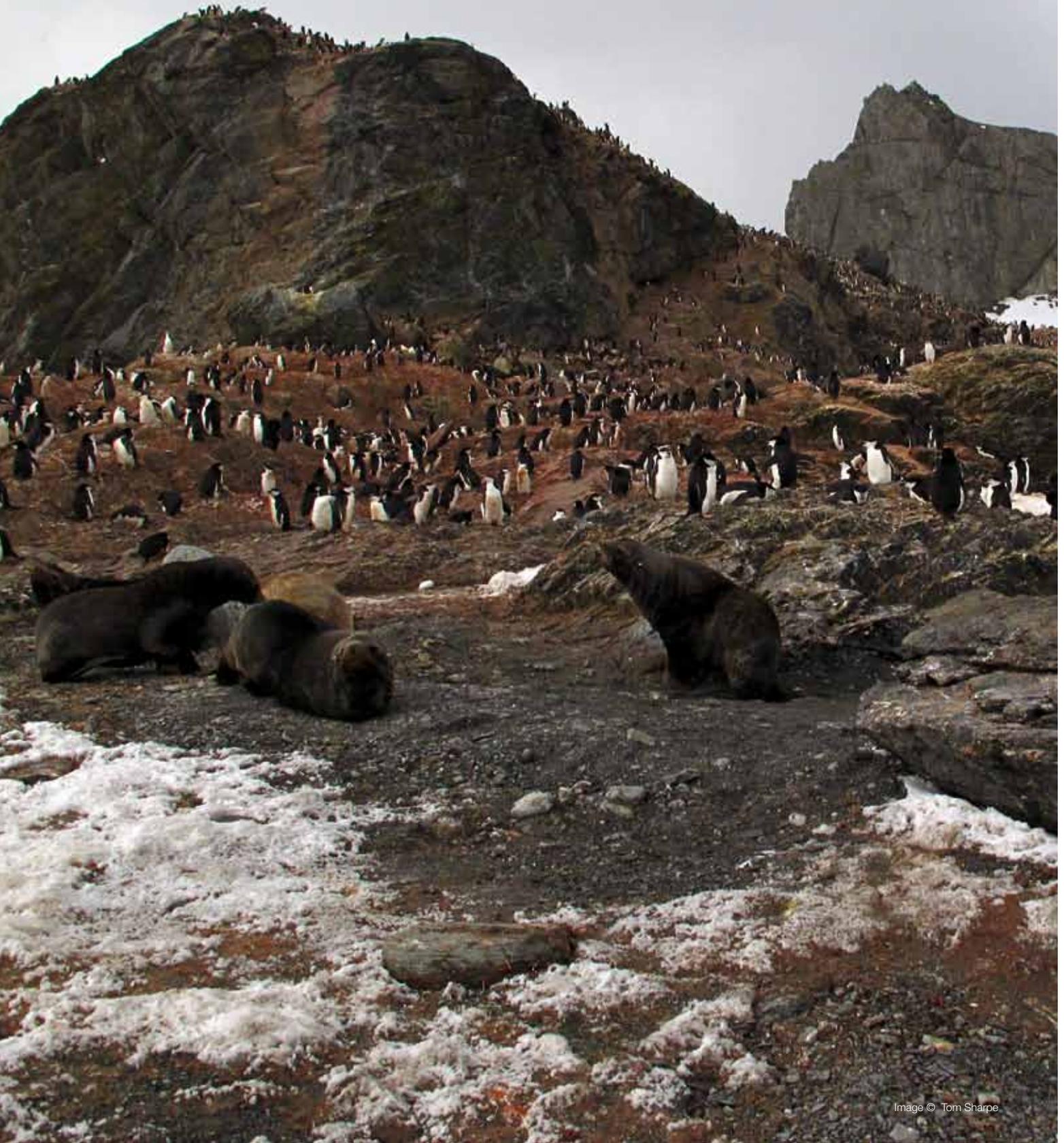


Bill Shankly, arguably Liverpool FC's most famous manager, hailed from the mining community that lived, worked and played in the village



SHACKLETON'S

GEOLOGIST



Tom Sharpe* recounts a harrowing tale of geological derring-do in the South Atlantic

On 30 August 1916, 27 year-old James Wordie FGS and his companions were huddled in the cold, filthy darkness of their makeshift hut on the bleak north coast of remote, ice-covered Elephant Island where they had been marooned for four and a half months. Patiently awaiting a meagre lunch of boiled seal bones and seaweed, a shout brought them rushing out, scattering their cooking pot on the way, to see an approaching ship. Within an hour, lunch forgotten, Wordie was on board the *Yelcho*, clutching his diaries and a bag of 30 rocks. These were all he had to show for two years as geologist on Ernest Shackleton's Imperial Transantarctic Expedition.

Distinction

Born in Glasgow in 1889, James Mann Wordie graduated in 1910 with distinction in geology from Glasgow University before moving to St John's College, Cambridge. There, in 1913, Wordie met a group of scientists, recently returned from Captain Robert Falcon Scott's British Antarctic Expedition, who were now based at the Sedgwick Museum. Inspired and encouraged by Scott's geologists (Raymond Priestley, Frank Debenham and Griffith Taylor) and physicist Charles Wright, in March 1914, Wordie applied to join Sir Ernest Shackleton's proposed expedition to cross the Antarctic continent from the Weddell Sea to the Ross Sea. Shackleton also planned to send scientific parties to explore the region at the head of the Weddell Sea and to establish the relationship of Graham Land to the rest of the continent. It was to one of these that Wordie was to be assigned.

The expedition ship *Endurance* set sail on the eve of the outbreak of the First World War and Wordie joined it at Buenos Aires. His geological work began when they reached South Georgia. During November 1914, while the ship was at the whaling station of Grytviken, Wordie collected rock specimens from at least six sites on the island and began a geological map, recording the much-folded structure. These were to be the

last outcrops Wordie saw for 16 months. Within six weeks of their departure from South Georgia on 5 December 1914, *Endurance* was locked in the pack ice of the Weddell Sea. It was to remain so for the next 10 months.

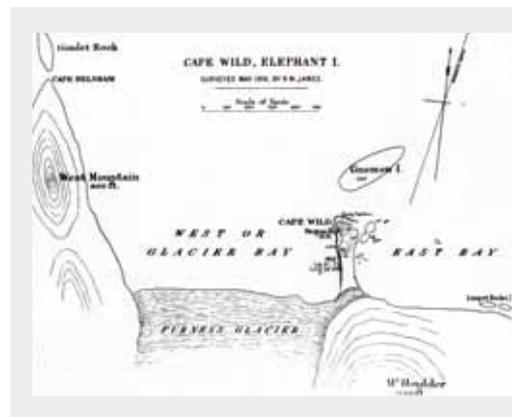
Pitied

Thomas Orde Lees recorded in his diary (16 October 1915) "The scientist most to be pitied on this expedition is Wordie, the geologist, for his *métier* lacks the necessary materials at sea ...". But he did have some rocks to work on, as Shackleton explained in *South*: "The geologist was making the best of what to him was an unhappy situation; but was not without material. The pebbles found in the penguins were often of considerable interest, and some fragments of rock were brought up from the sea floor with the sounding-lead and the drag-net."

The dredge could provide sizeable specimens: on 29 March 1915, Wordie hauled in a boulder of red grit weighing about 20kg and a smaller block of fossiliferous limestone. A month later the dredge brought up several hundred pebbles in glacial mud and sand. The innards of Emperor penguins, especially, proved a treasure-trove of rocks, with one bird providing two different kinds of granite, other igneous rocks, grit and several different sandstones. From these and the dredged material, Wordie was able to conclude (correctly) that the geology of the Weddell Sea coast more closely resembled that of Victoria Land on the far side of the continent than that of adjacent Graham Land.

By August 1915 *Endurance* had been carried over a thousand kilometres west and north by the rotational current of the Weddell Sea Gyre, but slowly the pressure of the moving ice was crushing the ship and on 27 October 1915, *Endurance* was abandoned. The men set up camp on the ice and less than a month later *Endurance* sank, taking with it Wordie's South Georgia rock collections. But the loss of the specimens was the least of their worries.

Shackleton and his 27 men spent the ►



Above top: Outline map of Elephant Island
Above middle: Map of Cape (now Point) Wild by Reginald W. James of the *Endurance* Expedition, May 1916. The Furness Glacier has receded since 1916 and now lies near the bottom edge of this map
Lower middle: James Mann Wordie (reproduced courtesy of the Scott Polar Research Institute, University of Cambridge)
Above lower: Looking towards the south end of Lookout Hill, with Gnomon Island beyond, from the east shore of the spit, Point Wild, Elephant Island. The hut was situated in front of the large boulder at the foot of the cliff towards the left of the picture

Left: Point Wild from the west. Lookout (Penguin) Hill is to the left

“LESS THAN A MONTH LATER, ENDURANCE SANK, TAKING WITH IT ALL WORDIE'S SOUTH GEORGIA ROCK COLLECTIONS”



Above: Map of Cape (now Point) Wild by Reginald W. James of the Endurance Expedition, May 1916. The Furness Glacier has receded since 1916 and now lies near the bottom edge of this map

Left: The marooned party on Elephant Island, 10 May 1916. Wordie, wearing his glasses and smoking a pipe, is in the back row, fourth from the left (reproduced courtesy of the Royal Geographical Society)

► next four months dragging their three lifeboats and camping on drifting ice floes before taking to the boats when the ice finally broke up in April 1916. The remarkable navigational skills of Frank Worsley, the Captain of *Endurance*, got them to Cape Valentine, the most easterly point of Elephant Island on 15 April 1916. They hauled their boats ashore and set foot on land for the first time since leaving South Georgia 16 months earlier. It soon became clear, however, that the beach was swept by storm waves, so the party was forced to relocate seven miles west along the north coast of the island to a rocky point and boulder spit they named Cape Wild.

As geologist, perhaps Wordie was particularly glad to see land; during his brief stay at Cape Valentine, he found time to collect half a dozen specimens, and while sailing to Cape Wild made note of the dip of the foliation in the rocks exposed along the coast which he described as “about as inhospitable as one could well imagine”.

Elephant Island

Although Elephant Island offered refuge, there was little chance of rescue; so Shackleton took five of the party back to sea in an audacious, but ultimately successful attempt to reach South Georgia - over 1200 kilometres away - to seek help from the whalers there. Organising the rescue of his men would take Shackleton over four months, and

success would come only at the fourth attempt.

The 22 men remaining at Cape Wild spent the winter in a cramped hut made from their upturned boats. There was little opportunity to explore, as the site was hemmed in by impassable cliffs and ice (which Wordie did try, unsuccessfully, to climb). He combed the beach for erratics, and recognised that the bouldery spit on which they were camped was the right lateral moraine of the Furness Glacier, which rises steeply above Cape Wild. He was also able to collect specimens from the local bedrock, “a dozen or so fairly representative rocks. The rocks are unfortunately very monotonous - metamorphic schists - and the amount of rock accessible is extremely small”.

When Shackleton arrived on the *Yelcho* off Cape Wild at about 1300hrs on 30 August 1916, the men had little time to organise their departure. Ever the geologist, Wordie made sure he took some of his specimens with him. “The end was rather a hurry” Wordie later wrote in his diary: “... it was best to cut and run. And so all my beach exotics are left behind: the only rocks I have are those in situ. But can one complain? - My notes are safe and every man is safe”.

Once in Chile, Shackleton put Wordie in charge of the expedition’s scientific results which were summarised in an appendix in *South*. The rocks Wordie brought back (six from Cape Valentine

and 24 from Cape Wild, were the first to be collected from Elephant Island and were described by G W Tyrrell in Wordie’s 1921 paper on the geology of the Weddell Sea area. Tyrrell struggled to make sense of them, but today we recognise them as Cretaceous chloritic schists of the Scotia Metamorphic Complex. The collection survives in Glasgow University’s Hunterian Museum where, neatly arranged and curated, it belies the tale of incredible hardship suffered by the expedition and of the endurance of Shackleton’s geologist. ◆

* Tom Sharpe is Chairman of the History of Geology Group

FURTHER READING

- Shackleton, E 1919. *South. The Story of Shackleton’s Last Expedition 1914-17*. London: William Heinemann.
- Smith, M 2004 *Sir James Wordie Polar Crusader. Exploring the Arctic and Antarctic*. Edinburgh: Birlinn
- Smith, M 2014 *Shackleton*. By Endurance We Conquer. London: OneWorld.
- Sharpe, T 2014 On the rocks on Elephant Island. *The James Caird Society Journal*, 7, 21-32.
- Wordie, J M 1921 *Shackleton Antarctic Expedition 1914-17; geological observations in the Weddell Sea area. Transactions of the Royal Society of Edinburgh*, 53, 17-27.

READERS' LETTERS

Geoscientist welcomes readers' letters. These are published as promptly as possible in Geoscientist Online and a selection printed each month. Please submit your letter (300 words or fewer, by email only please) to ted.nield@geolsoc.org.uk. Letters will be edited. For references cited in these letters, please see the full versions at www.geolsoc.org.uk/letters

Website woe



Image © KieferPix/shutterstock.com

Sir, It is very hard for me to express my acute frustration at the seemingly never-ending lack of availability of the Society's on-line CPD reporting facility.

The Geological Society, one of the oldest and most erudite scientific institutions in the world, cannot seem to be able to provide a



functional website for its Fellows. I (foolishly) intended to maintain my personal CPD records here (compulsory for CGeol). The facility has been unavailable for very many months, so I'm forced to look to another institution for assistance.

I am affiliated to a couple of other professional organisations; the Institute of Quarrying and the Institute of Materials, Minerals & Mining, all with annual subscriptions that are far lower than the Geological Society's, but which all boast consistently reliable and fully operational websites.

Professionalism really must start at home. Please get it to together guys!

MARK GODDEN

Nic Bilham replies: We understand Fellows' frustration that website login (and hence online CPD reporting) remain unavailable. Please accept our apologies. We have experienced considerable difficulty working with our website contractor and are now working with a new contractor to fully replace the affected parts of the website, as part of a wider IT upgrade. Fellows can continue to record their CPD activity using the log book available on the website – contact membership@geolsoc.org.uk for assistance.

NIC BILHAM DIRECTOR OF POLICY AND COMMUNICATIONS

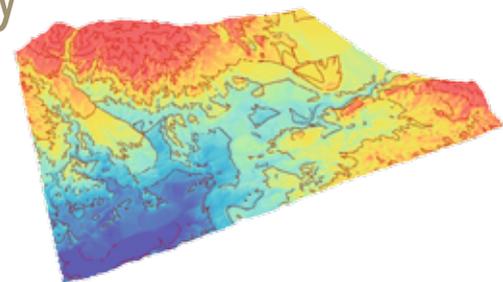
Extrapolation: fantasy v. reality

Sir, Martin Geach (*3D models: stepping back, Geoscientist 26.5 June 2016*) is raising an issue that was familiar to many petroleum geologists in the 1980s: computer mapping of geological structures. This old chestnut seems to have echoed across the decades and still resonates today. I remember many a heated discussion about algorithms during interminable meetings to agree procedures for mapping oil and gas fields that crossed North Sea block boundaries and could vary in shape and volume distribution depending on which interpolation technique was used in CPS-1 or Zmap.

Data points (ie wells) were usually more than 200m apart, unlike Martin's example. Although our volumes were measured from

a surface down to a plane (eg the gas-water contact) the volumes, and the distribution of volumes by block, could vary widely between methods. Martin's examples of Kriging and IDW methods are almost incredibly close in their volumetric results. However, the difference between them and the RBF/RST method is more than a factor of two - an intolerable outcome.

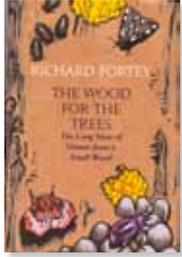
I suspect a wild over-extrapolation in the NE corner of the RBF/RST model where data are absent (as shown by the curious shape of contours in this area in the Kriging and IDW examples) and the algorithm has generated an unrealistically deep hole in the model. This also occurs in the SW, where it appears the depths are much greater (indigo colour) in the RBF/RST model than



in the other two models. A rotation of the 3D view to show the depth axis, or a couple of cross-sections sliced across the model, would clearly reveal these reckless departures which, unless corroborated by real data points, should be eliminated by the geologist. At least, they should if these deep troughs lie on my side of the block boundary!

CHRIS GARLAND

The Wood for the Trees



Someone should perhaps write a book about the things distinguished scientists get up to when they retire. Thomas Huxley withdrew from greater scientific affairs to take up alpine flowers, and it is perhaps a shame that he never wrote a book about them. Richard Fortey FRS (former President of the Society and Senior Palaeontologist at the Natural History Museum), finding the proceeds from a TV series burning a hole in his pocket, decided that he would buy Grim's Dyke Wood, four acres of Chiltern woodland not far from his native Henley.

He made it a project, and proceeded to study the wood's every aspect: geological, archaeological, historical, botanical, mycological and zoological. The result is this delightful amalgam of natural and human history - *Geoscientist's* recommended summer read - which underlines a point dear to my own heart, which is that you can tell the history of the world from any locality on its surface - like William Blake, seeing the world in a grain of sand.

Using a 'country diary' approach to describe life on the edge (of a Chalk escarpment), each chapter covers a different month. Fortey then draws in his many themes in due season - his beloved fungi in November, moths in June, and so on, dragooning a dazzling array of experts to help him lend weight and detail to his observations. Finally, true museum man that he is, he harvests some cherry wood, cuts it into planks which he seasons himself, and commissions a beautiful bespoke 'cabinet of curiosities' in which to keep his notebook and all the interesting bits and bobs he accumulates during the year.

Fortey is one of those lucky writers who makes his readers wish they knew him better, that they could spend time with him in tweedy pursuits, bumbling about in Grim's Dyke, getting their knees wet from leaf mould, sitting on fallen logs and making natural historical notes in leather-bound books. Never has the author's whimsical, woollyjumpery, Bryonesque, and (now and then) donnishly testy personality come over quite as faithfully as it does in *The Wood for the Trees*.

He says in the introduction that it is a book 'both romantic and forensic, if such

a combination is possible'. What follows surely proves that it is; that the status of beech tree and liverwort are indeed compatible with the play of the light; the passage of the seasons and people with the 'incomparable pleasures of discovery'.

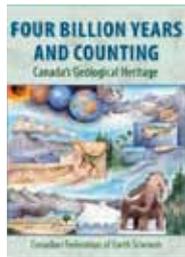
Indeed, as his focus widens, Fortey's confidence as a writer seems to grow - to the point of including culinary suggestions and recipes (a hallmark of his TV appearances), and even to using the word 'questing' far more often than any other nature writer might have dared. After Evelyn Waugh's ridicule of the genre through the inept pen of his hapless journalist character William Boot (author of the deathless line: 'Feather-footed through the plashy fen passes the questing vole') this also constitutes 'life on the edge'.

Reviewed by: **Ted Nield**

THE WOOD FOR THE TREES - THE LONG VIEW OF NATURE FROM A SMALL WOOD

by RICHARD FORTEY. William Collins 2016 ISBN 978-0-00-810466-5 306pp Hbk
List Price: £22.00 www.harpercollins.co.uk

Four Billion Years and Counting: Canada's Geological Heritage



Before agreeing to review this book I did a quick Internet search just to see if it has a mention, what price it might be and frankly if it was worth reviewing. What I found there was a

revelation! *

On another site one of the authors explained the origin of the book: "One day last summer, a 40-ish well-educated woman visited our house. ... She asked me about my professional background and I told her that I am an Earth scientist. She looked puzzled and said: 'and what do you do with that, other than teach?' I was dumbstruck... then noticed her nice shiny and stylish watch and said 'well, let's begin with your watch, where do you think its component materials came from?'"

Thus began what can be described as a *tour de force* [the book comes in English and French] of geological outreach. Although written from a Canadian perspective, it has a wide, immediate and

absorbing interest for geologists of all levels. The standard of the material is superlative with high quality colour photographs, illustrations and artistic recreations added to a crystal clear language. It describes the technicalities of our subject in a way which focuses effortlessly upon the core message: geology matters. It is a masterpiece of good communication.

There are 20 chapters in three parts, covering foundations [of the science], the Evolution of Canada [but not just Canada] and Wealth and Health [the way that geology is used]. Each chapter is quite short and to the point and written by a phalanx of skilful authors. The whole thing has been funded by five major supporters and the chapters by 20 or so backers, indeed a very impressive collaborative effort. It is a good read at an extremely reasonable price.

On the other hand, will the '40-ish well educated woman' buy it and read it? Perhaps it's up to you to recommend it to those who might be in need, and then you can borrow it back! I'm just a little surprised that Air Canada did not part-fund the book because once you have this in your hands then you may well be on your way to Banff quite soon.

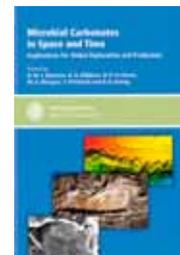
*For links, see online version of this review in the 2015 collection. *Editor*

Reviewed by: **Arthur Tingley**

FOUR BILLION YEARS AND COUNTING - CANADA'S GEOLOGICAL HERITAGE

- Eds: FENSOME R, WILLIAMS G, ACHAB A, CLAGUE J, CORRIGAN D, MONGER J, NOWLAN G. Nimbus 2014 Canadian Federation of Earth Sciences. Reprinting June 2016. ISBN: 9781551099965.
www.fbycbook.com/#!home/mainPage

Microbial Carbonates in Space and Time



Recent discoveries in 'unconventional' carbonate reservoirs such as the Lower Cretaceous pre-salt of the Campos Basin, offshore Brazil have stressed the importance of research into microbial carbonate (microbialite) deposits. This Special Publication not



only succeeds in compiling a diverse range of 14 papers on the economic importance of microbialites; it also manages to place such deposits in a context that those with a background in carbonate sedimentology can appreciate.

Microbialite deposits are found throughout the geological record, the book addressing this with a series of case studies that spans the Neoproterozoic to the Cenozoic. The papers in each section are varied, including facies association, stratigraphic architecture and petrophysics. Each paper complements the others, with work ranging from microscopic to seismic scale. A pleasantly surprising inclusion is that of work on seismic and core from the Campos Basin microbialite discoveries. The decision of companies operating offshore Brazil to release data into the public domain is an important one, as it allows those with an interest to finally study these previously 'classified' and enigmatic deposits.

Overall, the quality of the publication is excellent, with most figures reproduced in colour. Each paper is well written with clear, engaging illustrations. Of particular note is a paper on Ediacaran microbial carbonates, which contains eye-catching annotated field photographs and schematic models that are a joy to read. As a minor point, some papers are printed in black and white and although not illegible, certain figures may lack the impact of those printed in colour.

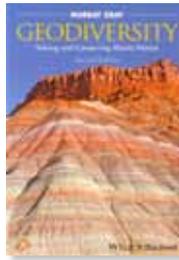
This comprehensive SP is an ideal starting point for anyone interested in microbial carbonates. It effectively summarises the combined knowledge of academia and industry, and is applicable to both. At present, most readers will be postgraduates already involved in related studies. However, in the future this book will become increasingly relevant to undergraduates as frontier microbialite plays become the norm in the oil and gas industry. This work will undoubtedly pave the way for exciting developments in our understanding of a long overlooked section of carbonate sedimentology.

Reviewed by: **Jack Stacey**

MICROBIAL CARBONATES IN SPACE AND TIME: IMPLICATIONS FOR GLOBAL EXPLORATION AND PRODUCTION

by: D W J BOSENCE, K A GIBBONS, D P LE HERON, W A MORGAN, T PRITCHARD AND B A VINING. Geological Society Special Publication 418 (hbk). ISBN: 9781862397279.
List Price: £90. Fellows Price: £45.
www.geolsoc.org.uk/SP418

Geodiversity



To quote the author, this book 'is about the value of difference, diversity and distinctiveness in the natural world'. It uses geological and geomorphological diversity – geodiversity

– as a demonstration of this variety and sets out the intimate relationship and influence of geodiversity on our world: its evolution, changing landscapes and biodiversity, and our own history, culture and well-being. Following the simple formula 'value + threat = conservation' Murray Gray establishes the value and importance of geodiversity, demonstrates that geodiversity is threatened and then sets out how geodiversity is conserved, reflecting both established approaches and new concepts in geoconservation.

This is the second edition and much has changed since the first was published in 2004. Notably global geoconservation effort, co-operation and profile have seen significant development. Here perhaps the greatest advance has been in relation to Geoparks. In 2004 this was a relatively new initiative with 15 European Geoparks. Now worldwide there are 120 Global Geoparks recognised in 33 countries and, as of 2015, the 'UNESCO Global Geopark' has become the first new UNESCO designation in over 40 years.

There has also been a gradual shift in emphasis. The established protected area approach remains (for example in the UK: World Heritage Site, National Park, Site of Special Scientific Interest and Local Geological Site) but alongside there is a growing realisation of the importance of taking a wider and more integrated approach. Gray examines in detail the role of geodiversity as an 'ecosystem service', considers different approaches to landscape characterisation (which all use geodiversity as a fundamental character) and discusses the importance of integrating geodiversity and biodiversity conservation.

My view remains that the greatest challenge for geoconservation is the value placed on geodiversity (and therefore the need for its conservation). Here Gray has made a significant contribution. The term 'geodiversity' has gained global traction and this second edition will continue this growth: a plethora of new examples of geoconservation in practice make this

the most comprehensive account of geodiversity and geoconservation (from a global to a local level) to date.

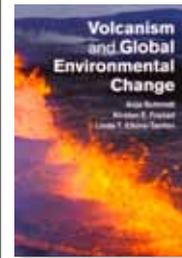
For anyone (geologist or not) who wishes to make the case for geodiversity and geoconservation then this is highly recommended reading and, if you own the first edition, don't worry - the second is an invaluable companion.

Reviewed by: **Jonathan Larwood**

GEODIVERSITY: VALUING AND CONSERVING ABIOTIC NATURE 2nd Edn

by MURRAY GRAY, 2013. Published by: Wiley
Blackwell 508pp ISBN 978-0-470-74215-0 (sbk)
List price: £37.50

Volcanism and Global Environmental Change



The publication of this book comes on the back of the 2010 eruption of Eyjafjallajökull which raised in the general public's consciousness the potential of volcanic eruptions to affect our climate, environment

and how we go about our daily lives. This multidisciplinary volume is divided into three parts; the first focuses on the origins, features and timing of large volume volcanism; the second on assessing gas and tephra release both in the present day and paleo-record; and the third deals with modes of volcanically induced global environmental change. The 20 chapters are a mixture of recent advances in the field and broader reviews, supported generously with monochromatic illustrations, figures and diagrams, as well as a central section of colour figures.

The main message is that some large past eruptions (e.g. continental flood basalts) had global impacts affecting climate and environmental chemistry and potentially triggering mass extinctions; not every eruption instigates major environmental change however, and the mechanisms which control different modes of volcanism and their range of associated environmental effects are the subject of ongoing research. Gas and aerosol particles from highly explosive and volumetrically large eruptions have the potential to circulate in the stratosphere, causing hemispheric or

global perturbations to climate and environment, however the complex physical and chemical interactions of these particles remain to be fully explored and understood.

For me, the best feature of the book is that it brings the reader up to date with current advances in quantifying the impacts of recent volcanic eruptions (e.g. in satellite and aircraft-based remote sensing techniques) and links this to knowledge of past events in the geological record. The book deals with a selection of impacts including extinctions, ocean ecosystems, and the environmental and climatic impacts specific to ash and gas deposition as well as those generated by large igneous province magmatism. The authors are careful to highlight that scaling climatic effects of both historical and present day activity to large volume volcanism is challenging, however, if we are to be better prepared to deal with the fallout of global eruptions these are challenges which need addressing.

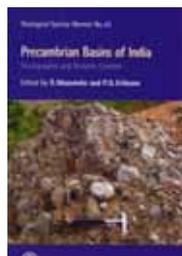
Volcanoes and the Environment by Marti and Ernst (2008, also Cambridge University Press) provides a valuable broad introduction into this subject area, whereas *Volcanism and Global Environmental Change* affords a useful update of key areas where notable recent advances have been made.

Reviewed by: **Sabina Michnowicz**

VOLCANISM AND GLOBAL ENVIRONMENTAL CHANGE

by ANJA SCHMIDT, KIRSTEN E. FRISTAD AND LINDA T. ELKINS-TANTON (EDS.), 2015.
Published by: Cambridge University Press 339pp
(hbk) ISBN: 9781107058378
List Price: £75.00. www.cambridge.org

Precambrian Basins of India: Stratigraphic and Tectonic Context



This book provides a detailed and thorough review of the 22 basins in India (frequently referred to as the 'Purana Basins' or simply 'The Puranas') that between them preserve a sedimentary and tectonic history from around 3.4Ga into the Eocambrian. The basin fill is in each case unmetamorphosed to only weakly metamorphosed, in contrast

to the high grade metamorphic and igneous rocks of the underlying crystalline basement.

The first three papers are introductory: setting out the purpose of the book; reviewing basin classification schemes, particularly those based on plate tectonic setting and subsidence mechanism; and describing the structural history and geology of the four cratons that underlie the Puranas - the Aravalli-Bundelkhand, Singhbhum, Bastar and Dharwar Cratons.

The next 17 papers deal with the Purana Basins themselves, plus one chapter on some rather enigmatic metasediments south of all the other basins. Each of the papers follows the same pattern: geology of the basement; stratigraphy and geochronology of the basin fill; a detailed description of the sediment fill; discussion and conclusions. In each case, the basin-fill lithologies and structures are described in considerable detail at all scales.

Most of the basins are located on the margins of their host craton, and are related to divergent plate motion and associated lithospheric stretching and thinning. A small number are related to intra-craton transtension and to convergent plate motion.

The next two papers deal with the mineral resources. The first of the two stresses that though the Purana Basins are rich in building stone, limestone for cement, evaporites, phosphorite, barite and uranium, they are comparatively deficient in metallic minerals, apart from minor occurrences of pyrite, copper-lead-zinc and manganese ores. The second paper deals more with the cratons and their rich endowment of iron, manganese, chromium, copper-lead-zinc, molybdenum, gold and platinum ores.

The final paper summarises the Purana Basins, stressing that the concepts and mechanisms of both plate tectonics and sequence stratigraphy, initially studied and synthesised in Phanerozoic basins, are equally applicable to the Puranas. Any differences in the stratigraphic architecture can be ascribed to variations in accommodation vs. sediment supply, or to the evolving inter-relations between hydrosphere, atmosphere and biosphere.

The book is profusely illustrated, but whereas the originals were obviously coloured, nearly all are now B&W,

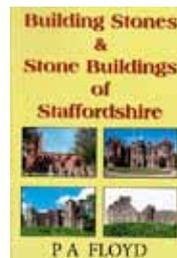
rendering many different rock groups in the same shade of grey. This is my only reservation about what is otherwise a fine piece of work.

Reviewed by: **Pete Webb**

PRECAMBRIAN BASINS OF INDIA: STRATIGRAPHIC AND TECTONIC CONTEXT

by R. MAZUMDER and P.G. ERIKSSON
(Eds) Published by: The Geological Society 2015
ISBN: 978-1-86239-723-1 List price: £120;
Geological Society £60; other qualifying societies
£72. 352 pp, hbk www.geolsoc.org.uk/m0043

Building Stones and Stone Buildings of Staffordshire



We all know that the UK is rich in the use of local natural stone for many buildings. This is a new addition to the subject and you get a lot of book for your money! The book gives you 339 pages covering a wide

variety of topics:

- ◆ Historical and geological background to the wealth of stone utilised throughout the centuries
- ◆ Issues of conservation and restoration, and the problems of sourcing suitable replacement material
- ◆ The major features of Staffordshire's building limestones and sandstones, and their physical and chemical properties
- ◆ Illustrated guide to the stone heritage of selected Staffordshire buildings, integrating historical, architectural and geological aspects, covering castles, country houses and ecclesiastical buildings, as well as villages, civic buildings and monuments.

This is a weighty volume, but it covers the topic extremely well. It is divided into three main parts (assuming little or no prior knowledge of the subject). This is a substantial work and it is easy to access. As someone who travels frequently to various parts of Staffordshire, I have already found the book invaluable. This book will become the standard work on the subject and will be invaluable for those engaged in preserving our building heritage.

It is written in an engaging style, with good use of images and maps that make it accessible to those who perhaps do not know the area covered in great detail. The most important part of the



book for me is the third section which covers the use of stone in buildings in Staffordshire. This is the most substantial part of the book (218 pages) and it covers in detail the use of building stone in heritage and vernacular buildings. Each of the buildings has a section devoted to it, which gives the reader an overview of the key historical aspects, the architectural features and the building stone. These reviews are accompanied by excellent photographs making each section easy to access and understand. The book could be used as a building stones field guide to Staffordshire, giving as it does such detailed information about so many of the most important buildings in the county.

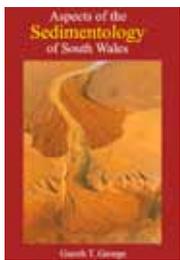
The author has succeeded in his aim of writing a book for "...people interested in the wider field of natural history and earth science..." – it is quite simply a stunning piece of work – I hope that other counties will get similar coverage!

Reviewed by: **Gordon Neighbour**

**BUILDING STONES & STONE BUILDINGS
OF STAFFORDSHIRE**

by P A FLOYD. ISBN: 978 07223 4543-6 Published
by: Arthur H. Stockwell Limited
List Price: £14.95 www.ahstockwell.co.uk

**Aspects of the
Sedimentology of
South Wales**



Aspects of the Sedimentology of South Wales follows Gareth George's successful, also self-published, *The Geology of South Wales: A Field Guide* (2008, revised 2015).

Both books are packed with detail, demanding intensive study rather than casual reading.

Following an introduction, one chapter covers clastic sedimentology, from petrology through sedimentary structures and facies to sequence stratigraphy. Sedimentary rock units of South Wales then appear as case studies in chapters on major depositional environments. Aeolian systems are represented by modern coastal dunes, and alluvial fans by the Ridgeway Conglomerate and Triassic fanglomerates from the Vale

of Glamorgan. The variety of fluvial systems is illustrated with examples from the Old Red Sandstone and the Upper Carboniferous. Upper Carboniferous units dominate chapters on deltas (also represented from the Pleistocene of Pembrokeshire), shorelines and shelves, and estuaries and incised valleys. The Carboniferous Limestone represents shallow marine environments, and Lower Palaeozoic turbidite systems exemplify deep-sea systems.

The author demonstrates an encyclopaedic knowledge of these rock successions, derived from a career-long study in the context of research, publishing, working with industry and teaching students of all ages. Detailed figures enhance the text throughout, including photographs, annotated sketches, interpretive diagrams, graphic logs and innovative 'mini analogues' of ancient systems based on modern environments. Much of the content draws on unpublished material, but there is an extensive reference list, as well as a detailed index and useful appendices.

If I wanted to be picky, I could query why the overview covers just clastic sedimentology when a major chapter deals with carbonates, or whether the Upper Carboniferous really merits such dominance. But that really would be unwarranted. This book is packed with a wealth of detail. Although beginners might be daunted to learn of structures preserved "at the base of falling-stage and forced-regressive sandbodies" (p.25) and students are unlikely to need this much detail about one part of the world, anyone who wants to know the current state of understanding on the sedimentary geology of South Wales in one convenient source will be fascinated by this book with its meticulously detailed content and effective, exemplary communication.

If you love the geology of Wales, or want to plan a field course here, buy a copy. Better still, buy three or four copies - for the field, the office, the library, and at least one more for when you wear the others out.

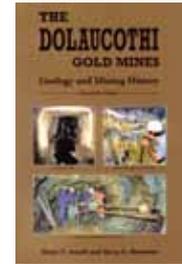
Reviewed by: **Geraint Owen**

**ASPECTS OF THE SEDIMENTOLOGY
OF SOUTH WALES**

by GARETH T GEORGE
Published by: gareth@geoserv.co.uk,
2014. 277pp, sbk. ISBN 978-0-9559371-1-8,
List Price: £18.75

**Dolaucothi Gold - a
vision revisited**

**Dolaucothi Gold
Mines - Geology &
Mining History**



Welsh Gold has always generated interest and the Dolaucothi Gold Mines (also known as Ogofau) are probably the oldest mines in the United Kingdom.

They are the only known mines outside the Dolgellau gold belt and lie about 120km north-west of Cardiff, close to the village of Pumsaint in Carmarthenshire. They have been worked periodically from Neolithic and Roman times until final closure in 1940.

The site was resurrected from dereliction between 1978 and 1999 by the staff and students of the Department of Mineral Exploitation (later the School of Engineering) of the University of Cardiff. In 1999 the National Trust took over the lease and has continued the development to create today's mining heritage site.

The two books reviewed here, although by different authors, are essentially complementary. The first describes the geological setting, the mining and mineral processing and industrial archaeological heritage of the old mining area, whilst the second gives a detailed description of the work undertaken between 1978 and 1999 to restore the abandoned mine workings and create a unique experience in the industrial heritage of Wales.

The first book, co-authored by a mining geologist and an industrial archaeologist, is a revised and expanded edition of a publication that had seen three editions since 1983, the last being in 1995. Data from work undertaken by Earth scientists and archaeologists in the succeeding period are included, together with many colour photographs and diagrams.

The text starts by presenting details of the history of the site's ownership and a chapter placing the mineralisation in both the local

and a Welsh context. The evidence of the Roman mining and ancillary operations are described followed by details of the late 19th century and early 20th Century workings. The final phases of commercial operation between 1930 and 1940, which at their peak employed up to 200 people, are described. The book finishes with a chapter covering the processing of the ores and highlights the visible remains of the processing sites and buildings.

The second book covers a period of 21 years from 1978 to 1999 and describes how an initial vision of a centre for specific higher education purposes expanded to the creation of an educational centre for the local community and visitors of all ages and levels of knowledge and experience.

Work on the site is divided into three phases each of which forms a chapter. The first, from 1978 to 1984, covers the initial rehabilitation of the abandoned workings and describes the work done, how it was progressed and who was involved. The second, from 1984 to 1988, includes the use of the mine as an educational facility for both teaching and research and looks at further developments which included the installation of 1930s surface buildings and equipment salvaged from a closed mine in North Wales. The final phase, from 1988 to 1999, covers later developments at the site and looks at the significant changes from a site used by a limited group from the University of Cardiff to one of much wider use and interest.

These books will be a fascinating and nostalgic read for many, and for those less familiar with the mines, certainly the first will be an essential read for anyone considering a visit to the area.

Reviewed by **Stephen Cribb**

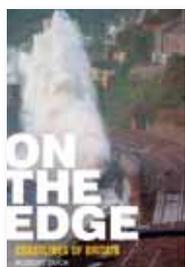
THE DOLAUCOTHI GOLD MINES – GEOLOGY AND MINING HISTORY

by ANNELS, ALWYN E & BURNHAM, BARRY C
(2013) Caerleon: APECS Press. 99pp
ISBN 978-0-9563965-5-6
List price: £12.50 pbk www.apecspress.co.uk

DOLAUCOTHI GOLD – A VISION REALISED

by ISAAC, ALUN. (2012) Caerleon: APECS Press.
200pp ISBN 978-0-9563965-2-5
List price: £12.50 pbk.W: www.apecspress.co.uk

On the edge - coastlines of Britain



This book summarises the development of the railways around the coastline of Britain since the beginning of all rail development. The book examines how railway lines have

influenced and altered the physical landscape of our coastline.

Written in a very readable style and not an academic treatise, it provides plenty to think about. The only significant weakness is the lack of maps to illustrate the often very detailed descriptions of how railways were constructed and impacted on our coast.

For any environmentalist the first part of the book is a stark illustration of how uncontrolled development can have serious detrimental effects on ecosystems, the landscape/seascape, the health of coastal communities, and the economic activities that our ancestors carried out. Therefore the book is a strong advocate (albeit silently) for the rigour of thorough environmental impact assessments of new railway developments.

Today, we take rail safety extremely seriously, but it is clear that this was not always the case. Some startling facts and figures are presented about the poor safety record of early rail travel, not all due to operational or design failures. Many were due to poor route selection that took little account of geological setting. Numerous incidences of landslips/landslides and washouts along the coastal railway lines are documented, many resulting in fatalities.

The final part of the book looks at the impact that access by rail to beaches has had on our coastline. There are some fascinating accounts of how taking beach sand and gravels for construction (often of the railways themselves) has resulted in complete changes to the coastal hydrodynamics. As we now know, changes to coastal flow regimes are never something to be carried out without considerable care and forethought. For decades there was no control over removing beach materials; but slowly, control was brought to these practices. Yet local authorities were often the worst offenders, trying to maintain their beaches and rail access

without caring about the impact of their beach construction/mining might have on communities elsewhere along the coast.

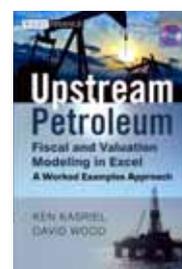
All in all, a fascinating, valuable and worthwhile book that will be of interest to rail engineers, geologists and environmentalists.

Reviewed by **James Montgomery**

JAMES MONTGOMERY

by ROBERT DUCK. Published by: Edinburgh University Press 2015 ISBN : 978-0-7486-9762-5.
www.euppublishing.com

Upstream Petroleum



Petroleum economics is a vital tool for companies, investors and governments whether the oil price is US\$37/bbl (end 2015) or US\$110/bbl (when

this book was published). Economic modelling is used by companies to assist in or determine investment decisions. On the other side of the contractual fence, modelling is used by governments to determine the fine balance between extracting enough 'rent' from companies while still make their country an attractive investment opportunity.

The third use of economics is for the benefit of investors in oil and gas companies to determine the value of the assets owned by the company (conducted by the company or a contracted third party). This is one area the industry could improve. How often do companies claim their assets are worth billions of dollars and a concomitant volume of oil? Part of the problem lies with the role of the independent contractor - supplied with data and guided by the company - used to determine the worth of assets in a competent person's report. The authors recognise this issue, urging readers to be nascent economists in the treatment of abandonment and income tax towards the end of field life.

The authors have adopted a practical approach to the subject. Much of the book is about cell formulation within spreadsheets to correctly reflect contractual arrangements. This approach does not make for good



reading (as the authors warn!). The book takes on the appearance of the transcription from a taught course comprising abundant bullet-pointed text.

Getting the spreadsheet cells functioning correctly to reflect contract terms is one aspect of the book that is very thorough. However, even if the model works correctly the results might be meaningless unless the assumptions are based on some reality. The authors hammer home the point of ensuring that all input is properly audited and checked by a relevant expert. Optimistic production profiles, low costs and a positive oil or gas price outlook can do wonders for the valuations of assets.

This book bears resemblance in style to a Haynes Manual rather than an academic treatise, but just as a Haynes manual does not make the user a mechanic, this book will not make the reader a petroleum economist. Recently, I needed some help on a model and plunged into the book seeking solutions – I could not find the solution. The book is expensive and needs heavily discounting to reflect what is required in the industry – severe cost reduction!

and vernacular buildings. Each of the buildings has a section devoted to it, which gives the reader an overview of the key historical aspects, the architectural features and the building stone. These reviews are accompanied by excellent photographs making each section easy to access and understand. The book could be used as a building stones field guide to Staffordshire, giving as it does such detailed information about so many of the most important buildings in the county.

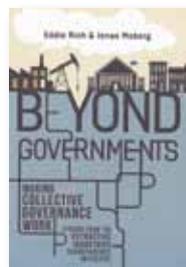
The author has succeeded in his aim of writing a book for “...people interested in the wider field of natural history and earth science...” – it is quite simply a stunning piece of work – I hope that other counties will get similar coverage!

Reviewed by: **Stephen Crabtree**

UPSTREAM PETROLEUM FISCAL AND VALUATION MODELING IN EXCEL: A WORKED EXAMPLES APPROACH

by KEN KASRIEL & DAVID WOOD, 2013.
Published by John Wiley & Sons, 344pp (plus CD with supporting EXCEL models) (hbk) ISBN 9780470686829
List Price £100 www.eu.wiley.com/WileyCDA/WileyTitle/productCd-0470686820.html

Beyond Governments - making collective governance work



The Extractive Industries Transparency Initiative (EITI) was born in 2003 to try to reconcile the flow of funds between the extractive industries and the recipient government. The first criterion of EITI was that there should be “Regular publication of all material oil, gas and mining payments by companies to governments and all material revenues received by governments from oil, gas and mining companies to a wide audience in a publicly accessible, comprehensive and comprehensible manner.

EITI's emphasis on the oil, gas and mineral sectors is the primary reason why this initiative should be of interest to Earth Scientists. The magnitude and consequences of the challenge are quite staggering. After 10 years of EITI reporting, Nigeria received US\$9 billion more revenue than would have been the case before EITI reporting. The authors estimate that as a consequence of the improvement in accounting principles, four African states' revenue may see revenues replacing aid within the space of one more electoral cycle.

The initiative has involved representatives from diverse sectors of society, each of which had different perspectives on the challenge. Citizens wanted a better deal and to participate in policy discussions; governments wanted more revenue and investment and to polish their reputation, and companies wanted a more predictable environment in which to operate and demonstrate their social and economic contribution.

The authors propose that the EITI principles can be usefully applied where there is a problem in which there is a wide range of opinions and no consensus. They suggest that review of international financial flows might benefit from this approach (illicit flows from Africa amounted to US \$865 billion between 1970 and 2008). They even note the use of these principles with respect to the conflict in Syria as an example.

I wonder whether it might work for Climate Change. The challenge seems to me to be to get potential participants to recognise that there is a situation in

which a novel approach might work. Whatever the application, the authors repeatedly stress that one should start small to build trust between participants, and that the product rather than the process should be foremost.

It is a short book, easily read, and there are good summaries at the end of each chapter.

Reviewed by: **Richard Haworth**

BEYOND GOVERNMENTS: MAKING COLLECTIVE GOVERNANCE WORK - LESSONS FROM THE EXTRACTIVE INDUSTRIES TRANSPARENCY INITIATIVE

by EDDIE RICH & JONAS MOBERG (Eds) 2015.
Published by: Greenleaf Publishing 153pp (sbk)
ISBN: 139781783531851
List Price: £20 www.greenleaf-publishing.com

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! The Psychologist's Just Been** by Tom Lindsay. Fictionalised autobiography of an exploration geologist. Mirador publishing 2016 203pp sbk.
- ◆ **NEW! The Origin and Nature of Life on Earth - the emergence of the fourth geosphere** by Eric Smith and Harold Morowitz. Cambridge University Press, 677pp, hbk.
- ◆ **NEW! Ecological Climatology - concepts & Applications** by Gordon Bonan (3rd Edn) 2016 CUP 692pp Hbk
- ◆ **Arthur Smith Woodward - his life and influence on modern vertebrate palaeontology** by Johanson Z. et al. (Eds) Geological Society of London 2016 Spec Pub #430 362pp (hbk)
- ◆ **Stochastic Analysis of Scaling Time Series - from turbulence theory to applications** by Schmitt FG and Huang Y. Cambridge UP 2016 204pp hbk
- ◆ **Rock Deformation from Field, Experiments and Theory** by Faulkner et al. GSPH Special Publication #409
- ◆ **Industrial Structural Geology** by F L Richards et al. (eds) Geological Society Special Publication #421 267pp hbk
- ◆ **Chemical, Physical and Temporal Evolution of Magmatic Systems** by L Caricchi et al. (eds) Geological Society IAVCEI Special Publication #422 223pp hbk
- ◆ **Volcanic Geology of Sao Miguel Island (Azores Archipelago)** by Gaspar et al (Eds) Geological Society Memoir #44, 2015 hbk 309pp
- ◆ **Applied Thermodynamics for Meteorologists**, by Sam Miller. 2015. Cambridge University Press 285pp, hbk

PEOPLE NEWS

CAROUSEL

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

◆ Michael D Campbell



Vice President of the American Association of Professional Geologists

(AIPG), has presented a Gene Shoemaker Graduate Scholarship (\$2,500.00) and the Ted H. Foss Undergraduate Scholarship (\$1,000.00) to two students at Rice University. The awards were among a record seven scholarships awarded by AIPG and the Texas Chapter, to students attending Texas universities. See W: http://aipg-tx.org/_docs/RiceU-EarthScienceGrad-2016.pdf

◆ John Ludden



Executive Director of the BGS received a CBE in the Queen's Birthday

Honours list for his services to geoscience. John said: "I am extremely proud to receive a CBE and view this as powerful recognition of the importance of the geosciences to the UK economy and the role that the British Geological Survey has in developing this."

◆ Martin Rudwick



has been given the Vladimir V. Tikhomirov History of Geology award

by the International Union of Geological Sciences (IUGS) for 2016. The Award was made for his lifetime's work on the history of the Earth sciences. Martin said: "As a paid-up historian for the past half-century, it gives me special pleasure to be given an IUGS 'Science Excellence Award!'"

A working party reports



The latest in the series of Engineering Group Working Party Reports was published in June, the occasion being marked by an all-day meeting at Burlington House. Members of the Working Party on the 'Engineering Geology and Geomorphology of Glaciated and Periglacial Terrains' were (pictured L-R): Dr Sven Lukas, Prof Julian Murton, Prof David Norbury, Prof Martin Culshaw, Prof David Evans, Prof James Griffiths, Mrs Anna Morley, Prof Mike Winter, Dr David Giles, Dr Michael de Freitas, Mr Chris Martin.

Personals

Neil McLaurin is looking for someone who can give a good home to his collection of the journal *Economic Geology* (published by the Society of *Economic Geologists*, SEG). The collection contains all the issues (thought with just one or two missing) from 1982 to 2012. Neil says he will even deliver within a 60 mile radius; otherwise it can be collected from his home in Oxfordshire.

➤ If you are interested, please contact E: azurite@tiscali.co.uk

◆ Verity Smith



CGeol, Senior Geotechnical Engineer at Atkins, was recently named

the 'Best Woman in Highways' at the 2016 European Women in Construction and Engineering (WICE) Awards for her work and contribution to knowledge in the field of Highways Geotechnical Asset Management. Verity joined Atkins in 2005, following a summer student placement with the company's ground engineering team in Birmingham. One of her most significant achievements has been her role, since 2011, as Deputy Geotechnical Liaison Engineer on the M25 motorway design, build, finance and operate contract.

IN MEMORIAM WWW.GEOLSOC.ORG.UK/OBITUARIES

THE SOCIETY NOTES WITH SADNESS THE PASSING OF:

Armitage, John *
Bishopp, David *
Burri, Peter
Colley, H *
Davis, Robert Vincent *
Exley, Colin
Flood, Raymond Edward *

Gosse, Andrew *
Morgan, Daniel *
O'Donoghue, Michael*§
Piffaretti, Joseph*
Ramsden, Robert *
Van der Werde, Roelof *
Wood, Christopher J *

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 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.





DISTANT THUNDER

Stamp of approval

Geologist and Science writer Nina Morgan* describes the revival of a forgotten geological hero

One of the most high profile honours a scientist can receive must surely be to appear on a postage stamp. And one of the least-known geologists to achieve this public recognition must be James Hector [1834 – 1907]. Born in Edinburgh, Hector received a medical degree from Edinburgh University in 1856, and thanks to a recommendation from Roderick Murchison [1792–1871], then Director of the Geological Survey of Great Britain, was appointed as surgeon and geologist on the Palliser Expedition [1857 – 60], which was searching for new routes in western Canada for the Canadian Pacific Railway. During the course of the expedition among other things, he measured the first stratigraphic section in the region; produced a

geological map; found evidence of extensive former glaciation; and sketched out the structure of the Rocky Mountains.

But in the Canadian popular imagination, Hector is best known not for his geological prowess, but for his involvement with the naming of Kicking Horse Pass – which straddles the Continental Divide on the border between British Columbia and Alberta. The name recalls an accident that nearly killed him.

Kick

While the Palliser expedition was exploring there in 1858, Hector was kicked in the chest by a horse. The result, recalled Metis Peter Erasmus, another member of the expedition, was that: “The doctor [Hector] was knocked unconscious. We all leapt from our horses and rushed up to him but all our attempts to help him recover his senses were of no avail... Dr Hector must have been unconscious for at least two hours.” In Hector’s own version of the story, his “grave was dug, and they

were preparing to put me in it” when he regained consciousness and winked at them.

The Palliser expedition proved a great success and in 1860 Hector returned triumphant to London to write up the final report. But he wasn’t there for long. In 1861, Murchison again recommended Hector for a job – this time for the Provincial Council of Otago, New Zealand.

Rise & fall

Hector arrived in New Zealand in 1882, during the height of the Otago gold rush and set to work. After mapping huge areas in Otago Province, he produced the first geological map of the region in 1864. He went on to set up the New Zealand Geological Survey and Colonial Museum in 1865. Then, as the only scientist working for the New Zealand Government, he became the official adviser on all things scientific. At various times he found himself running many of New Zealand’s scientific institutions. He was also instrumental in the development of what is now the Royal Society of New Zealand. In addition he published numerous scientific papers on topics ranging from geology to botany and zoology. He wrote two books: *Handbook of New Zealand*, first published in 1879, and *Outline of New Zealand Geology*, a summary of the first 20 years of the New Zealand Geological Survey.

But in the late 1880s, following a series of disagreements with members of the New Zealand scientific establishment, Hector fell from grace. Although he was knighted in 1887 and received numerous honours, he was relieved of responsibility for many of the organisations he ran. He retired from Government service in poor health in 1903, and died in 1907. His death was marked by obituaries in many scientific publications abroad, but he received little recognition in New Zealand at the time.

Resurrection

Sixty years after his death the tide turned, and Hector’s reputation underwent a revival. In 1967 the New Zealand



Post Office put the seal on Hector’s return to grace by using his portrait on a stamp issued to commemorate the centenary of the founding of the Royal Society of New Zealand. And to top it off, the Geoscience Society of New Zealand has now established an annual Hector Day on 16 March, Hector’s birthday. Celebrations range from picnics to cricket matches and geological field trips. All, it seems, has been forgiven.

➤ **Acknowledgement**
The inspiration for this vignette came from the article **Promoting geological heritage through postage stamps** by Jane Dove, **Geology Today**, vol. 32, March – April 2016, pp 70 – 74. Additional information was gathered from the **Wikipedia entry for James Hector**; entries for **Sir James Hector, Kicking Horse Pass and the Palliser Expedition** on **W: www.thecanadianencyclopedia.ca**; entries about Hector on **W: www.gsnz.org.nz/information/hector-day-i-9.html**; and about his map on: **W: www.otago.ac.nz/library/treasures/hector**.

* **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



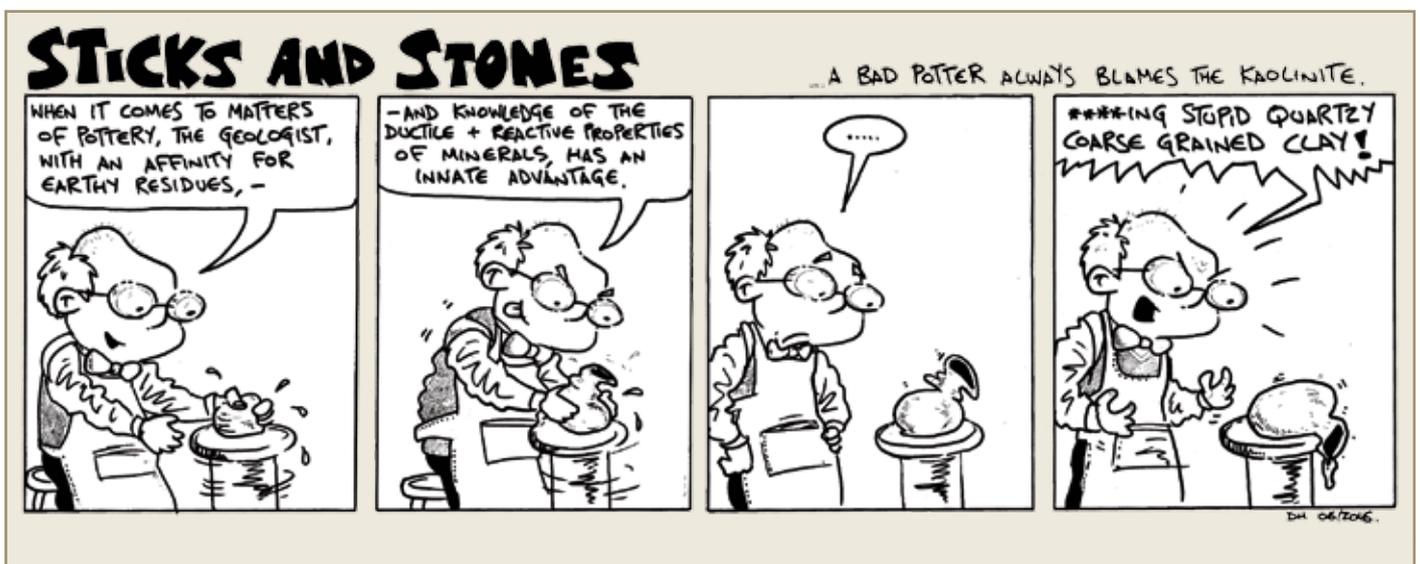
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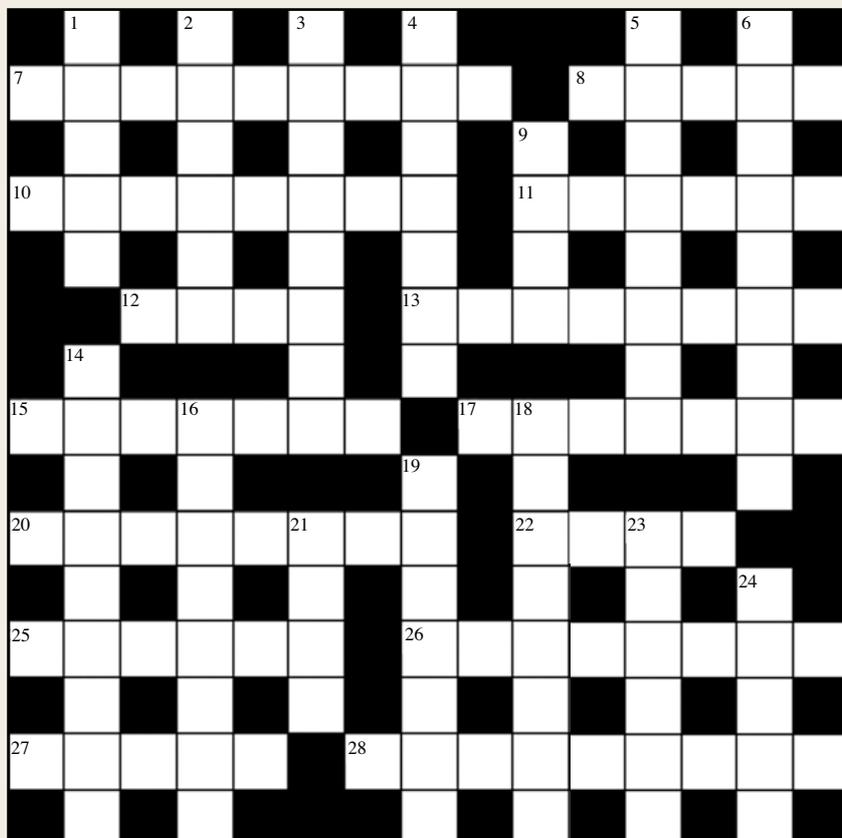
COURSE	DATE	VENUE AND DETAILS
Introduction to Micromine	16-17 August	Micromine, Challoner House, 19 Clerkenwell Close, Clerkenwell, London, EC1R 0RR. Charges. See website for links and details. E: mmuk@micromine.com
Resource Estimation in Micromine	18-19 August	Micromine, Challoner House, 19 Clerkenwell Close, Clerkenwell, London, EC1R 0RR. Charges. See website for links and details. E: mmuk@micromine.com
Lapworth's Logs	n/a	'Lapworth's Logs' is a series of e-courses involving practical exercises of increasing complexity. Contact: info@lapworthslogs.com. Lapworth's Logs is produced by Michael de Freitas and Andrew Thompson.

DIARY OF MEETINGS AUGUST 2016

COURSE	DATE	VENUE AND DETAILS
Magmatism of the Earth Conference and related strategic metal deposits V.I. Vernadsky Institute RAS, Mineralogical Institute of the Ural Branch of RAS.	4-9 August	International Conference, organised by Viktor Zaitsev. Venue: Maiss, Russia. See website for links and details. W: http://emsmd.ru/ Contact: alkaline.conference@gmail.com
Volcanism Plate, Tectonics, Hydrothermal Vents and Life Nordic Network of Astrobiology	23 August – 1 September	Summer school. Venue: University of the Azores, Portugal. Charges. See website for details. Convener: Wolf Geppert E: wgeppert@fysik.su.se
The 35th International Geological Congress IGC/IUGS	27 August – 4 September	Venue: International Convention Centre, Cape Town, South Africa. See website for details and links. Contact Danie Barnardo E: barnardo@geoscience.org.za



Crossword no.205 set by platypus



ACROSS

DOWN

- 7** Line joining points of similar principal stress orientations (9)
- 8** Third order geological time period (5)
- 10** Gently sloping, concave-up erosion surface flanking a mountain or mesa (8)
- 11** Erosional stack in arid or semiarid areas of US (6)
- 12** Case for bodkins (4)
- 13** Slide of sediment downslope under gravity (4,4)
- 15** Haliotid Archaeogastropod commonly found in bathrooms (7)
- 17** Mixture in which microscopically dispersed insoluble particles are suspended throughout another substance (7)
- 20** Stand on a ship's deck, mounted before the helmsman and credited to Lord Kelvin, housing navigational instruments (8)
- 22** See from afar (4)
- 25** French naturalist, mathematician and encyclopaedist 1707-1788 (6)
- 26** Lustre, as seen on the inside of a 15a (8)
- 27** Secret store (5)
- 28** Each of these is 10 billionths of a metre (9)

- 1** Sinuous ridge of gravel deposited by subglacial stream (5)
- 2** Medium-grade metamorphic rock characterised by flat, sheet-like grains in preferred orientation (6)
- 3** Younger faunal stage of the Middle Devonian (8)
- 4** Common unicellular algal phytoplankton (7)
- 5** One standard unit that helps medicine go down, apparently (8)
- 6** Citadel on an elevated site, usually with precipitous sides (9)
- 9** Units of resistance (4)
- 14** Degree of inclination, notably of the ecliptic (9)
- 16** Dipnoan airbreather, often found stuck in the mud (8)
- 18** Habitat of the 'sunshine miner' (8)
- 19** Westphalian sandstone (7)
- 21** Volcanic edifice (4)
- 23** Lateral segment of a trilobite (6)
- 24** Ventriloquist's spokesman (5)

WIN A SPECIAL PUBLICATION!

The winner of the June Crossword puzzle prize draw was **Richard Pidcock of Wakefield, UK**.

All correct solutions will be placed in the draw, and the winner's name printed in the October 2016 issue. The Editor's decision is final and no correspondence will be entered into. **Closing date - September 12.**

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

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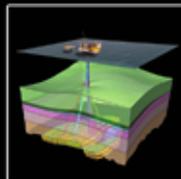
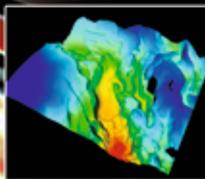
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Across:
7 Upwelling **8** Praia **10** Perlitic **11** Angler
12 Oslo **13** Reactors **15** Academe **17** Adenine
20 Radiates **22** Mobs **25** Soiled **26** Honolulu
27 Earns **28** Blackdamp

Down:
1 Upper **2** Realms **3** Flatworm **4** Unicorn
5 Brighton **6** Firebrand **9** Lava **14** Octagonal
16 Drilling **18** Dominica **19** Asphalt **21** Tide
23 Bolide **24** Flume



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- **Focus on the Wellsite** – Wellsite geology, focus on re-invigorating/updating/more fully exploiting fundamental techniques, use of real-time data, daily work flows and innovative processes.
- **Integrating Teams** – Working better together with wellsite geology, geomechanics, well engineering, biostratigraphy, geochemistry, wireline, petrophysicists, mudlogging and LWD. Improving communications.
- **Working Smarter** – What tools and techniques do we need to 'work smarter', more cost effectively and safely?

For further information and registration please contact:

Sarah Woodcock The Geological Society, Burlington House, Piccadilly, London W1J 0BG.

T: +44 (0)20 7434 9944 or email: sarah.woodcock@geolsoc.org.uk

or visit the conference webpage: www.geolsoc.org.uk/PG-Operations-Geology-Conference



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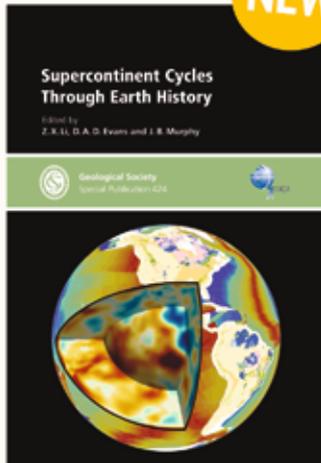


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NEW



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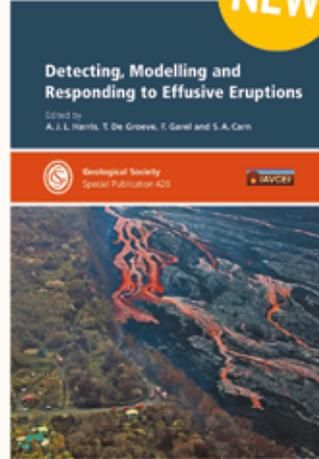
Edited by Z.X. Li, D.A.D. Evans and J.B. Murphy

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This Special Publication provides a snapshot of current research on Earth's palaeogeographic evolution characterized by cyclic supercontinent assembly and breakup, which is important for understanding the underlying geodynamic processes.

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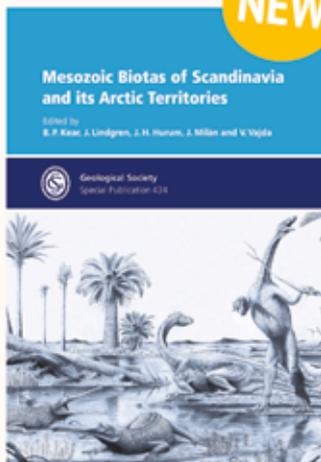
Edited by A.J.L. Harris, T. De Groeve, F. Garel and S.A. Carn

Published: June 2016 | 683 Pages
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NEW



Mesozoic Biotas of Scandinavia and its Arctic Territories

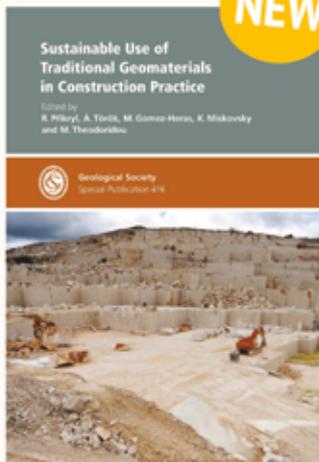
Edited by B.P. Kear, J. Lindgren, J.H. Hurum, J. Milàn and V. Vajda

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Showcasing the latest research and history of discoveries, this book encapsulates the spectacular record of Mesozoic life and environments from Scandinavia and its remote Arctic territories of Svalbard and Greenland.

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NEW



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Edited by R. Přikryl, Á. Török, M. Gómez-Heras, K. Miskovsky and M. Theodoridou

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