



The Edinburgh Geologist

Magazine of the Edinburgh Geological Society

Issue No 57

Spring 2015





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Cover Illustration

The geology of south-east Scotland as illustrated on
William Smith's celebrated map of 1815.

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Published March 2015 by The Edinburgh Geological Society

(Charity registered in Scotland number SC008011)

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ISSN 0265-7244

Maps and mappers, sex and beer

An editorial ramble by Phil Stone

The most-celebrated geological anniversary of 2015 will undoubtedly be the William Smith map bicentenary. Smith's trials and tribulations, and the iniquities heaped upon him by the Geological Establishment of the day, were well-rehearsed in Simon Winchester's popular book 'The Map that changed the World'. But there are still some less-well-known aspects of the story and I'm delighted to have Vicky Woodcock's assessment of the map in this issue of *Edinburgh Geologist*—with more on Smith's life to come next time. The map is commonly thought of as a representation of the geology of England and Wales, but at its northern margin it extends across Scotland as far as the south-west Highlands. Admittedly, the innovative biostratigraphic approach that proved so spectacularly successful for the English Mesozoic and Upper Palaeozoic successions was premature for the sparsely fossiliferous and less-studied rocks of southern Scotland. Nevertheless, Smith's map demarcated the Devonian and Carboniferous successions of south-east Scotland and the Borders relative to the Lower Palaeozoic of the Southern Uplands, and the Midlothian coalfield was

clearly shown (see our front cover), separated from the Carboniferous of the Midland Valley by the Pentland Hills Lower Palaeozoic inlier.

Smith's work was certainly revolutionary for the understanding of the geology of England; but for Scotland it was not the first recognisable representation of the geological outcrop pattern to be produced. Smith's map was published on 1 August 1815. Seven years earlier, on 4 November 1808, Louis Albert Necker had presented to the newly-formed Geological Society of London, a hand-coloured geological map covering all of Scotland with the exception of the Shetland Islands. Necker was a Swiss mineralogist who studied at the University of Edinburgh in 1806 and took the opportunity to travel extensively through Scotland. His map rested obscurely in London until rescued by our predecessors in the Edinburgh Geological Society who, in 1939, arranged for the printing of a facsimile. In turn, the availability of that edition passed, so a new printing was arranged as one of the events celebrating, in 1984, the Society's

150th anniversary¹. That 'third edition' was issued in 1985; copies are still available.

As you might expect, there are inaccuracies in Necker's map, but the overall effect is impressive. Skye, for example, shows an appreciation of the rock divisions approaching the modern interpretation, whilst in southern Scotland Necker's representation of the Galloway granites was more accurate than Smith's. However, the illustration of local outcrop derived from surface observation was one thing, Smith's mastery of the geology in three dimensions through the application of biostratigraphy was quite another.

The appreciation that surface observations could be extrapolated into a predictive understanding of the sub-surface was the first step that in time would lead to the establishment of a National Geological Survey. In England, systematic, government-

sponsored work by the newly established Geological Survey of Great Britain commenced in 1835 only twenty years after Smith's map was published. Work started a little later in Scotland, in 1854, as Ordnance Survey base maps became available, with the first Scottish headquarters office established in Edinburgh in 1867. Over the next century the location of the Edinburgh office changed several times until the organisation arrived at Murchison House in 1976. Forty years later, and now the British Geological Survey, it is once more on the move. The Charles Lyell Centre at Heriot-Watt University's Riccarton campus will be a joint venture with the University, led by Professor John Underhill. Very appropriate then that in this issue of *Edinburgh Geologist* we have an article by John setting out his vision for the collaboration.

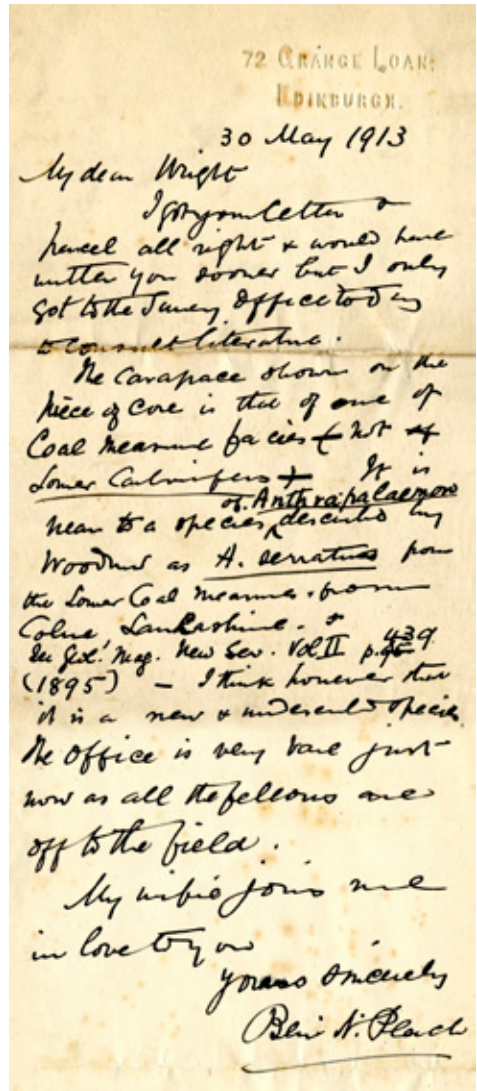
¹I'm grateful to Andrew McMillan for these details.

Part of Necker's geological map of Scotland showing the geology of Skye. Clearly separated are the 'Primitive' metamorphic and plutonic rocks (pink), the Mesozoic sedimentary strata (yellow) and the Palaeogene lavas (green).



For our third article we have an assessment not of a map but of a mapper. Ben Peach has almost mythical status in the panoply of Scottish geological heroes but of course there was much more to the man than revealed by his scientific profile. John Mendum and Anne Burgess provide a glimpse into his family life, and speculate on its interaction with his prolonged periods of field work. In researching their article John and Anne turned up so much material that a much longer version of their article will be included with the online *EG*. They emphasise his palaeontological knowledge and its application across the whole range of Survey activity, and so it was a happy coincidence that this aspect was also apparent in a letter written by Ben Peach and discovered recently by EGS member Alyn Jones amongst his late father's papers. The letter was written to a colleague, W B Wright, who was based in the Survey's Manchester office², and discusses Carboniferous fossils from the Lancashire Coalfield that had been sent to Peach for identification. It confirms his expertise

² Alyn Jones has provided the following information: R C B Jones joined the Geological Survey's Manchester office in 1925 when W B Wright was District Geologist. After mapping in Lancashire, he moved north and worked in Orkney, Morvern and Strontian. As *EG* went to press, the editors were saddened to learn that Alyn had died. We always enjoyed his correspondence.



The letter from Ben Peach to W B Wright of the BGS office in Manchester; it was discovered by Alyn Jones and generously presented by him to the BGS archive.

as extending well beyond the Lower Palaeozoic rocks of Scotland.

More sex please, we're Scottish

Back in *EG*46, Autumn 2009, we touched on the advent of sexual reproduction in Devonian fish. A feeling of *déjà vu* then, when the same theme once again fascinated the popular press in Autumn 2014. New discoveries had pushed back the critical date of the first copulation by about 20 million years, to 385 Ma, and the new celebrity fish was apparently Scottish. *Microbrachius dicki* was described in 1888 by Ramsay Traquair and named after Robert Dick, a well-known fossil collector active in northern Scotland who had presumably supplied the Caithness specimens to him. The unfortunate creature's name was tailor-made for the tabloids to turn the story into 'Carry on in the Devonian', whilst our more local titles couldn't resist patriotic headlines like 'Sex: Another top Scottish invention'. But of course there was more to the story, not least its origins in Estonia (which also has Devonian fish) where a box of previously neglected fossils first raised suspicions that *M. dicki* had unusual appendages. Online publication in *Nature* on 19 October 2014 unleashed the hacks. Alas, back in the Devonian it all ended badly. The dour placoderms of the Orcadian

Basin were not impressed by the innovation of *B. dicki* and, for them, it proved an evolutionary dead-end.

Beer and plate tectonics

Past *EG* editorials have occasionally noted the geological associations of wine branding, but EGS member John Studholme provides the opportunity to branch out into beer. He reported the acquisition from a well-known supermarket of a bottled beer called 'The Ridge', a Pale Ale produced by Harviestoun brewery at Alva. On the label the brewers explained that "[t]he Mid-Atlantic Ridge is where two tectonic plates meet at almost exactly the midpoint between America and Scotland. With this geological symmetry in mind, we've created a rock solid union between American Amarillo and British Fuggles hops to produce a US style Pale Ale with distinctive Scottish origins. And whilst we can't promise that the Earth will definitely move for you whilst drinking Ridge, we can guarantee you'll be savouring something with a seismic depth of flavour". Imaginative marketing yes, but unfortunately John doesn't say whether or not the stuff was any good. In assessing our national geological treasures we are on firmer ground with our two book reviews—Scottish gold and minerals of the Cairngorm mountains.

Cary, a prominent map publisher. It is not clear how Smith met Cary, but in 1812 he agreed to publish Smith's geological map of England and Wales. With Cary on board, Smith made relatively quick progress by comparison with the preceding decade. He oversaw the creation, by Cary, of a new topographical map at a scale of five miles to the inch for the specific purpose of providing the basis for his geological map. The fifteen plates that comprise Smith's map were then engraved during 1813 and 1814, with the result that by June 1814, he was ready to display part of the completed map to the Board of Agriculture, to an overwhelmingly positive reception (Cox, 1942). More profitably, he was later also able to display his finished work to the Society for the Encouragement of the Arts, Manufactures and Commerce, from whom he received the prize of fifty guineas offered for a 'Minerological Map'. Following the engraving of the plates, all that remained was for each map printed to be coloured according to Smith's plan of the succession of the strata.

The Map

Smith's completed map, *A Delineation of the Strata of England and Wales, with Part of Scotland*, showing twenty-three separate strata, was sold by subscription—a map and accompanying explanatory

memoir were sent to individuals who had subscribed to receive it as soon as a copy was ready for them, in one of six different progressively more expensive formats (Sheppard, 1922). This meant that he could refine the map as he discovered more of the country's geology. It is not known exactly when the various revisions took place—every copy is dated 1st August 1815—but Smith did keep an extremely close eye on the production process; he examined each map after it had been coloured, with his diary revealing that he rejected copies on which the colouring had been done in a 'slovenly manner' (Smith, quoted in Cox, 1942). The approved maps received a personal signature and, from 2nd November 1815 onwards, a number (Smith, quoted in Cox, 1942). This numbering system, along with the map's changing geology, allows us to deduce where in the series a particular extant map belongs—it is often even possible, thanks to his diary, to determine exactly which day Smith himself inspected it. Beginning with 1 to 100, he then marked subsequent copies a1 to a100, followed by b1 to b100. With around 400 maps thought to have been created in total, an unnumbered copy may be a particularly early or particularly late edition—a question that can be

resolved by the geology illustrated. There are a number of variations but the easiest to assess is the state of the geology of the Isle of Wight. In the earlier maps, the green of the Cretaceous strata stretches across the middle of the island, rising to a point; in the 'a' and 'b' series it sinks down to the south; on the later unnumbered copies it bisects the island two thirds of the way down, and additional outcrops appear in the south (Eyles, 1969a).

It is unknown precisely how many copies of Smith's map survive, with even an edition only in average condition being worth tens of thousands of pounds. Undocumented or forgotten copies are occasionally still uncovered today, such as the one recently rediscovered at the Geological Society of London. This map had for years been hidden

amongst material celebrating the centenary of the Society's foundation, and is particularly notable for its bright colours, extremely well-preserved state, and the fact that it is an early unnumbered copy. It was first brought to light last year by the author of this article, when employed at the Society, and has since been conserved and digitised in time for the bicentenary of its creation. At the time of writing, the unveiling of the newly conserved map is scheduled to take place on 23rd March—William Smith's birthday.

Following publication of his now-celebrated map Smith received little immediate credit or financial reward. Over the next few years he published a number of works, including *Strata Identified by Organized Fossils* (1816), a *Geological Section from London to Snowdon* (1817), and other sections and maps, notably a series of geological maps of 21 English counties (1819–1824), all while continuing to be engaged in professional work. He even suffered



The geology of the Isle of Wight as represented on map number 53, now held by the British Geological Survey.

the indignity of a ten-week spell in debtors' prison. Yet he never gave up on his dream of producing a more comprehensive and far-reaching geological work—among his papers at his death was found a variety of material for a suggested publication entitled *Geological System*, as well as a range of notes relating to other projects.

Legacy

Those interested in geology at the time of the map's publication largely fell into two categories: the better-off who saw it as a hobby, and those for whom it was intertwined with their profession and who understood its everyday utility. Smith wanted people to realise that fossils were not just intriguing specimens to collect and classify, but that they had a real significance when viewed in relation to the geological order of the strata (Porter, 1977). Smith's humble, practical background was inevitably a barrier to his interactions with the Geological Society of London, formed in 1807. Senior members had visited him before the publication of his map, possibly to view his fossil collection (Cox, 1942), but no constructive dialogue was established, and it is inescapable that just four years after Smith's map was published, a markedly similar map was published by George Greenough, the Society's first

president. But eventually Smith did receive the recognition he deserved: the Geological Society's Wollaston Medal in 1831 (the first recipient), an annuity from the Government, and an honorary degree from Trinity College, Dublin.

Smith was not actually the first to recognise the link between fossils and strata—geologists such as the Frenchman Alexander Brongniart had already deduced this—his importance lies in his having combined local knowledge into a picture of the whole country and presented that picture in an innovative and eye-catching manner (Porter, 1977). Today, his *Delineation of the Strata* is rightfully celebrated as the 'first geological map of a nation'; a remarkable feat given that it was 'based on data assembled by the unaided efforts of its author in such intervals of time as could be snatched from a busy professional life' (Cox, 1948). Although he omitted the majority of Scotland, the publication of his map led the way for other geologists, including John MacCulloch who assiduously geologically mapped Scotland for many years, his map finally being published posthumously in the 1830s.

Bicentenary Celebrations

There are many events taking place around the country to celebrate the 200th anniversary of the publication

of Smith's map, including two Geological Society of London meetings. The first of these will focus on Smith and his contemporaries, with visits to his fossils at the Natural History Museum, his birthplace, and his archive at Oxford; the second will look at the future of geological mapping. Exhibitions include those at the National Museum of Wales, Oxford University Museum of Natural History, The Natural History Museum, and the Yorkshire Museum. For a full list of events, go to www.geolsoc.org.uk/Events/William-Smith-Bicentenary. Celebrating Smith's legacy in a slightly different way, *Map: An anthology of poems after William Smith's geological map*, is due to be published by Worple Press in March, featuring award-winning poets such as Andrew Motion inspired by Smith, his life, and his famous map.

It is possible to purchase a copy of the map itself, either folded or flat, as well as the accompanying memoir, from the British Geological Survey — visit the Geology Shop either online (<http://shop.bgs.ac.uk/Bookshop>) or in person at Murchison House or Keyworth. Copies of these and Smith's county maps are also available from the Geological Society (www.geolsoc.org.uk/bookshop).

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- Victoria Woodcock, British Geological Survey, Edinburgh

The Sir Charles Lyell Centre: a new international hub for Geoscience Research

By Professor John Underhill

Heriot-Watt University (HWU) and the British Geological Survey (BGS) are joining forces to create a new research centre for Earth and Marine Science and Technology based at HWU's Edinburgh Campus. The Sir Charles Lyell Centre, opening early in 2016, will be the hub of a world-leading research cluster bringing science and technology together to tackle critical issues of natural resource and energy supply in a responsible and sustainable way. By bringing together leading researchers in the fields of geoscience, marine science, engineering, computing and mathematics, the Lyell Centre will play a key role in finding pragmatic solutions and providing evidence-based informed and reliable opinions in areas where inputs have traditionally been polarised.

The Lyell Centre represents a >£20million investment which is jointly financed by UK and Scottish funders, including the Natural Environment Research Council (NERC), Scottish Funding Council (SFC) and HWU. Its role is to promote innovative research at the core of geoscience, marine

and terrestrial ecology, computing, mathematics and engineering. The new fusion of geoscience expertise between HWU and the BGS affords the opportunity to develop and use innovative methods and new technologies to create real-world solutions for energy and environmental challenges and impacts. Research will take place in areas such as security of supply, geomaterials, earth observation and geomatics, global change and ecosystems, seafloor-mapping using advanced robotic vehicles, earthquake and volcanic risk and monitoring and natural hazards, as well as numerous others.

The Lyell Centre will build upon existing international partnerships that the University and BGS have, enhanced by the ability to draw upon and utilize HWU's new Malaysian and Dubai overseas campuses. In addition, it is hoped that the Lyell Centre will complement, and strengthen HWU's existing links with industry.

Heriot-Watt University

The University's history began in 1821 when under the auspices of

the School of Arts of Edinburgh, it founded the world's first Mechanics Institute, to "address societal needs by incorporating fundamental scientific thinking and research into engineering solutions". The University was founded by Leonard Horner and Robert Bryson, two individuals with a strong interest in Geoscience. Horner joined the newly formed Geological Society of London in 1808 and two years later was elected one of the secretaries. He remained devoted to the welfare of the society and was president in 1846 and again in 1860. In Edinburgh, the Mechanics Institute revolutionised access to education in science and technology for ordinary people, beginning a long and rich tradition of excellence in educating, inspiring and challenging the professionals of tomorrow. In 1885 it changed its name to Heriot-Watt College to commemorate George Heriot, the 16th century philanthropist and financier to King James VI of Scotland, and James Watt, the great 18th century inventor and engineer.

HWU has had a long tradition of support for women in Science, something that is exemplified by the fact that one of HWU's alumni, Dame May Ogilvie-Gordon subsequently became the first female Fellow of the Geological Society, the first female recipient of their

prestigious Lyell Medal and the first woman to be awarded a PhD in Geology in Germany at a time when it was not possible for her to matriculate at a British University.

Today, HWU is placed 13th out of 116 institutions in the 2015 Guardian University League Table. The REF (Research Excellence Framework) 2014, the system for assessing the quality of research in UK higher education institutions, ranked HWU 33rd position in the UK and 4th in Scotland. But, in 'Impact', which measured the demonstrable benefit that research makes to society at large, HWU was ranked 2nd in the UK and 2nd in Scotland. The collaboration between HWU and the BGS to form the Lyell Centre will enhance the academic reputation and outputs of both bodies through publication in high impact journals, the build-up in HWU's postgraduate capability and the development of new REF impact cases.

Structures & Governance

HWU has had a long standing commitment to Applied Research including in the field of Geoscience. These activities have historically been undertaken in different parts of the University, most notably in the Institute of Petroleum Engineering (IPE), the School of Life Sciences (SLS), the School of the Built

Environment (SBE) and the School of Engineering and Physical Sciences (EPS). In order to maximise the potential for integrated collaborative research, the University has formed a new school in Energy, Geoscience, Infrastructure & Society (EGIS), which is a merger between IPE and SBE and brings together the majority of existing staff in Applied Geoscience in one entity. EGIS and SLS are the two main University stakeholders in the project and new staff will belong to either one or both schools. The academic aim is to set up a new Institute of Applied Geoscience that nestles within the existing structures under the EGIS umbrella. The formation and name of the new school demonstrates the University's commitment to Geoscience.

As well as the University having set up an internal governance structure, representatives of NERC and its BGS Edinburgh and Keyworth research centres have participated in a Planning Group which has sought to address the population, financing, construction and design of the Lyell Centre. A Strategic Management Group, chaired by HWU's Principal, Professor Steve Chapman, has oversight of the key issues including a review of the scientific capability and direction of travel on which the Lyell Centre will embark. The clarity

of purpose and vision has directly led to joint bids for further funding and led to external support by the Lyell Estate, the SFC and the Wolfson Foundation, all of whom are engaged in the project.

The link-up between the BGS and HWU to form the Lyell Centre builds upon existing links and research collaboration. In the past couple of years, this has been cemented by the co-operation within the NERC Centre for Doctoral Training (CDT) in Oil and Gas that HWU leads and BGS is a core partner within. More details about the NERC CDT can be found at <http://www.nerc-cdt-oil-and-gas.ac.uk/>

Commitment

A sense of the genuine excitement surrounding the Lyell Centre can be gleaned from the engagement from senior management and Government figures.

Professor Steve Chapman, Principal of HWU, said the venture was based on a strong scientific synergy. "The Centre represents a tremendous opportunity, unifying our respective strengths in earth and marine sciences, creating an innovation hub in subsurface geosciences and generating greatly enhanced interaction between academic groups."

Professor John Ludden, Executive Director of the BGS, said, “I view the creation of the new Centre as an extraordinary opportunity to broaden our science base by partnering in key areas with Heriot-Watt University, in particular in geology and geophysics related to energy, urban renewal and the sea-floor.”

Scottish Cabinet Secretary for Education and Lifelong Learning, Michael Russell, said, “The creation of a European centre of excellence for earth and marine technology at Heriot-Watt University is great news for both industry and Scotland as a whole as it enhances our already strong reputation for world-leading scientific research and innovation. I’m proud that the Scottish Government has invested in this centre via the Funding Council, allowing the delivery of a unique postgraduate student experience based on cutting-edge collaboration between industry and universities. This will help to ensure better educated, more skilled and more successful individuals and help increase sustainable economic growth.”

David Willetts, who was Minister for Universities and Science at the time of the original announcement, said, “The creation of the Sir Charles Lyell Centre assembles world-leading

expertise from the British Geological Survey and Heriot-Watt University in a common enterprise bringing together investment and skills from the UK Research Council and University sectors to support future UK innovation and growth.”

Professor Duncan Wingham, Chief Executive of NERC, said, “NERC Council has been extremely impressed by the enthusiasm and commitment of both British Geological Survey and Heriot-Watt University to a shared vision for a national centre of innovation. We are very happy to have reached agreement with Heriot-Watt and the Scottish Funding Council to realise this vision.”

Research Themes

The two schools at HWU (EGIS and SLS) have worked together to identify the key and strategic research themes that they wish to pursue in the new centre. These themes are clustered in two main areas: Applied Geoscience and Ecosystems Science. They identify areas that complement and augment existing strengths at HWU and the BGS as well as identifying new areas of relevant geoscience research into which it is possible to expand. The University’s goal is to appoint geoscience research leaders who will heighten its academic prowess. In seeking to do this, one

of the additional key elements in the recruitment process is to identify synergies with the BGS so as to maximise value for the Lyell Centre.

In the field of Applied Geosciences the aim is to apply innovation and technology to solve existing issues in Earth and Marine Science including those associated with the important challenges resulting from the competing need for Energy Supply, Resource Management, Safe Construction and their Environmental Impact. Consequently, the University is seeking to populate the Lyell Centre with leading researchers under the umbrella of the following twelve themes:

- Conventional Exploration
- Marine & Quaternary Geoscience
- Characterising Subsurface Reservoirs
- Risks, Hazards and Predictability
- Geomaterials
- Subsurface Monitoring
- Earth Observation and Quantification
- Geomatics (Remote Sensing & GIS)
- Petroleum Basin Analysis
- Applied Geophysics
- Enhanced Oil Recovery and Unconventional Hydrocarbons
- Society, Economics and Policy

The Lyell Centre's ecosystem research ambition spans the

terrestrial, freshwater and marine realms. Grounded in basic ecology, the themes apply the latest microbiological, genetic or biogeochemical techniques to understand and manage ecosystems at a time when global climate is changing at rates faster than at any point in geological history.

- Marine ecosystems in a changing ocean
- Marine microbial ecology and biotechnology
- Marine pollution and ecotoxicology
- Marine conservation status and policy
- Terrestrial and freshwater ecosystems & biogeochemistry
- Organic waste management and terrestrial end uses

Respecting Geological Heritage

To understand the thinking behind the naming of the Lyell Centre one has to go back to the early 19th Century when HWU was first founded and modern geology as we now know it was in its infancy. Born in Kinnordy, Angus in 1797, Sir Charles Lyell, 1st Baronet, Kt FRS, is considered the leading geologist of his generation. He is best known as the author of *Principles of Geology*, which popularised James Hutton's concepts of uniformitarianism—the idea that the earth was shaped by

the same processes still in operation today. Lyell was a close and influential friend of Charles Darwin and Lyell was one of the first scientists to support *On the Origin of Species*. His wife, Mary Horner was daughter of Leonard Horner (1785–1864), the co-founder of Heriot-Watt University in 1821.

Lyell's studies of the Roman Macellum or 'Temple of Serapis' in Pozzuoli, near Naples in 1828 provide a perfect illustration of his understanding of the impact and significance of modern marine and geological processes. Whilst sitting contemplating the site, he observed a line marked by marine *Lithophaga* bivalve molluscs high up on three columns and

realised that this represented a former shoreline. He correctly deduced from this that the site had been submerged for a long period after Roman times and then uplifted again such that the former shoreline was now c. 2.74 m above the present one. In an instant he saw that whatever the geological cause—which we now know to be underground ballooning and deflation of a magma chamber—it had been on a relatively rapid (2000 years) time scale. The present elevation of the palaeo-shoreline on the columns shows that they have risen further since Lyell's day.

In an instant, Lyell had appreciated that the linkage between marine



The 'Temple of Serapis'. Left: Frontispiece from Lyell's Principles of Geology—the figure crouched contemplating the columns is Lyell himself. Right: The columns at Pozzuoli today.

and earth processes were not always gradual as many including he had previously presumed and came to understand the time scales on which some geological processes could operate. His links with HWU, the marriage between earth and marine processes that influenced his thinking so, the clear synergies with the BGS move and the strong support from the Lyell and Gifford families that administer the Lyell Estate in Kinnordy, all converged nicely and the naming of the Lyell Centre was a natural consequence.

Construction

The Lyell Centre is being built on the east side of HWU's Riccarton Campus on a site adjacent to the Enterprise Building that houses IPE, a component part of the School of Energy, Geoscience, Infrastructure and Society.

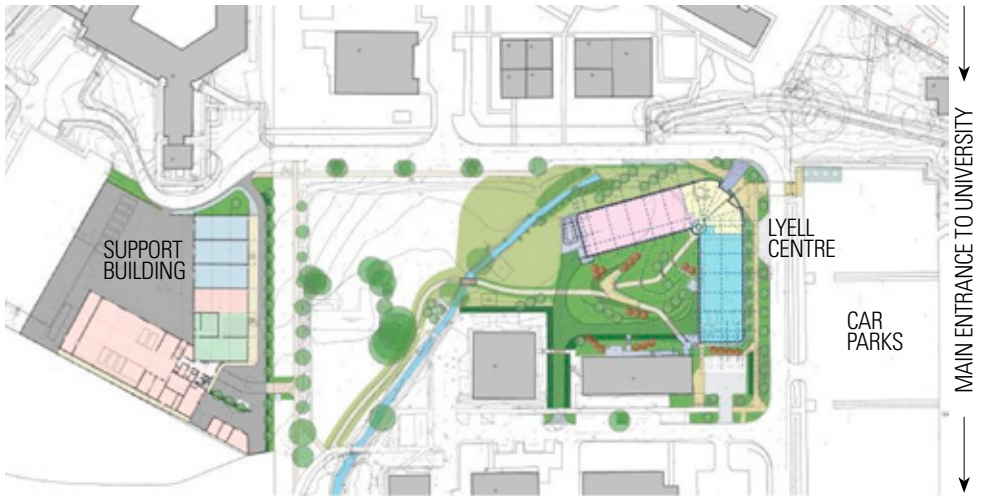
There are two main parts to the construction work: the main building and a support building. The main building will house the staff and most of the facilities for the Lyell Centre and consist of a three-story boomerang shaped building with two elongate wings linked by an area of joint collaboration space. The latter will retain BGS's retail facility, have collaborative meeting rooms and house a café on the top floor. The Support Building will be located on

an adjacent site in HWU's research park and house BGS's marine capability, facilities for HWU and the Scottish Core Teaching Archive.

The two projects were put out for competitive and separate tender, the outcome of which was that one contractor, Morrison Construction, was awarded both contracts. Work on the main building started on time as planned on 5th January 2015 and is expected to take around a year. A further three months contingency has been built in such that it is anticipated that BGS staff will move in during the first quarter of 2016 and the building will be officially unveiled and open for business in the second quarter of the year. An official Lyell ground-breaking event was convened on 21st January attended by NERC, BGS, SFC and the HWU partnership including all of the members of the Lyell Strategic Management Board.

Recruitment Campaign

Heriot-Watt University is actively advertising and seeking applications from research leaders in the fields of Applied Geoscience and Ecosystems Research with a view for appointments to be made throughout 2015 and to populate the new Lyell Centre main building from Q1 2016 when the BGS will move across from

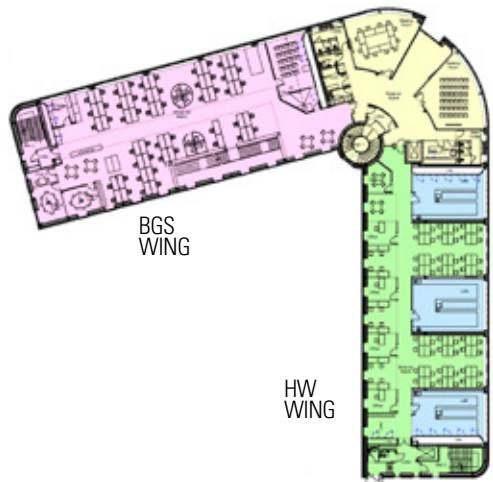


Site plan for the Lyell Centre and its Support Building adjacent to the main entrance road to Heriot-Watt University: pink/BGS, blue/Heriot-Watt.

Murchison House: <http://www.hw.ac.uk/about/careers/job-opportunities/lyell-centre-appointments-research-leaders.htm>

Contacts

Further details about any aspect of the Lyell Centre and the geoscience research opportunity that it represents can be sought by contacting Professor John Underhill and Professor Murray Roberts, who are the respective discipline leads for Earth Science/Applied Geoscience (email: J.R.Underhill@hw.ac.uk) and Marine Science/Ecosystem Science (email: J.M.Roberts@hw.ac.uk) respectively.



Internal design of the Lyell Centre—first floor design shown for illustrative purposes. Pink = BGS, green/blue = Heriot-Watt, yellow = communal space.



Architects design of the Lyell Centre.

Conclusions

These are really exciting times for Applied Geoscience and Ecosystem Science in Edinburgh. The Lyell Centre represents a major and substantive commitment to the subject on a scale not seen for decades. The major investment is recognition of the vital role that an understanding of geoscience plays in the modern world and the challenges that result therefrom. The creation of the Lyell Centre also highlights the benefit, added value and potential impact that collaboration between the BGS and a major research University can bring and add to

the mix, be it in energy supply or environmental impact. Opening in early 2016, the Lyell Centre will become a key and strategic research hub for Geoscience benefiting academia, industry and, through the provision of informed advice, government policy.

Professor John Underhill
Shell Chair of Exploration Geoscience
Lyell Centre Lead for Applied
Geoscience/Earth Science
School of Energy, Geoscience,
Infrastructure & Society (EGIS)
Heriot-Watt University

Benjamin Neeve Peach (1842–1925)

By John Mendum and Anne Burgess

Much has been written about Benjamin Peach, who worked for the Geological Survey in Scotland between 1862 and 1905. In concert with John Horne, Peach was instrumental in the mapping and deciphering of the Moine Thrust Belt in the NW Highlands and in the reinterpretation of the Southern Uplands. In his obituaries, written by John Horne and Edward Bailey, and the fulsome appreciation by Edward Greenly (1928), little mention is made of his personal life, yet he was married twice and the father of eight children, three of whom died young. This article provides a snapshot of the trials and tribulations of Peach's private and professional lives; for greater detail see the online version of this issue of *The Edinburgh Geologist*.

Ben Peach was born at Gorran Haven in Cornwall on 6th September, 1842, the youngest of 8 children to Charles William Peach (1800–1886) and Jemima Mary Mabson (1802/3–1882). Charles Peach was a Revenue Coast Guard and respected naturalist and geologist, notable for his discoveries of fossil fish and plants, mainly in Cornwall, and in 1854 of fossils in

the Durness Limestone Formation in northern Scotland. These finds attracted the attention of Sir Roderick Murchison who paid for the 17 year-old Ben Peach to attend the School of Mines in London (later Imperial College), after which on Murchison's



A young Ben Peach, image probably dating from 1862 when he first joined the Geological Survey aged 19. BGS image P575813.

recommendation he was appointed to the Geological Survey as an Assistant Geologist in January 1862.

Peach was one of the founding members of the Scottish Office of the Survey, formally created in 1867 with Archibald Geikie as Director, and in 1868 he was promoted to Geologist. His field maps from the late 1860s and early 1870s show that he was a good accurate mapper with the map face generally neatly annotated, and units clearly delineated and coloured. In contrast, on the obverse side are drawings (mainly pencil) or even paintings, whose subjects range from scenic views to animals and people, but also include diagrams, trial cross-sections, stratigraphical logs, and the odd calculation. Similar material fills Peach's field notebooks with the more attractive sketches, which emphasize the form of the subject, done in pencil, black ink, and watercolour. One landscape drawing (black ink) looking south in the Loch Eriboll area emphasizes the geological features and demonstrates Peach's intuitive ability to portray the geology in three dimensions. However, the order, way-up, and quality of the notebook contents are distinctly random. Geological notes and information, *sensu stricto*, are relatively rare, dates are not sequential, and several pages



Sheep, drawn in pencil with colour wash—detail from a larger sketch in one of Peach's field notebooks.

merely document the accounting of expenses.

Sadly, Peach's artistic abilities were not matched by his literary talents. Bailey's obituary states that '*He could scarcely bring himself to write or read.*'—far too harsh a judgement! However, his written contributions to memoirs were cursory. For the 'Southern Uplands' Memoir (Peach and Horne, 1899) Peach drew most of the abundant diagrams and maps, but made virtually no written contribution apart from the lengthy list of fossils in the Appendix. Even his literary contributions to the NW Highlands Memoir (Peach et al., 1907) were limited. Geikie, in

explaining the delays in producing the final manuscript, noted in the preface—*‘Some geologists find literary labour more irksome and arduous than field-work, and would rather survey many square miles of complicated ground than write a few pages descriptive of them.’* Presumably, it was Peach’s ideas, influence, and ‘management’ of such mapping, together with his seniority, that justified his first authorship of these two memoirs.

Although a small headquarters office had been set up in Edinburgh in 1867, the geologists spent most of their time in the field and treated their field address as their main residence. This peripatetic existence was unsettling and certainly created some problems for those with families. When in Edinburgh Peach was able to stay with his parents, but this situation changed when he married Jeanie Bannatyne (born 1846) from Springhill Farm, Douglas in 1871. Note that Peach had mapped the geology of the Douglas area in 1868. Subsequently, Jeanie gave birth to Charles William (1872–1949), Jeanie (1874–1975), Jemima Mary (1876–1887) and Christina Mowbray (1879–1883), all at Hassendean Cottage, Bakers Road, Gattonside, by Melrose. This period coincided with the time Peach was mapping in the Borders area and was

presumably resident at Gattonside. By the late 1870s Peach was the only field geologist still working in the south of Scotland. This rural existence changed around 1879–80 when he and his family moved to 8 Annandale Street in Edinburgh, close to his now-aged parents and sister Jemima at 30 Haddington Place.

Coincident with the Survey mapping of the Midland Valley and Southern Uplands in the 1860s and 1870s was the collection of fossils, both as stratigraphical markers and for populating a reference collection in Edinburgh. Thousands of specimens were acquired and their identification became an onerous task. Peach became much involved in this and in 1879 was appointed Acting Palaeontologist. Soon after he started mapping in the Highland Border around Callander and Aberfoyle, but continued to spend considerable time on palaeontological identification.

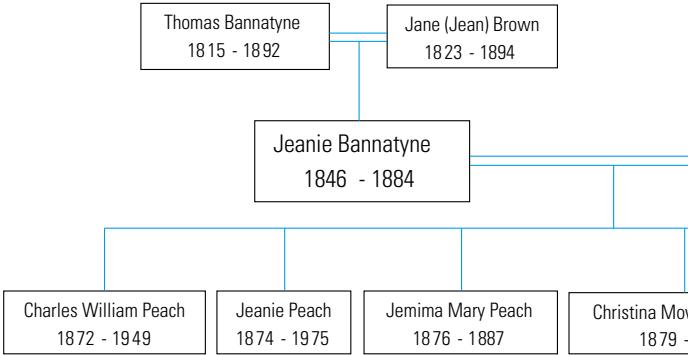
Following the departure of Archibald Geikie for London and James Geikie for the University of Edinburgh, Peach was effectively Acting Director for the Scottish Survey for over 2 years (1882–1884) in the absence of H H Howell. He was promoted to District Surveyor in 1883, the post carrying considerably greater responsibility, but attracting higher pay. Meanwhile, at home in

Annandale Street, Thomas Bannatyne (1880–1881) and Elizabeth Sarah (1882–1967) were born, but Thomas died when not 4 months old (at Springhill Farm, Douglas). In the following years Peach’s mother *Jemima* died (15th February, 1882), followed by his daughter *Christina* in 1883, and then sadly by his wife, *Jeanie* on 4th February, 1884. *Jeanie*’s cause of death is stated as haemoptysis, a common symptom of tuberculosis. Peach’s father was also now ailing and his sister *Jemima* was recorded in 1882 to be ‘in delicate health’. Amidst these domestic troubles Peach was charged with leading the work on the NW Highlands when the Survey commenced mapping in Sutherland in 1883. This followed Lapworth’s recognition of a major ductile and brittle shear zone at Loch Eriboll, now recognised as part of the Moine Thrust Belt, across which Lewisian, Torridonian, Moine and Cambro–Ordovician rocks had been translated westwards for several tens of kilometres. The work was arduous and the conditions

challenging, so much so that several of the geologists suffered from health problems. The Survey’s Annual Summaries of Progress in the 1880’s record the problems caused by the bad weather, the high ground, and the complex geology.

In February 1886 Peach’s father died at 30 Haddington Place leaving the house and estate (£571) entirely to his daughter (and Ben’s sister) *Jemima*. The following January his daughter *Jemima* died, aged 10, at 6 Annandale Street. However, later that year on 2nd November, 1887 Peach married Margaret Anne McEwen (1868–1921) at Kirkton in Assynt, where her father was the schoolmaster. Margaret (‘Maggie’) subsequently gave birth to Angus McEwen (1888–1909) and Benjamin Neeve (1891–1950), both at 13 Dalrymple Crescent, on the leafier south side of Edinburgh.

Peach family tree showing parents and children (for more generations see web version).

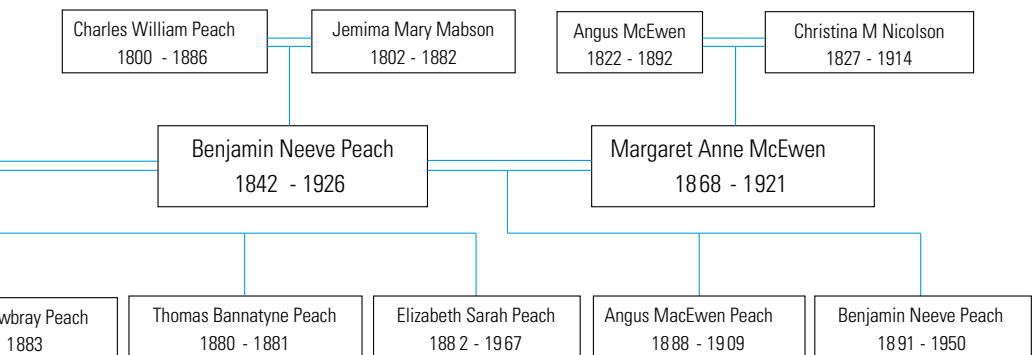


In the later 1880s and the 1890s Peach continued to map significant parts of the Moine Thrust Belt and the northern Highlands. The field mapping was in addition to his ongoing responsibilities as District Surveyor and Acting Palaeontologist. It had also become apparent that a full revision of the Southern Uplands was necessary, taking cognisance of Lapworth's graptolite zoning and revised stratigraphy. This field work started in 1888 and occupied Peach and Horne for some 8 years in the autumn, winter and early spring, leaving the late spring and summer months free for Highland work. Peach was only effectively confined to the office in 1897 to ensure completion of the diagrams and maps for the resulting memoir (Peach and Horne, 1899).

Early in 1891 Peach and his family moved to 86 Findhorn Place. As he still spent a great deal of time

in the field in the 1890s, his young wife was left to run the household in Edinburgh, albeit with domestic assistance. She was required to look after her two growing sons, and the extended family that included her stepson Charles William, and stepdaughters, Jeanie and Elizabeth Sarah ('Lizzie'). Peach's ailing sister Jemima, also needed care; she died in 1899, whilst resident at Findhorn Place. Peach's eldest son, Charles William graduated from Edinburgh University in Medicine in 1895.

In 1901 the Survey was reorganised under J J H Teall following Archibald Geikie's retirement in March of that year. In Scotland, Horne was promoted to Assistant Director, whilst Peach continued as District Geologist until his retirement in 1905. Peach had been a loyal supporter and true friend to Archibald Geikie throughout his tenure and wrote a heartfelt letter



expressing his gratitude immediately prior to his retirement. In practical terms Peach had benefited from being a Geologist for 15 years and District Surveyor for 18 years, whereas for many of his colleagues there had been no sensible career structure. Some had remained as Assistant Geologists for as long as 21 years with only limited pension provision.

Following retirement in 1905 Peach was a regular visitor to the Scottish office in 33 George Square, where he continued to check maps, supply data and text for memoirs, and undertake limited palaeontological work for many years. The publication of the NW Highlands Memoir (1907) and the construction of 3D plaster-cast models illustrating the geology of the Assynt area (from 1904 onwards) had generated considerable interest both nationally and internationally. Hence, the British Association field meeting to Assynt in September 1912, led by Peach and Horne, was attended by a cross-section of the geological establishment of both Great Britain and Europe. Peach had assisted with classes at the University of Edinburgh during the latter part of his Survey career and continued in retirement. He was awarded an honorary LL.D. in 1903. He served on the council of the Royal Society of Edinburgh between 1905–8 and 1911–12, and acted as Vice President between 1912

and 1917. The Geological Society of London had jointly awarded Peach and Horne the Murchison Medal in 1899, and they were awarded the Wollaston Medal in 1921.

Peach in a letter to W B Wright dated May 30th, 1913 alluded to his wife, but when Maggie died of breast cancer on 20th October, 1921, she was resident in Kingussie and her death was registered by her son, Ben. Thus, in the 1920s Peach found himself alone in Edinburgh with his family scattered across parts of the UK and in New Zealand. Together with Horne his main project was writing the text and preparing diagrams for a volume describing the Geology of Scotland. This work remained unfinished at their deaths, but the existing material on Highland areas was collated by M Macgregor and published posthumously in 1930, entitled 'Chapters on the Geology of Scotland'.

Peach died on 29th January 1926, with the cause of death listed as cerebral thrombosis and gout. He had been ill for some time and was resident with his niece Elizabeth Hay and her husband William Marshall, at 33 Comiston Drive. He left £5115 12s 3d in his will. The funeral service at the graveside in Morningside cemetery on February 1st was attended by his son Ben and his two daughters, several grandsons,

members of the Bannatyne family, and by numerous representatives from the survey and local geological community. The cemetery, which dates from 1878, was privately owned for many years. However, in 1992 it was purchased by Edinburgh Council as its administration, records and upkeep had become problematical, with housing built on some parts. At its western extremity, where Peach's grave is situated, a small part of the cemetery remains private, now fenced, gated, and rather overgrown. The concise description on Peach's rough granite gravestone has lost much of its lead lettering. His wives and children are buried elsewhere.



Peach's gravestone in Morningside Cemetery.

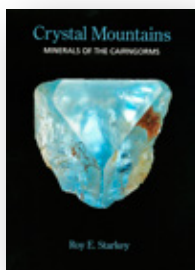
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Book reviews

Crystal Mountains—Minerals of the Cairngorms by Roy E Starkey. British Mineralogy Publications. 2014. 184 pp 236 illustrations. Hardback, price £35, ISBN 978 0 9930182 0 6. Paperback, price £25, ISBN 978 0 9930182 1 3.



To anyone interested in minerals the word 'Cairngorm' immediately evokes images of the smoky brown quartz commonly associated with Victorian Highland jewellery. Indeed, so apparently well-known is this material that the name 'Cairngorm' has long been applied almost universally to smoky quartz irrespective of its true source or even nationality. Yet something approaching an aura of mystery surrounds these 'Cairngorm stones'. Whereas the geology of the Cairngorm Mountains has attracted research since the earliest days of Highland geology, no comprehensive study or description of the smoky quartz, or of the other rarer gemstones

found here, has ever been attempted. Roy Starkey's book does just that.

After a rather comprehensive historical review of the collecting and working of the area's gemstones, a brief introduction to the geology sets the scene for one of the book's main attractions, a detailed and superbly illustrated exploration of the variety of minerals found there. Whereas particular attention is directed towards the three main 'gem' minerals, smoky, or 'cairngorm' quartz, topaz and beryl, the area's varied suite of other minerals is well covered. A fascinating chapter on 'The Diggers' who sought and exploited the workable stones is followed by a particularly well-researched account of the mineralogical interests of the Royal family, most notably Queen Victoria, through their Deeside connections. Succeeding chapters examine the activities of collectors, past and present, as well as the role of mineral dealers, museum and university collections in furthering understanding of the area's mineralogy. The work of jewellers and lapidaries, together with examples of many of the artefacts produced, add to the author's comprehensive treatment of his subject. A final chapter, intriguingly entitled 'Quartz

and World War II' touches upon the interest taken in quartz from the Cairngorms during contemporary research into the synthesis of quartz crystals for use as oscillators in telecommunications equipment. In conclusion, a short glossary assists the non-specialist reader in understanding the, mercifully few, technical terms that are inevitably necessary in a book of this sort, and is followed by a comprehensive and meticulously compiled reference list and index, both of which hugely enhance the book's reference value.

From the first pages it is apparent that this book is the product of high-calibre personal research borne of a passionate enthusiasm both for the minerals, and for the mountains that are their home. In addition to the obvious depth and rigour of the research, one of the book's most outstanding features is the quality both of the photography and reproduction of the very numerous colour images: even those long familiar with British minerals will surely marvel at the striking beauty of the smoky quartz, beryl and topaz specimens presented here. Throughout, the level of technical detail is entirely appropriate for the wide span of interests targeted by the book.

If I am allowed one critical remark it would be the author's enthusiasm

for verbatim quotation of previous writers. Whereas such quotations can be highly effective when particular points are best expressed in the words of the original author, the over-liberal use of quotations for otherwise unremarkable comments can become a little irritating. Almost 75% of the text of 'The Diggers' chapter comprises direct quotations, many of which do not merit such treatment and rather spoil the impact of those truly valuable direct quotations.

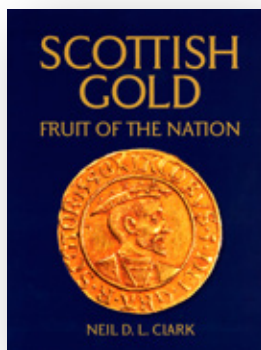
Such criticisms are, however, minor. The author deserves congratulations for this magnificent book which is a significant addition to British mineralogical literature. But it is much more than that. With its consummate coverage of such a breadth of scientific, social and historical topics it will appeal to, and deserves a place upon the bookshelves of, all who have any interest in British minerals, natural history, local to social and Royal history, gemmology and jewellery, and indeed any aspect of the Cairngorm Mountains or Scottish Highlands.

Brian Young

Copies of the book can be ordered at www.britishmineralogy.com, or email roy@britishmineralogy.com

Scottish Gold—Fruit of the Nation

by Neil D L Clark (with contributions from Alison Sheridan and Donald Bateson). Neil Wilson Publishing in conjunction with the Hunterian Museum, Glasgow. 2014. Paperback, 112 pp. Price £14.99. ISBN: 978-1-906000-26-4.



As a geologist, I opened this book in the assumption that it would detail the occurrence, geology, mining and characteristics of gold found in Scotland. In fact, although these issues are described in some detail, this book is far more than that. Perhaps a better title would be 'Gold in Scotland' as the book is a definitive reference work, covering almost every aspect of gold that one could think of as it relates to Scotland in particular.

The book opens with a chapter on the nature of gold, describing ancient alchemy and the search for

the 'Philosopher's Stone', derivations of the name, the gold standard and other uses of the metal. It quickly moves on to describe the geology of gold in terms of geological deposit type and relates these to deposits of gold in Scotland, including the Cononish mine near Tyndrum and deposits in the Southern Uplands. Chemical and mechanical-type deposits are also described.

There follows a fascinating account of the history of gold mining in Scotland mainly related to lead mining in the Crawford Moor district from around 1239 onwards. It describes the efforts of George Bowes and Bevis Bulmer in the time of James VI (around 1600) in which gold was mined from various alluvial occurrences around Leadhills and Wanlockhead. Mining commercially for gold ceased around 1621 but lead miners continued to pan for gold as a pastime in order to eke out their wages, and hobbyists continue this tradition today.

There are excellent accounts of the Scottish 'Gold Rushes' of 1852 to Kinnesswood in Fife and then in 1868–69 to Kildonan in Sutherland. The latter rush attracted up to 350 diggers per day. In the first week, some £150 000 in today's money passed through the Helmsdale Bank. A combination of bad winter weather, fees for licences and

royalties to the crown, plus a falling gold price, resulted in the diggings being closed in December 1869. It is estimated that some 400kg of gold (worth £13Million today) was recovered in the year.

Alison Sheridan then describes Gold in Ancient Scotland. Gold was used from around 4500BC in Europe but the earliest gold objects in Scotland date from 2300–2150BC in the form of gold ‘lunulae’. The Early Bronze Age produced Dagger Hilt-Bands in the form of corrugated gold and sheet gold discs by around 2020–1750BC. The Middle, Late Bronze and Iron Ages produced golden ‘torcs’ of various types, exhibiting fabulous workmanship. The Romans clearly knew about gold occurrences in Scotland, but didn’t mine any gold themselves and few artifacts remain. Gold reappears in Scottish Jewellery mainly in the form of gilding. One of the best known pieces, from around 8th century AD, is the Hunterston Brooch. We then pass on through the time of the Vikings. It is surprising that only 200 gold objects survive from the whole of Scottish prehistory and early history.

Donal Bateson takes up the story from about the 13th century onwards. He describes the gold coins of Scotland from the time of David II (1346) and gold used in the

form of gilding in Robert the Bruce’s tomb and in symbols of authority such as the Glasgow University Mace. The Honours of Scotland were made in the 15th century and are the oldest crown jewels in Britain. Following the Reformation, coinage dominates the use of gold and there are fine examples from the time of James VI. Coins and medals continued to be produced in Scotland and in the ‘Enlightenment’, a century after the Act of Union in 1707. Gold was used extensively thereafter to produce cups, prizes, medals and silver-gilt; this practice continues until the present day.

The book ends with a few brief hints on where to find gold in Scotland today.

This is a lavishly illustrated fascinating book, which is a ‘must’ for anyone interested in the subject of gold and its use in Scotland. It is excellently researched. I would recommend it thoroughly.

John McInnes



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