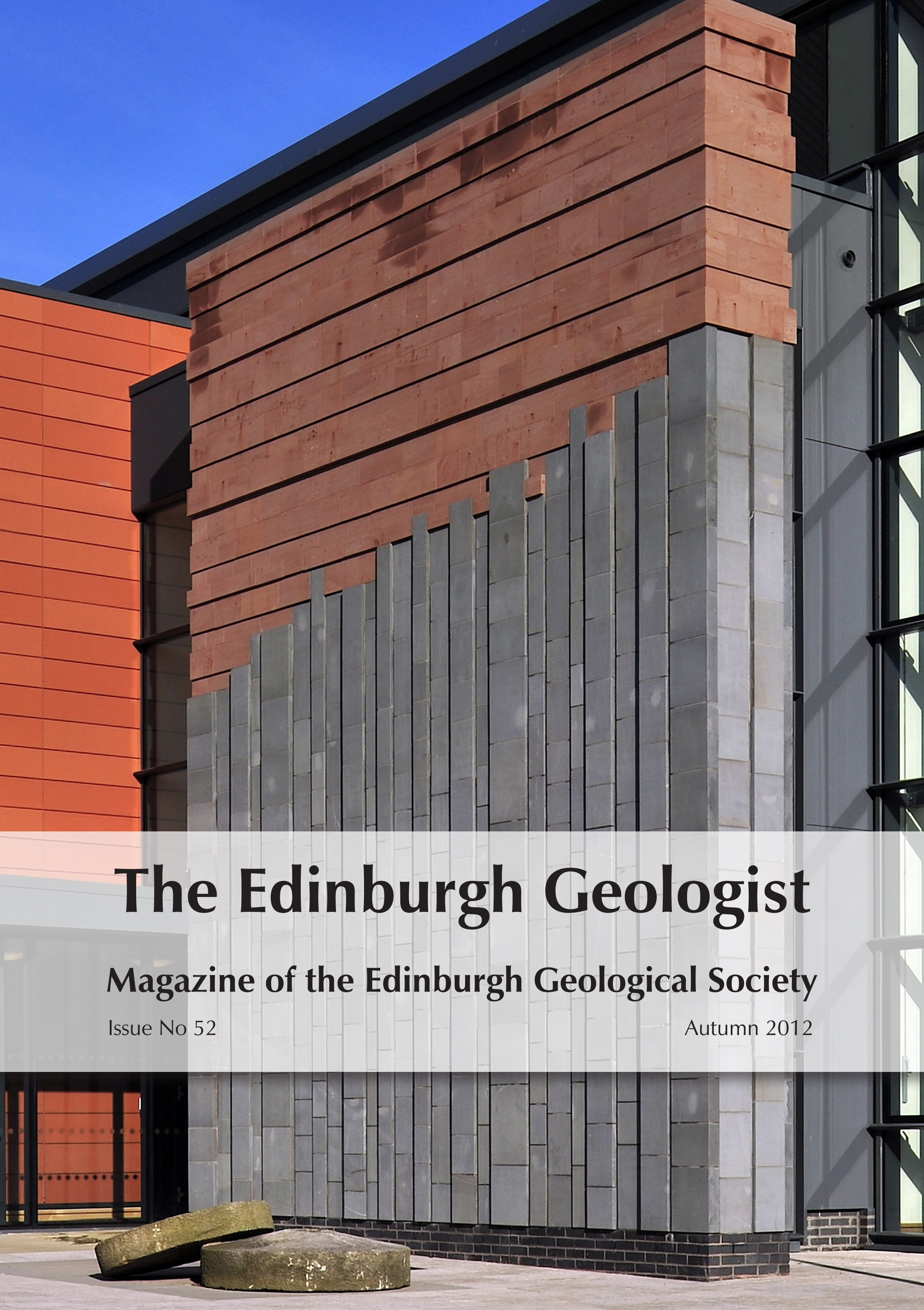

The Edinburgh Geologist

Magazine of the Edinburgh Geological Society

Issue No 52 Autumn 2012

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Cover Illustration

The recently completed James Hutton Building at the British Geological Survey's Keyworth (Nottingham) HQ features this striking architectural representation of his famous unconformity at Siccar Point, Berwickshire. In the real thing, gently dipping beds of Upper Devonian 'Old Red Sandstone' from the Stratheden Group overlie steeply dipping beds of Lower Silurian 'greywacke' from the Ettrick Group. In the reconstruction, Middle Devonian red sandstone from Balaldie Quarry, Fearn, Easter Ross (Raddery Sandstone Formation, Black Isle Sandstone Group) 'overlies' Lower Silurian 'greywacke' from Morrinton Quarry, Dumfriessshire (Gala Group). BGS image number P785457.

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Hutton reconstructed and illustrated, fossils lost and found, dying for science, and a musical survivor

An editorial ramble by Phil Stone

With a reconstruction of Hutton's Unconformity at Siccar Point on the front cover, it seems only fair to include a picture of the real thing in this issue of *The Edinburgh Geologist*. Now much-celebrated, the site proved seminal in Hutton's appreciation of geological 'deep time' and his boat trip there in 1788 with John Playfair and Sir James Hall has become the stuff of geological legend.

Hutton actually has three eponymous unconfomities (the other ones are on Arran and near Jedburgh) and those at Siccar Point and Jedburgh have been proposed as 'Global Geosites' on the basis of their historical importance, whilst a full-sized casting of part of the Siccar Point unconformity is housed in the American Museum of Natural History, New York. In Scotland, 'Hutton's Unconformity' at Siccar Point has attained iconic status: see for example one of the cover designs in our 'Book Reviews' section, or the multi-coloured version in corporate livery forming the logo of the recently established James Hutton Institute. Despite such celebrity, it is still worth recalling Playfair's thoughts from that first visit:

"We felt ourselves necessarily carried back to the time when the schistus on which we stood was yet at the bottom of the sea, and when the sandstone before us was only beginning to be deposited … An epocha still more remote presented itself, when even

Hutton's Unconformity at Siccar Point. This photograph by Dave Millward, BGS image number P774192.

the most ancient of these rocks instead of standing upright in vertical beds, lay in horizontal planes at the bottom of the sea … The mind seemed to grow giddy by looking so far into the abyss of time."

Hutton's influence is acknowledged elsewhere in this issue of *The Edinburgh Geologist*, in the article by Alexis Drahos and Christine Thompson on Pre-Raphaelite art. We also have articles by Peter Dryburgh, recalling our Society's centenary celebrations in 1934, and by Emily Tracey who takes a close look at the sequential use of different building stone in Callander.

Come up and see my etchings

James Hutton will only play a supporting role in an exhibition opening later this year, at Edinburgh's City Arts Centre, which will commemorate the death in 1812 of John Clerk of Eldin, Hutton's friend, travelling companion and illustrator. Clerk was a recognised artist in his own right and his etchings range across historical buildings, Scottish landscapes and of course geological themes. Unfortunately he did not illustrate the Siccar Point unconformity, but his representation of the Jedburgh unconformity is well known (see, for example, the front cover of *Scottish Journal of Geology*, volume 33 for 1997) and he also recorded an unconformity in the Isle of Man where Carboniferous limestone overlay the 'schistus', which in that instance was Ordovician strata of the Manx Group. There's even an unexpected link between Clerk of Eldin and Peter Dryburgh's article. The Edinburgh exhibition (3 Nov 2012 to 3 Feb 2013) should be well worth a visit and whilst there you can go next door for a look at *The Scotsman Steps*. You might be familiar with the book featuring Clerk's work, "James Hutton's Theory of the Earth: the Lost Drawings", edited by Professor Gordon Craig and published in 1978 by Scottish Academic Press. In conjunction with the exhibition, "The Etchings of John Clerk of Eldin" by Geoffrey Bertram will be published by Enterprise Editions. It promises 180 pages with over 100 plates and illustrations. More information at www.clerkofeldin.com.

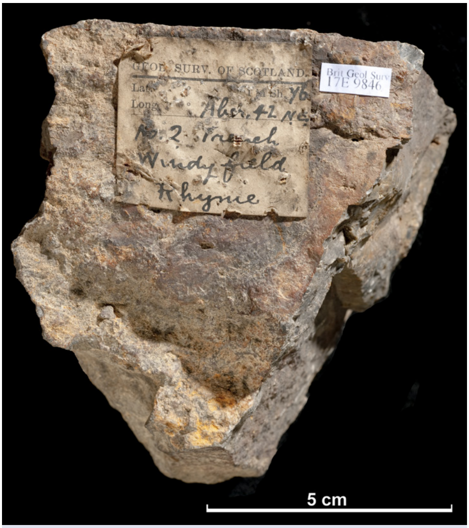
Lost and found

In the last issue of *The Edinburgh Geologist* I was bewailing the loss to science of various geological specimens and collections, so this time, to redress the balance, let's celebrate the reappearance of a few things. The discovery that got most Media attention was made in the British Geological Survey's headquarters in Keyworth, Nottingham. There, a long-overlooked and much-moved cabinet proved to contain hundreds of palaeobotanical thin-sections assembled by Joseph Hooker, contemporary and great friend of Charles Darwin, who had been briefly employed by the Survey in 1846. Some of the thin-sections had been made from specimens collected by Darwin during his voyage around the World on HMS *Beagle*, but some were even older and originated in—Edinburgh. In 1826 the fossilised remains of huge Carboniferous trees were discovered in Craigleith Quarry, and to study them the pioneer of thin-section microscopy, William Nicol, experimented with new techniques. From here the story seems to have descended into professional rivalry and skulduggery—for a full and entertaining account see Howard Falcon-Lang's article in *Geology Today*, 2012, Vol. 28(1), 26–30.

One of Joseph Hooker's thin sections of the Craigleith tree. BGS image number P775750.

Closer to home, in the British Geological Survey's Edinburgh base, Murchison House, a hessian sack full of rocks was finally opened after lurking in corners for 99 years, though only for the last 35 in MH. It proved to contain 85 specimens of the famous Rhynie Chert that had been excavated from a trench dug in October 1913 under the supervision of David Tait (later to be the Society's first Clough medallist in 1935–36). In another example of *recherché* palaeobotany this Devonian plant-bearing chert had been discovered late in 1912 by W Mackie and its importance was soon appreciated. All of the original material recovered was loose surface debris, and in the absence of any exposure a committee was formed under the auspices of the British Association for the Advancement of Science, chaired by John Horne, "to excavate Critical Sections". The committee dispatched David Tait, whose excavations found fossiliferous chert in three of the eleven trenches dug. These were described in the committee's report (*Reports on the State of Science* 1916; cf. Mackie, 1913, *Transactions of the Edinburgh Geological Society*, Vol. 10, 205–236), but it would appear that a sackful of rock from Trench 2 was overlooked. The Rhynie locality is now recognised as being of international scientific importance, and the complete absence of natural exposure makes the 'recovered', but well-documented material most welcome.

Of course, the rediscovery of collections such as Hooker's thin-sections and Tait's sackful of Rhynie Chert is always portrayed as a great coup. Would it be churlish to point out the years of underfunded curation that allowed the specimens to be 'lost' in the first place?



One of David Tait's labelled specimens from Trench 2 at Rhynie. BGS image number P772163.

And it's not just the reappearance of old material that should be celebrated, with one recent and spectacular find in the Scottish Borders well worthy of mention. The discovery by EGS member Stan Wood of a remarkable Early Carboniferous fossil assemblage attracted quite a lot of Media interest for the light it promised to shed on an elusive phase in the evolution of early reptiles from amphibians; a palaeontological hiatus at about 360 to 345 Ma hitherto known as 'Romer's Gap' after the American vertebrate palaeontologist Alfred Sherwood Romer. The initial fossil haul, from the River Whitadder near Foulden, included well over a hundred tetrapod bones and teeth, abundant fish remains, various invertebrates including shrimps, scorpions and eurypterids, and a range of plants. A major research effort is now planned involving National Museums Scotland, Cambridge University and the British Geological Survey. As the research progresses we hope to bring you more on this in future issues of *EG*.

To die for

We may be just a little early to celebrate the centenary of the discovery of the Rhynie Chert plant fossils, but we are just a little late in commemorating another centenary with a palaeobotanical association, but this is rather a sad one. On about 22 March 1912, Scott, Wilson and Bowers died on their return journey from the South Pole to their expedition's base on the Ross Sea coast of Antarctica; they were predeceased on their ill-fated trek by Evans and Oates. Scott and his companions, leading the 1910–1912 British Antarctic Expedition (more popularly known as the *Terra Nova* Expedition after the expedition's ship), had reached the Pole on January 18th, about a month after Amundsen's Norwegian expedition had achieved it. Some months later a search party found a collection of geological specimens with the bodies of Scott, Wilson and Bowers, 15.88 kg of rock deemed to precious to be abandoned. Amongst those specimens were pieces of Permian mudstone containing leaf impressions that proved to be from a tree of *Glossopteris* type. At the time this was scientific dynamite. Not only did it establish that Antarctica had once enjoyed a temperate climate, but it also firmly linked the Permian succession there into the floral province already established in the other southern continents. The recognition of the Gondawana supercontinent and its fragmentation by continental drift would inevitably follow.

It has become fashionable in dilettante circles to sneer at Scott and his companions, dragging their rocks to the bitter end, but that is to completely misunderstand their motivation. The *Terra Nova* expedition had been conceived as an essentially scientific endeavour of which the attempt on the Pole was just a part, and it was the scientific results that would ultimately count for most. The *Glossopteris* specimens were collected from Mount Buckley when Scott's party, already debilitated and low on supplies, took a deliberate detour from their route back from the Pole to make geological observations. In contrast, Amundsen regarded any scientific observation, no matter how trivial, as a waste of time and effort that distracted from his only objective of getting to the South Pole first. But even Amundsen felt it was necessary to come back with something, so grabbed about twenty rock fragments (vein quartz, schist and granite) from the last scree slope passed before arriving safely back at his expedition's base. It is reported that his companions objected even to this token effort, claiming that there were already plenty of stones in Norway. Those twenty specimens represented the entire contribution of Amundsen's expedition to terrestrial Antarctic science. The vast database and extensive collections amassed by the *Terra Nova* expedition, in biology, geology, glaciology, meteorology and accurate topographical survey, effectively founded modern polar science. Three geologists were members of the *Terra Nova* expedition — Frank Debenham, Raymond Priestly and Griffith Taylor — and all carried out exploration and research independent of the Pole attempt and under equally gruelling circumstances; their contributions have been rather overshadowed and deserve much greater recognition. But at least the hard-won specimens were not subsequently 'lost'. Most of the *Terra Nova* rocks and fossils are safe and sound in The Natural History Museum, London, though at least some of Priestley's specimens ended up in Glasgow, in the Hunterian Museum.

The amphioxus song

Finally: in the last *EG*, something more was promised as follow-up to *Survivors*, Richard Fortey's BBC television programme on evolution and extinction. Plenty of botanical survivors featured in the series but I think the most appropriate theme for *EG* arose when I was talking with Tony Irving about one episode in which Fortey dug up a lancelet. Tony and I recalled that when we were learning about theses things it was called amphioxus (as Fortey agrees in his 'book of the series'). Tony then dredged from the depths of the internet a celebratory song 'It's a Long Way From Amphioxus' to be sung to the well-known tune 'It's a Long Way To Tipperary'. The Internet source suggested that the words had been composed in the 1920s by an unknown author. But then I recalled that some of the same verses had been reproduced in Donald Prothero's excellent 2007 book *Evolution—What the Fossils Say and Why it Matters*. Therein, on page 206, Philip Pope is credited as the author, but no date is given. Anyway, at the risk of infringing someone's copyright, here are the first verse and the chorus:

A fishlike thing appeared among the annelids one day
It hadn't any parapods or setae to display
It hadn't any eyes or jaws or ventral nervous chord
But it had a lot of gillslits and it had a notochord

Chorus

It's a long way from amphioxus
It's a long way to us.
It's a long way from amphioxus
To the meanest human cuss.
So goodbye to fins and gillslits
Hello lungs and hair,
It's a long, long way from amphioxus
But we all came from there.

You can see the rest at: http://sniff.numachi.com/pages/tiAMPHIOXU;ttTIPRARY.html

Maybe we should schedule community singing at the next Fellows' Night.

Geology in the Pre-Raphaelite landscape: William Dyce's *Pegwell Bay*

By Alexis Drahos and Christine Thompson

In the Pre-Raphaelite landscape paintings of the nineteenth century, earth science is represented in a variety of ways[1]. Cliffs, mountain ranges and erosional features appeared with growing frequency in the works of artists of the time. Under pressure from photography, some painters tried to compete with it by creating portraits of rocks and mineralogical specimens. During the Victorian era, the figurative arts were imbued with geological science which was experiencing great developments in the same way that, for example, astronomy was. Painters and art critics began to socialize with scientists generally and, as interest in the deep past of our planet grew, with geologists in particular. The number of popular scientific publications increased. At all levels of society, people felt concerned about science. Even women, widely discouraged from taking up science, took an interest in fossil collecting and in observing stars with a telescope. Painters kept themselves abreast of the latest relevant discoveries in earth science. As a result landscape painting of the time demonstrated the tension and debate between science and religion over the origin of the Earth, its evolution, the significance of fossils, and so on. The publication of the epochal *On the Origin of Species*, by Charles Darwin in 1859, represented a turning point for these issues.

The aim of this article is to bring to the fore the influence of geology in Pre-Raphaelite landscape painting through one work: *Pegwell Bay 1858* (Fig.1) by William Dyce (1806–1864), a Scottish painter particularly interested in science. But first we should explain who the Pre-Raphaelites were and what artistic principles they followed.

The Pre-Raphaelite Brotherhood was founded in 1848 by John Everett Millais, along with William Holman Hunt and Dante Gabriel

[1] For a general discussion on Pre-Raphaelite landscape painting, see: Allen Staley : *The Pre-Raphaelite landscape*, Yale University Press, 2001. More specifically, to study the relationship between art and science in Pre-Raphaelite painting, see the exhibition catalogue: *Pre-Raphaelite Vision : truth to nature*, Tate Gallery, 2004

Figure 1 Pegwell Bay, Kent — a Recollection of October 5th 1858. William Dyce. Painted ?1858–1860. Photo ©Tate, London 2012.

Rossetti. They were young painters in revolt against the Academicism in which they had been trained in the 1840s. Rejecting post-Renaissance art in the Raphael tradition, they looked instead to medieval art for inspiration. They preferred to concentrate on the naturalistic detail of a subject within its precise setting, rather than idealising nature within an artificial design.

The Brotherhood's avant-garde movement was strongly championed by John Ruskin (1819–1900), the eminent critic and patron of the arts. He was no mean draughtsman and watercolourist himself, and a prolific writer, always at pains to emphasise the connections he saw between nature, art and society. Amongst his many interests was the study of geology. His liking for the science dated back to his boyhood when he began compiling a mineralogical dictionary and toyed with the idea of one day becoming President of the Geological Society of London. At Oxford he studied geology with William Buckland who was a Catastrophist: someone who believed that the face of the Earth had been repeatedly transformed by successive cataclysms, such as Noah's Flood. In 1840 Ruskin became a Fellow of the Geological Society of London and went on to deliver and publish numerous papers on geological subjects.

Later, Ruskin became an advocate of Uniformitarianism. This was a concept recently popularised by Charles Lyell (1797–1875), in his three-volume *Principles of Geology,* published 1830–33. As is well-known, it drew on the work of fellow Scot, James Hutton (1726–1797), the 'Father of Modern Geology', who first realised that the Earth was immensely old and shaped by the very same processes, such as erosion, that we can observe today. Hutton and Lyell rejected the older belief of Catastrophism. In their view, natural phenomena, such as wind, rain, earthquakes and volcanoes, operated in the present just as they had done in the past and would in the future. Consequently, under the influence of these scientists, Ruskin inherited a more dynamic vision of nature.

John Ruskin's five-volume *Modern Painters* (published 1843–1860) was hugely influential. In particular, the second volume (1846) played a formative role in the Pre-Raphaelite movement. In effect he acted as a counterbalance to Sir Joshua Reynolds, painter and theoretician of the second half of the eighteenth century, who had weakened landscape painting, preferring history painting instead. Henceforth, according to Ruskin, the artist should pay great attention to elements of nature and science. In Pre-Raphaelite landscape painting, therefore, the borders between art and science faded, especially when it came to geology. This fusion of art with geoscience is displayed in William Dyce's highly regarded and extremely detailed painting, *Pegwell Bay*.

William Dyce (1806–1864) was a distinguished Scottish artist, born in Aberdeen, and working in Rome, Aberdeen, Edinburgh and London. Perhaps influenced by his father, who was a physician and academic, Dyce studied medicine (and theology) before turning to painting. Further evidence of an interest in science is the fact that, while developing a career as a painter, he wrote a prize-winning essay on electro-magnetism. He was therefore predisposed to an appreciation of the Pre-Raphaelite Brotherhood's interest in, and respect for, science.

In *Pegwell Bay, Kent — a Recollection of October 5th 1858*, to give his painting its full title, William Dyce recalls a family holiday at this beach resort on the east coast of Kent. From left to right, one can see his son, his wife's sisters and his wife, collecting fossils or shells. The respective influences of Ruskin, geoscience and astronomy on the painting are demonstrated by the naturalistic detail; the cliffs, symbolic of the remote past of the earth; and the faint presence of the comet Donati in the sky, evoking the immensity of the Universe.

Take a look at the cliffs in the background. Clearly visible are flint-studded beds of the White Chalk Subgroup, which here date from the Coniadian and Santonian Stages of the Late Cretaceous Epoch, between 89 and 83.5Ma. Close study of the lithology reveals that the chalk formed in subtropical seas from thick deposits of carbonate ooze, rich in the remains of planktonic algae (coccoliths) and foraminifera, mixed with shelly debris.

Looking again at the painting, one can see that the chalk strata are gently inclined and have a system of fractures, perhaps the outcome of tectonic movement when the Tethys Ocean further south was closing. At the cliff-top there is an erosional surface overlain by Palaeogene sediments, topped in turn by a red 'brickearth'. The latter is a Pleistocene deposit of loess—very fine-grained, wind-blown sediment that probably originated as rock flour in glaciated areas further north. At the cliff-base we see caves and a wave-cut platform.

In this one picture we can trace the story of Pegwell Bay from deposition of the chalk, through its uplift, erosion and mantling with younger sediments, to the much more recent geomorphological features caused by wave-action—the sea-caves and wave-cut platform. They are bracketed in time by the comet overhead, representing the formation of the solar system about 4.55 billion years ago, and the nineteenth-century fossil-collectors in the foreground. Dyce seems to be gazing into what James Hutton's friend, John Playfair, called the 'abyss of time'.

In conclusion, the nineteenth century was a time when geology, especially through the writings of Charles Lyell, was becoming of interest to people from many walks of life. In the field of the history of art, the painting discussed in this article stands witness to the great impact of Lyell on John Ruskin and hence on Pre-Raphaelite landscape painting. At that time, science and art were very much interconnected, geosciences in particular being an inspiration for the Pre-Raphaelite art movement.

Pegwell Bay is, of course, a long way from Scotland and the artist's origins. In a future issue of *The Edinburgh Geologist* we hope to look at another Pre-Raphaelite painting with geological content, painted much closer to home.

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Reflections on a geological centenary

By Peter Dryburgh

Some years ago, when Professor Gordon Craig was going through the collections of the late Sir Frederick Stewart, he came across an interesting newspaper cutting reporting the centenary celebration of the Edinburgh Geological Society in 1934. He sent this cutting to me but, through an unfortunate combination of circumstances, it got filed away in the wrong place and was only rediscovered during a recent purge of my accumulated papers. The contents of the article and its historical context are of such interest that I thought it worthwhile to bring them to the attention of readers of *The Edinburgh Geologist*.

Before finding out about the 1934 celebrations, it may be of interest to readers to know something about what was happening a century before. In 1834 there were many important events, though not all connected with geology: Thomas Telford died, William Whewell first published the word 'scientist' and the French Foreign Legion was founded. In that year, Andrew Carnegie was one year old, Lord Kelvin was 19 and William IV had only three years to live before he was succeeded by Queen Victoria. At that time, the world of geology was in a state of upheaval. In his history of Edinburgh geology in the nineteenth century, Sir Thomas Holland stated:

"Geological science was then undergoing a process of rapid development, almost a revolution. The first of the three volumes of Lyell's Principles appeared in 1830 and the final volume in 1833. De La Beche issued the first geological maps and commenced the organisation of the Geological Survey of England and Wales in 1834. John MacCulloch's first map of Scotland was ready for publication in the same year."

In his detailed listing of that year's momentous geological events, Holland included the meeting of Murchison and Sedgwick to adjust the boundaries of their respective greywacke kingdoms and Murchison's proposal of the name *Silurian* for the Upper Series. Perhaps the most important event of the year was the meeting of the British Association in Edinburgh, which was attended by Buckland, Sedgwick, Murchison, Lyell, Horner and Agassiz, and during which Nicol read his paper on the preparation of thin-sections. After the meeting, Murchison wrote to Sir Philip Egerton:

"…the meeting was successful in every way… I may say without vanity that we geologists were all the fashion, and engrossed by far the greatest share of attention"

Although the BA Meeting provided the final impetus for the creation of the Edinburgh Geological Society, the time was certainly ripe or, as Holland puts it:

"…conditions were developing in Edinburgh before the Association came, and indeed the local atmosphere was already charged to a fairly high potential of frictional electricity by local conflict between the Neptunists and Plutonists."

Despite the massive impact of Hutton's work, which had been so magnificently publicised by Playfair, there had been a rather sterile period in Edinburgh geology during the early years of the century, largely due to the great influence of Jameson, the Regius Professor of Natural History, who, despite his great abilities, clung to his almost obsessive belief in Wernerian doctrine long after it had been discarded by most geologists as the result of extensive field observations and the experimental work of Sir James Hall, who had died in 1832. There seems little doubt that the British Association Meeting held in September 1834 resulted directly in the formation of the Edinburgh Geological Society by the students of Alexander Rose's extramural class. The minutes of the first meeting, held on December 8th record that:

"…after examining the evidence for Arthur's Seat being of volcanic origin, also the evidence for its being of aqueous origin, concluded that its resemblance to the lavas of existing volcanoes — the minerals contained in it being the same, the hardening and disturbance of the strata at the point of junction and neighbourhood show that it has been forced up in a state of great heat — and is of volcanic origin."

It should not come as a surprise to learn that Professor Robert Jameson never joined the new Edinburgh Geological Society.

The celebrations of the centenary of the Society in 1934 were given extensive coverage by *The Scotsman*. One whole column was devoted to a summary of the tributes paid by the world's geologists, while an additional piece covered the centenary dinner and associated speeches. A small group of members of the Society, including Professor E B Bailey, was photographed at a reception held by the University (see Figure 1).

EDINBURGH GEOLOGICAL SOCIETY CENTENARY.—Mr J. Adam Watson, Secretary; Dr R. Campbell; Sir John S. Flett, F.R.S., President; Professor E. B. Bailey, F.R.S.; Mr W. J. Gibson; Sir Harold Stiles, and Mr F. Crombie, Treasurer,

Figure 1 Members of the Edinburgh Geological Society at a reception at Edinburgh University on September 4th 1934.

Tributes to the Society were paid at a meeting held in the Grant Institute at The King's Buildings under the chairmanship of Sir John Flett, the President of the Society. Addresses were given by Sir Thomas Holland and professors from various countries: F D Adams (Canada), C F Kolderup (Norway), Baron de Geer (Sweden) and W N Benson (New Zealand). All the speakers emphasised the enormous influence that Edinburgh had had on world geology.

Adams related how he had stumbled across the 'lost' third volume of Hutton's *Theory of the Earth*. He had been reading in the library of the Geological Society of London and made a request for Hutton's work. The attendant brought him two printed volumes together with a rather shabby bundle and stated that he had found 'this old thing' on the shelf beside the other two and the Professor might just be interested in it. It turned out to be the missing manuscript of the third volume and was subsequently printed and published.

The praise given by the distinguished visitors was not confined to the academic geologists and the renowned work of Peach and Horne in the Western Highlands was credited with laying the foundations for the understanding of the great Caledonian mountain range. Robert Jameson, although associated so strongly with the outdated views of Werner, was given great praise by the Swedish speaker because of his many valuable suggestions concerning glaciation and land depression, icedammed lakes and other related features.

Tribute was paid also to the great work of Sir Archibald Geikie on the Scottish Survey and that of James Geikie as the leading 'glacialist' of the time.

The dinner was attended by about a hundred people and held in the Oak Hall at 70 Princes Street. This red sandstone building, designed by Hyppolyte Blanc in the nineteenth century, has survived the decades of post-war municipal destruction and stands next to British Home Stores; its ground floor is now a card shop (see Figure 2). It is worth noting that, when Princes Street was first built, number 70 was the home of John Clerk of Eldin, the artist.

Among the famous people attending the dinner was Professor D'Arcy Thompson, who proposed a toast to the City of Edinburgh, making many amusing references to the city's geology and its literary past. He drew attention to Charles Maclaren, one of the earliest editors of *The Scotsman* and one of the first members of the Edinburgh Geological Society.

The toast to the Society was proposed by Professor W W Watts of Cambridge, who made special reference to the admirable way in which the Society's contributors had dealt with the connection between chemistry and geology.

In reply, Sir John Flett gave his reminiscences of the Society from the time when he was a student—45 years before—and reflected on how often it had been on the verge of

Figure 2 ***70 Princes Street in April 2012.***

extinction but had prospered by its adversities. He made the interesting comment that he believed that its success was largely due to the success of its excursions—the results of their work were not all in the printed page, for some of the best work had been done in the field.

The *Scotsman* article, written in 1934, can be read today with considerable pride and satisfaction but it is impossible to ignore the item which appears in the matching column on the reverse side of the page. Most of the column is taken up by a report headed 'GREAT NAZI CONGRESS—Bells of Nuremberg Welcome Hitler' It is reported that 750 000 people came to the city for this rally, the first since Hitler had become Head of State.

"Herr Hitler's speech at the opening of the Congress to-night lasted only three minutes. He thanked the Nurembergers, on behalf of the party as well as himself. Their shining eyes were the most beautiful adornment of the town he said, and together with their recent high percentage of 'Yes' votes in the recent plebiscite, convinced him that he had been right to choose Nuremberg as the site of the Party Congress."

At the start of the article, the reporter comments that:

"The streets are full of men in black tunics and brown shirts, gripping with one hand the dirks of honour that dangle from their belts"

The terrifying significance of this event is apparent to us now but in 1934 it seems to have been just one more item of news: the lower section of the column containing the Nuremberg report is occupied by an announcement that all the Boy Scout Commissioners of Dundee had resigned in protest at the mishandling of their affairs by Scout headquarters in Edinburgh.

The Edinburgh Geological Society should be celebrating its bicentenary 22 years from now. If newspapers still exist by then, I can't help wondering what they will be reporting.

Further Reading

The Scotsman, September 5th 1934, page 12.

Sir Thomas H Holland (1935) *Trans. Edin. Geol. Soc. vol. XIII, Part 2 'Geology in Edinburgh at the beginning of the nineteenth century'*

'Princess Street', Life Association of Scotland (1938).

The evolving use of building stones in the Callander Conservation Area

By Emily A Tracey

The character of stone-built settlements in Scotland reflects a range of geographical, geological and historical factors. In any settlement, character evolves over time mainly due to changes in available materials, architectural fashion, and levels of craftsmanship. A recent building stone survey of the Callander Conservation Area in Loch Lommond and The Trossachs National Park, undertaken by Building Stones geoscientists at the British Geological Survey, uncovered how the evolution of building stone use defined the local character.

In Callander, as in many other settlements, the earliest buildings are constructed from locally sourced stone and therefore closely reflect aspects of the local geology. Over time, different building stone types are introduced as knowledge of stone quality improves and alternative building stones become more readily available (i.e. with the expansion of the railway). This evolution of building stones is often gradual and can be separated into unique masonry styles. 'Masonry style' refers to the combination of building stone type, block size/shape/tooling and coursing used in the main architectural elements (walling and dressings) of a building.

Block shape, which refers to the shape of individual stone blocks, ranges from 'rubble' (variable shape and size, not squared), through 'squared rubble' (variable shape and size, roughly squared) to 'ashlar' (regular shape and size, squared and rectilinear). Tooling, which refers to how the block was finished, ranges from non-tooled (i.e. 'rough natural') to highly skilled finishes (e.g. smooth, droved or stugged[1]). Coursing denotes how the building stone is laid to form a wall. This is dependent to a large degree on block shape; for example, rubble is typically left 'uncoursed', squared rubble is typically 'irregularly coursed', and ashlar is always 'coursed' (laid on a regular horizontal bed).

[1] **Stugged**: Random crude depressions obtained by removing larger irregularities by means of a punch to achieve a roughly flat surface. **Droved**: Fine parallel grooves either vertical, diagonal or horizontal produced by a chisel, giving an overall flat face.

Four masonry styles (i.e. particular combinations of stone type, block size/shape/tooling and coursing used in the main architectural elements of a building) define the Callander Conservation Area (CCA), each reflecting the available building materials, architectural tastes and masonry skills of the time. The main changes in masonry style can be linked to events affecting the availability of materials, in particular the opening of quarries in the local area (providing a reliable but restricted source of local building stone), the arrival of the railway (bringing a variety of stone and slate types from other parts of the UK), and the impact of the First World War (associated with a rapid decline in the number of operational building stone quarries in the UK, and a shift to 'modern', man-made building materials).

The town is centred on Main Street, the principal (oldest) part of which is around 0.75 kilometres long. Near its central point the street opens out on both sides into Ancaster Square, but is otherwise lined by buildings fronting directly onto it. A regular, grid-like street pattern is developed in the area immediately around Main Street, beyond which are areas of grand Victorian villas (notably

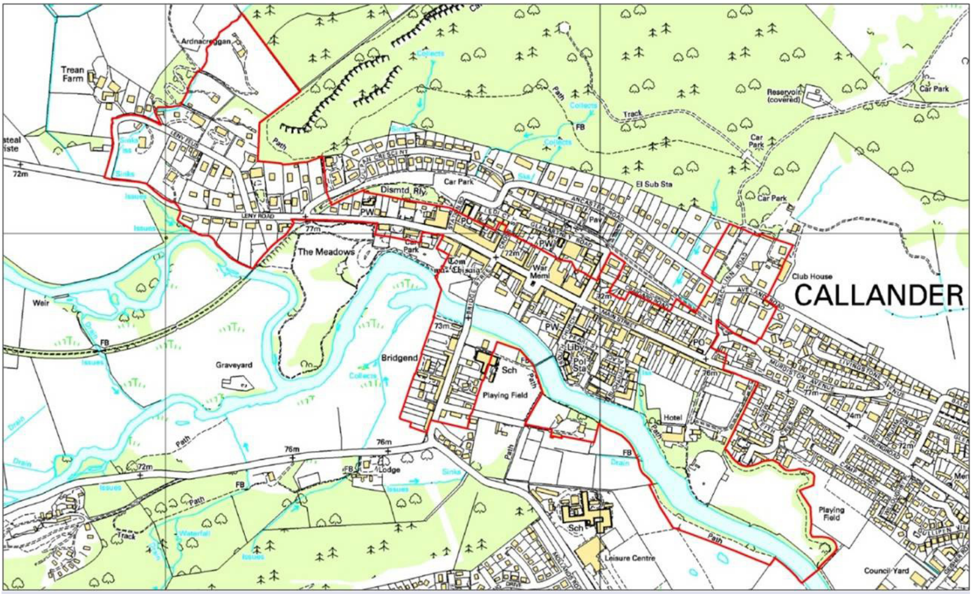

Figure 1 ***Map of the town of Callander and outline of the CCA. OS Map © Crown Copyright 2011. All rights reserved. BGS 1000372272.***

***Figure 2** Local building stones of Callander sourced mainly from three long-disused quarries located to the north of Callander (conglomerate) and in Lenny Feus (flagstone). Top left: typical early mixed rubble wall found in conservation area; top right: conglomerate building stone; bottom left: typical brown-grey flagstone, often face-bedded and mainly used as dressings; bottom right: typical purple-red flagstone, mainly used as building stone in the villas of Lenny Feus.*

Leny Feus) and modern housing. The Callander Conservation Area is broadly centred on Main Street and encompasses several hundred stone buildings (Figure 1).

Three of the most important stone types used in Callander buildings — conglomerate (*Callander puddingstone*), and two types of flagstone — were sourced locally, from three long-disused quarries in the wooded slopes north of the town centre (Figure 2). Each quarry exploited a separate division of the Old Red Sandstone Supergroup

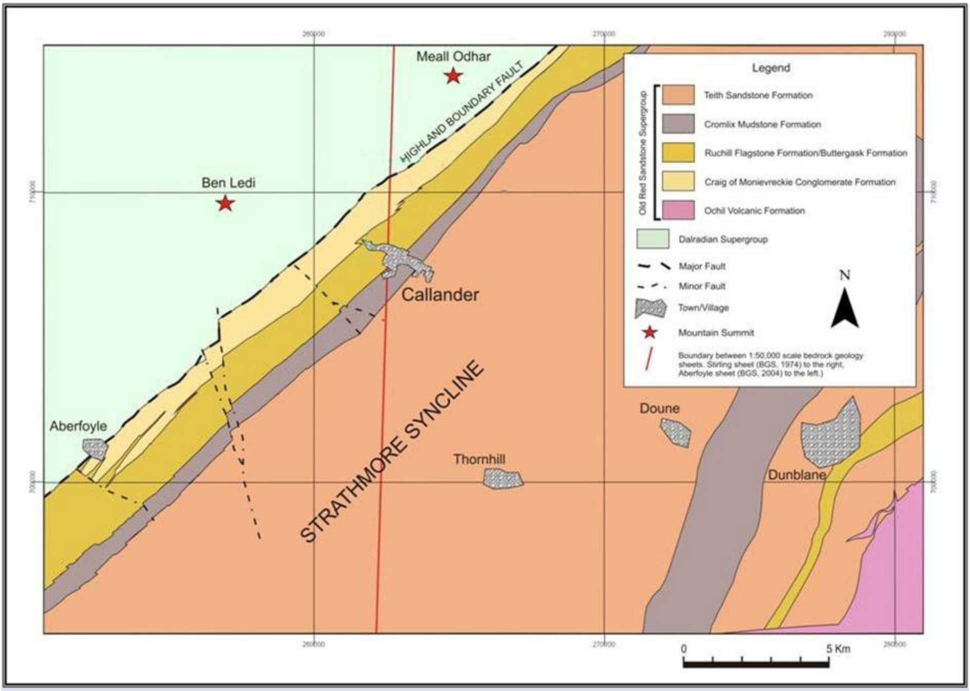

***Figure 3** Map of simplified bedrock geology in the Callander district. Callander straddles the outcrop of several major mapped 'Old Red Sandstone' divisions of conglomerate, sandstone and flagstone on the northwest limb of the Strathmore Syncline.*

exposed adjacent to the *Highland Boundary Fault* (Figure 3).

Historically, Callander occupied a strategically significant transit point for trade between the Highlands and Lowlands in Scotland. Town expansion was thus greatly influenced by the trade and manufacture of agricultural goods from as early as the 17th century. Early village development was focused around Bridgend, on the south side of River Teith (Figure 1). This area retains its historical feu patterns and remnants of 17th century building foundations.

By the end of the 18th century, the population of Callander exceeded 1000 for the first time. Development was focused in Ancaster Square and along Main Street. A daily coach to Stirling carrying passengers and delivering post began in 1835 and the first railway station in Callander was opened in 1858. The railway had a significant impact on the development of Callander, bringing people, trade, and new building materials to the town. Many important commercial, religious and civic buildings, including hotels, banks, churches and schools, were built during the latter half of the 19th century, as were the impressive residential villas of Leny Feus. Villa developments soon subsided along with a general use of stone in construction with the passing of Victorian times, the significant consequences of two World Wars, and the depression of the 1920s, not just in Callander, but across the United Kingdom.

Figure 4 Example of Masonry Style 1. 18th century mixed stone rubble constructions of Ancaster Square North (rear feu plots). The early constructions contain very large spans of stone for dressings, some of which still retain extraction tooling marks.

Masonry styles

Four masonry styles are recognised in Callander, each characterised mainly by a particular combination of stone types used in walling and dressings. Each is described below with a selection of typical examples.

Masonry Style 1

Buildings of the earliest masonry style (Masonry Style 1; Figure 4) are long, low structures with walling and dressings composed of mixed stone rubble sourced from fields and river beds. The rubble walling comprises cobbles and boulders of local conglomerate (*puddingstone*) and siltstone (*flagstone,* mostly of the red type), dolerite and other basic intrusive igneous rocks (*whin*), metavolcanic rocks (*greenstone*) metasandstone, schist and gneiss.

The buildings are located in the oldest parts of the town, notably in Bridgend and Ancaster Square. They are generally very simple constructions of mixed rubble walling and dressings formed of variably shaped blocks, with relatively small fenestration and little architectural detailing. Dressings are often large spans of stone, some of which retain the original extraction tooling marks. Large boulder footings were characteristically used along the base course of the buildings. This feature, which is common in early buildings, was designed to provide protection against rising damp and to provide a strong foundation. Large blocks of stone were often used in combination with small flaggy pieces of stone. For this reason, uncoursed or irregularly coursed rubble with rough natural finishes is characteristic of this masonry style.

Masonry Style 2

This masonry style is characterised by the first use of local grey-brown flagstone dressings in combination with mixed rubble walling, and by the appearance and eventual dominance of walling consisting entirely of conglomerate. It is a feature of late 18th to mid- 19th century buildings (Figure 5). These changes may partly reflect a reduction of the mixed stone resource, and partly the need for reliable, sustainable local stone resources as town development became more organised. Local quarries would have opened to provide the building stone needed for new construction.

The markedly heterogeneous texture of the conglomerate makes it very difficult to work, and in the earliest examples conglomerate walling consists of uncoursed random rubble with a rough natural finish. The local grey-brown flagstone dressings were commonly stugged or droved. This masonry style occurs throughout the Callander Conservation Area, most commonly in Ancaster Square and along Main Street. The buildings were constructed as part of a major development undertaken by the Commissioners for Forfeited Estates, who administered the lands forfeited by landlords who had supported the 1745 Jacobite rebellion.

Figure 5 Example of Masonry Style 2. Late 18th century construction on Main Street built of mixed stone rubble and conglomerate walling with grey-brown flagstone dressings.

The buildings are generally very simple constructions, similar architecturally to those of Masonry Style 1. They are attached builds with gable end chimneys and widely spaced windows flanking a central door; however, unlike Masonry Style 1, most of the buildings have two storeys (though in some cases the second storey is a later addition). The walling is typically irregularly coursed, random rubble

Figure 6 Examples of Masonry Style 3. St. Kessog's (1868) and Robertson House (mid 19th century) built of locally sourced walling stone (conglomerate and flagstone) with imported sandstone dressings. This masonry style is the most commonly used throughout the CCA.

conglomerate with a rough natural finish. Commonly, the rubble walling is 'lined out' to imitate ashlar masonry. The dressings are of local grey-brown flagstone, commonly stugged.

Masonry Style 3
This masonry style is characterised by walling of local Callander stone (conglomerate and flagstone) and dressings of imported Scottish sandstone (Figure 6). The appearance of imported sandstone dressings coincides with the opening of the Dunblane, Doune and Callander Railway in 1858, which stimulated a rapid expansion of the town and a rise in tourism. Large, regular-sized blocks of buff sandstone and red sandstone began to replace the dressings of locally sourced grey-brown flagstone. The sandstone dressings were commonly droved, high quality ashlar blocks. Compared to the locally sourced flagstone, the imported sandstone would have been attractive because it was available in larger blocks (making it more suitable for dressings), and was easy to carve.

Villas were constructed by the wealthy for summer homes and, in some cases, as permanent residences away from the city. A new development of villas expanded rapidly at Leny Feus. For these buildings, the typical masonry style is purplish-red flagstone walling and imported Scottish sandstone dressings. The use of the purplish-red flagstone walling is a characteristic feature of the Leny Feus area, reflecting the fact that the development is adjacent to the Leny Feus Flagstone Quarry; it is the

Figure 7 Examples of Masonry Style 4. The Old Bank on Main Street (C(s) listed, 1883) and building on Bridge Street (C(s) listed, late 18th century); both built of imported sandstone walling and dressings.

only part of the CCA in which this flagstone is the dominant stone type.

Masonry Style 3 is most common in buildings constructed in the period following the arrival of the railway (mid to late 19th century), but it continued to be used until the early 20th century. It is the most common masonry style in the Callander Conservation Area, and occurs in all parts of it.

Masonry Style 4
This masonry style is characterised by the use of imported sandstone for both walling and dressings (Figure 7). It first appears after the arrival of the Dunblane, Doune and Callander Railway in 1858 and was used in buildings until the First World War. Large, regular-sized, smooth ashlar blocks of regularly coursed buff sandstone and red sandstone were used in the construction of many of the larger, more important Callander buildings of this period, such as banks, hotels and churches.

Many buildings displaying this masonry style are located on Main Street. In most cases, older buildings would have been demolished to redevelop corner sites at cross streets and other prominent locations. Masonry Style 4 is also characterised by ornate carving and detailing. The relatively soft, homogeneous, imported sandstone allowed masons to produce a level of detail that was not possible with the hard, pebbly conglomerate. As a result (and in line with a widespread, general improvement in masonry skills), facades became more detailed with architectural elements such as string courses, cornicing, large bay windows, parapets and towers.

Conclusion

Four distinct masonry styles are recognised in Callander buildings, each characterised mainly by the combination of stone types used for walling and dressings. The first appearance of each masonry style typically reflects a change in the availability of stone building materials as the town developed. The main events affecting the availability of materials were: the opening of local quarries (c.18th century); the arrival of the railway in the second half of the 19th century; and the First World War (which coincided with the rapid demise of the building stone quarry industry in Scotland). With just a few exceptions, natural stone has not been used in buildings constructed since the First World War, leading to a gradual dilution of the traditional character of the built heritage in Callander.

Locally sourced conglomerate ('Callander puddingstone') is the most widely used natural stone building material in the Callander Conservation Area. The conglomerate is an unusual building stone in terms of its appearance and the fact that it is not easy to work (compared to sandstone and flagstone, for example). Nevertheless, it was used at all stages of town development up to the First World War. For much of this time, other widely available, easy to use and popular building stones were available, raising the question of why the conglomerate remained popular in Callander for so long. The locals may have been aware of its importance to the character of their town and its sense of identity. Alternatively, the importance of maintaining the local quarrying industry (and the associated jobs) may have over-ridden the aesthetic and economic reasons for using imported stone. Today, the conglomerate plays an important role in defining the 'sense of place' within the CCA.

Although imported stone has been used extensively, and man-made materials are used almost exclusively in modern buildings, the widespread and long-term use of locally sourced conglomerate, flagstone and slate has ensured that the built heritage within the Callander Conservation Area continues to reflect the local bedrock geology.

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Acknowledgements

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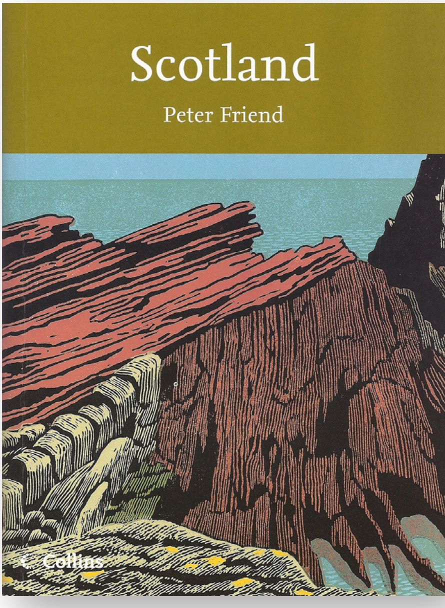
Book reviews

Scotland — Looking at the Natural Landscapes by Peter Friend. Collins New Naturalist Series, London, 2012. Paperback, 466 pp. Price £30. ISBN 978-0-00-735906-6.

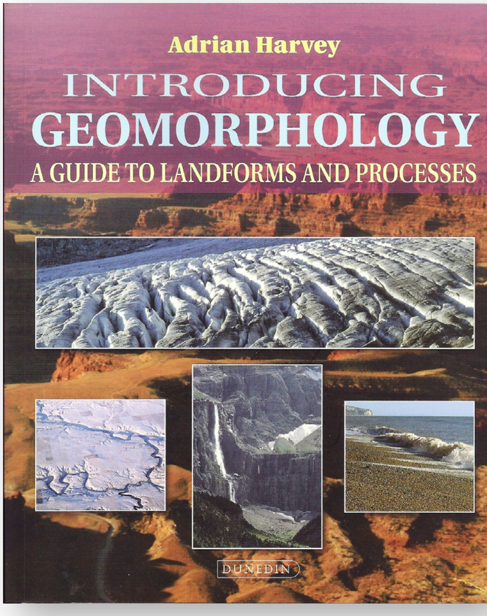


This is an ambitious book, setting out to provide a comprehensive integration of Scotland's geology and landscape development. No wonder it runs to a chunky 466 A5 pages. An introductory chapter sets out the rationale and is followed by two others that address in general terms the principal factors influencing modification of the Earth's surface and large scale geological processes. These lead into more focussed assessments of the episodes through which Scotland's rocks have been conjured and sculpted into such remarkably varied scenery. There follow nineteen chapters in which regions with some degree of landscape homogeneity are considered in detail, from Galloway in the south-west to Shetland in the north-east. A short concluding overview reprises the main themes of plate tectonics and glaciation.

The red meat of the book is contained in the regional chapters, each of which features a short historical introduction followed by more extensive sections on 'Stories from the Bedrock' and 'Making the Landscape'. Much detail is packed into these accounts, and some complex issues are tackled, yet the text remains accessible and entertaining. But what really struck me throughout the book is the splendid quality of the illustrations, of which there are 325, all in full colour. Well-chosen oblique aerial photographs, many appropriately annotated, are interspersed with maps and figures that utilise modern digital and graphical techniques to good effect. Happily there is no attempt to save space by reducing the size of the illustrations to the detriment of their content, with just a few exceptions where the images are also rather dark, figures 120 (Coll) and 159 (Kinnoul Hill) for example. These are exceptions though and the overall standard of illustration is impressive. I particularly liked the regular inclusion of sea level curves for the coastal regions—and their comprehensible explanation! Of course there are some inevitable irregularities and contradictions, mostly trivial and probably apparent only to those with some pre-existing local knowledge. From my vantage point I noted that the prominent linear valley coincident with the Glen App Fault in Galloway, and very obvious in aerial views, sometimes seduced the Southern Uplands (*sic*) Fault away from its true course to the north along the Stinchar Valley (Figure 52 for example). However, such pedantry should not detract from this excellent book, which concludes with suggestions for further reading (maybe just a trifle idiosyncratic) and a usefully extensive index. Friend's *Scotland* will be of interest and value to anyone seeking to understand the Scottish landscape and the eons of geological activity that have created it.

By Phil Stone

Introducing Geomorphology—A guide to landforms and processes by Adrian Harvey. Dunedin Academic Press Ltd., Edinburgh, 2012. Paperback, 124 pp. Price £9.99. ISBN 978-1-906716-32-5.



This book is the latest volume in Dunedin Press's 'Introducing' series (see reviews of companion volumes in *The Edinburgh Geologist* and *Scottish Journal of Geology*). Geomorphology, the scientific study of landforms of the surface of the earth, should really be of interest to us all. Long the preserve of physical geographers until recent decades, geomorphology provides the linkages between geography, geology and climate. No longer can geologists regard it as 'gardening', and a good thing too!

According to the author *Introducing Geomorphology* is 'not intended as a textbook'. Nevertheless it packs in a wealth of geomorphological concepts and UK and overseas landform examples which should interest any senior school student or undergraduate embarking on the study of geomorphology. It is based on the author's extensive teaching and research experience at the University of Liverpool. The text is concisely written, and a useful glossary provides basic definitions of technical terminology highlighted in bold throughout.

The book sets out to define geomorphology in terms of spatial and temporal scales and succeeds in linking geological processes and timescales with observed landforms. Thus, at global (e.g. continental) scale, Chapter 2 describes how plate tectonic processes over tens to hundreds of millions of years have formed mountain ranges, plateaux and plains and also demonstrates the influence of Quaternary glaciations over the last 2 million years in moulding the present day landscape. At 'regional-scale' (e.g. river basin) (chapter 3), regional tectonic and volcanic processes are very briefly discussed with longer sections on the influence on the evolving landscape of bedrock lithology and structure. Drainage evolution is developed in more detail and the chapter concludes with an interesting discussion of the links between regional and global processes across Europe. In this section an informative colour map shows the major geological structural units of Europe superimposed by Pleistocene glacial and permafrost limits.

Arguably readers can relate best to 'local-scale' geomorphology (chapter 4)—as this refers to landforms and processes that they can observe in the field. This chapter begins with a discussion of weathering processes and influence of climate on weathering regimes. Then, in turn, slope, fluvial, aeolian, glacial, coastal systems are described. Inevitably in an introductory volume such as this, the reader is left wanting further explanation. Although this is a good tactic encouraging the enquiring mind, throughout the chapter processes and landforms get limited and variable treatment. Thus fluvial processes and landforms are described in some detail but glacial and fluvio-glacial processes (which have had such a profound influence on landform evolution in northern Europe) are condensed into half the number of pages, and the vast array of glacial and fluvio-glacial depositional forms is described a single paragraph with the aid of a series of four small illustrations (fig.4.29). To assist the reader discover more, a brief personal selection of further reading, including several classic texts, is presented near the end of the book. Whilst the classics have indeed stood the test of time it was surprising not to see a few more recent texts get a mention (e.g. *Glaciers and Glaciation* by D I Benn and D J A Evans, Arnold, 1998, presents an excellent discussion of sediment-landform associations and landsystems).

Illustrations are of variable quality. Whilst the maps and most diagrams are clear and instructive, some of the photographs (mostly taken from the author's collection) are disappointing. It is not so much the quality of the originals but the size of the reproduced images. In attempting to show a very wide range of landform examples, the publishers of this small format book have necessarily had to compromise on image size. The smallest of the images measure only 65 by 45 mm. Whilst satisfactory for close-ups these are really too small for landscapes or even outcrop scale detail. Fewer but larger images would have worked better. Thus, for example, the series of four images showing landslides (fig. 4.9) and the series of four showing glacial depositional landforms, (fig. 4.29 mentioned above) could have been reduced in number. Other larger format photos work well and clearly illustrate the features being described (e.g. fig. 4.26 Glaciers, fig. 5.1 Grains Gill, see below).

Chapter 5 introduces the reader to landscape evolution through time. It uses contrasting examples from the 'tectonically stable' Howgill Fells of north-west England and the Sorbas Basin of south-east Spain (where neotectonic activity continues to the present day) to illustrate how relative and absolute dating techniques can be applied to decipher the sequence of events. In the Cumbrian example the loose interplay of terms such as boulder clay and glacial till could have been avoided although both are defined in Chapter 4 and the Glossary (where 'dimicton' should read 'diamicton'). Figure 5.1(excellent large format photograph of Grains Gill and accompanying interpretive sketch) shows the key landforms. Radiocarbon, luminescence and cosmogenic dating techniques are summarised (on p. 102 for 'ions' read 'isotopes') and Figure 5.2 includes Richard Chiverrell's summary diagram of hillslope activity over the last 3000 years in north-west

England and south-west Scotland. Interestingly, this correlates alluvial fan sedimentation phases mainly with human impact rather than climatic wettening periods. Perhaps there is a lesson here with regard to the extensive modern hilltrack infrastructure currently being developed for windfarms across the Southern Uplands.

The final chapter 6 is little more than a postscript and briefly outlines societal issues including the effects on river catchments of major dam schemes and climate change impacts. A section on scientific organisations is supplemented in the Further Reading section with useful websites.

Despite the quibbles about some of the illustrations, *Introducing Geomorphology* should inspire many to go out there with an enquiring mind. Whether on a walk in the Scottish hills or on the Mediterranean coast, whether on holiday in Iceland or visiting some arid part of Australia or Africa, wherever you are there is an opportunity to consider how the scenery around you reflects the tectonic setting, rocks and past and present climates. *Introducing Geomorphology* provides many of the relevant clues.

By Andrew McMillan

Addendum: Arthur Holmes and the Communication of Geology

In the last issue of The Edinburgh Geologist, number 51, we ran an article on the late Professor Arthur Holmes, and commented favourably on the exhibition illustrating his work that has been established in The Grant Institute, University of Edinburgh. Janet Bell, Curator of the Institute's Cockburn Museum, was justifiably complimented on the exhibition, but we should also have reported the part played by Dr Michael Johnson. Dr Johnson was the initiator of both the exhibition project and the adjacent memorial plaque, and did much of the necessary background research and organization. This should have been acknowledged in the original article and we apologise to him for the omission.

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