MacCulloch’s 1840 Geological Map of Scotland, fac-simile edition (a reproduction of the third issue of the map scanned from the original held in the British Geological Survey archives, reproduced half-scale at eight miles to the inch, size 74 × 93 cm, supplied flat only). 2007, British Geological Survey, Edinburgh. ISBN 9780751835007. £10 plus postage (available from BGS, Edinburgh; email: scotsales@bgs.ac.uk).

In the preface to the 1836 Memoir of MacCulloch’s geological survey of Scotland, which accompanied the map, Samuel Arrowsmith penned the following lines: “The following “Memoirs” have been printed verbatim from the manuscripts of the late Mr. MacCulloch, without note or comment. His sudden and lamented death has prevented my remarking on certain of his opinions and statements; but these, it is hoped, will be received as he meant them to be, by such as are competent judges of the real errors and deficiencies in the unfortunate Map, that became so fertile a source of his indignation”.

These rather negative lines hide a 20-year story of one man’s involvement in pursuing a line of arduous investigation that culminated in a masterpiece of mapping that ranks amongst one of the greatest achievements in geology during the early to mid-nineteenth century. John MacCulloch’s geological map of Scotland stands alongside William Smith’s 1815 map of England and Wales and Richard Griffith’s 1838 map of Ireland as the foundation stones upon which all later work has been laid. James Nicol’s 1844 geological map of Scotland drew upon MacCulloch’s map as a base for his own investigations, with Nicol stating his indebtedness to MacCulloch (1773-1835) and others who pioneered such work.

Others, however, were less than charitable, particularly Murchison who stated that the map ‘was so replete with errata that it would be a waste of time to attempt to enumerate them’. However, Murchison’s opinion should be treated with caution as he was highly critical of MacCulloch’s views, which culminated in a stinging attack when Lyell’s Principles of Geology were first published. This unfortunately coincided with the eventual publication in 1831 of MacCulloch’s two-volume student text on the System of Geology which had been written a decade earlier (MacCulloch 1831). Murchison wrote ‘If you wish to study geological science as it is, in the writings of your own countrymen, you will naturally consult the works of Lyell and De La Beche. But for a knowledge of what it was, I may request you to peruse these volumes of Dr MacCulloch’ (Murchison 1833, p. 376). This effectively ruined MacCulloch’s geological career as he had already been making himself unpopular by several outspoken attacks on palaeontologists and stratigraphers.

Judd in 1898 attempted to portray MacCulloch’s map in a more benign light and particularly praised the accuracy of areas of the map which Murchison had criticized. In particular, Judd reasserted MacCulloch’s original observations about the true field relations and age of the Torridonian Sandstone and its relation to the Durness Limestone. Murchison and Sedgwick had vehemently opposed MacCulloch’s interpretation and in deference to them MacCulloch appeared to allow his views to be replaced by Murchison’s insistence that the Torridonian strata were nothing more than downfaulted Old Red Sandstone. Hence they appear as a uniform pink colour on the map and are marked up as Old Red Sandstone in the key.

Despite increasing criticisms of MacCulloch’s views during the later 1820s, Lyell respected him and assisted in mapping Forfarshire during 1822–1824 whilst MacCulloch was laid up with one of his frequent bouts of ‘ague’ (malaria, a disease he named and about which he wrote two influential and important treatises). MacCulloch’s frequent bouts of illness from 1821 no doubt coloured his views and perceptions whilst he was laid low. Lyell commented that he found that ‘his spirits were much depressed by bodily sufferings – his imagination was then haunted with the idea his services in the cause of geology were undervalued and it was in vain to combat this erroneous impression’ (Lyell 1836, p.359). This perception, combined with a perfectionist attitude and a quest for cartographic precision, contributed to many difficulties with those who dealt with him, particularly publishers.

MacCulloch stood at a crossroads in the development of the geological sciences and it is here that the tide of history has, perhaps, been unkind to him. A Wernerian by initial training and a Huttonian by principle, he eschewed theories for hard observational facts. In an age where it was unfashionable not to take sides (Neptunist or Plutonist), MacCulloch tried to steer a course of pursuing geology by developing acute field observational skills. His high ability as an artist, chemist and mineralogist enabled him to see field relationships with a greater precision than many of his critical contemporaries. This culminated in his highly acclaimed work on the Western Isles (MacCulloch 1819). The maps in the atlas of this work formed the basis, with later revisions, for the western seaboard of his 1836 map and subsequent issues.

MacCulloch worked primarily in hard crystalline metamorphic rock areas and was critical of some of the new thinking about using fossils in stratigraphy as a cure for all geological problems in correlation. Part of the
problem lay in a perceived dichotomy between the proponents of stratigraphical palaeontology and those of mineral geology, who were linked by association to the old Wernerian doctrines. Perhaps due to his blunt writing style, an example of which is found in a letter to Leonard Horner where he described those who were applying the new ideas as ‘namby pamby cockleologists and formation men’, his remarks on palaeontology were frequently taken out of context. This led to his becoming increasingly embittered with the geological establishment of the time. Indeed he asked whether the proponents and practitioners of ‘fossil conchology’, brought up on the soft, relatively unaltered, highly fossiliferous young sediments, would be able to unravel the complexities of the regions in which he worked. It is often forgotten that MacCulloch is credited with the first published faunas in several areas of Scotland, notably in the ‘primary’ rocks of Sutherland (MacCulloch 1819).

MacCulloch’s geological map of Scotland is the result of many seasons spent in the field whilst assigned to the Trigonometrical Survey, a department of the Board of Ordnance, which was commanded by Colonel William Mudge. Its origins may have started in 1811 whilst MacCulloch was engaged in conducting his survey of limestones suitable for millstones used in gunpowder manufacture. The idea of surveying the whole region gradually came to mind after being appointed in 1814 to begin two investigations. One was a geological investigation eight miles either side of the zenith sector stations lying along the meridian from Baltia in Shetland to the English Border. The second survey (Mountain Survey) was to find a mountain more suitable than Schiehallion to calculate the Earth’s mean density — a repeat of Maskelyne’s experiment. Each of these surveys, coupled with a lack of written job description and with only verbal guidance given by Colonel Mudge, allowed MacCulloch the freedom to indulge in more general mapping and surveying activities. This gave him the opportunity, in his own time, to collect field data with the intention of eventually publishing a geological map of Scotland. To this end in 1821 he suggested that a mineralogical survey of Scotland could be conducted without extra expense as a by product of other duties. Remember that MacCulloch had been collecting data on the geology on Scotland since 1811 and that this data could readily be incorporated in the proposed map.

He approached Thomas Colby, who had replaced Major General William Mudge (promoted shortly before his death in 1821) as superintendent of the Trigonometrical Survey, and asked for a meeting which took place on 3 April 1821. It was a heated exchange in which MacCulloch was apparently not very coherent and threatened to hang or shoot himself. MacCulloch was evidently hoping for official orders for his geological map, but Colby said it was no concern of his as there were no formal written instructions concerning it. However, on 27 July 1821 MacCulloch was given permission to continue with his map at his own expense. In July 1826 MacCulloch eventually received a Treasury endorsement to continue with the map after he was pensioned off from his post as chemist with the Board of Ordnance, the instruction being that he could ‘transfer his undivided attention and services to the geological survey under the Treasury’. MacCulloch completed his map and memoir in 1832, not, however, without controversy. The fact that he had been paid to complete his map enraged his former friend Robert Jameson who heard about the payments in 1830. Jameson felt that he and the Wernerian Natural History Society had sole responsibility for the coordination of geological activities in Scotland. Therefore he attempted, without success, to get the payments to MacCulloch stopped. As a result MacCulloch justifiably complained of a vendetta and conspiracy against him and the publication of the map. Petitioning by the Highland Society, of which Jameson was a committee member, prevented publication of the map until 1836 when it was privately printed after MacCulloch’s death.

The British Geological Survey reproduction of the map is a superb representation of the original held in the BGS archives (Fig. 1). All attempts have been made to preserve the original map in the reproduction, with the only alterations being a reduction in scale from four miles to the inch to a more useable eight miles to the inch. The map was originally printed in four hand-coloured sections, each measuring 34 inches by 27 inches. The four sections of the map were scanned, aligned and the section lines digitally removed without loss of map information.

Care has been taken to preserve the colour fidelity of the original, something which is often difficult to achieve in poster reproductions. MacCulloch utilized 18 colours in the key to delineate lithology, although only 17 actually appear on the base map. The key colours appear brighter than those used on the actual map; this is due to the blackness of the original engraving of Arrowsmith’s base map, a criticism that MacCulloch was keen to point out and which shows up well on the BGS reproduction, with the colours appearing slightly muddy in areas of dense hachuring. In the Memoir MacCulloch gives full instructions to the colour copyists of the map as to the right pigment mixes and tints to achieve the effect he desired. As an example, the schists and gneisses (Moine and Lewisian) are coloured yellow using gamboge. The Torridonian (Old Red Sandstone as mentioned above) is in pink using pure lake in a diluted form, whilst the green representing quartzites (MacCulloch’s quartz rock) is made from Antwerp blue and gamboges. Prussian blue is used for the trap rocks and the colourists are instructed to use this as a weak tint over large areas as the poor quality of the engraving would render it too muddy in appearance if applied in too pure a form.

Of interest in this particular copy of the map is that it appears to have been presented by a member of the Murchison family in 1878 and contains numerous later pencil annotations and a few sketched in sections. These add considerably to the interest of the map,
particularly in view of the 'history' between Murchison and MacCulloch briefly outlined above, although I am unable to vouch for the author of the pencilled marks as there appears to be more than one hand involved. It is possible that the pencilled inscription 'Pres. R (or K) Murchison Esq, Apr 1878' has been done
It would be of great interest if, at a future date, a reproduction of the accompanying Memoir were to be made available, perhaps as an electronic download to accompany the map. This contains much pertinent information on the map, particularly the irritations of Arrowsmith’s topographic base map. MacCulloch expounds at length his criticisms of the inaccuracies of the base map in terms of its physical geography/topography as well as political geography (roads, villages etc.). He expresses indignation that the increase of access in terms of new roads and expanded settlements has rendered the accurate charting of geological data more difficult since the positions of the new roads cannot be plotted with any level of accuracy on the old base map. MacCulloch mapped at a time where there was no standard reference system and he was reliant on the accurate placing of both topographical and settlement features for delineating his geological boundaries. He also criticized the representation of topographic features such as hills and mountains on the map as bearing, in many cases, little relation to reality. Certainly the printing of such features made marking geological data difficult and in the BGS half-size reproduction it is easy to see why MacCulloch had such a problem since this has been compounded in the necessary reduction in scale. One wonders what the result would have been like if MacCulloch had had the cartographic advantages of William Smith using John Carey’s excellent specially prepared base map.

Another point that MacCulloch had issue with is one familiar to all field geologists, namely the marking of small-scale features such as thin beds of limestone, serpentine or small-scale intrusive features (‘trap veins’). He apologizes that, for the sake of visibility in colour, these have been made larger than they actually appeared in the field thus unavoidably introducing another source of error.

Perhaps MacCulloch should have the last word on his endeavours: ‘Let it hereafter prove what it may, it is the first and only work of such a nature and extent that has been executed by a single hand, and with even an attempt after accuracy’ (MacCulloch 1836).

For all those interested in the history of geology this beautifully reproduced map from the BGS cannot be more highly recommended and serves as a fitting testimonial to the endeavours of one man who ascended many of Scotland’s peaks just to examine the geology, accurately surveyed hitherto poorly charted parts of the coastline and traversed inhospitable areas in often highly inclement conditions. It is fitting that the first Government Geological Survey conducted in the British Isles was that of John MacCulloch, and that this important map is being reproduced by the BGS as part of the magnificent series of historical maps now being made available. If, at a future date, a quarter-scale version of the map could be produced it would look good framed in any office or home. The current half-scale version would need a rather large wall to do it justice as a mounted and framed map.

References

LYELL, C. 1836. Address to the Geological Society. Proceedings of the Geological Society, London, 2, 359.

MACCULLOCH, J. 1819. A description of the western islands of Scotland including the Isle of Man: comprising an account of their geological structure: with remarks on their agriculture, scenery and antiquities, A. Constable & Co., London.

MACCULLOCH, J. 1831. A system of geology, with a theory of the earth and an explanation of its connections with the sacred records, Longman, London.

MACCULLOCH, J. 1836. Memoirs to His Majesty’s Treasury respecting a Geological Survey of Scotland.

MURCHISON, R.I. 1833. Address to the Geological Society, delivered on the evening of 17th February 1832, by the President Roderick Impey Murchison Esq. Proceedings of the Geological Society, London, 1, 362-386.

Alan J. Bowden
National Museums Liverpool
UK

Whatever is Under the Earth: The Geological Society of London 1807 to 2007 by Gordon L. Herries Davies, Geological Society, London, 2007. 365 pp. ISBN 978-1-86239-214-4. £25 (introductory price for 2007 only).

To mark its bicentenary, the Geological Society has commissioned a new history of the Society. To the uninitiated the first half of the title may seem obtuse, but cast an eyeglass over the logo that adorns Geological Society publications and one finds this to be the English translation of the Society’s motto. As Gordon Herries Davies describes in his preface, the role of bicentennial biographer had been assumed by former Society President (1976–78) Wallace Pitcher. However, time was not on his side, and he passed the baton to Herries Davies fittingly, as we are told, at the foot of Salisbury Crags in 1997. It is a measure of Pitcher’s influence, and possibly also a comment on the conservatism of the Geological Society hierarchy, that Pitcher had the commission largely in his gift some 20 years after his presidency and more than 15 years after retiring his Chair in Liverpool. Herries Davies may be the author of the present volume but Wallace Pitcher is an abiding presence whose influence is both directly discernible in parts and, I suspect, conspicuous by its absence elsewhere; Pitcher died while Herries Davies was still writing in 2004.

Thus, this is the culmination of the best part of a decade of research and writing and there can be no doubt that Herries Davies has succeeded as a biographer and commentator. I will use reviewer’s prerogative and be critical where I think that is justified but that should not detract from what overall is a splendid achievement. The author had a difficult brief; the bicentenary of a learned society requires a definitive treatment and any historian must have this as the prime objective. However, the modern ‘Geol. Soc.’, particularly through its Publishing House, has a commercial agenda, so it needs
a volume that will sell. I made this part of my holiday reading and it was suitable entertainment. I read from cover to cover in three sittings and there were several competing attractions in our holiday destination. With a few stylistic reservations, this is a good read. Anyone who is sufficiently interested in the subject to be reading this journal will find Herries Davies’ book enjoyable and rewarding. As such, the author has more than satisfied the difficult brief.

The first thing to emphasize is that this is a biography of the whole two hundred years, not merely an addition to H.B Woodward’s centenary history; indeed Herries Davies is keen to take issue with Woodward on occasion. Here, an interesting double personality emerges in Herries Davies’ writing between the first half of the book (Chapters 1–4) which broadly represents the period covered by Woodward, and the second half (Chapters 5–9) which mostly describes the twentieth century (Chapter 10 is largely the author’s reflection on completion of the work). The first half is, for this reader at least, notably less well written. These chapters are burdened with quite clumsy metaphor, often drawn from contemporary but otherwise unrelated historical events; tautology; and a lexicon that is either archaic or pretentious. For example, in describing the introduction of the Stephenson’s to the Fellowship, Herries Davies tells us ‘it is singularly appropriate that the man who drove the Locomotive… and the man who built the Rocket… should eventually both have arrived at a station within the Society’ — amusing perhaps but a little too ‘cheesy’ for this reader. Similarly, it ill-behaves an author who describes Geikie as ‘more interested in grandiloquence’ to call tunnels ‘swelling terrestrial excrescences’ and use ‘forenoon’ as a synonym for morning. Indeed, there are a few (non-technical) words in this book that I’ve never seen before: erudite perhaps but also obfuscatory and certainly unsympathetic to anyone reading this in their second language.

Interestingly, such transgressions are notably less frequent in the second half of the book although there are some gems. In describing the way that members of the Geological Society Club would whisk off guest speakers elsewhere, the author gets in the way of the story a little too readily. The occasional nod to characters the author knew is fine and adds interest. A closing chapter centred on the author is equally acceptable after a decade of effort (although ‘Ms Pink Shirt’ might feel herself a little patronized). But elsewhere, the author gets in the way of the story slightly. This is most blatant when he dons the mantle of the Conversazione in celebration of the Society’s 1907 centenary. Throughout it is clear that the author is on a flight of fancy but its inclusion does lead one to wonder if Herries Davies would be able to restrain his ample imagination if inadequate documentation of factual events stood in the way of a yarn.

Criticism aside, one of the refreshing aspects of Herries Davies treatment is the decision to confront a few Geological Society demons. He does not shy from showing how conservatively the Society behaved in admitting women to the Fellowship. Herries Davies is equally candid about the state of the Geological Society Club would whisper off guest speakers to be entertained by their exclusive clique, Herries Davies describes the ordinary Fellows as ‘like guests at a wedding reception following the departure of the bridal pair and bishop’. How socially revealing; how many of us in matrimony command an episcopal presence? Certainly, the nuptials in my social stratum generally settle for events to be concluded by Priest, Vicar or Registrar. Equally, however ruthless were the efforts of the Office of the Deputy Prime Minister to wrest control of Burlington House, is it really appropriate or proportionate to draw comparisons with the Highland Clearances? An amusing aside does emerge from this episode though. For the sake of historical completion, and maybe also to add a measure of gravitas, Herries Davies habitually introduces new characters to his story using their full names. No exception is made for the former Deputy Prime Minister and it was therefore quite a shock to find the mild ‘Leslie’ where one has come to expect more colourful red-top epithets between the words John and Prescott.

I initially assumed that the change in literary style showed the author getting to grips with the task and realizing there was no need to embellish the second half with so much tautology and metaphor. Then I read Herries Davies acknowledgements and discovered that the first half of the book was written second. So maybe the indulgences were waves to the crowd from the athlete who knows he has the race in the bag? However, I wonder if there is another possibility? Apparently, Chapters 5 to 9 were written while Wallace Pitcher was still available to comment on the manuscript and Herries Davies duly acknowledges Pitcher’s advice. Could it be that Pitcher’s editorial pencil saved us some of Herries Davies more indulgent tendencies in the second half of the book? Whatever, one does gather the perception that Herries Davies is more comfortable in the nineteenth than the twentieth century. It is subtle but I think I am right to suggest that Herries Davies puts the characters first when describing the century of Sedgwick, Murchison, Lyell and co., whereas it is events, and the Society’s response thereto, that lead description of the century of Harker, Read and Watson.

My final critical observation is that Herries Davies allows himself into the story a little too readily. The occasional nod to characters the author knew is fine and adds interest. A closing chapter centred on the author is equally acceptable after a decade of effort (although ‘Ms Pink Shirt’ might feel herself a little patronized). But elsewhere, the author gets in the way of the story slightly. This is most blatant when he dons the mantle of geological ‘time lord’ and places his imaginary self at the Natural History Museum, South Kensington, for the Conversazione in celebration of the Society’s 1907 centenary. Throughout it is clear that the author is on a flight of fancy but its inclusion does lead one to wonder if Herries Davies would be able to restrain his ample imagination if inadequate documentation of factual events stood in the way of a yarn.
Society. It seems the Society was not well disposed to revolution. Of course, many of the revolutionaries were accidental Earth Scientists lured from the other sciences by the excitement of rapid discovery. They had seismometers, magnetometers and spectrometers and perhaps little respect for the hammers and breeches that had laid the stratigraphic and structural framework of Geology. Once again, the quoted words of Wallace Pitcher serve to illustrate the point: ‘You know, I’ve been reflecting on what the Society did in the 1960s for the establishment of the Plate Tectonic Theory. The answer seems to be almost nothing.’

This bicentenary coincides with another major challenge to those who understand the antiquity of our planet and the contrasting pace at which our species appears to be underlining the very unique qualities that led us to flourish here. Let’s hope a future President is not left to conclude that the Society failed in its duty on climate change in the ‘twenty-noughties’. 

Herries Davies’ finale is more positive. I will not spoil the story of how the Geological Society reached its current state of relative financial stability and I will spare the blushes of the men on whose integrity that stability is founded. The issue for Herries Davies is at what cost? The Society now has multiple personalities; is it in danger of letting its roles as professional body and commercial publishing house take precedence over that of learned society? If so, does it matter? Will commercial success and closer affiliation with industry undermine the intellectual independence of the Society? Time will tell, but it seems the Geological Society finds itself in rude health. That can only be a good sign for those of us who, in the words of recent Society President Lord Oxburgh, quoted by Herries Davies, find ourselves ‘really very worried for the planet’.

Rob M. Ellam
Scottish Universities Environmental Research Centre, East Kilbride

Land of Mountain and Flood: The Geology and Landforms of Scotland by A. McKirdy, J. Gordon and R. Crofts, Birlinn Ltd in association with Scottish Natural Heritage, 2007. 324 pp. £30.

At 1.765 kg (3.89 lb) this lavish volume is not designed for the pocket but it is not simply a coffee-table collection of pictures. It sets out to inform and excite the reader with a vision of the origins and development of what is undeniably diverse, and locally breathtakingly beautiful, scenery. The book is not intended as a geological textbook; it is written for those who already have an appreciation of the qualities of the Scottish landscape but seek to add the dimension of how and why it is the way it is.

The authors bring impressive credentials to this task. Alan McKirdy, currently with Scottish Natural Heritage (SNH), has worked in conservation for over 30 years and has edited or written a number of popular books on geology; John Gordon (also with SNH) has studied and written extensively on the landforms and glacial history of Scotland; and Roger Crofts (Chief Executive of SNH, 1992–2000) is an environmental and management advisor.

Following the Foreword and Preface, the Introduction outlines the importance of 3000 million years of Earth history to Scotland’s journey through time and the principal objective of the book: to provide an accessible story that will enable readers to interpret the landscape for themselves. The text is divided into six chapters.

Chapter 1, ‘Geology enriches all of our lives’, describes the role of geology in human history, its importance in providing raw materials (coal, building stones and water), its relationship to soils and agriculture, its place in renewable energy, in culture and in a variety of sports and outdoor pursuits. However, the authors should have known that the peaty characteristics of whisky relate to the smoke used in the malting process, and not to the water! The chapter closes making a strong case for geological conservation and noting the growing contribution of geotourism. From time to time it assumes technical knowledge that the reader has yet to acquire and although much of it is admirable it might have been better placed later in the book.

Chapter 2, ‘How the Earth works’, explains the beginnings of the Earth system and the plate tectonics theory that underpins contemporary geological thought. It describes the rock cycle, dating the past, and climate change, setting in place much of the technical understanding that will aid understanding in later chapters.

Chapter 3, ‘Scotland’s journey across the globe’, is essentially a résumé of geological history, with diagrams illustrating the global wanderings of parts of Scotland. The photographs of the Lewisian and Torridonian landscapes are excellent, the text emphasizing the fact that at the times of formation of their rocks these areas were attached to what is now North America. The Moine and Dalradian rocks, forming much of Highland Scotland, receive less attention and the account is dominated by discussion of the Caledonian Orogeny before arriving (in retrospect) at the deposits of the Iapetus Ocean from which it was to rise! The Cambro-Ordovician interval is less well illustrated and the narrative over-emphasizes beach environments in what were probably shelf-sea sand waves. However, the similarities between the fossil assemblage of the Durness Limestones of the NW Highlands and those of similar limestones in Canada and Greenland, contrasting with assemblages in Wales, provide some of the most compelling evidence of the disparate origins of the various parts of Scotland.

The beginning of the Devonian Period saw a newly assembled continent that included the area that later became ‘Scotland’. This was a barren environment, plants were only beginning to colonize the margins of the land (a fact barely mentioned) but most deposits are water-lain, attesting to the action of streams, large rivers and very large lakes. However, the narrative refers to this environment as ‘a desert’. The provenance of the
Lower Devonian deposits, which were not derived from the present Highlands, is not discussed.

The economically important Carboniferous deposits reflect a rapidly changing environment, characterized by repeated depositional cycles, but the account is over-enthusiastic about ‘reefs’ that bear little relationship to their modern namesakes. The volcanic rocks receive a justifiably thorough treatment and the reader cannot fail to be impressed by the fact that over 1000 vents have been identified in central Scotland, many with impressive present-day topography, illustrated in pictures of Dumbarton Rock and the Rock and Spindle.

The events of the Permian and Triassic Periods, treated together, include the results of recent work offshore, emphasizing that ‘Scotland’ was part of a significantly larger area. The desert conditions and the mass extinctions are described, but the opening of the Atlantic is confined to a box. Permo-Triassic rocks were deposited along both margins of the proto-Atlantic, and extended into rift valleys in Britain, but the narrative describes the break-up of Pangea as starting in the Jurassic. It also attributes the red colour of these rocks to deposition in desert environments although it more commonly reflects diagenetic changes after burial.

During the Jurassic large areas of ‘Scotland’ were land and apart from coal deposits at Brora there is no record of deposition. Marine deposits are found on the west coast and on islands including Skye, and on the east coast at Helmsdale. Cretaceous rocks are similarly poorly represented. Unfortunately the Chalk is described as consisting of the remains of tiny ‘sea creatures’ that most readers will understand to be animals, although the coccoliths forming these deposits were plants.

The Palaeogene Period is justifiably devoted to volcanic activity but, while indicating that much of this was related to the opening of the Atlantic, the authors refer only to the generation of ‘a line of volcanoes’, omitting to mention that this was the mid-Atlantic Ridge.

Chapter 4, ‘Shaping the landscape’, describes surface processes: weathering (with an excellent illustration of solifluction at Pittodrie), slope stability, rivers, glaciers (some material from Chapter 2 should have been here) and coasts are addressed. The highlight is a superb photograph of meanders in the Clyde. Most of the narrative is good but in avoiding an ‘academic approach’ it commonly overlooks details of process. Meandering rivers, for example, are described as ‘wandering’ and references to abandoned channels give no indication of how they form. Knowledge of these mechanisms would provide understanding of the relationships between features, and without it a wider appreciation may be lost in the acquisition of landscape features as one might collect stamps. Allusions to legends regarding the origins of some features add valuable colour. All travellers hear these and it is useful to place them in a rational context, but old ideas should come before new.

Chapter 5, ‘Future landscapes: Scotland in a global context’, does what it says. The opening discussion describes rising levels of carbon dioxide in the atmosphere, parallel climatic effects and their likely attribution. These are important issues today and, notwithstanding continuing scepticism in some quarters, are valuable inclusions. Descriptions of the potential effects of global warming, including landslides, floods, rising sea level, increased coastal erosion and tsunamis, are necessarily speculative but should provoke pause for thought.

Chapter 6, ‘Places to visit’, must have been difficult to write. How can the geology and landscape of Scotland best be illustrated? There are too many sites to list here but among them Siccar Point and Edinburgh with Arthur’s Seat and Salisbury Crags (with Hutton connections), Knockan Crag and the thrusts that built NW Scotland, the Cuillin Hills of Skye, with some of the most spectacular scenery in Scotland, Speyside and the Culbin sands, the Machair of the Western Isles, and Torridon and the buried landscape of the Lewisian name a few. There is a broad range, from afternoon strolls between other sightseeing, as in Edinburgh’s Dynamic Earth and Glasgow’s Fossil Grove, to serious mountain encounters like the Cairngorms, Skye and Torridon (with appropriate warnings regarding proper equipment and preparation). The sites selected, spread across Scotland, are calculated to provide a fulfilling experience of much that it has to offer. The excellent illustrations are commonly an invitation in themselves. The list might even become something akin to the Munro or Corbett charts with individuals setting out to see them all!

There are shortcomings in this publication. The text is simply written, but may try too hard to avoid technical terms: a few more clearly explained would help. Some rock descriptions are misleading. There is occasionally a lack of rigour implied by phrases like ‘minute quantities of radioactive material that some rocks...contained at the time of their formation, are accurately measured’. These reflect on the authors but they imply poor copy-editing. The few typesetting errors include a number of wayward hyphens, as in sedi-mentary and concen-trate.

Sections of the narrative and some text boxes are marred by poor organization. Clear statements of the current view of a situation are sometimes followed by previous ideas that simply cloud the issue and may confuse the reader. It is important to know how views develop, but if these appear chronologically the reader experiences the progression, otherwise they seem irrelevant. As an example (Chapter 2) begins at ‘the mid nineteenth century’, referring to ideas regarding features later attributed to glaciation, but the next paragraph steps backwards and indicates that ‘in the late eighteenth century’ Hutton and Playfair already had the right answer.

There are problems with terminology, beginning with ‘Ice Age’. The Quaternary Ice Age is defined as beginning c. 34 million years ago and the text refers only to the Ice Age. The four major Pleistocene glacial intervals, corresponding with Milankovich cycles, are also traditionally referred to as Ice Ages. The description of Glen...
Hugh Miller: Stonemason, Geologist, Writer by M. A. Taylor, NMS Enterprises, Edinburgh, 2007. ISBN 978-1-905267-05-3. £12.99.

Mention of the very name Hugh Miller should excite all Earth scientists since it was this heroic man whose highly influential writings convinced 19th century society of the fundamental role that geology plays in human culture. That he did so at a time when Christian religious conviction was so powerful is a lesson that should be as relevant today as creationism starts to seriously pervade western civilization. This excellent biography by Michael Taylor of the National Museums of Scotland is thus a timely reminder of perceived conflicts between science and religion. Crucially Taylor is able to demonstrate that Miller, who died in 1856, three years before the publication of Darwin’s On the Origin of Species, ‘held a middle course between the Biblical literalists and those geologists and materialists who saw no role for God’.

The book presents a well balanced account of Miller’s life, his family, his manual and literary labours, his religion and his impact on the fledgling new science of geology. It also offers a new assessment of the man’s tragic suicide in his Edinburgh Portobello house on 23 December 1856. Much has been made of Miller failing to reconcile his religious beliefs with his understanding of geology, yet Taylor quite sensibly steers away from this rather simplistic interpretation, commenting that if ‘anything drove him to death it was a typically Victorian obsession with work’. However, there were other circumstances, such as Miller’s horrific nightmares and possible mental illness to bear in mind as well. Alan, suicide also happens in our hectic modern world and yet often there are no obvious reasons.

Taylor’s easy but thoughtful style takes the reader through Miller’s not untroubled Cromarty upbringing. In 1807 at the age of five he lost his father at sea, but was fortunate to learn much from his maternal uncles who saw to his education and encouraged his literary interests. Within two years of leaving school at 16, Miller took up the trade as an apprentice stonemason. Like many before and since, he soon discovered the toll that stone dust can take on the lungs, yet he learnt the trade and his experiences are vividly brought to life by Taylor, who liberally employs quotations from Miller’s own writings. These and other sources are referenced under Notes at the end of each chapter.

Stone masonry work took Miller to the Highlands and then to Edinburgh for the first time, but lung illness forced him to reconsider his future and he returned to Cromarty in 1825. There he carved gravestones and embarked on his literary career with the Inverness Courier after initially failing to interest this newspaper and other publishers with his poems.

Miller’s interest in fossils had been kindled at an early age and by the 1830s it was a serious occupation for him. Taylor reminds us that his work as a stonemason did not automatically lead Miller to palaeontology; rather it was the finds he made on the Cromarty beaches at Navity and Eathie which sparked his interest. These were later to be so evocatively described in Miller’s articles in The Witness newspaper which were then published in the enormously popular The Old Red Sandstone (1841). This book firmly placed Miller as one of the foremost writers on science and enhanced his reputation amongst the evolving professional and academic geological fraternity. Yet, as Taylor indicates, although Miller was a keen observer with an exceptionally enquiring mind,
he seldom wrote any scientific papers and it was through contacts via the Geological Society of London that the significance of his fossil finds, especially his fish fossils, was truly recognized by other geologists.

What is interesting is that Miller recognized the significance of the difference between his Old Red fossils, ‘the remains of a different creation’, and those in the Liassic strata collected at Eathie, which again differed from those in the modern seas. In a sense, the geological timescale that we know today would not have mattered to Miller, who had no difficulty in rationalizing the great antiquity of the Earth. By the 1850s he was well known and respected in scientific circles and it was through his suggestion that the young Archibald Geikie was recommended to Sir Roderick Murchison as a good recruit for the Geological Survey. A later recruit was Hugh’s son Hugh Miller (junior) whose Survey mapping career in northern England and Scotland (including Cromarty) neatly evoked the changing roles in the world of geology for the amateur and the professional.

Miller’s Presbyterian background and upbringing certainly inspired his support for opposition to ecclesiastical patronage – which amongst other things enabled lairds to impose their choice of parish minister on a congregation. Taylor narrates the dramatic moments and commentary which preceded the biggest split of the Established Church in the Disruption of 1843. He sets out the background to the dispute, and explains Miller’s critical role and his influential writings in The Witness, the twice-weekly mainstream newspaper published in Edinburgh which he edited from 1840. Such was the impact of his writings that The Witness overtook The Scotsman in circulation for a short period. However, it was not a religious newspaper and Miller wrote on many issues. For example, he championed the cause of people displaced in the Highlands during the Clearances. Today when so much emphasis is placed on ‘public appreciation of science’, this book reminds us of Miller’s amazing ability to both educate and inform his wide and appreciative Victorian readership. Numerous passages of his writings are quoted, which amply demonstrate how far he went beyond simply popularizing science.

Miller’s name and works were revered after his death for well over a century, but declined in recent decades as scientific specialization accelerated in an unprecedented way. His detailed, lengthy writings, once engaging to contemporary readers, have failed to appeal to modern audiences as new media were invented to hype the science which now more than ever is divorced from religion.

Taylor has provided a well researched and illustrated thesis of Miller for the twenty-first century, showing how relevant his observations and questions are for today. Well indexed and with a glossary, notes of places to visit, suggestions for further reading and additional reference sources, this book should inspire anyone with an interest in the development of geology and palaeontology through its post-Hutton formative years. Taylor also describes the influential role of Lydia Fraser, Miller’s wife for 19 years, who saw to the publication of many posthumous works.

Thanks to Taylor we have an exceptionally readable account of a geological hero whose name is now associated with an Alaskan glacier, a North Sea oil field, type specimens (Pterichthys milleri) and many Scottish city street names. Busts of Miller sit in the National Portrait Gallery and the Hall of Heroes of the National Wallace Monument, and his plaid-wrapt statue by Handside Ritchie stands guard over his native Cromarty to remind us of his significant place in human history and enlightenment. The Cromarty monument, built in 1859, is inscribed ‘In memory of Hugh Miller, and in commemoration of his genius and literary and scientific eminence this monument is erected by his countrymen’.

Reference

MILLER, H. 1841. The Old Red Sandstone, or New Walks in an Old Field. J. Johnstone, Edinburgh.

Andrew McMillan
British Geological Survey
Edinburgh

Palaeogene Volcanic Districts of Scotland (4th edn) by C. H. Emeleus & B. R. Bell with contributions from D. Stephenson, British Geological Survey, 2005. 212 pp. ISBN 0852725191. £18.00

This new edition has packed in even more information than the previous editions. Extensive lists of up-to-date references, use of the most current data, and excellent colour illustrations (including a 1:625 000-scale bedrock map of the relevant area) adds to the comprehensive content.

As the foreword says ‘the boundaries of the area covered by this volume are not easy to define, either geographically or geologically’. However, the authors have achieved an excellent balance of geographical coverage, detailed geological information and regional synthesis including offshore geology – an aspect most often overlooked.

The structure of the book is broadly chronological but branches out to cover relevant process-based concepts (with emphasis on igneous and structural components). The geological scene is set in the first four chapters which summarize the geology (chapter one), and gives a very useful overview of pre-Palaeogene geology (chapters two to four). Chapter five describes the Palaeogene igneous geology regional setting whilst chapters six to ten describe the (mainly) igneous geology from a process-based concept (e.g. lava fields, dykes and sills, complexes) with particular reference to geographical context. The text ably introduces these issues and includes, where appropriate, balanced discussion of current debate as well as detailed geochemistry and petrology where relevant. In this respect, it is a much more comprehensive volume than previous editions. Historical and scientific fundamentals are well covered and the very structured layout of the text makes basic
information relatively easy to retrieve, aided by very good indexing. Structural elements are described in chapter eleven. The remaining chapters deal with Late Palaeogene through to Quaternary geology in addition to a short but well-conceived chapter on the economic geology of the district. Overall, the content is wide-ranging and goes beyond the obvious igneous and structural information to include all relevant aspects such as palaeosols, associated sedimentary rocks, palynology and palaeogeography. Indeed, it is difficult to see what has not been included in this synthesis, and a check of the more obscure aspects that could, so easily, have been overlooked or omitted never failed to find at least some reference or comment.

A superb feature of this book is the substantial number of very clear and instructive colour figures and plates throughout the text.

The book achieves the difficult balance of content, being accessible for students, professional geologists and interested amateurs alike.

Overall, an excellent update to an excellent text and superb value.

Suzanne Miller
National Museums of Scotland

Bonanzas and Jacobites: The Story of the Silver Glen by Stephen Moreton, NMS Enterprises, Edinburgh, 94 pp. ISBN 1-905267-08-8. £9.99.

This illustrated softback book is a superbly researched history of the mines, their mineralogy and, as Stephen Moreton puts it ‘an extraordinary tale of fortunes made and lost, of Jacobites and Hanovarians, of a loyal and loving wife, of buried treasure and sunken treasure, of treachery and betrayal, of conspiracy and greed and with a cast as diverse as the Old Pretender and Sir Isaac Newton’. Stephen has expertly combined a sense of adventure with mineralogical science and mining.

The book is divided into four chapters. Chapter one, which is rich in historic detail, deals with the discovery of the mines and the part they played in the 1715 Rebellion. This is achieved by marrying extensive extracts from letters with evaluative summary of the historic documents available in such a way that excitement of the discovery and the dangerous intrigue of the times are brought to life.

The Government Steps In is the title given to chapter two. It begins by telling how the riches of the mine were revealed at the royal court in London and how Sir Isaac Newton, then Master of the Mint, on analysis of the ore was impressed, declaring it ‘exceedingly rich’. Stephen Moreton, with his eye for detail, continues by presenting how the Erskines, the mine owners, turned this royal interest to their advantage by securing a pardon for Sir John Erskine’s actions in support of the Jacobite cause and of the early exploration, survey of the ore deposit and extraction. Once again this is conveyed by presenting large extracts from historic documents. The suspicions, betrayals, risks, riches acquired and opportunistic scheming taken by the characters involved is splendidly reported and makes fascinating reading.

Chapter three tells of a second bonanza: the discovery of cobalt. This equally absorbing account begins by reporting the efforts in 1759 of Charles Erskine (the brother of Sir John) to rework the mines, which were in a considerable state of disrepair having lain idle for many years. Whilst making improvements that would ease further mining, a mass of ore was discovered when driving a drainage level below the original silver bonanza. The new ore was sent for assay to the eminent Scottish chemist, Joseph Black in Glasgow, who pronounced it to be an ore of cobalt. Previously all cobalt had to be imported and consequently this discovery caused a great deal of excitement. The book delves into this, once again drawing heavily on documents of the time, in particular the records of the newly formed Cobalt Mining Company and letters from several shareholders including the irrepressible potter and cobalt expert, Nicholas Crisp.

The fourth and final chapter deals with descriptions of the mine and minerals. With the diligence that is apparent throughout the previous three chapters, Stephen Moreton goes back to the earliest records and mine plans. He marries these with his own observations and produces conclusions that unravel the myths and discrepancies that have developed and become incorporated in the literature. He ends by describing the major ore minerals, summarizing the geological history and origins of the deposits, and giving some thoughts on future prospects.

In summary, this is a remarkable in-depth account of the history of the mines of the Silver Glen (near Alva, Clackmannanshire). Stephen Moreton has produced an outstanding fusion of history, mining and mineralogy. Bonanzas and Jacobites is strongly recommended to anyone who has an interest in the history of mining, the social history of the Jacobite era or Scottish minerals. Even those without such background interests will find this account riveting and a treat.

Brian Jackson
National Museums of Scotland