

Book Reviews

An Excursion Guide to the Moine: Geology of the Northern Highlands of Scotland. Rob Strachan, Ian Alsop, Clark Friend & Suzanne Miller (eds). Edinburgh Geological Society, Geological Society of Glasgow, NMS Enterprises Ltd, 2010. 298 pp. ISBN 978-1-905267-33-0, £17.99, paperback.

NMS Enterprises advertise the new Moine guide on their website as describing ‘the varied rocks and structures that occur within the largely metasediments of the Moine Supergroup of the northern and central highlands of Scotland’ and including ‘some of the finest outcrops of deformed and metamorphosed sandstones in Scotland’. I feel that the publisher’s statement perhaps undersells its significance. The guide is an updated and expanded version of the original, published in 1988. It omits two excursions in the Central (Grampian) Highlands and those in the Moine Thrust Belt in Assynt, but includes several new areas in the Northern Highlands: Ross of Mull, the Loch Duich-Glenelg-Loch Hourn area, Glen Strathfarrar, South Sutherland, Durness and Faraid Head and the Great Glen. As such it gives a more comprehensive view of the complex geology of this region. The guide has also expanded (and in parts deleted) the number of localities within individual excursions, generally to update them, but also to avoid outcrops that have deteriorated, become overgrown, or are considered less relevant with 22 years of hindsight.

The new guide is an A5-sized book weighing 650 g, with a glossy, card cover. The guide will not fit easily into an anorak pocket and my cover is already showing signs of creasing from light usage; hence, it will need to be cosseted to withstand the ravages of any significant field usage. The layout of this revision is more spacious, aesthetically pleasing and the text is easier to read. This improved user-friendliness is augmented by the colour-coded excursions, highlighted text panels, and coloured diagrams.

A few small, sparse colour photographs are included; the subjects chosen are somewhat arbitrary. The photographs range from very useful and informative, e.g. Excursion 11: Loch Eriboll, to futile, e.g. Figure 12.4: dark cliff at Sango Bay. In Excursion 14, I am puzzled why a view across Loch Lochy to a part-forested hillside (Fig. 14.4) was chosen; in contrast, the subsequent figure (14.5) complements the text, illustrating the nature of the various shear indicators at Rosemarkie. Sadly, several other photographs also add little to the field guide. I am not convinced that photomicrographs of the Eastern Glenelg eclogite and mafic granulite add value. Surely good field photographs would be more informative and useful. An opportunity to illustrate some stunning geology and scenery seems to have been missed.

In contrast the diagrams are clear, apposite and eminently usable. The maps generally show the simpli-

fied geology with the localities marked. That said, the mode of marking localities is inconsistent. Generally, the excursion maps show simple numbers that relate to individual localities, but some show the individual exposures at particular localities. Thus, Excursion 1 consists of 23 individual localities grouped into 4 itineraries plus 2 extra localities. In contrast Excursion 11 is divided into 4 transects described in running text with significant individual localities labelled 1A, 1B, ...1H, 3A, 3B, ...3K, etc. The inconsistent labelling is somewhat irritating, but fortunately does not hinder the reader significantly at individual outcrops, or even when undertaking whole excursions.

At whom is the guide aimed? This is spelt out concisely in the Editorial Introduction – a **must read** part of the guide. It has been written for ‘informed amateurs, undergraduate students and professional geologists’. The geological terminology certainly takes no prisoners and at many localities, more interpretation of the geology is included in the new guide. Hence, it is ideal for informed professional leaders taking the above listed clientele, but when used by individuals who are unfamiliar with these or similar rocks, some of the finer points, overall 3D geometry, and the wider significance of the localities may be difficult to grasp. The guide recommends using *The Mapping of Geological Structures* and *The Field Description of Metamorphic Rocks* as useful background reading, but asking visitors to assimilate this information without assistance, guidance or context is a tall order. Also, I note that the terminology in these volumes has not been rigorously applied by the contributors, e.g. many ‘isoclinal’ folds are merely tight, and just what is a meta-amphibolite (p.44)?

General advice and other caveats are also given in the Editorial Introduction. These include a reminder that many localities have SSSI status (or are cited in the relevant GCR review) and should not be hammered. There are numerous reminders at individual localities to this effect, and it is important to heed this advice. Hence it is strange that at the eulysite outcrop at Locality 7.4, the guide states ‘hammering is required to search out these layers for fresh samples’. For geological research purposes, permission to collect fresh samples may be obtainable from SNH, but other visitors should desist from hammering this unusual lithology.

The last paragraph of the Introduction succinctly highlights a problem with the correlation of structures within the Northern Highlands, pointing out that the D₁, S₂, F₄, etc. numbers given at individual localities have only local significance. Indeed, it is certainly possible that ‘D2’ structures may be Knoydartian (Neoproterozoic) in some areas, but Grampian (early Ordovician) or even Scandian (Silurian) in other areas. This does not detract from local interpretations but it does make it difficult for the reader to decipher the wider

geological framework and the tectonic history. It has also given rise to several different tectonic models for the Northern Highlands.

The guide has been written by 19 contributors whose ages range from the low 30s to the upper 70s. Their combined experience and expertise of the rocks of the Northern Highlands is huge and the guide represents a definitive account of the rocks and where to see representative sections, outcrops, etc. Unsurprisingly, the different excursions and interpretations given do reflect their authors' opinions to varying degrees. In general, care seems to have been taken to avoid subjective statements and contrary interpretations are briefly mentioned in several excursions, e.g. Locality 3.9, p.86; Locality 7.2, p.144; Excursion 11, transect 4, p. 219; Locality 12.1, p. 226. In several cases references are cited to enable the reader to probe further, e.g. end of Locality 3.6. Only rarely are more individual subjective interpretations presented, e.g. Excursion 7, p.152.

The original mapping done by the contributors stretches back over 50 years and some excursion accounts show their age in the lithostratigraphical terminology used, which does not always conform to modern usage or accepted international schemes. It is acknowledged that these rocks are difficult to describe and categorize, and there is a strong historical legacy. However, little attempt seems to have been made to rationalize the terminology of rock units or even to use the Geological Society scheme for Precambrian Moine rocks (Holdsworth *et al.* 1994). In Excursion 3 (Glenfinnan to Morar), Figure 3.1 gives useful stratigraphical columns that show the relationships of the stratigraphy to the regional structure, but in the descriptions of Localities 3.4, 3.6 and particularly 3.7 the 'group' terminology of Powell (1964) holds sway. Other problems arise with the use of the terms Lewisian and Lewisianoid. Lewisian units relate unequivocally to the Archaean and Palaeoproterozoic foreland gneisses, e.g. Lewisian gneisses of the Moine Thrust Belt, whereas Lewisianoid denotes basement units of similar lithology, age, etc that cannot be directly correlated. This distinction is well explained in the Introduction to Excursion 13 and is applied consistently in excursions 9–13. However, Excursion 8 that covers the Strathfarrar Lewisianoid inlier only mentions the term Lewisianoid in the key to Figure 8.2. Similarly, in Excursion 6 it only appears in the introductory panel and in the keys for Figures 6.3 and 6.5. In both chapters, Lewisian is used throughout in the text. Conversely, in Excursion 4 the tiny Lewisianoid outcrop by Kinloch Hourn is labelled Lewisian on Figure 4.8. In the Summary of Geology (p.11–12) the term Lewisianoid is eschewed in favour of 'inliers of Archaean orthogneiss' and 'basement'. Yet, this seems a more logical place to define the term.

The Summary of Geology does a good job in succinctly describing the complex make-up of the Northern Highlands, its geological history and the numerous interpretations of its sedimentary, metamorphic and tectonic features. I would quibble with the assertion that

Moine deposition 'developed on the eastern margin of Laurentia at the same time as various crustal blocks separated from west Laurentia to form the Pacific Ocean', attributed to Dalziel & Soper (2001). More recent work, e.g. Li *et al.* (2008), has documented the formation of Rodinia at around 1000 Ma and formation of the proto-Pacific Ocean considerably later. The suggestion on p.19 that Cambro-Ordovician shelf sediments may once have been deposited unconformably on the Moine succession (attributed to Anderton 1985) is also suspect. However, the diagrams could have been improved. Figure S.1 shows a mix of structural and stratigraphical units for the Moine succession with an arbitrary change across the Strathconon Fault. In addition, Figure S.3 would benefit considerably from the addition of colour.

The guide contains detailed advice as to how to access the excursions, both by vehicle and on foot. I have not checked the multitude of grid references given; but a quick run through does reveal a few errors. I note that the NGRs for Localities 3.8 and 3.9 (R. Glendinning) give both the grid letters (NM) and the corresponding numbers (17). This is misleading as other localities merely define the 100 km grid square by the letters. They should read NM 613 842 and NM 668 933 respectively. Also Locality 8.3 should be NH 1990 3884 (not NG). On Fig. 11.11 the northing value should read 56, not 62, as it does on the right hand side. I note that grids are missing from Figures 4.4, 6.3, 6.5, and both grid and scales from Figures 14.1, 14.2 and 14.3.

The text itself seems largely free from typographical errors – good copy editing. Minor errors are p.19 (Figs S.2a and b): Bingen *et al.* 1998); p.188 (Loch Molach not Morlach). There is inconsistency with hyphens: semipelite (semipelite); micro-diorite (microdiorite); hornblende-bearing granitoid; mono-clinal. The figures show a few more errors. The main and possibly only misleading one is the location of Excursion 4 on Figure F.1. This is shown as between Loch Arkaig and Loch Nevis but should lie farther north to finish at Loch Hourn. The key is missing from Figure 6.4 (refer to Fig. 6.1). Minor text errors also occur on Figures 3.1 (E. MORAR |GROUP), Figure 14.2 (Hign strain), Figure 10.5 (Cemetery). Excursion 14 would benefit from the addition of generalized geology to Figure 14.1 and the inclusion of a geological map for Locality 14.7.

The new Moine guide can be likened to a secondhand car. It is mechanically sound, but may not be in the colour and trim that you would choose, its mirrors do not quite match, and it has a few dents, scratches and stone chips and the odd worn tyre. However, it is the only 'mode of transport' available. The guide is similarly indispensable if you need to visit geological localities in the Northern Highlands and want to appreciate and begin to understand the nature of the Moine and related rocks.

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British Regional Geology: Northern England (Fifth Edition). British Geological Survey, 2010. 294 pp. ISBN 978-085272652-5, £18, paperback.

Perhaps in these austere times, Mr Gradgrind from *Hard Times* would demand we weigh up the bare facts to compare this revised fifth version of the *Northern England* volume of the *British Regional Geology* series. The new edition has 294 pages compared to the 132 of the fourth edition published in 1971. The new edition is filled with colour diagrams, photographs and maps and retails for £18. While the fourth edition sold for 40p in 1971, the cheapest copy I could find online was £2.75 and you could easily pay over £10. By using the website *Measuring Worth* (<http://www.measuringworth.com/ukcompare/>) 40 new pence in 1971 comes out as the equivalent of £9 in 2010.

However, these stark, utilitarian figures while persuasive, do little justice to the huge difference between the two editions both in terms of the amount and quality of information presented in the new edition and the innovative and imaginative use of illustrations and bold typeface to pick out geological units within blocks of text (e.g. **St Bees Sandstone Formation**). Works, doesn't it?

For the purposes of BGS, Northern England covers an area running from the Scottish Border to a line running roughly from Morcambe Bay in the west to Teesside in the East. The Isle of Man is also included by extension of this line into the Irish Sea. As with other titles in the *Regional Geology* series, the subject material is divided broadly by time interval. However, the authorial team has made sensible decisions about when to split off particular topics into their own chapter. A welcome development is eschewing the previous approach of treating igneous and metamorphic events within their

own single chapters. This creates more integrated overviews of all the rocks within a geological interval or lithodemic unit. Such an Earth systems view makes it easier for non-specialists to understand the linkage between various events and the interdependence of different areas upon each other to understand the geological processes involved fully.

Indeed, the most striking difference between the new and previous editions is the way that much of the same evidence available to the geologists who worked on the 1971 edition has been significantly reinterpreted within a plate tectonics framework, which is noted in the preface to the new edition. If ever one needs to make the case that geology is a young and dynamic science, a comparative study of the two editions would make an instructive case. Gone are: geosynclines, obsolete explanations of faulting and outdated lithostratigraphy. In are: plate tectonics, Earth systems science; sequence stratigraphy, new isotope data and climate change.

The intended audience for such a volume is a broad one, but a good balance has been struck between providing detailed information for researchers and university-level readers and relating the events that have shaped the geology and landscape of Northern England in a linear narrative. In particular, many users, such as local government officers, conservation bodies and engineers, lack a detailed training in Earth sciences. Thus the tone of such a book has to be carefully pitched. The book succeeds in being informative and detailed without resorting to over-simplification and strained analogy that can be found in too many popular texts. As a researcher, I use the *Regional Geology* series to gain a rapid overview of an area and its broader history and the current text makes far more information available in one volume than the 1971 edition. However, the detail is not overwhelming and the lack of in-text citations avoids breaking up flow of the text, which should both avoid intimidating readers, unused to academic texts, and enhance their enjoyment of the book. A downside for me, as a palaeobiologist, is that many classic palaeontological monographs are now omitted in the selected bibliography, consulting the BGS Sheet *Memoirs* and older versions of the *Regional Geology* series would easily rectify this. The BGS has done much to integrate its electronic data and, along with the Ordnance Survey, has recently made most of their digital data freely available. Thus it is useful to have the reference numbers for the photographs and internal BGS reports included in captions and the reference lists, which make searching in the online BGS library catalogues easier.

A detailed reading of two chapters where I have more specialist knowledge (Carboniferous and Permian–Jurassic) is the sternest test of the quality and rigor of the text that I can provide. Certainly the stratigraphy and geological concepts are up-to-date, and the authors always extend their scope outside of Northern England when explanation or clarity requires it. Many of the block diagrams, again in full colour, are very instructive. Illustrations of fossils that were line drawings in the previous edition have largely been replaced by colour