

Book Review

British Regional Geology: South of Scotland (4th edn) by P. Stone, A. A. McMillan, J. D. Floyd, R. P. Barnes & E. R. Phillips. 2012. British Geological Survey, Nottingham. 247 pp. ISBN 978-085272-694-5, £18 (paperback).

This very attractively produced volume covers the geology of the Southern Uplands and the adjacent Girvan–Ballantrae district in the SW of the Midland Valley. A plastic wallet inside the back cover contains a 1: 625 000 bedrock geology map of southern Scotland (including a part of the SW Highlands) and part of northern England and shows the area covered by the book in its wider context.

As noted in the foreword to the volume, the previous edition was published in 1971 and was largely prepared in the late 1960s, before the widespread impact of plate tectonic theory on so many aspects of geological thought. The influence of that conceptual revolution is no more apparent than in the vigorous debates and huge advances made in interpreting the Lower Palaeozoic rocks of southern Scotland. The region is important not only for the understanding of the geological evolution of Scotland but also that of the rest of the British Isles and eastern North America. The presentation of the volume, abundantly illustrated with colour photographs, maps, cross-sections and diagrams, also represents a quantum leap from its drier antecedents.

The book both documents the geology of the south of Scotland and seeks to explain it. Most chapters begin with a general summary of the succession, structures or igneous rocks of the time interval it covers and an outline of what they mean in terms of palaeoenvironments and geological history. In some chapters specific topics are also discussed at a fairly simple level, such as turbidity currents and their deposits in the Ordovician and Silurian, aspects of stratigraphical classification and interpretation in relation to the Carboniferous successions and the record of climate change in the Quaternary sediments.

An introductory chapter summarizes the geological history of the region as presently understood. The widely accepted interpretation of its plate tectonic evolution at the margin of Laurentia during the Ordovician and Silurian is outlined here and explored in greater detail in subsequent chapters. It is recognized that some uncertainties remain; a comment with which I fully concur. The summaries of the post-Silurian units in this chapter develop a picture of deposition commonly being controlled by reactivation of Caledonian structures and of the tectonic effects of progressively more distant orogenies.

A wide range of geological, geochemical and geophysical information is synthesized and very well illustrated in the subsequent chapters. Representative fossils from many of the time intervals are also illustrated. Interpretations are summarized in diagrams ranging from block models of sedimentary environments to crustal cross-sections or plate tectonic

reconstructions. The captions to some of these rightly acknowledge a degree of uncertainty and some interpretations are open to debate but, again in contrast to earlier editions, they reflect an admirable mission to explain rather than simply document the geology of the region.

The Ordovician and Silurian successions of the Girvan–Ballantrae district are described separately from those of the Southern Uplands, which lie to the south of the Southern Uplands Fault – though at first glance the boundary of the area covered by the volume shown on one of the figures could be misinterpreted as being that fault snaking round the north of Girvan. That apart, the complex stratigraphies and structures of both areas are well summarized in the text and clearly illustrated in figures where the use of colour helps enormously. The ophiolitic Ballantrae Complex continues to be the focus of international interest and its obduction is considered as part of a much more widespread early Ordovician arc collision event at the Laurentian margin. The use of graptolites in establishing a stratigraphical framework for the Southern Upland successions, pioneered by Charles Lapworth in the early 1870s, is stressed here and in the introductory chapter. The graptolite biostratigraphy is of major importance in untangling the overall structure of the area and it resulted in the internationally recognized base of the Silurian System being formally defined at Dob’s Linn, near Moffat, in 1985.

A separate chapter summarizes the Caledonian structural and magmatic histories of both the Girvan–Ballantrae and Southern Upland areas in the context of the closure of the Iapetus Ocean. This culminated in the area becoming a rapidly eroding upland region. A short chapter describes Devonian volcanic units and the largely Devonian non-marine sandstones and conglomerates of the ‘Old Red Sandstone’ deposited here. Appropriately, the angular relationship between the Old Red Sandstone and the underlying steeply dipping Silurian rocks is highlighted at Siccar Point and near Jedburgh; two of James Hutton’s famous unconformities. As documented in the next chapter, during the succeeding Carboniferous Period much of the Southern Uplands formed a fairly low-lying barrier between the Midland Valley Basin to the north and the Northumberland–Solway Basin to the south. However, the eastern part of the region and its southern margin were areas of deposition during the Carboniferous as were basins interpreted as palaeovalleys within the Southern Uplands such as around Sanquhar and Thornhill. All these areas contain a wide variety of sedimentary rocks, many of them showing cyclicity. Their depositional environments ranging from alluvial to open marine are well described, as are the effects of syn-depositional faulting.

The Variscan Orogeny resulted in the uplift and some deformation of the Carboniferous basins of southern Scotland and Chapter 7 describes the subsequent non-marine

Permian and Triassic successions and their depositional environments in the western part of the area.

The Jurassic to Palaeogene history of the area is summarized in a single short chapter. Apart from Palaeogene mafic dykes there is no rock record from this long period of geological time in the south of Scotland but the chapter includes some reasonable speculation on possible subsidence, deposition and uplift based on the histories of adjacent areas. A much more substantial chapter documents the Quaternary history of the region based on both the glacial and periglacial landscapes formed during this interval and the sediments deposited during the period. All this is done in the wider context of Quaternary climate change.

The final chapter 'Geology and man' summarizes the very varied natural resources currently or historically provided by the region including coal, sands and gravels, crushed rock aggregates, limestone, clays and mudstones for brickmaking, building stones, aquifers and a plethora of metalliferous and other minerals. All bear testimony to the importance of geology to society.

The volume concludes with a bibliography, arranged chapter by chapter, and an extensive index. Apart from a very few figure captions, there are no references to previous work in the body of the text. This can cause frustration if one

wishes to follow up particular points made in the text but it does make the chapters flow more freely and makes them more accessible to the reader just looking for an overview. The bibliography provides a route into the literature that underpins the overall synthesis provided by the volume. Of course one could quibble with some of what is or is not included in the bibliography. As a palaeontologist, for instance, I would like to have seen more of the extensive literature on the macro- and microfossil faunas of the Girvan cover succession included, but it serves its purpose and the determined researcher will find the papers on topics not included within it.

This new edition of the south of Scotland volume in the British Regional Geology series is an information-rich but very readable account of an area that has been the focus of a huge amount of geological research in recent decades. Interpretations of the geology will evolve and new data will come to light but I am sure this will be the standard account of the area for many years to come. I am pleased to recommend it to anyone interested in the geology of this very varied and fascinating region

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