

Book Reviews

Circum-Atlantic orogens

Harris, A. L. and Fettes, D. J. (editors) 1988. *The Caledonian–Appalachian Orogen*. Geological Society Special Publication No. 38. Blackwell Scientific, Oxford. 643 pp. Price \$146 (hardback).

This volume is based on the 5-day symposium held in Glasgow in September 1984 at which were presented papers representing the end-product of research in IGCP Project 27—The Caledonide Orogen. The results of the first symposium of the project, held in Dublin in 1978, gave rise to the Geological Society's Special Publication No. 8—*The British Caledonides—Reviewed*. In contrast to the earlier volume, the editors of *The Caledonian–Appalachian Orogen* have presented the work in four time slices, each related to a particular stage in the evolution of Iapetus and its successor oceans. In each of the periods the entire orogen has been covered, with papers ranging from faunal provinciality, palaeoenvironments, tectonism, isotopic dating, metamorphism, volcanism and plutonic activity as appropriate. A final paper in each section attempts to review the main tectonic events of that time stage in the evolution of the orogen. In addition, a preliminary section deals with 'geophysical' aspects of the orogen. Not surprisingly, in order to keep the text within limits, the articles are for the most part written in a condensed review style. Thus readers looking for new data or details of a particular area or aspect of Caledonian geology will not find them in this book. On the other hand there is a wealth of references; something like 150 pages (25%) of the book contain reference lists, and although many of the references have been cited in several papers, the book provides an invaluable source for Caledonian–Appalachian literature.

It is most unfortunate that publication of the volume was so long delayed. Although the editors argue that most items have been revised up to 1986, the whole flavour of the book reflects the 1984 view of the orogen. Many of the papers have been superseded in part or in whole by more recent reviews by the same or other authors. New data on particular aspects have demonstrated errors in both fact and interpretation. This is particularly noticeable with the work on isotopic dating. There has been a burst of activity in both the Scottish and Scandinavian Caledonides such that the age of the main Dalradian deformation in the Grampians and of the Finnmarkian deformation in North Norway are both now considered to be Pre-Caledonian, a possibility considered by none of the contributors to the volume. Another example is the recent surge of interest in terrane tectonics as applied to the Circum-Atlantic Palaeozoic orogens, which has resulted in many models interpreting the orogens in terms of terrane analysis and of oblique plate motions. This approach, recognizing the importance of transcurrent displacements, is only seriously considered in the volume, for the Appalachians.

A welcome consequence of including Appalachian geology in the volume is to introduce Variscan events into a study of the Caledonides. These are included in the fourth time slice (mid Devonian–end Permian), and, although the section deals largely with the end Acadian and Alleghanian orogenies in North America, there is a particularly interesting paper on floral and faunal provinces and another on fluvial sedimentation in NW Europe.

As with most of the Geological Society's special publications, the standard of editing and production is generally very high. Readers, however, may find the spelling of Iapetus in place of Iapetus in some of the North American contributions irksome. On the whole, despite the fact that much of the contents is already out of date, I think serious workers in the Appalachian–Caledonide Orogen will want to buy this book. In the words of the editors: the volume is "intended to indicate the 'state-of-the-art' knowledge of the orogen in 1984" and in this I am sure it is successful.

Cardiff, U.K.

R. A. Gayer

Circum-Atlantic terranes

Dallmeyer, R. D. (editor) 1989. *Terranes in the Circum-Atlantic Paleozoic Orogens*. Geological Society of America Special Paper 230. Geological Society of America, Boulder, Colorado, U.S.A. 277 pp. Price \$45.

In his preface, editor Dallmeyer explains that "Project 233 of the International Geological Correlation Program was established in 1985 to provide a forum of exchange between earth scientists attempting to develop similar terrane concepts in Paleozoic orogens of the circum-Atlantic realm". This book could be viewed as the vanguard of the IGCP 233, in that it offers a collection of 15 papers in which workers from most Paleozoic orogens around the north Atlantic will find a good summary of the geology of their region written in the light of terrane concepts by a key researcher(s). Much of the material is not new, but the value of this publication is that it will make well-established data and ideas more accessible. The book is laid out as a series of independent papers, each accompanied by an extensive reference list necessary for such regional overviews (20% of pages). In providing an outline of the regional geology and tectonic history of their areas, the authors appear to embrace terrane concepts and terminology with varying degrees of reluctance or enthusiasm, controlled mainly by the ease with which the concepts can be applied. Many authors provide a useful and stimulating summary of 'open questions' or 'outstanding problems' for their area, either as a separate section or as discussion throughout their text. Strangely, papers on the important Paleozoic orogens of Spain and Portugal are absent and thus the book cannot be called comprehensive.

Stephens and Gee provide a clear summary of well-defined terranes and their emplacement in the Scandinavian Caledonides, while Ohta, Dallmeyer and Peucat focus on the smaller but immensely complex region of Svalbad in northern-most Scandinavia. Hutton describes the principal Caledonian terranes defined in the British Isles. Gibbons tackles the 'prime suspect terrane country' of Anglesey, North Wales, defining three Precambrian terranes and using some dubious field terminology ('knockers'): Franke gives an introduction to the wealth of data amassed on central Europe, where Variscan tectonothermal events predominate but where terrane definition is ambiguous. Comparison of Franke's treatment of the Bohemian Massif with that of Chaloupsky highlights the controversy still surrounding the description and interpretation of the geology of central Europe. Frisch and Neubauer boldly attempt to reconstruct the Paleozoic geotectonic setting of the eastern Alps from basement zones by applying the terrane theory. Piqué outlines the Paleozoic and Precambrian history of Morocco which lay on the edge of the west African craton. Unfortunately, I found that his figures did not satisfy the demands of his text. Lécroché, Dallmeyer and Villeneuve provide a clear summary of the evolution of the West African orogens where polyphase tectonics (Pan-African and Variscan) complicated the resolution of terranes. The coverage of Proterozoic events in many papers is necessary to provide the complete geological story; however the paper by Caby on the late Proterozoic belt of SW Nigeria and NE Brazil which has no Paleozoic history is out of place in this collection.

Keppie provides a highly authoritative paper on Northern Appalachian terranes and their accretion in which he redefines the term 'terrane'. In contrast, the majority of authors adopt a less rigorous attitude to terrane theory and few discuss the terrane terminology or concepts used. Keppie's paper contains a considerable amount of very detailed data in the form of superb time–space diagrams. Gromet discusses the implications of finding a late Paleozoic age for the accretion of Upper Proterozoic Avalonian terranes in New England. Horton and Drake delineate, interpret and classify 26 terranes accreted and amalgamated through four orogenies in the central and southern Appalachians. They usefully point out that terrane analysts can, philosophically, be divided into 'splitters' and 'lumpers', i.e. those

who tend to define several terranes when in doubt about the relationship between tectonostratigraphical units, and those who prefer to lump them all together in case they are related. Dallmeyer covers the terranes of the southern Appalachians, the Atlantic–Gulf coastal plane and their correlatives in west Africa. That the definition of terranes in the southern Appalachians is far from resolved can be clearly detected by comparing the terrane maps of Dallmeyer and Horton *et al.* Neuman and Max examine the possible correlation of early Paleozoic orogenic events around the north Atlantic.

An expanded and more unifying preface by the editor would have been useful; for example this would have been a perfect opportunity to advertise other publications and achievements of the IGCP 233 project. Particularly deserving of a mention here is the 'Tectonic map of Pre-Mesozoic Terranes in the circum-Atlantic Phanerozoic Orogens' (1:5,000,000, Oblique Mercator projection) of the North Atlantic region also published in 1989 by Keppie and Dallmeyer (\$25). This map, the first in a series of three, is a superb and comprehensive synthesis of stratigraphical and tectonic data from around the North Atlantic and in my view, could have been constructively linked to this publication.

Overall, this book is a useful collection of high quality papers produced to a high standard with good quality print and clear diagrams. The book benefits greatly from an effective index. It is certainly good value by today's standards and will, I expect, be particularly attractive to North American geologists.

Mary Ford

Plymouth, U.K.

Geological maps

Boulter, C. A. 1989. *Four Dimensional Analysis of Geological Maps: Techniques and Interpretation*. John Wiley & Sons, Chichester, U.K. 296 pp. Price £14.95 (\$41.95 in U.S.) (paperback).

During the first reading of *Four Dimensional Analysis of Geological Maps* I found the book most irritating. This I eventually attributed to the title which I will never like. On reading the book a second time I found the text both enjoyable and informative and suggest that future readers ignore the title.

Typographical and factual errors are rare and the presentation and style of text is clear and visually appealing (keywords are displayed in bold characters). Most of the diagrams are clear and do not suffer from the absence of colour. I felt that a few of the diagrams are rather too complicated (e.g. Fig. 9.34, p. 176) or cluttered (Fig. 9.40, p. 182) for an introductory text.

Chapters 2–5 cover the basics of map interpretation (rule of "V"s, etc.) and they are particularly clear and concise. Chapter 2 is a useful introduction to base maps, a topic often ignored in undergraduate courses. The description of remote sensing methods in map construction and interpretation (Chapter 5) is very useful and one of the most appealing features of the book.

Chapter 6 entitled "The Fourth Dimension—chronology" describes the various chronological frameworks used in the interpretation of geological maps and conveys accurately many of the problems in correlation. This chapter is well suited to undergraduate studies.

In the preface the author emphasizes that the text is introductory and admits in the acknowledgements his own bias towards structural geology. Unfortunately, Chapters 7–9 suffer from this bias. While an understanding of geological processes will always improve map interpretation these chapters go beyond that which may be considered introductory (e.g. Fig. 9.24, p. 166 and Fig. 9.29, p. 171). This may result in students believing that the interpretation of geological maps is structural geology and not a basic skill. From the tone of the preface I doubt that this is the wish of the author. The contribution of these chapters to map interpretation can be assessed very easily; Chapters 7, 8 and 9 contain, respectively, one, four and four real examples of geological maps when these chapters contain five, 39 and 45 figures, respectively. This is in marked contrast to Chapters 10 and 11 within which 50% of the diagrams constitute actual examples. The small number of examples is the main deficiency of this book but this could be rectified in future editions.

In many respects this is an excellent book for first year undergraduate classes. In particular, it conveys an impression that the interpretation of geological maps can be enjoyable; this is its main advantage over other texts on the subject.

The interpretation of geological maps is a skill that we are losing from the geological community as a whole; this book is one of only a few that goes some way to reversing that trend.

Graham J. Potts

Liverpool, U.K.

Problem maps

Bennison, G. M. 1990. *An Introduction to Geological Structures and Maps (5th edn)*. Edward Arnold, London. 69 pp. Price £4.95 (paperback).

This book, now appearing in its fifth edition, is one of the "problem-map" genre, of which several are published in the U.K. The maps, rarely based on real situations, depend largely on the construction of straight, parallel and equidistant structure-contours to define the geometry of formations which are uniformly dipping or folded into non-plunging planar-limbed folds; unconformities and faults are also commonly planar. The unreal nature of the maps is furthered by the fact that usually neither the stratigraphic order of formations nor their dip direction is given, and the artificiality persists to the extent that the strike of formations is commonly N–S (sometimes E–W), that the structure contours for different formations neatly coincide, and that dip and thickness values are nice round numbers.

I consider that such maps, far from helping students to interpret real geological maps, do positive harm. Because these maps focus on 'solving' a map (fitting a series of straight lines between the dots, making one dip calculation and establishing the stratigraphic order), the student simply does not *think* about the relationship between the boundary and the topography, but grabs a ruler. In spite of the exhortations of the author of this book to draw stratum-contours freehand because they are "seldom strictly parallel in nature" and to try to deduce the basic structure from outcrop patterns, these unreal maps do not encourage this behaviour.

Of course, real maps state the stratigraphic order, if known, and give us all the dip information available. Having said that, I think one reason these unreal maps became popular in the U.K. is the very variable, but often shameful, presentation of information on our Geological Survey maps in the past. Contours on our 1" to 1 mile and 1:50,000 maps are rarely visible through the murky colours and confusion of rocks and buildings, while dip arrows, if present at all, often have no values at their heads. Compare with the excellent U.S.G.S. maps of the same scale!

No doubt, defenders of such books (and there must be many recommending them to their students) would argue the need for such simple maps and solutions before confronting the complexity of nature. I accept that one or two such maps have a place to introduce some basic principles, but all experience of interpretation should be based on real maps with boundaries, faults and folds portrayed as the more or less complex surfaces they are.

The real enemies here, I suspect, are the examination boards in the U.K. who persist in the examination of such maps and thus influence their use in schools. I quote for instance, from the requirements for the practical examination in "A" level Geology of the Joint Matriculation Board: "The determination of the geometry of geological boundaries . . . (from) . . . the construction of stratum contours (strike lines) (*exercises will not be set involving curved stratum contours*)" (my italics). At University, students who have taken this examination find it very difficult to kick the straight structure contour and problem map habit and they have a very poor appreciation of the meaning of outcrop patterns on real maps.

The attraction of this book to University students, apart from its easy solutions, is the price. However, I would urge my students to go for the recently published, reasonably-priced, book by Lisle or even to consider those by Butler and Bell and by Boulter, all of which emphasize the use of real situations.

REFERENCES

- Boulter, C. A. 1989. *Four Dimensional Analysis of Geological Maps*. John Wiley & Sons, Chichester, U.K.
 Butler, B. C. M. & Bell, J. D. 1988. *Interpretation of Geological Maps*. Longman, Harlow, U.K.
 Lisle, R. J. 1988. *Geological Structures and Maps*. Pergamon Press, Oxford.

J. E. Treagus

Manchester, U.K.