

The introductory chapter covers a limited spectrum of material; briefly outlining maps in terms of relief, scale, map types (solid and drift), geological boundaries, cross-sections and symbols.

Chapter 2 is concerned with the basic principles and techniques employed to interpret maps, and covers them in two parts. The first part deals with stratigraphical nomenclature and the determination of stratigraphical sequence from a map. The second part of Chapter 2 includes the determination of dip and strike, the use of sedimentary structures, the significance of width of outcrop, the construction and use of structure contours, and the solution of three-point problems.

In Chapter 3 the discussion of individual groups of structures begins with folds. The reader is presented with a traditional description of fold geometries and attitudes which includes the analysis of morphology using dip isogons. Some discussion of boudinage is included in this chapter as well as the mechanics of folding.

The treatment of folds continues in Chapter 4, with particular attention being given to the effects of folds on outcrop patterns. There is also a full treatment of the influence of fold attitude on structural-contour patterns. Fold profiles are considered in terms of horizontal folds and rigorous methods for constructing profiles of cylindrical or parallel folds are given. Some of these methods have been superseded by stereographic techniques. Finally, contact strain in buckle folds and the importance of décollement surfaces are briefly discussed.

With Chapter 5 the organization of the book is changed; the description of structures and their representation on geological maps being combined into single chapters. Joints, veins and faults are discussed in Chapter 5, although the first two categories of structures are considered only briefly. Thus, the chapter rightly concentrates on faults, especially their morphology, attitude, senses of displacement and kinematic and dynamic classifications. Surprisingly, maps are little used to illustrate general points although the chapter is well illustrated.

Chapter 6 shifts to igneous rocks and their structure, with volcanics being considered first. Rock types are introduced, including some descriptions of textures in hand-specimens, a topic which is perhaps out of place in a book about structures and maps. Central volcanoes, lava plateaux and calderas are briefly described but other volcanic forms are not mentioned, and no maps of active or extinct volcanoes are included. The remainder of the chapter is concerned with intrusive rocks and begins with the effects of cross-cutting relationships, angles of inclination and concordancy. The next section about the occurrence of minor intrusions is well presented with excellent maps. Finally, major intrusions are considered, though no maps of lopoliths are included.

'Unconformities' are treated in a traditional manner in Chapter 7 with emphasis being given to types of unconformities, overstep, overlap, uplift and marginal unconformities, relative dating and reactivation. Illustrations in Chapter 7 include some simple subcrop maps.

In Chapter 8, 'Cratons and Orogenic Belts' Roberts describes some structures or processes not previously mentioned. For example, he deals with cleavage, refolding and migmatitic textures. There is, however, little attempt to demonstrate interrelationships between structures or to assess the general characteristics of the structural suites that are distinctive of cratons or orogens.

The book concludes with a bibliography of other texts in structural geology and allied disciplines, a list of British Geological Survey Maps and a comprehensive index. The execution of the line drawings used throughout Roberts' book is excellent, the use of graded ornament being particularly effective.

As a whole, the book suffers from attempting to integrate two topics (maps and structures) while nevertheless treating them separately. Somewhat surprisingly, examples from published maps of 'real areas' are not extensively used despite the hopeful comments in the preface. Although Roberts deliberately avoids too much discussion of the mechanical aspects of the genesis of structures, some of his accounts of deformation processes are dated. The book can, however, be recommended as a text with a traditional approach to structural geology and a strong emphasis on geological maps.

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The British Variscides

Hancock, P. L. (editor) 1983. *The Variscan Fold Belt in the British Isles*. Adam Hilger, 217 pp. Price: hardcover £34.00.

A paragraph on the dust cover of this nicely presented volume tells us that original contributions from leading specialists have been brought together to give the reader a comprehensive view of the Variscan fold

belt. This is not altogether true. In fact, the Variscan fold belt was carved up into divisions, mainly regional but also into aspects of the geology; each division was given to a specialist or small team to describe and the results put in order. The divisions are rational enough but the product is not comprehensive and the individual chapters are mainly reviews and not original contributions.

Before making an appraisal of this book I should like to say that, in my opinion, what is missing is a distinct head and tail. Whilst Rast's opening chapter goes some way to heading the volume it really contains material that should constitute a final chapter in which there is an integration or at least an attempt to find common threads to what had gone before. As it is, the volume ends in damp-squib fashion, fading into speculation and a couple of pages of useless tabulations.

The opening chapter deals with features of Variscan geology common to North America and Europe and the broad evolution of the belt. This is followed by chapters (2) on southern Ireland and then, in turn, South West Wales (3), the South Wales coalfield and its setting (4) and Bristol, the Forest of Dean and adjacent areas (5). Most of the rest deals with the South West Peninsula: on the deformation (6), the Lizard and pre-Orogenic volcanic activity (7), the granite batholith and post orogenic volcanism (8) and a separate chapter (though by the authors of Chapter 8) on the origin of the magmas and their relations to the evolving structure (9). Then follows a chapter reviewing recent (and not so recent) geophysical work in and around South West England (10) and the final chapter (11) is on sub-surface Variscan rocks through South East England into the Continent.

The space allocated to each of these must reflect the editor's view on the state of knowledge of the division or his assessment of its importance, and thus the equal weighting of southern Ireland and South West Wales may be justified. There is, however, an imbalance, so that constraining southern Ireland to twenty-seven pages might lead the reader to the view that it is a province with more stratigraphy than structure, no igneous rock component and not much to report in the way of geophysical studies. The chapter on South Wales, in contrast, becomes almost a field guide as well as a comprehensive account of stratigraphy and structure. Such imbalance is, I believe, inevitable and not a serious criticism.

Considering the space apportioned, the chapter on Ireland (2) is a good account and can be read with pleasure. In Chapter 3 the authors present a modern view of ground well known through the classic account by E. M. Anderson. There is emphasis on structural development and, apart from some curious phraseology and use of terms, it is a useful and readable review. Chapter 4 makes the geographical link between South West Wales and the Forest of Dean and Bristol districts. It is essentially a review with emphasis very strongly on the structure of the South Wales coalfield and its margins. Chapter 5 contains more stratigraphy but the structural geology is well described with a good account of the influence of early structures on Variscan deformation and the relations between structural evolution and stratigraphic development.

In Chapter 6 things go awry. Again the chapter is essentially a review and this must be expected in view of the diversity of the geology and the extent of the area. But, in reviewing literature, there is an obligation to present a balanced account of controversial problems and this the authors fail to do. Central to Hobson & Sanderson's chapter is detail of the 'problem of the fold confrontation' in mid South-West England, and the authors cite selected references from literature published between 1959 and 1973 to explain their point, completely neglecting more recent work. It is now established (e.g. Freshney *et al.* 1976, Isaac 1981, Stewart 1981, Turner 1981), that structures in this area are dominated by flat thrusts; allochthonous units with associated minor structures were stacked from south to north. In his introduction to the volume, the editor tenders what amounts to an apology; 'After the main text . . . had gone to press . . . relevant articles were published in the *Journal of the Geological Society* . . .' (i.e. Shackleton *et al.* 1982, Isaac *et al.* 1982) but this is only a poor excuse since descriptions of the thrusts were published some time ago. Much of the area in question is not well exposed and the detail only emerges after long days and weeks have been spent in painstaking mapping; it is not safe to project lines inland from cliff exposures. In a discussion of the paper read by Sanderson & Dearman (1973) John Sutton asked what efforts the authors had made to use the available palaeontological and stratigraphic information. The answer given then was somewhat evasive. Ten years on, much more data has slowly been accumulated and the question has more relevance than ever.

Old and experienced hands take on the igneous rocks of Devon and Cornwall for Chapters 7, 8, and 9. (It is not clear why Chapter 9 is separated from Chapter 8 which it follows logically and naturally.) All three chapters are well prepared and constitute a needed and hence

valuable synthesis so that we might excuse some overlap in content and treatment with appropriate chapters in other recently published syntheses. Predictably, Chapter 9 is open to criticism and one feels that the authors were rather happier writing up and interpreting their data than treading the shifting ground of magmatic-tectonic relations. Chapter 10 can be divided into two parts, dealing with Devon, Cornwall and the English Channel first and secondly the Bristol Channel area and South Wales. A pessimistic note is struck at the start 'it will be suggested . . . little of relevance to Variscan geology can be derived from existing survey data'. The tone brightens, however, and some interesting (if in places speculative) results are discussed. The final chapter has already been mentioned. Here speculation reaches its height and if interpretations of stratigraphy and structure between outcrops are as the author herself states 'the results of inspired guesses' they had better be left out altogether. How much better if the editor could have presented us at the last with an integration, showing how Ireland fits into the pattern, indeed how Devon and Cornwall relate to South Wales, the Cornubian batholith to the rest, and just what the 'Variscan front' really was.

Finally, a reviewer must try to decide whether a book should be recommended. The awful question then is—for whom? and one wonders why this volume was compiled in the first place and who the editor and authors hoped to serve. Of course it is a source book for geologists working in the Variscides and specialists need a broad frame for their own findings. Overall, I cannot imagine that it will become a best seller, though tutors are advised to be aware of its contents, at

least those who set essays on magmatic rocks of South West England, or put undergraduates to map in Pembrokeshire.

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