

My immediate impression on examining the book was that the list of chapter headings seemed strangely organized. For example, it would seem more logical for the chapter on the description of mesoscopic structures (11) immediately to precede the chapter dealing with the structural analysis of these structures (8), rather than be placed three chapters later. It is also clear from the chapter headings that most of the chapters deal with the basic methods of geometric analysis. Consequently Chapter 10, which is essentially an essay on experimental rock deformation, comes as something of a surprise. Although it is clearly written and is one of the chapters I enjoyed reading most, it does not fit comfortably or logically with the other chapters. Perhaps this is to be expected in multiply authored texts.

As well as the standard chapters that can be found in all structural manuals there is an excellent chapter (12) on fracture analysis which provides a lucid and helpful guide to data collection and processing. I was however rather disappointed with the casual (and misleading) definitions given for the conditions necessary for the formation of shear and hybrid (shear/extension) fractures, definitions of crucial importance to this chapter. The authors state that shear fracture occurs when all the principal stresses are compressive and that hybrid fractures form when one of the principal stresses is tensile and when the Mohr circle touches the failure envelope at two points. They omit to mention that the essential condition that determines whether shear or hybrid fracture occurs is the state of normal stress across the potential fracture plane. If this is compressive (and this condition can be achieved under conditions where all the principal stresses are compressive or when one of them is tensile) then shear failure results. If it is tensile, hybrid fracture occurs. This criticism does not, however, significantly detract from the contribution this chapter makes to an area which few books have had the courage to tackle.

Topics such as stereographic projection, structural analysis in both single- and poly-deformed terrains and the description of mesoscopic structures are adequately covered and compare favourably with other comparable texts. The chapter on the analysis of two-dimensional strain (15) provides a brief introduction to strain and illustrates the main techniques of strain determination. It was however disturbing to read in the introduction to this chapter that we would be primarily concerned "... with permanent strains that develop as a consequence of plastic deformation". Using the term plastic, with its specific rheological implications, as a synonym for the more general term ductile (which is used elsewhere in the chapter) seems rather casual, especially in this context. In defining the parameters of strain it could have been made clearer that the parameters relate to strain "in a particular direction". I would also have liked to see a distinction made between lines of no longitudinal strain and lines of no finite longitudinal strain. It was refreshing to see the chapter rounded off with a brief discussion of the use geologists make of strain data once it has been acquired.

The explosion of interest in cross-section balancing and section restoration in the last 10 years requires that the subject be covered in any teaching manual. Chapter 14 provides a good introduction to this subject. I was particularly impressed by the second half of the chapter which successfully introduces the various problems associated with cross-section balancing by considering a series of progressively more complex examples. The chapter deals only with thrust systems and ignores extensional structures and the balancing of sections from extensional terranes. Consequently techniques such as the chevron construction are not covered.

It is difficult to produce a book of this size devoid of minor errors and this book has its share of typographical errors and errors of omission (e.g. labelling missing from diagrams). Sometimes the errors are particularly unfortunate, as for example in Chapter 1 where, after carefully distinguishing between the rake (pitch) and plunge of a lineation, the text refers to the plunge of some slickensides in figure 1 but quotes the pitch. Nevertheless, on the whole the book compares favourably with other manuals and I would recommend that it be given serious consideration by anyone involved in giving an introductory course in structural geology. However its price is high for a paperback (particularly in £ sterling), which could limit its sales as a student course book.

REFERENCES

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- Ramsay, J. G. & Huber, M. I. 1983. *The Techniques of Modern Structural Geology. Volume 1: Strain Analysis*. Academic Press, London.
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- Rowland, S. M. 1986. *Structural Analysis and Synthesis: A Laboratory Course in Structural Geology*. Blackwell Scientific, Palo Alto.
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- ### Map interpretation
- Lisle, R. J. 1988. *Geological Structures and Maps*. Pergamon Press, Oxford. 150 pp. Price £9.95 (flexicover), £19.50 (hardcover).
- There has long been a need for a book which tackled the interpretation of geological structures from maps with the logical approach that this book adopts. It breaks away, largely, from the dependency on unrealistic 'problem' maps used by past texts and yet is not as esoteric in its approach as two other recently published books in the same broad field (Moseley 1979, Butler & Bell 1988). In spite of the reservations I express below this excellent little book should be a suitable text for many first-year courses in British Universities as well as for some A-level syllabuses. I doubt, however, the publisher's 'blurb' that it will match G.C.S.E. syllabuses.
- The book, subtitled *A Practical Guide*, is concerned with the interpretation of simple structures from geological maps. It deals in turn with uniformly dipping beds, folding, faulting, unconformity, igneous rocks and folding with cleavage, the first three chapters being the more substantial. The geometry of the relevant structures is well described, definitions and classification are meticulous and the principles of map interpretation carefully explained. This is aided by excellent diagrams and sketch maps often using two colours and good use is made of some 40 black and white photographs. Most chapters contain some worked examples and each concludes with problems using small maps, often based on real situations, as well as photographs. No answers to the problems are given and there is no indication of what the publisher's response would be to a request to photocopy maps for class use. Few text errors were discovered, although on problem 3.6 there is one small area wrongly ornamented and one dip value seems incorrect.
- My most serious criticism is of the approach to the recognition of folds. The author, quite properly, encourages the student to distinguish outcrop (boundary) patterns that are a consequence of folding from those due to topographic interference. However, throughout this chapter there is little emphasis placed on the simple analysis of dip information in the recognition of fold geometry. All the example and problems maps which are meant to distinguish fold and topographic effects on boundary patterns depend on the identification of hinge points and axial surface traces from the drawing or envisaging of structure contours. In each case, because of the absence of any dip information, there are at least two possible ways of drawing quite regular structure contour patterns, giving contradictory interpretations. This reveals the limitations of the 'problem' map, which generally the author eschews; real maps of single-phase folding of this simple geometry would (or should) contain sufficient dip information to distinguish between these interpretations.
- I would also have liked to have seen more emphasis on the use of the known stratigraphic order in the interpretation of structure and vice versa. Although proper emphasis is given to the use of structure contours, their use in the construction of both profiles and normal cross-sections is not explained. Some consideration should also have been given to the construction of hinge shape where there is neither plunge nor structure contour information. A modified Busk construction would have been useful and I would have expected at least a mention of the problems of balancing and restoration.
- In the chapter on faulting, the emphasis is on classification and the distinction of slip and separation. I would have liked to have seen more attention given to faults, especially to their mutual attitudes, their relation to shortening and extension of the crust and in general to their geometry on real maps. Unconformities are quite fully treated (though not the analysis of non-planar surfaces) and igneous rocks receive a short but not unreasonable treatment in the context of the book. However, I would like to have seen more than two problem maps bringing the various aspects of interpretation together.