gashes and stylolites); structures associated with homogeneous deformation (cleavage and lineations) and those which characterize heterogeneous deformation (folds and boudins). Incremental strain markers (pressure shadows and synkinematic crystals) are also considered. Lastly, as an appendix, some elements of tensor analysis and methods of finite strain measurements are given.

This book is original in that it favours a kinematic interpretation of structures rather than geometrical description alone. Its appreciation may well depend on a similarity of geological philosophy in the reader.

Finally, one must note that one of the advantages of this book, which will be translated into English, is its low price due to the camera ready copy.

Le livre de A. Nicolas, "*Principes de tectonique*", n'a pas son équivalent en français: il rassemble tous les apports récents concernant l'analyse des structures dans les roches déformées et leur interprétation en terme cinématique.

On y trouve d'abord les notions élémentaires de contrainte et de déformation, de la théorie de la déformation discontinue et de mécanisme de déformation continue. Cette partie de l'ouvrage est présentée très classiquement dans les trois premiers chapitres. Les chapitres suivants son consacrés aux structures: les structures caractéristiques de la déformation discontinuet (failles, joints, fentes de tension et stylolites), les structures liées à la déformation continue homogène (schistosité et linéations) et les structures liées à la déformation continue hétérogène (plis et boudins) sont successivement examinées. Les objets susceptibles de renseigner sur l'histoire (zones abritées, minéraux syncinématiques) sont inclus dans cette partie de l'ouvrage. Enfin, en annexe, sont donnés des éléments d'analyse tensorielle et de mesures de la déformation finie des roches.

L'originalité de l'ouvrage est bien évidemment de privilégier l'analyse cinématique par rapport à l'analyse géométrique. La question posée par l'auteur est celle de l'interprétation et non de la description. Chacun verra, dans ce choix, des avantages et des inconvénients.

Le succès de ce livre auprès des étudiants français qui n'ont pas à leur disposition une grande littérature sur le sujet, dans leur langue, est certain; ceci est sans nul doute dû au fait qu'il s'agit d'un livre de base, simple et clair et sa présentation économique est un encouragement supplémentaire.

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The R_f/ϕ technique

Lisle, R. J. 1985. *Geological Strain Analysis: A Manual for the R_f/ϕ Technique.* Pergamon Press, Oxford. 99 pp. Price: hardcover £11.50; soft cover £6.95.

This book is exactly what it says it is, a manual for the R_f/ϕ technique. Before readers are carried away by ecstasy at the thought of a book title and publisher's blurb that tell the truth, I should hastily add a caveat. The terminology of strain analysis is very precise and the "R_f/ϕ technique" is very different from the "unstraining R_f/ϕ technique"; in other words the book devotes almost all its attention to the analysis of originally random fabrics of the type very rarely seen in untectonized rocks. Even accepting the book at face value causes some difficulty because several nettles are not grasped, though the fairly specific restriction of scope does allow some grace. The theory of strain analysis involves some of the fundamental questions in structural geology but these are not tackled head on when they encroach upon the topic in hand. A much debated question is the geometrical relationship between planar/linear tectonic elements and the strain ellipsoid but this only rates a couple of lines. The phrase grain-boundary-sliding is nowhere to be seen despite the implications of this mechanism for strain analysis.

This book reflects the dichotomy of approach between analysts of finite/total/cumulative strain and those of strain histories. Page one in fact seems to suggest that nothing can be determined of the latter yet it is clear that analysis of initially non-random fabrics can only be successful if the strain history can be defined. In this regard the interesting debate of Siddans (1980) by De Paor (1981b) and Siddans (1981a) does not figure nor does another debate between these two authors on the subject of the R_f/ϕ method (De Paor 1980, 1981a, Siddans 1981b).

Much of the literature of strain analysis is liberally sprinkled with strings of assumptions which many people may find uncomfortable, thus letting them slip from view. The assumption/restrictions are not clearly spelt out in this text and several disturbing problems are left dangling. A handbook should guide the uninitiated firmly through the quagmire but here some quicksands were not fenced off. Non-ellipticity of markers was broached but the reader was told that little was known of "errors incurred by the use of markers which deviate in shape from exact ellipses". We are told a knowledge of initial shape factors is the basis of much strain analysis but page sixteen says "little is known of their R_i/θ properties". Rare 3-D analyses of tectonites (e.g. Bell 1981) appear to confirm our state of ignorance.

The acid test wasn't performed, that is, to ask a beginner to have a go at strain analysis of ellipsoid objects using this handbook. However, I suspect all would not be plain sailing. Several aspects were more clearly explained in the original publications and a series of omissions could cause problems (e.g. axes and curves on some graphs not labelled, R_i curves not formally named when introduced, and different lines on a graph having the same ornament when the text refers to them differently). The number of type-setting/proof-reading errors is mercifully small considering the abundance of elaborate equations.

The main advantage of the book is the publication of the standard R_i and θ curves for a variety of strain states making the method less exclusive. Unfortunately the limited scope means an opportunity was lost to produce a more definitive exposition on the fundamentals of strain analysis.

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Earth Science

Press, F. and Siever, R. 1986. *Earth* (4th edition). Freeman and Co, New York. 626 pp. Price: hardback £32.95; paperback £16.95.

The book, which first appeared in 1974, is written by two distinguished American geoscientists of whom one is a well-known sedimentologist at Harvard and the other has been a science adviser to the President of the U.S.A. It is written for first year university students who often have no particular intention to specialize in geology. The philosophy of the book is explained in a preface, although some of the suggested aims cannot be easily combined in an elementary presentation. To quote a few of the claims: the text is "broad", "stresses concepts", "shows how science is actually done", indicates "bases of geologic theories", "emphasizes dependence of geology on physics and chemistry", "is about geologic processes" and "methods", and "integrates the newest discoveries". That the authors by virtue of their experience and position are capable to carry out their complex task can be accepted; the real question, however, is whether this actually can be done.

The twenty three constituent chapters are divided into three parts, with the introductory part I referred to as Prologue, part II concerned with surface processes and part III with internal processes. Part I introduces basic geological notions, such as Earth's place in the solar system, its material composition, geological time and elements of structural geology. In general, part I reasonably presents a variety of geological concepts, although it is not clear why chapter 4 on structure, which suffers from minor errors, has been included at this stage.

Conversely, chapter 2 on geological rock record is valuable since it gives a non-geological reader a very direct impression as to how geologists work.

Part II deals with surface processes and is probably, from a geological standpoint, the most valuable part of the book. It relates surface phenomena to the environment. The topics such as landslides, water cycle and ground water and sedimentation are especially well presented, although deltas and associated phenomena, as well as oceanic processes, could have been treated more systematically.

Part III ideally should be the most basic part of the volume, yet it suffers from a somewhat uncoordinated approach. For instance, the chapter on plutonism precedes that on volcanism, magnetism and gravity are combined into too short a chapter and the chapter on crustal deformation carries a bias: orogenic movements are emphasised while extensional movements are virtually ignored. We are still in the throes of eugeosynclines and miogeosynclines. Chapters 22 and 23 on planets and matter and energy from the earth have the appearance of addenda, rather than integral part of the book.

Throughout the volume there are so-called boxes in which a more in depth treatment of specific issues, such as various calculations and elucidations are presented. Many of these are beyond the interest of elementary students who do not intend to become geologists. The same can be said about the suggested additional references at the end of each chapter, some of which are of research calibre.

The illustrations, and particularly photographs, are good throughout, although some of the graphs are too complex, while diagrams such as figure 17-18 are misleading in so far as it is not clear whether it is a map or a cross-section. There are remarkably few typographical errors.

If it is thought that this criticism is somewhat carping, it should be pointed out that at the time when the first edition of the book appeared, it was probably the most exciting elementary text in North America and elsewhere. The present edition does add something and introduces some aspects of new discoveries, but unsystematically and in my view, too selectively. Considering that many advances of the last few years have been on the borderline of structure and geophysics there is too little of this in the book. For instance, COCORP is briefly mentioned, but not in the index. References in the chapter on structure are restricted to M. P. Billings and E. S. Hills. Structural observations are adopted from texts with out-of-date interpretations. For instance in figure 17-4, crenulation foliation involving pressure solution is interpreted as shear. In a not entirely satisfactory section on orogenic belts (pp. 531–545) there are most curious statements such as that during collision "continental crust loses its rigidity", or that thrust-sheets often include "foreign fragments thrust inland". The next paragraph does talk about foreign terranes, but to an elementary student the equivalence of a terrane and fragment is not always clear, and aren't they supposed to be exotic terranes, anyway? Thus, the impression is given that the Taconian movements did not affect the Piedmont and that the Avalonian never existed. The relationship of high-grade crystalline cores of mountains (internides) to the low unmetamorphosed externides is not mentioned. The idealized section of the Canadian Shield (fig. 21-7) is uninstructive and is basically wrong, since the long evolutionary nature of the shields is entirely lost.

All in all this volume at the present time is not as good as its predecessor was in 1974. It may be that the present times demand new constructions and new texts or it may be that this is just a transition stage toward the next impression when the book will be recast and would acquire a new vitality.

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Global geophysics

De Bremaecker, Jean Claud 1985. *Geophysics: the Earth's Interior*. John Wiley & Sons, New York. 342 pp. Price: $29.95.

It is about a decade since a spate of books appeared propounding and explaining the theory of plate tectonics and reviewing our understanding of the way the earth works. Since then much of the tentative evidence used in establishing the theory of plate tectonics has been reinforced and new research has been centred on subjects like the dynamics of plate movement and lithospheric evolution. This book is derived from this body of knowledge and is the result of several years of teaching the subject. It is written for undergraduates with a background knowledge of mathematics and physics and who are familiar with the general concepts of plate tectonics. It is not another 'plate-tectonics' book but one which deals with the more global or academic aspects of geophysics as they relate to the structure, behaviour and processes of the earth's interior.

Geophysics is divided into the usual branches of seismology, gravity, geomagnetism and heat flow, and each branch is considered separately. The emphasis is on what each branch of geophysics tells us about the interior of the earth, and how answers are provided to specific questions. Instrumentation and measurements are covered only briefly, and at the end of each section rather than the beginning.

Such material only forms about half the book. The remainder is concerned with topics related principally to seismology and heat flow. In the part concerned with seismology there are sections on elasticity, harmonic analysis and linear systems, and in the part concerned with thermal aspects there are sections on viscous flow, temperatures in the earth and convection. The section on elasticity deals with stress and strain, elastic constants, and mentions the factors that need to be considered when using scale models in geology. There is a thorough explanation of the way fault-plane solutions are obtained and a discussion of attenuation of seismic waves and the quality factor. Simple but important facts are mentioned, for example, the fact that not all large earthquakes occur near plate boundaries, and the fact that tides are not caused solely by the gravitational attraction of the Sun and Moon. Some interesting pieces of information are included, for example, that Vening Meinesz was very tall and all the time he was at sea in a submarine making gravity measurements he was unable to stand upright.

The book is well written, there are a moderate number of equations, and ample figures. About one third of the figures are from other publications and some of these reproduce rather poorly, particularly when they have been reduced in size from the originals. Throughout the book there are short sections differentiated from the main text. These contain additional material, generally more mathematical in nature, and which are not essential to an understanding of the main material. Likewise, problems are given after some topics and the student advised to try and solve them. Several of the problems require the ability to write simple computer programs. This is surely a sign of the times. A set of solutions is not given in the book but is available from the publisher. There are six short appendices including lists of mechanical and magnetic quantities and basic information about the earth.

A reasonably priced book covering global geophysics at a moderately advanced level and suitable for college students is certainly needed, and this book goes a long way to satisfying that need.

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