Journal of Structural Geology, Vol. 13, No. 10, pp. 1197 to 1199, 1991
Pergamon Press plc. Printed in Great Britain

BOOK REVIEWS

Deformation and tectonics—a birthday dedication to H. J. Zwart

Knipe, R. J. and Rutter, E. H. (editors) 1990. *Deformation Mechanisms, Rheology and Tectonics*. Geological Society Special Publication No. 54. The Geological Society, London, U.K. Price £85, $142.

Volume 54 of The Geological Society of London Special Publications addresses a broad range of issues in rock deformation. The editors R. J. Knipe and E. H. Rutter ought to be congratulated for a thorough job in selecting a group of competent authors, choosing outstanding papers and molding manuscripts into a uniform frame. Throughout, the scientific and technical quality is excellent and many contributions will become classics which will be quoted for years to come. An extensive subject index helps to identify topic of interest. The volume is an outgrowth of an international conference on tectonics and microstructures which was held at the University of Leeds in March 1989.

The 47 papers from 90 authors are divided into eight groups: (1) The role of water (such as hydraulic fracturing, changes in pressure during seismic faulting, and alteration); (2) Fracture and faulting (the influence of heterogeneities, mineralization and strain rate); (3) Instabilities and localization (again emphasizing the heterogeneous nature of deformation and its causes at different levels from mantle phase transformations to stylolites in limestones); (4) Flow mechanisms and flow laws (dealing mainly through experiments with ductile deformation of single and polycrystals); (5) Rock fabrics (a pot-pourri of papers among which modelling of recrystallization of quartz could lead to a new approach to texture analysis); (6) Deformation of weak sediments (field observations are interpreted relying on mechanical principles); (7) Experimental modelling using analogue materials (closely related to the previous chapter but with an experimental approach); and finally (8) Deformation mechanisms and tectonics (with attempts to interpret microstructural observations on a larger scale). The spread of topics is very wide and so is the scale which ranges from the submicroscopic (e.g. high-resolution electron microscopy of dislocation cores) to the tectonic. In all sections there is an excellent mix of experimentation, modelling and natural observations. The volume emphasizes brittle and low-temperature deformation, which distinguishes it from other deformation volumes published in recent years. Curiously though, the successful brittle–ductile fault stress analysis of the French school is absent among the topics. However there is an impressive section on instabilities which provides access to phenomena which are of crucial importance to structural geology. Contributions on low-temperature deformation, fracture, faulting, pressure solution and mechanical properties of soft sediments dominate, and papers on intracrystalline ductile flow appear a bit misplaced; in a journal they may have received a wider exposure. But it is excellent to bring both groups together and personally—with my research interests more in the ductile regime—I found the book to open new perspectives and provide fascinating reading. I have been surprised to see how little contact there seems to be between geotechnical engineering/rock mechanics and geologists. In ductile deformation there is much more awareness of research in materials science.

Most contributions are research papers; some sections are introduced by reviews. The research papers are more impressive and it is amazing how many superb contributions this volume contains. Admittedly a few have been published in similar form elsewhere but several long-awaited and carefully prepared computations of new experimental results (including valuable data) and interpretations (for example on halite and calcite rocks and crystals) are finally complete. The volume ranks on a similar level as the famous Memoir 79 of the Geological Society of America and is highly recommended to those interested in the quantitative and mainly microstructural effects of deformation. At a list price of $142 it may not find its way onto many personal bookshelves but is essential for libraries where ever there is a Geology Department. One may also consider becoming a Fellow of the Geological Society of London and receive it at a bargain price of $68.

The volume is dedicated to the work of Hendrik Jan Zwart of the University of Utrecht on the occasion of his 65th birthday. His contributions to metamorphic and structural geology, particularly in the orogenic belts of the Pyrenees, the Caledonides and the Alps have indeed been monumental. Curiously this volume does not deal with any of the issues which brought Professor Zwart his reputation (except perhaps the last paper on Alpine deformation on Naxos) and in none of the 47 articles is there a single reference to Zwart's work. To remedy that it would have been nice to have the Preface of Emile den Tex followed by a list of Zwart's publications.

H.-R. Wenk

Berkeley, U.S.A.

Seismology for physicists

Gubbins, D. 1990. *Seismology and Plate Tectonics*. Cambridge University Press, Cambridge, U.K. 339 pp. Price $59.50 (hardback), $27.95 (paperback).

This is a well-written textbook for final-year undergraduate physics students, based on a course taught by the author and Dan McKenzie at Cambridge University. The Preface states that the main aim of the course is to give physics and mathematics students a broad but quantitative exposure to one aspect of modern geophysics, seismology.

The first chapter introduces the reader to earthquakes, seismic waves and a layered Earth with an outermost shell of plates responding to internal convection and conduction. The second chapter rapidly covers the mathematical background for elastic waves, deformation, strain, gravitation, stress, energy, heat conduction and density in the Earth. Exercises (a total of 68), guides to further reading, and a useful summary end this and succeeding chapters.

The next four chapters form the core of the book. Elastic waves (P, S, Raleigh and Love)—their reflection, refraction, dispersion and polarization (Chap. 3); travel-time tables and curves, velocity determinations including inversion methods, and specific methods for the location of earthquake epicenters and focal depths (Chap. 4); free oscillations, spherical and torsional oscillation modes of the Earth (Chap. 5); the earthquake source: seismic moment, the double-couple force system, fault-plane solutions, and synthetic seismograms (Chap. 6).

The final chapter introduces the physics student to plate tectonics. It briefly describes basic plate theory and its historical development, then presents plate movements and poles of relative motion, marine magnetic anomalies, cooling and sinking of oceanic lithosphere, subduction depths, and triple junctions. The plate history of the northeastern Pacific is given as an example.

The book shows well many connections between seismology and plate tectonics. It has many good, clear illustrations and examples. I especially liked the five long practical problems (102 pages, 30% of the book). Working through the practicals gives the reader an appreciation of the techniques used in studying dispersion and free oscillations in surface waves, locating an earthquake, performing a fault-plane solution, and calculating movements of triple junctions and plates through time. All or portions of 80 seismograms are included in the book, for use in the practicals, but some are too poorly reproduced to be usable. Stereo- and equal-area-nets (figs. 4.24 and 6.10) are included for the practicals, but they are printed sideways (east to top!) and reduced 50% (which is alright but the equations on pp. 130–131 must be changed because R is changed).

There are too many other drafting, lettering, caption or printing errors in the figures (1.1, 1.6, 3.2, 4.18, 6.7b, 7.1, 7.22, 7.24 (2), 7.28). Equation (4.5) has the ratio of shell radii inverted. I found a small number of other text misprints.