

The penultimate chapter is titled 'Rheology of the crust and mantle' compared with 'Fracture and flow in the crust and mantle' in the first edition. The original title more accurately describes the chapter's contents in that fracture as well as flow mechanisms are described in the new edition, including a section on brittle deformation. The main theme, however, is deformation of the lithosphere by creep mechanisms and flexure. Stress release by fracture and energy release through earthquakes is described and finally there is a short section on the viscosity of the mantle.

As a conclusion to this book, the author gives us a well-balanced review of current ideas on the mechanism of global tectonics. The historical development of various hypotheses are all included; contracting Earth, expanding Earth, the convection hypothesis, hypotheses dealing with the mechanisms of plate motions and continental splitting.

How accessible is this predominantly geophysical treatise to geologists with an interest in solid Earth processes and structural mechanisms but whose background is not strongly mathematics or physics orientated? The author set out to capture such an audience and in my opinion has succeeded even if at times he assumes a detailed understanding of geophysical techniques for the fullest appreciation of results being quoted. As a reference book it is likely to be valuable to the majority of working geologists and geophysicists. It is well illustrated and clearly written with a comprehensive reference list appended for each chapter.

R. McQuillin

REFERENCES

- McKenzie, D. 1978. Some remarks on the development of sedimentary basins. *Earth Planet. Sci. Lett.* **40**, 25–32.
 Sleep, N. H. & Snell, N. S. 1976. Thermal contraction and flexure of mid-continent and Atlantic marginal basins. *Geophys. J. R. astr. Soc.* **45**, 125–154.

Volcanic reading

Decker, R. & Decker, B. (editors and introductory passages) 1981. *Volcanoes and the Earth's Interior* (Readings from *Scientific American*). W. H. Freeman and Co., San Francisco. 141 pp. Price: hardcover £14.95; softcover £6.95.

This 141-page volume is a further collection of general review articles previously published in *Scientific American*, following a related theme. There are 10 articles of which the oldest was published in 1975 and the youngest in 1982.

I. *Volcanoes and Plate Tectonics*.

- (1) M. N. Toksöz. The Subduction of the Lithosphere (1975).
- (2) K. C. Macdonald & B. P. Luyendyk. The Crest of the East Pacific Rise (1981).
- (3) K. C. Burke & J. Tuzo Wilson. Hot Spots on the Earth's Surface (1976).

II. *Volcanic Products: Lava, Ash and Bombs*.

- (4) D. L. Peck, T. L. Wright & R. W. Decker. The Lava Lakes of Kilauea (1979).
- (5) L. R. Kittleman. Tephra (1979).
- (6) R. Decker & B. Decker. The Eruptions of Mount St. Helens (1981).

III. *Volcanic Windows into the Earth's Interior*.

- (7) P. J. Wyllie. The Earth's Mantle (1975).
- (8) K. G. Cox. Kimberlite Pipes (1978).
- (9) R. K. O'Nions, P. J. Hamilton & N. M. Evensen. The Chemical Evolution of the Earth's Mantle (1980).
- (10) R. B. Smith & R. L. Christiansen. Yellowstone Park as a Window on the Earth's Interior (1980).

The title of the book provides the prospective reader with a good indication of the contents of this series of papers. The articles cover the products of volcanic activity, mantle process generating volcanic activity and the evidence from volcanism for mantle petrology and geochemical evolution. As there is a related theme between the articles, and each one was originally published in *Scientific American* as a stand-alone article, it is inevitable that there should be considerable repetition on basic features such as the outlines of plate tectonics or the controls of volcanism.

The first section 'Volcanoes and Plate Tectonics' contains three good articles, especially that by Macdonald & Luyendyk which describes a portion of the East Pacific Rise near the Gulf of California. This provides fascinating reading and links different scientific disciplines with the description of hydrothermal activity which reaches a

temperature of 350°C, carries sulphides and has associated with it an unusual biological community. This is followed by a clear description of geophysical evidence for magmatic activity just beneath the ridge crest. Burke & Tuzo Wilson's 'Hot Spot' article also provides interesting reading. However, some of the features described, such as the number and location of hot spots and their importance in the initial generation of a spreading ridge are not universally accepted. This perhaps highlights one of the failings of *Scientific American* reviews in that they are presented as factual accounts and areas of controversy or alternative arguments are not always highlighted.

The second section covers 'Volcanic Products' and includes an article by Peck, Wright & Decker on lava lakes. A well-documented account of lava solidification is provided for these unusual environments. An inevitable account of the Mt. St. Helens' eruption is included and covers ground that is available in other similar publications.

The final section includes an article by Wyllie on the 'Earth's Mantle'. This is the least innovative of the articles, and is largely a basic description of physical properties of the mantle and their interpretation which is standard material in many text books. Cox's article on kimberlites is based largely on mineralogical evidence while O'Nions, Hamilton & Evensen examine the evolution of mantle as determined from isotopic ratios. This article is a very clear and concise treatment of an involved subject. It is in contrast to some appalling terminology used by Smith & Christiansen in their article about the Yellowstone Park volcanics. This is evidenced in their description of the simple difference in SiO₂ content between rhyolite and basalt with the sentence 'Where more than 72 percent of the rhyolite consists of silicon dioxides only 50 percent of the basalt consists of them'. However, this is only a minor point as in general the articles are well written and at a level attractive to both professional and interested layman. One point that would improve presentation and understanding of the text would be the numbering of the diagrams and appropriate reference to these in the main text. It is annoying to read a section of text and then overleaf to find a diagram making that text so much easier to follow. Why *Scientific American* persists in this practice is difficult to understand.

In conclusion, therefore, this series contains well-written and presented articles that offer up-to-date interpretations and theories. It should prove a good, reasonably priced, investment for both the non-specialist and interested layman.

D. Robinson

Mammoth lakes: geological unrest

Rinehart, C. D. & Smith, W. C. 1982. *Earthquakes and Young Volcanoes along the Eastern Sierra Nevada at Mammoth Lakes 1980, Lone Pine 1872, Inyo and Mono Craters*. William Kaufman, Inc., Los Altos, California. 63 pp. Price: softcover £4.50.

This small book describes earthquake and volcanic activity along a 250-km length of the eastern fault boundary of the Sierra Nevada in California. It is a book that is written for the interested layman, with general descriptions of the 'Pacific Ring of Fire' and measurements of earthquake intensity using the Richter scale.

The major earthquakes in the region at Mammoth Lakes in 1980 and Lone Pine in 1872 are described in journalistic fashion and old newspaper illustrations and headlines are reproduced. The major attraction to the geologist will prove to be the excellent photographs of the fault lines, scarps and uplifts of the area.

The recent volcanic alert, issued by the U.S.G.S. for the Mammoth Lakes region, will have heightened geological interest in the area. The geological tourist would therefore find this book a useful purchase with its excellent photographs, maps and brief description of the volcanic geology. In general, however, there is little of interest to the average geologist, not visiting the area, to attract their attention.

D. Robinson

Splitting continents

Illies, J. H. (editor) 1981. *Mechanism of Graben Formation*. Elsevier, Amsterdam. 266 pp. Price: hardcover US \$65.75, DFL. 135.00.

J. Henning Illies, the editor of *Mechanism of Graben Formation* and the foremost authority on the Rhine graben, died in the summer of 1982 and thus sadly this volume must be his epitaph. Illies' short

preface explains the background to the book and the internationally sponsored conference from which it arose. *Mechanism of Graben Formation* (17th in the series 'Developments in Geotectonics' and formerly parts 1 to 3 of volume 76 of *Tectonophysics*) contains eighteen papers divided among six sections: (1) modelling graben formation, (2) crust and mantle structure, (3) stress regime, strain release and geothermal implications, (4) geological contributions: active rifts, (5) geological contributions: extinct rift valleys, (6) epilogue.

As with several other books about grabens, edited or co-edited by Illies, this one understandably over-emphasizes the Rhine graben (half the contributions) at the expense of other rifts, in particular the East African rift. Perhaps more surprising than the emphasis on the Rhine is that the book does not include at least one article on graben fields, such as those of the Basin and Range Province in the U.S.A. or the western Turkish–Aegean region; both terrains characteristic of broad zones of intracontinental spreading within generally convergent regimes. Likewise, it is also surprising that space was not found for contributions on the tectonic implications of listric fault geometry and extensional allochthons. The omission of these topics is particularly difficult to understand considering that the book contains several articles unlikely to become required reading except as examples of how-not-to-do-it; for example, fig. 23 on page 240 should provide material for lively undergraduate discussion papers.

Any selection of articles for approbation is bound to be personal and

depend on the interest of the reader. Those whose enthusiasms are for geophysical or broadly geodynamic aspects are most likely to appreciate the first section, especially M. H. P. Bott's paper 'Crustal doming and mechanism of continental rifting'. Structural geologists looking for an account of a graben system that has not been the subject of innumerable previously published papers will enjoy Illies' discussion of 'Graben formation—the Maltese Islands—a case history'; a refreshing article in a book which is perhaps overweighted with derivative or recycled material.

The paper which deserves to become the most widely cited is also by Illies: 'Mechanism of graben formation', the title of the Epilogue in which the editor sums up his thoughts on grabens. Using the Rhine graben (*sensu lato*) as an example, Illies illustrates and discusses the genesis of many of the characteristics displayed by isolated grabens transecting hundreds or thousands of kilometres of continental lithosphere. The great merit of the article is that it concisely summarizes and synthesizes much of the previously published work by Illies and his collaborators, and demonstrates the links between the North Sea basin and the Alpine fold system. Illies shows how the Rhine graben (*sensu stricto*), the diffuse zone of spreading across the Rhenish shield and the Lower Rhine embayment, although possessing different tectonic histories and displaying different structural styles are nevertheless all responses to lithospheric extension.

P. L. Hancock