generation and the starting point for his plea in Chapter 16 ('Theoretical geology'): for professional tolerance in the evaluation of new, sometimes undocumented ideas.

While I can certainly recommend *The Geology of Switzerland* to all *Journal* readers, I do so with some reservation. The book is engaging, mostly because it reads like a detective story; controversies in Alpine geology find their resolution in the development of new methods or the conceptualization of new geological processes, which in turn inspire the next generation of geologists. This is the stuff of which science is made and in this regard, the book cannot fail to capture the minds of interested readers. However, in neglecting important elements of the Alpine orogen and in failing to update the older Swiss edition of his book, Hsü has missed a golden opportunity to pass on a balanced, state-of-the-art document to serious students of Alpine geology. Both points are important to consider when using the book as an introductory text.

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Central American island arc

Seyfried, H. and Hellman, W. (editors) 1994. *Geology of an Evolving Island Arc. The Isthmus of Southern Nicaragua, Costa Rica and Western Panama. Profil* (Band 7), Institut fur Geologie und Palaontologie Universitat Stuttgart, Germany. 433 pp. ISSN 0941-0414.

This dedicated volume of the journal *Profil* of the University of Stuttgart contains 22 short to long papers on Central America and the nearby Atlantic and Caribbean. Topics concentrate on igneous petrology and petrogeny, sedimentation and stratigraphy, paleontology and paleoclimates, and paleogeography. Fifteen papers discuss various aspects of Costa Rican geology, including five on the pre-Campanian Nicoya Complex (generally considered an ophiolite). There are six other papers covering other parts of Central America, and one on Colombia and southern Panama. One paper by Montero discusses stress distributions derived from neotectonics, but otherwise there is no detailed structural geology in the volume. Several of the articles deal with the plate tectonic framework of Central America and the Caribbean in the Mesozoic and early Tertiary. Two papers (Krawinkel & Kolb, Obando *et al.*) describe sedimentary deposits related to strike-slip faulting such as pull-apart basins, and Bottazzi *et al.* give profiles of listric thrusts. Several papers, especially that by von Heune & Fluh, discuss the indenting affect of the Cocos Ridge and the buttress effect of the Nicoya Complex, on subduction in the Middle American Trench.

There are 31 different authors from 18 institutions: European (11), North American (2), South American (2) and Costa Rican (3). The bulk of the Europeans are German. Seventeen papers are in English, 4 in Spanish and 1 in German.

The first three papers (Winsemann, Donnelly, Krawinkel & Seyfried) discuss paleogeography and plate tectonic aspects of the Caribbean Plate and especially its southwestern edge in Central America. The next three papers (Appel *et al.*, Meschede & Frisch, Tournon) give geochemical and geochronological details. The next four papers (Kussmal *et al.*, Montero, von Heune & Fluh and Barboza & Zucchi) discuss igneous rocks, neotectonics, offshore geophysical studies and seismic stratigraphy. Four more papers (Astorga, Calvo & Bolz, Gursky and Winsemann) cover the Nicoya Complex (Cretaceous basalt, peridotite and associated sediments) and suggest several origins. Four papers (Seyfried *et al.*, Krawinkel & Kolb, Obando *et al.* and Bottazzi *et al.*) describe details of the Neogene sedimentary basins, and three papers (Fischer & Aguilar, Lucas & Alvarado and Hooghiemstra) cover land vertebrates, palynological data and other paleontological details. The final paper by Sprechmann *et al.* presents a stratigraphic chart of Costa Rican sedimentary basins.

This book does a good job of covering the geology of Central America, although most of the details are from Costa Rica, Nicaragua and northern Panama. It is a valuable book for those interested in ophiolites, igneous geochemistry, Central American stratigraphy and small tectonic plates. It has good background data on other aspects of Central American geology and paleontology, including several papers describing offshore sedimentary profiles. The several reference lists will be valuable to new workers in Caribbean geology. It is well put together by the editors, has a minimum of minor misprints, and seems fairly sturdy (it survived my reading without falling apart).

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Plugging a physical gap

Chapman, R. E. 1994. *Physics for Geologists*. UCL Press, London. Price: £35.00 hardback; £12.95 paperback.

This modest book, in price and size, brings together the principles and mathematics of physics which are relevant to geology. Written for students or professional geologists who have forgotten the physics learnt at school, or for those who have gaps in their physics education, this 143-page book sets out basic principles and processes of physics which are needed by geologists, in a clear and simple fashion. The writing is straightforward, and the subdivisions of the book make it easy to use as a reference text. I have reviewed the book as a structural geologist, not as an expert physicist or geophysicist.

The book begins with 'Basic concepts: dimensions, definitions and dimensional analysis' (Chapter 1). All are nicely presented, with the latter put into the context of geological modelling. Chapter 2, entitled 'Force', deals with statics and dynamics, inertia, energy, equilibrium and gravity. A short third chapter on 'Optics' then deals with reflection and refraction, and briefly defines polarization, pleochroism, birefringence and stereoscopy. These might have benefited from more illustration, rather than relying mainly on text. The physics becomes more compressed in Chapter 4, 'Atomic structure': just 4 pages of definitions of neutrons, protons, electrons, α and β particles and isotopes. Chapter 5 follows on with 'Electromagnetic radiation', presenting the physics of radiation, isotopes and age dating. These two chapters might well have been combined.

Short chapters on 'Heat flow' (6) and 'Electricity and magnetism' (7) provide important physics for geological and global processes, but might usefully have focused on important geophysical applications. For example, I searched for the information on magnetic reversals, so important in the development of the ideas of sea-floor spreading. Just a sentence at the end of the chapter mentions palaeomagnetism, and yet this is probably one of the most important applications of physics to geology, which underpins polar wandering, sea-floor spreading, and thus the whole of plate tectonics.

A structural geology audience such as this *Journal's* might be particular interested in Chapter 8 'Stress and strain'. It begins with a good summary of force and stress, but strain is defined only briefly as 'the change of shape or volume of a body as a result of stress'. The definition, $\varepsilon = \delta l/l$ comes later, in the section on elasticity and Hooke's Law. Next comes friction. Viscosity is considered here, defined as the property of internal friction of a fluid. Sliding is considered next, then just half a page on bending and folding, with no mathematics or physics, and no mention of the Biot–Ramberg approach. The chapter goes on to consider fracture, in terms of Coulomb criteria and the Mohr circle, and ends with compaction and consolidation. 'Stress and strain' thus includes quite a mixture of physical processes and models of material behaviour, yet 'rheology' and 'plasticity' are not introduced nor defined.

Chapters 9 and 10 are, respectively, 'Sea waves and acoustics' and 'Sound and other waves'. Given the breadth of topics in the previous chapter, these related topics might more sensibly have been combined.

Chapter 11 on 'Fluids and fluid flow' is one of the most detailed in the book, reflecting the author's experience and interests in petroleum and ground water studies. It opens interestingly, by stating that much of the literature on this topics contains errors, and that it is a difficult topic. While many users of the book may find the summary treatment of Reynolds number, solid settling, Bernouilli and Darcy theorems, and flow in pipes to be useful, in the end it is unclear how this physics can be applied in practice to rocks. As has been stated earlier for palaeomagnetism, some practical examples and applications would have brought this difficult topic alive to a geological audience.

The final chapter, 'Some dangers of mathematical statistics', provides warnings for geologists using statistical analysis. This is not strictly physics, but useful nevertheless. The short Appendix contains some additional notes, references and suggested further reading.

I found this book to be a valuable source of definitions, equations and principles of physics, in a brief format. As such, it is likely to be a good purchase for a wide range of geologists, particularly those teaching physical processes. Unfortunately, I did not find it particularly good for the physics of structural geology. Strain and deformation are not properly described. People pursuing the mechanics of structures such as folds, or the physics behind phenomena such as boudins, shear zones, faults and joints (none are listed in the index), will require another book. Nevertheless, the book is good value for covering a wide expanse of physics in a simple way, and for covering some of the topics in the author's closest experience (fluid flow) in more detail.

I think there is one way that this book could have been livened up above that of a dry physics text for geologists. It is likely that some readers will wonder how *Physics for Geologists* differs from the subject of *geophysics*. While it cannot be said that geophysics incorporates *all* applications of physics to geological processes, much of the physics outlined in this book does underpin modern geophysics: e.g. topics such as earth structure, global plate tectonics and geomagnetism. What better way to bring this book alive, for geologists, than to include practical applications: examples such as the discovery of ocean floor 'magnetic stripes' which led to the idea of seafloor spreading, and then to plate tectonics? Food for thought, perhaps, for the 2nd Edition?

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