prepared to consider the statistics even though they have yet to be introduced formally or mathematically to their meaning.

Finally, I must emphasise that I do not wish to be critical of this book. It is certainly very good value for money at £16.95 for the paperback edition. Personally, I did not find the approach taken off-putting and I will certainly make use of it in my attempts to teach (circular) statistics to my students. For this I am indebted to the author. However, my bitter experience warns me that I should not expect many of my students to use this book when I recommend it to them. Hopefully, if they go on to serious data collection and appraisal, they will remember this book and give it the attention both it and their data deserve and demand. In the meantime, let me repeat my plea for a more intuitive approach to teaching all branches of statistical data analysis in the Earth Sciences, one which excites and therefore instructs.

References

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Skating on ice

Bennett, M. R. and Glasser, N. S. 1996. *Glacial Geology: Ice Sheets and Landforms.* Wiley. Price £19.99 softback; £45 hardback.

Research on glaciers and their geomorphic effects is conducted by scientists with widely divergent backgrounds and approaches. Scientists who have never trudged up a moraine, but with enviable facility in continuum mechanics, share journal space with those who meticulously describe and interpret glacial sediments but feel faint when confronted with differential equations. I am sympathetic toward attempts to synthesize and condense work from such different perspectives into a glacial geology text.

There is strong need for such a text. The widely used *Glaciers and Landscape* by Sugden and John is 20 years old. Drewry's *Glacial Geologic Processes* provides a good synthesis of concepts from glaciology and glacial geology but includes little on landform evolution and glacial history. Paterson's classic, *The Physics of Glaciers*, does not discuss glacial geomorphology.

The goal of this text is "to provide an account of glacial geology which is accessible to the undergraduate and uncluttered from unnecessary detail". The text, indeed, is not cluttered with details and is refreshingly thin. Its traditional but logical organization works well. After introducing the subject, the authors begin with a discussion of glacial history and the causes of ice ages. This is followed by two chapters aimed at introducing some of the fundamentals of glaciology: glacier mass balance and flow and the movement of water in glaciers. The following seven chapters focus on the processes and landforms of glacial erosion and deposition, including a discussion of lacustrine and marine sedimentation. The final chapter examines large-scale patterns of glacial sediments and landforms.

In evaluating an introductory text, such as this, a critical question is whether the authors succeed in reaching meaningful and accurate conclusions, despite the need to minimize detail. In the case of a glacial geology text, this requires a thorough knowledge of both the charactistics of glacial landforms and the mechanics of glacial processes. The authors consistently demonstrate that they are familiar with the former but not the latter. Their frequently misleading discussions of the mechanics of glacier flow, erosion, sediment transport, and deposition are the weakest parts of this book. For example, beginning students of glacial geology will learn from this book that the idealized temperature profile through a polar glacier is linear (it isn't), that the contact force between abrading clasts in glaciers and a rock bed depends primarily on the difference between the ice overburden pressure and the basal water pressure (it doesn't), and that deformation of sediment beneath the Antarctic ice streams has been observed directly (it hasn't). These and other misconceptions in this book are, in part, a result of an unfortunate reliance on interpretations, sometimes decades old, that are grounded more on intuition than on reliable measurements and sound physical reasoning. It is disturbing to see old myths perpetuated and modern studies neglected.

For this reason I suspect that structural geologists will find the descriptive aspects of the book interesting but many of the mechanical interpretations naive. Many glacial processes are highly relevant to structural geology: nonlinear viscous creep of ice, shearing, faulting, and comminution of granular materials beneath glaciers, the role of low effective stresses in sustaining fast glacier sliding, and the slow growth of cracks in bedrock loaded by glacier ice are examples of problems with obvious analogues in structural geology. Unfortunately, it is precisely these kinds of subjects that are not treated authoritatively in this text. For example, structural geologists will be surprised to learn on page 38 that creep and large-scale folding are two distinct ways in which a crystalline solid (ice) can deform.

Another shortcoming of the book is that by adopting the scope of earlier texts it does not address some to the most exciting and topical developments in glacial geology this decade. For example, the authors do not mention the discovery of quasi-periodic layers of ice-rafted debris (Heinrich layers) in sediment cores from the North Atlantic and the consequent flurry of hypotheses regarding past interactions between ice sheets, oceans, and climate. Nor do they discuss the complementary and unprecedented insights gained from recent Greenland ice cores. Structural geologists interested in the coupling between glacial erosion and tectonic uplift, an issue of widespread current interest, will find no discussion of the subject. I am tempted to attribute these omissions to the long duration of the publishing process, but citations that post-date these studies are included in the text.

It is perhaps, too easy to dwell on flaws and omissions; I would recommend this book for those interested in a concise description of glacial landforms and sediments. Geologists, however, interested in an accurate, contemporary synthesis of what is known about glacial geologic processes and history should look elsewhere.

References

Drewry, D. (1986) *Glacial Geologic Processes.* Edward Arnold, London.

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Controversies in Central America

Mann, P. 1995. *Geologic and Tectonic Development of the Caribbean Plate Boundary in Southern Central America.* Geological Society of America, Special Paper 295; 349 pp, 8 plates in pocket. Paper, $100.

This weighty volume contains 17 articles on the geology and tectonics of Panama and Costa Rica, organized by Paul Mann of the University of Texas and dedicated to Richard Weyl (1912–1988), a leader in geologic studies of Central America and the Caribbean. Though the majority of authors are American, some researchers are from Costa Rica, Mexico, Europe and Japan. There is a short biography of Weyl and a list of 33 of his most pertinent publications. Mann has written an excellent 22-page preface/introduction. The book is well-illustrated with line drawings, maps, and a few black-and-white halftones. The folded plates, split into two pockets fore and aft, are useful and amplify the texts, especially the last two which show bathymetry and a perspective diagram of offshore Pacific Costa Rica.

Paul Mann prepared a preface for the book, which contains several valuable sections. There is a history of geological work in the region, and several lists and maps of published and unpublished works. The organization and purposes of the volume are described. Mann's plan is