Review

MALTMAN, A. J., B. HUBBARD and M. J. HAMBREY, *eds*. 2000. *Deformation of glacial materials*. London, Geological Society (Special Publication 176). 352 pp. ISBN 1-86239-72-X, hardback. List price: £79.00/$132.00; Geological Society of London member price: £35.00/$58.00; American Association of Petroleum Geologists member price: £48.00/$80.00.

In *Deformation of glacial materials* Maltman, Hubbard and Hambrey provide a valuable compendium of 24 research papers on topics related to the deformation of ice, of glaciers and of glacial sediments. The volume is the outcome of an interdisciplinary conference held at the Geological Society of London in September 1999, and includes contributions by 45 different authors from 24 institutions in Europe, North America and Australasia. After an introductory overview by the editors, the papers are divided into sections on ice deformation (four papers), glacier flow and structures (seven papers), subglacial deformation (six papers) and glaciotectonic structures (six papers). Each paper is completely self-contained including its own abstract and list of references, and there is also an eight-page index covering the whole volume. In addition to the usual line drawings and black-and-white photographs, two of the papers include colour illustrations, and each section of the volume is fronted with a full-page photograph, making a total of 181 illustrations. The book is solidly and pleasingly bound in the standard hardback livery of the Geological Society Special Publications series, and the production quality overall is good.

Notwithstanding the volume's unifying theme, the papers cover a wide range of subject matter. Some are large-scale reviews of sections of the discipline or of substantial datasets. These include a review of existing and new ice-core data on basal ice formation and deformation in Greenland (R. Souchez and others), a review of recent progress in understanding subglacial deformation (R. B. Alley) and a review of structural styles and deformation fields in glaciers (M. Hambrey and W. Lawson). Others are local case-studies of deformation phenomena. These include descriptions of folding in Johnsons Glacier, South Shetland Islands, Antarctica (L. Ximenis and others), of deformation structures in Variegated Glacier, Alaska, U.S.A. (W. Lawson and others), and of moraine-mound formation by englacial thrusting in North Wales (D. I. Graham and N. G. Midgley). Several papers take a modelling approach to deformation topics, such as A. C. Fowler's instability mechanism for drumlin formation, R. A. Hindmarsh and K. F. Rijsdijk's viscous model of till rheology to describe gravitational instabilities in glacial sediments, and A. Hubbard and B. Hubbard's paper on the contribution of high-resolution glacier flow modelling to structural glaciology. There are also laboratory studies, such as the use of a geotechnical centrifuge in modelling the rheology of clean and sediment-rich ice (D. H. B. Irving), investigations of the strength and hydraulic conductivity of glacial sediments (B. Hubbard and A. J. Maltman), a study of the effect of H_2SO_4 on the stress exponent in ice crystals (I. Baker and others), and experimental work on fabric development in glaciers (C. J. L. Wilson). There are also examples of papers that take the "natural laboratory" approach to field investigations, such as descriptions of the behaviour of ice in a subglacial tunnel (S. J. Fitzsimons and others), and the interpretation of ice-crystallographic data from different positions in Glacier de Tsanfleuron, Switzerland (J.-L. Tison and B. Hubbard). Scales of analysis range from micromorphology of glacial and glaciolacustrine sediments (papers by J. Menzies, by E. R. Phillips and C. R. Auton and by S. Fuller and T. Murray) to large-scale glaciotectonic structures in the North Sea (M. Huuse and H. Lykke-Andersen), and from the radar identification of zones of sediment deformation beneath the Antarctic ice sheet (M. Siegert) to the interpretation of deformation indicators in thin sections of tills (F. M. van der Wateren and others).

A recurring theme in glacier-related literature over the last 25 years has been a call to develop links between glaciology, geology, Quaternary science and geomorphology. This has stemmed in part from a recognition that problems of deforming materials in glaciology are parallel to equivalent problems in other fields such as structural geology, that each discipline might find advantage in using the other as an analogue, and that joint inquiry might make more progress than independent efforts. Another recent example of this sort of effort to bring together specialists from different disciplines to consider glaciological topics was the special issue of *Quaternary Science Reviews* on the glaciological basis of Quaternary science (Murray, 1997). This new volume is very much in that tradition, but although it succeeds in highlighting the potential value of interdisciplinary dialogue, few of the contributions actually contribute materially to such a dialogue. An exception is the work of P. Herbst and P. Neubauer who specifically use glacial structures of Pasterzenkees, Austria, as a natural model of geological tectonic structures. Their demonstration that glaciers, extensional allochthons on top of an orogenic wedge, and raft tectonics at passive continental margins can all be discussed in terms of the same structural conditions represents genuinely interdisciplinary work of a type that many potential readers of this volume might have hoped to see repeated in different areas of the subject. For example, the interpretation of sediment structures within basal ice still cries out for a structural geological approach, the impact of intravenous water flow on englacial strain still awaits a comprehensive hydrogeological treatment, and the analogues between glacier and rock metamorphism and deformation remain often mentioned but rarely addressed. Efforts such as this volume are interdisciplinary in that they recognize the value of an interdisciplinary approach, but not in demonstrating that such an approach has actually been adopted at the level of individual research projects. Its back cover claims that this volume "addresses how methods for unravelling deformation structures evolved in recent years by structural geologists can be used for glacial materials, and the opportunities offered to structural geologists by glacial materials for studying deformation in rocks". Indeed it does, but the discipline has a long way to go before these opportunities are routinely exploited by its practitioners. Presumably, when branches of a discipline do become genuinely coincident in their approach, the need for volumes such as this will in fact diminish, as interdisciplinary research becomes the conventional mainstream of research output.

Both the strengths and the weaknesses of this volume stem partly from its origins as a conference volume. From this origin it derives the strength of its eclectic assortment

of cutting-edge reports and reviews, the vibrant mixture of established authorities and relative newcomers amongst the authors, and its sense of being a record of a moment in the history of a moving research frontier. At the same time, conference proceedings are inevitably limited by the list of individuals who attended the conference, and by the research papers that they choose to offer. This volume is impressive in that some of the biggest names in this part of the discipline appear among the authors, but inevitably readers will be disappointed by some notable absences. Had the content of the volume not been limited by the composition of the conference, readers might have seen a more rounded treatment of the topic and a more comprehensive representation of the "state of the art". As it stands, the book inevitably presents a partial view of the subject, dominated by one section of the global research community. This is reflected in the fact that although 24 institutions are represented in the list of contributors, 2 of these institutions are represented in 9 out of the 24 papers and 1 (the editors') is represented in 6 out of the 24. Seven of the authors contribute to more than 1 paper, and 15 of the authors also served among the referees for other papers in the volume. The impression that this gives is of a rather small, closely centred research field, but this is more an artefact of conference logistics than of international research activity. As with any compilation volume, or any issue of a journal, readers will each find sections, or papers, that they are more or less interested in. This volume is much like a special issue of a journal, to be dipped into differently by readers with different interests. It does not try, or pretend, to be a comprehensive review of the field. Although it would be unfair to criticize the volume for this, it is hard not to regret that some such comprehensive review has not been produced. Some areas of research on the deformation of glacial materials are inevitably under-represented in this conference volume. For the general reader who is interested in the overall theme of the deformation of glacial materials as well as in the details of individual research projects, the volume might have benefited from the insertion of keynote papers or historical perspectives at the start of each section to tie the work that was represented at the conference into the context of work that was not. Some of the papers included do serve this function, but not in a consistent way throughout the book.

Whether conference proceedings are produced as special issues of journals, as independent volumes, or as parts of a society series as in this case, is often a political decision as much as a scientific one. *Deformation of glacial materials* is an example of a book that could equally well have been produced as a journal issue. From the readers' point of view, however, all that really matters is that they know where to find a set of valuable papers on an important topic. They will find that right here! This book should find a place on the shelves of all glaciologists, glacial geologists and Quaternary sedimentologists. If the good intentions of the editors come to fruition, it will also find shelf space and discussion time among a much wider group of researchers who might profitably be drawn into its subject area.

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Murray, T., *ed.* 1997. The glaciological basis of Quaternary science. *Quat. Sci. Rev.*, **16**(9), Special Issue.

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