

Deformation of Glacial Materials

edited by A.J. Maltman, B. Hubbard & M.J. Hambrey, 2000. Geological Society (London) Special Publication No. 176; vii + 344 pages, hardbound. US\$ 132.00 / £ 79.00 (GSL member price US\$ 58.00 / £ 35.00; AAPG member price US\$ 80.00 / £ 48.00).
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This volume arises from a conference on glacial deformation held at the Geological Society of London in September 1999 with the aim of fertilizing the interdisciplinary exchange of information between structural geologists and those involved in the study of glacial deformation and of deformed glacial or Quaternary successions. Structural geologists have much to offer in the interpretation of deformed glacial sequences that may also provide valuable analogues for larger lithospheric processes. A worthy aim, but does the volume live up to its potential?

Divided into four parts the volume attempts to blend review or summary papers by leading researchers with detailed site-specific investigations which form the normal material in conference proceedings. The volume achieves this to varying degrees, although the material remains somewhat eclectic and often very site-specific. The first section on *Ice Deformation* contains four papers, which range from a review of basal-ice formation and deformation beneath the Greenland Ice Cap based on ice-core data (Souchez et al.) to a paper by Irving et al. that reports the results from the physical modelling of the rheology of clean and sediment-rich ice. This is followed by a section on *Glacier Flow & Structures*, which starts with one of the best papers of the volume, a review by Hambrey & Lawson on the structural styles and deformation fields within glaciers. This paper is a must for students of glaciology and illustrates the potential to be obtained from a detailed analysis of the tectonic history of glacier ice. This is followed by a paper by Lawson et al. that documents the deformation history and structural assemblage resulting from the 1982-83 surge of Variegated Glacier in Alaska, adding to the already extensive bibliography of this famous glacier. The section contains a further five papers, which cover a range of detailed investigations. Of these papers, that by

Hubbard & Hubbard illustrates the potential of high-resolution glacier flow modelling in providing a framework within which to interpret structural assemblages within glaciers.

The third section of the book contains six papers on *Sub-Glacial Deformation*. This starts with a somewhat offbeat review of subglacial deformation by Alley, which - although of interest to the specialist - may leave some students floundering. Later within this section, Fitzsimons et al. reports a set of interesting observations on ice deformation beneath cold-based ice in Antarctica. In addition, Hindmarsh & Rijdsdijk extend their work on the viscous modelling of subglacial deformation by evaluating the ability of such mathematical formulations to describe gravitational loading instabilities within glacial sediments. The final section of the book, *Glaciotectonic Structures*, contains a further six paper on a range of subjects concerned with the manifestation of glaciotectonics in the landforms and sediment record. Menzies provides a comprehensive and extremely well illustrated review of micromorphological structures induced by the deformation of glacial sediments: a paper that is likely to be widely cited by all those involved in the interpretations of thin sections of glacial sediment. Van der Wateren et al. review the kinematic indicators available with which to deduce the direction of subglacial shearing and illustrate the potential benefits afforded by the rigorous application of structural geology in the interpretation of deformed glacial successions. The final paper in the section deals with moraines produced by glacial thrusting within one of the most famous Quaternary localities in the UK, that of Cwm Idwal.

In summary, the volume contains an eclectic collection of papers typical of most conference proceedings. As a delegate at the original conference, I am left wondering about all the papers that got away, and that might have enhanced the coherence and value of the volume as a whole. It is also perhaps a shame that the review papers are not all of the same standard, which might have enhanced the value of the volume to the student. As regards the aim of the original conference and volume, to bridge the gap between the fields of structural and glacial geology, the volume sadly fails to do this. What is perhaps missing is a review of relevant literature from the field of structural geology that would have informed glacial geologists of pertinent literature and concepts - something that could easily have been written by the collective talent of the editorial team.

Despite this, the editors are to be congratulated on producing a professional and attractive volume, although their efforts are spoilt by a number of production errors. For example, some of the captions on the photographic frontispieces which start each section are transposed and some of the running headings on individual papers are wrong. Yet I am confident that this volume will find its way into many libraries and onto the shelves of most glacial geologists.

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