KNIGHT, P.G. *ed.* 2006. *Glacier science and environmental change.* Oxford, Blackwell Publishing. xiv + 527pp. ISBN-10: 1 4051 0018 4, ISBN-13: 978 1 4051 0018 2, hardback. £125.

This is a large book which is rather difficult to categorize. It is not a textbook, it is not a report of a conference, it is not a treatise, rather it is a collection of papers, some authoritative surveys, others more specialized treatments, and yet others short papers on recent work. In the introductory chapter by the editor it is explained that each of the book's five sections opens with a keynote introduction followed by a series of articles by leading authorities covering themes of major significance in the discipline. Distributed between these articles are shorter papers that provide research case studies.

Each of the chapters has a half-tone illustration beside the heading. These are not captioned and, although some of them are illustrations or parts of illustrations that are included among the figures for the chapter, many are not and none of them is explained. Indeed three of them are identical and are the same as the picture that appears on the dust cover of the book which reveals that it is a photograph by the editor. This figure also occurs at the beginning of the references and as one of the pictures preceding a section! This seems a pity; if some of the pictures had been identified they could have added to the usefulness of the chapter concerned. Each chapter has its own black-and-white illustrations, some of which are also available in colour on the website associated with the book, and there are also a number of colour plates included in a separate section in the middle of the book. This section has 24 pages, which are not included in the pagination of the book. The rationale behind the choice of illustrations to be presented as colour plates is not obvious. For example, plates 38.3 and 38.9 are line diagrams and plate 80.1 is a block diagram with some of the blocks coloured in. These could perfectly well have been black-and-white line diagrams in the text. However, figure 81.2 is very difficult to interpret in black and white as it relies on colours to indicate the magnitude of the basal traction, with both very small and very large values appearing dark.

In general the book is well put together, though as is to be expected the quality of the writing is variable and the absence of abstracts may make it hard for secondary services to cover the book adequately. Some illustrations are not well captioned or described. For example, figure 11.1 refers to 'a dark grey line' and a 'grey pattern', neither of which seem clear on the essentially black-and-white illustration; in figure 24.6 the 'dashed line' mentioned in the caption appears to be missing; in figure 34.2 Ψ in the figure becomes χ in the caption; figure 39.1b is quite unnecessarily small; the caption for figure 53.3 refers to 'left' and 'right' which should be 'top' and 'bottom'; in figure 63.3b the *x* axis is unlabelled; in figure 63.3c the *x* axis is split for no apparent reason! The references are all gathered together at the end of the book, which no doubt saves repetition, although the use of surnames only as keys to the references leads to some ambiguities: Clark 1994 could be either C.D. or P.U. Clark; Clark *et al.* 2000 could be either C.D. or I.D. Clark; Jansson *et al.* 2003 could be K.N. or P. Jansson; Warren 1992 could be C.R. or W.P. Warren. There are also alphabetization problems: De Geer follows De La Chapelle, Dean and DeConto; nine papers by Eyles N. come between Eyles, C.H. and Eyles, C.H. *et al.*; Hubbard, B. comes between Hubbard, A. and Hubbard, A. *et al.*, which is followed by Hubbard, B. *et al.* There are also some problems with the references themselves: Glen, 1958a and 1958b are the same paper, one with the wrong page numbers; Zwally, H.J., I suspect, is the same person as Zwally J.H., but if not is in the wrong place; and I also suspect that Grouset F. is the same person as Grousett F.E.

The first section (referred to in the book as part 1) is entitled 'Glaciers and their coupling with hydraulic and sedimentary processes'. The keynote introduction is by G. Boulton and there are 18 further chapters, most of which are quite short (two to four pages). One is unique in that it has a criticism by D.I. Benn and D.J.E. Evans of the subglacial megaflood hypothesis of J. Shaw and co-workers which has already featured in chapter 4 (eight pages) by Shaw, and there is a reply by Shaw and M. Munro-Stasiuk also included in chapter 8. The other relatively long chapter in this part is chapter 9 (ten pages) on groundwater under ice sheets and glaciers by J.A. Piotrowski.

Part 2, entitled 'Glaciers, oceans, atmosphere and climate', starts with a keynote paper by J.T. Andrews. This emphasizes the complexity of the interrelations between these geophysical systems. It begins with a quotation from P.W. Anderson, 'I have yet to see any problem, however complicated, which, when you look at it in the right way, did not become still more complicated', and the end conclusions bear this out! The 15 further chapters vary in length from 1 to 13 pages, the longest being that by C.F.M. Lewis and J.T. Teller on glacial runoff from North America and its possible impact on oceans and climate. This continuously uses two dating systems: it opens with the words 'At the Last Glacial Maximum, about 18–21 ka (21,000–25,000 cal. yr)' without giving any explanation for these two apparently inconsistent dates. This paper also uses the unit $Sv = 10^6\,m^3\,s^{-1}$ as its unit for runoff, despite Sv being the internationally recognized abbreviation for the sievert, the SI unit of radiation! Apart from these editorial niggles, the chapter is generally clear in its message. The second longest (11 pages), authored by S.J. Marshall, is on modelling glacier response to climate change, which shows how far we are at present from a good model. Again the shorter chapters are of varying quality: some give very good clear accounts, while in others I found it more difficult to follow the argument.

Part 3, entitled 'Changing glaciers and their role in earth surface evolution', has a much shorter (four-page) keynote paper by D. Sugden which summarizes its field well but leaves the detail to others. This is reflected in the larger number of longer surveys in this part: seven pages by J. Kleman and others on reconstruction of palaeo-ice sheets – inversion of their glacial geomorphological record; seven pages by J.T. Andrews on the Laurentide ice sheet: a review of history and process; ten pages by D.G. Vaughan on the Antarctic ice sheet; eight pages by R. Naruse on the response of glaciers in South America to environmental change; sixteen pages by C.D. Clark and others on palaeogeography of the last British–Irish ice sheet: challenges and some recent developments; and eight pages by Yao Tandong and others on changing glaciers in High Asia. These are all reasonable summaries of their topics, but again suffer from poor figures in some cases. There are also 12 shorter papers in this part of the book.

Part 4, entitled 'Glacier composition, mechanics and dynamics', has a six-page keynote paper by T.H. Jacka

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followed by a ten-page review paper by K.M. Cuffey on manifestations of ice microphysical processes at the scale of whole ice sheets. There are 14 more papers in this part, the most substantial of which are seven-page articles on superplastic flow of ice relevant to glacier and ice-sheet mechanics by D.J. Goldsby, environmental conditions, ice facies and glacier behaviour by W. Lawson, and fast glacier flow and ice streaming by S. Tulaczyk. Apart from some presentation problems of the kind already mentioned (on p. 293, for example, the half-width is stated to be ϕw, whereas in the equation beneath ω appears), these are good, clear accounts, as are the ten other shorter papers.

Finally, part 5, entitled 'The practice of glaciology', has a six-page keynote paper by R.B. Alley and S. Anandakrishnan which summarizes the importance of actual observation to verify what theory is telling us. It is followed by a good 13-page survey by J. Bamber of remote sensing in glaciology. Of the 19 further papers in this part, there are seven-page articles on borehole-based subglacial instrumentation by U.H. Fischer and B.P. Hubbard, ice-core chronology by C.U. Hammer, numerical modelling of polar ice sheets through time by P. Huybrechts, integrated perception of glacier changes: a challenge of historical dimensions by W. Haeberli, and laboratory experiments in glaciology by N.R. Iverson.

The book would be a most useful introduction to the present state of glaciology for anyone starting to work on the climatic interrelations of ice. Indeed, with the present interest in climate change and the role ice may have as both an indicator of change and a contributor to both climatic changes and sea-level rise, there will no doubt be an increasing number of such people. As such it should fill a need. It is just a pity that the subediting and production of the book are not up to the standard I would have expected for a book of this price and with this sort of market in view.

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