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Book Reviews

Antarctic Marine Geology

John B. Anderson
Cambridge University Press, Cambridge (1999).
292 pages. Price £70/$115. ISBN 0521 59317 4.

Writing a book is a tremendous effort, and is not easy. Generally, for that effort to be recognised and the book considered worthwhile, the author needs support, certainly from friends and family but also from constructive critics and from the publisher. There is no doubt John Anderson has put in considerable effort, and been supported by friends and family. Moreover he is respected within the community; no one has spent more time mapping and sampling glacial sediments of the Antarctic continental. So why does this book fail?

The six chapters can be split into those addressing the field that John knows extremely well, and the others. Chapters 3 & 4 cover continental shelf morphology, relief-forming processes, and sedimentology. Chapters 5 & 6 (*Continental Margin evolution* and *Antarctica's glacial history*) are partly derived from them, and Chapters 1 & 2, covering the environment (glaciology, physical oceanography etc) and (pre-glacial) geologic history, are essentially introductory. The treatment in different chapters is at very different levels: a more accurate title would have been "Antarctic *Continental-Shelf, Glacial* Marine Geology". Better still would have been a monograph with that title rather than this more general book, so that most of Chapters 1 & 2 and parts of Chapters 5 & 6 could have been omitted, and the remainder would have undergone peer review. This book is best viewed as a draft for such a monograph.

Harsh words, needing to be justified. Firstly, what is expected of a textbook? Clarity, authority, discrimination, a logical progression of thought, definitions - all primarily the author's responsibility, but developed by stern but constructive review from fellow scientists and the careful, sympathetic copy editing expected of a publisher. Here, these attributes are missing. For example there are no definitions. Further, the quality of chapters peripheral to the glacial shelf marine geology is uneven. For example, a wide range of authorities is cited within Chapters 1 & 2, but citations are at times bizarre. On p. 49 an expert in Devonian (350–400 Ma) fossils is sole cited authority on the major magmatic activity that accompanied the mid-Jurassic (*c.* 180 Ma) break-up of Gondwana, and again on the environment of eruption of the Kirkpatrick Basalts. Elsewhere, the Deccan Traps (*c.* 65 Ma) are made part of that mid-Jurassic activity. On p. 36 a cited author has changed sex. On p. 24 the "West Wind Drift" and Antarctic Circumpolar Current are mentioned in succeeding sentences with no indication that they are different (old and new) names for the same current (also the "Circum-Antarctic Current" of p. 205). "The boundary between CPDW and AABW corresponds to a temperature minimum layer....." (p. 24) is a misinterpretation of Fig. 1.33.

The central chapters (3 & 4) comprise a multitude of detailed descriptions of shelf topography and shelf sediments. There is much value here, but it is not always easy to find. Citation is almost always of papers by Anderson or his students, and the selection lacks discrimination and synthesis. More testament than textbook. The author may claim this imbalance merely reflects the actual proportion of work on the Antarctic continental shelf that he and his students have done, but he neglects also the Arctic, where the onshore record is abundant and very many have worked offshore. There are differences (the Antarctic has recently been colder, which is important), but repeated comparison between hemispheres, with differences discussed, would have been a sounder basis for interpretation, better serving Antarctic shelf glacial geology.

Further, some of the views expressed prevent uncritical acceptance: for example, several times (e.g. p.7, p. 90) it is stated or implied that ice streams occur because ice flow converges. Surely this reverses cause and effect? Also, that ice from a "marine ice sheet" (the WAIS, with a base in places below sea level) flows faster than that from the EAIS (base mostly above sea level) BECAUSE the WAIS is marine-based. Surely ice sheets are sufficiently in equilibrium that ice flow to the margins is approximately equal to accumulation? The WAIS drains faster because WAIS is accumulating more snow. In the same vein, EAIS flow is said to be divergent (thus slow etc) because it is radially outward, whereas Ross and Weddell Sea flow (of the WAIS) is convergent. There is no consideration of the reduction in ice thickness within an ice stream, of the uneven distribution of precipitation and its dramatic increase with proximity to the margin, of the effect of temperature on ice strength. These views of ice behaviour clearly influence the picture presented of glacial sedimentation, so we read (p. 90) that ".....the rate of sediment delivery to the sea by marine ice sheets should be much greater .....because marine ice sheets flow much faster than terrestrial ice sheets"

Chapter 5 (*Continental Margin evolution*) is largely a recycling of Chapters 3 & 4. It is a partial rather than a balanced view of continental margin evolution, focussed on those margins where the author has worked and on those aspects of margin evolution on which his work bears. Also two particular summary statements (p. 205) raise concern "....dramatic change....associated with the onset of glaciation....manifested on the continental slope and rise as .....sediment mass movement in the form of huge slumps, debris flows, and submarine fans". Certainly glacial sediment transport can exceed pre-glacial transport, but the author reports huge slumps and their products only from Wilkes Land and the southernmost Weddell Sea, a minority of the margins surveyed, and most glacial sediment is transported from the

upper continental slope by small-scale slides and turbidity currents. And (also p. 205) "More rapid advance and retreat of the ice shelves onto the continental shelves during the Plio-Pleistocene are recorded in virtually every seismic record from the continental shelf." Once the effect of re-erosion of older glacial shelf sediments is eliminated (to the extent that it can be, with confidence), and the study is confined to sections actually dated (by cores or drill sites) this assertion is doubtful. The effect of both assertions is to obscure a key contribution to understanding glacial history from margin sediments: that the continental shelf sedimentary record is almost everywhere incomplete (topsets are vulnerable to erosion during later grounding line advances) and a more complete (and recoverable) record is to be found in sediment drifts of the continental rise.

Chapter 6 (*Antarctica's glacial history*) begins with a critical analysis of data NOT emanating from the continental shelf (for example, deep-sea oxygen isotopes and clay mineralogy, ice-rafted detritus). Authorities in those fields would disagree with the conclusions. The approach in the succeeding part, on shelf data, is less critical and, as in Chapters 3 and 4, the data used stem almost entirely from the Rice group. A degree of partisanship in a book promoted as a textbook becomes a trap for the unwary. It is necessary to repeat: don't believe everything you read.

The publishers do not seem fully to have supported the author. There are many proofing lapses, involving both text and figures. Missing scales on seismic profiles I found particularly irritating, but these are not the only problems. For example, Fig. 4.9b shows no data from tills, when it aims to illustrate differences between tills and glacial-marine sediments. Copy editing has been inadequate throughout. Examples are: (p. 87) "The bay occupies a sedimentary basin, the Prydz Bay Basin."; (p. 102) "Significant changes in grounding zones probably occur at rates of 50 to 200 years (....)." The text retains American options; spelling, the extra comma in lists. This was presumably a CUP marketing decision, but some usage is colloquial (for example, "Inside Passage", "Iceberg Alley").

A more general conclusion should be drawn from the evidence presented in the book. It is not the author's conclusion, so must be clearly stated. It is this. The history of Antarctic glaciation, which is crucially important to global palaeoclimate, can be understood only by combining data from ALL relevant regions and fields of study. The Antarctic continental shelf is one of these, but only one, and not necessarily the most informative. The sedimentary record on the Antarctic continental shelf is a direct record of glaciation, insofar as the sediment was transported and deposited directly by ice, but that record is partial: the many unconformities in the shelf sedimentary record are evidence of time gaps in sediment preservation, some of them very long. Further, the mode of deposition of proximal glacial marine sediment on the shelf, typically downslope from an ice grounding line, suggests that the preserved sediment record, as might be sampled at a particular site, may represent very short periods.

So, don't think of this as a textbook (it isn't one) but as a monograph. Chapters that are not about the glaciated Antarctic continental shelf contain very little information that is not better absorbed from elsewhere. There is a lack of discrimination and synthesis, copy-editing and proof-reading, and some questionable assumptions (review is missing, and important). As a monograph this volume is expensive, so you have to hope your library buys it. Otherwise, you'll just have to read the original papers and draw your own conclusions.

PETER BARKER

Diary

2000

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23–27 July **Physics and Chemistry of Ice,** Canterbury, UK. Contact: J. Dore, University of Kent, Canterbury, Website: http://kiwi.ukc.ac.uk/physics/events.html E-mail: pcice@ukc.ac.uk

27 Aug–1 Sept **SCAR VIIIth International Biology Symposium**, Amsterdam, the Netherlands. Contact: Netherlands Committee for Antarctic Research, Netherlands SCAR Committee, PO Box 93120, 2509 AC The Hague, The Netherlands, E-mail: alw@nwo.nl