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Book reviews

Geology and Paleontology of the Ellsworth Mountains, West Antarctica

Edited by *G F Webers, C Craddock* and *J F Splettstoesser*
Memoir 170, Geological Society of America, 1992.
459 pages. $97.50. ISBN 0 8137 1170 3.

This long-awaited memoir is the first geological overview of the Ellsworth Mountains, a spectacular mountain range that lies in a structurally anomalous position between the Transantarctic Mountains and the West Antarctic margin. The volume grew from a special symposium on the Ellsworth Mountains held at the Geological Society of America annual meeting in New Orleans, 1982. It represents field studies begun in 1959 by C. Craddock, one of the editors, continued in the 1960's, and culminated in the largest geological field programme, and the first geological survey of the Ellsworth Mountains in 1979–80 led by G.F. Webers, the senior editor.

The book contains 23 chapters written by an international group of scientists. It includes systematic descriptions of a wide range of fossils found within the 13 km thick Cambrian–Permian sedimentary succession, details of the glacial history, structure, stratigraphy, sedimentology and burial history. It also contains an interesting description by K.B. Sporli and others of some unusual breccia bodies within deformed Cambrian limestones in the Heritage Range, southern Ellsworth Mountains. They conclude that the breccias formed at depth by dissolution from hydrothermal solutions in association with cave-like processes such as roof collapse.

Three plates are included in the back pocket: one, a colourful 1: 250 000 geological map and cross sections of the Ellsworth Mountains originally published separately in 1986, a second showing selected glacial features of the Ellsworth Mountains, and a third illustrating the structure of the Sentinel Range, northern Ellsworth Mountains.

There are two appendices. *Appendix 1* is a short, less than one page, account by J.F. Splettstoesser, of the economic resources of the Ellsworth Mountains. It adds little to the volume and is little more than a statement that no economic deposits have been found. *Appendix 2*, on the other hand, is a useful bibliography completed in May 1990 as a guide to the literature on the geology of the Ellsworth Mountains, with a few citations added in proof.

The volume is well-produced and for the most part well-illustrated. It will form an extremely useful reference book for the geology of the Ellsworth Mountains but is by no means the final word on the subject. The editors conclude that further work is needed to fill in some of the remaining gaps in the geology, and additional sampling of the fossil faunas is required to establish a more complete understanding of the palaeoenvironments and life that existed during Palaeozoic times. C. Craddock and others, in chapter 21, also highlight some interesting problems to be addressed.

Nearly half the volume (193 pages of a total of 443) is taken up with descriptions and illustrations of the fossil assemblages. This is perhaps not surprising considering the title of the volume and the interests of the senior editor. Although it is clearly useful to see these assemblages, from a remote part of the world, described in detail and well-illustrated, the amount is out of proportion to the rest of the volume and the geology of the Ellsworth Mountains. Many people may have preferred to see, for example, more detailed sedimentology, and descriptions and illustrations of the basic rock units, together with a chapter discussing the importance of the Ellsworth Mountains in West Antarctic and Gondwana geology.

There is no attempt to address the long-standing debate as to the original location and movement history of the Ellsworth Mountains within Gondwana, initiated by J.M. Schopf's 1969 suggestion that the mountains were translated to their present position from an original location north of the Pensacola Mountains and near the East Antarctic shield. The editors, in a useful initial summary chapter of the geological history briefly review the literature on this topic and conclude that the original location of the Ellsworth Mountains remains to be established. Many people will be disappointed that this subject did not receive more attention and would wish to see a more detailed discussion. K.B. Spörli and C. Craddock come closest to doing this in chapter 20 where they discuss the structure of the Heritage Range. They postulate, from their structural data, that the principal stress axes had rotated during deformation and briefly considerhow rotation of the Ellsworth Mountains could cause reorientation of stresses.

In conclusion, this memoir is a useful account of the geological history of the Ellsworth Mountains and is essential reading for those interested in West Antarctic geology and Gondwana fold belts. However, it is a great pity that we have had to wait so long for it to be produced. Some authors volunteered the information that their papers were submitted in 1983 and 1985 whereas other papers were not accepted until 1992, the year of publication. This has created a noticeable imbalance in the currency of the various chapters for which the authors that submitted early (and presumably on time) should not be held responsible. The reasons for the delay in the publishing of this volume are not stated but it is clearly unacceptable and has undoubtedly resulted in a lack of research within the Ellsworth Mountains over the past 10 years. Nevertheless, 'better late than never' and the publishing of this book will undoubtedly be the springboard for many more proposals and further research in the most spectacular, and most enigmatic mountain range in Antarctica.

BRYAN C. STOREY

Climate and sea level change: observations, projections and implications

Edited by *R.A. Warrick, E.M. Barrow & T.M.L. Wigley*
Cambridge University Press, Cambridge (1993).
424 pages. £45. ISBN 0 521 39516 X.

Everyone seems to be interested in sea level rise. This may be one aspect of the greenhouse effect that people can easily visualize and worry about, especially because it is known that certain areas (Bangladesh, for instance) are already having significant problems. The causes are complex: changes in ice on land and changes in the temperature and thus density of ocean water cause changes in sea level but these are modulated locally by vertical motion of the land due to tectonic processes and post-glacial rebound as well as by the works of humankind: land subsidence due to pumping changes in sediment supply to coastal deltas, construction of artificial reservoirs and depletion of groundwater reservoirs.

The Antarctic Ice Sheet has been implicated as one of the causes of sea level change, although it is perhaps the least well defined. This book, therefore, may be of special interest to Antarcticans, as well as to those who are looking for an overview of the causes and projections of sea level change and the impacts of these changes on natural systems.

This book originated with a workshop held in Norwich UK in 1987. The book is referred to in the Intergovernmental Panel on Climate Change (IPCC) volume on scientific assessment (1990). It is good to finally have it before us. Many of the chapters have been updated to 1991 or 1992 because the field is evolving rapidly; unfortunately, some other chapters were closed in 1989. The 25 chapters by 36 contributors, mostly from the UK and USA, are of good to excellent quality, and the volume is well edited and attractively produced.

Following an overview, a section innocently termed Data includes chapters on sea levels as measured over different temporal and spatial scales. This is followed by Projections, including discussion of air temperature, small glaciers, Greenland and Antarctic, atmospheric modelling, and the relation of climate change to tropical storm intensity and magnitude. the chapter on the Antarctic Peninsula – although very brief – is a welcome addition; this area is rarely discussed in sea level analyses yet may be very important. Ten chapters then follow in a section on Impacts and Case Studies. These address a variety of specific areas, including the Norfolk Coast, Bangladesh, Egypt, the Mississippi delta, the Netherlands, eastern South America and Hong Kong; and present a variety of approaches such as Geographic Information Systems, storm surge modelling, problem assessment, amelioration schemes and land-use planning. Although some of these dwell on local problems, many are of broader application and all are interesting. The consequences of sea level rise range from the obvious, such as coastal erosion and inundation, to more subtle problems such as inland flooding and salt-water intrusion from deep-water estuaries. The book closes with three chapters of Summaries and Recommendations, which obviously originated as committee reports.

In general, this is a clear and reasonably complete discussion of the problem of predicting sea level change and its impacts. The sections on the observation of sea level change and the projection of future changes is similar in many ways to the chapter by Warrick & Oerlemans in the IPCC Scientific Assessment volume. Some new ground is broken, but some chapters appear to represent pre-IPCC understanding. The impacts case studies are more specific and more interesting than those in the IPCC Impacts Assessment volume.

This reviewer was surprised to see so little discussion or emphasis on what are likely to be the best new techniques for deriving global sea level rise values using mantle rebound modelling (Peltier, Wahr & Trupin, Carter) or for calculating ocean thermal expansion using coupled ocean-atmosphere ocean circulation models (Bryan). The discussion of the Greenland Ice Sheet contribution by Wigley & Raper seems naive by present day standards – the authors project a current rate of mass lost into the future, yet flux divergence, core data, ice-margin advances, and possibly satellite altimetry indicate thickening, and air temperature has decreased in the past 30 years (Chapman & Walsh), and they do not discuss in any depth the likely increase in snow precipitation due to global warming. A more general approach is taken by them for Antarctica, where terms are listed for changes in accumulation, instability of the West Antarctic Ice Sheet, and other changes due to large-scale ice dynamics; unfortunately, these terms are difficult to estimate. Oerlemans, on the other hand, uses modelling to estimate some of these terms and concludes that there is no evidence that the Greenland and Antarctic ice sheets are currently out of balance. The current great debate on the present state of the Antarctic Ice Sheet is ignored.

These criticisms aside, this volume is one of the best syntheses of the causes, projections and impacts of sea level rise. One only wishes that the terrible uncertainties in the projections had been made more explicit.

MARK F. MEIER

Glaciers

Michael Hambrey and *Jurg Alean*
Cambridge University Press, Cambridge 1992.
208 pages. £19.95. ISBN 0 521 41915 8.

This work is first of all an extraordinary fine collection of photographs of glaciers and glacial landscapes. I suppose very few people have seen more of ice on earth than the authors. Without becoming technical, Hambrey and Alean give an introduction to how glaciers work, and how they affect the landscape. The book contains 12 chapters, dealing with the general physical characteristics of glaciers (1–5), glaciers as conveyor belts (6), meltwater (7), icebergs (8),

glaciers and volcanoes (9), glacial erosion (10), wildlife around glaciers (11), and ice, climate and civilization (12). The book also has a glossary, which will be of great use to the non-specialist.

I do not have any substantial criticism of this book. The pictures are beautiful and instructive (there could have been a few on snow-->ice crystals), and the layout is perfect. The only point where a little more could have been included is graphic illustrations. For instance, when the authors discuss the fact that so many pictures and drawings of the Untere Frindelwaldgletscher exist that its fluctuations could be traced back to 1600 AD, it would have been nice to show a curve illustrating this. Or when they claim that glacier fluctuations in the Alps are in good agreement with the summer temperature series from Basel, it would have been more convincing if this series had been shown. [It should be noted, by the way, that several studies with glacier models, attempting to simulate glacier fluctuations with the Basel series as input, have failed to give a satisfactory result due to an inadequate mass balance reconstruction]. In this instance I cannot avoid making a comparison with the book *Die Schweiz un Ihre Gletscher* (Kümmerley und Frey 1981 translated into English and other languages), which contains a more appealing collection of maps and graphics to go with the photographs.

A few statements in the book need comment. For instance, the authors write that, if mankind had not induced an enhanced greenhouse effect, the next ice age may well start within a few thousand years from now. Such statements should not be made unless accompanied with a careful explanation of time scales and Milankovitch radiation variations. Another point concerns the discussion on cold and temperate glaciers. On page 40 I read 'In much colder regions, where the mean annual temperature is below 0°C, much of the ice is below the freezing point'. This is not quite true, and also not in line with the earlier discussion the authors present on meltwater and refreezing. They also state that 'further towards the glacier bed heat flow from the bedrock warms the ice'. Here frictional heating should have been mentioned, as it contributes significantly to raising the ice temperature.

Glaciologists will find more such points, but the text is not meant for them. Glaciologists should buy the book to look at the pictures, laymen to look and read. The authors love glaciers, and it shows. I can only recommend this book.

JOHANNES OERLEMANS

The Distribution and Abundance of Antarctic and Subantarctic Penguins

E.J. Woehler and *S. Poncet*
Scientific Committee on Antarctic Research, Cambridge, UK 1993.
76 pages £10.00. ISBN 0 948277 14 9.

A pervasive activity among marine ornithologists the world over has been the assessment of size and trends of seabird populations (e.g., J.P. Croxall *et al.*, eds., *International Council for Bird Preservation*, Technical Publication No. 2, 1988), in fact, done without the legal impetus stemming from direct exploitation as is the case among experts assessing other vertebrate groups, such as cetaceans (e.g. the International Whaling Commission). Development of this habit among seabird biologists is based on the belief that trends in seabird populations are useful indicators of the state of marine food webs or of levels of marine pollution (e.g., *Scientific Committee, CCAMLR Monitoring Programme Standard Methods for Monitoring Studies*, Hobart, 1991). In the Southern Ocean, particularly, long-term trends in penguin populations have been implicated as indicators of ecosystem change due to intense fisheries, e.g. on cetaceans (R.M. Laws, pp. 411-436 *In*, G.A. Llano, ed., *Proceedings of the 3rd SCAR Symposium on Antarctic Biology*, Smithsonian Institution, Washington D.C., 1977), or climate change (e.g., R.H. Taylor and P.R. Wilson, *New Zealand Journal of Ecology*, **14**, 25-29, 1991).

Best known among all the world's seabirds, from a regional perspective, are trends in penguin populations of the Antarctic, particularly during the past 20 years, and due to the energy of the SCAR Bird Biology Subcommittee (BBS) and it's long-time chairman, John Croxall. The publication reviewed here is the third of a series of ever expanding compilations of regional penguin populations, the first published by the British Antarctic Survey (J.P. Croxall and E.D. Kirkwood. *The Distribution of Penguins on the Antarctic Peninsula and Islands of the Scotia Sea*, Natural Environment Research Council, 1979) and the second also a result of efforts by the BBS (G.J. Wilson, *BIOMASS Scientific Series No. 4*, SCAR/SCOR, Cambridge, 1983). This third issue is the first to contain results of standardized census methods established in the late 1970s thanks again to BBS efforts.

The exhaustive work by Woehler and Poncet presents all available census data on the seven species of penguins that nest exclusively in the Antarctic and subantarctic: Emperor *Aptenodytes forsteri*, king *A. patagonicus*, Adélie *Pygoscelis adeliae*, chinstrap *P. antarctica*, gentoo *P. papua*, macaroni *Eudyptes chrysolophys*, royal *E. schlegeli* and rockhopper *E. chrysocome*. The summary includes data also presented in its predecessors. The data are presented as chronological tables with accompanying maps; data are qualified on the basis of likely, or calculated, accuracy depending on census method. The volume concludes with a summary of localities

and regions where data on population size are lacking or in need of improved accuracy.

This is an important work; I know of at least three publications that cited it in its pre-publication state and several others that should have done so. Now, with its official publication, it is likely to be cited extensively by Antarctic ecologists.

DAVID AINLEY

Primary Succession on Land

Edited by *J. Miles and D.W.H. Walton*
Special publication series of the British Ecological Society, number 12. Blackwell Scientific Publications, Oxford.1993 309 pages. £35.00. ISBN 0 632 03547.

This attractively produced volume records the proceedings of a symposium held at the University of Liverpool during September 1989. Most chapters have been updated with reference citations up to 1992.

Primary succession is defined as "the establishment and subsequent development of the first assemblage of species on a previously unvegetated surface". The stated aim of the symposium was to review the field of knowledge, to identify gaps and to distinguish more clearly those features which distinguished primary from secondary succession.

The organizers describe their difficulties in drawing together "microbiologists and ecologists, botanists and zoologists into a more coherent discussion on the earliest stages of community development". This has resulted in no discussion of the establishment of animal communities and the absence of a detailed treatment of long-distance dispersal of propagules.

Note is made of the paucity of research on the earliest stages of colonization of bare ground associated with algae, lichens and mosses. This is reflected by 11 of the 19 chapters being devoted primarily to vascular vegetation.

Individual chapters range widely, from reports on particular studies, e.g. the effect of harmful soil organisms in degeneration of marram grass in coastal foredunes, to broader reviews, e.g. the role of vascular plants associated with symbiotic nitrogen-fixing bacteria.

The geographic scope is equally extensive, from the deserts of continental Antarctica, to the slopes of Mount Vesuvius, glacial moraines in Norway and the tropical forests of Krakatoa, Indonesia.

These reviews and reports of particular research are sandwiched between a brief introduction, which outlines the processes involved in primary succession, and a concluding chapter, which recapitulates this in the light of the symposium's proceedings and leads on to some general conclusions. These sections provide valuable overviews which place in context the other diverse chapters.

Discussion of Antarctic research is provided in just four chapters. J.R. Vestal suggests that cryptoendolithic lichens and cyanobacteria constitute climax communities. It will be interesting to read of the results of experiments set up in the Ross Desert to analyse the effects of a range of additional nutrients and inhibitory substances on the cryptoendoliths. Will these treatments stimulate shifts in microbial activity and community structure?

Following a brief review of the potential microbial colonizers of Antarctic soils, D.D. Wynn-Williams describes processes in maritime Antarctic soils on Signy Island. The importance of algae and cyanobacteria in stabilizing soil surfaces is demonstrated by the application of ultra-violet epifluorescence microscopy. However, he points out that the dependence on this primary microbial colonization of the bryophyte and lichen succession has yet to be established.

Some evidence for such a dependence is provided by R.I. Lewis Smith in his discussion of the role of bryophyte propagule banks. Again the emphasis is on studies at the fellfield site on Signy Island. *In situ* and laboratory culture experiments showed the presence of numerous and diverse bryophyte propagules in unvegetated soils. The dispersal of these propagules is discussed and speculative comment is provided on the possible effects of global warming and increasing UV-B on the development of vegetation in the climatically sensitive peripheral Antarctic regions.

Although not primarily focussed on Antarctic examples, there is much of relevance to the region in D.W.H. Walton's chapter. He reviews knowledge of the role of microorganisms, lichens and bryophytes in biological weathering of mineral substrata. Many examples are provided of their physical and chemical actions but it is noted that we are still very ignorant of the rates of natural biological weathering. Several suggestions for further work are presented which could usefully be pursued in Antarctica.

In several years' time Antarctic terrestrial scientists might be in a position to gather together their accumulated knowledge of primary succession. If so, this will probably contribute to understanding of the role of microorganisms, lichens and bryophytes in more temperate regions of the world, a topic barely touched in this volume. Certainly there is a huge field of stimulating interdisciplinary research to be developed.

The international programme, "Biological Investigations of Terrestrial Antarctic Systems" (BIOTAS) provides a framework and there is already a wealth of ideas outlined in the BIOTAS Newsletters (Smith & Wynn-Williams 1987–92) and the BIOTAS Manual of Methods (Wynn-Williams 1992, Cambridge: SCAR, 263pp). As Miles and Walton state in the final chapter " There remains a great deal to be learnt about primary succession".

PAUL A. BROADY