Antarctic Science 1 (1): 77–82 (1989)

Book reviews

Antarctica: soils, weathering processes and environment

I.B. Campbell and *G.G.C. Claridge*
Elsevier Science Publishers, Amsterdam & New York (1987). 406 pages. Dfl 220. ISBN 0 444 42784 8.

Soils are not the most obvious feature of Antarctica. Limited as they are to the slightly over 1% of Antarctica free from ice they could well be dismissed as of little importance and probably inadequately researched. That would be unwise and this volume demonstrates clearly how the dedication of a few soil scientists over almost three decades has resulted in a detailed understanding of a group of unusual soils.

Antarctica is a big place and the studies by the New Zealand and American pedologists, which form the bulk of this volume, have concentrated on soils in the dry valleys of Victoria Land. These are typically xeric soils, in some cases very old and almost always with associated salt accumulation. The authors have attempted to keep the volume Antarctic-wide but published information from the maritime Antarctic islands, the Antarctic Peninsula and some areas of East Antarctica is limited, and this makes the book seem less comprehensive than it really is. Their approach, both in the book and in their many published papers, has been essentially descriptive. As yet there has been little evidence of much experimental work on Antarctic soils.

The authors have attempted to set the scene for the non-Antarctic soil scientist with initial chapters on geology and geomorphology, climate and biology, emphasizing those features of significance in soil formation and development. They then embark on the meat of the volume in two chapters dealing with soil-forming processes — physical and chemical weathering — followed by three chapters describing soil properties, soil distribution and soil classification. Salts in soils are given a separate chapter. To draw the book together the authors use a synthesis of data on soil weathering and glaciology to reconstruct the chronology of the last four million years in Victoria Land. The book concludes with a short chapter on the sensitivity of these special soils to damage and the need for their conservation and management.

The book is well structured and easy to use. Misprints are almost totally absent. The colour photographs of soil profiles and weathering at the start of the volume are a valuable illustration for those who have never visited Antarctica There are many good half-tone illustrations and it is a pity that the one on p. 127 was apparently printed upside down. The bibliography is extensive with over 350 references but is by no means exhaustive. This is unfortunate since most workers will turn to this volume as the principal source on Antarctic soils. Missing, for example, are some of the relevant theses on American work and quite a few significant references on the biology of the soils. Rather surprisingly the important initial paper by David and Priestley (*British Antarctic Expedition 1907–09, Geology*, **1**, 1–319. 1914) which describes the algal peat, the mirabilite at Cape Royds, the chemical analysis of guano and the processes of weathering is not quoted, nor is the only major micromorphological study of Antarctic soils (Kubiena. *Hamburger Geographische Studien*, **24**, 349–373. 1971). There are few references after 1982 which suggests that the manuscript was probably completed around then and the publishers took rather a long time to produce the volume.

I believe it would have been better if the authors had included some mention of the subantarctic soils which show much clearer analogies with arctic soils than the cold desert soils of the Antarctic continent do. They apparently felt this to be outside their remit. Few data are given on microclimates yet it would seem that the frequency of freeze/thaw and wet/dry cycles would be of fundamental importance in any discussion of weathering processes. The authors compare the various attempts at classification of Antarctic soils and conclude that the present international definitions of a soil would exclude the ahumic polar soils. Their case is well made that these do constitute soils, that they are beyond the extremes of present classifications but that by relaxing some of the rigid definitions for certain categories they could be included. Their value in developing our understanding of important soil processes is considerable and would be enhanced by placing them in the correct global context.

Given the statement that 'the soil pattern is very much a function of the geology and geomorphology' I would have liked to see a more extensive treatment of some aspects of geomorphology, which is restricted to only 17 pages. It would be churlish however to carp in the face of this effort to bring together in an accessible form most of the literature on Antarctic soils. As always I would have hoped for a volume priced at an affordable level for the working scientist — which this clearly is not.

This is not the first book devoted to polar soils but it is the first concerned only with Antarctic soils. The authors are to be congratulated on their synthesis, which provides a fitting culmination to their years of field work. This volume provides a baseline for future efforts and demonstrates how far we have gone in our understanding of continental soils and how little we know of maritime soils. There remain considerable opportunities in the Antarctic and the Subantarctic for interested soil scientists.

D.W.H. Walton

Palaeontological results of the Polish Antarctic expeditions — Part 1.

Edited by *A. Gaździcki*
Palaeontologia Polonica, No. 49 (1987), 168 pages, 53 text figs, 44 pls.

This single volume brings together many of the results of studies by Polish workers on the important marine faunas from Oligocene–Miocene glacio-marine sequences on King George Island, South Shetland Islands. A geological introduction by Krzysztof Birkenmajer is followed by eight papers covering recycled Cambrian microfossils and Cretaceous belemnites, and descriptions of the Tertiary ostracods, corals, polychaete jaws, gastropods, crabs and echinoids. Most of the papers are primarily systematic in content, although those by Wrona, on the enigmatic Cambrian *Hadimopanella*, and by Roniewicz and Morycowa, on the coral *Flabellum rariseptatum*, present a more discussive treatment of their subjects. All the papers are in English, with a translation of the abstract in Polish, and the text is amply illustrated by text figures and plates which are good, if lacking in a little crispness. Andrej Gaździcki, in the preface, anounces that this is the first of a series to be published in *Palaeotographia Polonica* on the studies of Polish palaeontological collections from Antarctica. With a literature which is already becoming voluminous and dispersed, Polish geologists are to be congratulated for bringing together papers in such a convenient volume and I look forward with interest to seeing the second in the series.

M.R.A. THOMSON

Proceedings of the Symposium on Macquarie Island, University of Tasmania, 11–15 May 1987

Edited by *M.R. Banks* and *S.J. Smith*
Papers and Proceedings of The Royal Society of Tasmania, volume 122, part 1. Royal Society of Tasmania, Hobart (1988). 318 pages. $(Aus)30. ISSN 0080 4703.

Islands can be regarded as an ideal package for many types of scientific investigation. They come in a variety of sizes and positions, they have clear boundaries — at least for the terrestrial scientists — and they often contain unique communities and endemic species. The subantarctic islands are no exception to these general rules and have attracted increasing attention. Several general books have already been published on Macquarie Island but this appears to be the first scientific symposium devoted to the island.

The symposium was jointly organized by Antarctic Division, who have for many years contributed the major research effort on the island, and Tasmanian Parks and Wildlife Department, who have the management responsibility for the island as a Tasmanian State Reserve. It was a brave attempt to bring together as broad a view of the island as possible and the 33 papers presented cover the range from upper atmospheric physics to the origin of the island.

The editors have organized the papers into nine groups of which three are biological (14 papers), three are physical (10 papers), one is on earth sciences (6 papers) and the remaining two are on history and management (2 papers). As in most symposia of this type the quality of the individual papers is rather uneven. It must be said that the necessity for achieving a broad view appears to have allowed the inclusion of material that might not have made it into major journals.

The papers on tectonic history (Williamson) and on the age of the rocks (Duncan & Varne) give a useful overview of the major geological features. Especially interesting was the paper on the origin of landforms (Adamson *et al.*) in which evidence is offered that some landforms, previously attributed to glacial action, can be ascribed to faulting. The preliminary data on palaeolake deposits (Selkirk *et al.*) also casts doubt on the extent of the previous glaciation.

Substantial papers on the history of the elephant seal industry (Hindell & Burton) and on the recovery of the fur seal population (Shaughnessy *et al.*) make a valuable complementary pair. The continuing decline in elephant seal numbers at Macquarie and the dramatic expansion in both populations and distribution of *Arctocephalus gazella* in the South Atlantic make both these species of particular interest. Short papers deal with the status of black-browed and grey-headed albatrosses on the island, banding studies on giant petrels and the occurrence of viruses in birds. Research on viruses in the Antarctic and Subantarctic has been very limited and this information on Newcastle Disease Virus and tickborne viruses is welcome.

The marine scientists reported on morphotypes of *Durvillaea antarctica* (Klemm & Hallam), gave a useful paper on the offshore fauna with a checklist (Dawson) and an annotated list of benthic and pelagic fish (Williams). The terrestrial biologists made only a limited input to the symposium with an overview of the effects of rabbits (Scott), wind patterns and pollen fall-out (Peterson & Scott) and a review of past and future management objectives for controlling introduced species (Brothers & Copson).

Finally, the physics and meteorology papers. Streten's paper on the climate of Macquarie and the island's role in atmospheric monitoring is a useful introduction and, being followed by papers on climate warming (Adamson *et al.*) and changes in trace gas concentrations (Francey *et al.*), underlines the value of the island as a monitoring station. This point is also stressed for upper atmospheric research (Cole). An ionospheric paper concludes that present map systems for the critical frequency of the F-region are inad-

equate (Esposito) whilst a curious paper examines just one year's ozone data without reference to any work later than 1982 (Mallis) — surely a major oversight? A paper on geomagnetic pulsations (Grant *et al.*) shows how they are related to auroral substorms and the value of this approach in propagation predictions. Quite why the paper proposing a radio beacon experiment (Essex) was included is not clear.

The editors and the Royal Society are to be congratulated both on the speed of production and the final appearance of the volume. It will provide a useful reference for some of the science on the island but would have benefited from a more rigorous selection for its contents. The apparent lack of activity in botany and entomology is surprising, given the intrinsic interest of the flora and fauna. The emphasis in several papers on the role and importance of monitoring in assessing climatic change is in keeping with the global concern on the effects of climate warming. Macquarie appears to be well placed for studies of this type. Would it, I wonder, have been useful to have increased the length of the volume and published the detailed annotated bibliography prepared by Selkirk *et al.* here, rather than as an ANARE Research Note? The symposium clearly demonstrated the value of the island to many different disciplines — but will this be sufficient to establish an adequate level of funding for what could be important research in the future?

D.W.H. WALTON

The Greenpeace book of Antarctica: a new view of the seventh continent

John May

Dorling Kindersley, London (1988). 192 pages, illustrated, hard cover. £14.95. ISBN 0 863 18283 6.

Greenpeace is now wholly committed to pursuing its campaign to designate Antarctica as a World Park, to minimize the effects of human presence there and to prevent the exploitation of the continent's mineral resources. In 1987 the environmental group established a small base at Cape Evans on Ross Island, manned it through two winters and undertook a modest scientific programme. In doing so, according to their interpretation of the Antarctic Treaty, they may seek membership of the Antarctic Treaty as a Consultative Party, and have already achieved observer status in some of the institutions of the Antarctic Treaty System. I had fully expected Greenpeace's book of Antarctica to be a hard-hitting environmental extremists' view of Man's intervention in the seventh continent and of the threat he and his rapidly expanding activities and developments are posing to its unique environment and ecosystems. However, I was pleasantly surprised since it has been written with considerable care to avoid the expression of such feelings and it approaches the Antarctic 'problem' sensibly and sensitively. Also, because of its format and content, I had expected the book to be largely a repetition of the excellent 'Antarctica: Great Stories from the Frozen Continent'. (Reader's Digest, Sydney, 1985). However, it is not. The latter concentrated on historical exploration of the Antarctic and Subantarctic; the Greenpeace book, quite naturally, is concerned more with the environment and Man's interaction with it and with the political issues (and excludes the subantarctic islands).

It is divided into four main chapters, each containing a number of short topic sections of mainly two to three pages. The first chapter, 'Terra Incognita', contains 13 such articles on the physical features of Antarctica including its geological evolution, topography, ice cover and climate. The second chapter describes 'Life at the End of the World' in nine sections. These include the terrestrial and marine (but unfortunately not the freshwater) flora and fauna, with separate sections on krill, fish, seabirds, seals and whales, and their interaction in the ocean food web. Chapter three deals with 'The Human Presence' and comprises 12 sections. These provide a brief account of exploration, and enlightening summaries of the development and implementation of the Antarctic Treaty and of the status and stations of each of the Consultative Parties in Antarctica. The impact of the stations and of tourism is treated realistically and sympathetically. Various conservation issues are addressed in sections on protected sites and exploitation of natural resources. The concluding section is a personal account by Dr Charles Swithinbank (formerly of the British Antarctic Survey) who recounts his 38 years of experience in Antarctic research and administration.

The final chapter on 'Greenpeace Perspectives' describes where the organization stands at the crossroads of the Antarctic political scene. Its concept of Antarctica in terms of the World Park Strategy is clearly stated. The chapter ends with a section in diary form of personal experiences by the members of the team who established the Greenpeace station, followed by interviews with key personalities in Greenpeace's campaign in Antarctica. Unfortunately, it is in these accounts that, among much very rational and thought-provoking discussion, some of Greenpeace's more extreme views are expressed, e.g. 'the ultimate aim: to urge forward the declaration of Antarctica as a World Park, where the use of natural resources to commercial ends will be prohibited. Seems logical? For most people, yes, but not for the heads of the Treaty states, who, ''manage'' Antarctica. They are at this moment [November 1986] busily negotiating the mineral exploitation of Antarctica — behind closed doors, of course. We must put a stop to this before we lose the last paradise on Earth', and 'I believe we have created a good, well balanced campaign that has the potential to make a significant impact on Antarctic developments'.

The book ends with several Appendices including data on Antarctic bases and refuges, a summary of the Antarctic

Treaty and its membership, a brief bibliography, a rather superfluous gazetteer and an index.

This is a highly informative and sensibly priced book, which should appeal to both layman and specialist, whether conservation-oriented or merely interested in remote parts of the world. It is well produced with excellent figures (including up-to-date satellite imagery of sea ice distribution and the ozone 'hole') and photographs (most of which are informative rather than just illustrative). Parts of the text have been written by experienced Antarcticans (formerly of the BAS), while two others have served as consultants (also formerly of BAS) and who were largely responsible for maintaining a high standard of accuracy and presentation throughout. Unfortunately, though, numerous factual errors have been overlooked, some of the more glaring being: Haswell Island is not in Dronning Maud Land (but in Queen Mary Land): the South Orkney Islands are not part of the South Shetland Islands (i.e. the Elephant Island group is misnamed); Siple is not a Soviet station (but American); the whaling station on Deception Island was not established by the Chileans in 1906 (but by the Norwegians in 1912); Ecuador's claim to much of Ellsworth Land has never been formally proposed or recognized; Antarctic pearlwort *Colobanthus* (even when spelled correctly) *subulatus* does not occur in the Antarctic (although *C. quitensis* does); the Antarctic midge *Belgica antarctica* is not 12 mm long (it is *c.* 2 mm long). However, such mistakes should not detract from what is an excellent and fascinatingly readable account of Antarctica, its environment, ecological systems and Man's increasing involvement in it. There is ample material to provoke serious consideration of how the Antarctic Treaty System is or is not succeeding, and what is required to maintain rational and environmentally sound progress in this last arena of unspoilt Planet Earth. So long as Greenpeace handles its involvement in Antarctic affairs with discretion and respects those who are more experienced, I am sure it will play an important role in the future of Antarctica's management.

R.I. Lewis Smith

South Georgia, British Antarctic Survey GEOMAP Series, Sheet 1, 1:250 000 geological map and supplementary text

D.I.M. Macdonald, B.C. Storey and *J.W. Thomson*
Cambridge University Press, Cambridge (1987). 63 pages. £15.00. ISSN 0951 8886.

The systematic production and publication of geological maps tends to be a low profile activity, overshadowed in the earth science prestige stakes by more glamorous areas of research. Geological mapping also tends to be an underfunded activity, so that even first-world countries such as the United States are still not fully covered by good maps at a standard scale. Yet another problem is that the geological map output of many large countries — for example China, India, and the Soviet Union — is not, for misconceived strategic reasons, made generally available. In that context it is a pleasure, for one whose long professional career has been concerned with geological map production in Geological Surveys, to review the first of an important new series of geological maps.

The British Antarctic Survey's GEOMAP Series is a progression from the BAS 500G Series of geological maps, which provided a set of reconnaissance geological sketch maps, at a scale of 1:500 000, of the greater part of British Antarctic Territory. It is not intended to provide a systematic coverage of any region of Antarctica, and later maps already planned have scales between 1:10 000 and 1:2 500 000. This first sheet shows the geology of South Georgia at a scale of 1:2 500 000. At this scale the roughly 170-km by 30-km island occupies only about one eighth of the available area of the map sheet. At first unfolding there is therefore a general impression of too much ocean and ancillary marginal information (see below), but reflection quickly indicates that this is due to the problem posed by the elongate shape and oblique orientation of the island and to the fact that any larger scale in common use (e.g. 1:125 000) would have made it impossible to restrict the map to a single sheet — an obviously desirable objective.

The geology represented on this map is derived almost entirely from a British Antarctic Survey programme which started in 1969 and involved 11 geologists over a period of eight years; other sources of information are documented both on the face of the map, which was compiled by J.W. Thomson, and in the accompanying text. The map is well designed, drafted, and printed; the representation of the rocks concealed beneath glaciers by a paler tint of colour chosen for the equivalent exposed rocks is particularly successful, and gives the map a geological integrity that would not have been possible with the glaciers white. Both the general aesthetic impact of the map, and the clarity of its geological representation are of a very high standard, and it is in that context that the few following crictical comments are made.

My strong preference for the layout of legends (in Australia normally called references) is that the boxed units should be arranged in relation to a vertical scale of time, so that the geologist unfamiliar with the area gets an immediate feel for both the total age of the rocks shown and for their relative ages. On this map the boxed units are arranged, in groups, in accordance with the tectonic interpretation of the geological evolution. But in this scheme Upper Cretaceous igneous intrusions appear at the top, at the same level as the uppermost Jurassic–Lower Cretaceous Cumberland Bay Formation. The difficulty of immediately reading the time relationship of the rocks from the legend is compounded by showing isotopic ages (in Ma) in the map, while using only

biostratigraphic names in the legend. Thus the Smaaland Cove intrusion is shown as 127 Ma on the map and Lower Cretaceous in the legend. A vertical scale showing both years and biostratigraphic names on the legend, with the boxes arranged accordingly, would make the map more easily readable without reference to the text; of course, many of the units shown are not well fixed in time, but there are simple ways of indicating possible age ranges without confusion. A minor design criticism is that some of the colours, particularly the reds and greens of the 'Basin floor' and their overlaid white dots, seem excessively strong.

The publisher of any geological map has to decide whether that map should be independently readable, or whether it should be considered in principle as yet another figure to the text which accompanies it. My impression is that, for the map reviewed, this question has not been completely addressed, or resolved. The fact that this publication is the first of the GEOMAP Series seems to indicate that the map is seen as its major component, with the accompanying 'Supplementary text' as the lesser part. If that was indeed the intended balance, then there are apparent anomalies in both parts. The 'Supplementary text', which in the Preface is called a memoir and on a sheet of paper accompanying the review copy is described as an explanatory booklet, is a major descriptive publication in its own right which does much more than explain the map. This beautifully produced 63-page monograph, written by D.I.M. Macdonald and B.C. Storey, is a model of how regional descriptive geology should be written up — using a clear and readable prose style, with abundant attractive and informative illustrations, with enough detail to make it interesting, and with clearly-signposted references to their sources. Surely its quality justifies a better title than 'Supplementary text'?

By contrast the map, although also an excellent production, could have been differently presented if it was to stand out as the greater component of the publication. The abundant spare area on its face has already been noted; most geologists could think of better things to fill that space than some of the marginal information which is included. As an example, perhaps the listings of topographic and bathymetric sources could have been put elsewhere, and the space used for larger-scale maps of some of the small areas whose geology is too complex for clear representation of a scale of 1:250 000, such as Cooper Island and the area south of Storey Glacier.

But in spite of these criticisms the British Antarctic Survey is to be congratulated on its initial production in this series, and this publication deserves to be widely known and apprciated, by the wider community of geoscientists as well as Antarctic specialists. The sale price of £15.00, high for a map but good value for this excellent publication, ought not to deter either individual geologists or institutional libraries from buying it.

A.F. TRENDALL

Man in the Antarctic: the scientific work of the International Biomedical Expedition to the Antarctic (IBEA)

Edited by *J. Rivolier, R. Goldsmith, D.J. Lugg* and *A.J.W. Taylor.*

Taylor and Francis, London (1988). 223 pages + xxv. £26.00. ISBN 0 850 66280 X.

This interdisciplinary and international investigation in the austral summer of 1980/81 covered physiology, psychology and clinical medicine. The complex experimental design, philosophy and protocols are all discussed in detail. Twelve men of five nationalities took part, all but one personally involved in one or more of the various projects.

An ambitious programme of work was prescribed at the outset, purposely designed to be intense in nature. The programme included a prolonged period of laboratory study, prior to the expedition in Antarctica, during which baseline measurements and assessments were made. The 71-day expedition was followed by further laboratory-based studies. Field measurements were undertaken during an overland traverse to 400 km inland from Dumont d'Urville station.

The difficulties encountered in organizing an international expedition of this nature are briefly outlined in the forewords and are more thoroughly discussed in the text. The compromises made to the planned programme of work due to the limitations imposed by the environment are well reported and are worthy of more general recognition, since all field work investigating Man in his environment suffers, to varying degrees, from similar problems.

The methods and tests of assessment used for monitoring during the expedition and in the baseline studies and follow-up phases were those which had been well tried and tested in other work. However, a major difference in this study was that each investigator was also required to be a subject in his colleagues' studies. The advantages and disadvantages of the investigators also acting as subjects during such an intense work effort are presented at an early stage in the text and are highlighted frequently throughout the report.

Although the reported intention was to monitor the response of Man to the Antarctic environment without creating an experimental scenario, it was obvious that the monitoring method was itself a limitation on this. In estimating the energy expenditure of certain routine activities on base or during travel between base camps the equipment required to be worn was necessarily more cumbersome than was desirable. Using this apparatus prevented the subjects from working in a normal fashion, so that the samples collected could not be said to be representative of habitual activity. Similarly, the psychological results showed that the intensive nature of the whole programme of study added to the other stress agents and became a factor of some importance in itself. The problems of using results based upon a small number of subjects are evident and are encountered regularly by those

studying Man in Antarctica.

The work of the whole expedition is reported here in a very well organized fashion, and the difficult task of integrating a large number of investigations of various disciplines has been achieved. The bibliography and appendices give valued support to the text. In some instances, however, the layout of tables is confusing and more explicit legends would improve the clarity of certain figures and tables.

The honest form of the narrative (especially the examination of group psychology and the failure to work as a team) would make interesting reading not only for those interested in the Antarctic but also for those anticipating organizing or participating in expedition field work in other areas. This is the first major volume on Antarctic biomedical research since the book by O.G. Edholm and E.K.E. Gunderson (*Polar Human Biology*. London: Heinemann Medical. 1973) and comes at a time when there appears to be a resurgence of interest and enthusiasm for Antarctic medical research.

S.E. Wilcock

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