Antarctic Science 3 (4): 451–457 (1991)

Book reviews

From Antarctica to outer space—life in isolation and confinement

Edited by *Albert A.Harrison, Yvonne A.Clearwater and Christopher P.McKay*
Springer-Verlag (1991) 410 pages.
US$39. ISBN 0 387 97310 9.

The Antarctic has been seen increasingly in recent years as a possible analog environment for long term space travel. The present volume is based on papers presented at a conference in 1987 in Sunnyvale principally on the human experience in Antarctica, under joint sponsorship by the US National Aeronautics and Space Administration (NASA) and National Science Foundation (NSF) and with particular emphasis on relevance to space.

These studies are at the forefront of our understanding of Man's adaptation and are international, but with a strong feeling of national accomplishment in the field. This book relies heavily on US experience: 36 of the 45 participants were from USA, 9 were from other countries (France, UK, Zealand, Australia and Canada). Most remarkable was the absence of any direct Soviet input.

The volume is divided in four parts. Firstly, an introduction to the human side of isolated and confined environments with data derived from Antarctica, Outer Space, submarines and even remote US national parks. The second part of the book discusses theoretical issues underlying research on isolated and confined humans, a third part focuses on basic psychological and social responses to isolation and confinement. Finally, there is a part on interventions and outcomes which discusses selection, training and environmental designs. There is also a final conclusion presenting recommendations, heavily influenced by the US background of the three editors.

Although many Antarctic operators have used selection programs, and some also follow up programs, there is apparently not the corresponding amount of systematic data on psychological selection available. The pioneer in this research, E.K.Eric Gunderson developed selection batteries very early, but these were either not used, or not researched adequately. It seems as if considerable portion of largescale potential data from the mid-sixties to the mid eighties have simply been lost or not exploited. However studies of smaller groups at French, New Zealand and Australian stations, demonstrate that there are normally few dramatic changes either during the stay or following the stay. Another pioneer, A.J.W. Taylor, who contributes to this volume, has summarized his results in a famous paper entitled "Antarctica Psychometrica Unspectacular".

Boredom and monotony may be one of the highest sources of risk for long stays. Some degree of sensory deprivation has been described, (at least as stimulus reduction) and there have been claims of altered consciousness in the Antarctic and in space. These factors do not seem to be related to the harsh environments, but more to the organization and work load that a group has under the particular circumstances.

To be taken seriously Psychologists must demonstrate their ability to contribute to the exploration of Antarctica and space. Suedfeld gives recommendations for this. Soviet medical experts have claimed that the main medical problem in space is psychology, but NASA seems to believe that concerns about astronaut adaptation were unfounded, since no space mission has been jeopardized by psychological factors. Suedfeld suggests that researchers should think in terms of experiences within environments rather than of environmental characteristics, they should study differences and similarities between experiences, and knowledge should be based on similarities in the experience rather than on the environment. An obvious future improvement would be general agreement on standard batteries both for selection and for follow-up of the experience from space, Antarctic and sub-sea environments. Some initiatives have now begun to address this.

Many of the authors' comment the positive effects of the Antarctic experience, whilst the lack of problems, and a feeling of accomplishment and enrichment after such an expedition seems to be reasonably well established. There is some concern over the "re-entry" into civilization and on the desirability of consultation and support systems, particularly after a long stay.

Readers from other nations, like the present reviewer, cannot help noticing the heavy US influence. The constant mention of "national" data, committees, boards, research committees, governmental proposals etc. all refer only to US interests. This ought to have been avoided in a volume which obviously addresses an international audience, and an area of international collaboration. The publisher has a European base, with offices spread all over the globe! There is, for instance, a speculation on what would happen if a German killed a Greek on a US Antarctic base. There is an interesting discussion of the US legal issues, but no mention of the possibility that German and Greek authorities also might have a certain interest in such a case, or references to international agreements and experience from international marine law. Provincialism is provincialism even if the province is very large!

The challenge and experiences gained at the limits of our existence as a species affect us all, and interest us all. The empirical material from visits to space will be limited. There are interesting experiences from sub-sea environments not mentioned in this volume. There is an abundance of experience from the Antarctic, and, also to some extent, from the Arctic.

The volume is highly recommended to anyone interested in these issues. There are short comings in the volume, and perhaps the lack of representativeness for the total human experience could not be helped at the time the Conference was held. However, I still recommend the volume as a very good introduction and a useful review of the present state of knowledge.

HOLGER URSIN

The future of Antarctica

Edited by *Grahame Cook,*
Manchester University Press, Manchester (1990) 168pages. £10.95. ISBN 0 7190 3449 3.

A conference on Antarctica: an Exploitable Resource too Valuable to Develop? took place at the Sir Robert Menzies Centre for Australian studies at the University of London in either late 1989 or early 1990. The papers were compiled into this small book (only 104 pages of text exclusive of useful appendices containing maps, texts of the Antarctic treaty and the Convention on the regulation of Antarctic Mineral Resource Activity [CRAMRA]) which addresses the hottest issues confronting the Antarctic Treaty Consultative Parties in the early 1990's. Some of the discussion is being overtaken by events, but fortunately, the general quality and broadness of the coverage will make the book useful to diplomats, historians, international lawyers, scientists and other environmentalists for some time to come.

The substantive papers are by experts and spokespeople for various disciplines or points of view. Richard Laws, President of the Scientific Committee on Antarctic Research (SCAR) (not noted in the book) and former director of the British Antarctic Survey makes the case for the importance of Antarctica for scientific research, not only for the intrinsic value of the particular study, but as a still essentially pristine place to study the effects of global change (e.g. pollutants and CO_2 in the ice), the ozone hole etc. Laws concludes that some of the proposed regimes, such as a World Wilderness Park were likely to militate against the continuing pursuit of scientific goals by weakening the Antarctic Treaty.

One of the best papers is on the geological realities of the mineral resource potential, by experienced Antarctic earth scientists Robert Willan, David Macdonald, and David Drewry (present director of BAS). They make a good case against any likelihood of the economic exploitation of either petroleum (on-or offshore) or hard minerals, for sound scientific reasons. The geological evidence at present, they conclude, shows that Antarctica contains no more than hypothetical and speculative resources. I am becoming convinced that Antarctic geologists and geophysicists have not made this point loudly and clearly enough to politicians and environmentalists, probably because we are aware of the impossibility of proving a negative. Even the title of the conference is misleading in this respect. The Antarctic Environmental Protocol was hung up for a time in Madrid in June, 1991 because of this issue but, as finally agreed by consensus, prohibits mineral resources activities other than scientific research. John Heap, the guru of the Antarctic Treaty System, attempts to make the political case for CRAMRA. Unfortunately for his position, which I believe has many valid points, that the train has apparently left the station. Heap's paper still deserves careful study for a number of interesting ideas that it contains. He notes that the conditional gentleman's "moratorium" on mineral activity will come under increasing strain and perhaps begin to crumble. Heap states that "activity which is seen by some as scientific research, and by others as prospecting in disguise could serve as a corrosive catalyst". Hopefully, the new Environmental Protocol will solve this problem.

John Burgess, of the Australian Department of Foreign Affairs, ably presents his country's position for a comprehensive regime for environmental protection (for which a consensus has existed for several years) and a ban on mining. He notes that for various reasons CRAMRA was a "public relations disaster". Burgess points out that when Australia reversed its position in 1989 and opposed CRAMRA, "it bypassed the [scientific] community which had been so influential in previous important Antarctic decisions". Greenpeace also has strong views on Antarctica, which Kelly Rigg proclaims. She states that "the most serious threat facing Antarctica is that of mineral exploitation"; aside the Environmental Protocol, this view is incorrect because there is no likelihood of any economic resources. Rigg also worries that "the spirit of cooperation will be lost as research priorities shift towards resource exploitation and results are increasingly considered to be proprietary data"– a point for scientists to ponder.

Catherine Redgewell, a lawyer at the University of Manchester, discusses the legal regime and attacks the United States position of 1989 as "the weakest of the proposals" (it changed considerably by June, 1991). She also does not like "contrived ambiguities, bifocalism and restrictive interpretation" some of which have probably been crucial in allowing the Antarctic Treaty to survive for thirty years. Grahame Cook, fellow at the Sir Robert Menzies Centre (and the editor) discusses future developments. Both these writers have been overtaken by events. Cook foresightedly remarks that CRAMRA "contains many good initiatives...which could serve as useful models for a comprehensive environmental regime". The Environnmental Protocol contains many of these, but has much broader application than mineral resource activities and avoids the potentially disruptive claimant issue.

JOHN C. BEHRENDT.

Permafrost and periglacial processes

Edited by *H.M.French, E.A.Koster and A. Pissart*
John Wiley & Sons Ltd, Chichester
Volume 1 (1990). £75 ISSN 1045 6740

Research on permafrost and periglacial processes has a long history. Previously the majority of papers have appeared in conference proceedings or in journals with a geographical focus. More recently the growth of applied science in this area has seen papers on permafrost in geotechnical and engineering publications.

The advent of a new journal is usually taken to indicate that a particular group of specialists feel inadequately catered for in the established journals. Perhaps a new focus is required to bring the literature together, or maybe there has been a sudden upsurge of activity in a specific field that requires a new outlet for the material generated.

In the editorial in the first issue Hugh French makes it quite clear he believes the journal is necessary to provide a focus for an interdisciplinary science and engineering community and as a response to the upsurge of interest in the polar regions.

With four parts per year the first volume contains 320 pages of papers and book reviews. There are 20 standard papers, six short communications and three book reviews. Although the journal will publish in either English or French only two of the contributions are in French. The three editors are assisted by an Editorial Board of 12 members from nine countries.

The journal is typeset in double column with a format slightly smaller than A4. Abstracts are in English and French. Illustrations are as authors submit them. The matt paper renders good halftones well — loss of detail in some was clearly due to a poor original print. At £75 it is not especially expensive for libraries but it seems unlikely that many individuals will purchase it. Why not have a reduced subscription for individuals ?

Categorisation is difficult but a crude analysis shows that in the first volume there were 11 contributions on Arctic sites, 11 on alpine subjects, one on Antarctica and three on laboratory studies. There is only one paper so far on the geotechnical and permafrost management fields which the journal hopes to attract. Clearly the editors trawled widely to fill the initial volume with contributions on China, New Zealand, USSR and South America as well as the more usual areas of Canada and the USA.

I welcome the arrival of this journal on the scene. I hope that it will provide a more rigorous treatment of material previously published in the proceedings of the International Permafrost Conferences, an initial reference point in a disseminated literature and an important vehicle for promoting interdisciplinary interests.

D.W.H.Walton.

Polar marine diatoms

Edited by *L.K. Medlin and J. Priddle*
British Antarctic Survey, Natural Environmental Council, Cambridge. (1990). 214 pages. £22.50. ISBN 085665 140 0

For a long time diatoms have been regarded as main producers in seawater as well as in sea ice, playing a vital role in the trophic structure of polar regions. Now, it is often put forward that other photoautotrophs e.g. the nanoplankton can dominate in the marine polar regions. Yet, the presence of diatoms in polar ecosystems is of outstanding significance. Usually they dominate over photoautotrophs in sea ice and often over those being in plankton. Diatoms have clear species features of the frustule structure that can usually be identified in light microscope after a quite simple preparation. Because these features are present in often solid siliceous frustule diatoms can be identified in fixed, long-preserved, crumbled or fossil materials. Density of cells, species composition and dominance of diatoms depend on external environment. Therefore, they are organisms of specific indicatory attributes, useful in oceanobiological as well as paleontological investigations. Marine diatoms of polar regions has been studied since last century; at first from the taxonomic point of view, next closer concern was also aimed at ecological and physiological data.

The studies on polar diatoms have been performed for a long time. Difficult environmental conditions make it difficult to collect diatoms in various seasons, habitats and water masses. So, much is unknown in ecology and taxonomy of polar diatoms. Recent intensive taxonomic investigations take into account intraspecific variations and are based on the material cultured and collected in different seasons. Methods of microscopy, scanning electron microscopy especially, are used in these investigations. The source taxonomic studies based on electron microscopy cannot always be used in ecological researches. There is a great shortage of summary work on the above topics.

The book contains 24 articles by 17 specialists of polar diatoms and is illustrated by 326 drawings and 260 photographs. It is divided into three main parts: ecology (9 chapters), taxonomy (15 chapters) and bibliography containing 740 references. The ecological part deals with the main pelagic ecosystems in polar regions. The taxonomic section refers to 12 genera of Centrales and 18 genera of Pennales.

The first four ecological chapters deal with sea ice. The first of them by Squire is on the formation, distribution, and properties of sea ice important from the biological point of view. Horner then gives examples of the assemblages of microalgae in the Arctic and Antarctic sea ice and some observations of their seasonal development. About 500 species of photoautotrophs from nine groups have been reported from the ecosystem associated with sea ice. Next Poulin deals with Arctic diatoms describing the history of

studies, seasonal and annual variations, and geographical variability in species composition. Finally Horner presents a variety of sea ice sampling devices.

In the remaining five ecological chapters the polar plankton ecosystems are described. Priddle presents the main taxonomic and ecological features of phytoplankton and of pelagic inhabitants of other trophic levels in the upper water colomn of the Southern Ocean. The next three chapters are on the Arctic Ocean ecosystem. Carmack and Swift show us the complex physical oceanography of the Arctic Ocean describing geographical data, water masses, large scale, surface and thermohaline circulation. Sakshaug describes environmental conditions for the growth of the primary producers and blooms of plankton algae. Data presented by Hasle considers the influence of the ice edge and geographical factors on the composition of the planktonic diatom.

Finally Gersonde discusses biostratigraphy, palaeo-oceanography of the Southern Ocean and of the high latitudes of the North Atlantic and the North Pacific.

The taxonomic part contains the key to diatom orders and families. Terms of diatom morphology are specified and illustrated. This part includes descriptions of particular families, directions useful for identification, keys to species or lower systematic units (a total of 179 taxa, including resting spores) and illustrations of taxa. Each chapter is elaborated by the specialists working on the given group.

One must emphasize the editors' effort to organize all the taxonomic chapters on the same format, which greatly facilitates usage of the book. However, some characteristics of taxa are not complementary, e.g. species distribution mentioned in tables. Data on autecology of species are not insufficient, possibly because of difficulties in data collection.

In spite of the many studies, descriptions of polar diatoms are often based on various and sometimes incorrect sources. "Polar Marine Diatoms" will facilitate standardization of diatom identification, making an important contribution to correct determination and comparisons of studies performed by different scientists. The organization of the book is good.

The provision of data on diatom morphology, structured keys and descriptions based on observations in light microscope, tabulated morphometric and distribution data for each taxa described, directions how to identify species based on water and permanent mounts make identification quite easy.

The book is essential for polar diatomologists and useful for other scientists. It is unfortunate that basic methods of collection, fixation and preparing permanent mounts of diatoms are not mentioned, whilst author, subject and taxonomic indexes would have been useful additions.

This book complements the "Handbook of the common plankton diatoms of the Southern Ocean" by Priddle and Fryxell (1989). Both these books deal almost exclusively with pelagic taxa. Only a few descriptions refer to taxa of epiphytic and benthic diatoms. It seems that there is a need for another book devoted to sessile polar diatoms which are often present in neritic plankton, animal food and sediments.

This is a very valuable manual that can be recommended to all scientists interested in polar ecosystems. It is both an introduction and at the same time a summary of the present state of knowledge on the ecology and taxonomy of polar marine diatoms. The editors and authors are to be congratulated for bringing us such a valuable book.

R.LIGOWSKI

Geological history of the polar oceans: Arctic versus Antarctic.

Edited by *Ulrich Bleil and Jorn Thiede.*
Kluwer Academic Publishers Group, Dordrecht (1990).
Dfl. 360 U$199. ISBN 0 792 307 399.

Publications from international thematic workshops that convene specialists to describe and debate recent data and ideas can be a valuable outlet of contemporary science to the broader community. The well edited and carefully indexed volume of Drs. Bleil and Thiede comprises 37 papers from a 1988 NATO Workshop with the same title in Bremen, Germany. The potential scope of the book is vast and highly relevant to current interests in the polar regions and their role in global change. The editors have attempted, as they note in their prologue, the first comparison of the evolutions of the Arctic and Antarctic regions and the impact of these evolutions on Cenozoic glaciations of the Earth.

The papers are a mixture of overview and data papers, (with greater emphasis on the latter), that give an even sampling of five general topics: (a) physiography and plate tectonics of the polar deep-sea basins and their continental margins, (b) polar ice-covers as geological agents, (c) modern depositional environments of polar oceans, (d) Quaternary history and paleoceanography of polar oceans, and (e) pre-Quaternary records of polar ocean history. To the credit of the editors and authors, most aspects of these wide-ranging subjects are touched upon, albeit briefly in many cases. Thoughtful discussions by the authors offer the reader a broad view of the geologic processes of the polar oceans and adjacent continental margins.

Some of the more intriguing and interpretative aspects of the workshop papers are those that deal with comparisons of the Cenozoic glacial histories of the polar deep-sea basins. As the majority of workshop papers deal with geologic and paleoceanographic data from the Atlantic sectors of the Arctic and Antarctic, much discussion centers on the effect of water masses within, and possibly linking, these two regions. Many factors are identified as possible candidates for affecting the cyclic glacial histories of the polar regions, but the new data and discussions suggest that paleoceanographic linkages, if they exist, have been complex. For instance, such inherent complexity of water masses

becomes apparent in the Eocene to Present global distribution and development of biosiliceous sediments as presented by Baldauf and Barron from ODP drilling.

Bleil and Thiede provide a good sampling of polar ocean papers, yet several geographic areas of the Southern Oceans, the Antarctic continental margin, and the ice-covered Arctic basins have been omitted. This is not surprising in view of the large scope of the subject. Moreover, few geologic data exist in some of these areas. In other polar basin areas, however, some important data bases have not been included. Overall, the book is an important contribution, and compiles much of our present knowledge about the geologic processes of the polar oceans and about possible linkages between glaciations in the north and south polar regions. The book should be a useful reference to those who would like to gain a greater understanding of the Arctic and Antarctic. As with most proceedings volumes, it is not a basic text on the polar regions.

The clear, but unstated, message of the Bleil and Thiede volume is that a full understanding of the processes affecting Cenozoic glaciations of the polar regions will not be possible until geologic samples can be obtained from deep within the Cenozoic basins that lie beneath the Arctic Ocean ice-cap and the Antarctic continental margin.

ALAN K. COOPER

Geological evolution of Antarctica

Edited by *M.R.A. Thomson, J.A. Crame and J.W. Thomson.* Cambridge University Press, Cambridge. (1991) 722 pages £50.00 US$89.50 ISBN 0 521 37266 6.

This book comprises the proceedings of the 5th International Symposium on Antarctic Earth Sciences, held at Cambridge in August 1987. It is unfortunate that it has taken almost four years to appear in print, only a few months before the next symposium in Saitama, Japan. Nevertheless, its publication will be welcomed by Antarctic earth scientists, for it contains research papers on a wide range of geological and geophysical topics. The book is very well produced, and is edited to a high standard.

The symposium had two major themes: "Tectonic evolution of the Antarctic crust" and "Palaeoenvironmental evolution of Antarctica since the late Mesozoic". The proceedings volume is divided into six sections, the first five of which deal with the crustal development of various parts of Antarctica, namely, the East Antarctic craton (20 papers), the Transantarctic Mountains (17 papers), the Weddell Sea-Ross Sea region (18 papers), the Pacific margin (33 papers), and with Gondwana break-up (10 papers). The final section deals with the evolution of Cenozoic palaeoenvironments (17 papers). The popularity of the section on the Pacific margin, which includes the Antarctic Peninsula, is natural in a symposium held in Cambridge, the home of the British Antarctic Survey.

The days of reconnaissance geological mapping of Antarctica are now largely over, and a high proportion of the papers in this volume have relevance for the earth sciences in general, rather than for Antarctic geology alone. The first two papers in the book — Kuehner & Green on the application of high-pressure experimental studies to mafic dyke emplacement and Harley on the evolution of granulite terranes — are good examples. The Napier Complex of Enderby Land, discussed by Harley, contains some of the oldest known terrestrial rocks (3900 million years) and some of the highest temperature regional metamorphics (~1000°C). Contributions by Hole *et al.* on mantle-crust interaction during granitoid genesis, and Harris *et al.* on basalt geochemistry and mantle heterogeneity also deserve mention. Many papers (and not only those concerned with the recently active subduction zone of the Antarctic Peninsula region) describe the geological evolution of particular areas in terms of plate tectonics. Many others have implications for the geological evolution and subsequent break-up of the Gondwana supercontinent, for Antarctica is surely the key piece of the Gondwana jigsaw.

The evolution of West Antarctica, which consists of several discrete crustal blocks (microplates), is particularly complex, and contributions by Garrett (Aeromagnetic studies of crustal blocks and basins in West Antarctica), Milne & Millar (Mid-Palaeozoic basement in eastern Graham Land), Rowley *et al.* (Tectonic setting of the English Coast, eastern Ellsworth Land), Elliot (Triassic-early Cretaceous evolution of Antarctica), Bradshaw (Cretaceous dispersion of Gondwana in the south-west Pacific-Antarctic sector), and Storey (Crustal blocks of West Antarctica: reconstruction and break-up model), among others, consider aspects of the formation and eventual break-up of this area. West Antarctica appears to have been an area of active subduction since the mid-Palaeozoic, including the period of extensional break-up into several continental plates during the late Mesozoic and Cenozoic.

The section on Cenozoic palaeoenvironments is of particular interest, even to a hard-rock geologist like this reviewer. Stratigraphical and palaeontological evidence (reviewed by Webb) indicates a complex history of glaciation in Antarctica during the past 36 million years, and on King George Island, at least, even earlier (Birkenmajer). Four major periods of glaciation are recorded in Oligocene-early Miocene marine sediments of McMurdo Sound (Barrett *et al*), and a marked climatic cooling during the Cretaceous-early Cenozoic transition is suggested by the considerable narrowing of growth rings in fossil wood from the northern Antarctic Peninsula (Francis). In contrast, the late MiocenePliocene Hallett Coast shield volcanoes were formed in a subaerial environment, implying one or more periods of glacial retreat (McIntosh & Gamble); oxygen isotope measurements on mid-Pliocene molluscs from Marine Plain, Vestfold Hills,

the site of an important vertebrate fauna, including a dolphin, suggest temperatures significantly higher than today's (Quilty). The presence of late Pliocene-early Pleistocene tillites (Sirius Group) at altitudes of 1800–2600 m in the Dominion Range area of the Transantarctic Mountains was interpreted by McKelvey *et al.* as recording more than 1300 m of uplift since their deposition by the ancestral Beardmore Glacier. Fossil plants (including *Nothofagus*, the southern beech) in the Sirius Group also indicate a much more temperate climate (possibly 15–20°C warmer) than that of today.

JOHN W. SHERATON.

Recent meetings

Eighth International Symposium on Gondwana, Hobart, Tasmania, Australia, 24–28 June 1991

This symposium was organized under the auspices of the IUGS Subcommission on Gondwana Stratigraphy, and included a number of workshops and meetings of IGCP project groups; there was much to interest Antarctic earth scientists. Comparisons and correlations with areas once adjacent to Antarctica are essential for understanding the geological evolution of Antarctica, and of Gondwana as a whole. Hence, virtually all of the symposium's ten sessions contained something of relevance to Antarctic geology.

Sessions on Precambrian mobile belts/sutures and Proterozoic assembly of Gondwana, late Proterozoic/early Palaeozoic tectonics, Gondwanaland basin development and break-up, magmatism and associated tectonics, and Gondwana floras had high proportions of papers dealing specifically with Antarctic topics. A number of these discussed correlations between Antarctica and other Gondwana fragments, including southern Africa, Sri Lanka, India, and south-eastern Australia. It is, of course, very difficult to determine in detail the pre break-up positions of Gondwana fragments on the basis of geological correlations alone. Marine geophysical data show that break-up and subsequent spreading were tectonically complex processes, involving considerable continental crustal extension, and commonly with an oblique, but variable, extension direction; this point was considered by Stagg & Willcox and Willcox *et al.*, in relation to the Australia-Antarctic region.

Other contributors dealt with aspects of the geological evolution and reassembly of Gondwana in more general terms, for example, Schmidt (Palaeomagnetism and the Palaeozoic geography of Gondwana), Li & Powell (Review of the late Proterozoic to late Palaeozoic palaeomagnetism of Gondwanan continents), Unrug (The Gondwana supercontinent — the middle Proterozoic building blocks, late Proterozoic assembly, and unsolved problems), Sadowski (Geometry of the accretion of Gondwana), Veevers (Gondwana facies of the Pangaean supersequence), Grikurov *et al.* (Crustal provinces in the southern high latitudes in relation to Gondwana break-up), and Long (The rise of vertebrates in Gondwana). Particularly noteworthy was the paper by Dalziel (Gondwana as the offspring of an Eocambrian supercontinent), who postulated that the Laurentian and East Antarctic-Australian cratons were continuous in the late Precambrian, before rifting of the Atlantic margin of Laurentia from the proto-Andean margin of South America in the earliest Cambrian; early Palaeozoic sea-floor spreading isolated Laurentia from South America and East Antarctica-Australia and led to the final amalgamation of the smaller Gondwana supercontinent about 500 m.y. ago. Also of particular interest was the contribution by Hill *et al.* (Last remnant of Antarctica's Cenozoic flora: *Nothofagus* of the Sirius Group, Transantarctic Mountains) describing the occurrence of (Southern Beech) leaf and wood fossils in upper Pliocene glacial sediments of the Sirius Group at an altitude of about 1800 m in the Dominion Range area. This was interpreted as indicating temperatures 15-20°C warmer than today's and rapid subsequent uplift of the Transantarctic Mountains (up to 500 m/m.y.), perhaps rather surprising in view of the apparent lack of significant present-day seismic activity in the area.

Several papers were presented at a one-day workshop on the geology of the Prince Charles Mountains. This area is of unusual interest, because it represents by far the best-exposed cross section of the East Antarctic Shield, extending some 800 km south of the Mac.Robertson Land coast. The region is drained by Lambert Glacier, the largest in the world, which flows into the Amery Ice Shelf. Much of the northern Prince Charles Mountains (and adjacent coastal outcrops) consists of *c.* 1000 Ma granulitefacies metamorphics, which were the subject of several papers, whereas late Archaean to early Proterozoic medium to high-grade metamorphic rocks crop out to the south. Webb & Fielding discussed the evolution of the Lambert Graben, which probably began to form in the late Carboniferous, and Arne presented apatite fission track evidence that considerable uplift of the Prince Charles Mountains occurred during the Early Cretaceous and was probably associated with Gondwana break-up. Clearly, studies of the Mesozoic-Cenozoic geological evolution, as well as the glacial history, of the Prince Charles Mountains provide a valuable opportunity for comparisons with the Transantarctic Mountains.

JOHN W. SHERATON