unity is that each part of the system has to be interpreted and applied by reference to the other parts. However, the question of the effects that this regime might have for states that have not become parties to any of the treaties of the Antarctic Treaty System remains problematic. Without excluding the possibility that some parts of the regime have acquired an 'objective' quality and therefore create rights and confer obligations upon third states, the author logically concludes that 'To acknowledge a right for third States to be active in the area in disregard of the rules prescribed by the Antarctic Treaty system would be enormously detrimental to the community's interest in the well-being of that area' (page 296).

This book will be very useful for any person who has an interest in the legal regime established for Antarctica. The many problems are clearly explained by a lawyer who has considerable experience in public international law. The author, the former Legal Advisor to the Foreign and Commonwealth Office, has succeeded in providing in eloquent language an up-to-date survey of the Antarctic Treaty regime. Appendices presenting the full text of the main treaties comprising the Antarctic Treaty System complement the author's contribution. Although the form of the work — a written version of a series of lectures — does not lend itself to the extensive use of references, the author has included a useful bibliography divided according to the different issues covered. (Serge Pannatier, University of Neuchâtel, Avenue du Premier – Mars 26, 2000 Neuchâtel, Switzerland.)

THE CRYSTAL DESERT: SUMMERS IN ANTARCTICA. David G. Campbell. 1992. Boston, New York, London: Houghton Mifflin Company. 308 p, maps inside covers, hard cover. ISBN 0-395-58969-X. £17.99; US$21.95.

This book is a personal account of three summers spent in Antarctica by an American who is Professor of Nations and the Global Environment at Grinnell College, Iowa. He is a marine biologist who was studying the pathology of amphipods while based at the Brazilian station Commandante Ferraz on Keller Peninsula, King George Island in the South Shetland Islands. It is not an expedition account, nor is it a scientific treatise; it is a remarkable description of a small part of Antarctica and some of the scientific work undertaken there.

The book is arranged in 12 chapters with a prologue and followed by a Linnean appendix, extensive notes to supplement the text, references, and a comprehensive index. The prologue forms a good introduction to the South Shetland Islands, King George Island in general, and Admiralty Bay in particular, where Keller Peninsula projects southward into the head of the bay. The author's three visits are put in context, and the station, its environs, and its members are described. Some of the earlier history of the South Shetland Islands, including the other bases that clutter Fildes Peninsula and make it 'the urban slum of Antarctica' (page 9), is also sketched for the reader.

The chapters of the book have rather fanciful titles at first glance, but they are apposite for their content. The first, 'Seabirds and wind,' records the voyage from South America to the Antarctic, as seen through the eyes of a keen observer, describing the ship, the sea, the birds, the seals and whales, and the ever-present wind. In the second chapter, 'Memories of Gondwana,' the reader is given a glimpse of the geological evolution of Antarctica, revealing the oft-surprising fact that it was once a verdant land, very different from its frigid nature of today. 'Life in a footprint' opens with an account of an elderly tourist trampling a moss bed, which, through her footprints, will bear testimony of her passing for decades to come. An earlier such comment is probably the source of the generalization that the Antarctic ecosystem is fragile, a point strongly disputed by some biologists who point to the extreme robustness of other parts of the ecosystem. The chapter continues with a description of the Antarctic flora, illustrated with extracts from historical accounts. 'Penguins and hormones' may sound a little obscure, but the author points out that it is the secretion of a few molecules of sex hormone from the hypothalmuses of 35 million chinstrap penguins during the dark of winter that ensures the continuation of the species. Here the professional biologist is gently teaching the layman some science while writing a readable account of these unique birds. He continues to educate in chapter five, 'The galaxies and the plankton,' drawing a numerical parallel of astonishing proportions between the stars and the myriad planktonic creatures of the sea, further emphasizing the numbers with the diet of a blue whale. Here, too, is an excellent account of Antarctic krill, from its biochemistry to its swarming behaviour. In chapter six, 'The bottom of the bottom of the world,' the author goes underwater to see the wealth of marine life inhabiting the sea bottom in Admiralty Bay. In doing so he also describes the experience of scuba diving in Antarctic waters. Next is a fishing trip and the subsequent laboratory work to examine the parasites, followed by collection of seal excrement to look for further parasites in 'The worm, the fish and the seal.' Once again, this is not dull science but the work of a literate enthusiast who can breathe life into his passion.

Chapter eight, 'Visions of ice and sky,' introduces a change in direction with a brief history of Antarctic exploration. The author begins with the tales from Polynesian folklore and the Indian arrowheads dredged from Escurra Inlet, mentioning the scepticism that greeted this find, suggesting that it might be a subtle political ploy to support the Chilean territorial claim to the Antarctic Peninsula. He continues with the voyages of the eighteenth and early nineteenth centuries, quoting extensively from contemporary journals and other sources to provide an insight to the conditions of the seafarers who sailed south and the expectations of those who sent them. The history continues with the bloody slaughter by the sealers under 'The indifferent eye of God,' when the 'southern summer of 1820–21 was a dark one for the fur-seals' (page 168) of the South Shetland Islands. Following the virtual extinction of the fur seal by 1825, commerical attention in the Southern

Ocean was turned towards the whales. 'The tern and the whale' describes the birds in the title, but focuses on the whales, their behaviour, and their migratory and reproductive cycles, all of which make fascinating reading. Hypotheses of animal navigation are discussed, although no conclusions are drawn; there are some amazing records quoted, such as the sei whale that swam 3550 kilometres in 10 days. Then the whaling industry is exposed in 'The passing of the leviathans,' bringing the history up to date. The author evidently disapproves of the industry, describing the whaling stations on South Georgia as 'these ghost settlements are themselves vandalous acts on a pristine landscape, graffiti left by an industry of such rapacity that it extirpated its prey and extinguished its own fires' (page 229). The final chapter, 'The tempest,' describes the last days on the station, sitting out bad weather while waiting for the relief ship to arrive. Here the author also mentions other matters that have escaped discussion: ozone depletion, the Antarctic Treaty, and the nuclear reactor at McMurdo Station. The journey ends in Punta Arenas and a night camped in a beech copse at the foot of the Torres del Paine.

The dust jacket of the book proudly proclaims that this is the 'Winner of a Houghton Mifflin Literary Fellowship Award' and continues on the flap, '*The crystal desert* is not only the most eloquent book ever written about Antarctica but one of the best portraits of a place ever published.' Such blatant self-serving propaganda by the publisher is guaranteed to raise this reviewer's hackles at the outset; who has ever read all the published books about Antarctica to be able to make such a statement, let alone all the world's travel books? Despite starting to read in a very negative frame of mind, I quickly came to appreciate the reasons for these comments. This is a wonderfully written book with an intricately woven thread that keeps the reader enthralled and thirsting for more. It is a beautiful description of a unique part of the planet, and I began to find sympathy with the publisher's puff, although I still regard it as excessive. Nevertheless, I would recommend the book to anyone wishing to read a description of the Antarctic. Memories of Admiralty Bay came flooding back to me as I recognized individual features described by the author; I could see it all again in my mind's eye. But I wonder how accurate a picture the general reader will paint in his mind's eye, because the book contains not a single illustration; perhaps it will not matter that his picture is inaccurate, enjoyment of the pen picture may be more important. There are, inevitably, some errors: Shackleton's party was on Elephant Island in 1916, not 1918, and he sailed to South Georgia, not South Georgia Island; 35 million chinstrap penguins is almost certainly a gross over-estimate. Such errors are irritating because they are avoidable, but they should not detract from the overall enjoyment of the book.

This book is an excellent addition to the literature on Antarctica and should be on every explorer's shelves. However, the armchair-explorer may like to have one of the many good photographic essays on Antarctica to hand to provide a visual reference frame. (P.D. Clarkson, Scientific Committee on Antarctic Research, Scott Polar Research Institute, Lensfield Road, Cambridge CB2 1ER.)

CLIMATE MODES OF THE PHANEROZOIC. L.A. Frakes, J.E. Francis, and J.I. Syktus. 1992. Cambridge: Cambridge University Press. xi + 274 p, illustrated, hard cover. ISBN 0-521-36627-5. £40.00.

In recent years concern over climate change as a result of anthropogenic release of greenhouse gases has led to increased interest in the mechanisms and geological history of climate change. Indeed, the study of palaeoclimatology has proliferated as a result of renewed interest by earth scientists and funding councils alike. This book provides a much needed review of the climatic history of the Earth during the last 600 million years, and discusses possible mechanisms of global climate change.

Based on the available data, the authors divide the Phanerozoic into alternating cool and warm modes. Four warm modes are recognised: 1. Early Cambrian to Late Ordovician, 2. Late Silurian to Early Carboniferous, 3. Late Permian to Middle Jurassic, and 4. Late Cretaceous to Early Tertiary. These warm modes alternate with five cool modes: 1. Late Ordovician to Early Silurian, 2. Early Carboniferous to Late Permian, 3. Middle Jurassic to Early Cretaceous, 4. Early Eocene to Late Miocene, and 5. Late Miocene to Holocene. The evidence for each warm or cool mode is covered in individual chapters. The amount of available information and consequent chapter length are directly related to geological age, with considerably more detail available for the Late Mesozoic and Tertiary than for the Palaeozoic. Some of the climatic interpretations are widely accepted (such as the Early Carboniferous–Permian glaciation), whilst others are more controversial (for example, the cool mode during the Middle Jurassic to Early Cretaceous). The final chapter of the book considers the causes and chronology of climate change. In particular, the chapter focuses on the importance of atmospheric CO_2 levels as a control on global climate, and considers the significance of the carbon isotope record for palaeoclimatic studies.

Although this book reviews the evidence for climate change, it is a very personal view of the available data, and some aspects will prove to be controversial for a long time. The authors are inconsistent with their acceptance of certain techniques. For example, stable isotope data and calculated palaeotemperatures are apparently accepted for the Ordovician–Silurian cool mode (chapter 3, page 21), yet in chapter 4 the reader is told that the estimation of palaeotemperatures from oxygen isotopes is an unsatisfactory technique for the Palaeozoic! Commonly the authors quote palaeotemperature values calculated from oxygen isotope data rather than quoting the actual oxygen isotope values, or provide a mix of both temperatures and isotope data. As the calculated palaeotemperature values are dependent upon assumptions made about the original water composition, and, indeed, which equation was used, it would have been considerably more useful to the reader