went unnoticed for some time. In the 1960's, when it was unexpectedly discovered that the long-used coat of arms of the Society was illegal and must be replaced, the design for the new armorial bearings promptly incorporated the double helix as a symbol of the growth and advancement of science. Conversaziones, symposia, television programs, annual lectures for school children, new prizes, and fellowships have in recent years brought the Society in closer contact with the general public. Its membership has been widened and more fellows from the arts, letters, and technology have been added; women, never barred by charter, were admitted in 1949.

Family albums are understandably of greater interest to family members than to outsiders. This work will be more attractive to Scots and Scotophiles than to ordinary readers. Scholars will continue to turn to original sources in studying the Society. Nevertheless this slim volume, with its many anecdotes, exceptional illustrations, and well-organized information, serves as a useful introduction to a distinguished group.

ELIZABETH C. PATTERSON
*Department of Physical Sciences, Albertus Magnus College, New Haven, Connecticut 06511*

## Geomorphology

**The Mountains of Northeastern Tasmania**. A Study of Alpine Geomorphology. NEL CAINE. Balkema, Rotterdam, 1983 (U.S. distributor, MBS, Salem, N.Y.). viii, 200 pp., illus., + plates. $25.

Australia's poverty in mountains is redeemed in Tasmania. The mountains in the island's west are better known because of the glacial sculpture, temperate rainforest, most southerly Pleistocene spread of humans, and conservation conflict in that area. The mountains of northeastern Tasmania have received as much scientific attention in Caine's work on their geomorphology over nearly 20 years as have the mountains of the island's west.

Caine has published nearly a dozen papers and a monograph on these remnants of a faulted dolerite sill. Most of these earlier writings not only dealt with facets of the geomorphology of the mountains in isolation but also centered on elaborating methods for the study of these particular kinds of landforms. The earlier writings are drawn upon selectively in the book under review, and their essentials are amalgamated and then fleshed out into a synthesis that incorporates a good deal of unpublished material.

Such a regional synthesis might have only an Antipodean audience; its wider appeal results from the intrinsic interest of the region and from the approach Caine has taken. The region has an array of transported blockfields of periglacial origin that is hard to match globally and a set of topples around its biggest mountain, Ben Lomond, that, because it is in a simple geological context, lends itself particularly well to analysis of its mechanism of emplacement. The systematic meaning of the zonal blockfields and the azonal topples cannot be appreciated fully except against their regional background. The fashion, fortunately now passing, to oppose the nomothetic and the idiographic aspects of geomorphology had its risks.

The approach of the book is catholic in its evenhanded attempt to evaluate the roles of structure, climate, and history, though in the upshot the climatic factor is assessed as subordinate to the structural; it is puritanical in its thoroughgoing endeavor to quantify (and by corollary to test statistically) not simply the morphometry and sedimentology but the implications of all genetic and historical interpretations, especially as a means of adjudicating between multiple working hypotheses.

The last point is vital because in the author's view present-day processes are almost irrelevant to understanding the landscape in northeastern Tasmania. Most Quaternary meso- and microforms, if not the largest elements inherited from the Tertiary, suggest virtual stability in warmer intervals such as the Holocene and development in colder periods, generally by periglacial processes and in the case of Ben Lomond by glacial actions as well.

Chronology is the weak part of the study despite gallant wrestling with meager evidence. Rind thickness and weathering pan size are crucial to this attempt at chronology. Given the general statistical rigor of the book there is an unaccountable failure to quantify the vital comparison of rind thickness of dolerite clasts belonging to the two glacial periods that Ben Lomond experienced.

One would have welcomed more discussion of the contrast between the two glaciations, the later one comprising but a few small cirque glaciers below a plateau that carried no ice but had nourished ice caps in the earlier glaciation. The impossibility of the survival of tors through an ice-cap glaciation, which is proclaimed to have been but lightly erosional, needs to be argued rather than assumed, given contrary views elsewhere. Generally, however, there is frank recognition when matters remain problematic. There is no presentation of the wind regime, though weight is given to snow drifting. The place names of Ben Lomond and Mt. Barrow should have been put on maps. One has to refer to other publications of the author to follow parts of the argument.

This criticism amounts to little; the book is welcomed as stoutly representative of a modern geomorphology that has absorbed the quantitative revolution and yet remained firmly tied to the ground.

J. N. JENNINGS
*Research School of Pacific Studies, Australian National University, Canberra City ACT 2601, Australia*

## Reproductive Ecology

**Breeding Biology of the Adélie Penguin**. DAVID G. AINLEY, ROBERT E. LERESCHE, and WILLIAM J. L. SLADEN. University of California Press, Berkeley, 1983. xii, 240 pp., illus., + plates. $27.50.

The authors of the present book, who have produced more than a dozen publications between them on Adélie penguins at Cape Crozier, here treat their previous work cursorily and concentrate on material not previously published. The book might appropriately have been subtitled "A Study of Reproductive Success in Relation to Age." Copious details are given of how age affects behavior at the Cape Crozier colony, the likelihood of breeding, different measures of reproductive success, and subsequent survival. The authors also examine the interaction of age and experience, and this is one of the most illuminating facets of the book. Because there is great variation among them in age at first breeding (from three to eight years) the Adélies provide a particularly good opportunity to study this interaction. Moreover, Adélies change mates more often than most seabirds, allowing the role of mate fidelity to be evaluated. The book will be an indispensable reference for anyone dealing with these topics.

The study also provides new insights into the effects of position of breeding site within the colony on breeding success. Among the Adélies at Cape Crozier, unlike some other seabird colonies, sites in the center were not preferentially occupied by older breeders. The oldest birds were concentrated in a band be-

"The beach at Cape Crozier during early spring; flocks of Adélies parade back and forth waiting for the right conditions under which to make a departure." [From *Breeding Biology of the Adélie Penguin*]

tween the center and the periphery. Although peripheral sites were less successful than those away from the edge of the colony, the effect was found mainly among younger breeders. For those eight years or older there was little or no effect.

I found some problems with the organization of the book. Although the methods are clearly outlined at the outset, with excellent definitions of all the terms used, their influence on the subject population is not dealt with until later. Thus on p. 192 we suddenly learn that banding, the foundation of the study, caused a 28 percent decline in survival during the following year, and the reader has to mentally check over the previous results to see which might have been affected. Another important fact that is not made explicit until chapter 8 is that during the early years of the study, when most birds of known age were quite young, reproductive success was generally lower than in later years. This must cause a bias in the results of some analyses involving data from several years.

The final chapter provides a discussion of deferred maturity in seabirds. Because breeding Adélies suffer heavy predation by leopard seals close to their colonies, the cost of breeding, in terms of adult survival, is high. This creates strong selection against breeding before the age at which the chance of success is good. The authors also deal briefly with possible factors regulating the population. They point out that the Adélie population of the Ross Sea has been declining over the past 20 years, casting some doubt on the theory that Antarctic penguin populations are expanding in response to a decline in the stocks of large whales.

Essentially this work is more akin to a long scientific paper than a book. It is dense with data, mostly in tabular form (over 100 tables and only 30 figures) and is aimed at professional ecologists. It is not casual reading, but no one interested in seabird biology or long-term population studies should be without it.

ANTHONY J. GASTON
*Canadian Wildlife Service,*
*Ottawa K1A 0E7,*
*Canada*

## Effects of $CO_2$ on Plants

**$CO_2$ and Plants**. The Response of Plants to Rising Levels of Atmospheric Carbon Dioxide. EDGAR R. LEMON, Ed. Published for the American Association for the Advancement of Science by Westview, Boulder, Colo., 1983. xxii, 280 pp., illus. $25. AAAS Selected Symposia Series, 84. From a conference, Athens, Ga., May 1982.

Carbon dioxide occurs in the atmosphere at a concentration of approximately 335 parts per million, but experiments have shown that the optimum level for photosynthesis (in C3 plants) is about 1000 parts per million. Consequently an enrichment of $CO_2$ in the atmosphere can be considered to be a boon, since significant increases in crop yield may be expected. Because plants play a dominant role in carbon flux and storage, enhanced productivity resulting in an increased biomass would, in turn, result in an increase in the flux through the nitrogen and other major cycles. This book describes how as a result of the use of fossil fuels the concentration of $CO_2$ in the atmosphere is increasing annually by over 1 part per million. The book considers the changes that are predicted to occur in the environment and discusses possible alterations in trends of plant growth in a situation where the atmospheric $CO_2$ values are approximately double present ones. This is predicted to occur within the next 100 years if the increase in $CO_2$ levels continues at present rates.

The volume is the proceedings of an international conference on rising atmospheric $CO_2$ and plant productivity. Its first chapter briefly discusses the necessity of assessing the far-reaching results of the use of fossil fuels and emphasizes the need for further investigation of the effects of elevated $CO_2$ levels on plant growth. The second chapter gives an overview of the changes in $CO_2$ concentration that are predicted to occur and describes the major effects such changes would have on climate and plant growth. A doubling in atmospheric $CO_2$ would cause the mean temperature of the earth to increase by approximately 2°C and also cause a change in the global pattern of precipitation. The profound consequences that these linked events would have on the biosphere are considered. Though an increased atmospheric $CO_2$ concentration might prove to be a boon to agriculture because it would increase crop yields, it is also potentially hazardous because it could disrupt the dynamic equilibrium of the earth's atmosphere and energy budget. The dire implications for the future are well worth consideration.

The remaining six chapters form the core of the book. They review data on the response of photosynthesizing plants to levels of $CO_2$ approximately double current ones. The chapters are concerned with the many sites and levels of possible change to individual plants and plant communities over a spectrum of environmental conditions. It is evident that photosynthetic carbon fixation is increased by elevated $CO_2$ levels, and the opportunity to enhance plant productivity by exploiting increased atmospheric $CO_2$ is discussed. It is shown that the insufficient ambient $CO_2$ in the present atmosphere is a limitation to photosynthesis in C3 species and that a large portion of the newly fixed carbon can be lost by the process of photorespiration in these plants. It is concluded that a doubling of the atmospheric $CO_2$ will promote increased rates of $CO_2$ fixation, but there is no evidence to suggest that increased photosynthesis could prevent the rise in ambient $CO_2$. The discussion is taken one step further, to a consideration of more physiological aspects, such as whole leaf photosynthesis, stomatal response, and whole canopy transpiration. It is interesting to note that in addition to increasing the rate of photosynthesis an increased $CO_2$ level tends to alleviate water stress and salinity stress and in this way may further aid plant