biota, nor of the relationships between genome function, physiology and ecology in the Antarctic. Rather, it comprises a series of typically well-written, well-informed, and well-reasoned papers, conveying foremost the fascinating depth of current understanding of some key issues in Antarctic biology. They make good reading both for those directly concerned with Antarctic biology, and those less so, and would provide a nice basis for a graduate class in the topic. One imagines that some of these reviews will become standard citations for the issues in hand, and that those citations may well have long half-lives.

This said, to someone who is not deeply immersed in the Antarctic literature, these papers seem to beg one overriding question. Why does Antarctic biology sometimes seem to remain so disconnected from much of biology at large? Time and again, papers in this volume provide convincing arguments as to the wider implications of Antarctic science, particularly in the context of some of the pressing issues facing humanity (most obviously climate change). And yet, time and again, I found myself wondering why connections were not being drawn more strongly to the wider literature, and why only by reading a volume explicitly on Antarctic biology was I finding some of the best examples there seem to be to illustrate my lectures and writing on biodiversity at large. Perhaps addressing those issues would also make for a good thematic journal issue (if not an edited book).

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Deep-Time Perspectives on Climate Change: Marrying the Signal from Computer Models and Biological Proxies

Edited by M. Williams, A.M. Haywood, F.J. Gregory & D.N. Schmidt
ISBN 1-86239-240-4, £95 (fellows £57)

In recent years, the development of new proxies, approaches and data interpretation techniques has significantly improved the possibilities and accuracy of reconstructing past environments from geological records. Hand-in-hand with this progress a rapid increase in the number of climate simulations is available from a broad range of General Circulation Models (GCM) which contributes to a much better understanding of future and past climate change. Although highly complex, climate models still represent a simplification of the real world and their performance and reliability have to be validated using proxy data from past climate records. Bringing together the two groups of “data collectors” and modellers and facilitating their interaction is the major aim of this book on deep-time perspectives on climate change. The high-quality printed book, nearly 600 pages thick, unites climate modelling, palaeoceanography and palaeontology to address fundamental events in the climate history of the Earth over the past 600 million years. However, the vast majority of the 26 peer-reviewed articles are related to the last 70 million years, clearly reflecting how data availability and our knowledge about the Earth System decreases the further back we go along the geological time scale.

The book focuses on different aspects of palaeoenvironmental science such as proxy methods, the controlling mechanisms of climate change, extreme climate modes and climate transitions. Most contributions are written in a review-style, which makes this book a valuable source for up-to-date literature search and global palaeodata syntheses. Examples of such very useful literature and data compilations are a comprehensive review of Phanerozoic climate modes, controls and geological proxies by Vaughan, a review of the Early Permian fossil record of Gondwana by Stephenson et al. and a discussion of the role of marine organic carbon reservoirs during the Early Palaeozoic Icehouse by Page et al. Price & Grimes and Hart bring together terrestrial and marine geological records documenting Late Cretaceous climate variability. For the Neogene, Dowsett presents a summary of Pliocene global sea surface datasets, whereas Fauquette et al. and Jiminez-Moreneo et al. provide a more regional compilation of Miocene and Pliocene vegetation data for the Mediterranean. A meaningful discussion on the potential use and application of selected palaeoceanographic proxies in reconstructing past sea surface conditions can be found in Lawrence et al. (alkenones), Kucera & Schoenfeld (foraminifera), and Lear (Mg/Ca palaeothermometry).

Many contributions in this book concentrate on geological transitions or climate extremes and discuss their controlling mechanisms. Vannier describes the Early Cambrian origin of complex marine ecosystems and the role of ecosystem-build-up processes versus non-biological factors. Armstrong compares Cenozoic and Ordovician glaciation and proposes a unified theory, which rejects the axiom that Ordovician glaciation was unique in Earth History. Twitchett discusses triggers for mass extinction at the Permian-Triassic boundary and critically reviews the runaway greenhouse model. The termination of the Mesozoic, characterized by another mass extinction at the Cretaceous–Tertiary boundary, is surprisingly not the subject matter of a separate contribution in this book. Cenozoic changes from greenhouse to icehouse climate conditions are presented in a considerable detail. Unfortunately, most Paleogene to Neogene contributions focus on palaeoceanographic proxies only, whereas compilations of terrestrial palaeobiological datasets are mostly restricted to the Mediterranean. Sluis et al. and Coxall & Pearson, respectively, present a thorough and well-written review of
available data and hypotheses regarding the Palaeocene–
Eocene Thermal Maximum and Eocene–Oligocene
greenhouse to icehouse transition. The Oligocene–Miocene
boundary is characterized by a shift toward cooler climates
and Pfuhl & McCave discuss the importance of opening of
seaways and the inception of a full Antarctic Circumpolar
Current. The Miocene was a critical time of palaeoceano-
graphic reorganization in which the closure of the Panama
Isthmus played a key role. Schmidt reviews causes and
consequences of the closure of the Central American
seaway and provides a comprehensive compilation of both
marine and terrestrial proxy data. The book ends with a
paper by Ravelo et al. reviewing marine proxy evidence for
Northern Hemisphere glaciation and the role of a shoaling
thermocline as a critical threshold.

The book is a very successful attempt to marry the signal
from computer models and biological proxies. However,
it also gives the impression that in deep-time
palaeoenvironmental science, climate modelling is clearly
the weaker partner in this young marriage. Only about five
articles of the book have a clear focus on climate
simulations and data-model comparisons, whereas many
contributions of “data collectors” only marginally refer to
climates models. Deep time modelling is a challenging task,
as the number of proxy data for boundary conditions
strongly decreases with geological age. Therefore, in
contrast to the Quaternary, the number of “deep-time”
modellers is rather limited. Sohl & Chandler provide a
challenging and careful combined data/model approach to
simulate Neoproterozoic palaeoclimate. Kiehl describes
opportunities and limitations of computer models
simulating Late Palaeozoic palaeoclimates. Haywood et al.
give a comprehensive overview on their mid-Pliocene
climate modelling exercises, which clearly demonstrates the
rapid progress in deep-time modelling and data-model
comparison techniques in recent years. Markwick gives
impressive examples of how biological proxy data can be
processed and synthesized in a Geographical Information
System to define climate boundary conditions and facilitate
data-model comparisons. Hill et al. presents not only a new
Pliocene model of the mid-Pliocene East Antarctic Ice
Sheet, but also a thorough data-model comparison for Polar
Regions.

In conclusion I can highly recommend this book to anyone
who is interested in getting a comprehensive overview of
deep-time palaeoenvironments and climate modelling. The
book is very useful for “data collectors” who need an
update or summary on state-of-the-art deep time geology
and also to modellers for whom it provides a rich source of
data to validate and test their simulations. Given the
differences in scientific approaches, languages and
techniques, the liaison between “data collectors” and
modellers represent a major challenge for both scientific
communities. Despite these difficulties the editors
succeeded in producing a coherent and valuable
publication, which is a promising start to a hopefully
happy and long-lasting relationship.

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Snow and Climate: Physical Processes, Surface
Energy Exchange and Modeling

Edited by R.L. Armstrong & E. Brun
ISBN 9780521854542, 256 pages, £65

Sixteen established scientists from the fields of hydrology,
glaciology and climatology have gathered to write this book
on snow-climate interactions. We all know that this
interaction is complex (snowdrift!) and that there are many
ways and tools to study it, from detailed field observations
on snow plots not larger than half a football field to global
climate models with grid sizes that are easily as large as a
million football fields. This wide range of scales and
possible scopes has not deterred the authors and their
efforts have resulted in the very readable Snow and Climate.

The book begins with a short introduction on snow
formation and how snow, once deposited at the surface of
the Earth, interacts with climate. Chapter 2 delves deeper
into the physical processes governing ice crystal formation,
snowpack and snow grain characteristics, snow
metamorphism and grain classification, followed by heat,
water, air and radiative transfer in snow. Chapter 3 deals
with the mass and energy exchange between snow pack
and atmosphere. Initially, the level of detail is greater here
than in Chapter 2, but the level of mathematics always
remains moderate and accessible. I particularly liked the
sections describing multiple-month example time series
of energy and mass balances of various types of snow
surfaces. It is in these sections that the material really
comes alive.

Chapter 4 updates us on the art of snow cover modelling.
A strikingly long list of existing snow models and GCM
snow routines is presented. Apart from being useful in
itself, the length of this list clearly stresses the need for the
continuation of snow model inter-comparison projects such
as SNOWMIP. One such model is used by the authors to
illustrate the sensitivity of an alpine snow cover to changes
in snow physical parameterizations (albedo, surface
roughness). Perhaps unsurprisingly, the sensitivities turn
out to be quite large and we must conclude that, in spite of
their realistic looking output, snow models can still be
improved. Of course, this would require new and original
validation experiments, especially from the polar regions
where in situ data are sparse. Finally, Chapter 5 describes
available snow cover data, measurement devices, snow
stratigraphic studies and remote sensing applications.