Chapter 7 focuses a theme running through the preceding chapters on the case of South Africa in the Antarctic. The colonial and apartheid past of South Africa has alienated black South Africans from conservation, which is perceived as an elitist concern associated with dispossession, and anti-development resulting in low economic growth and job creation. This perception has relevance for understanding how other developing countries may perceive an apparently hegemonic environmental debate about conserving Antarctica. There exists the possibility that the legitimacy of the Antarctic Treaty could be undermined by the marginalisation of developing countries. The challenge is to develop measures of environmental values in the Antarctic relevant to the multi-cultural, multi-lingual population operating there.

Chapter 8 "Lines in the ice: classifying Antarctic Environments", discusses how Antarctica, although widely perceived as pristine is, in places, under pressure from human activities especially research, tourism and the logistics required to sustain these. There is a need for a regional approach to managing the issues and to develop classifications of environmental domains which go beyond previous classifications of Antarctica - much of the chapter is concerned with progress in this area. Past approaches have defined boundaries based on knowledge and belief of what drives variation in Antarctic environments so human values have played a significant role in classifications. To resolve these issues a numerical and spatial framework has been adopted for future conservation planning.

The final substantive chapter "Exploring the Southern Ocean: rational use or reversion to the tragedy of the commons", focuses on the Ross Sea fishery for the Antarctic toothfish and invokes Garrett Hardin's 'tragedy of the commons', a theme which is relevant to any discussion of the values we attach to the only continent with no native human population.

The differing backgrounds of the various authors have inevitably produced different understandings of values and as the editors point out the book provides a snapshot in time of the values and motivations presently driving Antarctic governance. Nevertheless, there is a fascinating theme running through the book of the interplay between national agendas in the Antarctic and values. There is more work to do in the future, for instance the arts were omitted here so no emotional dimension of values and aesthetics was considered. Furthermore, the editors conclude that the subject will undoubtedly need to integrate disciplines as it develops in order to provide a more detailed understanding and operationally useable context of Antarctic values.

There is fascinating writing here by people who have taken a step back and thought hard about the drivers of our attitudes to the Antarctic and how these shape the way we identify and deal with the problems that face us down south.

PAUL G.K. RODHOUSE

Antarctic Science, **26** (2014)
doi:10.1017/S095410201400042X

Antarctic Futures: human engagement with the Antarctic environment

Edited by Tina Tin, Daniela Liggett, Machiel Lamers & Patrick T. Maher
Springer, Dordrecht, Heidelberg, London, 2013.
ISBN 978-94-007-6581-8, 360 pp. £90.

This book attempts a timely task of trying to bring the many strands of human impact on Antarctica together and make a stab at predicting the changes likely to occur over the next 50 years. The 35 authors have varying degrees of experience of Antarctic Treaty meetings but all have relevant Antarctic experience in one form or another. Of course, the Committee on Environmental Protection at the annual Antarctic Treaty Consultative Meeting is specifically charged with oversight of almost all the activities reviewed but access to its deliberations is limited and much of the dialogue there is both less well informed than this book and often ends up being politicised. This volume tries to focus on the published data and what we can learn from it, although politics necessarily intrudes through discussion of governance. With 15 chapters, the scope is wide but still not complete.

The Introduction gives a useful potted history of human discovery and exploitation in respect of whaling and sealing, research stations, tourism and fishing and then considers briefly how these impact the continent and surrounding sea, before outlining the governance tools used to manage these. Since the authors of this chapter apparently intended to provide here a conceptual framework for the rest of the book I was quite surprised that the framework was simply half a paragraph in the very short conclusions and consisted of three rather open ended questions. Surely a conceptual framework could be rather more, establishing a wider brief in which the human impacts could be seen to interact in various ways? My conceptual framework would have asked what role the Antarctic environment played at a global scale, how was its functionality damaged by historic impacts, what was the relative importance now of direct impacts versus indirect impacts on present and future functionality, what needed to be assessed to make management decisions, was the management/governance tool set adequate and if not why not and then how these elements interacted in predicting the future. Many of these elements are considered in the

following chapters but not within a conceptual framework, rather at a practical level.

The book is in four parts with a few pages of summary at the end of each of the first three parts. Interestingly, the chapters are framed like stand-alone scientific papers rather than as connected chapters of a single book.

Part I considers Species and Ecosystems and in six chapters looks at Antarctic wildlife, marine living resources including whales, biota transfers and, rather curiously, trampling on Antarctic soils. Woehler *et al.* give over much of their chapter on wildlife to predicting what the impacts will be by 2060. They exclude climate change as a driver which is a shame as it interacts with all of the other elements they examine. Miller's account of fisheries focusses largely on krill and is especially useful in its evaluations of risk and uncertainty, and whilst questions of enforcement and compliance are important he identifies climate change as the major future management problem. The conclusions of the whaling chapter, not surprisingly, concentrate on "Special Permit" whaling and do not recognise that the lack of current research on Southern Ocean whales is one of the problems in improving their conservation. Why is there so little research if the whales are seen as such a major political issue? The chapter on movement of biota is excellent on terrestrial species but seems to have ignored the potential for marine invasions, not least from carriage on the increasing number of ships. The final chapter deals with direct surficial impacts from both national programmes and tourism and considers a growing problem. What would have been interesting is a chapter on the impacts caused by research and its supporting logistics with an assessment of the value of knowledge gained against the damage caused.

Part II contains three regional case studies - Fildes Peninsula, Deception Island and McMurdo Station. I was especially impressed by these as they provide examples of how monitoring for impacts and change can be conducted where the drivers come from science, tourism and logistics in different degrees. They also examine the different approaches to managing the three areas that I am certain contain important lessons for the immediate future that could and should be applied more widely.

Part III, called "Actors and Sectors", is made up of five chapters dealing with values, wilderness, tourism, environmental challenges for national programmes and an unusual chapter on strategic thinking in environmental governance. The chapter on values emphasises the obvious but often overlooked point that each of the Treaty Parties brings a different cultural attitude to its participation, flavoured by history, language and politics. Roura and Tin provide critical comments on the failure to articulate a strategic vision and suggest that it would be good to "reboot" the ATS to reinvigorate it, although quite how this could be done is not stated. What they do provide is an aspirational vision for the Antarctic wilderness that I hope will be reflected in the next conservation strategy. Regulating tourism is a longstanding discussion area but Jabour offers a new idea in the adoption of tourist operators by sponsoring states, but given the legal liabilities entailed this seems unlikely to happen. The challenges facing national operators are summarised by Sanchez & Njaastad and whilst they recognise progress in many areas through COMNAP the differing remits and financing of operators, together with their political direction by home governments, make achieving best practice in almost any field unlikely. The fact that some MNAPs still have not appointed an environmental officer over 20 years after the Protocol was agreed is surely a matter of great concern. As for their contention that station numbers will not increase - I beg to differ. Lamers *et al.* discuss the need for strategic thinking, especially since the Treaty has found many ways to avoid dealing with contentious issues with later consequences. I would hope that some of their ideas are discussed in the CEP to test them against the *real politik*.

The final section is the conclusions, where the editors try to tie the rather disparate elements together. Perhaps surprisingly, the general conclusion is not that more environmental legislation is needed but simply proper implementation of the tools already available, which would include better information sharing, and a more ready acceptance of good practice from elsewhere in the world. Although they do not mention in perhaps the current SCAR initiative towards a new Conservation Strategy will help in progressing some of their specific suggestions? They conclude with an examination of human motivations and future challenges. Whilst the contentious subject of "scientific whaling" may now have been settled by the International Court judgement, there are still important unresolved questions over bioprospecting, the Law of the Sea, and the hypocrisy of several states in their dealings with CCAMLR. If the sovereignty claims remain a major driver of national activities for some countries then progress towards a utopian state of sustainable environmental management for the good of all will never be achieved. I applaud their final sentiments - that we need to change from Business as Usual - but conclude that the nasty world of geopolitics is only driven by power, greed and national agendas so progress here will be very slow, if indeed there is any progress.

This is an important volume and a very useful attempt to bring together many of the separate and topical environmental strands that concern the ATS and connect them with the social sciences, which have been rather neglected in the Antarctic. It should be required reading for all CEP delegates. Many of the chapters provide valuable overviews of where we are in specific fields, which will make this volume a useful reference to

have to hand, whilst the attempt to predict the future state in each area is certainly likely to stimulate discussion.

D.W.H. WALTON

Antarctic Science, **26** (2014)
doi:10.1017/S0954102014000431

Antarctica and Supercontinent Evolution

Edited by S.L. Harley, I.C.W. Fitzsimons & Y. Zhou
Geological Society of London Special Publication 383, 2013.
ISBN 978-1-86239-367-7 (Hardcover), 237 pp. £229.

The volume comprises a 35-page synthetic chapter by the editors and a collection of analytical papers on India-Australia-Antarctica connections, the West Antarctic margin, and detrital zircons from the Transantarctic Mountains.

The Mesoproterozoic Rayner Province in the Lambert Glacier area, by E.V. Mikhalsky *et al*., shows that this province has common features with the Australian Albany-Fraser Orogen and evolved during closure of the intervening ocean to produce a metamorphic belt suturing Australia, Antarctica, and India at 1.0 Ga.

Pb isotopic domains from the Indian Ocean sector of Antarctica, by M.J. Flowerdew *et al*., finds the feldspar lead-isotope compositions of coastal complexes are identical to those of the Indian Dharwar Craton, and the Rayner Complex and Prydz Belt correlate with the Eastern Ghats Belt.

Boron- and phosphate-rich rocks in the Larsemann Hills, Prydz Bay, by E.S. Grew *et al*., considers granulite-facies paragneisses enriched in boron and phosphorus in the Larsemann Hills, and similar rocks in the Windmill Islands and at Broken Hill, Australia.

The c. *1000–900 Ma and* c. *550–500 Ma tectonothermal events in the Prince Charles Mountains–Prydz Bay region,* by Xiaochun Liu *et al*., considers the 1000–900 Ma Rayner orogeny that involved magmatic accretion and collision with India, and the 550–500 Ma Prydz orogeny on the south-east margin of the Indo-Antarctic block, suggesting that the major suture is located southeastwards of the Prydz Belt.

Contrasting metamorphic records and their implications for tectonic process in the central Sør Rondane Mountains, eastern Dronning Maud Land, by T. Adachi *et al.*, provides evidence that constrain models of the formation of Gondwanaland.

Possible armalcolite pseudomorph-bearing garnet–sillimanite gneiss from Skallevikshalsen, Lützow-Holm Complex, by T. Kawasaki *et al.*, finds a P–T path that matches that for similar rocks in Sri Lanka.

Anatarctic reworking and differentiation of continental crust along the active margin of Gondwana, by C. Yakymchuk *et al.*, deals with the Hf–O isotope composition of zircons to highlight prominent arc-parallel and arc-normal variations in the mechanisms and timing of crustal reworking versus crustal growth along the active margin of Gondwana.

Reconstruction of the early Mesozoic plate margin of Gondwana by U–Pb ages of detrital zircons from northern Victoria Land, by M. Elsner *et al.*, finds that age-clusters at 190–250 Ma reflect coeval magmatic activity along the Gondwana margin, and those at 500–700 Ma and 800–1200 Ma reflect crustal sources beneath the polar ice sheet.

The editors conclude that "geophysical data reveal prominent geological boundaries under the ice, but there are insufficient data to trace these features to exposed structures of known age. Until we can resolve the subglacial geometry and tectonic setting of the *c.* 0.5 and 1.0 Ga metamorphism, there will be no consensus on the configuration of Rodinia, or the size and shape of the continents that existed immediately before and after this supercontinent."

JOHN VEEVERS