supporting work for the TransAntarctic Expedition and establishing the fledgling New Zealand programme.

Whilst much of what he has to say will be familiar to anyone who has worked in the Antarctic there is a subtle blend of both determination and pride in what they achieved. As a physicist his role was to establish the first Kiwi Antarctic magnetic observatory but, of course, like everyone else he had to take a full part in building the station as well. Some of the information he gives is interesting - how, for example, Hillary decided that the site at Butter Point originally selected for the station was inaccessible and Pram Point was chosen by him instead to the consternation of those who wanted to be away from the Americans and some of the scientists for whom Ross Island was not ideal. As Gerard says that "the Scott Base magnetic observatory must be easily the most poorly sited magnetic observatory in the world", but Hillary was not concerned about the scientific requirements. Indeed, as Gerard remarks, his scientific huts were the last to be built. His account of the air hostesses that arrived on board a chartered Pan American Stratocruiser will bring wry smiles to those whose memories stretch back to an Antarctic culture completely without women. And his comments on the "race to the Pole", although suggesting this was created by the media, recognize that Hillary had this in mind from a very early stage as he was an ambitious man and getting to the Pole first would raise his own profile as well as that of New Zealand. As it turned out the enthusiasm for things Antarctic generated by this in New Zealand was crucial in ensuring that the government continued to support scientific research after IGY.

In his final chapters he discusses tourism into the Ross Sea, the Mt Erebus air crash and the weather during Scott's expedition. He also makes some interesting comments about the effects of free alcohol on performance after he left the station and on the lack of the organization of New Zealand activities in those days!

The publishers say this seems to be the only first-hand account by a scientist of the building and establishment of Scott Base and as such provides a much needed personal view to read alongside the official narrative in Helm and Miller (1964) and the brief account in Fuchs and Hillary (1958). These days scientists do not need to build their own stations and, despite all the efforts and experience, planning still sometimes goes awry. However, it would appear that the experience of overwintering has not changed much and is still something that can be a truly formative experience.

D.W.H. Walton

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Antarctic security in the twenty first century

Edited by Alan D. Hemmings, Donald R. Rothwell & Karen N. Scott
Routledge, 2012.
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ISBN 978-0-203-121000-9 (e-book)

The concept of security seems an odd one to apply to a continent dedicated to peace and science but the editors make the case that the Antarctic Treaty itself actually provided the first security construct for the continent. Their approach has been to propose that security in the 21st century context is multidimensional and needs to be considered from a variety of view points, which will often seem somewhat tenuous in an essentially uninhabited area. Much of the book is based on "what ifs" and concerned with legal approaches which may seem of little interest to scientists but there are important elements in many chapters for those interested in the way in which the continent is managed. Indeed this is an important volume attempting to ensure Antarctica is adequately connected with developments elsewhere in the world. There are 17 chapters, the first and last by the editors, and of the 14 authors all except three come from Australasia.

The three editors set the scene in Chapter 1, arguing that it is appropriate and necessary to consider security as a series of regimes covering state security, Antarctic Treaty regime security, maritime security, environmental security, resources security and finally human security. Whilst it is clearly true that Antarctic security has evolved from the international tensions of the 1950s to what is now the largest demilitarized zone on Earth I remain unconvinced that their expansion of the application of security terminology to all these other fields is really justified.

In Chapter 2 Nasu provides an analytical framework for law and policy on Antarctic security, a chapter very much devoted to his general contention that almost anything can be justifiably considered in a security context. Much of this chapter is not about Antarctica but a much more general discourse on the way security issues have been developed through the United Nations or with respect to international health issues like AIDS, concluding that international law for Antarctica needs to more clearly recognize and address the extra-territorial issues.

Donald Rothwell provides an interesting analysis of the security aspects of the Treaty in Chapter 3 beginning with a brief history of its origins but without mentioning the secret preparatory meetings in Washington. Here the reader will feel on more familiar ground as he discusses the limitations on military use in Articles I and V, the territorial provisions of Article IV and the inspection regime to underpin trust between states. He concludes that the ATS has dealt effectively with various challenges but that the Japanese whaling programme is a security stumbling block, an

unreasonable conclusion in the context of the ATS since this is an issue specifically for the International Whaling Commission and not the Treaty fora. I felt that he should have explained why states such as Namibia, Cook Islands and Mauritius participate in CCAMLR and not the Treaty, as this is closely tied to economic self interest rather than scientific or political interest.

Chapter 4 by Duncan French examines what he believes is the inequity in the way bioprospecting has been addressed by the Treaty, the "dichotomy between rhetoric and aspiration on one hand and political reality on the other "and the future incorporation of global principles and values into the Treaty legislation. Whilst this may appeal to international lawyers most scientists will find it difficult to see as an important issue.

Meanwhile Alan Hemmings uses Chapter 5 to attack what he considers is the complacency over Article IV as the solution to territorial security, remarking on how states go to considerable lengths to avoid discussing the issue and examining some of the newer issues that reflect on possible changes, including the old chestnut that there are now 193 states in the UN as against the fact that there were only 82 when the Treaty was signed. Given the fissiparous nature of territorial boundaries over the past 100 years this is neither surprising nor relevant as any state can acceded to the Treaty. That most of the new mini-countries created over the past 50 years have not joined is clearly a political decision on their part and should not be construed as relevant to the territorial claims. The fact that some states dispute the claims is surely nothing new in a world beset with territorial difficulties like Kosovo, Kashmir, Palestine, the Indo-Chinese Border, etc. Hemmings has provided a very useful drawing together of a diverse literature on the topic of territoriality and, even whilst disagreeing with some of his conclusions, I welcome his analysis of one of the taboo areas for Treaty discussions.

In Chapter 6 Klaus Dodds examines the Antarctic Peninsula and the three competing claims. In a useful overview of the history there were some points I would dispute. The title British Antarctic Survey was used for the successor to FIDS because the scientific work of the organization was survey at that time - not simply map making for political objectives as he implies but geological and biological surveys to understand the continent and its flora and fauna. I would also dispute his contention that the Treaty did not introduce a new security regime when it is clear that the inspection procedures were treated as just that by the USA and the USSR. He maintains that the Falklands conflict was a warning that the Antarctic was contested but since it did not disturb the Treaty meetings nor did the conflict spill over into Antarctic waters I cannot see how this can be true. His remark that there is an unwillingness to collaborate over logistical operations between Chile, Argentina and the UK is interesting since the problem is principally one created by Argentina who rigidly control access to Antarctica through their military logistics rather than the UK which uses civilian ships for logistics. The British opposition to Argentina as the location for the AT Secretariat was based on the general principle that no claimant state should host the facility rather than simply opposition to Argentina. Whilst it is true that the annual Antarctic cruises of the Royal Naval hydrographic vessels (HMS *Endurance*, *Scott* and now *Protector*) clearly do have a political significance the improvement of charts, especially for the Peninsula area, is in the interests of all users as well as the UK, although Dodds sees this activity purely as a political initiative.

Sam Bateman discusses the possibility that the Antarctic could become militarized, basing much of his projections on what he sees as the increasingly assertive role of China and the role that Antarctic stations could play in monitoring via satellites. He asserts that the inspection regime is essentially perfunctory, the use of private contractors can mask military activities (especially gathering signal intelligence) and some research may have military applications. Since conspiracy theories always have supporters I am sure some will find this chapter alarming. And when Rothwell examines law enforcement and Foster the history of resource extraction there is little new in factual terms, but they do bring some diverse material together.

Clearly the delimitation of continental shelves under the Law of the Sea had the potential to cause considerable difficulties in the Treaty forum. Weber's chapter 10 describes the various activities, including the relatively aggressive approaches by Australia and Argentina to safeguard their future claims and the responses from others, but concludes that this has not significantly disturbed the governance. Joyner's chapter on bioprospecting illustrates clearly the developments over the last decade but fails to note that all attempts to introduce any of the elements from the Convention on Biological Diversity have foundered because the USA has not signed it.

The chapter by Haward on marine resources deals with a serious security area with illegal fishing, surveillance using military satellites and the use of the armed forces to make arrests. The interactions of CCAMLR with the Treaty and with the IWC, as well as the impacts of climate change on the Southern Ocean make this an area of continuing tension, as shown by the recent negotiations for the Ross Sea protected area. The chapter by Jabour on maritime security is timely given the recent completion of the IMO Polar Shipping Code. She provides a ranked list of threats to the marine environment and discusses port state responsibilities, a vexed question for the Treaty Parties. Chaturvedi raises issues with the way climate change is perceived and acted upon by the Treaty Parties. He fails to remind the reader that for many years the USA effectively blocked progress on climate change because of the policy

of George W Bush to deny it was happening. As he notes the SCAR contribution clearly sets out what is known but so far the Parties seem not to have found any new ways of reacting to a phenomena in Antarctica which is mired in international disagreement elsewhere.

Scott's chapter examines science and its role as well as picking up on the interactions between the Treaty regimes and other global agreements, and how that blurs lines of responsibility. I appreciated the way she illustrated the fragility of the EIA procedures using the Lake Vostok case. She provokes dispute by suggesting that the Treaty should directly oversee research proposals and activities, have veto powers over the acceptability of CEEs, proactively manage bioprospecting and actively seek closer working relationships with other relevant regimes such as the IMO and IWC. Quite how this will be achieved is not suggested. The chapter on whaling by Mossop attacks the Treaty over its determination to avoid all whaling activities and suggests that this will eventually weaken its authority as long as there is no solution to Japanese activities. Indeed in the final chapter the editors ask if it is time to change the membership rules for the ATCM, to accept that many non-signatories may have political interests in the area and recognize that the status quo may not provide the protection required for the future.

This is a major work which brings the many strands of Antarctic activities together under the nebulous concept of "security". Whilst I remain unconvinced about much of the "what if" approaches the book contains some very useful overviews and some thought provoking ideas which challenge the Treaty Parties in several ways.

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The Cryosphere

S.J. Marshall
Princeton University Press, 2011.
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ISBN 9780691145266 (Pbk), 304 pp. £16.95

Shawn Marshall's The Cryosphere forms part of the 'Princeton Primers in Climate' series and, as such, is of a handy size (that will slip easily into a jacket pocket), uncluttered by reams of references to published work, and fairly inexpensive. Less positively, the cover and (greyscale) illustrations are somewhat bland and image reproduction is lacklustre. That said the quality of the book's content is beyond question. In its 288 pages The Cryosphere manages to provide an overview of all aspects of the Earth's cryosphere while, at the same time, leaving the reader feeling that he or she has gained significant technical insight into many of its key characteristic processes.

The book is also deliberately written in a highly readable and accessible manner, combining technical analysis with anecdotes, quotations, historical perspective, and even poetry. The text certainly bears the author's stamp: for example, in illustrating the small number of materials that (in common with H_2O) are less dense in their solid form than their liquid form, characteristically writes "Imagine the sight of sunlight sparkling off a diamond-berg in a sea of liquid diamond". That in itself is surely enough to make anybody read on.

The book's nine chapters cover just about all aspects of the Earth's cryosphere, following a very readable *Introduction to the Cryosphere* (Ch. 1) with an outline of the *Material Properties of Snow and Ice* (Ch. 2), accurately and evocatively referring to ice as a "quirky and intriguing material". Chapter 3 covers *Snow and Ice Thermodynamics*, bringing a close to the coverage of the underlying physical properties of the materials concerned. Chapters 4 through 7 then address the main environments comprising the cryosphere, namely *Season Snow and Freshwater Ice* (Ch. 4), *Sea Ice* (Ch. 5), *Glaciers and Ice Sheets* (Ch. 6), and *Permafrost* (Ch. 7). Each of these chapters manages, in about 15 to 40 pages each, to convey a thorough and rigorous appraisal of the fundamental properties of these environments as well as the key processes occurring within them and influencing them. These sections are rich in observation and context - including, for example, a table of the most common (twenty-five) Inuit terms for snow on page 73 - as well as being scientifically accurate and rigorous. Revealing the author's own research background, these sections are scattered with the basic equations approximating the key physical processes characterizing these environments.

The final two chapters of the book bring much of what has preceded them together in addressing *Cryosphere-Climate Processes* (Ch. 8) and *The Cryosphere and Climate Change* (Ch. 9). Again, these sections are written with authority and are interesting to read, for example deriving a global-scale physical analysis of albedo-temperature interactions and, interestingly, considering the role of the cryosphere as a large-scale latent energy buffer, both in Chapter 8. This in particular, along with the subsequent presentation of changes experienced by the Earth's cryosphere over the past 50 million years or so, allied to a parting expression of the potential societal impacts of continuing ice mass loss and consequent sea level rise, certainly convey a valuable 'take home' message for interested readers and policymakers.

The author states early on in The Cryosphere that "The text is intended as a brief introduction to the topic, but I hope that these pages capture the essential physics and character of the cryosphere and inspire others to further exploration of the cryosphere's role in Earth's climate". This the author manages to do in both an expert and highly readable manner.

B. HUBBARD