

One doubts whether there is much more that can be set forth on these events and the editors' presentation is exhaustive, and indeed, rather exhausting. This reviewer wondered towards the end of reading the book, whether a little tighter editing might have made the whole work more accessible for the more general reader rather than for the specialist, for whom it is clearly

essential. But there is no doubt concerning the diligence of the editors with regard to unearthing the obscure written sources and in obtaining access to the oral ones. This book is an essential basis for any study of the events in question. (Ian R. Stone, Scott Polar Research Institute, University of Cambridge, Lensfield Road, Cambridge CB2 1ER.)

GEOLOGICAL HISTORY OF GREENLAND: FOUR BILLION YEARS OF EARTH EVOLUTION.

Niels Henriksen. 2008. Copenhagen: Geological Survey of Denmark and Greenland (GEUS). 272 p, illustrated, hard back. ISBN 978-87-7871-211-0. £44. doi:10.1017/S0032247409008560

This is an imposing book in many ways; a large format, beautifully illustrated and produced volume. It has been well translated from the Danish original that was published in 2005. It is aimed at a general readership with an interest in earth science and is excellent at explaining in layman's terms current geological concepts and theories relevant to the geology of Greenland. It is also sufficiently detailed to be of interest to the more knowledgeable reader, and includes references and further information to help those wishing for a deeper and more technical understanding.

Although more than three-quarters covered by permanent ice and snow, the exposed bedrock around the periphery of Greenland is largely free of vegetation and weathering, affording an unparalleled opportunity to study the evidence of the earth's crustal processes. Dr Henriksen has managed to achieve a skillful balance between the huge and sometimes embarrassingly clear amount of visual evidence available, and the need to condense and simplify this to the point where it makes a sensible and accurate story for the general reader.

Opening with a concise overview of the geological time scale, he uses this and his encyclopaedic knowledge of the region as a basis for organising information gathered

from the whole of Greenland; hence the sub-title of the book. Brief summaries of the field methods employed in such a vast and inhospitable area, and of the evolution of the present day landscape, lead on to the core of the book which works through all the major geological eras represented in Greenland. Structures and rock types are illustrated with excellent clarity and their relation to global features and events are explained, retaining a very good geological perspective overall. The many high quality photographs have something to show the tourist and general visitor to almost any part of the island, as well as illustrating relevant geological features described in the text. Colour is often an important aid to the field geologist, and the excellent colour reproduction in these illustrations is particularly worthy of note.

There is extensive description and analysis of features of the Precambrian eras for which southern Greenland is particularly famous. The fold belts and sedimentary basins of Archaean, Proterozoic and Phanerozoic age are all given a thorough descriptive treatment and the complex features of the Caledonian orogeny are described and explained. Younger sedimentary and volcanic formations are also described in detail and linked to global events and the development of the north Atlantic Ocean, and there are equally thorough sections on the current ice age, offshore research and exploration, and commercial mineral and hydrocarbon operations.

Although expensive in pounds sterling, this is an excellent and thoroughly recommended book for all but the more advanced research worker. (D.W. Matthews, Drummore of Cantray, Cawdor, Nairn IV12 5XY).

CLIMATE CHANGE AND GLOBALIZATION IN THE ARCTIC. E. Carina H. Keskitalo. 2008. London and Sterling, VA: Earthscan. xii + 254 p, hardcover. ISBN 978-1-84407-528-7.

doi:10.1017/S0032247409008523

The publication of the Arctic Council's Arctic climate impact assessment, *Impacts of a warming Arctic*, in November 2004 was the culmination of sustained scientific focus on global climate processes and the resulting impacts in the latter part of the twentieth century and the early part of the twenty-first century. Research on impacts of climate change, and particularly that dealing with human impacts, has increasingly moved to consideration of how humans are able to adapt to change, leading to a surge in publications on adaptation and adaptive capacity.

Climate change and globalization in the Arctic is the latest in a series of publications on climate change, vul-

nerability, and adaptation from Earthscan. The goal of the current publication is to demonstrate the vulnerabilities that local stakeholders in the Arctic consider that they are subject to and the adaptations that they can institute. This is undertaken from a political-science perspective using case studies in the Scandinavian north, with the intent of adding a European dimension to vulnerability studies of the Arctic. More accurately, however, the book only addresses Arctic stakeholders in selected northern European regions rather than across the circumarctic. The title of the book is somewhat misleading in two ways: it does not cover the circumarctic, and it is not well integrated.

The book comprises two introductory chapters, three case study chapters, and one concluding chapter. Chapter 1 defines and discusses the fundamental concepts of vulnerability, adaptive capacity, and globalization that frame the remaining chapters. These emphasize social

vulnerability, that is, the risk and stress people face from environmental change and their response to such change; economic and political globalization; and adaptation to change as a political process at multiple levels of governance. Chapter 2 sets out the methodology that is adopted in the three case studies: a qualitative approach based on stakeholder interviews. The semi-structured interviews sought information on a stakeholder's socioeconomic circumstances, sensitivity to environmental changes, and the type of coping strategies a stakeholder might adopt in response to political and climate changes. This was supplemented by a review of local newspaper reports.

Chapters 3–5 detail the three case studies, which assess social vulnerabilities in key economic sectors of northern Norway, Sweden, and Finland, namely the forestry industry (chapter 3), commercial reindeer herding (chapter 4), and the fishing industry (chapter 5). These detailed descriptions provide a solid portrayal of the political, economic, and physical forces that individuals and organizations in each of the sectors contend with. In chapter 3 we become aware of the effects of increased internationalization of the forest industry on local sawmills in Sweden and the necessity for workers to become more mobile in order to seek employment. At the company and government level we are introduced to the ramifications of market-driven strengthening in forest certification — one stakeholder viewing this as the result of British consumer demand. The effects of increased mechanization, supplementary feeding, and global meat markets on reindeer herding are developed in chapter 4, with a particular focus on the impacts and adaptation of traditional Saami herders. A significant issue voiced is that while reindeer herders have the ability to respond to many of these changes, they have no ability to control market prices, something that impacts their profitability and in turn their livelihood. One stakeholder cites the impact on their profitability through lower demand for reindeer meat resulting from competition with New Zealand deer meat. Chapter 5 traces the numerous interacting factors that have affected the fishing industry along the Barents Sea coast of Norway, including the introduction of individual transferable quotas in 1990, changes in fish-processing, restructuring of the local fishery and fishing rights, and the evolving multiple-level structure of governance and regulation. One local fishing organization contrasts the

open rights people have had to fish for the last 10,300 years to the restricted rights of the last 15 years. The three case studies are notable for the detailed narratives (between 100 and 150 notes per chapter) that support each one.

Chapter 6 concludes the vulnerability assessment by summarizing the common economic, political, and environmental changes facing the various stakeholders across the three case studies, and the primary drivers of adaptive capacity. These drivers include human, social, political, financial, and institutional capital. Adaptations that stakeholders identify are described as being either individual economic adaptations (for example, diversification, technological changes, and marketing) or broader scale adaptations (for example, promoting legislative or regulatory changes to increase resource access, and greater inter-organizational coordination and networking to promote greater influence). The overriding adaptive strategies that emerge with respect to climate change are market diversification, reducing dependence on the local environment, and adjusting spatial and temporal harvesting patterns.

This volume provides a detailed and thorough examination of vulnerability and adaptation in the northern European Arctic, and serves as a useful reference for stakeholder views in the forestry, fishing, and reindeer herding sectors. It is impressive for the detailed narratives that support the case studies, and it is mainly these case studies that are the contribution to emerge from the text. The book is also valuable in providing a northern European perspective on globalization and climate changes effects in the Arctic. However, there is a minimal level of synthesis connecting both the three case studies and the conclusion that limits the relevance of the book beyond the northern European Arctic and the three industry sectors that are examined. The content of this volume would be strengthened by conceptual linkages in the concluding chapter to the key ideas on vulnerability and adaptation dynamics presented and reviewed in the introduction. Such a contribution will be highly valuable and broadly useful to diverse stakeholders striving to adapt to rapid change, such that vulnerabilities can be anticipated and, perhaps with enough knowledge and wisdom, minimized. (Lilian Alessa and Andrew Kliskey, University of Alaska Anchorage, 3211 Providence Drive, Anchorage, Alaska 99508, USA.)

THE LONG THAW. David Archer. 2009. Princeton: Princeton University Press. 180 p, illustrated, hard cover. ISBN 978-0-691-13654-7. U.S.\$22.95. doi:10.1017/S0032247409008559

We all have our own perspectives on climate change. Most of us probably see it as a problem to be faced by ourselves, our children and our grandchildren. If we are optimists, we may hope that within this time span humanity will have found ways of stabilising greenhouse gas concentrations and, consequently, the Earth's climate will start to return towards its pre-industrial state. Undoubtedly there will be problems to be faced in the meantime, while mitigation

measures are put into place, but, given enough time and the willingness to act, we may hope that we can put things right eventually.

David Archer's book, *The Long Thaw*, could be read as a polemic against such complacent thinking and makes a strong case for taking urgent action on greenhouse gas emissions. His central thesis is that human-generated CO₂ has a very long lifetime in the atmosphere. While much of this additional atmospheric carbon gets absorbed by the oceans relatively quickly (on a timescale of a few hundred years), further reduction through neutralisation by ocean carbonates and by silicate weathering takes much longer. Archer has estimated that 17–33% of the total fossil fuel