

about 50% in comparison to temperate species, and also having more deformable red blood cells so they can pass through blood vessels with greater ease. Icefish have evolved a strategy unique amongst vertebrates, with the complete loss of red blood cells and a great reduction in white blood cells, thereby greatly reducing their blood viscosity. In turn, icefish have had to adapt to relying on oxygen dissolved within their blood plasma, along with an 80% reduction in vascular resistance and a cardiac output that is 10 times higher than in red-blooded polar species.

A considerable amount of research has been carried out on swimming and muscle physiology of polar fish, and this is reviewed in Chapter 8. All Antarctic fish with the exception of one species are primarily labriform swimmers, only utilising sub-carangiform swimming for high-speed swimming. Both red and white muscle fibres are much larger in Antarctic fishes than temperate species, with red muscle fibres having a 40% larger diameter and white fibres up to 500%. Both red-blooded Antarctic fish species and the icefish also lack muscle myoglobin. A similar reduction or loss of myoglobin is also seen in Arctic fish species, suggesting this may be a general low-temperature adaptation. Very high mitochondrial densities have also been shown in Antarctic fish red muscle, up to 50% of the fibre volume, much higher than temperate fish.

Lastly, in Chapter 9 the nervous systems of polar fishes are discussed. Evidence is presented that cold adaptation of nerve conduction velocities has occurred with velocities in polar species higher than temperate species when tested at the same temperature. However, the net trade-off appears that the nerves of Antarctic fishes fail at lower maximal temperatures than temperate species.

*The physiology of polar fishes* provides an excellent overview of current research in polar fish physiology. The book covers the main areas of focus for polar fish research over recent decades. By necessity, areas in which only limited research has occurred are omitted. I have very few criticisms of the volume. The authors chosen are highly qualified to write the chapters, and the book has been generally well edited. My only minor criticisms are that it would have been nice to see a more standardised chapter format, in particular in the way individual chapters are summarised. Also there is some small overlap of information between chapters, in particular Chapters 6 and 7, which also contain minor contradictions. However, these are insignificant criticisms, and I am sure any researcher working in this area will find this book invaluable both now and for many years to come. (Keiron Fraser, British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET.)

### References

- di Prisco, G., B. Maresca, and B. Tota. 1991. *Biology of Antarctic fish*. Berlin: Springer Verlag.
- di Prisco, G., E. Pisano, and A. Clarke. 1998. *Fishes of Antarctica: a biological overview*. Milan: Springer-Verlag.

Eastman, J.T. 1993. *Antarctic fish biology: evolution in a unique environment*. New York: Academic Press.

Kock, K-H. 1992. *Antarctic fish and fisheries*. Cambridge: Cambridge University Press.

**THE PHYSICAL GEOGRAPHY OF FENNOSCANDIA.** Matti Seppälä (Editor). 2005. Oxford: Oxford University Press. xxxii + 432 p, illustrated, hard cover. ISBN 0-19-924590-8. £130.00. doi:10.1017/S003224740623599X

This new book, part of the Oxford Regional Environment series of texts on physical geography, explains the 'state of the art' knowledge of a rather peculiar region — Fennoscandia — consisting of Finland, Sweden, and Norway. The region has a long and interesting geological history. The Archaean bedrock currently exposed over large areas has at times been covered by sediments; remodelled by orogenies, volcanism, and erosion; and inundated by the Paleozoic ocean. Furthermore, Fennoscandia has endured erosional and depositional effects of multiple glaciations. The current landscapes were finally remodelled into their present forms during the last glaciation, which ended some 10,000 years ago. The isostatic adjustment of the crust changed the distribution of water and land and can still in some areas be observed as shoreline displacement, rerouting of rivers, etc.

The editor of this special volume, Professor Matti Seppälä, is a well-known and honoured Finnish scientist, with special interests in Arctic geomorphology. In the preface, he explains that this volume is logically limited in area to Finland, Sweden, and Norway, although both Denmark and Iceland are often mentioned as part of Scandinavia. An important reason is the fact that only the three countries are resting on an Archaean crystalline basement known as the Baltic Shield. Although the Shield does extend east into westernmost parts of Russia, where the geomorphology is similar to that of Finland, the Russian part was excluded because of difficulties in finding suitable contributors.

*The physical geography of Fennoscandia* is divided into three separate parts. Part I covers various aspects of the physical environment of the study area. The Fennoscandian setting is described in the chapter on landforms and bedrock by Karna Lidmar-Bergström and Jens-Ove Näslund. They give a concise description of the geology, including the crystalline basement, the sedimentary rocks, orogenic and tectonic processes, the various petrographic regions, and naturally how these have influenced the present-day landscape. Details that have not been covered in the text are well documented in the many references.

The second chapter, by Matti Eronen, deals with the isostatic uplift following the unloading of Fennoscandia due to the melting of the continental ice sheet that covered most of the region 15,000–20,000 years ago. The crustal rebound has slowed down considerably, although in the central parts of the area, around the Northern Quark and

the Bothnian Bay, the rate of uplift is still 8–9 cm per decade. Thanks to the rapid uplift, glacially sculptured bedrock formations, emerging from the sea, show well polished surfaces, chatter marks, *roche moutonnée*, and other glacial features generally obliterated by weathering and a floral canopy. Other features that are explained in the text are the early formation and development of the Baltic Sea Basin following the northward retreat of the ice margin. Glacial drift, both as till and fluvial deposits, is a major contributor to a variety of both micro- and macro-landforms.

The third and fourth chapters, by the editor of the volume, describe the various glacially induced landforms found in Fennoscandia and also the processes currently influencing landforms. Thanks to the asymmetrical relief, with high mountains of Norway in the west and gently undulating topography of central Sweden and the main part of Finland, examples of virtually all types of glacial erosional and depositional features can be found. In chapter 19, Seppälä discusses many of the special features attributable to permafrost or strong seasonal frost. These include patterned grounds, frost shattering, etc, and even *palsas*, defined as peat mounds with a permanent ice core. The formation and distribution of extensive peatlands, various types of mires, are covered in the fifth chapter, by Hannu Pajunen.

Chapters 6 and 7 deal with climate. Matti Tikkanen explains the regional variability of present-day climate, influenced by the proximity to the Atlantic Ocean in the west, and the huge landmass of Eurasia to the east. The recent climatic trends are discussed by Anders Moberg, Heikki Tuomenvirta, and Yvind Nordli. They discuss historical records of climate indices (temperature, precipitation, atmospheric circulation, etc) and the trends that can be extracted from the data. They do, however, refrain from attributing the warming trend observed during the twentieth century to increasing greenhouse gases.

Veli Hyvärinen and Juha Kajander discuss the rivers and lakes of Fennoscandia in chapter 8. They provide data on the drainage areas and discharge rates of rivers and the sizes and areal distribution of lakes, both showing specific peculiarities depending on season. Winter freezing and spring floods cause the most dramatic events. These issues are further elaborated by Esko Kuusisto in chapter 9, explaining snow accumulation as a geographic element. In a book that is supposed to be based on fact, he does, in the end, unfortunately venture into hypothesising over the future of snow cover in the region using model studies and climate scenarios.

Per Holmlund in chapter 10 describes the nature of the many mountain glaciers found in Norway and northern Sweden. He also discusses mass-balance issues in relation to climate models.

The influence of climate, and especially summer temperatures, but also soil types, altitude, and relief on the development of vegetational zones is discussed by Olavi Heikkinen in chapter 11. The shifts in timberline and northern limits have been used in analysing past climates.

Part II of the volume describes various physiographic regions, beginning with the Atlantic coast and fjords along the western seaboard in chapter 12, in which Geoffrey Corner writes about the various coastal types to be found along the Norwegian coast. In chapter 13 he moves away from the coastline to higher altitudes and gives a short course in the palaeogeological and geomorphological development of the Scandes mountains.

Karna Lidmar-Bergström and Jens-Ove Näslund, in chapter 14, take the next region under closer scrutiny: the uplands and lowlands of Scania, southern Sweden. This area shows considerable geodiversity due to a host of processes influencing the relief. The most important factor was the strong tectonic activity in the area, giving rise to a horst and graben landscape. Remodelling by multiple cycles of deep weathering and erosion in pre-glacial, glacial, and postglacial times paved the way to the present terrain.

The Baltic Sea, being an outstanding feature of Fennoscandia, actually separates the Scandinavian peninsula (Sweden and Norway) from Finland. As described by Rune Frisé, Carl Erik Johansson, and Veli Suominen in chapter 15, wherever the fractured Baltic Shield rises above sea-level, the landscape is characterised by a multitude of islands and skerries. Some of them consist of exposed bedrock, others of glacial drift, or a combination of the two. Due to variations in the integrity of the bedrock, amount of deposited drift, rate of land uplift, and exposure to wind and waves, the coastal stretches have been classed into different archipelago regions.

The specific characteristics of the lake district of Finland and the mountain taiga of Sweden are described by Esko Kuusisto and Leif Kulman in chapters 16 and 17, respectively. Carl Erik Johansson classifies in chapter 18 the major rivers discharging into the Gulf of Bothnia. He also provides a detailed description of some of these rivers in an appendix.

In part III, the editor has grouped together four chapters dealing with human impact on the environment. John Westerholm describes the role of various livelihoods on the landscapes. These range from primary land use — that is, farming, forestry, drainage of lakes and mires, etc — to secondary production connected with industrialisation, and human mobility and tourism classed under tertiary activities.

A major adverse effect of industrialisation was the increase in air-borne sulphur deposition in Fennoscandian lakes. This issue is ventilated by Ingemar Renberg, Richard Bindler, and Tom Korsman in chapter 21. Further discussion on issues of lake pollution is taken up by Jaakko Mannio, Brit-Lisa Skjelkvåle, Anders Wilander, Eirik Fjeld, and Seppo Rekolainen in chapter 22. They note that the natural state of lake waters in Fennoscandia is governed not only by precipitation and run-off, but also by variations in bedrock, soil, and vegetation. A deterioration in water quality observed in very many lakes has been due to the increase in nutrients derived from agriculture and urban sewage discharges. Fortunately, investments

in control of water pollution have in many cases led to marked improvements.

In the final chapter, Antti Haapanen discusses the conservation of biodiversity. According to him, fragmentation of natural habitats has at least in part been prevented by establishing national parks and nature reserves of sufficient size. He also notes that semi-natural habitats are becoming endangered due to major changes in land use.

There is a comprehensive index at the end of the book, and each chapter contains a concise list of references aiding the reader to find additional information on the subject at hand. A short description and affiliation of the contributors is also given.

The topics covered by the various chapters, their grouping, and their order of presentation could have been organised differently. It also seems that the editor had an ungrateful and difficult task of rounding up the various topics and finding suitable authors and keeping them in line. How well he succeeded is a matter of opinion, but considering the scope of the book, my view is that Seppälä did a good job. But in any good treatise there is also room for some criticism.

Due to the many authors, the quality of the language is not uniform, and, in fact, the non-English background of several of the authors is clearly detectable. This can also be seen in some of the terminology used in the text. Although geological and geographical glossaries are available both in printed form and on the Internet, a special glossary of some of the terms used in the text might have been beneficial for a person not well versed in the field.

The index in the back of the book is quite helpful, although the purpose of including a list of figures is not clear. In my view, the search for a specific figure is easier by paging through the book than by searching the list. Furthermore, it is a pity that neither the captions associated with the plates nor the list of colour plates in the beginning of the book give any hint of the page number where they are mentioned in the text itself.

Another minor complaint has to do with some of the illustrations. Although most are well chosen and informative, the print quality has not always been the best. This is especially true of many of the photographs, many of them being dull grey with low contrast and clarity. The four colour plates, placed in the middle of the book — obviously due to binding constraints — are much better thanks to the glossy paper on which they are printed. The graphics are generally good, although in some cases the reproduced figure size is not in good agreement with the portrayed information.

Despite some shortcomings, the book *The physical geography of Fennoscandia* gives a very good general view of this northernmost part of mainland Europe. It is suitable reading both for the specialist and the interested layman, and will surely find a worthy place in a private library as well as in an institutional one. (Boris Winterhalter,

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**THE S.S. *TERRA NOVA* (1884–1943): FROM THE ARCTIC TO THE ANTARCTIC, WHALER, SEALER AND POLAR EXPLORATION SHIP.**

Michael C. Tarver. 2006. Brixham, Devon: Pendragon Maritime Publications. 256 p, illustrated, hard cover. ISBN 0-9552208-0-7. £30.00.

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At first glance, it is surprising that Ann Savours' comprehensive 'biography' of the famous polar exploration vessel *Discovery* was not followed by a multitude of similar books on polar ships, for their names are seared into the annals of polar history as clearly as the names of the explorers who sailed in them. From *Erebus* and *Terror* to *Fram*, *Endurance*, and *Aurora*, their timbers reverberate with the tales of the frigid human endeavours played out upon their decks. Often these endeavours are tied in the minds of polar pundits to a particular expedition or adventure, and such is the case with S.S. *Terra Nova*, the famous vessel used by Captain Scott on his final British Antarctic Expedition 1910–13. This has been particularised to the point where it is often simply called the *Terra Nova* Expedition. Yet such particularity is mistaken, for many of these vessels had long and distinguished polar careers spanning many decades and numerous expeditions. As such, their stories can be useful vehicles for the historian, much as the original vessels were useful vehicles for their captains, in penetrating the wider — and often unknown — polar landscape. Against such a canvas, one expedition becomes a passing moment, if an apex, in a ship's tale. All too often, however, the apex is brief and the deep layering of its remaining history appears to render the ship's story as inscrutable as the ice which it was built to penetrate. So perhaps we should not be surprised that polar writers have generally avoided the subject, preferring the quick returns from subjects more glibly researched and profitable. I am glad to say that this book is an exception.

The story of S.S. *Terra Nova* has taken 20 years of research to uncover, and for this meticulous work the author, Mike Tarver, is to be warmly congratulated. From the day the keel of this powerful steam-whaler was laid in Dundee, to the day the floundering ship was sunk by shell-fire from the United States' navy, the story of *Terra Nova* is a remarkable one. Whether as a Dundee whaler; as part of the fleet of 'wooden walls' sealing for Bowring Brothers from Newfoundland; or in her moments of fame in the British National Antarctic Expedition (1901–04), the United States Fiala-Ziegler Arctic Expedition (1903–05), or the British Antarctic Expedition (1910–13), her 60-year career is lovingly unveiled through a remarkable collection of sailors' anecdotes and photographs. Even the appendices are of interest, including the reproduction