

Sea Ice: An Introduction to Its Physics

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Book Reviews

IN THE TEETH OF THE WIND: SOUTH THROUGH THE POLE. By Alain Hubert and Dixie Dansercoer with Michel Brent. Norfolk, UK: The Erskine Press, 2001. 210 pp. \$45.00. ISBN 1852970669.

At the dawn of the 21st century, blank areas denoting the unexplored have vanished from the maps of our planet. Nonetheless, adventurers and explorers continue to find new challenges by climbing unnamed peaks, traversing jungles, circumnavigating the globe with balloons, or venturing into deep seas and the polar regions. *In the Teeth of the Wind* by the Belgians Alain Hubert and Dixie Dansercoer with Michel Brent, relates one such story of modern exploration. More than just the diary of Hubert's and Dansercoer's 1997–1998 journey across the Antarctic, this book combines modern travel reporting with a story of physical challenges and accomplishments, scientific research, personal relationships, and adventure.

The book opens with a preface by Baron Gaston de Gerlache, president of the Belgian National Committee for Antarctic Research, who places this adventure within the context of a remarkable line of early Belgian Antarctic exploration. A 210-page description of the planning and preparation, and of the journey itself, follows.

The first chapter (12 pages) briefly reviews the history of Belgian exploration in Antarctica. It introduces Hubert and Dansercoer, their previous adventures, and the planning of their trip. The development of sail-supported sports and travel is also covered, which leads into how the idea of crossing Antarctica by these means grew into a reality. In their traverse of the Antarctic continent the two-person team used power-kites (sails harnessed to the skiers' bodies) to help them pull their two sledges across the ice shield. The authors point out the meticulous attention paid to gear and food selection, mental preparation, and achieving the required physical fitness.

Then follows "The Journal," a 156-page account of the journey. This section, written in the style of a travel journal giving a day-to-day report, is the core of the book. The at-times repetitive description of 99 days of travel is skillfully enlivened by intertwining personal monologues from the two authors. This sharing of their thoughts provides insight into their mental commitment, personal relationship, and growth during the journey.

The book traces their Antarctic traverse along a route from the former Belgian research station Roi Baudouin Base (presently known as Blue Tourist Base) via the South Pole to McMurdo. The expedition suffers from an abundance of problems right from the start. However, these setbacks are eventually overcome with skill and determination. Help from Michael Brent becomes critical when one of the sledges fails and needs to be replaced. The scientific component of the project is also documented. Stratigraphic, temperature, and snow density data were regularly recorded. Snow samples were collected and investigated by macrophotography for shape and form of snow crystals and by isotopic analysis for paleoclimate research.

This book is well written and readable. Another compelling feature is the 96 color photographs, a few of which are in double-page format. Four maps and graphs are used to illustrate the route. The book concludes with five appendices: (1) Power Kites for Traction (4 pp.), (2) The Scientific Mission (3 pp.), (3) The Polar Diet (7 pp.), (4) Equipment List (4 pp.), and (5) Previous Crossings or Attempted Crossings of the Antarctic (5 pp.).

In the Teeth of the Wind is easy reading that will appeal to a wide range of enthusiasts, from the hard-core mountaineer and Arctic adventurer to the mainstream traveler, and to all of those who will

never give up the dream of wandering in the footsteps of their childhood heroes, or beyond.

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WILLIAM BRADFORD: SAILING SHIPS AND ARCTIC SEAS. By Richard C. Kugler, with contributions from Eric A. R. Ronnberg Jr., Adam Greenhalgh, and R. M. Riefstahl. Seattle and London: New Bedford Whaling Museum in association with The University of Washington Press, 2003. 178 pp. \$35.00. ISBN 09722222-1-9 (paper).

What is the attraction of the Arctic? To many it is the challenge of living in a difficult and unusual environment. To some, it is the history of human settlement and heroic exploration in the days of wooden ships and iron men. To many in science, it is the unique and substantial contribution of the high latitudes to the Earth's biological and physical systems. But to almost all of us, it is, in addition, an aesthetic attraction.

I crave snow-topped mountains, dreary wastes, and the cruel Northern sea with its far horizons at the edge of the world where infinite space begins. Here skies are clearer and deeper and, for the greater wonders they reveal, a thousand times more eloquent of the eternal mystery than those of softer lands. (Kent 1996)

This book is a beautifully produced catalog of William Bradford's landscape art as represented by a special retrospective organized by the New Bedford Whaling Museum. However, it is more than an exhibition catalog, with a fascinating discussion of Bradford's life and times by Kugler, a chapter on his mastering of form and development of style by the noted marine historian Ronnberg, and a discussion of his remarkable travel folio by Greenhalgh. The quality of the color reproductions is excellent, and the word "arctic" is misspelled only once in a chapter title. The book is replete with information on the life and history in the New England maritime and the coasts of Labrador and West Greenland in the mid-19th century.

William Bradford (1823–1892) was a lineal descendent of the governor of Plymouth Colony. After an unsuccessful career as a shopkeeper in New Bedford, Massachusetts, he turned to art, specializing in carefully rendered "ship portraits." He became enamored of the scenery farther north and managed to promote numerous expeditions to Labrador and Greenland, reaching 75°N latitude in Melville Bay. On many of these trips he took along photographers so that he could use these early pictures in addition to field sketches in oils or charcoal/graphite as preliminary studies for studio canvases. Along with his contemporaries Frederic Church and Albert Bierstadt, he became famous for huge, spectacular landscapes that became well known in America and Europe. He also produced a large book of photographs (*The Arctic Regions*) and gave lectures ("The Bradford Recitals") on the Arctic that included notes about Norse expeditions in Greenland, indigenous peoples, glaciers, and icebergs and were accompanied by Inuit songs. Following his death, his reputation (along with that of Bierstadt and Church) declined, but his work has attracted renewed interest with retrospectives beginning in 1969.

Bradford's landscapes of sailing ships and the arctic coasts show incredible and accurate detail, and he was obviously fascinated by

icebergs. His works are not as romanticized as those of Bierstadt, but they show a profound sense of atmospheric effects and the glow of sun on ice.

From dead white to glossy, glistening satin; from the deepest green to all the lightest shades; and from faint blue to deepest “lapis lazuli,” and again, as some lofty berg passed between us and the sun, its crest would be bordered by a rose-coloured halo, in which sometimes prismatic shades appear. The wild, rugged shapes, indescribable and ever-changing, baffle all description. (Bradford 1873)

This book is a well-produced and attractive addition to our knowledge of landscape art, especially of the northern shorelines and the ships that plied them in the 19th century. Many of the reproductions are exquisite—I especially like the “oil sketches” made on board in the field, which have a freshness and spontaneity (and often an offbeat composition) that is valued in the art world now but is subdued in Bradford’s large studio landscapes. However, all of the works are significant and, in addition to their artistic merit, cast light on arctic exploration and voyaging in a time long past.

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SEA ICE: AN INTRODUCTION TO ITS PHYSICS, CHEMISTRY, BIOLOGY AND GEOLOGY. Edited by D. N. Thomas and G. Dieckmann. London: Blackwell Science, 2003. 416 pp. (?) 89. ISBN 0-632-05808-0.

Sea ice covers about 7% of our planet, making it one of the largest biomes on earth. The book *Sea Ice: An Introduction to Its Physics, Chemistry, Biology and Geology*, edited by Drs. David Thomas and Gerhard Dieckmann, provides the scientific community with an excellent source of reference on the biology of sea ice from micro- to macroscale as well as on physical models, large-scale characteristics as derived from satellite observations, and paleo reconstructions. The book includes contributions from a host of international authors who thoroughly discuss state-of-the-art techniques and insights related to sea ice. The varied contributions make the individual chapters demanding, and in some cases provide more detail than necessary. However, a comprehensive glossary and abundant illustrations help to overcome these difficulties.

The book contains a wealth of interesting facts. It is absolutely fascinating to learn about high-latitude species adaptations. Tiny sea-ice organisms survive at temperatures down to -20°C by forming cysts or maintain metabolism by adjusting the proportion of unsaturated fatty acids to retain membrane fluidity at extremely low temperatures. Polar seals have very small flippers to retard heat loss in the cold water, but this makes them less agile on beaches and consequently dependent on pack ice for breeding.

A very useful comparison summarizes the major differences between arctic and antarctic sea ice in all its aspects, from physical properties, such as average extent and heat flux, to biological curiosities, such as species of fish and nematodes associated with the ice.

The different authors convincingly show the importance of understanding the mechanisms that control sea-ice formation and the impact the vast frozen world has on the global climate system.

Sea ice strongly affects the atmosphere because it acts as insulating material and limits energy flux between the ocean and atmosphere. The high albedo of the ice surface keeps solar radiation from being absorbed by the surface and is instead reflected back into the atmosphere. This feedback mechanism is the main reason that scientist expects that climate signals may be amplified in polar regions.

Equally significant is the impact of sea ice on the ocean. When the ice is formed, brines are rejected, increasing the salinity of the upper ocean layer as such by initiating convection. Or the other way around: when ice is melting, fresh meltwater floats as a very stable layer on top of the ocean.

Whereas these processes are understood in broad outline, complex feedback loops are increasingly recognized. Current dynamic sea-ice models are included in global circulation models, but several authors point out the fundamental problems that still prevent accurate predictions.

Recent large ice breakups in both the Arctic (Ward-Hunt Ice Shelf in September 2003) and the Antarctic (Larsen B Ice Shelf in February–March 2002) focused media attention on retreat and decay of polar ice. Both breakups are interpreted as signs of global warming. In this perspective it is interesting to look at results of a survey, “Public Attitudes towards Global Warming,” that the American Geophysical Union (AGU) has conducted (Immerwahr 1999). The survey states that although most Americans (74%) believe the atmosphere is gradually warming, personal concern for global warming has dropped from 35% of the people interviewed in 1989 to 24% in 1997. According to the survey, this decrease is mainly caused by the fact that people are confused about the causes and effects of global warming. In addition, a large part of the public (44%) thinks that scientists are still divided about the issue. Apparently, in 1999 the scientific community had not yet conveyed a sense of unanimity.

This conclusion is still true for the issues concerning melting of sea ice. Although two decades of satellite data show declining sea-ice extent in the Arctic (-2% per decade), the trend for the Antarctic sea ice appears insignificant ($+0.4\%$ per decade). It is still under discussion whether 22 years of data is sufficient to delineate a trend or whether the decline could be attributed to natural variability. Comiso in Chapter 4 inclines toward interpreting the data as a negative trend since he found a strong correlation between Northern Hemisphere ice extent changes and temperature changes. However, Haas in Chapter 3 shows that actually one would need to know ice volume changes instead of only area changes. Despite reported dramatic thinning of Arctic ice (e.g., Rothrock et al. 1999), he concludes that scientists are still having tremendous trouble with measuring ice thickness on a regional scale and over longer time spans. Complete new insights are expected from the upcoming CryoSat satellite mission, which is aimed at providing monthly fields of Arctic-wide mean sea-ice thickness. It appears that the general public will need to wait for further conclusive evidence, but earth scientists interested in the complexities and ongoing discussion have a great source of information in this book.

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