

rock types in nature. My suggestion here is that a diagram showing the relationship of granite/rhyolite – diorite/andesite – gabbro/basalt would have been useful for the reader to understand the chemistry and cooling comparisons of these common igneous rocks.

Chapter 5 — ‘Faults, earthquakes, and mountain building’ — introduces the factors that have helped to shape southeast Alaska and bring its present terranes to where they are presently. Modern earthquake activity includes the landslide in Lituya Bay in 1958, in which 40 million cubic yards (30 million m³) of rock slid into the head of the bay as a result of an earthquake along the Queen Charlotte-Fairweather Fault, creating a tsunami in the narrow bay that stripped the walls of trees as much as 1800 feet (550 m) above sea level.

Chapters 6 (‘Alexander Archipelago’) and 7 (‘Coast mountains – exhumed lower crust’) discuss the various means of terrane movement and placement of the major components of the coast, including the Coast Plutonic Complex, which is subdivided into three parallel belts of similar rocks that extend the length of southeast Alaska — western metamorphic belt, central pluton-gneiss belt, and the eastern metamorphic belt. Rapid glacial erosion of mountain belts likely keeps pace with tectonic uplift, thus limiting the height of mountain belts. As an example, the landscape in Glacier Bay is currently rebounding at 1 in yr⁻¹ (3 cm yr⁻¹), possibly due to a combination of the weight of glacial removal and tectonic uplift. Chapter 8 — ‘Regional geology’ — provides details of some of the major areas in southeast Alaska, including Glacier Bay, where glaciers have retreated more than 60 miles (100 km) in the last 200 years, a reasonably well documented area of historic accounts (John Muir visited here in about 1900). Further areas discussed in respective subheadings include Haines and Skagway, at the northern end of Lynn Canal, which offers spectacular glaciated scenery; Klondike Gold Rush, where the discovery of gold in 1896 initiated a major gold rush starting in 1898; and Sitka, the oldest non-native settlement in southeast Alaska, which became the capital of Russian Alaska in 1804 and remained so until the United States purchased Alaska in 1867. Remaining subheadings include discussions of Chatham Strait; Juneau; Gold mining and the westernization of southeast Alaska; Tracy Arm, Endicott Arm, and Holkham Bay; Frederick Sound; Petersburg and Wrangell; Clarence Strait and Prince of Wales Island; and Ketchikan and Misty Fiords. It was noted that LeConte Glacier, near Petersburg, is the southernmost tidewater glacier in North America. It retreated one-half mile since 1994, with flow rates ranging between 25 and 95 feet (8–29 m) per day, contributing considerable icebergs as a result.

One-page additions within the chapters include helpful summaries of measuring glaciers, Earth magnetism as a tool for determining ancient positions of the Earth’s crust, and radioactive isotopes as a tool in radiometric dating of rocks. On the whole, the writing style and level of writing, along with the excellent diagrams, provide an

excellent reference book for passengers on cruise vessels traveling along the Inside Passage, the most-used ship and Alaska Marine Highway route from Ketchikan to Petersburg, Juneau, and Haines. The 28 color photographs add to the explanations in the text, and the numerous diagrams and geologic maps, all in colour, deserve much attention. The photographs are especially a treat for those who have been in this area and experienced considerable overcast skies, rain, and fog, obliterating the spectacular scenery. I expect that the book will be made available in the shops of all the ships transiting this area, and shops in the settlements visited. The book is basically error-free, with a single typo noted, and the alternating use of the terms ‘comprised of’ and ‘composed of’ in several instances (see amphibole and andalusite in the glossary, page 113, for example). (John Spletstoeser, PO Box 515, Waconia, Minnesota 55387, USA.)

LIFE IN ANCIENT ICE. John D. Castello and Scott O. Rogers (Editors). 2005. Princeton, NJ: Princeton University Press. xxii + 307 p, illustrated, hard cover. ISBN 0-691-07475-5. \$US45.00. doi:10.1017/S0032247406285991

Life in ancient ice results from a 2001 workshop of the same title organised by the editors and sponsored by the National Science Foundation. The book has 20 chapters, comprising an introductory and concluding chapter by the editors with 18 chapters in between that are research articles. The articles are primarily by US and Russian researchers, since these were the main workshop participants. Cryobiology is an emerging field and the research presented at the symposium and in the book was conducted largely prior to 2000. Thus, as the first compendium of cryobiological research in terrestrial systems, it provides a good starting point for those interested in the field.

An attractive aspect of the book is the diverse range of topics that are covered by the research articles. ‘Life’ is broadly defined in this volume, encompassing viruses, prokaryotes, and eukaryotes (algae, fungi, and diatoms). Similarly a broad range of icy environments are featured, including lake ice, permafrost, and ice cores from ice caps and ice sheets. The approaches and methods used in the research articles vary widely, too, including culture-based work, molecular techniques, and fluorescent sensing tools (biologgers). Given the diversity and complexity of the techniques, environments, and approaches in the book, it will probably appeal most to graduate students and researchers. However, it is also a useful resource for senior undergraduates contemplating graduate research in cryobiology, since it provides stimulus for the many different aspects of cryobiology in which one can conduct research.

The editors note and address the significant challenges that face researchers in cryobiology, especially those working with ice cores. The primary challenge is contamination of the samples with organisms external to the environment of interest. Chapter 2 provides a

methodological study assessing the effectiveness of a variety of decontamination protocols for ice cores. A further challenge to biologic ice core researchers is the limited volume of sample that can be obtained following thorough decontamination, coupled with the low biomass typically reported in meteoric glacial ice 10^2 – 10^4 cells ml^{-1} . These challenges can preclude the typical triplicate experiments that are conducted in other fields of biology, and may make it difficult to get reproducible results.

The research articles in chapters 3–17 demonstrate the tenacity of life in frozen systems and report on the existence of life in all icy systems investigated from the accretion ice of Lake Vostok, 3600 m below the surface of the Antarctic ice sheet, to Siberian permafrost that may be up to 3 million years old. The book demonstrates the effectiveness of ice sheets as repositories for biological material that probably reflect both atmospheric and biospheric changes over glacial-interglacial cycles, for example, in chapter 5 (diatoms), chapter 6 (biogenic particles), chapters 11 and 12 (fungi), chapter 13 (viruses), and chapters 15 and 16 (bacteria). In chapter 7 a reasonable case is made for an active terrestrial biosphere at sub-freezing temperatures in permafrost using incorporation of ^{14}C to demonstrate bacterial activity. Chapters 8–10 focus on the ability to resuscitate fungi and phototrophic organisms (cyanobacteria and algae) from ancient permafrost that may be up to 3 million years old, and discuss the implications this has for microbial longevity and viability in frozen matrices.

Chapter 17 provides an overview of the accretion ice of Lake Vostok, situated beneath the East Antarctic Ice Sheet, and the physical setting of this intriguing environment. The chapter also provides a useful synthesis of the work prior to ~2001 on the biological components of the accretion ice. A number of papers have been published since ~2001 on the biological, chemical, and physical properties of the accretion ice of Lake Vostok. However, there is still an ongoing debate as to how the properties of the accretion ice can be utilized to infer the properties of Vostok lake water.

Chapter 18 highlights a new and innovative technique being pioneered by Price and colleagues in using the fluorescence properties of organisms as a possible method for their remote detection in ice using a 'biologger.' Chapter 19 describes living cells in terrestrial permafrost as a model environment for astrobiological exploration, and there are clear parallels between certain terrestrial and Martian permafrost environments. Additionally, the editors note more broadly in chapter 20 that life in ancient ice, whether it be in permafrost, ice sheets, or ice accreted from subglacial lakes, has important implications for the search for life in ancient ice on other planets/satellites in the solar system, most notably Mars and Europa. Further, an important principle in Earth Sciences that the present is the key to the past is highlighted in chapter 15 despite the overall biological nature of the book and the research. Christner and others note the importance of studies on ancient ice from the Pleistocene as poten-

tially being informative guides to icy biospheres during periods of pervasive low-latitude glaciation in the Neoproterozoic.

One minor omission in the book is that valley glaciers are a notable terrestrial icy environment where important findings were made during the infancy of biological research in ancient ice. Overall, however, the book is a good introduction to the subject and will stimulate significant interest in this emerging research field. (Mark Skidmore, Department of Earth Sciences, 200 Traphagen Hall, Montana State University, Bozeman, MT 59717, USA.)

THE WHITE DARKNESS. Geraldine McCaughrean. 2005. Oxford: Oxford University Press. 264 p, hardcover. ISBN 0-19-271983-1. £12.99. doi:10.1017/S0032247406295998

Almost at the end of *The white darkness*, Sym, the 14-year-old narrator, and heroine in the OED sense of 'a woman distinguished by exalted courage and fortitude,' asks what happened to the bodies of Scott, Wilson, and Bowers, and the death tent, on the Barrier. 'The search party burned them where they were...' A typo, presumably, but curiously symbolic in a novel where violence is the preferred mechanism for propelling the plot. Combining two genres — adventure story and ghost in the head — the highly successful and multiple award-winning children's writer Geraldine McCaughrean deploys conmen and murder, low cunning and madness, suicide, drugs, untrammelled innocence, and miraculous survival, over the icy wastes of unclimbed Antarctica.

The Pengwings Expeditionary Force uses a DC-6 to fly its rich clients to a blue ice runway at Camp Aurora on the eastern edge of the Ross Ice Shelf, with views of the Queen Maud Mountains, and an Otter to take them on to desired destinations — an emperor penguin colony, a 'fur seal colony.' The DC-6 catches fire and burns, stranding the party, all of whom, with the exception of Sym, Uncle Victor, and a Norwegian filmmaker and his handsome young son Sigurd, have sickened with stomach problems. While the camp sleeps unnaturally soundly the four drive away in a Hagglund packed with fuel and food, south across the ice shelf, towards Uncle Victor's obsession, revealed to Sym only days before: Symmes' Hole.

Despite Uncle Victor buying Sym a swirly red silk skirt and red camisole in Paris before whisking her to Antarctica without her mum's consent, despite not being her real uncle, despite Sym suffering not only the turmoils and insecurities of a deeply shy adolescence, plus a disability, deafness, but also a damaging, constricting interpretation of her life so far, sex with a 14-year-old does not feature. Symmes' Hole is the geographical soft spot in the Earth's crust, one in the north, one here in the south, letting sunlight penetrate to the Insiders living in the subterranean labyrinth beneath. Or so John Cleeves Symmes posited 140 years ago. Uncle Victor is a believer.