
Preface

'As far as we could see, the inland ice was an unbroken plateau with no natural landmarks. From the hinterland, in a vast solid stream, the ice flowed with heavily crevassed downfalls near the coast'.

Douglas Mawson *The Home of the Blizzard* (1915)

'Unseen and untrodden under their spotless mantle of ice the rigid polar regions slept the profound sleep of death from the earliest dawn of time. Wrapped in his white shroud, the mighty giant stretched his clammy ice-limbs abroad, and dreamed his age-long dreams'.

Fridtjof Nansen *Farthest North* (1898)

Ice and snow environments in the polar and alpine regions have always been a focus of fascination for humankind. There is something almost seductive about the stark beauty of icy places. They demanded exploration, and as the history books show extraordinary people like Nansen, Amundsen, Scott, Mawson, and Shackleton sought to reveal their secrets, in some cases at enormous human cost. The age of exploration paved the way for the large-scale scientific investigations of today, supported by the type of logistics and technology that the early explorers could never have imagined. The polar regions are warming more rapidly than lower latitudes and this has heightened interest in their ice sheets, glaciers, sea ice, and ice-covered lakes. Climate change and its possible impact on ecosystem function and biodiversity have become major scientific issues.

Ice sheets and glaciers have not traditionally been the domain of biologists, rather they have been the territory of physical and chemical glaciological investigations. It has only been in the last decade or so that glacial environments have come to be

regarded as another ecosystem in the cryosphere. It has become evident that biological processes play an important role in the geochemistry of these environments. Like other extreme environments, such as Antarctic lakes, they are systems dominated by microorganisms. Today, glaciology demands an interdisciplinary approach involving microbiologists, geochemists, glaciologists, and modellers. Now it is not uncommon to find university research groups involving all of these disciplines working together in an integrated manner. The Bristol Glaciology Centre exemplifies this approach. The literature is expanding exponentially, but one of the major challenges is to elucidate in much more detail what the microbial communities of the cryosphere contribute to biogeochemical processes, particularly in subglacial environments.

While there are many excellent books dealing with specific components of cryosphere biology, there is no single volume that covers a wide range of ice and snow environments. This volume is intended for both the specialist and non-specialist. Many students of glaciology have little biological knowledge, and likewise biologists may lack knowledge of the physical and chemical aspects of the cryosphere. The important issue of climate change is embedded within each chapter, rather than being treated separately under one heading. We have covered a wide spectrum of cryospheric environments (excluding the permafrost) including snow, supra- and subglacial and ice sheet environments, sea ice, and lake ice. The first chapter is intended as a background introduction to the more detailed treatment of each environment in the succeeding chapters. We have also included a chapter on astrobiology because many of the ice environments are regarded as an analogue

for extraterrestrial life. Lastly, we consider future directions, as some exciting technologies are being developed that provide much greater scope for studying life in glacial environments on Earth and on other planets.

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