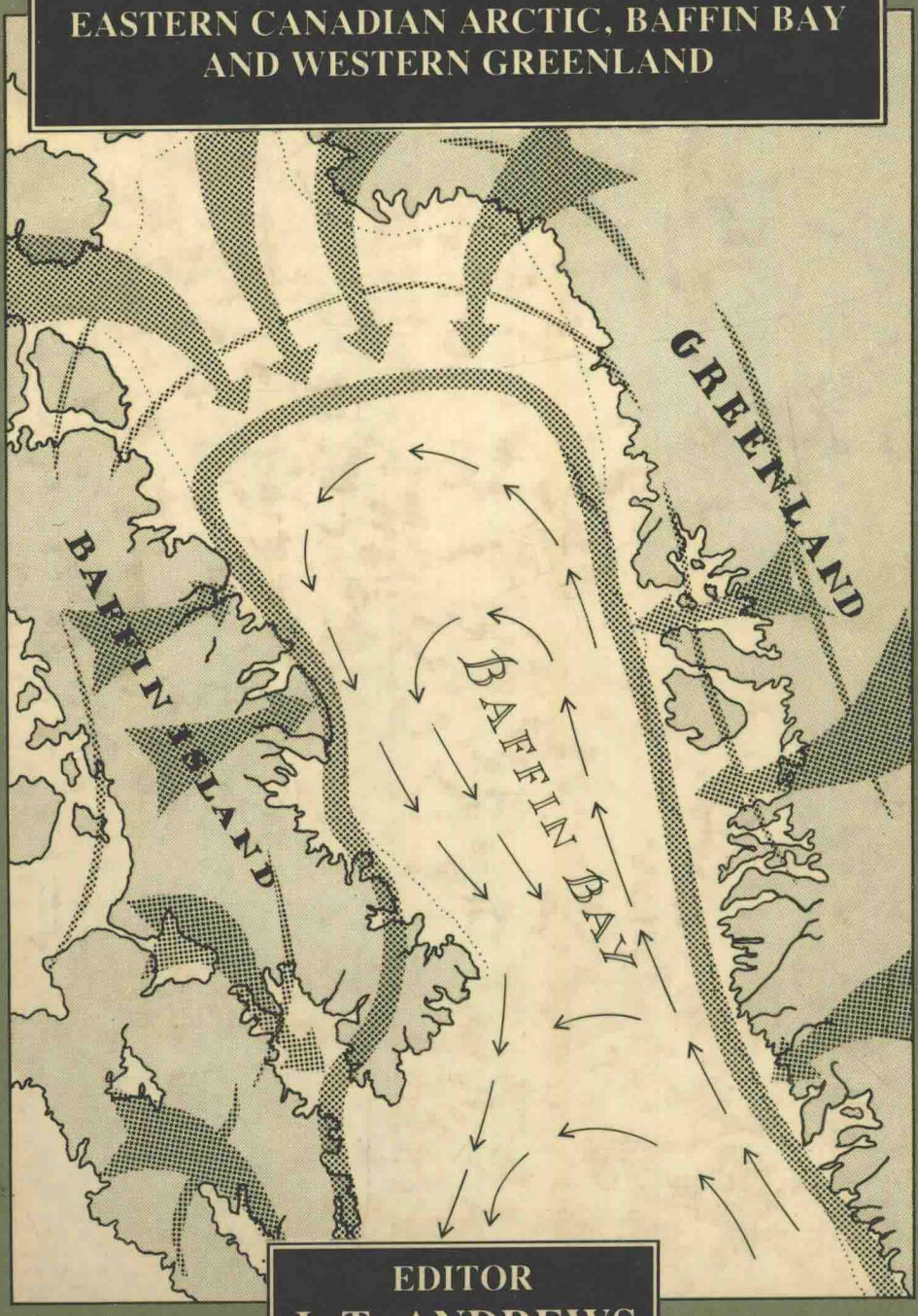
QUATERNARY ENVIRONMENTS

EASTERN CANADIAN ARCTIC, BAFFIN BAY AND WESTERN GREENLAND



EDITOR
J. T. ANDREWS

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Institute of Arctic and Alpine Research,
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Preface

Sometime in the late 1970s at an annual meeting of the Geological Society of America, Professor A.L. (Art) Bloom of Cornell University said words to the effect: it would be a good idea to try and consolidate all the work that has gone on concerning the Quaternary history of the Eastern Canadian Arctic. Several years later this book seeks to accomplish that goal. However, as is very clear from the title and the contents of many chapters the scope of the work has increased so as to include the important companion research that has been undertaken in Baffin Bay, on surrounding ice caps, and on the terrestrial and lacustrine deposits of West Greenland.

This volume represents the combined efforts of scientists from Denmark, England, Canada, and the U.S.A. The process of compiling the 26 chapters started some 2 to 3 years ago and it is with some relief that I am now at the moment of writing the Preface and the Acknowledgements. I have certainly learned a great deal from editing this volume and the studies reported on will serve as both a testimony to past concepts and ideas as well as pointing toward new theories. The ocean and lands surrounding Baffin Bay have a central part to play in any reconstructions of Quaternary environments at either the regional or global scales.

John T. Andrews
Boulder, Colorado
14 November 1984

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During the final stages of production I was able to "request" the assistance of several people at INSTAAR who read between one and three chapters in a final effort to check for typographical errors, references, and other details. Thus I thank Martha Andrews, Kerstin Williams, Anne Jennings, Chip Layman, Harvey Thorleifson, Chris Waythomas, Many Wilson, Lisa Osterman, and Phil Wyatt for their valuable assistance. Jim Walters did a great deal of the drafting for those chapters that came from INSTAAR members and, with great care, undertook the final pasting in of the figures. His work is greatly appreciated. Roger Jones and Geoffrey Palmer of Allen and Unwin are to be thanked for their assistance and interest in this volume.

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Although the bulk of the material in this volume is original, there are a number of figures that have been reproduced with the permission from the publisher or journal. These are noted under the appropriate figures as "with permission". Here I wish to specifically outline the source for these permissions.

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Part I
INTRODUCTION TO QUATERNARY STUDIES AND PRESENT ENVIRONMENT

Contents

1 Introduction to Quaternary studies

J. T. Andrews and S. Funder

This volume deals with Quaternary history of the areas around Baffin Bay--principally Baffin Island and West Greenland--as well as oceano graphic changes in the Bay itself and in the adjacent Davis Strait. Tucked away at the edge of world maps, to most people it is a remote and unknown region. To Quaternary scientists, however, the region is far from obscure; indeed, the wealth of geological, glaciological, and paleobotanical material in the area have made the Baffin Bay region one of the most important sources of paleoenvironmental data in the entire Northern Hemisphere. Much work has already been accomplished in documenting climatic and environmental changes in the region, but much more remains to be done. It is not a small area, as Figure 1.1 illustrates, and it has a much shorter history of scientific research than regions of comparable size on the other side of the North Atlantic Basin. Nevertheless, studies in and around Baffin Bay have already made important contributions to our understanding of glaciation and deglaciation on a global scale. It is therefore the purpose of this volume to summarize the work accomplished to date, to reflect on the implications of this work, to identify areas of uncertainty and confusion, and to chart research plans for the future. We envisage the book as part of a continuing research program, rather than an end in itself.

Research on the glacial and climatic history of the entire area has been in progress for more than a century, but the pace and volume of research has noticeably increased over the last two decades. It is the purpose of this volume to present a synthesis and an in depth assessment of the Quaternary history of this region. The book is <u>not</u> intended to present a series of detailed reviews of previous observations and theories; the object is to present, in a single volume, the latest thinking and the latest observations. Such an objective is obviously constrained by the "wisdom" of the past, but the

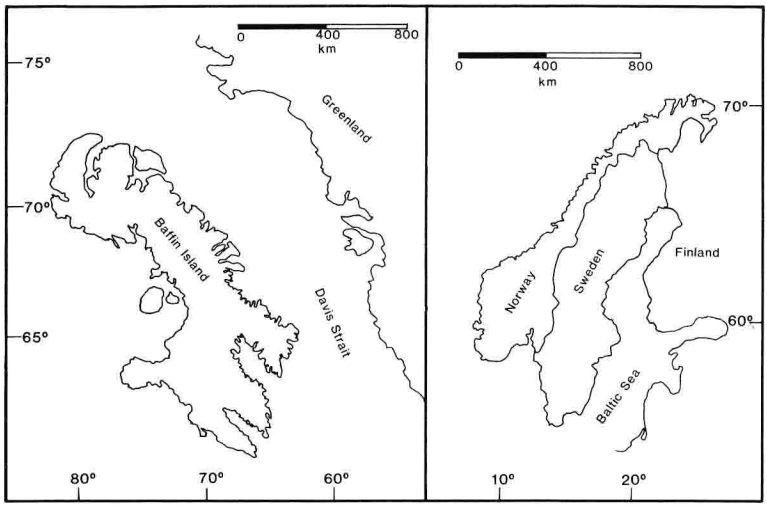

Figure 1.1 Comparison of the size of the area included in studies in this volume with the region of Fennoscandia at the same scale.

pace of research has been so rapid over the last one to two decades that concepts have also been forced to shift and change to keep pace with the new observations. However, it now appears to us that the magnitude of new findings has slowed down--there are still, however, many important questions left unresolved or even unasked. Thus, it is an appropriate moment to take stock of the multifaceted research programs that have been carried out in this region sponsored by different governments, different universities, and from different disciplines. We need to sit back and examine: Where do the different data sets point to a common conclusion?; Where do the data from different areas or disciplines appear contradictory?; Where do the observations from this critical area of the Northern Hemisphere stand in terms of the continuing, and important debate on the question of the necessary conditions for glaciation of Arctic areas?, and the question of the in or out-of phase glacial chronologies of the arctic margins of the great ice sheets?

In a recent book Denton and Hughes (1981) have critically examined the field data from Arctic areas and presented a scenario for glaciation and the timing of that glaciation that is radically different from the interpretation of most field workers (e.g. Funder and Hjort, 1973; England et al., 1981; Klassen, 1981; Miller and Dyke, 1974; Nelson, 1980, 1981; Miller et al., 1977), but which is supported by others (e.g. Blake, 1970, 1975). The major aim of this volume is

to objectively examine the field and laboratory data in order to present whatever model the authors feel explains most facets of the actual Quaternary record. This volume can also be considered as a companion study
of the "Paleoecology of Beringia" (eds. D.M. Hopkins et al. 1982). In that book authors considered the Quaternary events of the Yukon Territory, Canada, Alaska, and eastern Siberia. Together, our two studies include significant new data and interpretations of Quaternary events in two quite different Arctic settings.

Because of the studies on deep-sea marine cores in the north eastern North Atlantic south of 55°N (Ruddiman and McIntyre, 1973; Ruddiman, 1977; Ruddiman and McIntyre, 1981), and the extension of those studies into the Norwegian and Greenland seas (Kellogg, 1976; 1980), the Quaternary oceanographic changes, and their inferred impact on the glacial and climatic history of Northwest Europe has become an accepted tenet of research. In particular, the movement of the oceano graphic "Polar Front" has been mapped by Ruddiman and McIntyre and has been used by several workers to explain the terrestrial Quaternary record. It has been tacitly assumed by many researchers that the Quaternary history of the northwestern North Atlantic simply mimics its larger brethren. The literature to date does not support such an assumption.

The northwestern arm of the North Atlantic Ocean consists of the geographical features Baffin Bay, Davis Strait, and the Labrador Sea (Fig. 1.2). On the east side of these seas is the subcontinent of Greenland which is dominated by the Greenland ice sheet, covering an area of c. 2 x $10^6 km^2$ (Fig. 1.3). In the north, the ice-sheet meets the ocean for a distance of 100 km in Melville Bugt, the ice-free land being restricted to islands and isolated rocky outliers protruding from under the ice sheet. Calving glaciers, forming major outlets from the Inland Ice, occur in the embayment to the north of the Nugssuaq Peninsula, and in Disko Bugt. To the south the ice-sheet is separated from the Davis Strait by a strip of land, c. 100 kilometers wide, with scattered ice caps and numerous mountain glaciers. The land strip, c. 125,000 km^2 in area, is dissected by long and narrow fjords. It is in this region that the large majority of the Greenland population lives. Across Baffin Bay and Davis Strait is the 450,000 km^2 area of Baffin Island which is largely unglaciated. However, small plateaux ice caps exist on Baffin Island, Bylot Island, and Devon Island and, in addition, all these areas have a variety of valley and cirque glaciers largely concentrated in the mountains and uplands that fringe the northwestern North Atlantic. Relatively warm marine currents sweep northward along the coast of West Greenland, whereas the eastern coast