

Long-term Environmental Change in Arctic and Antarctic Lakes

Edited by

Reinhard Pienitz

*Université Laval,
Québec, Canada*

and

Marianne S.V. Douglas

*University of Toronto,
Toronto, Canada*

and

John P. Smol

*Queen's University,
Kingston, Canada*

 Springer

CONTENTS

| | |
|--|-------|
| Acknowledgements | xiii |
| The Editors | xv |
| List of Contributors | xvii |
| Editors and Board of Advisors of <i>Developments in Paleoenvironmental Research</i> Book Series..... | xxvii |
| | |
| 1. Paleolimnological research in polar regions: An introduction. <i>Reinhard Pienitz, Marianne S.V. Douglas and John P. Smol</i> | 1 |
| Introduction | |
| Observational/instrumental evidence for rapid climate change in the circumpolar regions | |
| Why do we need paleolimnological data from arctic and antarctic regions? | |
| Geographic scope of the book | |
| The focus and the structure of this volume | |
| Acknowledgements | |
| References | |
| | |
| Part I: Major Indicators and Approaches | |
| | |
| 2. Geochronology of high latitude lake sediments. <i>Alexander P. Wolfe, Gifford H. Miller, Carrie A. Olsen, Steven L. Forman, Peter T. Doran and Sofia U. Holmgren</i> | 19 |
| Introduction | |
| Dating recent high latitude lake sediments using ^{210}Pb and ^{137}Cs | |
| Radiocarbon dating | |
| Optically stimulated luminescence | |
| Future directions in high latitude lake sediment geochronology | |
| Summary | |
| Acknowledgements | |
| References | |
| | |
| 3. Physical and chemical properties and proxies of high latitude lake sediments. <i>Scott F. Lamoureux and Robert Gilbert</i> | 53 |
| Introduction | |
| Polar environmental systems | |
| High latitude lake systems | |
| Physical and chemical proxy records in high latitude lakes | |

Framework for interpreting the environmental significance of physical
and biogeochemical sedimentary records in high latitude lakes

Summary

Acknowledgements

References

4. Palynology of North American arctic lakes.
Konrad Gajewski and Glen M. MacDonald..... 89

Introduction

Synthesis of methodological aspects

Select North American studies

Conclusion – Outlook

Summary

Acknowledgements

References

5. Algal indicators of environmental change in arctic and antarctic lakes and ponds.
Marianne S.V. Douglas, Paul B. Hamilton, Reinhard Pienitz and John P. Smol... 117

Introduction

Historical overview of algal research in the Arctic and Antarctic

Algal indicators

Ecological classifications of algae

Paleolimnological reconstructions

Other applications

Summary

Acknowledgements

References

6. Aquatic invertebrates and high latitude paleolimnology.
Ole Bennike, Klaus P. Brodersen, Erik Jeppesen and Ian R. Walker..... 159

Introduction

Notes on different zoological indicators present in lake sediments

Discussion

Summary

Acknowledgements

References

7. Use of water isotope tracers in high latitude hydrology and paleohydrology.
Thomas W.D. Edwards, Brent B. Wolfe, John J. Gibson and Dan Hammarlund... 187
- Introduction
 - Isotopic labelling in the hydrological cycle
 - Isotope hydrology at high latitudes
 - Water isotope tracers in paleolimnology
 - Summary and future perspectives
 - Acknowledgements
 - References
8. Lake sediments as records of arctic and antarctic pollution.
Derek C.G. Muir and Neil L. Rose 209
- Introduction
 - Challenges in the study of high latitude lake sediment cores
 - Spatial and temporal trends of metals, persistent organic pollutants
and anthropogenic particles
 - Summary
 - Acknowledgements
 - References

Part II: Regional Syntheses

9. Paleolimnology of the middle and high Canadian Arctic.
Alexander P. Wolfe and I. Rod Smith 241
- Introduction
 - Environmental background
 - Wisconsinan glacial history
 - The limnological legacy
 - Historical development
 - Pre-Holocene lake sediment records
 - Holocene climatic evolution and paleolimnology
 - The latest Holocene: a time of unprecedented change
 - Problems, recommendations and conclusions
 - Summary
 - Acknowledgements
 - References

10. Paleolimnology of the North American Subarctic.
Bruce P. Finney, Kathleen Rühland, John P. Smol and Marie-Andrée Fallu 269
- Introduction
 - Description of study region
 - Paleoindicators of the North American Subarctic
 - Regional syntheses
 - Challenges and future directions
 - Summary
 - Acknowledgements
 - References
11. Holocene paleolimnology of Greenland and the North Atlantic islands
 (north of 60°N).
N. John Anderson, David B. Ryves, Marianne Grauert and Suzanne McGowan... 319
- Introduction
 - Paleolimnological themes across the northern North Atlantic
 - Synthesis and areas for further research
 - Summary
 - Acknowledgements
 - References
12. Paleolimnological research from northern Russian Eurasia.
*Glen M. MacDonald, Thomas W.D. Edwards, Bruce Gervais, Tamsin E. Laing,
 Michael F.J. Pisaric, David F. Porinchu, Jeffrey A. Snyder, Nadia Solovieva,
 Pavel Tarasov and Brent B. Wolfe* 349
- Introduction
 - Recent analyses using biological evidence
 - Stable isotope studies of lake sediments from across northern Russian Eurasia
 - Regional lake status data bases and lake-level records from northern
 Russian Eurasia
 - Summary
 - Acknowledgements
 - References
13. Paleolimnological studies in arctic Fennoscandia and the Kola Peninsula (Russia).
Atte Korhola and Jan Weckström 381
- Introduction
 - Origin and sedimentological characteristics of lakes
 - Holocene changes in physical attributes
 - Holocene trends in chemical attributes

Holocene trends in aquatic communities
 Recent limnological changes
 Summary
 Acknowledgements
 References

| | |
|--|-----|
| 14. Paleolimnological studies from the Antarctic and subantarctic islands. <i>Dominic A. Hodgson, Peter T. Doran, Donna Roberts and Andrew McMinn</i> | 419 |
| Introduction | |
| The role of the Antarctic in Earth system science | |
| Antarctic limnology | |
| Antarctic paleolimnology | |
| Antarctic paleolimnology and Earth system science – case studies | |
| Discussion | |
| Outlook | |
| Conclusions | |
| Summary | |
| Acknowledgements | |
| References | |
| 15. Paleolimnology of extreme cold terrestrial and extraterrestrial environments. <i>Peter T. Doran, John C. Priscu, W. Berry Lyons, Ross D. Powell, Dale T. Andersen and Robert J. Poreda</i> | 475 |
| Introduction | |
| Perennially ice-covered lakes | |
| Perennially ice-sealed lakes | |
| Subglacial lakes | |
| Exopaleolimnology | |
| Summary | |
| Acknowledgements | |
| References | |
| 16. Epilogue: Paleolimnological research from arctic and antarctic regions. <i>Reinhard Pienitz, Marianne S.V. Douglas and John P. Smol</i> | 509 |
| Glossary, Acronyms and Abbreviations | 513 |
| Index..... | 541 |