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Introduction
Glacial History, Paleogeography and Paleoenvironments in Glaciated North America

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Introduction

GLACIAL HISTORY, PALEOGEOGRAPHY AND PALEOENVIRONMENTS IN GLACIATED NORTH AMERICA

In these issues of *Géographie physique et Quaternaire* we present a set of papers in recognition of the foundation that Vic Prest and others have laid for our present knowledge of Quaternary glacial history of Canada, and the related fields of paleogeography and paleoenvironments. Unlike Volume 41 of *Géographie physique et Quaternaire*, devoted to The Laurentide Ice Sheet, the papers provided herein do not represent a co-ordinated attempt to summarize the knowledge of a particular topic. Instead, taken as a whole, they provide a snapshot of Quaternary studies in Canada today and a reflection of the variety of research topics. Many of the papers stem from presentations made in the Vic Prest Symposium at the Canadian Quaternary Association Bi-Annual Meeting, June 5-8, 2005, in Winnipeg, Manitoba. These papers and presentations cover the themes of glacial history, paleogeography and paleoenvironments in glaciated North America.

We are pleased to present 19 papers of relevance to Canadian Quaternarists within a Canadian geoscience journal, in keeping with the tradition of publications by Vic Prest. The following outline describes the papers contained in the two volumes.

GLACIAL HISTORY

Six papers cover the theme of glacial history. Two papers present new information on ice flow characteristics of the Laurentide Ice Sheet (LIS). First, **McMartin and Henderson** (Vol. 58) present a comprehensive paper on the complexities of the Keewatin Ice Divide, supplying new evidence supporting and constraining the migration of the divide. Earlier notions of a stable ice position throughout the last glaciation are rejected, based on abundant field evidence, in favour of the hypothesis of a shifting ice divide. The authors compile numerous ice-directional indicators from central Nunavut, indicating that flow directions changed significantly through time, and that the main divide migrated by as much as 500 kilometres between ice-flow phases. Furthermore, they show that the relict glacial landscape reflects protection under an ice divide. The second paper, by **Veillette** (Vol. 58), documents the ice flow and dispersal patterns in the region Québec, south of Lake Mistassini and north of the St. Lawrence River. It reveals a complex ice-flow sequence, beginning with a major ice flow toward the northwest in the Québec highlands, overprinted by a second one toward the southeast from a position north of Lake Mistassini, and by flows toward the southwest, south, and southeast during deglaciation. These papers are important for assessing the relative stability of ice sheets, which is beneficial to ice-sheeting modeling and for mineral exploration.

A short paper by **Winsborrow, Clark and Stokes** (Vol. 58) provides a synopsis of Laurentide ice streams along with an up-to-date map. A total of 49 hypothesized ice streams have been compiled in this review from published sources, satellite imagery and air photo interpretation. The paleo-ice streams of the LIS exhibit a much greater range in size than the modern examples of Antarctica. The map and dataset in this paper will be of use in future reconstruction and modelling of the LIS.

Stumpf, Broster and Levson (Vol. 58) describe and interpret various stratigraphic units of the Bulkley River, in central British Columbia, in order to reconstruct the glacial history of this mountainous region. Their stratigraphic framework, based on the composite stratigraphy of glacial sediments in the region, has the potential to be applied and compared to other similar glaciated mountainous regions.

A paper by **Carlson, Jenson and Clarke** (Vol. 58) presents the stratigraphy, till fabrics and grain size analyses from two till sections: one from the Lake Michigan Lobe of the LIS and the other from the Hudson Bay Lowlands. The fabrics are used to demonstrate the depth of deformation in sediments at the base of the LIS. This paper contributes to the interpretation of the bed of the LIS, which is important to better understand the behaviour of the ice sheet and to improve its modelling.

Russell, Arnott and Sharpe (Vol. 58) present a detailed description and interpretation of the stratigraphic architecture and sediment facies of the western Oak Ridges Moraines of southern Ontario to assess its role in the groundwater system of this populated region of Canada. According to their model, the Oak Ridges Moraine was deposited in three stages in a subglacial environment, which included a subglacial lake in the Lake Ontario basin. This new interpretation postulates that the moraine formed during deglaciation with subglacial meltwater ponding and episodic and catastrophic subglacial meltwater discharge.

PALEOGEOGRAPHY

Eight papers are presented within the paleo-geography theme. Four papers discuss post-glacial relative sea-level changes along marine margins, and their implications. **James, Hutchinson, Barrie, Conway and Mathews** (Vol. 59) presents detailed

evidence and geochronology documenting the post-glacial uplift and sea level history in the northern Strait of Georgia, British Columbia, which compliments earlier studies in this area. In Atlantic Canada, **Bell, Daly, Liverman, Shaw, Batterson and Smith** (Vol. 59) document the relative sea-level history for northwestern Newfoundland, an area of interest due to the presence of an isostatic hingeline and large spatial gradient in sea-level response along the coastline. They present two revised relative sea-level curves and interpret these with respect to the glacio-isostatic history of the region, and the position and migration of an ice-marginal forebulge. These two papers convey an improved understanding of the relative sea level history along the glacial margins of North America, and provide constraints on crustal response for geophysical models. In comparison, **Shaw** (Vol. 59) presents new geomorphic evidence of postglacial terrestrial environments on the continental shelves of Atlantic Canada. It highlights multibeam sonar evidence of submerged geomorphic features, including fluvial features, deltas, and coastlines, and places these into the context of post-glacial and relative sea-level history. The author further discusses the evolution of landscapes since the last glacial maximum. Lastly, **Dionne, Dubois and Bernatchez** (Vol. 58) confirm that the lower terrace at the southwest extremity of the Portneuf Peninsula corresponds to the Mitis terrace, which occurs at several localities along the lower St. Lawrence estuary. New radiocarbon ages confirm that the terrace dates to 1830 to 1880 BP, indicating that it is contemporaneous to most localities on both shores of the Lower St. Lawrence estuary.

Dyke, Dredge and Hodgson (Vol. 59) present a synthesis of deglacial marine and lake-level elevations for North America and Greenland. This paper starts with some basic concepts of glacial isostasy, and marine and lake limits. It is aimed at deriving information about the rate and pattern of the late deglaciation and at providing possible targets for validating geophysical models of the last deglaciation. It is a timely contribution, both because of the large increase in marine and lake-level observations since previous compilations and because of the rapid progress being made in geophysical modeling of past ice sheets and associated glacial isostatic processes.

Two papers describe former lake-level shorelines and elevations. In a short paper, **Karrow** (Vol. 58) presents new shoreline elevation data from North Bay, Ontario, for various outlet stages of glacial Lake Algonquin. This paper is a substantial contribution to ice-margin / shoreline correlations and to quantifying Algonquin shoreline tilts in the area. In contrast, a major synthesis of the glacio-isostatic adjustment, paleo-environment and lake levels of the Great Lakes basin is offered by **Lewis, Blasco and Gareau** (Vol. 59). The authors use an empirical approach of describing post-glacial vertical crustal deformation, which is then used to generate the paleogeography of the region. These reconstructions lead to the discovery of a long-lasting lowstand when lake levels stood many metres below the elevation of lake outlets. Possible causes for this lowstand include the predominance of dry air masses over the Great Lakes basin prior to the establishment of modern, moister air masses, an hypothesis that is highly significant in the context of future climate change.

A final short paper by **St-Onge and Gullentops** (Vol. 59) describes the morphodynamics on Ellef Ringes Island, in a cold, high latitude semi-arid region. This work highlights the significance of fluvial processes in arid, high arctic environments and provides a process-based geomorphological map illustrating the influence of geological structure and lithology on the various landforms.

PALEOENVIRONMENTS

Five papers are presented within the theme of paleoenvironments. In the first, **Dyke** (Vol. 59) summarizes the late glacial and Holocene history of biome change within glaciated North America. Dyke uses a qualitative approach, based on mapping of biome types interpreted from published research, drawing together an extensive amount of published data, with detailed review and commentary. Unlike other recent biome reconstructions, these reconstructions incorporate fossil mammal data in conjunction with paleovegetation.

Two papers examine late glacial and early Holocene paleoenvironments. The first, by **Curry and Yansa** (Vol. 58) pertains to the paleovegetation and paleoclimate in mid-continental North America between *ca*. 24 and 15.7 ka BP. Here, the authors describe the ice-stagnation conditions of the Harvard sublobe, and subsequent tundra-like conditions that occurred in ice-marginal settings. The second, by **Wolfe, Huntley and Ollerhead** (Vol. 58) provides a significant contribution to the late glacial and early Holocene dune and paleoclimatic history of central and western Canada. Here, the authors interpret dune activity between 16 and 13 ka, occurring in ice-proximal tundra settings along the margins of the Laurentide and Cordilleran ice sheets, and anticyclonic dune-forming winds along the margins of the retreating LIS between 13 and 9 ka.

Next, **Fisher and others** (Vol. 58), present new insights into abrupt shifts in the water cycle of the North Pacific over the last 2 000 years, as derived from stable isotopes from Cordilleran glacial ice cores and lake sediment records. A shift from predominantly zonal flow transport of water vapour to mixed (modern) flow in A.D. 1840 is interpreted as coinciding with the end of the Little Ice Age.

Lastly, **Medioli, Dixit, Smol, Anderson and Burbidge** (Vol. 59) briefly describe recent changes in sedimentation and limnology of several floodplain lakes, and document the effects of European settlement on small lakes and plant ecology in the Red River basin.

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Ad hoc editors