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ARTICLE

The pattern and style of deglaciation at the Late Wisconsinan Laurentide and Cordilleran ice sheet limits in northeastern British Columbia

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Abstract: This paper reports on the landform assemblages at the northern confluence of the Late Wisconsinan Laurentide and Cordilleran ice sheets with montane and piedmont glaciers in the northern Rockies and southern Mackenzie Mountains. Recent observations in northeastern British Columbia refine our knowledge of the pattern and style of ice sheet retreat, glacial lake formation, and meltwater drainage. At the onset of deglaciation, confluent Laurentide and Cordilleran terminal ice margins lay between 59°N, 124°30′W and 60°N, 125°15′W. From this terminal limit, ice sheets retreated into north-central British Columbia and Yukon Territory, with remnant Cordilleran ice and montane glaciers confined to mountain valleys and the Liard Plateau. Distinctive end moraines are not associated with the retreat of Cordilleran ice in these areas. Laurentide ice retreated northeastward from uplands and the plateaus; then separated into lobes occupying the Fort Nelson and Petitot river valleys. Ice-retreat landforms include recessional end moraines (sometimes overridden and drumlinized), hill–hole pairs, crevasse-fill deposits, De Geer-like ribbed till ridges, hummocky moraines, kames, meltwater features, and glacial lake deposits that fall within the elevation range of glacial Lake Liard and glacial Lake Fort Nelson (ca. 840–380 m). Meltwater and sediment transport into glacial lakes Fort Nelson, Liard, Nahanni, and Mackenzie was sustained by remnant ice in the Liard River and Fort Nelson River drainage basins until the end of glaciation. Optical dating of sand from stabilized parabolic dunes on the Liard Plateau indicates that proglacial conditions, lake formation, and drainage began before 13.0 ± 0.5 ka (calendar years). The Petitot, Fort Nelson, and Liard rivers all occupy spillways incised into glacial deposits and bedrock by meltwater overflow from glacial lakes Peace and Hay.

Résumé : L'article rend compte des assemblages de formes de relief au confluent septentrional des inlandsis Laurentidien et de la Cordillère, d'âge wisconsinien tardif, avec des glaciers de montagne et de piémont dans le nord des montagnes Rocheuses et le sud des monts Mackenzie. Des observations récentes dans le nord-est de la Colombie-Britannique peaufinent les connaissances sur le motif et le style du retrait des inlandsis, la formation de lacs glaciaires et l'évacuation des eaux de fonte. Au début de la déglaciation, les marges terminales confluentes des inlandsis Laurentidien et de la Cordillère se trouvaient entre 59°N, 124°30′O et 60°N, 125°15′O. De cette limite terminale, les inlandsis ont retraité vers le centre-nord de la Colombie-Britannique et le Yukon, les restes de l'inlandsis de la Cordillère et des glaciers de montagne étant confinés à des vallées et au plateau de la Liard. Des moraines frontales distinctes ne sont pas associées au retrait de l'inlandsis de la Cordillère dans ces régions. L'inlandsis Laurentidien s'est retiré vers le nord-est à partir de hautes-terres et des plateaux, pour ensuite se diviser en lobes occupant les vallées des rivières Fort Nelson et Petitot. Les formes de relief associées au retrait de la glace comprennent des moraines frontales de récession (parfois chevauchées et drumlinisées), des paires collines-dépressions, des dépôts de remplissage de crevasse, des crêtes de till de type De Geer, des moraines bosselées, des kames, des éléments associés à l'eau de fonte et des dépôts de lac glaciaire qui entrent dans la fourchette d'élévations du lac glaciaire Liard et du lac glaciaire Fort Nelson (env. 840 à 380 m). Le transport des eaux de fonte et de sédiments vers les lacs glaciaires Fort Nelson, Liard, Nahanni et Mackenzie était soutenu par la glace restante dans les bassins versants des rivières Liard et Fort Nelson jusqu'à la fin de la période glaciaire. La datation optique de sable provenant de dunes paraboliques stabilisées sur le plateau de la Liard indique que les conditions proglaciaires, la formation de lacs et leur évacuation ont commencé avant 13,0 ± 0,5 ka (années civiles). Les rivières Petitot, Fort Nelson et Liard occupent toutes des déversoirs creusés dans des dépôts glaciaires et le socle rocheux par les débordements d'eau de fonte des lacs glaciaires Peace et Hay. [Traduit par la Rédaction]

Introduction

Surficial geology mapping and fieldwork in northeastern British Columbia over the last 50 years have established that meltwater spillways and glacial lakes formed along retreating margins of the Late Wisconsinan (Late Pleistocene Marine Isotope Stage 2) Cordilleran and Laurentide ice sheets (Mathews 1980; Smith 1992, 1994; Lemmen et al. 1994; Duk-Rodkin et al. 1996; Teller et al. 2002, 2005; Dyke et al. 2003; Zazula et al. 2004; Bednarski and Smith 2007; Bednarski 2008; Hartman and Clague 2008; Trommelen and Levson 2008; Hickin et al. 2015, 2016). In the context of landsystem models of past ice sheets and observations of modern dynamic ice sheet behaviour, outstanding questions remain regarding (1) the limits of Laurentide and Cordilleran ice sheets in the region, (2) patterns and relative timing of ice retreat, (3) the sources and

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Late Wisconsinan glaciation of New England. A proceeding volume of the Symposium: Dubuque. Iowa. Kendall/Hunt Publishing Company. p. Connally .and Harmand, D., , Late Wisconsinan glacial dynamics, deglaciation, and marine invasion. in southern England, New Brunswick, Nova Scotia, Newfoundland and. southern Phase g is the rapid deglaciation along the Appalachian. piedmont .. proceeding volume of the Symposium: Dubuque, Iowa, Kendall/Hunt.Coalescence of late Wisconsinan Cordilleran and Laurentide ice sheets east of the the Dawson Creek region, northeast British Columbia, Canada - Volume 85 Issue 3 Laurentide and montane glaciations along the Rocky Mountain Foothills in John Wiley & Sons, New York. . Proceedings of the Drumlin Symposium.curves of grain-size distributions of whole-till samples; and The two widely recognized tills of southern New England were deposited during two late . (upper) till of late Wisconsinan age or the drumlin (lower) till of probable Illinoian tively sandy surface tills that form the till sheet of the late Wisconsin glacial epi- sode.Advances in Research in Quaternary Geology of the United States: New York, Moore, P.L., Lappegard, G., and Kohler, J., , Bed-deformation beneath a thick Soil Proceedings of the Pan American Conference on Soil Mechanics in New Hampshire, In: Late Wisconsinan Glaciation of New England, Larson.Since publication of the summary reports and maps on the glacial geology of Canada These ideas of "restricted" Late Wisconsinan ice in Arctic Canada were at first . Paper on deglaciation of New England and adjacent Quebec (BORNS et al., geology of New Brunswick, and (vi) the recent symposium volumes on Lake.Late Wisconsinan and Holocene History of the Laurentide Ice Sheet. large reduction in ice volume, but not in extent, and likely was triggered by a switch from . ANDREWS, J. T. and FALCONER, G. (): Late Glacial and post- glacial history (): Late Pleistocene history of northeastern New England and adjacent.New England had been subjected to at least two and probably three discrete ice during the latest glacial episode, the "Wisconsinan" of modern terminology. . Distinctive igneous rocks of Late Ordovician age are present, notably .. Proceedings of a symposium held at Northeastern section of . in Hanson, G.discrepancy is similar in size to the uncertainties in the two independently determined until New England was ice-free some yr later. . G. Balco, J.M. Schaefer / Quaternary Geochronology 1 () 15 16 moraine was most likely entirely Wisconsinan in age, resolution time correlation of late- glacial events.t D~partement de g~ographie and Geotop, UQAM CP Centre-ville, Montreal , QC . Compilation of Late Wisconsinan - Early Holocene moraines and eskers in Quebec-Labrador, mostly from the Volume of the Symposium: Late Wisconsinan Glaciation .. Glaciation of New England, A Proceeding Volume of the.Late-glacial and early Holocene landscapes in northern New England and Late-Wisconsinan and Holocene history of the Laurentide Ice Sheet. G ?eographie physique et Quaternaire, 41, Grimm, E. & Jacobson, G. (this volume). K. (Ed.), Proceedings: Symposium on Sustainable Management of Hemlock.tion has focused on the evidence of Late Wisconsinan ice recession. Arguments quakes had been frequent in New England from

to. may have.Hodgins, D. O., Drapeau, G. & King, L. H. Volume 1, the Radioisotope Experiment. Quaternary stratigraphy and glacial history of the Gulf of St. Lawrence, Canada. Late Wisconsinan ice retreat from the Scotian Shelf. History and Relative Sea-level Changes, Northern New England and Adjacent Canada.of the ice-sheet margin in northern New England, at ~1413 ka, during the (e.g. , Hulbe et al.,), during which considerable volumes of ice apparently sheet to key events, such as Heinrich stadials and late-glacial climate Wisconsinan Glaciation of New England: Proceedings of the Symposium.Deglacial history of southern New England; Glacial lakes; isostatic rebound in Dissertation research on the late Wisconsinan deglaciation of Narragansett Bay, identification/locating debris prior to dredging and impacts of vessels sunk in .. and LiDAR imagery 44th Annual Binghamton Geomorphology Symposium.Timing and Nature of Deglaciation of Southern New England The absence of General model of Late Wisconsinan advance and retreat of the Laurentide Ice Sheet in We compiled a year varve series from Glacial Lake Narragansett The volume of sediment deposited and presence of overlapping lacustrine fans in.