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LATE WISCONSINAN DEGLACIAL ICE-FLOW PATTERNS IN WEST-CENTRAL NEWFOUNDLAND

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ABSTRACT

Reconnaissance-level striation mapping is an effective method of obtaining an understanding of a region's general ice-flow history. Results from striation mapping in the White Bay area (NTS map areas 12H/5,7,10 west half,11,14,15 west half and 12I/2) suggest a complex ice-flow history, with the area being affected by ice centres located in the Topsail Hills, Long Range Mountains and the Baie Verte Peninsula. Three major ice-flow events, probably related to the Late Wisconsinan maximum have been recorded. The earliest ice-flow direction was to the northeast from a centre in the Long Range Mountains and Topsail Hills area, followed by a eastward flow into White Bay from the Long Range Mountains and radially outward from the Topsail Hills ice centre. The third flow was a late topographically controlled valley flow from the Long Range Mountains and Baie Verte Peninsula ice centres.

INTRODUCTION

This study is a continuation of a project initiated in 1989 to provide rapid regional striation mapping of insular Newfoundland, and to gain a broad understanding of the glacial ice-flow history. Understanding of ice-flow directions and history is important when using drift-prospecting methods in mineral exploration. Work in 1992 consisted of reconnaissance-level mapping of glacial striations, covering the Deer Lake–White Bay area (Figure 1) (NTS map areas 12H/5,7,10 (west half),11,14,15 (west half) and 12I/2). This area has been the site of considerable exploration interest, especially for gold and base metals. However, mineral exploration has been hampered by thick overburden and poor outcrop exposure and an understanding of the ice-flow history of this area can enhance the effectiveness and efficiency of exploration in this drift-covered area.

PREVIOUS WORK

Previous work suggests that the Island of Newfoundland was glaciated by local ice caps during the Late Wisconsinan and that the Laurentide ice only reached the tip of the Northern Peninsula (Grant, 1989). Local ice-flow patterns in the Sandy Lake area have been identified by MacClintock and Twenhofel (1940), who suggested that the ice moved northward into White Bay across the Sandy Lake area. Lundqvist (1965) identified northwestward-flowing ice followed by a northeastward flow in the Sandy Lake area. Grant (1972) recorded north-oriented crag-and-tail features north of Sandy Lake. Rogerson (1979) working on the west side of Birchy Ridge, identified an early northeastward flow followed by a later northwestward flow. In contrast, Vanderveer and Sparkes (1982), working in the same area, suggested an early south and southwestward flow into the

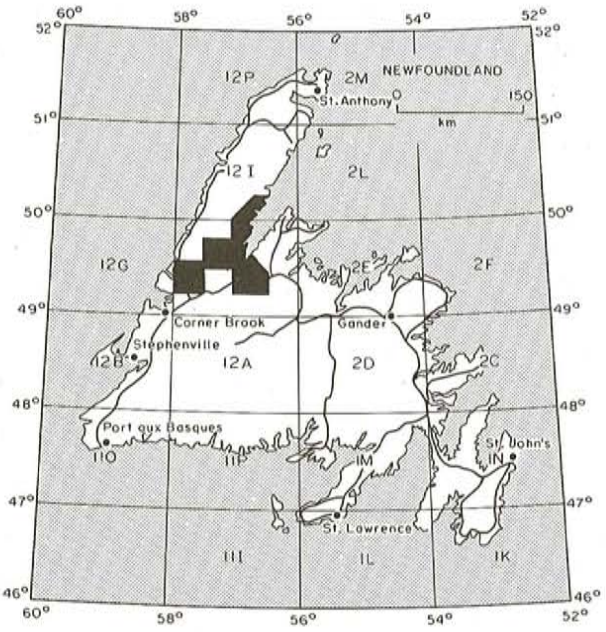

Figure 1. *Map showing location of study area.*

Deer Lake basin followed by a second flow advancing in an east and southeastward direction from the Long Range Mountains, followed by a late third flow advancing south and southwestward into the basin. Reconnaissance work by Batterson and Taylor (1990) identified a westward to northwestward flow across Deer Lake from a probable source in the Topsail Hills, followed by a more recent southwestward flow in the northern part of the basin and along Birchy Ridge.

Striation mapping in the Sops Arm area by Vanderveer and Taylor (1987) identified an early easterly flow followed

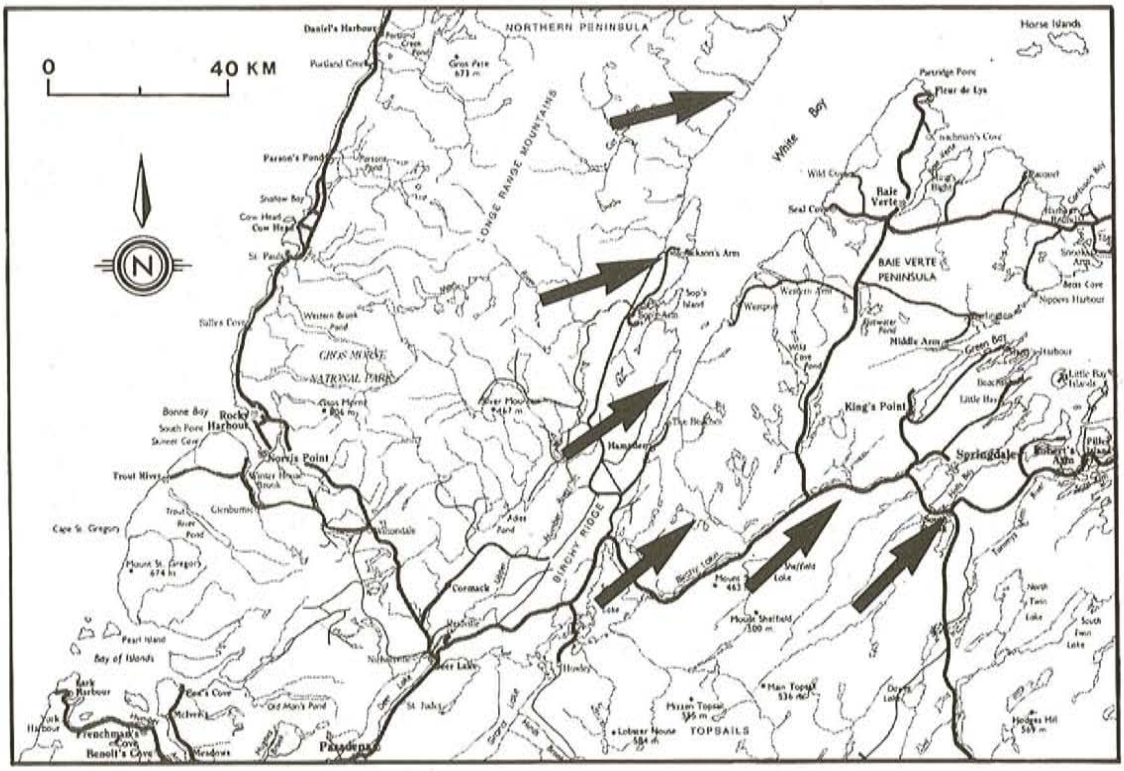

Figure 2. *Arrows indicate the direction of the first ice-flow event.*

by a later northeasterly flow from a source in the Long Range Mountains.

Liverman (1992) working in the Springdale map area, recorded ice flow over the south and west of the map area as a single major flow, from the Topsails, parallel to major valleys converging on Halls Bay. Close to the coast, a two-phase ice-flow history is found, in which the initial flow was parallel to Halls Bay (northeasterly), followed by a subsequent flow toward the coast.

Grant (1974) discusses the theory of multiple shrinking ice caps, which formed during the final stages of deglaciation. Two of these remnant ice centres located in the Long Range Mountains and southern Baie Verte Peninsulain may have affected the field area.

METHODS

Glacial striations are small grooves or scratches cut into the bedrock surface by rock fragments carried at the base of a glacier (Sudgen and John, 1976). The orientation of these striations represent a record of ice-flow direction at the time of their formation. Local variations may occur in the orientation of individual striations due to topographic effects.

Field work consisted of truck traverses along all primary and secondary roads and all-terrain-vehicle (ATV) traverses along logging roads. Boats were used to obtain access to small islands and coastal exposures. Recent logging-road construction and upgrading has made access to most of the field area very good. Access to the east side of the Long Range Mountains is limited to ATV use on overgrown logging roads.

All exposed bedrock surfaces were examined for striations and other erosional ice-flow indicators. Approximately 525 single or multiple striation sites were found during the 1992 field season. Ice-flow direction, where possible, was determined from the morphology of the bedrock surface using nailheads, chattermarks, miniature crag and tails and stossing. Sites that contain more than one striation direction were interpreted to be the result of either separate glacial advances or different ice-flow directions within one flow event. Relative age relationships between the flows were indicated by crosscutting striae and leeside preservation. All available striation data have been entered into a striation database and is available upon request (Taylor *et al.*, 1992).

INTERPRETATION

The data collected in 1992, and by previously mentioned authors, suggest a complex and sometimes confusing history but is interpreted as a deglacial sequence from the Late Wisconsinan maximum.

FIRST ICE-FLOW EVENT

The oldest ice-flow event recorded had a northeastward trend across most of the study area and is consistently preserved on the leeward surfaces of outcrops that show one or more subsequent ice-flow events (Figure 2). The probable

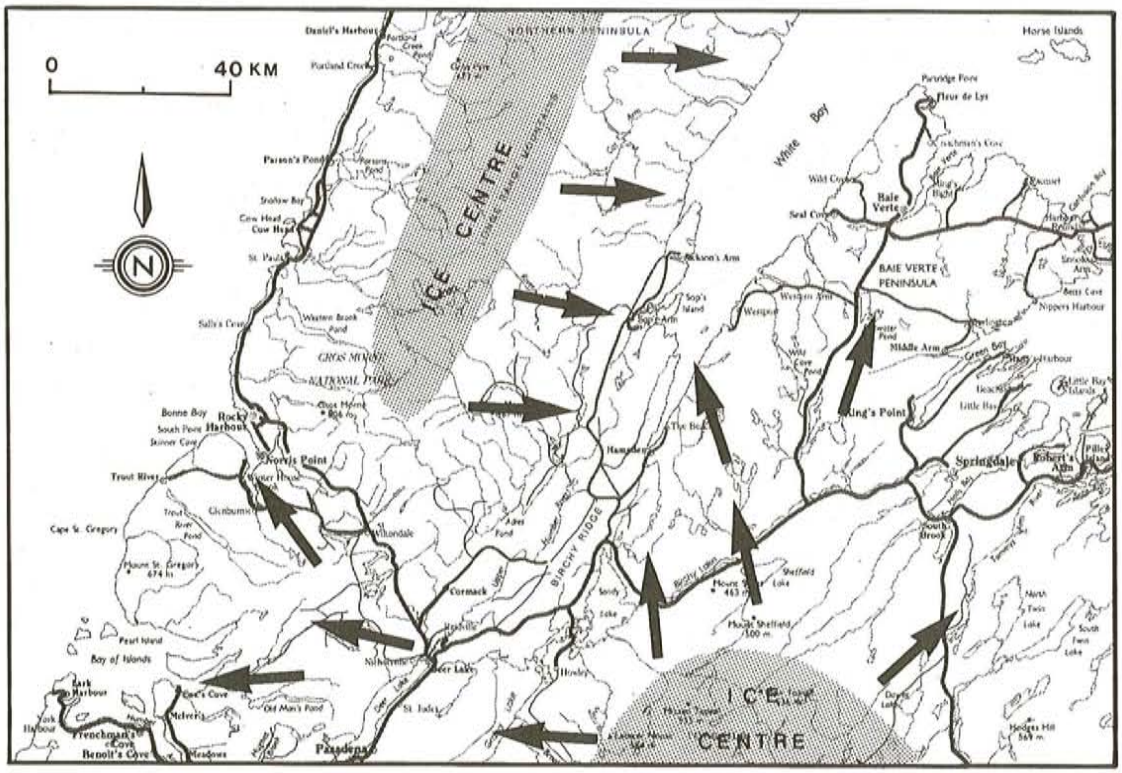

Figure 3. *Arrows indicate the direction of the second ice-flow event.*

source of this ice is an ice centre connecting the Long Range Mountains and Topsail Hills (the southern extent along the west coast is unknown, and is to be mapped in 1993). This flow was previously recognized by Vanderveer and Taylor (1987) in the Sops Arm area but suggested it to be a later flow. More detailed work in 1992 suggested this (northeastward) flow to be the oldest. Liverman (1992) identified a early northeastward flow across the Springdale (NTS 12H/8) map area exiting into Halls Bay.

SECOND ICE-FLOW EVENT

Following the first ice-flow event, a thinning of the ice sheet occured allowing independent movement from centres located in the Long Range Mountains and Topsail Hills. Striation evidence from the Topsail Hills suggested a radial flow pattern as ice moved north from the Topsail Hills across Sheffield and Birchy lake to exit into White Bay, and flowed to the west across Grand Lake and Deer Lake to exit into the Bay of Islands (Batterson and McGrath, *this volume*). Ice-flow on the eastern side of the Long Range Mountains was eastward toward the coast, to exit into White Bay (Figure 3). Flow near the coast was topographically controlled and was diverted around topographic highs to exit through existing valleys and bays.

THIRD ICE-FLOW EVENT

The third ice-flow event was a local late-stage event probably related to remnant ice centres in the Long Range Mountains and on the southern Baie Verte Peninsula (Grant, 1974). Ice from these remnant centres was topographically controlled following valleys. Ice from the Long Range Mountains followed south- and southeast-trending valleys into the Deer Lake Basin. Evidence of a late flow on the southern portion of the Baie Verte Peninsula shows westward flow into White Bay (Figure 4).

A southward flow was identified in the Hampden area, but its extent is not known at this time. A southerly flow in the Hampden area is also documented by Vanderveer and Sparkes (1982). Batterson and McGrath (*this volume*) also identify a southerly flow in the Deer Lake area. The relationship between these southerly flows is not currently known and is anticipated the problem may be resolved in the upcoming field season.

IMPLICATIONS FOR DRIFT PROSPECTING

An understanding of the ice-flow history for this region will probably assist mineral-exploration geologists in the interpretation of dispersed mineralized float and geochemical anomalies in glacial diamictons. In the case where heavy drift cover has been identified, it is essential to remember the area has been affected by changing ice centres associated with shifting ice centres. In areas where multiple flows have been identified, the earlier flows should be considered. The earlier ice-flows may have initially dispersed the sediment before it was affected by a later or more recent flow. Most of the field area has a thick drift cover and it is likely that a complex till stratigraphy exists over parts of the region (Batterson and

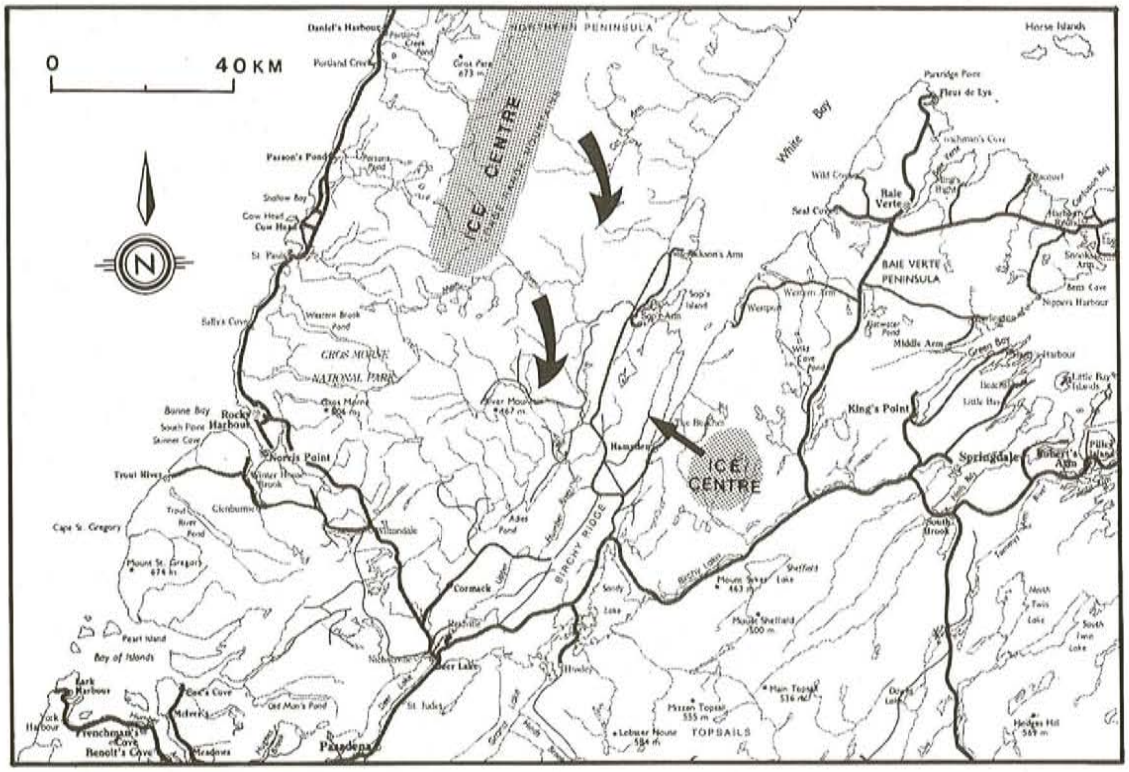

Figure 4. *Arrows indicate the direction of the third ice-flow event.*

McGrath, *this volume*). In such cases, provenance and thus geochemistry of each till unit will differ, and care must be taken in sampling.

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Note: Geological Survey Branch file numbers are included in square brackets.