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LATE WISCONSINAN ICE-FLOW PATTERNS IN SOUTHWESTERN NEWFOUNDLAND

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ABSTRACT

Results from striation mapping of the southwest coast of Newfoundland (NTS 11P/12,13; 12A/4,5,6,12; 12B/8,9,10,11,16; and 12G/1) suggest three ice-flow events related to Late Wisconsinan glaciation. The earliest ice-flow direction was a topographically controlled southwest flow from a centre to the north. The second event originated from an ice centre in the Topsail Hills—Meelpaeg Lake area, with ice-flow along the west coast trending westward and flow along the south coast trending south-southeastward. The third and most recent flow was a late, topographically controlled flow from remnant ice centres in the Topsail Hills trending northwestward, and from the Meelpaeg Reservoir area trending south-southwestward.

Ice flow on the Port au Port Peninsula also suggests a three-phase sequence, with the oldest flow trending southwestward crossed by a southward flow parallel to the coast, followed by a late westward flow across the peninsula from a source in the Topsail Hills.

INTRODUCTION AND OBJECTIVES

A regional striation-mapping project was initiated in 1989 to provide a broad understanding of the ice-flow history of insular Newfoundland. Determination of the ice-flow history can enhance the effectiveness and efficiency of exploration in drift-covered areas. Newfoundland has been the site of considerable interest in gold and base metals but exploration in many areas has been hampered by thick overburden and poor outcrop exposure.

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 or minor shifts in the dispersal centre. Work in 1993 consisted of reconnaissance-level mapping of glacial striae over NTS 11P/12,13; 12A/4,5,6,12; 12B/8,9,10,11,16; and 12G/1 (Figure 1).

PREVIOUS WORK

Evidence from previous studies suggests that the Island of Newfoundland was glaciated by local ice caps during the Late Wisconsinan (Grant 1989), rather than, as earlier workers believed, being covered by Laurentide ice from Labrador (MacClintock and Twenhofel, 1940; Lundqvist, 1965). Glacial erratics from the Canadian Shield and onshore-directed striae suggest that Laurentide ice reached only the tip of the Northern Peninsula, where it attained elevations of 300 m and was confluent with Newfoundland ice, perhaps as far south as Port au Choix (Grant, 1993).

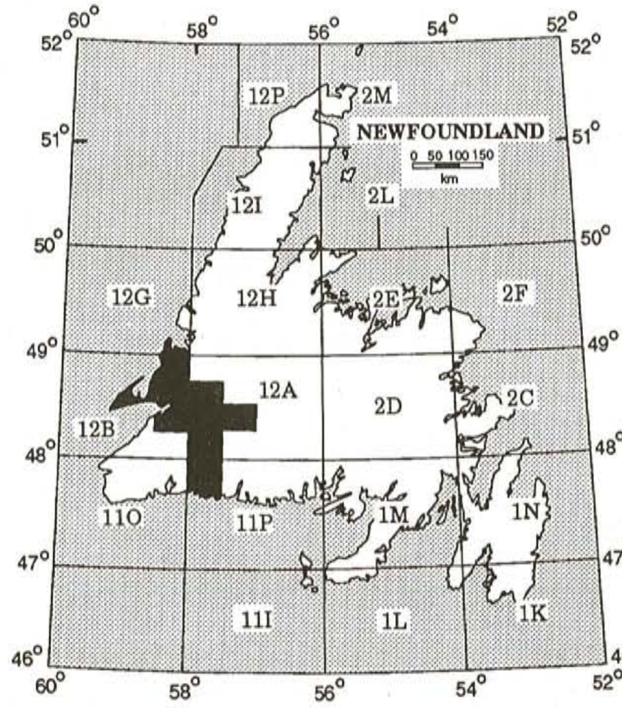

Figure 1. *Map showing location of study area.*

Local ice-flow patterns in the St. George's Bay area were described by Brookes (1973), who recorded early ice flow toward the west and northwest, succeeded by ice movements toward the southwest and south.

Sparkes (1987) and Sparkes and Neuland (1986) identified three phases of ice flow in southwestern Newfoundland. A regional southward flow (180 to 210°) was found over an area south of the Annieopsquotch Mountains to the coast. A southwest ice flow was identified in the Peter Strides Lake area, and a westward flow in the King George IV Lake area.

Batterson and Vatcher (1992), working in the Corner Brook area (NTS 12A/13), noted an early southwest flow followed by a later westward flow, with flow toward the coast being topographically controlled.

LOCATION AND ACCESS

The field area is from Corner Brook in the north, to Stephenville (including the Port au Port Peninsula) in the south, and southeast along the Burgeo Highway to the community of Burgeo. Recent logging-road construction and upgrading has made access to most of the field area very good. Areas accessible only by helicopter include the Blow Me Down Mountains, Lewis Hills and the Annieopsquotch Mountains. Field work consisted of truck traverses along all primary and secondary roads and all-terrain-vehicle traverses along logging roads and abandoned railway lines.

FIELD METHODS

All accessible bedrock surfaces were examined for striations and other erosional ice-flow indicators. Approximately 375 single- or multiple-direction striation sites were recorded during the 1993 field season. Ice-flow direction, where possible, was determined from the morphology of the bedrock surface using nailheads (Plate 1), chattermarks, miniature crag-and-tails (Plate 2), and stossing. Sites that contain more than one striation orientation may be the result of either separate glacial advances or different ice-flow directions within one flow event. Relative age relationships between each set of striations are determined by crosscutting sets of striations and preservation of older sets of striations in the lee of younger striations.

Plate 1. *Nailhead striation: ice-flow direction indicator; ice flow is from right to left.*

A complete listing of striations recorded can be obtained from a database of striation information (Taylor *et al.*, 1993).

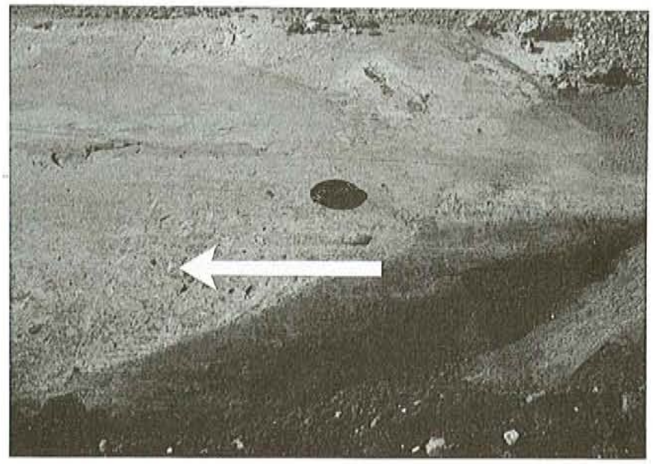

Plate 2. *Crag-and-tail: ice-flow direction indicator; ice flow is from right to left.*

Efforts continue on the compilation and development of this database for the Island of Newfoundland. To date, approximately 7500 striation measurements have been entered into the database with information coming from the Newfoundland Geological Survey Branch and Geological Survey of Canada studies, along with published reports.

INTERPRETATION

At most sites, only a single ice-flow direction is recorded. Sites revealing multiple directions are confined to areas where recent removal of overburden has exposed fresh unweathered bedrock surfaces. The soft Carboniferous bedrock throughout the study area generally results in poor striation preservation.

Based on a compilation of all available data, the following sequence of events is proposed.

FIRST ICE-FLOW EVENT

The oldest ice-flow event recorded throughout the study area was southward (220°), and was confined to the northwest between Corner Brook and the Port au Port Peninsula (Figure 2). These southwest-trending ice-flow indicators appear only on leeward surfaces of outcrops that show one or more subsequent ice-flow events and parallel major geological structures such as Grand Lake and Georges Lake. A possible source for these indicators is a centre in the Long Range Mountains north of the field area. Early southwest-trending ice was also recorded by Batterson and Vatcher (1992) in the Corner Brook area; Batterson and McGrath (1993) in the Pasadena area, and by Batterson and Taylor (this volume) in the upper Humber valley.

SECOND ICE-FLOW EVENT

The second, and most prominent, ice-flow event originated from a large centre encompassing the Topsail Hills, Annieopsquotch Mountains and Meelpaeg Reservoir areas (Figure 3). Ice flow along the west coast trended westward

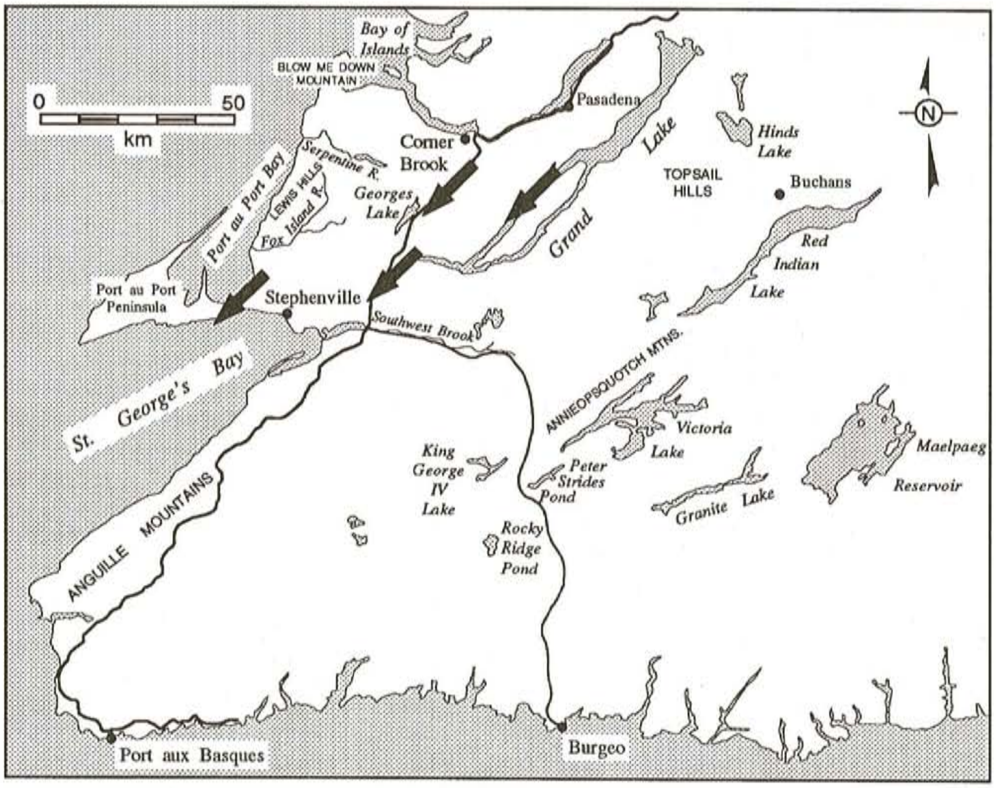

Figure 2. *Arrows indicate the direction of the first ice-flow event.*

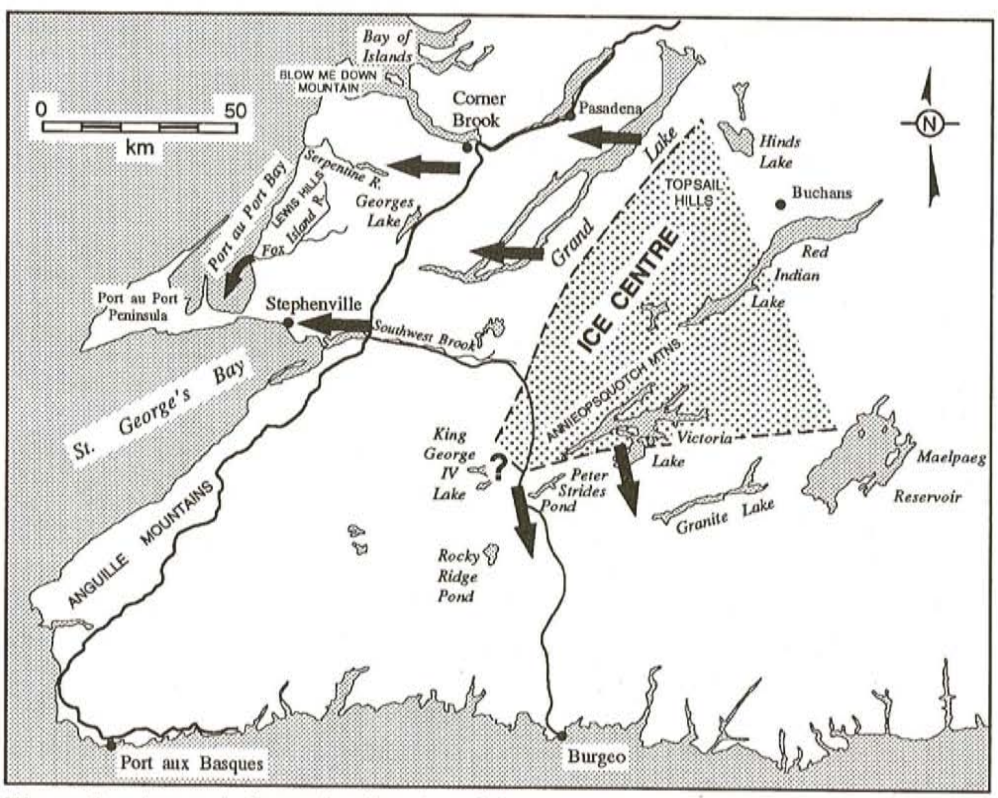

Figure 3. *Arrows indicate the direction of the second ice-flow event.*

across Grand Lake to exit through the Bay of Islands, Serpentine River and Fox Island River. As the ice reached the coast, flow was likely unconfined and developed a lobate form. This may account for south-flowing ice recorded on the Port au Port Peninsula (Plate 3). This flow was also described by Brookes (1973).

Ice flow along the Burgeo Highway shows two distinct directions. Flow in the Southwest Brook area was generally westward, parallel to the valley while flow south of the Anniespoquotch Mountains followed a south-southeastward trend to the coast.

THIRD ICE-FLOW EVENT

During the late stages of deglaciation, a thinning of the main ice centre occured, allowing the development of independent ice centres in the Topsail Hills and Meelpaeg Reservoir area (Grant, 1974; Figure 4). Ice flow from the Topsail Hills centre was generally northwestward (300°) toward the coast where topographic control became more important in determining ice-flow direction.

Ice flow from the Meelpaeg Reservoir ice centre shows a strong westward flow around the Annieopsquotch Mountains (and may have topped these hills in the early stages of this event). As the ice continued to thin, flow became topographically controlled and deflected

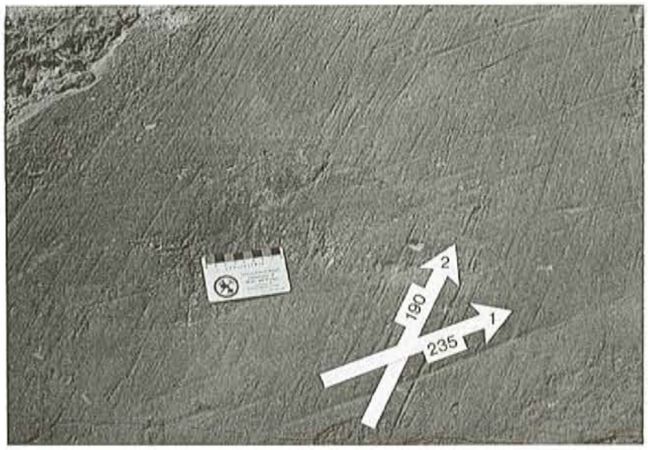

Plate 3. *Striated outcrop surface on the Port au Port Peninsula showing a south flow (190°) crossing an older southwest flow (235°).*

1) Early southwest flow along the west coast between Corner Brook and the Port au Port Peninsula from a probable centre in the Long Range Mountains;

2) flow from a large ice cap encompassing the Topsail Hills and Meelpaeg Reservoir shows westward ice-flow along the west coast from Corner Brook to Southwest Brook and south-southeastward ice flow over areas south of the Annieopsquotch Mountains; and

3) separation of the main ice cap into remnant independent ice centres in the Topsail Hills with ice flow to the northwest, and Meelpaeg Reservoir area with ice flow to the south-southwest.

IMPLICATIONS FOR DRIFT PROSPECTING

The striation data show that multiple ice-flow events affected the entire region, and that the ice-flow history is quite different in sub-regions separated by ice divides. These striation data should be used with surficial geology maps (Liverman and Taylor, 1990; Grant, 1991) when applying soil geochemistry and drift prospecting. Striation data will give an overall picture of the provenance sources of till in a specific area, and where till is fairly thin and is a single stratigraphic unit, will probably provide sufficient information on provenance and direction of transport. Where a thick till stratigraphy exists, careful mapping of the till units combined with till fabric analysis may be required to properly explain transport directions.

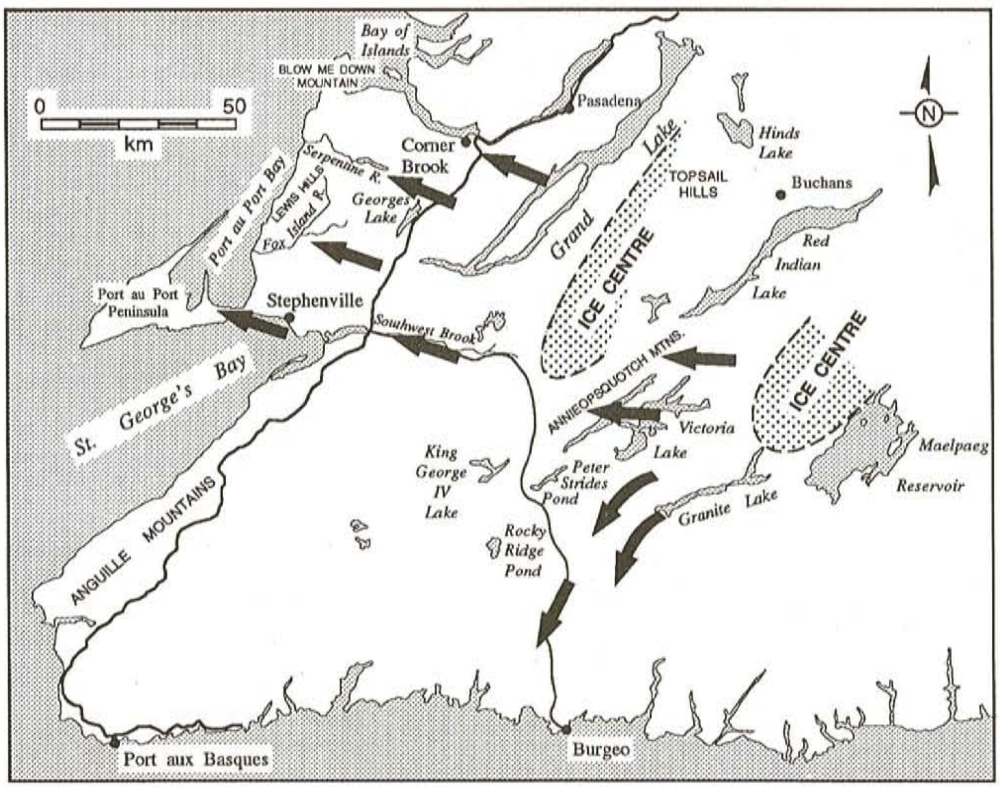

Figure 4. *Arrows indicate the direction of the third ice-flow event.*

around the Annieopsquotch Mountains in a south-southwesterly direction toward the coast. This is consistent with the southward ice flow identified by Sparkes and Neuland (1986) and Sparkes (1987).

TENTATIVE GLACIAL HISTORY

A tentative sequence of events in the deglaciation of southwestern Newfoundland is postulated based on recently collected data and the work of others previously mentioned.

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