Atlantic Geology

Unusual Till Ridges in the Kitty's Brook Chain Lakes area of West-Central Newfoundland

Christopher M. Tucker

Volume 10, Number 1, April 1974

URI: https://id.erudit.org/iderudit/ageo10_1rep02

See table of contents

Publisher(s)

Maritime Sediments Editorial Board

ISSN

0843-5561 (print)
1718-7885 (digital)

Explore this journal

Cite this article

Tucker, C. M. (1974). Unusual Till Ridges in the Kitty's Brook Chain Lakes area of West-Central Newfoundland. *Atlantic Geology*, *10*(1), 8–13.

Maritime Sediments, Vol. 10, No. 1, April 1974, pp. 8-13.

Unusual Till Ridges in the Kitty's Brook Chain Lakes area of west-central Newfoundland*

CHRISTOPHER M. TUCKER
Memorial University of Newfoundland, St. John's, Newfoundland**

Introduction

Although dominant late Wisconsin ice flow in west-central Newfoundland was to the northeast, it is from the Kitty's Brook - Chain Lakes area of the High Central Plateau, so named by Twenhofel and MacClintock (1940), that late topographic flow was directed north into Sheffield Lake and down-valley to the southwest and then northwest into Sandy Lake (Fig. 1). The Kitty's Brook - Chain Lakes valley system contains a series of large southeast-northwest oriented till ridges similar in size and general orientation to those just southwest of location 7 (Fig. 1), and others approximately 14 miles (22.4 kms) south-southwest of Chain Lakes. Initially, the features appear similar to ribbed moraine, described by Prest (1968) as "individual ribs (consisting) of bouldery ridges up to a mile (1.6 kms) or more in length; 30-90 feet (9-12 meters) high with crests 300-1000 feet (90-300 meters) apart", (p. 6). The possibility exists, however, that the ridges within Chain Lakes valley may be a form of recessional moraine or if included with those to the southwest, reworked drumlins that parallel an earlier northwest-southeast ice flow, (Grant, pers. comm.).

The uncertain origin of the deposits and the importance of the zone in the sequence of deglaciation justifies its inclusion in an overall study of west-central Newfoundland and in the summer of 1972 a reconnaissance survey was made of the area.

Previous Research

Several researchers made note of the general area. Coleman (1926) decided that the High Central Plateau had not been glaciated during the Wisconsin, rather that glaciation was probably of Kansan or Jerseyan age. He assumes that the amount of periglacial and postglacial weathering of the Topsails granite (Neale and Nash, 1963) rules out a Wisconsin ice cover. Later studies in surrounding areas negate Coleman's suggestion.

MacClintock and Twenhofel (1940) make specific mention of the Kitty's Brook area:

"From Kitty's Brook Station to the top of the Plateau at Gaff Topsail (there are) morainal hills 50 to 200 feet (15-60 meters) high composed of gravel and till. Interspersed are kettle holes of equivalent dimensions, many of which contain lakes.

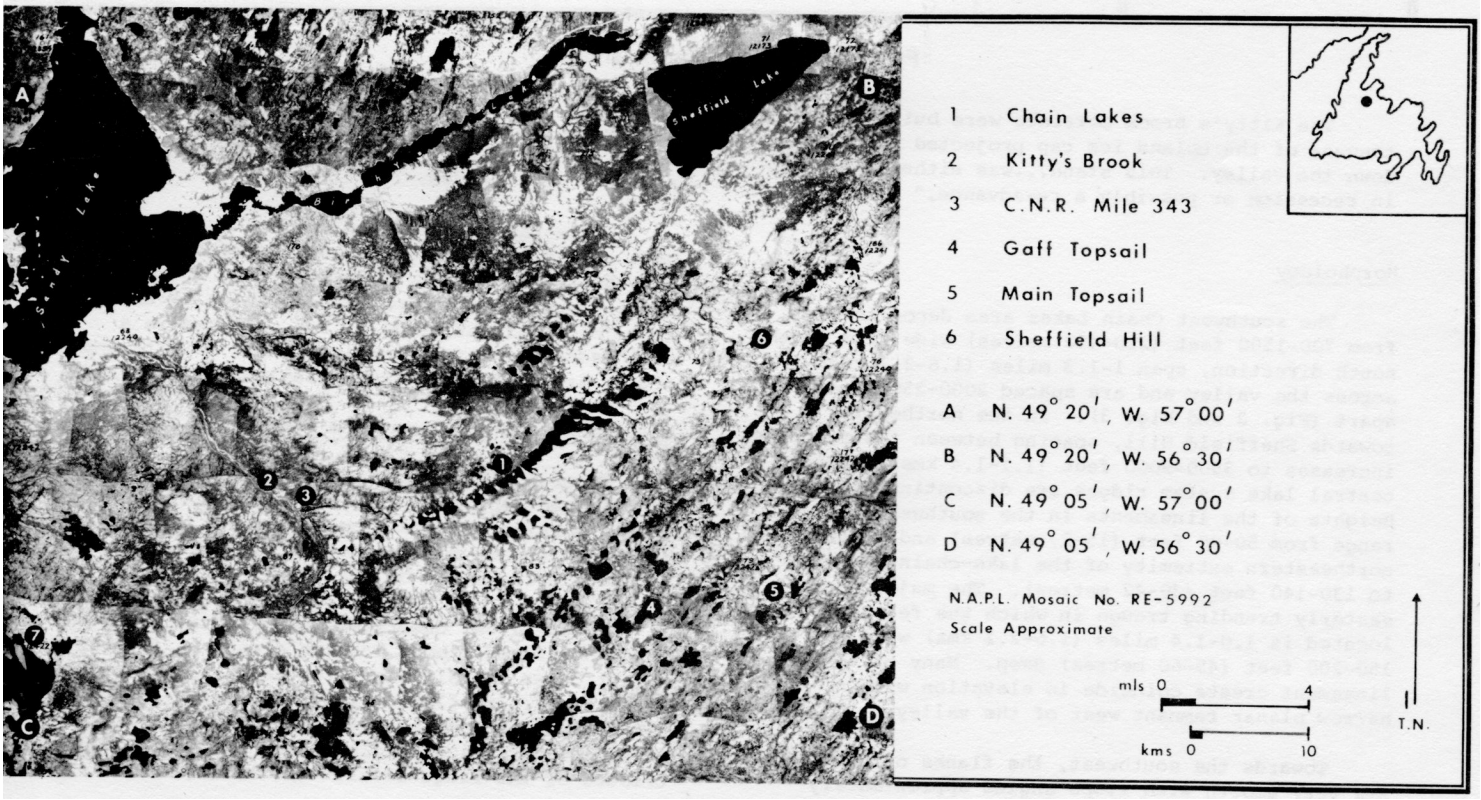


Fig. 1. Kitty's Brook - Chain Lakes Area.

*Manuscript received May 10, 1974
**Present address: Terrain Sciences Division, Geological Survey of Canada, Ottawa

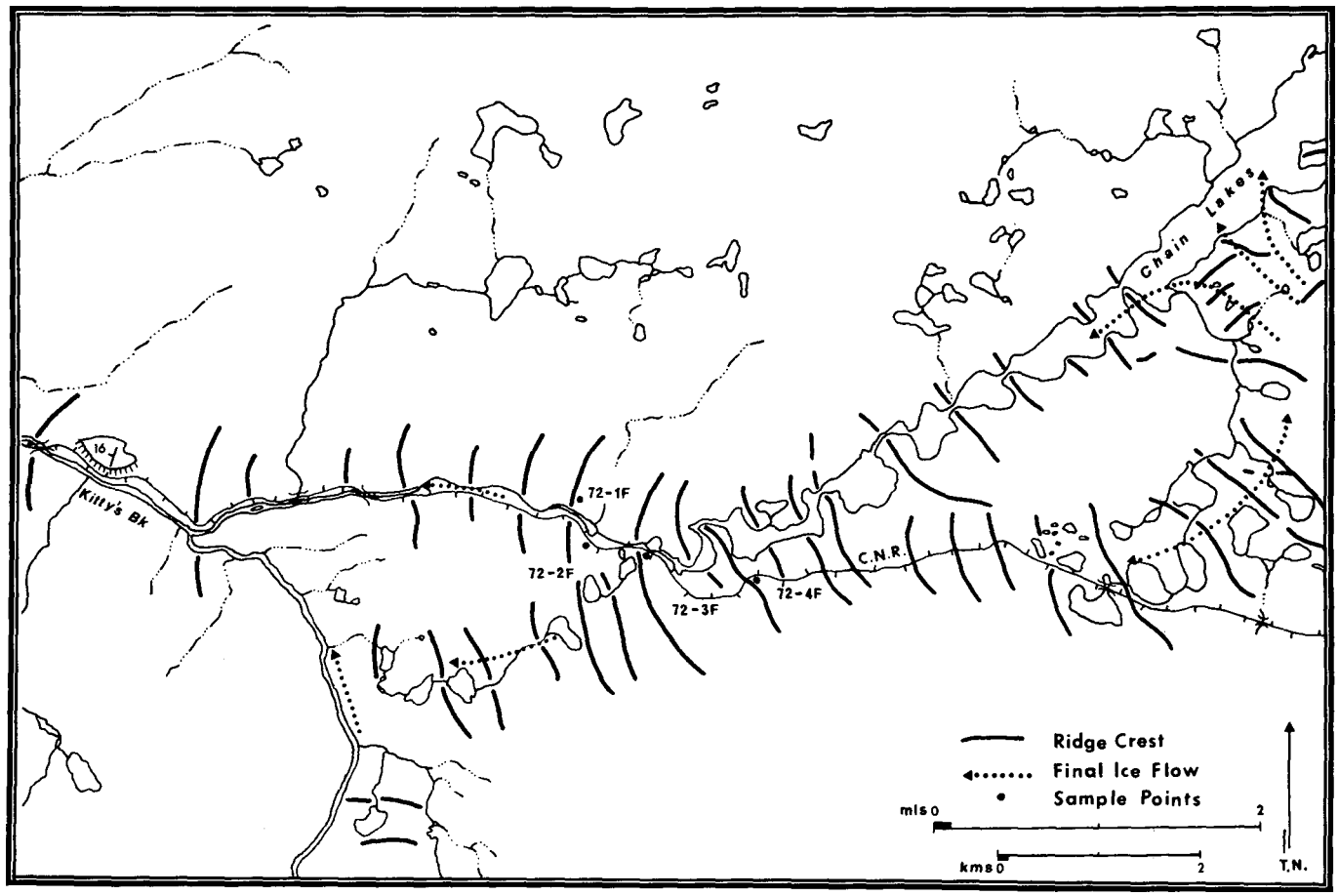


Fig. 2. Till ridges and fabric sites.

The Kitty's Brook moraines were built when tongues of the upland ice cap projected part way down the valley. This stand...was either a halt in recession or possibly a re-advance," (p. 1745).

Morphology

The southwest Chain Lakes area deposits are from 700-1500 feet (210-450 metres) wide in a north-south direction, span 1-1.3 miles (1.6-2.1 kms) across the valley and are spaced 2000-2500 feet apart (Fig. 2 and Fig. 3). In the northeast, towards Sheffield Hill, spacing between the features increases to 3500-5000 feet (1.1-1.4 kms) while central lake system ridges are discontinuous. Heights of the lineaments in the southwest area range from 50-90 feet (15-27 metres) and at the northeastern extremity of the lake-chain increase to 130-140 feet (39-42 metres). The major north-easterly trending trough in which the features are located is 1.0-1.4 miles (1.6-2.1 kms) wide and 150-200 feet (45-60 metres) deep. Many of the lineament crests coincide in elevation with a narrow planar remnant west of the valley.

Towards the southwest, the flanks of the ridges are very smooth with slope angles approximately equal on each side (Fig. 4). At the northeastern end of the valley system slopes are steeper and concave in plan and profile towards the southwest, suggesting ice contact features. Lakes in the centre of the valley are elongated while at the ends they are rounded.

Since the deposits are concave up slope at both ends of the valley system, orientations of 285-350 represent only a trend normal to the structural trough. Ridges on the east side of the plateau (middle-right, Fig. 2) are oriented in a northeast-southwest direction; their heights and slopes are similar to those previously described.

Till Fabric and Textural Analyses

Several till fabric analyses were completed on selected deposits (Fig. 2). If the ridges were ribbed moraine or recessional features, one would expect a primary mode normal to ridge crests since both are derivatives of ice flow.

Cowan (1968) describes the orientation of straight-ridged ribbed moraine clasts as "appearing in all cases to fall close to the direction of a glaciation", (p. 1150). For curved ridges he found that fabrics indicated movement related to "both the direction of glaciation and to some attribute of the ridge itself" (p. 1153).

A recessional moraine is formed of ground

TABLE 1

Till Fabric Data, Calculated and Interpreted

Sample	Mean	Standard Deviation	1° mode	2° mode	Feature Trend
72-1F	010	30°	350	090	010
72-2F	010	42°	355	055	010
72-3F	005	27°	020	160	345
72-4F	325	22°	330	200	320

moraine dumped by stagnating ice, but since it has been carried along during advance it should show some clast orientation paralleling final flow.

Railway cuts were used as fabric sites where possible, otherwise pits were dug to a depth of 36-48 inches (90-120 cms) in an attempt to avoid zones affected by frost heaving and weathering. Feature trends were noted in the field, while primary and secondary modes were visually interpreted from the Rose diagrams (Fig. 5, a, b, c, d). Means and standard deviations were calculated from till fabric data and are presented in Table 1.

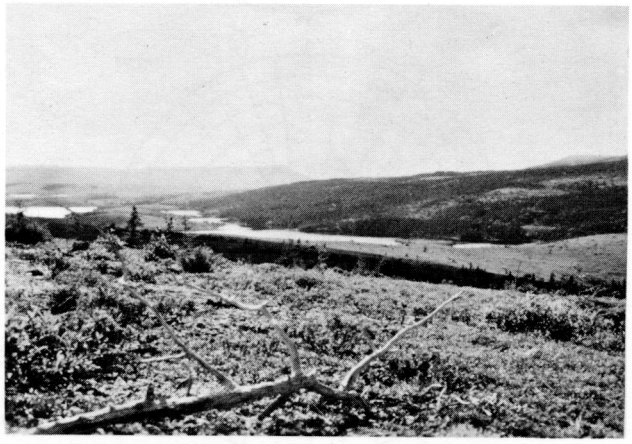


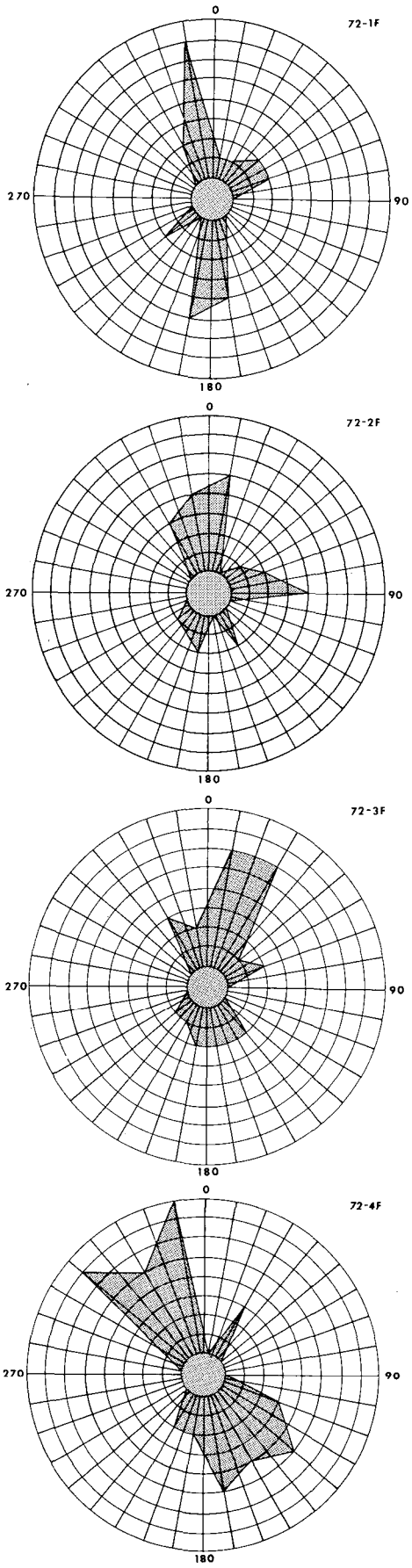
Fig. 3. The Chain Lakes valley system photographed facing southwest.

Fig. 4. Till ridge 72-4F typical of the southern part of the valley Note the lobate crest and shallow slope angle.

TABLE 2

Calculated Data for Chain Lakes Samples 72-1F - 72-4F

Sample	Mean	Inclusive Graphic Standard Deviation	Kurtosis	Inclusive Graphic Skewness
72-1F	1.13ø	2.54ø very poorly sorted	0.8 Platykurtic	0.04 near symmetrical
72-4F	1.10ø	2.52ø very poorly sorted	0.66 very Platykurtic	0.08 near symmetrical



Primary orientations for 72-1F and 72-4F are approximately parallel to feature elongation. Fabric 72-2F has a weakly developed primary mode with a strong secondary mode normal to the ridge crest.

Primary mode orientation for 72-3F is 180° from the assumed ice flow direction, that is it shows a marked plunge toward 010. This probably occurred because the till fabric diagram was constructed from clasts on the northerly or up-valley slope of the ridge; all other samples were obtained from central positions or down-valley slopes. Otherwise, the till fabric orientation at 72-3F has a primary mode sub-parallel to ice flow and a secondary mode parallel to feature elongation. In all cases two fabric modes have been observed; one parallel and one transverse to assumed ice flow from Kitty's Brook valley. If one is to explain the features either as ribbed moraine or recessional moraine, the bimodal aspect of the till fabric diagrams needs clarification.

The purpose of the textural analysis was to ascertain if the ridges are glacial or glaciofluvial in origin. Since only a general indication of texture was required, samples were collected from till fabric pits 72-1F and 72-4F (Fig. 2) and a wet sieve analysis was completed at whole ø intervals. The mean, inclusive graphic standard deviation, kurtosis and inclusive graphic skewness were calculated as outlined by Folk (1968). Results are presented in Table 2 and are indicative of glacial till.

Fig. 5. Clast orientations (Also see Fig. 2).

Fig. 6. View of the Kitty's Brook delta photographed facing northwest. Beds are oriented 020, 16 degrees L.

Discussion

Glenn, Donner and West (1957) note that where there is a secondary mode in till fabric diagrams, it is usually at right angles to the primary mode and may exceed it in magnitude. In this instance, the authors are assuming that a primary mode is parallel to ice flow rather than being the dominant orientation. They suggest that there are significant correlations between prolateness of clasts and a tendency to transverse modes, which they account for by collisions between more elongated stones.

Harris (1969) explains the relation of secondary modes to roughness of terrain. In areas of high relative relief he found that till fabrics had a high Minimum Significant Orientation Count (M.S.O.C.) and poor modal orientation in the direction of ice flow. With a relative relief of 100-200 feet (30-60 metres) a notable development of transverse modes was observed.

Similarly, Andrews and Smith (1970) describe the occurrence of a dominant mode at right angles to ice flow. They interpret the phenomenon with the idea that as ice ascends a bedrock slope, clast rolling and thrusting becomes the main orientation - producing process; that is, a transverse mode is created by changes in local flow conditions.

Dreimanis (MacClintock and Dreimanis, 1964) presents a series of till fabrics with two maximum orientations separated by an angle of 60°. One represents the penultimate glacial movement, the other defines the latest, which re-orientated at least half of the elongate pebbles parallel to the fabric maximum of the overlying till.

It is felt that a process similar to that described by Dreimanis may be applicable to the Kitty's Brook - Chain Lakes area. One might suggest that the dominant till fabric modes parallel to feature elongation were obtained from an earlier ice flow over the ridge north of Chain Lakes towards White Bay, however, the mechanisms proposed by previously mentioned researchers may be partially responsible for the bimodal aspect of the till fabrics.

The Kitty's Brook Glaciofluvial Deposit

At mile 343 of the C.N.R., on the north side of Kitty's Brook valley there is a small outwash delta or fan (Fig. 6). Foreset bedding in the deposit strikes 020, dips 16°L and contains large stones 1-3 feet (0.3-0.9 metres) in diameter. On the valley floor and in the topset material, large well rounded to subrounded boulders 2-4 feet (0.6-1.2 metres) in diameter are visible. These are indicative of large volumes of water that must have poured down the valley late in deglaciation.

Air-photo analysis of the feature locates several meltwater channels that may have contributed to its formation. The deposit appears to be a delta formed in a small glacial lake dammed up between two of the ridges (Fig. 2), and since emptied by incision of Kitty's Brook. The deposit is presently being used by Canadian National Railways as a borrow pit and it is impossible to determine the former extent of the delta though, since it is nearly 60 feet (18 metres) thick, deposition probably continued for a considerable period of time.

Conclusions

Several features of the ridges prohibit their classification as ribbed moraine. Clast orientation is not well enough defined to meet the parameters outlined by Cowan (1968); also their dimensions and spacing are greater than described by Prest (1968). From their morphology and the till fabric analyses, the following tentative system is suggested for their constitution.

Initially the Chain Lakes till ridges and those to the southwest, may have been southeast-northwest oriented drumlins from an early Wisconsin ice flow. More detailed work is necessary on this aspect of their origin.

In the late Wisconsin, the High Central Plateau was an ice dispersal center and as such, final ice flow was to the north, as evidenced by eskers and meltwater channels located outside the present study area. Ice pouring off the plateau flowed towards Sheffield Lake and southwest down Kitty's Brook valley (Fig. 1). The large northeast-southwest oriented till ridge east of Chain Lakes (Fig. 2) may be related to topographic flow from the plateau into the valley system. Ice contact slopes in the lower northeast sections of Chain Lakes valley suggest that rather than forming a series of true recessional moraines, ice stagnated in large blocks behind the deposits, giving them their elongated, concave-convex forms. Hence the deposits may be classified as recessional-ablation moraine.

The delta in Kitty's Brook valley was deposited just before a final glaciofluvial stage which connected the individual ponds and formed a complete drainage system.

Acknowledgements

In addition to those mentioned in Paper 1974A* the writer would like to thank R.M. Slatt, Department of Geology, Memorial University of Newfoundland for providing laboratory facilities to enable various sedimentological analyses to be completed.

Information presented in this report is condensed from an M.Sc. thesis completed in 1973 for the Department of Geography, Memorial University of Newfoundland.

References

ANDREWS, J.T., 1963, The cross-valley moraines of north-central Baffin Island, Northwest Territories, Geog. Bull. Can., vol. 8, no. 2, p. 174-193.

_____, and KING, C.A.M., 1968, Comparative till fabrics and till fabrics and till fabric variability in a till sheet and a drumlin: a small scale study, Proc. Yorks. Geol. Soc. vol. 36, p. 435-461.

*Paper 1974A is entitled: A Series of Raised Pleistocene Deltas; Halls Bay, Newfoundland; Mar. Seds.. v. 9, no. 2.

_____, and SMITH, D.I., 1970, Statistical analysis of till fabric - methodology, local and regional variability, Quart. J. Geol. Soc. London, vol. 125, no. 500, Part 4, p. 503-542.

COLEMAN, A.D., 1926, The Pleistocene of Newfoundland, Bull. Geol. Soc. Am., vol. 6, p. 467.

COWAN, W.R., 1968, Ribbed moraine: till fabric analysis and origin, Can. J. Earth Sci., vol. 5, no. 5, p. 1145-1159.

DREIMANIS, A., and VAGNERS, U.J., 1971, Bimodal distribution of rock and mineral fragments in basal till, In Till, a Symposium, R.P. Goldthwaite, ed., Columbus, p. 237-250.

FOLK, R.L., 1968, Petrology of Sedimentary Rocks, Hemphils Book Store, Austin, Texas, 170 p.

GLEN, J.W., DONNER, J.J., and WEST, R.G., 1957, On the mechanism by which stones in till become oriented, Am. J. Sci., vol. 255, p. 194-205.

HARRIS, S.A., 1969, The meaning of till fabrics in Processes and Method in Canadain Geography - Geomorphology, p. 143-164, Methuen Pub., Toronto.

MACCLINTOCK, P., and TWENHOFEL, W., 1940, Wisconsin glaciation in Newfoundland, Bull. Geol. Soc. Am., vol. 51, p. 1729-1756.

_____, and DREIMANIS, A., 1964, Re-orientation of till fabric by overriding glacier in the St. Lawrence Valley, Am. J. Sci., vol. 262, p. 133-142.

MURRAY, R.C., 1955, Directions of glacier ice motion in south-central Newfoundland, J. Geol., vol. 63, p. 268-274.

NEALE, E.R.W., and NASH, W.A., 1963, Sandy Lake Map Area, G.S.C. Paper 62-28.

PREST, V.K., 1968, Nomenclature of moraines and ice flow features as applied to the Glacial Map of Canada, G.S.C. Paper 67-57.

_____, GRANT, D.R., and RAMPTON, V.N., 1967, Glacial Map of Canada, G.S.C. Map 1253A.

SMALLEY, I.J., and UNWIN, D.J., 1968, The formation and shape of drumlins and their distribution and orientation in drumlin fields. J. Glac., vol. 7, p. 377-390.

TWENHOFEL, W.H., and MACCLINTOCK, P., 1940, Surface of Newfoundland, Bull. Geol. Soc. Am., vol 51, p. 1665-1728.