

# Glacial History of the Eastern Mealy Mountains, Southern Labrador

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**ABSTRACT.** Two continental glaciations, both considered Wisconsin in age have been noted in the eastern Mealy Mountains. The earlier ice sheet reached a minimum elevation of 3,000 feet (925 m.) and may have overtopped the summit plateaus of 4,000 feet (1,240 m.). The ice moved from west to east. The vertical limit of the later ice sheet varied from 2,300 feet (710 m.) in the west to 1,800 feet (555 m.) in the east. Cirques were carved prior to both glaciations. The development of active glaciers with pronounced end moraines, subsequent to the second and later glaciation, was restricted to cirques oriented towards the east and southeast. Cirque glacier re-advances have probably not occurred within the last few hundred years.

**RÉSUMÉ.** *Histoire glaciaire des monts Mealy orientaux, Labrador méridional.* Dans les monts Mealy orientaux, on a distingué deux glaciations continentales, toutes deux considérées comme d'âge wisconsinien. La plus ancienne calotte atteignait une altitude minimale de 3000 pieds (925 m) et a peut-être recouvert les plateaux sommitaux de 4000 pieds (1240 m) d'altitude. La glace se déplaçait d'ouest en est. La limite verticale de la calotte plus récente variait de 2300 pieds (710 m) dans l'ouest à 1800 pieds (555 m) dans l'est. Des cirques ont été creusés antérieurement aux deux glaciations. Postérieurement à celles-ci, le développement de glaciers actifs à moraines terminales prononcées s'est limité aux cirques orientés vers l'est et le sud-est. Aucune réavancée de glacier de cirque ne s'est probablement produite au cours des derniers siècles.

**РЕЗЮМЕ.** *Хронология оледенения в восточной части Гор Мили на юге Лабрадора.* Два континентальных оледенения предположительно Висконсинского возраста были отмечены в восточной части Гор Мили. Более ранний ледяной покров достигал минимальной высоты в 925 м и, возможно, перекрывал вершинные плато на высоте в 1240 м. Лед двигался с запада на восток. Вертикальная граница более позднего оледенения колебалась между 710 м на западе и 555 м на востоке. Цирки образовались до начала оледенений. Развитие активных ледников с четко выраженными конечными моренами, последовавшее за вторым и более поздними оледенениями, происходило лишь в цирках восточной и юго-восточной ориентации. Возможно, что в течение нескольких последних столетий повторное наступление ледниковых цирков отсутствовало.

The eastern Mealy Mountains are situated on the south shore of Lake Melville, 60 miles east of Goose Bay, Labrador (Fig. 1). The range rises quite abruptly on the east, south and west sides from a plateau surface at 1,500 feet (460 m.) to attain summit elevations of 4,000 feet (1,240 m.). Structurally it consists of an anorthosite pluton, flanked on the south and southwest sides by granodiorites and on the east side by granitic gneisses (Eade 1962). The glacio-morphological features of this area were examined during the summer of 1965 and certain conclusions reached with regard to the glacial history.

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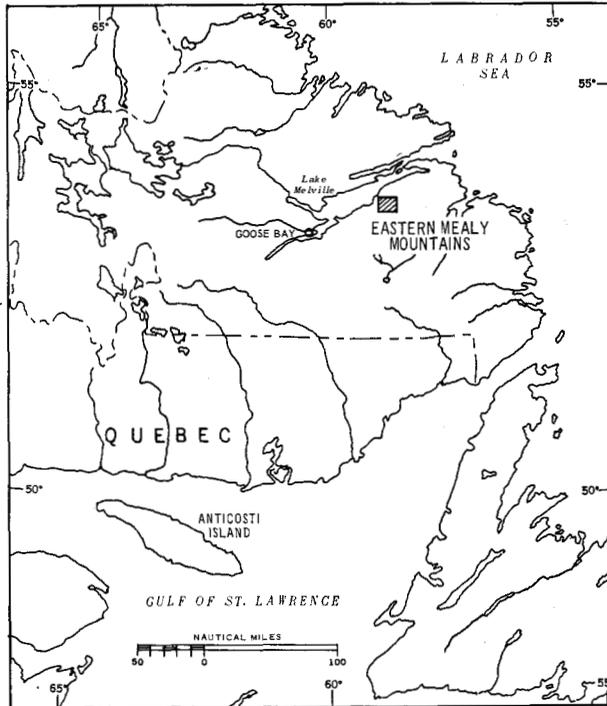


FIG. 1. Location of field area on the Labrador coast.

Several morphological criteria have been used in the mountain areas of northern Labrador to determine the origin and extent of the ice sheets affecting these areas. They include the altitudinal distribution of erratics (Ives 1963, Tomlinson 1963), and the altitudinal distribution, extent and size of lateral and terminal moraines (Andrews 1963, Johnson 1964). An attempt was made to find evidence of this type in the eastern Mealy Mountains, where the absence of till sheets precludes the use of stratigraphy. The altitudinal limits of glacial striae and their orientation are also of great importance in elucidating the history of glaciation in this area.

The distinction between frost-shattered bedrock, and sound bedrock, the former associated with long exposure to sub-aerial processes, the latter indicative of recent emergence from under an ice cover, has been used in northern Labrador to define vertical glacial limits since the Sangamon Interglacial (Ives 1958, Løken 1962). Such weathering trimlines are non-existent in the eastern Mealy Mountains. Indeed in some cases small patches of felsenmeer occur at low altitudes within recently glaciated terrain, whilst smooth unweathered surfaces are not uncharacteristic of the mountain tops.

#### PERCHED BOULDERS AND ERRATICS

There are numerous perched boulders at all elevations in the eastern Mealy Mountains, although there is an obvious decline in frequency with altitude. In most cases they consist of anorthosite resting on anorthosite. At lower levels the

small grooves associated with the large perched blocks, the lack of detrital material beneath them and their association with striated surfaces indicate glacial emplacement. At high altitudes supporting evidence of this nature is lacking and their value as indicators of summit glaciation is equivocal. Therefore the distribution of possible indicator erratics was carefully noted. The most conspicuous were pink granodiorite boulders which afforded a good visual contrast with the grey and black anorthosites. A few granodiorite boulders occur on two of the four summit plateaus visited, but these do not appear to form conclusive evidence of summit glaciation for the following reason. A transition in mineralogy from a section containing only plagioclase feldspars to a section containing increasing amounts of orthoclase was noted in two perched blocks. Correspondingly the colour of the blocks changed from black to pink. These blocks are likely to be erosion residuals or pseudo-erratics. Ives (1966) has found similar pseudo-erratics on Baffin Island.

#### STRIAE

The distribution of striae enables a definite minimum upper glacial limit to be determined for the eastern Mealy Mountains. The highest striae occur in a narrow col at an altitude of 3,000 feet (925 m.), approximately 1,000 feet below the summit level of the mountain range (Fig. 2). The unusually continuous and deep grooves may be the result of topographic constriction of an ice sheet as it passed through the col.

Only 2 other striae fields above 2,500 feet (770 m.) were noted, but below 2,500 feet (770 m.) the frequency of occurrence increases down to 1,800 feet (555 m.) where most of the bedrock surfaces are obscured by the glacial deposits of the valley zone.

At higher levels, i.e. between 2,400 and 3,000 feet (740 and 925 m.) the striae fields trend in a west-east direction, with the exception of the highest field whose north-south orientation corresponds with the topographic trend of the col. At lower altitude most of the striae fields exhibit a strong southwest-northeast trend which happens to correspond with the trend of a major system of inter-

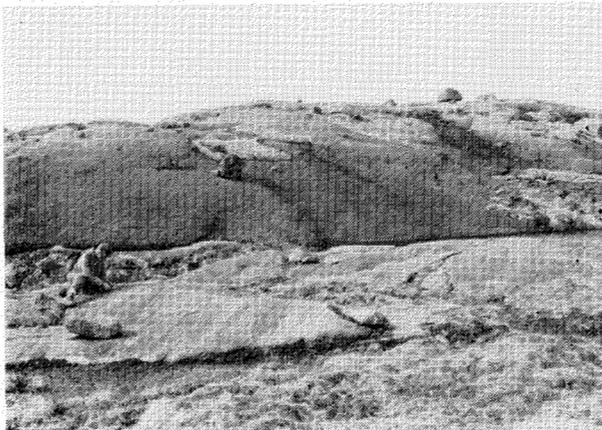


FIG. 2. Glacial striae in a col at 3,000 feet (925 m.) in the eastern Mealy Mountains.

connecting valleys and watersheds within the mountains. The evidence indicates the movement of an ice sheet of continental proportions through the region in an easterly direction. The upper parts of this ice sheet were affected to a lesser degree by the underlying topography than were the basal parts which were channelled in a northeasterly direction through the valley system. There is no indication that the change in orientation of the striae can be related to 2 different ice sheets as the striated surfaces are equally well preserved from subaerial weathering.

The vertical limit of this continental glaciation was at least 3,000 feet (925 m.) in the eastern Mealy Mountains. The smooth striated surfaces suggest it was Wisconsin in age. There are no indications of lateral moraine limits, and extensive areas of the summit plateaus consist of unweathered bedrock surfaces. Thus summit glaciation by this ice sheet is considered probable.

#### LATERAL MORaine LIMITS

Extensive lateral moraines, eskers, kames and outwash deposits fringe the eastern front of the Mealy Mountains. The lateral moraine limit is very distinct; it descends from 2,000 feet (615 m.) to 1,800 feet (555 m.) over a distance of about 8 miles. In the western part of the field area the valleys are covered with glacial debris to a height of 2,300 feet (710 m.) but lateral moraines are not so continuous as along the eastern front.

The lateral moraines and associated ice contact and outwash deposits indicate the occurrence of a second glaciation in the region, whose vertical limits varied from 2,300 feet (710 m.) in the western area to 1,800 feet (555 m.) in the southeastern area. This glaciation is considered continental in origin mainly because the lateral moraine traversing the eastern mountain front is clearly separated from the cirques 200 to 500 feet (60 to 155 m.) above by expanses of bare or thinly-veneered bedrock. Where this moraine crosses the mouths of 2 of the lower cirques it curves inward towards the cirque. The gentle regional slope of the moraine indicates that a large lobe of this continental ice sheet swept around the northeastern end of the mountains and moved southwards.

It is possible that this glaciation is contemporaneous with that described by Andrews (1963) as the Saglek glaciation in the Nain-Okak area of northern Labrador. His glacial limits were identified on a similar basis of lateral and terminal moraines.

#### CIRQUE GLACIATION

Twenty-one readily identifiable cirques are counted in the eastern Mealy Mountains. Most were briefly examined on the ground and the rest on air photographs. Their orientation and the height of their floors is plotted on Fig. 3. The main reason for the lack of cirques in the northeasterly and southwesterly quadrants is not climatic. It is the result of a northeasterly-southwesterly structural trend which has caused the long flanks of the mountains to be oriented towards the southeast and northwest.

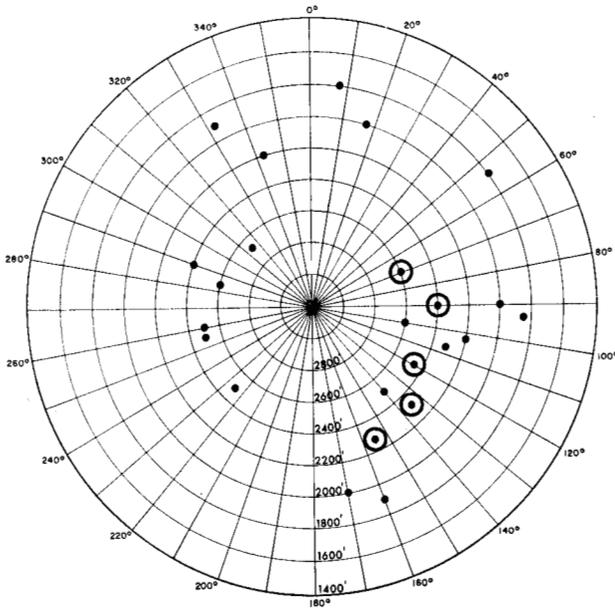


FIG. 3. Orientation and height of cirques in the eastern Mealy Mountains (cirques fronted by late glacial moraines are ringed).

It is deduced from the lack of moraines in many of the cirques, and from their large size and considerable incision into the plateau that they were fashioned before the earlier of the two recognised glaciations. This glaciation presumably removed pre-existing moraines.

Five of these cirques certainly contained glaciers since this glaciation, as they are fronted by well-defined end moraines. In 3 of the cirques, suites of terminal moraines are present, the innermost damming up a small lake in each case. The crests of the innermost moraines are sharply defined and streams cut through them, in narrow gorges. Multiple glacial advances in the late-Wisconsin and possibly also in the postglacial period are therefore indicated. The vegetated nature of the moraine surfaces and the cover of crustose lichens indicate that glaciers capable of producing well-formed moraines did not develop during the last two or three hundred years, i.e. within the *little ice age*.

The easterly or southeasterly orientation of cirques containing moraines is of interest (Fig. 3). This may be the result of wind drifting from the summit plateaus; the prevailing winter wind may have been from the west as at present.

#### ACKNOWLEDGEMENTS

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## REFERENCES

- ANDREWS, J. T. 1963. End moraines and late glacial chronology in the northern Nain-Okak section of the Labrador coast. *Geografiska Annaler*, 45 (2-3):158-71.
- EADE, K. 1962. Geology, Battle Harbour — Cartwright, Coast of Labrador, Newfoundland. Geological Survey of Canada, Map No. 22.
- IVES, J. D. 1958. Mountain-top detritus and the extent of the last glaciation in northeastern Labrador-Ungava. *Canadian Geographer*, 12:25-31.
- . 1963. Field problems in determining the maximum extent of Pleistocene glaciation along the eastern Canadian seaboard. A geographer's point of view. In: *North Atlantic biota and their history*, edited by A. Love and D. Love. Symposium Publications Division, Pergamon Press. pp. 337-354.
- . 1966. Block field, associated weathering forms on mountain tops and the Nunatak Hypothesis. *Geografiska Annaler*, 48A(4): 220-23.
- JOHNSON, J. P. JR. 1964. *Deglaciation and emergence of the Webb Bay — Port Manvers Run area of Labrador*. Unpublished Ph.D. thesis, McGill University, Montreal.
- LØKEN, O. H. 1962. On the vertical extent of glaciation in northeastern Labrador-Ungava, with a discussion by J. D. Ives. *Canadian Geographer*, 6(3-4):106-19.
- TOMLINSON, R. F. 1963. Pleistocene evidence related to glacial theory in northeastern Labrador. *Canadian Geographer*, 7(2):83-90.