A. MacS. Stalker

CANADA

DEPARTMENT OF MINES

HON. CHARLES STEWART, MINISTER; CHARLES CAMSELL, DEPUTY MINISTER

GEOLOGICAL SURVEY

W. H. COLLINS, DIRECTOR

MEMOIR 141

No. 120, GEOLOGICAL SERIES

Geography and Geology of Lake Melville District, Labrador Peninsula

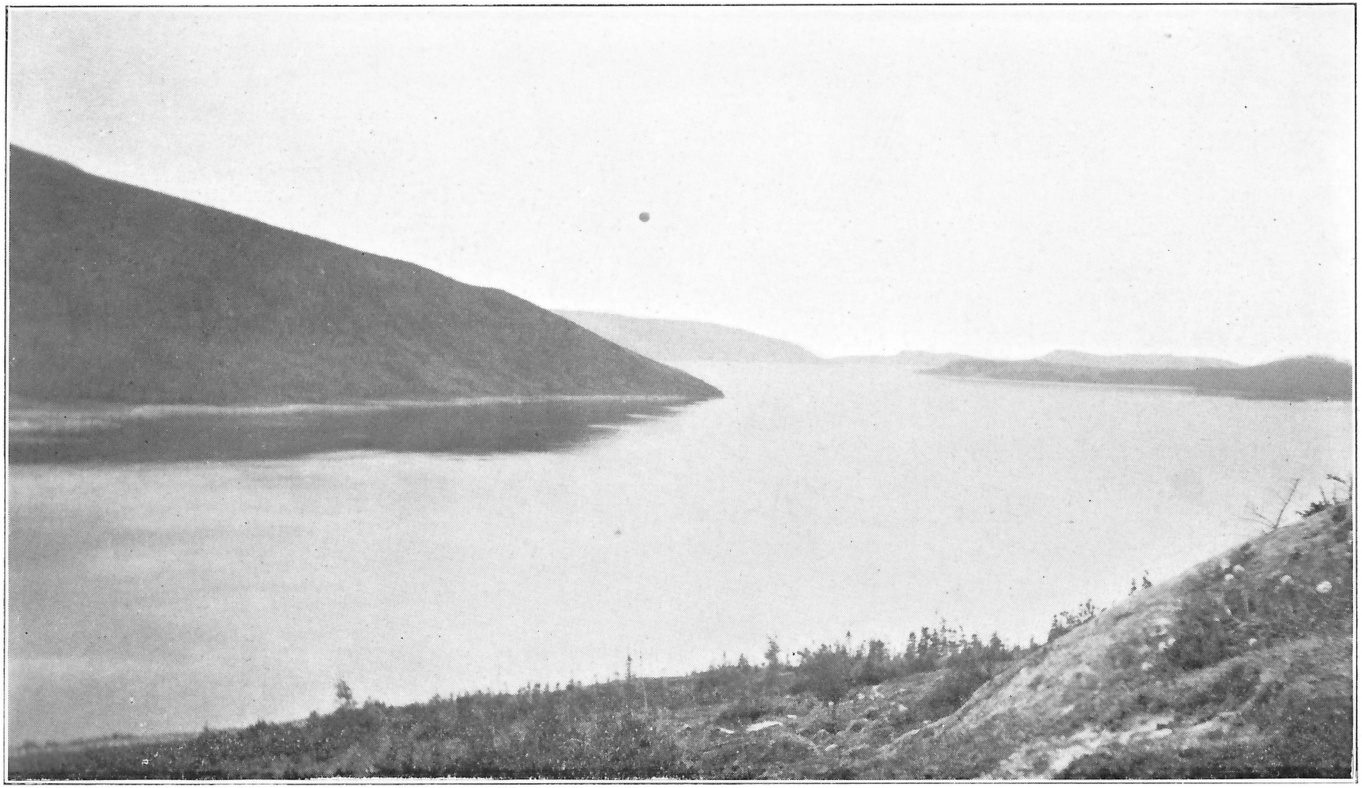
BY

E. M. Kindle

OTTAWA
F. A. ACLAND
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1924

No. 2032

Price, 25 cents.



View up Double Mer from lower end. (Pages 10, 13.)

CANADA
DEPARTMENT OF MINES
HON. CHARLES STEWART, MINISTER; CHARLES CAMSELL, DEPUTY MINISTER

GEOLOGICAL SURVEY
W. H. COLLINS, DIRECTOR

MEMOIR 141

No. 120, GEOLOGICAL SERIES

Geography and Geology of Lake Melville District, Labrador Peninsula

BY
E. M. Kindle

OTTAWA
F. A. ACLAND
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1924

No. 2032

CONTENTS

	PAGE
Introduction	1
Historical review	3
Geography	10
Hydrography	43
Stratigraphic geology	55
Economic geology	69
Summary	70
Appendix	73
Index	103

Illustrations[1]

Plate I. View up Double Mer from lower end .... Frontispiece

II. A. View of Northwest river looking toward lake Melville 83
B. Boulder rapids near mouth of English river 83

III. A. Mealy mountains looking across muskeg from the south side of lake Melville 84
B. Forested lowland at the foot of Mealy mountains, west of Long point 84

IV. A. Eskimo family and home, mouth of Double Mer 85
B. Floe ice, Hamilton inlet 85

V. A. Spruce forest at Mud lake 86
B. Spruce forest near mouth of Kenemich river 86

VI. A. View toward the northwest across small rock basin lake on hill top, showing St. John island in the distance 87
B. Sawmill, mouth of English river, lake Melville 87

VII. A. Fish house at Indian harbour 88
B. Fishing boat and fish house at Indian harbour 88

VIII. A. Hudson's Bay Company's pier, store, and warehouse at Northwest River 89
B. Hudson's Bay Company's residence at Northwest River 89

IX. A. View of Rigolet, from The Narrows 90
B. Boulder-covered shore-line of The Narrows west of Rigolet 90

X. A. Indians around camp fire at Northwest River 91
B. Indian mother and children at Northwest River 91

XI. A. An Indian canoe factory at Northwest River 92
B. Boulder bar, Hamilton river 92

XII. A. View of Muskrat falls looking down stream 93
B. *Littorina rudus* var *groenlandica* on the intertidal zone, Rigolet 93

XIII. A. Bank of Mulligan river, north shore of lake Melville 94
B. Naskaupi river opposite mouth of Red river 94

XIV. A. Domino gneiss with trap dyke at the right 95
B. Boulder barricade, just east of entrance to Double Mer 95

XV. Laminated clay trenched by trickling rain water 96

XVI. Figure 1. Concretion of cemented sand and fine gravel, Kenemich river, Labrador 99
Figures 2 and 3. Concretions attached to pebbles, Kenemich river, Labrador 99
Figures 4 to 8. Concretions of irregular shape with thin outer shell of ferruginous material 99
Figure 9. Subspherical concretion with outer shell of non-indurated material, Kenemich river, Labrador 99
Figures 10 and 11. Concretions with median constriction, south side lake Melville, Labrador 99

[1] Figures 2, 3, 7, 8, 9, drawn by A. Miles, are based on pencil sketches by L. Kindle.

Illustrations—*Continued*

		Page
Plate XVI.	Figure 12. Concretion with constrictions, south side of lake Melville...	99
XVII.	Figures 1 and 2. View of the two halves of a concretion showing the shell of a *Yoldia* as the nucleus	101
	Figure 3. Concretion with a marine shell attached to the surface, Kenemich river, Labrador	101
	Figures 4 and 5. Concretions with shells partly enclosed, Kenemich river, Labrador	101
	Figures 6, 7, and 9. Concretions with thread-like ridges corresponding to the lamination of the clays in which they were formed, Kenemich river, Labrador	101
	Figure 8. Concretion with iron-stained surface, Kenemich river, Labrador	101
	Figures 10 and 11. Views of the two halves of an egg-shaped concretion from Macleod, Alberta	101
Figure 1.	Index map showing location of area described in report	2
2.	General view of the south side of The Narrows showing sand-terraces..	9
3.	View of Mealy mountains	12
4.	Sketch map of waterways connected with Hamilton inlet	14
5.	Cross-sections of Lake Melville valley and Double Mer	17
6.	Map showing the distribution of *Littorina rudis* var *groenlandica*	52
7.	View at the narrowest part of Double Mer showing the contrasting topography of opposite shores	57
8.	Sand-terraces at Moliak cove, lake Melville	64
9.	Sand-terraces connecting hills of Precambrian rocks on the west side of The Backway	67
10.	Outline map and cross-section of Goose bay based on soundings by Leroy Bowes	68

Geography and Geology of Lake Melville District, Labrador Peninsula

INTRODUCTION

The great peninsula which lies between Hudson bay and the Atlantic ocean has long been known as Labrador peninsula. The name Labrador, signifying as it does in this connexion one of the great natural physical divisions of the continent, has a definite meaning. The precise significance of the name as used in this way is in sharp contrast with the vague meaning which attaches to "the coast of Labrador" as the name of a political subdivision of the Labrador peninsula subject to the authority of Newfoundland. No agreement has ever been reached between the Canadian and Newfoundland governments regarding the western boundary of Newfoundland Labrador. Some maps showing this western boundary of "the coast of Labrador," as claimed by Newfoundland,[1] place it in the Hamilton River basin about 350 miles west of the boundary claimed by Canada[2] in Hamilton inlet.

Among geographers the impression has been rather general that only the eastern seashore of Labrador peninsula is under the jurisdiction of Newfoundland and the region to the west of it under the control of Canada. It is, therefore, a matter of considerable importance and some complexity to ascertain precisely how far inland the seashore extends along the waterways known as Hamilton inlet, The Narrows, and lake Melville. Careful attention was given during the progress of the field work to the biological and geological data which appear to have a bearing on this problem, both on account of their application to a question of political geography and their general scientific interest. The highly interesting biological problems of distribution, which every river with a gradually expanding estuary presents in the modification of the marine and terrestrial forms of life associated with it as the transition is made from typical marine to brackish and freshwater conditions, are found here. But they are modified and complicated by the interpolation of a large lake between the sea and the drainage system of a considerable part of eastern Labrador. As a result of this unusual feature of the drainage the region is a peculiarly inviting one in which to study the influence of salinity in controlling the distribution of plants and animals and even the indigenous human races of the region—the Indian and Eskimo. The present discussion of the distribution of the invertebrate fauna has been confined to salinity control, but it is hoped in a future paper to deal with certain phases of bottom control as has been done with the Bay of Fundy fauna at certain localities.[3]

The writer is indebted to Captain F. Anderson for various favours, including transportation for his party from Halifax to Rigolet. To Mr.

---

[1] Century "Atlas of the World." Edition of 1899, No. 59.

[2] Rand McNally Co.'s "Indexed Atlas of the World," vol. II, p. 317. The boundary shown on this map is assumed to be only approximately the same as that claimed by Canada.

[3] Kindle, E. M., "Bottom Control of Marine Faunas as Illustrated by Dredging in the Bay of Fundy." Am. Jour. Sci., 4th ser., vol. 41, pp. 449–461, 3 figs., May, 1916.

L. Bowes and other members of the Acadia staff he is indebted for geographical information concerning Lake Melville basin and particularly for the elevations of a number of mountain peaks near the shores of the lake which are shown on one of the maps in this report.

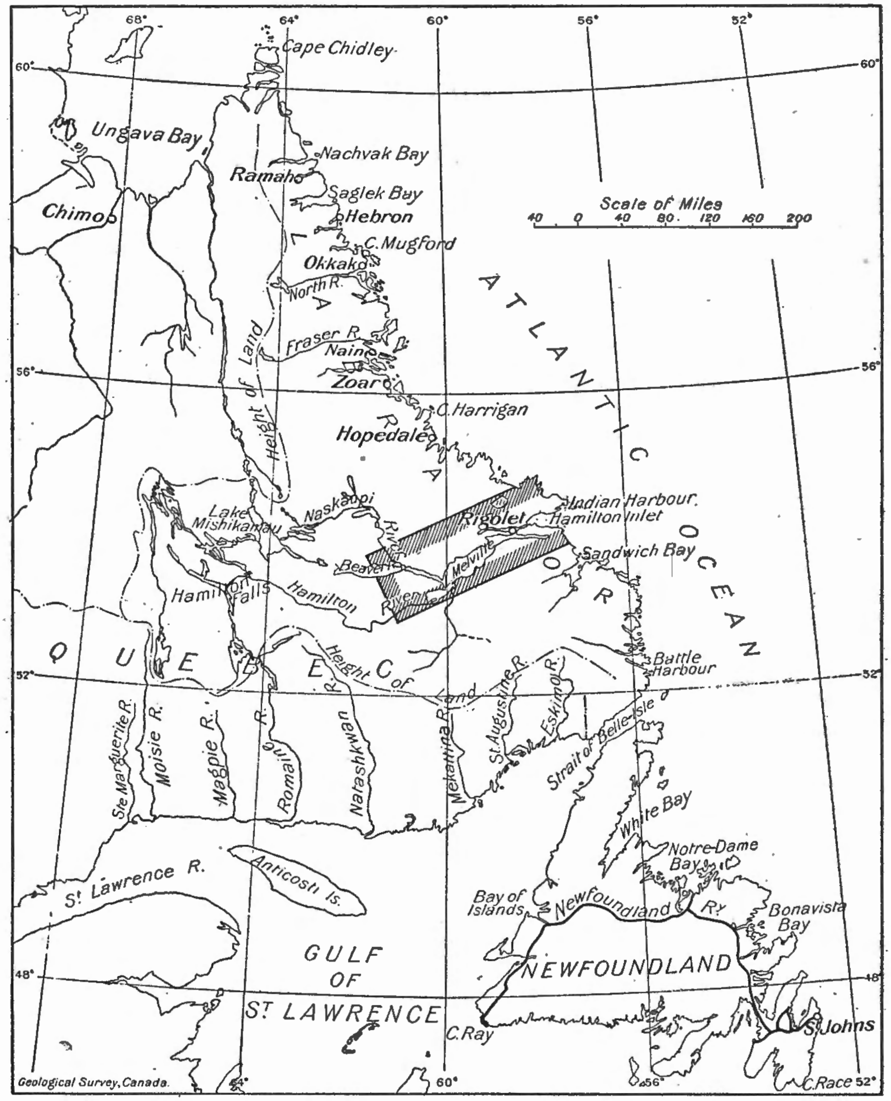


Figure 1. Index map showing by shading location of map-area described in report.

During the field work the writer traversed the north and south shores of lake Melville. The Backway and Double Mer were traversed, and some of the streams entering lake Melville ascended to the head of canoe navigation. Hamilton river was ascended to Muskrat falls. The entire length of Grand lake was traversed, and Naskaupi river, which enters this lake near its head, was ascended to the junction with the Red. A short canoe trip was made up the latter stream. The general geographic relations of the region examined are indicated on Figure 1. The areal relations of the formations recognized in the course of the writer's work, and the earlier work of Low in the interior and Packard on the coast are shown on Figure 4.

Numerous soundings and hydrometer readings were taken, and dredging was done at a number of points.

A list of plants collected by Mr. R. H. Wetmore, botanist of the expedition, representing the flora of the district, is included in this paper.

HISTORICAL REVIEW

EARLY EXPLORATION AND SETTLEMENT

Labrador has the paradoxical distinction of being the first discovered and one of the least known parts of North America.

The name Labrador appears to be derived from the Portuguese word *llavrador* meaning husbandman. It was a farmer (llavrador) from the Azores, according to the legend on the Wolfenbuttel map of 1534, "who first gave notice of seeing it."[1]

The early maps show Labrador as an extension of the Greenland coast.

Jacques Cartier and Martin Frobisher were among the early navigators who visited the coast of Labrador. Cartier characterized the country as "the land that God gave to Cain" and stated that there was "not one cartload of earth on the whole of it." He added, however, that "if the land were as good as its harbours it would be a good country."

The English navigator, John Cabot, who rediscovered Labrador in 1497, returned with glowing accounts of the abundance of cod-fish there. His son, Sebastien, reported the shoals of cod-fish so numerous that they "sometimes stayed his ships." French, Spanish, Portuguese, and English fishermen soon verified and utilized the immensely rich fisheries discovered by the Cabots. These have been continuously exploited down to the present.

Davis on his second voyage of discovery in 1586 appears to have been the first European to enter Hamilton inlet, which he called Ivucktoke inlet. The name Esquimaux bay was given to it by the French who preceded the English in the bay. It was in 1777 that an Englishman first wintered in the bay.[2]

A map made in 1703, by a Frenchman named Delisle, which shows Hamilton inlet as a long, narrow bay without any large river at its head, was one of the first maps to indicate clearly the location of lake Melville.

---

[1] There are six other theories regarding the origin of this word. *See* Proc. and Trans. Roy. Soc. Can., vol. 7, p. 52, 1890.

[2] Davies, W. H. A., "Notes on Esquimaux Bay and the Surrounding Country." Trans. Lit. and Hist. Soc., Quebec, vol. 4, p. 86, 1843.

The first maps of lake Melville having any approximation to accuracy were made by engineers of the British Admiralty; the second of these was published in 1860.[1]

Among the interesting names associated with the cartography of Labrador is that of the famous explorer Captain James Cook. In 1764 he received a commission as marine surveyor of Newfoundland and Labrador, "in which arduous service he continued until the winter of 1767."

The Hudson's Bay Company began to establish trading posts in Labrador at an early date. They acquired the Rigolet post in 1837, according to Davies.[2]

Packard[3] has summarized the work of the early explorers on the Labrador coast and published a very full list of the charts relating to the coast.

Low[4] reviewed briefly the work of the principal explorers who contributed to the knowledge of Labrador, previous to his own epoch-making expeditions.

W. S. Wallace[5] has clearly outlined the many interesting episodes which comprise the four hundred years of Labrador history, much of which directly relates to the fisheries or the fur trade.

Gosling's work[6] is by far the most voluminous discussion of Labrador's history.

LATER EXPLORATORY AND SCIENTIFIC WORK

John McLean, an agent of the Hudson's Bay Company, made extensive journeys in Labrador in 1838 and 1839, crossing from Ungava bay to Hamilton inlet and discovering Grand—now called Hamilton—falls of Hamilton river. McLean's[7] observations on the geology of the regions traversed are brief, but remarkably keen and significant in view of their early date.

Packard's work[8], which was done in 1860 and 1864, represents the pioneer work on the geology and natural history of eastern Labrador.

In 1887, R. F. Hólme[9] attempted to reach Hamilton falls and prepared a good map of Hamilton river as far as lake Winikapau. The map was published in the Transactions of the Royal Geographical Society.

Henry G. Bryant[10], and C. A. Kenaston ascended the river to Hamilton falls in 1891.

Our knowledge of the geology of the interior of Labrador dates from Low's work in the early nineties. His report is the only one which deals with Labrador peninsula as a whole.

The Brown-Harvard Expedition to Nachvak bay resulted in a list of the plants observed on the east coast, by E. B. Delabarre,[11] and a list of the coast birds, by Henry B. Bigelow.[12]

---

[1] Coast of Labrador, Sandwich Bay to Nain, including Hamilton Inlet, Admiralty, London, 1876, correction to 1881.

[2] Op. cit., p. 86. Mr. C. P. Plaxton states that the Hudson's Bay Company's records show that they acquired the Rigolet post in 1836.

[3] "The Labrador Coast," pp. 21–59, 1891.

[4] "Report on Explorations in the Labrador Peninsula," Geol. Surv., Can., vol. VIII, pp. 7L–19L, 1895–1897.

[5] "Labrador—The Country and the People," by W. T. Grenfell and others, pp. 1–36, 1910.

[6] "Labrador—Its Discovery, Exploration, and Development," 1910.

[7] "Notes of a Twenty-five Years' Service in the Hudson's Bay Territory", vol. II, p. 116: London, 1849.

[8] "The Labrador Coast," New York, 1891.

[9] "Journey in the Interior of Labrador, 1887," Roy. Geog. Soc. Proc., vol. 10, pp. 189–205, 1888.

[10] "Exploration in Southeastern Labrador," Geog. Soc. of Phil., Bull., vol. 11, pp. 1–15, 1913.

[11] Brown-Harvard Expedition, 1900: Geog. Soc. of Phil., Bull., vol. 3, pp. 167–201, 1902.

[12] "Report on Ornithology: Birds of the Northeastern Coast of Labrador", The Auk, 1902, vol. XIX, pp. 24-31. Rept. of the Brown-Harvard Expedition to Nachvak, Labrador. Bull. Geog. Soc. Phil., vol. 3, pp. 202–206, 1900.

Mrs. Leonidas Hubbard[1] is one of the notable later contributors to the geography of eastern Labrador. She traversed lake Melville and Grand lake, Naskaupi river, and George river to Ungava bay, and published a map of the waterways traversed.

No name is so well known and closely associated with Labrador as that of Dr. Wilfred T. Grenfell.[2] His book gives the results of his own intimate knowledge of the coast, its people and animal life, and includes chapters by well-known specialists on the insects, crustaceans, mammals, birds, flora, geology, and Indians.

The principal recent contributions to the geology of eastern Labrador are those of Daly[3] and Coleman.[4] Coleman's work was confined to the coastal strip and the high mountains of northeastern Labrador, but Daly's deals with nearly the entire eastern coast.

William B. Cabot[5] has for several years made the study of the Indians of Labrador the main objective of vacation trips to the region. His observations have appeared in a chapter of Dr. Grenfell's book and in a volume on Labrador which includes a sketch map showing the canoe route with connexions between Nain and George river.

BIBLIOGRAPHY[6]

Audubon, John J.—"Ornithological Biography, or An Account of the Habits of the Birds of the United States of America; Accompanied by Descriptions of the Objects Represented in the Work Entitled "Birds of America," and Interspersed with Delineations of American Scenery and Manners," vol. II, pp. 154, 522-533, 1834.

Babcock, W. H.—"Markland, Otherwise Newfoundland," Geographic Review, vol. 4, pp. 309-315, 1917.

Baillairgé, G. F.—"Imperial Statutes Relating to Labrador Since the British Conquest of Canada, 1760; Memoranda—Canada from the Atlantic to the Pacific and Arctic Oceans, Arctic Voyages, Voyages of Discovery in the North, and Public Works," Public Works Dept., p. 242, 1889.

Bell, Robert.—"Geology and Economic Minerals of Hudson Bay and Northern Canada," Roy. Soc. of Can. Proc., vol. 2, sect. 4, pp. 241-245, 1884.

"Observations on the Geology, Mineralogy, Zoology, and Botany of the Labrador Coast, Hudson's Strait and Bay," Geol. and Nat. Hist. Surv. of Can., Rept. of Progress, pt. DD, 1884.

"The Labrador Peninsula," Scottish Geog. Mag., vol. 11, pp. 335-361, map and illus., 1895.

Bent, A. C.—"Notes from Labrador," Bird Lore, vol. XV, pp. 11-15, 1913.

Bent, A. C., and Townsend, C. W.—"Additional Notes on the Birds of Labrador," Auk, vol. 27, pp. 1-18, Jan., 1910.

Bigelow, Henry B.—"Birds of the North Eastern Coast of Labrador," Auk, vol. XIX, pp. 24-31, 1902.

Brandenburg, Broughton.—"The Story of the Cod and His Foes," Metropolitan Mag., vol. XIX, No. 11, pp. 161-166, Nov., 1903.

Bryant, H. G.—"A Journey to the Grand Falls of Labrador," Geog. Soc. Phil., Bull., vol. 1, No. 2, pp. 37-84, 1894.

"Exploration in Southeastern Labrador," Geog. Soc. of Phil., Bull., vol. 11, pp. 1-15, (map at p. 62), 1913.

Bush, K. J.—"Catalogue of Mollusca . . . . Coast of Labrador," U.S. Nat. Mus. Proc., vol. 6, pp. 236-247, 1883.

---

[1] "Labrador from Lake Melville to Ungava Bay," Am. Geog. Soc. Bull., vol. 38, pp. 529-539, 1906.
[2] "Labrador—The Country and The People," pp. I-XII and 1-497, Macmillan Co., N.Y., 1910.
[3] "Geology of the Northeast Coast of Labrador," with plates, Mus. Comp. Zool., Bull., vol. 38, pp. 205-270, 1900-1903.
[4] Geol. Surv., Can., Mem. 124, 1921.
[5] "Labrador," Small, Maynard and Co., Boston, 1920.
[6] A complete bibliography up to 1891 has been published by Packard in "The Labrador Coast," 1891, pp. 475-501.

Cabot, William Brooks.—"Labrador," pp. 1-354, 2 maps. Small, Maynard and Co., Boston, 1920.
Cartwright, George.—"A Journal of Transactions and Events during a Residence of Nearly Sixteen Years on the Coast of Labrador, Containing Many Interesting Particulars Both of the Country and Its Inhabitants not Hitherto Known." 3 vols. 1792.
Cary, Austin.—"Geological Facts Noted on Grand River, Labrador," Amer. Jour. Sci., vol. 42, pp. 419-421, and 516, 1891.
"Exploration on Grand River, Labrador," Amer. Geog. Soc. Jour., vol. 24, pp. 1-17, 1892.
Chappell, Lt. Edward.—"Voyage of His Majesty's Ship Rosamund to Newfoundland and the Southern Coasts of Labrador." Printed for J. Mawman, London, Eng., 1818.
Chimmo, W. (Comm. H.M.S. "Gannett").—"Visit to Northeast Coast of Labrador," Roy. Geog. Soc. Jour., vol. 38, pp. 258-281 (with map), 1868.
Coleman, A. P.—"The Building of the Torngats," Can. Alpine Jour., vol. 7, pp. 67-70, 1916.
"Northeastern Part of Labrador and New Quebec," Geol. Surv., Can., Memoir 124, No. 106, Geol. Series, 1921.
Cooke, Wells W.—"Labrador Bird Notes," Auk, vol. 33, pp. 162-167, Apr., 1916.
Coues, Elliot.—"Notes on the Ornithology of Labrador," Proc. Acad. Nat. Sci. Phil., vol. xiii, pp. 215-257, 1861.
Daly, Reginald A.—"Geology of Northeast Coast of Labrador," with Plates, Mus. Comp. Zool. Bull., vol. 38, pp. 205-270, 1900-1903.
"Report on Geology," Bulletins of Geog. Club of Phil., vol. III, pp. 206-212, 1901-1903.
Davies, W. H. A.—Esquimaux Bay and Surrounding Country," Lit. and Hist. Soc., Quebec, vol. 4, pt. 1, pp. 70-94, 1843.
Dawson, S. E.—"Canada and Newfoundland," vol. 1, North America Stanford's Compendium, 1897.
Delabarre, E. B.—Brown-Harvard Expedition to Nachvak, Labrador, 1900: Geog. Soc. Phil., Bull., vol. 3, pp. 65-212, 1902.
England.—Supplement relating to the Newfoundland and Labrador Pilot, 1899. (England—Admiralty.)
Fernald, M. L.—"Harshberger's Phytogeographic Survey of North America," Rhodora (Book review), vol. XIII, pp. 213-224, Oct., 1911.
Fernald, M. L., and Sornberger, J. D.—"Some Recent Additions to the Labrador Flora." Reprinted from Ottawa Naturalist, vol. 13, pp. 89-107, July, 1899.
Flaherty, R. J.—"Two Traverses Across Ungava Peninsula, Labrador" (with map): Geog. Rev., vol. 6, pp. 116-132, 1918.
Ganong, W. F.—"Cartography of the Gulf of St. Lawrence from Cartier to Champlain," Proc. and Trans. Roy. Soc. Can., vol. VII, for 1889, 1890.
Gordon, Lt. A. R.—"Reports on the Hudson's Bay Expedition," Dept of Marine and Fisheries, Canada, 1884-1886.
Gosling, W. G.—"Labrador—Its Discovery, Exploration, and Development." 574 pp., London, 1910.
Grenfell, Dr. W. T.—"What's in Labrador," Can. Forestry Mag., vol. XVI, pp. 499-502, Nov., 1920.
Grenfell, Dr. W. T. and Others.—"Labrador, The Country and the People," pp. XII and 497, maps, illus., 6 appendices, and index. New York, 1910.
Hamilton, Capt. R. V.—"On the Portion of the Coast of Labrador Between Blanc Sablon Bay in Latitude 51° 20′ N. and Cape Harrison in lat. 55°N.", Proc. Roy. Geog. Soc. London, vol. IX, pp. 131-137, 1864-1865.
Hantzsch, B.—Beitrage zur Kenntniss des nordostlichen Labradors. Mitt des Verein fur Erdk. zu Dresden, Nos. 8 and 9, 1909 (English abstract in Bull. Amer. Geog. Soc., Sept., 1909).
Hind, H. Y.—"Explorations in the Interior of Labrador Peninsula," 2 vols., London, 1863.
"Explorations up the Moisie River to the Edge of the Table Land of Labrador Peninsula," Royal Geog. Soc. Jour., vol. 34, pp. 82-87 (with map), 1864.
"Observations on Supposed Glacial Drift in Labrador Peninsula," Can. Naturalist, 2nd ser., vol. 1, pp. 300-304, 1864.

Holme, R. F.—"Journey in the Interior of Labrador, 1887," Roy. Geog. Soc. Proc., vol. 10, pp. 189-205, 1888.

Hubbard, Mrs. Leonidas.—"Labrador from Lake Melville to Ungava Bay," Amer. Geog. Soc. Bull., vol. 38, pp. 529-539 (map at p. 529), 1906.

"A Woman's Way through Unknown Labrador: An Account of the Exploration of the Nascaupee and George Rivers," 305 pp. and 52 illus. and map. No index. New York, 1908.

Hurlbut, G. C.—"Geographical Notes on Labrador," Amer. Geog. Soc. Jour., vol. 23, pp. 455-458, 1891.

"The Name of Labrador," Amer. Geog. Soc. Jour., vol. 26, pp. 77-78, 1894.

Kendall, W. C.—"The Fishes of Labrador," Portland Soc. Nat. Hist., vol. 2, pt. 8, pp. 207-243, 1909.

Kindle, E. M.—"Notes on the Forests of Southeastern Labrador," Geog. Rev., vol. XII, No. 1, pp. 57-71, Jan., 1922.

Kumlien, Ludwig.—"Howgate Polar Expedition, 1877-78," U.S. Nat. Mus. Bull. 15, 1879.

Lieber, O. M.—"Geology of Coast of Labrador," U.S. Coast Survey Report, pp. 402-408, 1860.

Low, A. P.—"Report on Explorations in the Labrador Peninsula along the East Nain, Koksoak, Hamilton, Manicuagan, and Portions of Other Rivers in 1892-93-94-95," Geol. Surv., Can., Ann. Rept., vol. VIII, pp. 1 L-387 L, 1895.

"The Labrador Area," Ottawa Naturalist, vol. 10, pp. 208-216, Mar., 1897.

"The Cruise of the Neptune, 1903-1904," Govt. of Canada, pp. 1-355, 1906.

Packard, A. S.—"A List of Animals Dredged Near Caribou Island, Southern Labrador, during July and August, 1860," Can. Nat. and Geol., vol. VIII, pp. 401-429, Dec., 1863.

"Observations on the Glacial Phenomena of Labrador and Maine With a View of the Recent Invertebrate Fauna of Labrador," Boston Soc. Nat. Hist. Memoirs, vol. 1, pp. 210-303, 1866-1869.

"Glacial Marks in Labrador," Amer. Nat., vol. 16, pp. 30-33, 1882.

"Notes on the Physical Geography of Labrador," Amer. Geog. Soc. Jour., vol. 19, pp. 403-422 (map at 448), 1887.

"Who First Saw the Labrador Coast?" Amer. Geog. Soc. Jour., vol. 20, pp. 197-207, 1888.

"Geographical Evolution of Labrador," Amer. Geog. Soc. Jour., vol. 20, pp. 208-230, 1888.

"The Labrador Coast—A Journal of Two Summer Cruises to that Region," pp. 1-513. New York, 1891.

Pedley, Chas.—"History of Newfoundland from Earliest Times to 1860," 531 pp., London, 1863.

Prichard, H. Hesketh.—"Through Trackless Labrador," with a Chapter on Fishing by G. M. Gathorne-Hardy, 244 pp. New York, 1911.

Prowse, D. W.—"A History of Newfoundland from the English, Colonial, and Foreign Records," 634 pp. London, 1896.

"Newfoundland Guide Book, including Labrador," 1905.

Quebec.—"Extracts on the District of Ungava . . . Territory of New Quebec," Dept. of Col., Mines, and Fish., Quebec, Mines Br., 1913, 1915.

Ross, A. H. D.—"The Forest Resources of the Labrador Peninsula," Can. Forestry Jour., pp. 28-37. Jan., 1905.

Rouillard, Eugéne.—"La Cote Nord du Saint-Laurent et le Labrador Canadien," 188 pp., map, illus. and indices. Quebec, Dept. Colonization and Mines, 1908.

Ruedemann, Rudolph.—"On Some Fundamentals of Pre-cambrian Palæogeography," Proc. Nat. Acad. Sci., vol. 5, pp. 1-6, Jan., 1919.

Stearns, Winfrid Alden.—"Notes on the Natural History of Labrador," Proc. U.S. Nat. Mus., vol. VI, pp. 111-137, 1883.

"Labrador—A Sketch of Its Peoples, Its Industries, and Its Natural History," New York, 1884.

Stein, R.—"Bernard Hantzsch's Notes on Northeastern Labrador," Bull. Amer. Geog. Soc., vol. XLI, pp. 566-575, 1909.

Stosch, Lieut.—"In den Gewassern von Labrador," Gaea norvegica, No. 5, 1909.

Tarr, Ralph S.—"Rapidity of Weathering and Stream Erosion in the Arctic Latitudes," Amer. Geol., vol. XIX, pp. 131-136, pl. VI, Feb., 1897.

Tarr, Ralph S.—"The Arctic Sea Ice as a Geological Agent," Amer. Jour. Sci., vol. III, pp. 223-229, Mar., 1897.
"Evidences of Glaciation in Labrador and Baffin Land," Amer. Geol., vol. XIX, pp. 190–197, Mar., 1897.
Difference in the Climate of the Greenland and American Sides of Davis' and Baffin's Bay", Amer. Jour. Sci., vol. III, pp. 315–320, Apr., 1897.
Townsend, Chas. W.—"A Labrador Spring", 262 pp., Boston, 1910.
"Captain Cartwright and his Labrador Journal, edited by *Chas. W. Townsend*, with an introduction by Dr. Wilfred Grenfell", 3 vols.—vol. 1, "Labrador, Description and Travels;" vol. 2, "Frontier and Pioneer Life, Labrador;" vol. 3, "Hunting, Labrador," 1911.
"A Short Trip into Labrador by Way of the Natashquan River," Bull. Geog. Soc. Phil., vol. XI, pp. 170–182, 1913.
"Some More Labrador Notes," Auk, vol. 30, pp. 1–10, Jan., 1913.
"In Audubon's Labrador," 353 pp., Cambridge, 1918.
Turner, L. M.—"Physical and Zoological Character of Ungava District, Labrador," Roy. Soc. Can. Proc., vol. 5, sect. IV, pp. 79-83, 1887.
Wallace, Dillon.—"The Long Labrador Trail," 315 pp. Outing Publishing Co., 1907.
Weiz, Rev. Samuel.—"List of Vertebrates Observed at Okak, Labrador, with Annotations by A. S. Packard, Jr.," Proc. Nat. Hist. Soc. Boston, vol. X, pp. 264-277, 1864-1866.
White, James.—"Boundary Disputes and Treaties," Canada and Its Provinces, vol. VIII, pp. 751-958. Toronto, 1913.
Zon, Raphael and Sparhawk, W. N.—"Forest Resources of the World," vol. II, pp. 518-519, pl. X, New York, 1923.
"Explorations in Newfoundland and Labrador in 1887, made in Connection With the Cruise of the U.S. Fish Commission Schooner *Grampus*," Rept. Smithsonian Inst., pp. 709-728, 1889.

MAJOR GEOLOGICAL EVENTS

In Labrador, where man is still in the hunting and fishing stage of development, human history moves slowly, but its geological history has unfolded even more slowly. The latest important events in the geological record date far back of the days of Lief and other bold Norse explorers, who appear to have visited the coast about one thousand years ago. Far older than this earliest recorded human event in the region is the latest chapter of the geological history of Labrador, which relates to the uplift of the coast following its subsidence at the end of the Glacial period.

The story of Labrador's recent geological history is recorded on the bleak and barren cliffs of the eastern coast in bold and legible characters. No fisherman can fail to recognize the autograph of the sea in the elevated boulder beaches and terraces of sand (Figures 2, 8, 9) which may be seen in many places 200 feet or more above the present sea-level. These elevated sea-beaches, which at scores of localities look almost as fresh and perfectly preserved as those now being built, demonstrate that the eastern coast-line has risen 300 feet or more in Hamilton Inlet district. This emergence of the land, and the disappearance of the ice-sheet, together form the latest important events in the geological history of Labrador. This chapter takes us back only a few thousand years—eight or ten perhaps —to the glacial period, during which, as a result of the annual snowfall exceeding slightly the annual melting power of the sun, nearly the whole peninsula became covered with an ice-cap many hundreds of feet thick. The striæ or grooves cut in the solid rock by the pebbles and boulders frozen in the glaciers of this cap may be seen wherever frost action has not destroyed them.

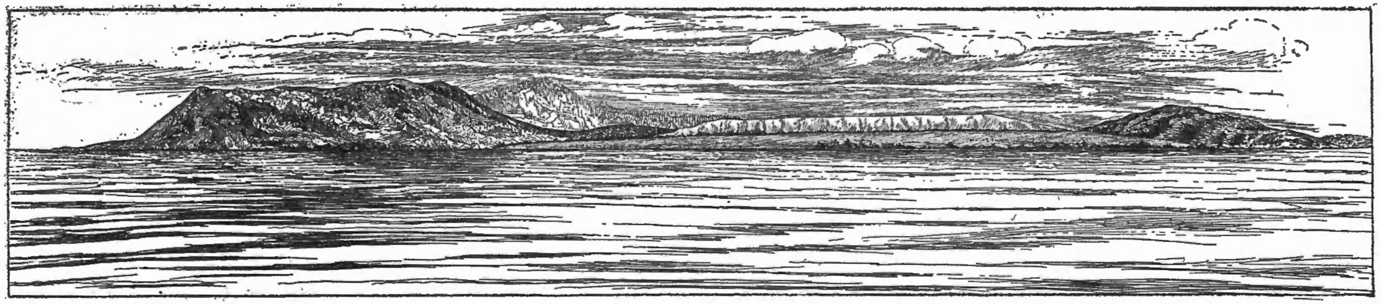


Figure 2. General view of the south side of The Narrows showing sand-terraces.

These two chapters in Labrador's geological history—the glacial epoch and the depression and re-elevation of the land—carry us back only a little way in Labrador's history, no more than 100,000 years or so.

The sculpturing of many of the great valleys and the building of the bedrock formations out of which they are carved are processes which reach well back toward the early epochs of geological time and represent a period not of thousands but of millions of years.

GEOGRAPHY

LOCATION, TRANSPORTATION, AND COMMUNICATION

Hamilton inlet is located about 200 miles north of the strait of Belle Isle. Lake Melville and Hamilton inlet together afford a continuous waterway which permits sea-going vessels to penetrate about 150 miles inland beyond the outer islands (Plates I and II A). The entire eastern coast-line of Labrador is a succession of deep bays, inlets, and fringing islands, but nowhere else on the coast are there navigable waters so far inland. The general relations of the region under consideration in this report are indicated in Figure 1.

Lake Melville region is relatively accessible and may be reached by steamers of the Newfoundland Government sailing from St. Johns on the east coast and from Curling on the west coast of Newfoundland. From Canadian points the Curling route is the more direct and involves a steamer trip from North Sydney, Cape Breton island, to Port aux Basques, and a railway journey thence to Curling. A steamer service at intervals of seven to ten days was maintained during the summer of 1921. Rigolet (Plate IX A) and Indian harbour are ports of call for these vessels. Northwest River and other points in the region can be reached by the gasoline launch that carries the mail. Most of the fishermen reach their summer stations in schooners.

A wireless station maintained by the Newfoundland Government is located at Indian Harbour in Hamilton inlet.

In winter the only communication with the outside world s by dog team. Mail is sent up the coast in winter by this method as far as Rigolet.

TOPOGRAPHY AND DRAINAGE

General Relations. The work of Low, Hind, Cabot, and others who have penetrated far into the interior of Labrador, indicates that the southern two-thirds of the peninsula is a plateau that in few places rises more than 2,000 feet above sea-level. Lake Melville region lies on the eastern border of this plateau. The major part of it may be regarded as belonging to the marginal part of this extensive plateau, where wide and deep valleys become dominant geographical features. This region is deeply incised by three valleys directly connected with the sea (Figure 4) and by numerous minor ones. Two of these valleys, Lake Melville and Double Mer, are bordered along part of their northern sides by lowlands a few miles wide, rising from 50 to 200 feet above sea-level. These lowland plains, which may be called the Lake Melville and the Double Mer lowlands, are cut in sedimentary rocks which may be of Cambrian age.

Relief. The mountains of the plateau margin are composed of crystalline rocks of Precambrian age and rise near the valleys as a rule from 800 to 2,000 feet A.T. A few of the higher peaks stand more than 3,000 feet above the sea (Figure 3).

A group of mountain summits located about 35 miles north of The Narrows show points quite near the coast which are marked 2,000, 2,280, and 2,430 feet respectively on the navigation chart.[1]

The most striking topographic feature of the region is the great depth to which the fiord-like valleys extend below the level of the adjacent plateau margin.

Bold, rocky shores, rising a few hundred feet above tide, border Hamilton inlet, which is dotted with numerous islands rising from a shallow bay. The elevations increase in a southwesterly direction from Hamilton inlet. The highest point near The Narrows is 1,000 feet A.T., and south of Henrietta island and The Backway, elevations of 1,100 to 1,350 feet occur.

Mealy mountains, bordering the south shore of lake Melville, constitute the most prominent topographic feature of the region. Seven peaks south of the eastern end of lake Melville exceed 3,000 feet, the highest rising 3,800 feet A.T.

These mountains rise steeply from the shore of the lake and the lowland which borders the western part of it for a distance of 60 miles west of Henrietta island. Davies, who was one of the first to publish a description of these mountains, gives the following account of the significance of the name and the winter aspect of Mealy mountains. " . . . There is an interval of about fifteen to twenty days at the latter end of August and first days of September when they are free from snow except in the deep ravines, where the snow remains constantly. They derive their name, I believe from the patches of snow distributed over their surface during the greatest part of the summer, giving them the appearance of being powdered over with meal. When viewed in winter, in fine weather, at the time of sunset, these mountains present scenes of great beauty; and it is difficult for the imagination to conceive anything more beautiful than the tints that their summits assume as they are touched by the last rays of the setting sun, long after he has disappeared from the eye, while every little ravine, every inequality in their surface, is chiselled out against the clear, cold sky with a precision and vividness that are alike beautiful and wonderful."[2] The highest points stand a few miles back from the front of this wall. About 10 miles west of Long point a lowland begins which lies between the mountains and the lake (Plate III). This plain consists of Pleistocene sand and clay deposits with an average elevation of perhaps 50 feet, and reaches a maximum width of about 15 miles in the vicinity of Carter basin. It extends beyond the western end of the lake up Hamilton valley about 10 miles, until it terminates at the sides of the schistose hills that closely approach Hamilton river 10 or 12 miles above its mouth.

Davies states that "After passing the first range of mountains, on leaving the bay (lake Melville), an elevated plateau is gained, which

[1] British Admiralty Chart 375. Sandwich Bay to Nain.
[2] Davies, W. H. A., "Notes on Esquimaux Bay and the Surrounding Country," Trans. Lit. and Hist. Soc. of Quebec, vol. IV, pt. 1, p. 73, 1843.

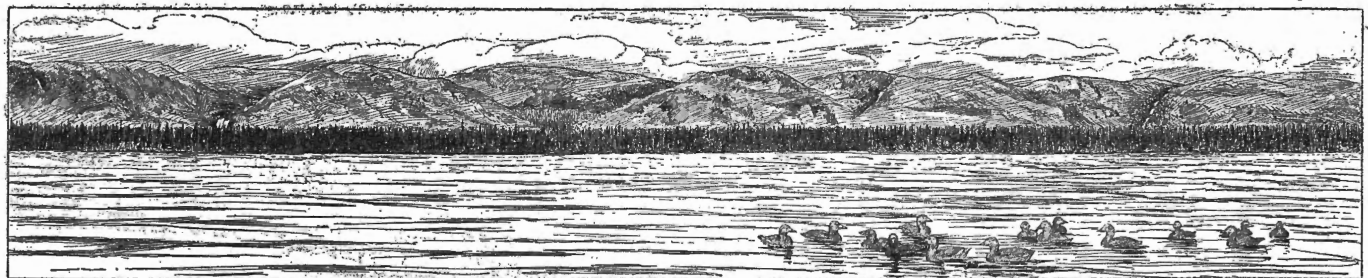


Figure 3. Mealy mountains, west of Esquimo Paps, south side of lake Melville, showing forested lowland at their base.

continues until the shores of the gulf of St. Lawrence are approached, when the country becomes more mountainous and slopes rapidly to the seaside; the breadth of the plateau may be about 140 miles—it abounds with lakes, some of them of considerable size, but so shallow that, according to the gentleman who explored it by my orders, 'they might rather be called swamps overflowed with water than lakes'."[1]

On the north side of lake Melville the mountains lack the scarp-like regularity of outline which they show on the opposite side of the lake.

Between Lowland point and Mulligan bay the highlands retreat from the shore a few miles, and farther west tend to break up into isolated knobs, of which Mulligan hills and Mokami hill (1,590 feet A.T.) are striking examples. Lake Melville lowland which has been etched into the Double Mer sandstone, lies between the lake and the margin of the highlands.

The physical features impressed on the geography of Labrador in Preglacial time are not masked to any great extent, as they are in many other glaciated regions, by deposits of the Ice age. Aside from transported boulders which encumber the surface nearly everywhere, glacial deposits are extremely rare.

Bare, rocky slopes are met with nearly everywhere on the mountains which are free of superficial deposits, except where sand or clay terraces have been built during Postglacial time along the lower 300 feet of the hill and mountain slopes.

The principal topographic features of this region are considered to be the joint product of structural features and pre-Quaternary erosion action on sharply contrasted rock types, modified by glacial action only in minor details.

Lakes and Sea-Connected Valleys. The interior of Labrador peninsula "is covered with myriads of lakes that occupy at a moderate estimate at least one-quarter of the total area."[2] Nearly all these are shallow lakes, the product of glacial damming, or rock basins. A few, however, are more than 400 feet deep, like lake Winikapau, an expansion of Hamilton river, 100 miles west of lake Melville. Small lakes are numerous in Lake Melville region; nearly every brook flows into or out of one.

The very deep, fiord-like lakes connected with or near Hamilton inlet constitute one of the most prominent geographical features (Plate I and Figure 4). There are four of these deep waterways known respectively as Grand lake, lake Melville, The Backway, and Double Mer (Figure 4). All the rivers and streams of the region flow through or empty into these deep, narrow waterways. Grand lake, which is entirely fresh, has a depth of 90 fathoms, and a length of about 40 miles. Lake Melville, into which Grand lake empties, is a tidal lake and shows a maximum depth of 160 fathoms. The Backway, at least 80 fathoms deep, is a narrow arm connected with the eastern end of lake Melville. Double Mer approaches more closely than the others the fiord type (*See* Plate I), but the maximum depth found is only 46 fathoms.

The great depth of lake Melville allies it on the one hand with the fiords of Norway and on the other with the deep inland lakes and rivers

[1] Davies, W. H. A., Op. cit., p. 80.
[2] Low, A. P., "Report on Explorations in the Labrador Peninsula along the East Nain, Koksoak, Hamilton, Manicuagan, and Portions of Other Rivers," Geol. Surv., Can., Ann. Rept., vol. 8, p. 23 L, 1895.

of Quebec. The lake extends nearly 1,000 feet below sea-level and with its steep mountain scarp rising nearly 2 000 feet above it on the south side, recalls the gorge of Saguenay river which reaches, in places, 800 feet below sea-level and is rimmed with nearly vertical walls rising 1,500 feet above the surface. The Norwegian fiords deepen greatly inside their portals. In Sogne fiord the water near the entrance is less than 600 feet deep, whereas 25 miles inland the depth is nearly 4,000 feet. Lake Melville shows a similar shallow outlet and deep interior basin. The Narrows which connect it with the sea have a depth of only 9 to 30 fathoms near Rigolet. Less than 10 miles west of this shallow water the basin deepens to 160 fathoms and seawards it expands into the relatively shallow coastal indentation called Hamilton inlet, where depths of 20 to 40 fathoms prevail.

The term fiord, however, appears inapplicable to lake Melville, if we accept Professor Gregory's definition, in spite of its great depth and the shallow, sill-like outlet. According to Gregory, "no great river flows into a fiord for the main drainage of the land is away from the fiord coast."[1] One of the largest rivers in Labrador peninsula flows into lake Melville and the main drainage of this region is toward the coast which rises rapidly inland along the eastern part of Lake Melville valley. It appears, therefore, that lake Melville can be more properly regarded as a lake-like expansion of the Hamilton than as a fiord.

The Spanish term "ria" has been rather widely used by geographers for indentations of the seashore that contrast in important features with fiords which they somewhat closely resemble. According to Professor Penck their indentations never extend so deeply into the land and "they increase outward both in depth and width, so that they widen seaward like a funnel."[2] A better short description of Hamilton inlet than this would be difficult to write. A dictionary definition defines "ria" as a river mouth[3] and Gregory states that "they usually receive large rivers and the drainage of the adjacent country."[4] Hamilton inlet receives the drainage of Hamilton river as well as Double Mer and appears to be a typical ria.

The preceding discussion appears to show that Hamilton inlet belongs with the class of seashore indentations called rias and that physiographers would consider at least its outer shores to be a part of the seacoast. The outlet of lake Melville, which is known as The Narrows, is, at Rigolet, rather narrower than parts of the channel of lower Hamilton river before it expands into lake Melville. Since neither the lake nor The Narrows conforms even approximately with the definition of a fiord, The Narrows may be technically regarded as the mouth or outlet of greater Hamilton river enlarged by the waters of Grand lake, Kenamu and Kenemich rivers (which join the Hamilton north and east of Goose bay). From the standpoint of a physiographer the term seacoast would, therefore, not be applicable beyond or southwest of the junction of The Narrows and Hamilton inlet.

Hanging Valleys. On the south side of lake Melville nearly all the smaller streams descend the steep northward-facing slopes of Mealy

[1] Gregory, J. W., "Nature and Origin of Fiords," p. 66, London, 1913.
[2] Penck, A., Morphologie der Erdoberfläche, vol. II, p. 566, 1894.
[3] Univ. Dictionary, vol. 8, 1908.
[4] Gregory, J. W., "Nature and Origin of Fiords", p. 70, London, 1913.

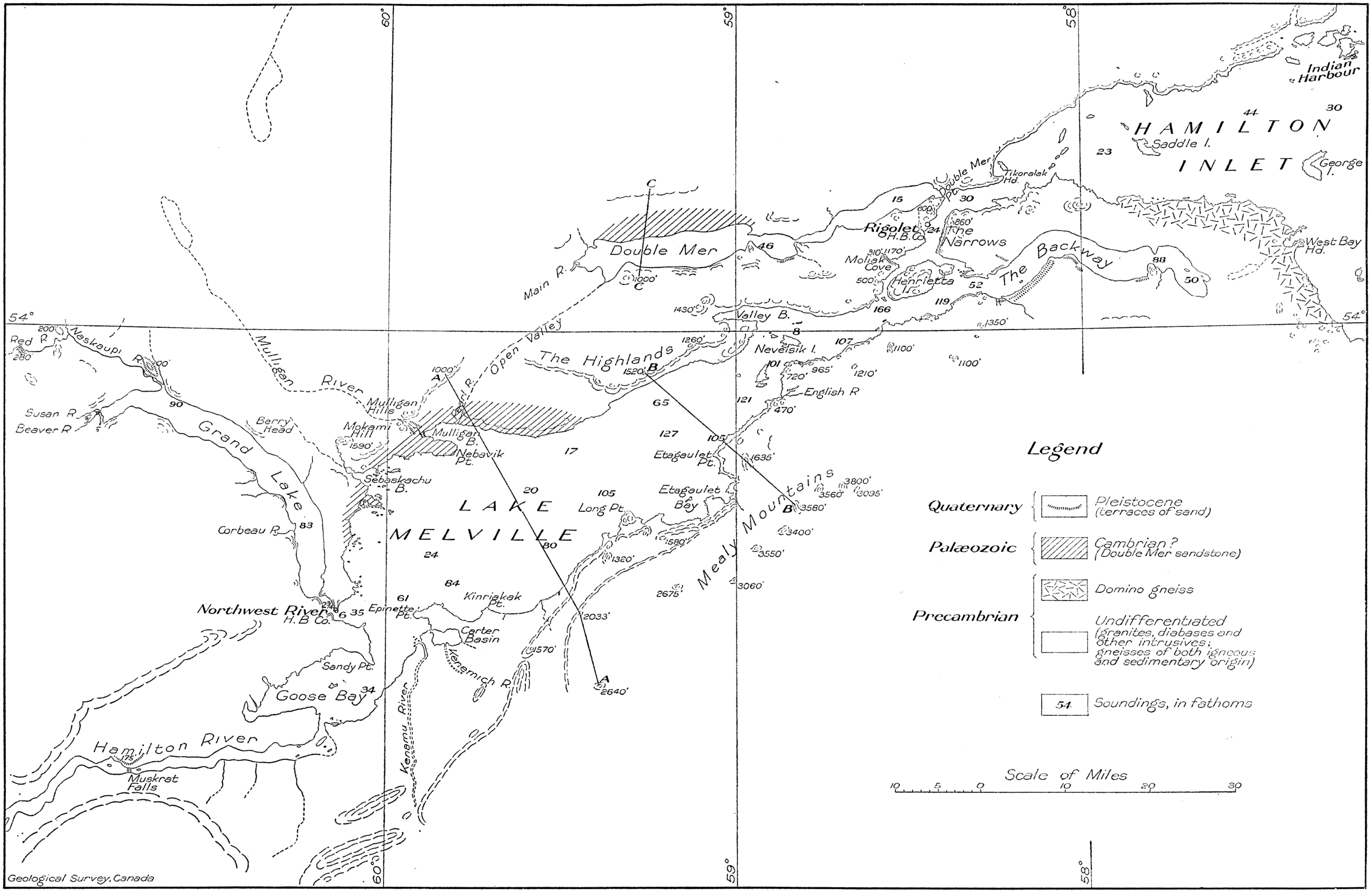


Figure 4. Sketch map of waterways connected with Hamilton inlet, showing areal distribution of Palæozoic rocks, conspicuous sand-terraces, and representative soundings. From surveys by A. P. Low and E. M. Kindle, Geological Survey, and from chart by the Department of Naval Service.

mountains by a series of rapids and falls. On a bright day several of the waterfalls, gleaming in the sun, may be seen from the north side of the lake at a distance of 20 miles or more. The mountain front between Little river and Long point is marked by four or five small streams which descend by a series of cascades. The largest of these descends by six falls and intervening rapids from an elevation of 800 feet or more.

Kenamu river, by far the largest stream entering lake Melville from the south, is the only north-flowing stream which has a valley cut approximately to grade. The deep V-shaped gorge by which it crosses Mealy mountains can be seen at a great distance.

The high, scarp-like mountain slope, which borders more than half the south side of Double Mer, is characterized, like the south side of lake Melville, by streams with hanging valleys. The contrasting types of topography on the two sides of this waterway are shown in Figure 7.

In both Lake Melville and Double Mer basins the north shores are without hanging valleys and have only streams with valleys of normal type cut to grade. The significance of these contrasts will be considered in discussing the drainage history of the region.

Through Valleys. Valleys which extend uninterruptedly through from one drainage system to another have been called "through valleys" by Professor W. M. Davis. An example of this type of valley connects Double Mer and Lake Melville basins, cutting through the highland which separates these two basins as a broad, open valley which reaches lake Melville on the east side of Mulligan bay (*See* Figure 4). Relatively small streams occupy the opposite ends of the valley, one flowing into lake Melville, and the other into Double Mer. The statements of trappers indicate that other through valleys occur in the same general region. The valley with the small lake back of Rigolet appears to be one of these.

DRAINAGE DEVELOPMENT

The drainage system of this region, as it existed at the close of the Tertiary period, was the result of subaerial erosion directed or controlled by the structural features of the district. Nearly all the bolder and more fundamental features of the present drainage system probably developed during the Tertiary period. The old valleys of Tertiary date were, however, profoundly modified by the work of the ice during the Glacial period and by marine deposits still later. Re-elevation has given, as the product of this complex threefold ancestry, the present drainage system.

The valley of the Hamilton and its wide expansion, lake Melville, is the dominant or trunk valley of the region. The valleys that join the northwest and southeast sides of this great valley are of surprisingly contrasted types. On the northwest side occur wide, mature valleys like Grand Lake-Naskaupi valley, whereas the hanging valley descending the steep slopes by a series of cascades is the common type on the southeast side. The Kenamu, the largest southern tributary, enters Hamilton valley through a deep gorge. Double Mer, the only large valley outletting to the sea independently of the Hamilton system, duplicates in a smaller way on its northern and southern sides the contrasted types of valley shown by the two sides of lake Melville. Its streams, however, except the one at its head, are of rather insignificant size.

78863—2½

The explanation of these and some other features of the drainage is to be found in structural features of Pre-Tertiary origin. The steep, scarp-like, northwest face of Mealy Mountain highland and the equally steep mountain face which borders much of the south side of Double Mer are considered to be fault scarps which are probably of Pre-Tertiary age. The lowlands cut in the sandstone which floors the north sides of both of these valleys are terminated on the north by abruptly rising mountains of Precambrian rocks. The contact between these Precambrian mountains and the sandstone in both cases is believed to be a fault-plane. The wider parts of both Double Mer and Lake Melville basins are believed to be defined by fault-planes which have dropped down two large blocks (*See* Figure 5 A and C). On the relatively soft Palæozoic beds of these younger rocks have been cut the Double Mer and Lake Melville lowlands which are considered to be limited in part at least by fault-planes, as indicated in Figure 5 A and C. The effect of the downfaulting of these blocks was to bring in contact two strongly contrasted types of rock—the Double Mer sandstone and the Precambrian schists. Differential erosion in Tertiary and earlier times developed on these sandstones and other superposed and probably softer beds now entirely vanished, the relatively wide valleys which came in late Quaternary times to be occupied by lake Melville and Double Mer waterways.

In the bed of lake Melville the soundings made by the hydrographic engineers show clearly the location of three distinct valleys which occupied the broad western half of this basin in Preglacial time. Two of the three depressions representing them (Figure 5 A) can be followed by the soundings to the mouths of Mulligan and Sebaskachu rivers. The third, which is near the south side of the lake, corresponds to the original valley of Hamilton river. These three old Preglacial valleys which the lake soundings disclose in the widest part of the lake draw together in a seaward direction after the usual style of river valleys and where the lake grows narrower, east of Long point, unite into a single valley a few miles west of St. John island. This represents the old Preglacial trunk stream of Hamilton river. A cross-section of this part of the lake is shown in Figure 5 B.

The three valleys recognizable in the soundings of lake Melville referred to above may be more precisely described as modified Preglacial valleys. Details of these valleys have been changed by lake deposits since, and by ice erosion before, the departure of the glacial ice-cap. For long periods during the early and late stages of the glacial epoch, valley glaciers were undoubtedly active in deepening these three valleys as their separate ice streams flowed into the main trunk valley. While Lake Melville valley was completely ice filled, differential deepening of these individual valleys probably ceased and differential deepening probably then occurred chiefly at certain points in the main valley.

The valley occupied by Grand lake and the lower part of Naskaupi river is, after that of Hamilton river, the largest valley in the region, and trends nearly at right angles to Hamilton River and Lake Melville valley. Its direction corresponds in a general way with the strike of the gneissic rocks which the valley traverses. The northwesterly strike and southwesterly dip of the rocks appear very clearly to have controlled the trend

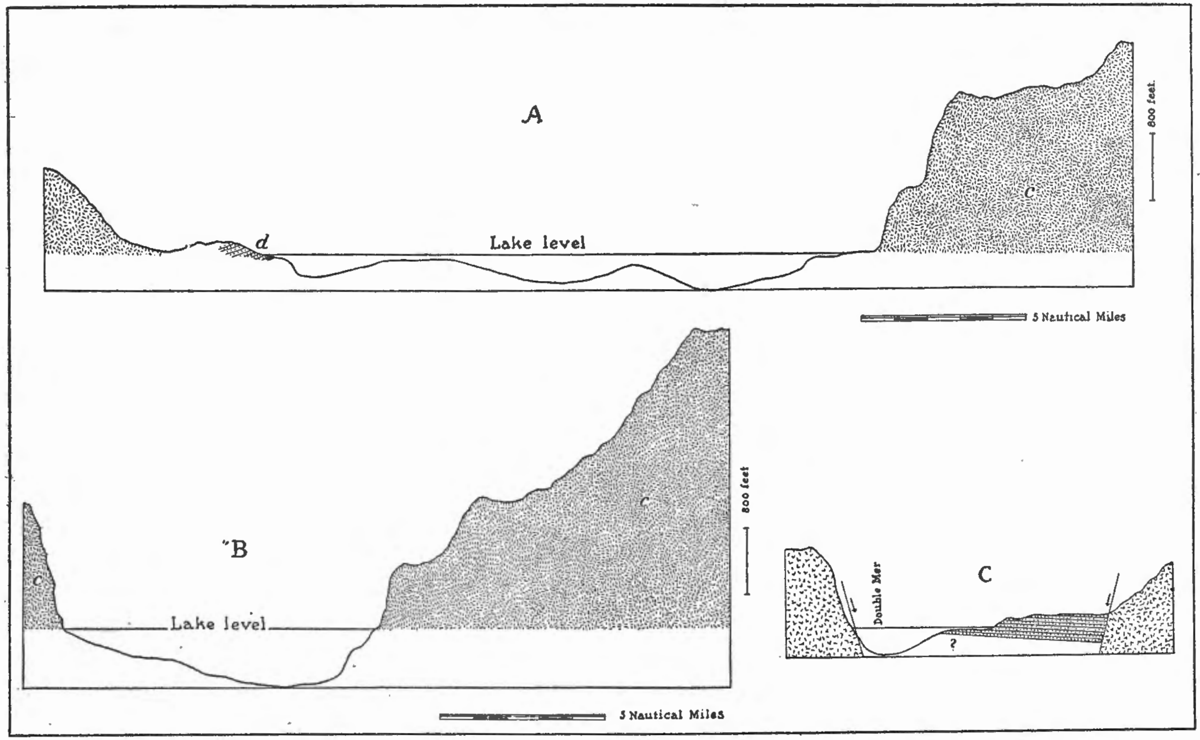


Figure 5. Cross-sections of Lake Melville valley and Double Mer.

A. Section east of Mulligan bay, showing Palæozoic sandstone (d), Precambrian rocks (c), and three Pre-Quaternary valleys in lake bottom.
B. Section 11 miles west of Neveisik island where the three valleys have united into one cut in Precambrian rocks.
C. Diagrammatic cross-section of Double Mer showing inferred faults and the structural relations of the Double Mer sandstone and the Precambrian rocks.

of Grand lake. All the promontories on the west side of the lake present distinctly steeper profiles than the slopes of those on the opposite side, as would be expected in such a strike valley.

The major features of the drainage system of this region, which were developed in Preglacial time as outlined above, were modified in many details by the covering of the Labrador ice-sheet. During the period when the region was covered by an ice-sheet and in the intervals between possible withdrawals and re-advances of the great ice-sheet of eastern North America, many modifications and minor changes occurred in that valley. These changes in the old Tertiary drainage system included the local deepening of valleys by glacial scour and the partial filling of valleys with glacial debris elsewhere. This cut-and-fill process, which the great valley glaciers continued for long periods both before and after maximum glaciation, transformed, in the interior, the normal rivers of Tertiary time into streams with numerous lake-like expansions. Other profound modifications of the valleys were produced during Pleistocene time when the whole region was depressed about 300 feet. It was at this time that the great system of sand-terraces and marine and freshwater clays was added to the valleys.

In spite of the extensive character of the changes locally developed in the drainage system which Tertiary and earlier erosion has impressed on the region, the wide, mature valleys of preglacial origin are easily distinguished as to age from the narrow V-shaped gorge of Kenamu river, which has been developed in Quaternary time. There can be no doubt that Naskaupi and Hamilton valleys within the limits of the accompanying map (Figure 4) are preglacial valleys and that Grand Lake and Lake Melville basins are parts of the old valleys of these two major rivers and their tributaries. The Naskaupi flows through a broad, mature valley for 18 or 20 miles above its mouth, which is as far as the writer traversed it. This old valley, and the valley formed by the junction of Susan and Beaver rivers at the western end of Grand lake, unite near the upper end of Grand lake, forming Grand Lake valley which is comparable in width with Naskaupi valley and represents its continuation. The preglacial Naskaupi river joined the Hamilton in late Tertiary time somewhere near Goose bay. These two, combined probably with the Kenamu, whose Pre-Quaternary valley is unknown, formed the preglacial Hamilton. This stream, which was the main trunk river of eastern Labrador, flowed through the wide, deep valley of Lake Melville basin and reached the sea via The Backway valley. The inference that the preglacial Hamilton flowed seawards by The Backway instead of by The Narrows, as it now does, is based on the much greater width and depth of The Backway, and the fact that the land is very low between the seashore and the eastern end of The Backway. The Narrows was probably developed either in late Tertiary time or during some stage of the Glacial period as a through valley connecting Double Mer and Hamilton valleys just as they are connected by a through valley which joins the upper end of Double Mer and Mulligan bay (*See* Figure 4). When the final retreat of great valley glaciers which marked the late stages of glaciation began it may be presumed that the high mountains southwest of The Backway, together with the mountain ridge immediately north of the western half of it, supplied an abundance of glacial ice to the terminal end of Hamilton valley, which kept it blocked for a long period after the ice-sheet had vanished from much of the adjacent parts of the valley. This situation would have compelled the restored river to seek a new outlet to the sea by any low divide or through any valley which it found free of ice. It is the writer's opinion that a pre-existing valley, corresponding in position with the present Narrows and the waterways on the northern and southern sides of Henrietta island, was appropriated by Hamilton river while the original terminal section of the stream was ice-dammed. When the ice finally withdrew from The Backway its outlet was blocked with glacial debris, and the new channel had been sufficiently deepened to prevent the river from resuming its old outlet to the sea.

When Hamilton river returned to its old channel after the valley glaciers had finally disappeared it was not the graded channel it had left at the beginning of the Ice age, but a basin irregularly deepened and widened by the scouring work of the ice (*See* Figures 4 and 5 A and B). Near Henrietta island this basin has a depth of nearly 1,000 feet. It seems most probable that much of this great depth represents glacial overdeepening. If it represented the original depth of the old Preglacial Hamilton valley cut when the land stood 1,000 feet higher than at present, comparable soundings should be found in the broad, shallow sea zone in Hamilton inlet, or south of it. But no depths approaching this have been found either here or elsewhere between the coast-line and the margin of the continental shelf. The navigation sheet shows that the prevailing depths of the sea within 2 miles of the shore range as a rule between 20 and 50 fathoms. Along the axis of lake Melville and Grand lake for a distance of 125 miles soundings are found ranging from 80 to 160 fathoms. Since no comparable depths are known outside the shallow sill of The Narrows, which separates Lake Melville and Grand Lake basins from the sea, the great depths of these waterways appear to be referable mainly to overdeepening by glacial erosion.

This glacial erosion has doubtless been most intense and profound in those parts of the valley where structural features have resulted in valley floors of relatively soft or easily eroded rocks. In Double Mer and Lake Melville basins the Double Mer sandstone and possibly other softer and now completely removed formations have supplied this factor leading to overdeepening. The convergence of valley ice streams at certain angles may have added locally to their erosive power.

The Labrador coast has all the characteristics of a drowned shore-line. The islands forming a belt nearly 50 miles wide at Hamilton inlet and rising from a shallow sea, and the numerous indentations of the coast-line represent the subsidence of an old land surface which left only the higher points projecting as islands. This subsidence truncated the seaward ends of many rivers. The converging trends of Sandwich bay, The Backway, and the south shore of Hamilton inlet suggest that the streams which these several shore-lines represented previous to the depression of the coast may have united into a single stream somewhere east of Stag islands. The late Pleistocene re-elevation of the coast, amounting to a little more than 300 feet, has caused a retreat of the valley arms of the sea from their earlier extension far up Hamilton and Naskaupi valleys. If there should be a further coastal elevation of 200 feet or more, the mouth of the Hamilton will again approximate its preglacial location somewhere in the eastern part of Hamilton inlet or farther south.

CLIMATE

The coastal strip and the interior of Labrador present surprising climatic contrasts, resulting chiefly from the influence of the Labrador current which carries an Arctic climate southward along the entire eastern coast of Labrador. In passing through the strait of Belle Isle in July a stream of floating ice and bergs is met with, which increases in volume as one proceeds up the coast (Plate IV B). Throughout most of July the vast ice fields move steadily southward under the influence of the Labrador current, dispensing a polar temperature over the western side of Davis bay and the adjacent coast. The summer climate on the Labrador coast is notably colder than that of the west coast of Greenland even, according to Professor Tarr.[1] This results from a northward-moving current on the Greenland side and a polar current on the Labrador side of Davis bay.

The sub-Arctic climate which the southward-moving ice fields bring as far south as the strait of Belle Isle extends only a short distance inland from the coast. In going inland by way of The Narrows and lake Melville one finds that there are two Labrador climates. One is a sub-Arctic climate which characterizes a narrow coastal zone of islands and sea-facing mainland called "the Labrador" by the cod fisherman. This strand and island zone is chilled by ice-floes and is nearly or quite treeless. Inside this seashore strip is the heavily forested interior Labrador, where a summer climate replaces the ice-chilled coastal climate and forests cover the valleys and much of the mountains.

Holme concisely summed up the great contrast between the interior and coastal climate in the statement that "A journey of 20 or 30 miles in summertime up the country from the sea is like passing from winter to summer."[2]

Small berg fragments and ice-cakes were seen in Hamilton inlet, 18 miles west of Indian Harbour, on August 20, 1921, but the floe-ice had all disappeared before that date. No floe-ice was seen during the summer at or near Rigolet.

Around the western end of lake Melville, potatoes, rhubarb, and other hardy vegetables do well. Mr. Leroy Bowes found that potatoes had been killed by frost before September 10 at Mud lake on lower Hamilton river. Midsummer frosts are reported to occur at Northwest River, about one year in four or five.

Low states that, according to the journals kept at Northwest River post, the lowest temperature recorded from 1867 to 1893 was 53 degrees below zero. There are several records of 45 degrees below zero, which appears to be the minimum winter temperature of most years. At

[1] Tarr, R. S., "Difference in the Climate of the Greenland and American Sides of Davis and Baffin's Bay." Am. Jour. Sci., vol. III, pp. 315-320, 1897.
[2] "A Journey in the Interior of Labarador, July to October, 1887," Roy. Geog. Soc., vol. X, p. 189, 1888.

Rigolet, where the temperature is moderated by the open sea, the thermometer has rarely registered 40 degrees below zero.

In the summer of 1921 there was no snow on the mountains about lake Melville during July and August, except very small patches at elevations above 2,000 feet. On the outer islands near Indian Harbour a few small patches of snow still persisted near sea-level as late as the last week in August. It is reported that some snow is seen in midsummer during exceptional seasons at Rigolet.

The climatic conditions in the summer months near the western end of lake Melville are well shown by the detailed record of the weather kept by Mr. Leroy Bowes at Carter basin, which, through the courtesy of Capt. F. Anderson of the Naval Service, is included as an appendix to this report.

This record shows, for the 69 days which it covers, only 25 days without rain, mist, or snow, and only 11 days are recorded as "bright" or "clear" for the entire day.

Mr. Bowes found Goose Bay area to lie in a zone subject to more frequent rains than the part of the lake to the east of it. There is, he states, a "peculiar raindrift over the western end between The Narrows off Sandy point and the Hamilton river. I have noticed that the rain seems to sweep that area much more than the eastern section and I have never observed one day when it did not appear to be raining over some portion of Goose bay. The storms seem to pass toward the Hamilton river and then travel some distance up from its mouth."

Mr. Bowes' record for July 23 is of special interest, because of the unusual atmospheric conditions on that date. It is as follows:

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
July 23, 1921	6.15	29.90	61	76	57	E.	1	N 10	Dull
	12.50	29.95	55	....	....	E.	1	N 10	Very smoky, dark yellow
	7.00	29.98	55	....	....	E.	1	N 10	ditto

At Rigolet, which is about 85 miles east of the area referred to in Mr. Bowes' notes, the atmosphere showed, on the same date, a curious greenish-yellow colour, giving quite the most extraordinary appearance to the sky that the writer has ever seen. The temperature at this station was in the neighbourhood of 40 degrees all day. This condition was not accompanied by any smell of smoke and the easterly wind could not have brought smoke directly from any region in which forest fires were burning. The records of the Meteorological Service show, however, that the winds over the region to the south and west of lake Melville were undoubtedly from the northwest and west on July 22 and 23.

The temperature range for the summer months over the western part of lake Melville is indicated by the maximum and minimum records, recorded by Mr. LeRoy Bowes at Carter basin. These are as follows: July maximum 79, minimum 42; August maximum 79, minimum 42; September maximum 64, minimum 35.

The temperature records which these figures summarize date from July 15 to September 24.

Mr. J. Patterson of the Meteorological Service has supplied, from the records of the weather bureau, the following table of winter temperatures, which were recorded at a station on the opposite side of lake Melville from Carter basin, where the weather conditions are presumably identical with those at Carter basin.

Temperature at Northwest River, Labrador, December, 1920, to March, 1921, Inclusive

Date	December 1920		January 1921		February 1921		March 1921	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1	7	31	−27	− 6	−25	0	20	33
2	30	37	−25	−15	−34	10	10	35
3	− 5	5	− 8	3	−25	4	7	33
4	−12	0	−10	8	−28	12	7	14
5	−11	8	− 8	10	−24	24	−25	21
6	−13	12	−13	6	−20	15	−14	18
7	− 3	28	−25	− 3	−34	8	−10	21
8	20	28	−34	−13	−24	16	−10	22
9	20	32	−13	12	−29	34	10	33
10	3	42	− 6	14	10	40	9	42
11	0	36	−15	23	−3	26	−10	25
12	− 3	28	−27	− 6	−24	10	−10	38
13	−13	24	−25	5	−20	21	−23	30
14	−16	10	−24	− 8	−31	22	−20	25
15	−17	22	−27	5	−31	24	−19	7
16	−15	8	−14	10	−25	22	−27	9
17	15	28	−34	−15	−20	10	− 6	10
18	15	35	−15	− 5	−24	3	10	28
19	16	30	−24	5	−21	7	−10	28
20	15	33	−10	0	−24	10	−13	20
21	28	34	− 6	18	−22	21	13	24
22	20	29	−15	12	−21	27	−11	30
23	− 4	20	−20	20	− 3	30	− 3	35
24	−10	18	−20	3	3	31	− 1	40
25	0	15	17	−10	−10	23	5	45
26	0	5	− 3	7	−23	14	30	54
27	0	5	−25	10	−21	12	7	25
28	−13	− 2	−25	5	10	35	27	38
29	−17	5	−23	10	....	....	7	16
30	−30	− 5	−10	12	....	....	− 4	36
31	−25	5	−30	− 5	....	....	0	34

Minus signs indicate below zero.

In the following table the maximum and minimum winter temperatures at Northwest River, for the four coldest months of 1920 and 1921, are arranged for convenient comparison with similar figures for Ottawa.

Maximum and Minimum Temperature December to March, 1921

	Ottawa		Northwest River	
	Max.	Min.	Max.	Min.
December	42	− 9	42	−30
January	44	−23	23	−34
February	45	− 8	40	−34
March	71	0	54	−27

Mr. Davies, writing from experience gained by residence at Northwest River, states that "The heat, in summer, is often great, though it seldom lasts beyond a single day at a time. I have seen the thermometer as high as 86 degrees, at four o'clock p.m., and once on the 21st of August, 1840, it rose as high as 94 degrees in the shade."

Navigation, according to Davies, opens in lake Melville about the first or second week in June. "By the latter end of November the bay is generally frozen over." Grand lake, because of its great depth, "rarely freezes before the middle of December, nor does it break up till the middle of June."[1]

PLANT GEOGRAPHY

Contrasts between the Coastal and Interior Floras. The most conspicuous feature in the plant geography of the region is the sharp contrast between the flora of the interior and the flora of the seashore. The general absence of forest trees from the flora of the seacoast and their abundance in the interior, cannot escape the notice of even the most superficial observer. Randle F. Holme has stated clearly the impression which this contrast makes on the visitor.[2] "The Arctic current, with its icebergs and icy waters, freezes the coast, but has no effect on the inland. At a distance of not more than 12 miles from the coast there commences a luxuriant forest growth, which clothes the whole of the country, with the exception of a few spots, chiefly towards the north, called 'barrens.' These barrens are what we should call moors, and are the homes of vast herds of caribou. The climate a few miles inland is totally different from that on the coast." The nature of these contrasts is suggested by Plates IV and V.

A great number of plants other than trees which are abundant inland are absent from the seashore flora. The relative poverty of the seacoast flora, as represented by the island flora near Indian Harbour, is clearly illustrated in the following list of the plants of the region in which the species found respectively in the Interior and Island floras are checked in parallel columns.

[1] Trans. Lit. and Hist. Soc., Quebec, Feb. 1843, pp. 76 and 84.
The writer was informed that Grand lake as a rule freezes over after Christmas and that frost seldom comes in the Grand Lake valley until October.

[2] Proc. Roy. Geog. Soc., vol. X, p. 189, 1888.

Provisional List of Plants Found in Lake Melville and Hamilton Inlet District[1].

—	Interior or mainland flora	Island flora
	Lake Melville basin and Double Mer	Indian Harbour
Thelypteris Phegopteris (L.) Slosson	x	
T. Dryopteris (L.) Slosson	x	
T. spinulosa (O. F. Muell.) Nieuwl	x	
Athyrium angustum (Willd.) Presl	x	
Osmunda Claytoniana L	x	
Equisetum sylvaticum L., var. *pauciramosum* Milde	x	
E. palustre L	x	
Lycopodium annotinum L	x	
L. annotinum L., var. *acrifolium* Fernald	x	
L. annotinum L., var. *pungens* (La Pylaie) Desv	x	
L. alpinum L	x	
L. obscurum L	x	
L. complanatum L	x	
Abies balsamea (L.) Mill	x	
Juniperus communis L., var. *montana* Ait	x	
Sparganium angustifolium Michx	x	
Potamogeton heterophyllus Schreb., var. *graminifolius* (Fries) Morong	x	
Triglochin maritima L	x	
Hierochloë alpina (Sw.) R. and S	x	
Phleum pratense L	x	
P. alpinum L	....	x
Agrostis hyemalis (Walt.) BSP	x	
A. alba L., var. *vulgaris* (With.) Thurb	x	
Calamagrostis canadensis (Michx.) Beauv., var. *Langsdorfii* (Link) Inman	x	
C. neglecta (Ehrh.) Gaertner, Meyer, and Scherbius	x	
Cinna latifolia (Trev.) Griseb	x	
Deschampsia flexuosa (L.) Trin., var. *montana* (L.) Parl	x	
Poa eminens J. S. Presl	x	
P. pratensis L	x	
Glyceria nervata (Willd.) Trin., var. *stricta* Scribn	x	
G. borealis (Nash) Batchelder	x	
Festuca rubra L	x	
Hordeum jubatum L	x	
Elymus arenarius L., var. *villosus* E. Meyer	x	x
Eleocharis palustris (L.) R. and S	x	
E. acicularis (L.) R. and S	x	
Scirpus caespitosus L. var. *callosus* Bigel	x	
S. rubrotinctus Fernald	x	
S. atrocinctus Fernald, var. *brachypodus* Fernald	x	
Eriophorum Chamissonis C. A. Meyer	x	
E. callitrix Cham	x	x
E. gracile Roth	x	
E. angustifolium Roth	x	x
E. Scheuchzeri Hoppe	....	x
Carex projecta Mackenzie (*Carex tribuloides* Wahlenb. var. *reducta* Bailey)	x	
C. echinata Murr. var. *angustata* (Carey) Bailey	x	
C. canescens L	x	
C. brunnescens Poir	x	
C. Macloviana D'Urv	x	

[1] Nomenclature and numbers are as found in Gray's "New Manual of Botany," seventh edition, by Robinson and Fernald; names not in this manual are those validated in recent revisions, chiefly by Prof. Fernald.
The plants in this list were collected by R. H. Wetmore. Determinations were made by R. H. Wetmore under direction of Prof. M. L. Fernald, of Harvard University.
See also checklist of plants of the region, by R. H. Wetmore "Plants of the Hamilton Inlet and Lake Melville Region, Labrador," Rhodora, vol. 25, Jan. 1923, pp. 4-12.

Provisional List of Plants Found in Lake Melville and Hamilton Inlet District—Continued

—	Interior or mainland flora Lake Melville basin and Double Mer	Island flora Indian Harbour
C. glareosa Wahlenb, var. *amphigena* Fernald	x	
C. stipata Muhl	x	
C. maritima O. F. Mueller	x	
C. salina Wahlenb, var. *kattegatensis* (Fries) Almq	x	
C. lenticularis Michx	x	
C. rigida Good	x	
C. rariflora Smith	x	
C. miliaris Michx	x	
C. vesicaria L	x	
C. rostrata Stokes	x	
Juncus trifidus L	....	x
J. balticus Willd., var. *littoralis* Engelm	x	
J. filiformis L	x	
J. alpinus Vill., var. *insignis* Fries	x	
Luzula spicata (L.) DC	....	x
Clintonia borealis (Ait.) Raf	x	
Smilacina trifolia (L.) Desf	x	
Maianthemum canadense Desf	x	
Streptopus amplexifolius (L.) DC	x	
Iris setosa Pall., var. *canadensis* Foster	x	x
Sisyrinchium angustifolium Mill	x	
Habenaria hyperborea (L.) R. Br	x	
H. dilatata (Pursh) Gray	....	x
Spiranthes Romanzoffiana Cham	x	
Goodyera repens (L.) R. Br., var. *ophioides* (Fernald)	x	
Listera cordata (L.) R. B	x	
Salix lucida Muhl	x	
S. lucida Muhl., var. *intonsa* Fernald	x	
S. planifolia Pursh	x	
S. anglorum Cham	....	x
Populus tremuloides Michx	x	
Myrica Gale L	x	
Betula glandulosa Michx	x	x
B. microphylla Bunge	x	
Alnus crispa (Ait.) Pursh	x	
Comandra livida Richards	x	
Rumex occidentalis Wats	x	
R. acetosella L	x	
Polygonum aviculare L	x	
P. viviparum L	x	x
Chenopodium album L	x	
Arenaria lateriflora L	x	
A. peploides L	x	
A. groenlandica (Retz.) Spreng	x	
Stellaria borealis Bigel	x	
S. crassifolia Ehrh	x	
S. humifusa Rottb	x	
S. longipes Goldie, var. *laeta* (Richards.) Wats	....	x
S. media (L.) Cyrill	x	
Cerastium arvense L	....	x
C. alpinum L., var. *lanatum* Hegetschw	....	x
Silene acaulis L., var. *exscapa* (All.) DC	....	x
Ranunculus reptans L	x	
R. pennsylvanicus L. f	x	
R. acris L	x	
R. hyperboreus Rottb	....	x
R. lapponicus L	x	

Provisional List of Plants Found in Lake Melville and Hamilton Inlet District—Continued

—	Interior or mainland flora	Island flora
	Lake Melville basin and Double Mer	Indian Harbour
Thalictrum polygamum Muhl	x	
Coptis trifolia (L.) Salisb	x	
Actaea rubra (Ait.) Willd	x	
Draba incana L	x	
Thlaspi arvense L	x	
Capsella bursa-pastoris (L.) Moench	x	
Cochlearia sp. (undetermined)	....	x
C. sp. (undetermined)	....	x
C. sp. (undetermined)	....	x
Sarracenia purpurea L	x	
Sedum roseum (L.) Scop	....	x
Parnassia palustris L	x	x
Ribes prostratum L'Her	....	x
Pyrus dumosus (Greene) Fernald	x	
Amelanchier Bartramiana (Tausch.) Roem	x	
Potentilla monspeliensis L	x	x
P. palustris (L.) Scop	x	
P. tridentata Ait	x	x
P. pacifica Howell	x	x
Geum macrophyllum Willd	x	
Rubus idaeus L	x	
R. Chamaemorus L	x	x
R. triflorus Richards	x	
Sanguisorba canadensis L	x	
Prunus pennsylvanica L.f	x	
Dryas integrifolia Vahl	....	x
Trifolium pratense L	x	
T. repens L	x	
T. agrarium L	x	
Astragalus alpinus L	....	x
Oxytropis campestris DC. var. *caerulea* Koch	....	x
Vicia Cracca L	x	
Lathyrus maritimus (L.) Bigel	x	x
Geranium pratense L	x	
Callitriche palustris L	x	
Empetrum nigrum L	x	x
Viola labradorica Schrank	x	x
Epilobium angustifolium L	x	x
E. latifolium L	x	
E. palustre L	x	
E. palustre L., var. *longirameum* Fernald and Wiegand	x	
E. glandulosum Lehm., var. *adenocaulon* (Haussk.) Fernald	x	
Hippuris vulgaris L., var. *maritima* (Hellen.) Wahlenb	x	
Coelopleurum lucidum (L.) Fernald	x	x
Angelica atropurpurea L	x	x
Cornus canadensis L	x	
C. suecica L	x	x
C. stolonifera Michx	x	
Pyrola minor L	x	
P. secunda L., var. *obtusata* Turcz	x	
P. chlorantha Sw	x	
Moneses uniflora (L.) Gray	x	
Ledum groenlandicum Oeder	....	x
L. palustre L	x	x
Kalmia angustifolia L	x	
K. polifolia Wang	x	x

Provisional List of Plants Found in Lake Melville and Hamilton Inlet District—Continued

—	Interior or mainland flora	Island flora
	Lake Melville basin and Double Mer	Indian Harbour
Phyllodoce caerulea (L.) Bab.	x	
Chamaedaphne calyculata (L.) Moench	x	
Arctostaphylos alpina (L.) Spreng.	x	
Chiogenes hispidula (L.) T. and G.	x	
Vaccinium pennsylvanicum Lam. var. *myrtilloides* (Michx.) Fernald.	x	
V. pennsylvanicum Lam., var. *angustifolium* (Ait.) Gray	x	
V. uliginosum L.	x	
V. Vitis-Idaea L., var. *minus* Lodd.	x	x
V. Oxycoccos L.	x	
Diapensia lapponica L.	x	
Statice labradorica Hubbard and Blake	....	x
Primula farinosa L.	....	x
P. farinosa L., var. *macropoda* Fernald	x	
Trientalis borealis Raf.	x	x
Gentiana Amarella L.	x	
Mertensia maritima (L.) S. F. Gray	x	x
Galeopsis tetrahit L.	x	
Mentha arvensis L., var. *glabrata* Fernald	x	
Veronica scutellata L.	x	
Castilleja pallida (L.) Spreng., var. *septentrionalis* (Lindl.) Gray	x	
Euphrasia arctica Lange	....	x
Pedicularis flammea L.	....	x
P. groenlandica Retz.	x	
P. euphrasioides Stephen	x	
Rhinanthus Crista-galli L.	x	
Pinguicula vulgaris L.	....	x
P. villosa L.	....	x
Plantago decipiens Barneoud	x	
Galium trifidum L.	x	
G. labradoricum Wiegand	x	
G. triflorum Michx.	x	
Linnaea borealis L., var. *americana* (Forbes) Rehder	x	
Viburnum pauciflorum Raf.	x	
Solidago lepida DC.	x	
S. macrophylla Pursh.	x	
S. macrophylla Pursh., var. *thyrsoidea* (E. Meyer) Fernald	x	
Aster foliaceus Lindl.	x	
Erigeron acris L., var. *asteroides* DC.	x	
Anaphalis margaritacea (L.) B. and H., var. *occidentalis* Greene	x	
Achillea Millefolium L., var. *nigrescens* E. Meyer	x	x
Chrysanthemum Leucanthemum L., var. *pinnatifidum* Lecoq. and Lamotte	x	
Artemisia canadensis Michx.	x	
Petasites palmatus (Ait.) Gray	x	
Senecio palustris (L.) Hook.	....	x
S. pseudo-arnica Less.	x	
Cirsium muticum Michx.	x	
Leontodon autumnalis L.	x	
Taraxacum ceratophorum DC.	....	x
T. officinale Weber	x	
Lactuca spicata (Lam.) Hitchc.	x	

Water-loving Plants

It is well known that certain plants, such as spanish moss, bougainvillea, the orange, or the palm are dependable exponents of the climatic conditions where they are found. It is perhaps not so well known that certain plants afford equally infallible evidence regarding the salinity of the waters in or near which they grow. Everyone knows that cat-tails flourish only in fresh water, and anyone familiar with the tropical seashore is aware that the mangrove tree can grow only where its roots reach sea-water. A host of plants show a love for, or antipathy to, a salt water habitat quite comparable with that exhibited by the mangrove of the tropics.

It is proposed in this section to consider the Hamilton Inlet and Lake Melville plants from the point of view of indices of the salinity of the water of the region. Harold St. John, describing the plants of the north shore of the gulf of St. Lawrence, states that "within reach of the influence of salt water, whether the shore be marshy, sandy, or rocky, is a characteristic assemblage of plants commonly known as halophytes because they grow where salt water is the governing factor. On a stretch of coast of this length a certain number of these plants are as certain to be present throughout its extent as is salt water itself."[1] St. John recognizes on the coast studied by him 66 true halophytes.

A complete list of the known shore-plants of this region, which includes the halophytes, follows. The list includes only those plants of Lake Melville and Hamilton Inlet region which are believed to be adjusted to a coastwise, lakeshore, or river habitat.

The list, it will be noted, includes a few species like *Juncus balticus* Willd. var. *littoralis* Engelm and *Poa eminens* L., which seem to be equally well adapted to fresh or saline water habitats. Others are confined strictly to a freshwater habitat. Several species are associated with slightly brackish water conditions.

But the species of chief interest in this connexion are those confined to parts of the shoreline where the water is strongly saline or typical sea-water. The species adjusted to this kind of habitat include such plants as *Iris setiosa* var. *canadensis*, *Polygonum viviparum* L., and *Ranunculus lapponicus*. These species do not extend west of The Narrows. The list includes seven such species which do not appear to extend their range west of the head of The Narrows. The inability of these salt-loving plants to extend their range west of the head of The Narrows affords very clear botanical evidence of the change that takes place in the salinity of the water west of The Narrows.

There is, probably, no better criterion for recognizing the points on the shore where the marine waters merge into the brackish waters of lake Melville than the distribution of the marine alga, *Fucus cf. evanescens*. This plant, which covers much of the surface of the inter-tidal zone about Rigolet and eastward, as well as the large kelp, disappears from the shore west of The Narrows.

---

[1] "A Botanical Exploration of the North Shore of the Gulf of St. Lawrence Including an Annotated List of the Species of Vascular Plants," Geol. Surv., Can., Mem. 126, 1922, p. 11.

The following list includes only those plants found growing on or near the shores of Hamilton inlet or its islands and The Narrows connecting lake Melville with this inlet, together with those found on the margins of the lake itself or its tributaries. The indication marks used are as follows: *litt.* for littoral or marine shore plants; *fr.* for plants growing on the banks of freshwater bodies; and *br.* for those of brackish bodies of water, as lake Melville, The Backway, or Double Mer. Combinations of these will be self-explanatory, meaning that the plant is found in both areas mentioned.

List of Plants with a Salt, Freshwater, or Brackish Habitat[1]

Plant	Habitat	Remarks
Sparganium angustifolium Michx......	fr.	In and around stagnant pools. (Only found in small lake back of houses at the mouth of Mulligan river)
Potamogeton heterophyllus Schreb. var. *graminifolius* (Fries.) Morong.	fr.	In running fresh water. (Naskaupi river, above mouth of Red river)
Triglochin maritima L................	br.	Only found in weak, brackish waters, *e.g.* shallow tidal rivers, near the headwaters of the salt water. (Tidal stream at Caravalla bay. Only in salt water at high tide)
Hierochloë alpina (Sw.) R. and S.....	litt.	On high banks near the shores on the islands in Hamilton inlet. Not found inland at all. Indian Harbour and neighbouring islands
Phleum alpinum L..................	litt.	Found only on rocky banks near the shore on the islands of Hamilton inlet, Indian Harbour, and neighbouring islands
Calamagrostis neglecta (Erhrh.) Gaertner, Meyer and Scherbius	fr.	On the banks of Naskaupi river and on the shores of The Narrows near Rigolet, and on many other places along lake Melville; grows almost ubiquitous along shores
C. canadensis (Michx.) Beauv., var. *Langsdorfii* (Link) Inman.	fr. and br.	Found only at inner end of lake Melville and on the banks of rivers flowing into it
Cinna latifolia (Trev.) Griseb.........	fr.	Not found except on rivers and on the shores of the brackish waters near their mouths; Muskrat falls; and small lake at Northwest River; common
Deschampsia flexuosa (L.) Trin. var. *montana* (L.) Parl.	fr.	Found near fresh or slightly brackish water, *e.g.* head of Double Mer and on shores of strongly brackish water along both sides of The Narrows around Rigolet
Poa eminens J. S. Presl....	br. and fr.	Found both near strongly brackish and fresh water. The Narrows near Rigolet and small pond at mouth of Mulligan river
Glyceria nervata (Willd.) Trin., var. *stricta* Scribn.	fr.	Not seen near any trace of salt or brackish water. Head of Grand lake and on Naskaupi river
G. borealis (Nash) Batchelder.. ...	fr.	(same as above)
Festuca rubra L.....................	br.	Only where brackish influence is strong. The Narrows near Rigolet
Hordeum jubatum L.................	fr.	Only on banks of Naskaupi river, near Grand lake
Elymus arenarius L., var. *villosus* E. Meyer	br. and litt.	Not found near head of lake Melville, but gets more and more plentiful as one gets nearer Hamilton inlet
Eleocharis palustris (L.) R. and S.....	fr.	
E. acicularis (L.) R. and S...........	fr.	18 miles up Naskaupi river
Scirpus rubrotinctus Fernald..........	fr.	Head of Grand lake, only found on banks of rivers and freshwater lakes
S. atrocinctus Fernald var. *brachypodus* Fernald	fr.	
Carex projecta Mackenzie (*Carex tribuloides* Wahlenb. var *reducta* Bailey)	fr.	Head of Grand lake and along Naskaupi river Naskaupi river

[1] This list has been prepared by Mr. R. H. Wetmore, the author's assistant.

List of Plants with a Salt, Freshwater, or Brackish Habitat—Continued

Plant	Habitat	Remarks
Carex canescens L	fr. and br.	On lake shore where water is brackish. Small lake at Northwest River
C. brunnescens Poir	br.	Where water is strongly brackish, as along The Narrows, and at portage at Muskrat falls
C. stipata Muhl	fr.	Only on river bank, Naskaupi river
C. glareosa Wahlenb. var. *amphigena* Fernald	br.	Where water is strongly brackish. Rigolet shores
C. maritima O. F. Mueller	br.	Found wherever a salinity content is apparent in the water, even to the head of lake Melville
C. salina Wahlenb., var. *kattegatensis* (Fries.) Almq.	br. or fr.	Found on river banks and around the head of lake Melville, where water is only slightly brackish
C. lenticularis Michx	br.	Only found where water was slightly brackish. Small lake at Northwest River
C. rigida Good	fr.	Banks of freshwater lake. Head of Grand lake
C. rariflora Smith	br.	Banks of The Narrows near Rigolet, Labrador
C. miliaris Michx	fr.	River banks, Naskaupi river
C. vesicaria L	br.	Only seen on shores where water was slightly brackish. Small lake at Northwest River. Islands in Sebaskachu bay
C. rostrata Stokes	fr.	River banks, Naskaupi river
Juncus balticus Willd., var. *littoralis* Engelm	fr. and br.	Found on shores where water is entirely fresh and also strongly brackish. Head of Muskrat falls. Islands in Sebaskachu bay
Juncus filiformis L	fr. and br.	Found where water was fresh as well as where slightly brackish; not seen around lake Melville except near head of lake. Naskaupi river and Grand river also
J. alpinus Will., var. *insignis* Fries	fr.	Only along a river bank and head of lake. Naskaupi river and Grand lake
Iris setosa Pall., var. *canadensis* Foster	br. and fr.	Common where water is strongly saline. Not seen above The Narrows
Salix lucida Muhl	fr.	On freshwater shores, Grand lake
S. lucida Muhl., var. *intonsa* Fernald	fr.	On sandy shore of freshwater lakes and rivers, Grand lake and Naskaupi river
S. planifola Pursh	br.	Seen along shores of brackish water, *e.g.* common along lake Melville, The Backway, etc.
S. anglorum Cham	....	Depressed on shores and heights above at Indian Harbour
Myrica Gale L	fr.	On shores of ponds, rivers, etc., usually around stagnant water, slow-moving brooks, etc.
Alnus crispa (Ait.) Pursh	fr.	On shores of rivers; common. Mulligan river, and lake near mouth; the only alder noticed
Comandra livida Richards	br.	Very common along The Narrows, diminishing as the interior is reached along lake Melville. None seen above Mulligan bay
Rumex occidentalis Wats	br.	On shores where water is variable in brackish content, as on shores of lake Melville, as well as on Naskaupi river; not seen below The Narrows
Polygonum viviparum L	br. and litt.	Very plentiful wherever a strong saline content is in the water. Not found common west of The Narrows
Arenaria lateriflora L	br.	At mouth of a tidal river, where water is only slightly brackish. Near mouth of stream at Caravalla bay
A. peploides L	br.	Common on shores of strongly brackish water. Along shores at Rigolet
Stellaria borealis Bigel	fr.	On river bank—Mulligan river, about 5 miles up
S. crassifolia Ehrh	br.	On muddy shore near headwaters of tide in a shallow tidal river. At Caravalla bay, lake Melville
S. humifusa Rottb	br.	Growing with *Stellaria crassifolia*

List of Plants with a Salt, Freshwater, or Brackish Habitat—Continued

Plant	Habitat	Remarks
S. longipes Goldie, var. *laeta* (Richards.) Wats.	br. and litt.	Found from Indian Harbour to head of The Narrows. Only an occasional plant in Lake Melville region
Ranunculus reptans L.	fr.	Growing on bottom of shallow pool, at head of Grand lake
R. pennsylvanicus L.f.	fr.	Common on banks of Naskaupi river
R. hyperboreus Rottb.	fr.	In shallow pool on Indian Harbour island, up back of hospital
R. lapponicus L.	br.	Common on the shores at The Narrows near Rigolet. Not seen elsewhere
Draba incana L.	br.	On shores of The Narrows. Seen also at eastern end of lake Melville, but not beyond Long point, on the south shore
Parnassia palustris L.	litt. and br.	Common on south shore of lake Melville east of Epinette point. Found also at Indian Harbour
Potentilla monspeliensis L.	br. and litt.	Found at Indian Harbour, and also along shores of The Narrows as well as of lake Melville to its head. Not so common in the latter region
P. palustris (L.) Scop.	br.	Common along The Narrows and eastern end of lake Melville
P. tridentata Ait.	br.	Along The Narrows and eastern end of lake Melville
P. pacifica Howell	litt. and br.	Very common around the inlet and on the shores of the islands, and westerly into the lake as far as Northwest River. Not seen west of this place
Geum macrophyllum Willd.	fr.	On Kenemich river only
Lathyrus maritimus (L.) Bigel.	litt. and br. also fr.	Probably the commonest plant on all salt and brackish shores. Not seen west of Northwest River, and not as plentiful here as farther east. A few seen on freshwater shores
Callitriche palustris L.	fr.	An albino of next above. Under water in Naskaupi river
Epilobium latifolium L.	fr.	On gravelly shores of rivers, Mulligan river
Epilobium glandulosum Lehm., var. *adenocaulon* (Haussk.) Fernald.	fr.	On river banks. Naskaupi river
Hippuris vulgaris L., var. *maritima* (Hellen.) Wahlenb.	br.	In water of stream, Caravalla bay near head of tidal influence
Coelopleurum lucidum (L.) Fernald	br.	Common on all brackish shores. More plentiful around The Narrows than inland
Angelica atropurpurea L.	fr., br., and litt.	Found on river banks (Kenemich river), banks of lake Melville wherever travelled, and also on the shores of the islands of Hamilton inlet. Commoner farther from shores from last, on the alluvial soils
Cornus canadensis L.	br. and fr.	Common on rocky shores everywhere and particularly common within The Narrows and westward
C. stolonifera Michx.	fr.	Found common on river banks—Kenemich river, Naskaupi river, etc.
Primula farinosa L., var. *macropoda* Fernald	fr.	Only seen on sandy beach at head of Grand lake
Gentiana Amarella L.	br.	Common along the shores of Double Mer. Not seen elsewhere
Mertensia maritima (L.) S. F. Gray	br. and litt.	Found only on very brackish or coastal shores, viz., on shores of The Narrows in Double Mer and at Indian Harbour. Not seen elsewhere.
Mentha arvensis L., var. *glabrata* Fernald	fr.	Shores of Naskaupi river only
Castilleja pallida (L.) Spreng, var. *septentrionalis* (Lindl.) Gray	fr.	Only seen on sandy beach at head of Grand lake
Galium trifidum L.	br.	Only seen on brackish shore of small lake at Northwest River

List of Plants with a Salt, Freshwater, or Brackish Habitat—Continued

Plant	Habitat	Remarks
G. labradoricum Wiegand............	br.	Only seen on west shore of small lake at Northwest River
Solidago lepida DC..................	fr.	Found only on Kenemich river
Aster foliaceus Lindl.................	fr.	Only found on shores of freshwater lakes—Grand lake. Common on shores of The Narrows and lake Melville
Achillea Millefolium L., var. *nigrescens* E. Meyer	br. and fr.	Very common everywhere. Only one plant found on Naskaupi river
Artemisia canadensis Michx...........	fr.	Found only on gravelly shores of Grand river
Senecio Pseudo-Arnica Less...........	br. and litt.	Common on Hamilton inlet and westward into lake Melville as far as Sebaskachu bay. None seen west of this

FORESTS

Barren Zone. The sub-Arctic climate, which the southward-moving ice-fields bring as far south as the strait of Belle Isle, extends only a short distance inland from the coast. When crossing the eastern threshold of Labrador peninsula by way of lake Melville, it is found that there are two Labradors—"the Labrador" of the cod fisherman, chilled by the ice-floes and nearly or quite treeless, is the one best known. Farther inland where salmon and trout fishing take the place of cod fishing, a pleasant summer climate replaces the ice-chilled coastal climate, and forests cover both mountains and valleys.

Along the eastern coast of Labrador, bare, rocky slopes without timber form the background of the southward-moving procession of bergs and floe-ice which continues throughout most of July.

The bleak, time-eaten, rocky shores of the islands and mainland to which the mirage often gives a variety of aspects are, with a few trifling exceptions, barren of trees from the western end of the strait of Belle Isle to the vicinity of Sandwich bay. A few islands in or near Sandwich bay have considerable patches of black spruce on shores which do not face the open sea. In general, however, forests are either absent on the seacoast or confined to the sides of ravines or small valleys where the topography affords some protection to the timber, which is always dwarfed.

Even in the more protected areas near the seacoast, where forests have become established, the trees are invariably small. The dwarfed character of some of the forests nearest the seacoast is very clearly indicated by the following quotation from Townsend which refers to the Cape Charles region in southeastern Labrador: "Our passage through these rugged woods is slow and painful. The stiff and crooked branches of the trees interlock for self-protection. One great advantage in many of these regions is that when one is uncertain about the way, by standing on tiptoes one can generally overlook the forest."[1]

Hamilton Inlet. Probably nowhere on the coast of Labrador can the transition from the barren outer islands to the forested interior be better seen than on Hamilton inlet. This bay has a length of about 40 miles in

[1] Townsend, C. M., "Along the Labrador Coast," 1907, p. 26.

an east-west direction, and is dotted with numerous rocky islands. The eastern or outermost of these are clothed only with lichens, emerald green moss, and a variety of flowering plants. Trees are entirely absent, if we except a variety of arctic willow and a dwarfed birch, which grow prostrate upon the ground, their branches seldom rising more than 2 or 3 inches above the rock crevices that protect their roots.

At Indian Harbour the small islands are entirely destitute of forest. Fifteen miles to the westward the shores of the mainland and the islands begin to show patches of black spruce of a dwarfed type. These show at a distance on the hill-slopes as blotches of dark green on the light green of the moss-covered surrounding areas. The stunted spruce becomes somewhat larger and the areas covered by it are more extensive as the head of the inlet is approached.

It is clear that floating ice is the main factor in keeping the outer shores deforested. Great fields of ice persist in the outer parts of the inlet until the latter part of July. The ice, however, is seldom, if ever, seen in midsummer within many miles of Rigolet.

At the head of Hamilton inlet the trees, though small, make up dense forests that clothe a large part of the land surface.

Interior. The dwarfed spruce forests about the head of Hamilton inlet (Plate IV A), with trees 15 to 35 feet high, give way to forests with much larger trees in the area around lake Melville. At Rigolet, squared timbers used for hauling out vessels were observed which would be considered creditable representatives of any Canadian forest. One of these pieces measured: length, 59 feet; butt dimensions, 1 foot 4 inches by 9 inches; dimensions at small end, 9½ inches by 6½ inches. The log was cut near the head of the lake and is much larger than any seen near the seashore.

Black spruce (*Picea mariana*) is the dominant tree throughout Lake Melville district, but white spruce becomes increasingly common inland (Plate V). The white birch (*Betula alba* var. *papyrifera*) is a very common tree, and in tracts that have been burned over it has taken possession of the ground to the exclusion of all other trees. The largest specimens were seen where they occurred sparingly in forests of black and white spruce.

Where the birch constitutes the whole of the forest, as it commonly does in burned-over tracts, its light-green foliage distinguishes it at considerable distances from the darker evergreens. The forest colour effects vary greatly with light and distance. Under a grey sky the black spruce forests are nearly black in the middle distance, dark green in the foreground, shading off into deep dark blue in the distance. Under a half-clouded sky the forested mountain slopes are marked with blotches of dark blue on a field of light green, the colour scheme changing constantly with the shifting of the clouds. In some cases at the finish of a shower a spruce-covered island, rainbow arched, will furnish a picture not easily forgotten. Labrador has been described as a land of rainbows; the dozen or more showers a day experienced on many days during the summer of 1921 seem to justify the title, and in such seasons protect the forests against forest fires.

Any traveller in a Labrador forest soon becomes aware of a carpet of sphagnum moss into which he sinks, in many places to his knees. If the sphagnum moss be absent, it is commonly replaced by caribou moss. Where the trees are not too closely spaced the ash-grey of the caribou moss gives a colour contrast with the dark green of the black spruce, visible at a considerable distance. The rolls of partly detached bark which hang about the trunks of the large birch trees give them a curiously shaggy appearance. The white or dun-coloured trunks of the birches, which are sprinkled sparingly through many of the spruce forests, relieve the monotony of these sombre-hued trunks. Where the spruce trees have their maximum development they reach a height of from 75 to 100 feet. These forests "are of the very darkest hue of green and down their hoary, moss-floored isles" sunlight has little chance to penetrate.

Nearly everywhere the white blossom of the Labrador tea is seen during July. As its blossoms fade the dark pink Lambskill takes its place, decorating the woods with a profusion of delicate colour throughout the latter part of the summer. About the first of August the half-ripe, low-bush cranberries begin to show rosy cheeks above the moss, and a little later the rich, dark purple bearberries spread a feast of delicious fruit and ravishing colour on the grey, rocky summit of every hill and mountain. The wild currant, crowberry, and bake-apple are among the other refreshments which the forests set before their visitors. Alder and willows generally form the forest border along the streams. The fragrant-leaved sweetgale is also frequently seen about the margin of the forests.

The principal trees in the approximate order of their abundance in Lake Melville district are:

Black spruce (*Picea mariana* BSP)
White or canoe birch (*Betula alba* var. *papyrifera*)
Tamarack (*Larix laricina* Koch.)
Balsam fir (*Abies balsamea* Mill.)
White spruce (*Picea canadensis* BSP)
Balsam poplar (*Populus balsamifera* L.)
Yellow or grey birch (*Betula lutea* Michx. f.)
Aspen poplar (*Populus tremuloides* Michx.)

White and black spruce, and fir are the trees which have been used for lumber in the region. Both the white and black spruce reach a large size in many localities. The following figures indicate the character of some of the larger trees in these forests. On Mulligan river a black spruce 5 feet 6 inches in circumference 20 inches above the ground was measured. Another black spruce on Kenemich river measured 9 feet 10 inches in circumference. Its fine, straight trunk appeared to be 100 feet high. The black spruce here probably reaches a greater average size than in Nova Scotia. At the head of Grand lake a spruce which had a diameter of 25 inches was noticed in the driftwood. A white birch on the Kenemich measured 5 feet 1 inch in circumference. These figures represent a few of the largest trees, but many others nearly or quite as large were seen. A large proportion of the forest trees approach these figures sufficiently closely to furnish a large supply of logs suitable for lumber. There are vast quantities of smaller timber on the mountain slopes, which will no doubt be used eventually for pulpwood.

The shores of lake Melville are bordered by a considerable area of relatively flat or slightly rolling land on which the best timber is found. On the mountain slopes much smaller trees occur.

Grand lake, which is about 40 miles long, lies northwest of lake Melville and empties into it. It is without any lowland border, the mountain slopes descending precipitately on the west and by gentle slopes on the east. Extensive forests of fine timber about this lake are reported to have been destroyed by fire about 35 years ago. Considerable areas of birch furnish the only conspicuous evidence of these fires at present. At cape Blanc, which is a steep-sided mountain rising from the lake side, the scars of old avalanches are plainly visible. In some of these the timber and soil have both been stripped completely from the mountain face. In others the succession of birch in the midst of a black spruce forest, bounded sharply by perfectly straight lines, tells the story of an old avalanche.

On Naskaupi river and Red river the broad sand and clay terraces support a better forest growth than Grand Lake basin. Mrs. Hubbard, who traversed the entire length of the Naskaupi, reports one of the trees on the Naskaupi to have a circumference of 9 feet. She states that[1] "the valley is mostly well wooded with spruce and balsam as far as Mabelle island and here the spruce reaches splendid size."

The best forest in Lake Melville region is reported to be located back of Mud lake on the south side of Hamilton river. A considerable amount of lumber was cut around the west side of Goose bay a few years ago when sawmills were in operation. Fairly large trees grow along both banks of the Hamilton as far up as Muskrat falls.

The writer's observations did not extend above Muskrat falls, but according to Low, a good forest growth is found up Hamilton river as far as Hamilton falls. He states[2] that 150 miles from the mouth of the river "the trees on the slopes about the falls are largely white spruce upwards of 70 feet in height."

Davies, describing the uplands to the north and west of lake Melville as they appeared eighty years ago, says, "it is composed of ranges of round-backed hills, traversing the country in all directions; they do not, in the interior at least, assume the altitude of mountains—the intervals between them are filled either by lakes or marshes; so that in looking down from the brow of some more elevated hill, an interminable succession of naked hills and lakes is seen, giving an indescribable aspect of desolation to the country, which is greatly heightened by the effects of the fires that have ravaged the whole country. Indeed, there can be little doubt that at one time nearly, if not the whole, of the interior of Labrador was covered with wood[3], which has since been destroyed by fire; in almost every direction the naked stumps of trees are seen, rising out of the moss that now covers the country. Hundreds of miles of the country are now nothing but a barren waste of naked rocks from this cause, which in the recollection of some of the old hunters were covered with wood formerly. These fires are caused, in a great measure, by the inflammable nature of the moss that covers so large a part of the ground, and which, when dried by a continuance of fine weather, will ignite by a spark, and burn with great rapidity. Notwithstanding that the Indians are well aware of the danger of so doing, they generally

[1] Hubbard, Mrs. Leonidas, "Labrador from Lake Melville to Ungava Bay," Bull. Am. Geog. Rev., vol. 38, 1906, p. 533.

[2] Grenfell, W. T., and others, "Labrador: The Country and the People," 1910, p. 153.

[3] There is no reason for believing that the northern part of Labrador peninsula which is north of the timber line has ever had any more timber than it now has.

make use of the moss, when they wish to inform their friends that they are in any particular part of the country, and this they do by setting fire to it."[1]

Upper Limit of Trees. Elevation is only one of the factors controlling the upper limit of trees on the mountain slopes. Steepness of slope, relative amount of soil, and the direction toward which a particular mountain side faces are other factors (Plate VI). The size of the trees invariably decreases with elevation and near their upper limit many of those which persist maintain their positions only by taking an attitude approaching closely to the horizontal. In the heavy forests that border English river on the south shore of lake Melville, the upper limit of upright trees is 815 feet. Horizontal trees continue up to 900 feet, but above this the mountain is barren.

Southeastern Labrador Forests. Bryant and Townsend explored parts of the region south of lake Melville and some of their comments on the forests are given below. The rivers traversed by them enter the gulf of St. Lawrence between Mingan islands and the strait of Belle Isle. Townsend[2] writes of the timber along the Natashkwan valley, nearly opposite the east end of Anticosti island, as follows:

"The forest trees gradually increase in size from the coast, where, in places, as on the plateau back of the little village of Natashkwan, they are nearly prostrate to this point where they appear to have reached about their maximum, and attain a height of 50 or 60 feet. Black spruce and balsam fir are the predominating trees, but white spruce are not uncommon. White birches are scattered here and there and often form pale-green patches in a sea of dark spruces and show where a fire has swept through. Mountain ashes are few and far between, as well as aspens, but, on the borders of the river, alders and dwarf willows are common. Of larches only a few remnants are left of this once abundant tree. Some years ago a devastating worm—the larva of a saw-fly—swept through the country and the larches were nearly exterminated. At Rigolet, on Hamilton inlet, I had seen in 1906 the larches covered with these worms. Fortunately in this region of the Natashkwan, at least, there are enough scattered veteran larches left to perpetuate the race, and vigorous seedlings are growing up, and I saw nothing of the worm.

"The largest balsam fir I measured at this place close to the eighth falls was 64 inches in circumference 3 feet from the ground. A black spruce was 43 inches, a white birch was 72 inches. The white birches are rough and lichen-stained—grey and green and black—and the bark peels off in great rolls and hangs all over the trunk in rags."

The observation of Townsend that the trees on the Gulf coast can survive only as prostrate dwarfs corresponds with the conditions which may be observed farther east and north.

St. Augustin river, which enters the gulf of St. Lawrence 150 miles east of Natashkwan river, was ascended in 1912 to the height of land by Henry G. Bryant. Concerning the forests observed on this expedition Bryant writes as follows:[3]

---

[1] Davies, W. H. A., "Notes on Esquimaux Bay and the Surrounding Country," Trans. Lit. and Hist. Soc., Quebec, vol. IV, pt. 1, Feb., 1843, pp. 77–78.

[2] Townsend, Charles W., "A Short Trip into Labrador, by Way of the Natashquan River," Bull. of the Geog. Soc., Phil., vol. XI, 1913, pp. 170–182.

[3] Bryant, H. G., "An Exploration in Labrador," Bull. Geog. Soc., Phil., vol. XI, 1913, pp. 1–15.

"Referring to the timber resources of the region traversed, it may be of interest to mention that for the first 25 miles above the mouth, the hills rising from the broad valley of the river are covered with a thick mantle of firs and spruces of small size and growing in the close formation so characteristic of the Laurentide landscape. These growths of the lower valley are suitable for pulp manufacture; but aside from this, possess little commercial value. For the next 25 miles to the vicinity of the first falls, the size of the two varieties mentioned improves and many scattered groves of birches are observed. Beyond this for about 20 miles, a noticeable increase in size and quality of the spruces is apparent, while the firs have become a less important element in the forestation. While the best timber is not continuous here, many tracts may be seen containing trees which measure 3 feet from the ground, something over 2 feet in diameter.

"In the neighbourhood of the height of land, the country is more open, while the tops of the ridges are often quite bare. Some of the finest spruce timber encountered on the journey was found in small groves in sheltered localities within a few miles of the lake sources of the river."

Forest Products. Two large sawmills were started in the district several years ago. One of these is near the mouth of Grand river at Mud lake; the other is at Carter basin. They have not been in operation in recent years, but this is not from lack of good logs. At present only one small mill, with portable gasoline engine, furnishes lumber for local use, and the forests remain practically untouched. Lumber and other ordinary forest products, excepting the product of the small mill on English river (Plate VI B) are not at present produced in Lake Melville region. Much of the lumber for local consumption is still cut with the old hand whipsaws. Until the boundary question is settled, and it is known whether Newfoundland or Canada has authority to grant timber concessions, it is not likely that any serious attempt at lumber or pulpwood production will be undertaken.

It may be noted here that this region is closer to the British and European market than is any part of the Maritime Provinces.

Future Development. Examination of a map[1] of the distribution of North American forests will show the very important rôle which Labrador will probably play in supplying forest products for the world market of the future. Lake Melville and Double Mer waterways are of peculiar importance in this connexion, because they afford about 200 miles of navigable waters which are usable by sea-going vessels. These waterways include lake Melville, Grand lake, Double Mer, and The Backway. This penetration of the heart of the best of the Labrador forests by deep waterways must become an important element in keeping transportation costs at a low figure.

Canada is destined by its geological and geographical features to remain permanently the great forest country of North America. Compared with the area of the great forest belt extending from the Labrador coast to the Pacific, the widely scattered forest areas to the south of it appear insignificant in size. Lake Melville may reasonably be expected to become in the future one of the important eastern outlets for the forest products of the eastern part of this vast forest zone.

[1] Zon, Raphael, and Sparhawk, W. N., "Forest Resources of the World," vol. II, 1923.

FAUNA

Only a few of the more conspicuous or better known animals can be mentioned in a report having the scope of the present one. Most of those observed belong either to the seashore fauna or the fauna of the forested interior. The majority belong to the latter fauna.

By far the most abundant mammal in the region is the Labrador lemming. This ubiquitous little creature is equally abundant on the islands of Hamilton inlet and in the interior. It may be seen in numbers everywhere darting rapidly along its tunnel-like runways, as a rule more or less open at the top, from one bit of cover to another. It no doubt affords an important source of food supply to the predatory birds and some of the fur-bearing animals.

Sharply contrasted with the general distribution of the lemming is the coastal distribution of the polar bear. Though reported to be rare in the region, a few are taken along the coast. Its distribution seems to be sharply limited to the coast. The writer has heard of no cases where the polar bear has been taken west of Rigolet. The skull of a specimen taken during the season of 1921 on one of the islands in the eastern part of Hamilton inlet was seen by the writer at Indian Harbour.

Practically all the fur-bearing animals, with the exception of the seals and white foxes, are confined to the forested interior, where nearly all the trapping is done. These include the mink, marten, muskrat, weasel, beaver, otter, lynx, and fox. The red, white, cross, and silver varieties of the fox are taken.

The otter, beaver, and groundhog were observed during the summer, and a specimen of the latter was killed near the head of Double Mer.

Ducks were seen in The Backway in flocks numbering thousands. Loons and gulls are common on lake Melville, but characteristic sea birds like the guillemot are not found on the waters of lake Melville.

Toads were seen at Northwest River and green frogs were taken at Mud lake. Specimens collected were identified by C. L. Patch as *Bufo americanus* (American toad) and *Rana pipiens* (Leopard frog).

The harbour or freshwater seal (*Phoca vitulina*) is abundant in the river, lake, and sea waters of the region as far west as Muskrat falls. The largest number of individuals seen at any one locality was just below Hamilton falls, where about fifty were observed at one time.

The cod is unknown in The Narrows and the waters west of them. Cod fishing is confined to the waters adjacent to the islands in the eastern part of Hamilton inlet. Commercial fishing in lake Melville and the western part of Hamilton inlet is confined to salmon fishing.

The grampus whale may be seen daily near Rigolet. In many places two or three were seen together and at times the caplin on which they feed were observed in numbers shooting out of the water just before the surface was broken by the curved back of a grampus following the school. This whale, although very conspicuous east of Henrietta island, was not seen west of that island, during the summer. It no doubt at times extends its range for short periods into lake Melville, but the normal habitat seems to be in the saline waters east of the lake.

It will be seen from these notes that typical marine animals like the guillemot, grampus whale, and cod are unknown west of The Narrows, the cod not even extending into The Narrows.

INHABITANTS

The people of "the coast of Labrador" and the adjacent interior belong to four groups. These are the Newfoundland fishermen, who spend only the summer on the Labrador coast, the Eskimo, the Indians, and the "liviers." It is the cod fisherman from Newfoundland, and his picturesque shack always located on the shore, that first catch the eye of the visitor from the south. The largest group of these fishermen is located at Indian Harbour, the headquarters of the cod fishing industry.

The salmon fishing industry which is, after cod fishing, the most important summer occupation, is carried on chiefly by the "liviers" in the waters of lake Melville and The Narrows. The salmon catch is shipped from the interior posts, Rigolet and Northwest River (Plates VIII and IX).

The region was divided originally between the Indian and the Eskimo, the former holding the interior, the latter the coastal strip. The Eskimo (Plate IV A) are now nearly extinct in Hamilton Inlet region and southward, although Holme[1] reported in 1887 that they were "numerous" in Hamilton inlet. The territory formerly held by the Eskimo was approximately the same narrow shore zone now occupied by the Newfoundland and French-Canadian fishermen, but all the vast interior river and lake region belonged to the Indian. When the white man first came to the gulf of St. Lawrence, the Eskimo held the narrow seacoast strip as far west as Mingan, opposite the western part of Anticosti island. The acquisition of firearms from the French enabled the Indians, in 1600, to drive the Eskimo eastward to the strait of Belle Isle. Since then he has retreated very slowly to his present southern limit at Hamilton inlet.

The Labrador Indians belong to two tribes, the Montagnais of the south and the Naskaupis of the north (Plates X and XI A). Hamilton river and lake Melville form in a general way the boundary between the hunting grounds of these two Indian groups. About seventy-five Indians, representing both tribes, came under the writer's observation during the summer of 1921. In religion all the southern and eastern Indians appear to be Roman Catholics. They were encamped in their dome-shaped canvas tents at Northwest River and pendant crosses were much in evidence on some of them. The following observations on the Indians who were encamped for a few days near the trading post at Northwest River are quoted from Mr. William B. Cabot[2], who has an unequalled knowledge of the psychology and customs of these people.

"The group I was with last summer, known as the Northwest River Indians, have at any rate a good deal of Naskaupi blood, and some membership of actual Naskaupis. Their affiliation is quite with the latter, the

[1] "A Journey in the Interior of Labrador": Proc. Roy. Geog. Soc., vol. X, p. 190, 1888. This statement is open to question, since Davies, writing in 1842, states that "they (the Eskimo) are now reduced to eight families, though they had numbered upwards of 300" as late as the beginning of the present century. (Trans. Lit. and Hist. Soc., Quebec, p. 89, 1843.)

[2] Personal letter, Nov. 21, 1921.

regular Montagnais not mixing with them. You may have noticed that the Montagnais Indians camped by themselves far down the beach last summer. They hold themselves above the Northwest River people.

It is as well if one is having to do with the people there to know that the name Naskaupi is a term of contempt applied by the southern Indians and not to be used to a person's face. At best it means an ignorant person, and probably includes the idea of dirtiness and general indecency. I have never heard a dignified Indian use it. The general Montagnais name for the Naskaupis is Big People, the Montagnais being small themselves. The actual name is Pakquockanun or Pakquockamus, I am not sure of my own writing of the word. The boy I had to come back with me, Gilbert Blake, and who spoke Indian fluently, called them Crees, which by their own account they are, having come north from the region southwest of Hudson bay, within historic time, to get away from the Iroquois."

According to the estimate of the Dominion Department of Indian Affairs, the total number of Montagnais Indians who came to the southern coast of Labrador in 1908 was six hundred and ninety-four. All these, with the exception of the few too decrepit to travel, spend the greater part of the year in the interior. The summer journeys in search of caribou and other game in many cases take them a very considerable distance along the rivers and lakes. All of them make a spring or summer trip to the coast, where they dispose of the winter's catch of fur and secure supplies from the traders.

Samuel Roberston[1] estimated the number of Montagnais Indians on the coast in 1841 "from the Saguenay downwards" at about 700 and including those about lake St. John, at 1,000. The latter estimate he suspected was too large. This estimate published in 1843 is surprisingly near the 1908 figures of the Indian Department, and suggests no material change in the numbers of the Indians during the past seventy years. Cabot has the impression that their numbers are diminishing and stated "The people of the Labrador inland are a remnant."

Davies stated that "of the thirty-two families who frequented the bay (lake Melville) in 1840 only nine belonged to it."

The Naskaupis of George river formerly showed relatively little inclination to visit the trading posts. McLean said of them that "of all the Indians I have seen, the Naskaupis seem most averse to locomotion; many of them grow up to man's estate without once visiting a trading post.[2]"

In the old days, savage reprisals resulted when either race entered the hunting territory of the other. Battle Harbour,[3] according to tradition, is one of the names which has survived from the days when the Indian and Eskimo tried to settle disputes concerning their hunting grounds with the tomahawk and the spear. The Eskimo have disappeared from the coast south of Hamilton inlet, which the Newfoundland fishermen now occupy during the summer. Nearly all of them return to Newfoundland for the winter. The Indian still survives in southern Labrador, but lives as his ancestors did, except that canvas canoes and tents have supplanted the birch-bark canoe and the skin-covered teepee.

---

[1] Roberston, Samuel, "Notes on the Coast of Labrador," Trans. Lit. and Hist. Soc., Quebec, vol. IV, 1843, p. 40.

[2] "Notes of a Twenty-five Years' Service in the Hudson's Bay Territory," London, 1849, p. 119.

[3] Hawkes, E. W., "The Labrador Eskimo," Geol. Surv., Can., Mem. 91, 1916, p. 17. Gosling (Labrador, 1910, p. 167) considers Battle a modification of the Portugese word batel-canoe, but admits the immemorial hostility between the two races.

In Labrador, as elsewhere on the northern frontier, natural selection is producing a type of man well adapted to a changing environment. This new type will in time supplant the Indian.

In a country where elemental conditions prevail as they do in Labrador, natural selection is not an academic term but a stern reality. Nature undertakes to make of every man who claims a home in Labrador either a hunter or a fisherman. For the failure starvation awaits just around the corner. The man who is a product of an environment where these two arts are not important or essential, must, when he comes to Labrador, speedily acquire them unless he is able to maintain connexion with his old environment and its resources. The tragic death in 1903 of Leonidas Hubbard illustrates the remorseless way in which this fundamental law works in Labrador.

The hardy French and English fishermen, who came into the region a century and a half ago, found it to their liking, as did the Scotch traders of the Hudson's Bay Company who followed them. They and their successors have left as descendants a brown-skinned race of Eskimo or Indian extraction on the maternal side. These are the "liviers", as they are called to distinguish them from the Newfoundland fishermen who do not "live here," but come and go with each fishing season. Unlike the Indian, who is willing to starve but not to work when game is scarce, the "livier" is apt to have the industrious habits of his paternal ancestry. Many of them have comfortable cabins always well stocked with rifles and some supplied with a few books and, in one instance which the writer recalls, with a small organ. Throughout the summer the "livier" devotes himself to the salmon and trout fishing in lake Melville, and in winter to trapping. At the approach of winter he goes into the forest for the trapping season, sometimes with a companion or with dogs, but in many cases, alone, and from 50 to 200 miles from any settlement. The solitary trapper ordinarily knows no other companionship for three or four months except that of the trees, the stars, and the aurora. If the trap-line be a long one, 4 a.m. will find a good trapper on the trail. These men appear to be as perfectly adjusted to, and satisfied with, their environment as the foxes and the otters whose pelts they seek.

The permanent or winter homes of the natives or "liviers" are commonly located in groups of three or four near a river mouth. In many cases, however, solitary houses are located many miles from any others. Small shacks have been constructed along some streams at intervals of 20 or more miles, which are occupied only for night camps by trappers in winter.

It is difficult to estimate the number of people living in Lake Melville district. The results of various inquiries and the writer's own observations indicate that eight or nine families occupy the shores of Double Mer. This probably represents about thirty persons. The population of the shores of lake Melville west of Rigolet includes about two hundred and fifty people. Northwest River and Rigolet have respectively about seventy and forty-five people. The total population of the Lake Melville and Grand Lake basins, exclusive of Indians, appears to be about four hundred and fifteen persons.

Failure to mention the insect pests would render incomplete any discussion of the environment of the people of eastern Labrador. Packard's remarks on the mosquitoes and black flies indicate briefly but clearly the disturbing and annoying character of this factor. He states that "The armies of black flies were supported by light brigades of mosquitoes. They fly into our faces; they do not bite hard, like the mosquitoes, but the vampires suck long and deep, leaving great clots of blood. No wonder that these entomological pests are a perfect barrier to inland travel, and that few people live during the summer away from the sweep of the high winds and dwell on the exposed shores of the coast to escape these torments.[1]"

Whether the insect pests of the interior and the fear of the Indian have been factors in keeping the Eskimo confined to the coast may be questioned, but there is no doubt about the abundant food supply of the seashore being the essential bond between this race and the coastal strip. A race so fully able as the Eskimo to supply all of its wants on the seashore would have little reason for exposing itself to the attacks of both its hereditary human and insect enemies by taking up its abode inland.

Freedom from the mosquito and black fly pests has evidently been considered in locating the admirably planned and equipped hospitals established along the coast by Dr. Grenfell. The Indian Harbour hospital, located on an outlying island 40 miles from the head of Hamilton inlet, seems to be entirely free of mosquitoes and flies. An inland hospital at Northwest River, 130 miles west, is occupied by the Indian Harbour hospital staff in winter after the insects have vanished and when people have returned from the islands and seacoast to their winter houses located near the trapping grounds. Very few of the houses about the mosquito-infested bays and river mouths of lake Melville are occupied during the summer. Most of their owners occupy temporary camps or summer houses along the eastern part of the lake where the salmon fishing is good, or go out to the seacoast for the cod fishing season.

Probably no more definite habitat limits ever existed between native races than those recognized by the Indian and the Eskimo in the Labrador peninsula prior to the advent of the white man. Turner writes of the Eskimo, "The region inhabited by the Innuit is strictly littoral"[2]. Hawkes[3] states that "the Eskimo rarely inhabit a border country in heavy numbers, but prefer a screen of hunting territory between themselves and their inveterate enemies, the Indians......This is true of northern Alaska, the Mackenzie and Coppermine districts, Hudson bay, and Labrador as well......The coastal habitation of the Labrador Eskimo is broken only at Davis inlet, on the Atlantic coast, where the Eastern Naskapi come out yearly to the Hudson's Bay Company post to trade."

Occasional clashes between the two races were incidental to the maintenance of the inviolability of their respective domains. These were checked and eventually eliminated shortly after the opening of trading posts, through the influence of the traders. Esquimo island, near the eastern end

---

[1] Packard, A. S., "The Labrador Coast," 1891, p. 75.

[2] Turner, L. M., "Ethnology of the Ungava District, Hudson Bay Territory", Smith. Inst., 11th Ann. Rept., Bureau of Ethnology.

[3] Hawkes, E. W., "The Labrador Eskimo" Geol. Surv., Can., Mem. 91, pp. 17 and 24.

of lake Melville, is said to have been the scene of the last battle over the interracial boundary in the Hamilton Inlet region. This island is a short distance inside the forested zone. The Indians asserted, according to tradition, that the Great Spirit had made an unmistakable sign by which to distinguish the territories of the two races—all that was covered with forest belonging to the Indians and all that was barren being for the Eskimo.[1]

From the coast south of Hamilton inlet the Eskimo has disappeared and the cod fisherman has taken his place. A few Eskimo families still persist in Hamilton Inlet district (Plate IV A). North of that area in many places the Newfoundland fishermen appear to have either supplanted the Eskimo or occupy the coast conjointly with them. The Newfoundland fisherman, like the Eskimo whom he has supplanted, depends upon the sea for his livelihood. He has as a result of his occupation cofined his activities to the coastal region as closely as the Eskimo did.

Three trading companies have representatives at Northwest River. These are Hudson's Bay Company, the French Company, and the Porter Company. At Rigolet (Plate IX), the Hudson's Bay Company, and the Porter Company one mile east of Rigolet, operate stores. A Newfoundland trader keeps a store at Indian Harbour.

HYDROGRAPHY

NOMENCLATURE

The instability and lack of uniformity which has characterized the usage of some of the geographical names applied by various authors and maps to the region under discussion make it desirable to define the meaning given in this report to the names discussed in the following paragraphs.

Davis Bay. This name, which applies to the great bay lying between Greenland and Labrador south of Davis strait, was not introduced until 1897, and will not, therefore, be found on older maps. The following definition of the term and explanation of the reasons for its introduction, which are quoted from Tarr's[2] original definition, appear to justify its use in place of the broadly inclusive name Atlantic ocean as a rule seen on charts showing the eastern coast of Labrador.

"It is a rather remarkable fact that the great bay which extends north to the Arctic circle, from the main Atlantic to Davis straits, should have been given no name. Baffin bay extends from cape York to Davis straits at the Arctic circle; but no name is applied to the bay south of this. Because of the difficulty experienced in the attempt to write this article, on account of the absence of such a name, I would propose for the bay between Labrador and Greenland and south of Davis straits, the name Davis bay, after the first navigator of these waters, who, in the year 1587, made the perilous voyage in a sailing vessel as far north as Upernavik."

---

[1] Holme, R. F., Proc. Roy. Geog. Soc., vol. X, 1888, p. 193.
[2] Difference in the Climate of the Greenland and American Sides of Davis' and Baffin's Bay: Am. Jour. Sci., vol. III, Apr., 1897, p. 315.

Hamilton Inlet. Hamilton inlet is a funnel-shaped indentation of the Labrador coast on the western side of Davis bay, some 40 miles in depth. It was known to Davies[1] and other early writers on Labrador as Esquimaux bay. Near Indian Harbour and Tub harbour the trend of the coast-line changes rather abruptly, bearing towards the southwest in the vicinity of Pompey island and toward the west near Tub harbour. The resulting pocket is called Hamilton inlet. This definition of Hamilton inlet does not coincide with the limits given the term as it is used in some of the maps and publications relating to the region. Both Low and the Admiralty chart make the name include the broad western expansion commonly known as lake Melville. The confusion which results from embracing under one designation two distinct bodies of water affords sufficient reason for delimiting the boundaries of Hamilton inlet so that it does not overlap or include the body of water known as lake Melville. The extended application of Hamilton inlet to include lake Melville was, probably, adopted by Low[2] from one of the British Admiralty charts, which, among other geographical inaccuracies, shows lake Michikamau draining into the strait of Belle Isle instead of into lake Melville.

The Narrows. This name applies to the narrow channel which, like the constriction of an hour glass, connects lake Melville and Hamilton inlet. As the name is used in this paper The Narrows extend from the northeastern side of Henrietta island to the junction of Double Mer and Hamilton inlet. The Narrows have an average width of a little more than one mile and a length of about 12 miles.

Lake Melville. Lake Melville extends about 90 miles in a southwesterly direction from the western end of The Narrows. It expands to a maximum width of about 20 miles.

This body of water is called Groswater bay on Cabot's[3] map and the same name has been used by Low as a synonym for lake Melville. The considerable width and narrow outlet—about one mile at Rigolet—make the term "bay" appear altogether inapplicable to a body of water having the shape of lake Melville. This waterway is the product of geologic changes which occurred in Quaternary time, causing the deepening and widening of the old preglacial Hamilton river, and it may be considered a local modification or expansion of Hamilton river of Tertiary times.

Northwest River. This is the name of a trading post and village located at the outlet of Grand lake into lake Melville. On the British Admiralty chart of the "North Atlantic ocean, western part,[4]" first published in 1870, which shows the whole of Labrador peninsula as well as Hudson bay and Baffin bay, the name Northwest river is given to a stream draining lake Michikamau and flowing southeast across the divide into the gulf of St. Lawrence, where Esquimaux river of later maps empties. This imaginary and impossible river, which is laid down as flowing across the course of Hamilton river and disregarding the divide, has disappeared from the more recent maps. The name appears on Low's map[5] attached to a somewhat hypothetical stream shown as a western branch of Naskaupi

[1] Davies, W. H. A., "Notes on Esquimaux Bay and the Surrounding Country," Trans. Lit. and Hist. Soc., Quebec, vol. IV, 1843, p. 70.
[2] Geol. Surv., Can., vol. VIII, 1895, p. 123L.
[3] "Labrador," 1920, Small, Maynard and Co., Boston.
[4] Admiralty Chart No. 2060B, published at Admiralty, Nov. 1, 1870. New edition, Nov., 1912.
[5] Geol. Surv., Can., Ann. Rept., vol. VIII, N.S., 1896.

river. A map "prepared for Dr. Wilfred Grenfell" gives to the stream now generally called the Naskaupi the name Northwest river. The name does not appear as a river name on the map published by Mrs. Hubbard,[1] and it is also omitted from Cabot's[2] sketch map of eastern Labrador. The name Northwest river appears originally to have been applied to the river now generally known as the Nauskapi.

There appears at present to be no reason for using this name in any other sense than as the name of the short outlet stream uniting Grand lake and lake Melville (Plate II A) and for the trading post located at its mouth.

Little Lake. The expansion of the outlet of Grand lake forms a shallow basin with the maximum width of about one mile. This basin, which has received no distinctive name on previous maps and reports dealing with the region, is called Little lake on the chart recently completed by the Hydrographic Survey.

Kenamu and Kenemich Rivers. All the maps examined by the writer, including the Admiralty chart of lake Melville, Low's map, the Hubbard map, and Cabot's map, show Kenamu river emptying into Carter basin. This river enters the lake a mile west of Carter basin.

Kenemich river is represented by the maps as flowing in a westerly or northwest direction and entering the east side of Carter basin. As a matter of fact it enters the southwest side of this basin (Plate V B).

RIVERS

English river is the most easterly stream of noteworthy size entering lake Melville from the south. Deep water just inside the mouth affords good anchorage for a launch. Navigation by canoe or launch is blocked less than half a mile from the mouth by boulder rapids (Plate II B). A sand-terrace, about 200 feet high, borders the river on the east near the rapids. Immediately to the southwest the mountains rise to a maximum elevation of 1,070 feet. Three knobs lying in a north and south direction west of English river showed barometer elevations of 810, 880, and 970 feet. This stream reaches the lake through a valley of mature type, in marked contrast with the small streams to the west of it, all of which descend the mountain slopes by a series of cascades.

About 2 miles southeast of Kindryakak point, Little river enters lake Melville. It is 50 or 60 feet wide at the mouth and affords a good launch anchorage inside. The channel widens to 100 yards or more 400 yards from the outlet and meanders through a lowland at the foot of the mountain scarp. This is probably the stream called by Holme "Gudder's Bight river," which he reports having ascended a few miles.[3]

Kenemich river enters the southwest side of Carter basin, not the southeastern as shown on previously published maps (Plate V B). It meanders through a heavily timbered lowland as far as it is practicable to ascend by canoe—a distance of about 14 miles—without making any notable approach to the mountain wall south of it. Above the lower 5 miles it has an average current of about 4½ miles an hour, and can be

[1] Am. Geog. Soc., Bull., vol. 38, 1906, pp. 529–539.
[2] Cabot, W. B., "Labrador", Small, Maynard and Co., Boston, 1920.
[3] Roy. Geog. Soc., vol. X, 1888, p. 193.

navigated by launch for a few miles. There is a rather gradual rise of the banks from a height of less than 10 feet at the mouth to 60 or 70 feet, 14 miles from the basin. The stream is as a rule 60 to 80 feet wide, the width being generally quite uniform.

The Kenamu is the largest river entering lake Melville from the south. The mouth is too shallow to be entered by launches. The river traverses the sand-plain bordering the south shore of the lake for several miles after leaving the deep V-shaped notch in Mealy Mountains plateau, and joins lake Melville one mile west of Carter basin. Davies says of this river: "Its course is, therefore, short, and as the lakes from whence it takes its rise are at a high elevation, it is extremely rapid and full of falls. I had it explored for about 80 miles; in the whole of this distance it was nothing but a succession of rapids. Its banks are mountainous. About 30 miles from its mouth it cuts through the range of the Mealy mountains."[1]

Mr. Wm. B. Cabot, who is acquainted with this stream, writes as follows concerning it: "It is perhaps 18 miles to the Mealy gap by the river, or, say, 12 straight, then 4 miles nearly straight south through the range. You can see the notch from anywhere off shore, on that end of lake Melville. There is no trouble getting up, two boys could take a canoe a mile above the gap, wading the bars. From there the river is the worst I know for 25 miles, just wide screeching shallows with a lot of pitch. At low water I don't see how anything could go up or down. The Mealy ridge may be 2,000 feet high at the gap. The heavily sculptured valley wall beyond runs nearly 1,000 feet high for 20 or 25 miles along the east side, the west side being comparatively low for, say, 15 or more, when a long ridge or two at 1,000 feet come to the river from the northwest. Beyond these the country flats off, probably showing no hills of account short of the southern slope valleys. I took it that from the last hills we saw well beyond the main height of land."

"I might say about the east valley wall along Kenamu beyond the Mealy gap, that the 1,000-foot height mentioned would be from sea-level. Probably it is a little more than that to the south, for the last hills we were on overlooked the flat, central country south a trifle, and this ought to be rather over 1,000 feet judging from Bryant's levels at the head of St. Augustine. As I remember it the last hills look 600 feet or 700 feet above the river, and the fall of the river from there down might be 300 feet or 400 feet; am sure it is more than 200 feet.

There are no lakes of size anywhere on Kenamu water."[2]

Mr. Leroy Bowes states that "There is a rise of the waters in the Kenamu river corresponding to the rise of the lake level at regular periods, but in this stream more than in the other investigated, the rise seemed to be caused more by the damming or piling up of the lake waters at the entrance than by any tidal effect.

As the maximum of the tidal range was reached, a considerable slackening of the current was noted. However, slight as this current was even at the mouth of the river, it was observed to be always in an outward or northeasterly direction."

[1] Davies, W. H. A., "Notes on Esquimaux Bay and the Surrounding Country," Trans. Lit. and Hist. Soc., Quebec, vol. 4, 1843, p. 75.

[2] Letter from Wm. B. Cabot, Nov. 21, 1921.

Hamilton river, the largest stream on the eastern drainage slope of Labrador peninsula, expands to form lake Melville. The river has a width of a little less than 1 mile where it joins Goose bay and widens to about $1\frac{1}{2}$ miles a short distance above that point. The stream is navigable by launches as far as Muskrat falls, 27 miles above lake Melville. The channel is obstructed by sand-bars and difficult to follow for the first few miles above the mouth. At Muskrat falls the river is contracted to a width of 100 yards or less and drops over a ledge of Precambrian rocks about 25 feet high (Plate XII A). This fall, and a second one, a few hundred yards higher up, of about the same height, necessitate portaging over a sand-terrace 170 feet high.

The river has low banks barely rising above highwater level near Goose bay. These rise by successive terraces to a height of about 100 feet some 15 miles above the bay. The erosion of these banks of sand and clay furnishes a vast amount of sand which is rapidly silting up the shallow water of Goose bay.

About 20 miles above lake Melville three or four boulder bars project from the south bank of the river. The bars are 50 to 60 feet across and extend from the timbered bank 40 to 100 feet into the stream (Plate XI B). They are separated by sandy bays. Nearly everywhere else below Muskrat falls the banks are of sand or clay. The boulders of all sizes which constitute these bars have been dropped, probably, by floating ice, checked and grounded at these points by eddies or slack current.

For several miles above lake Melville the mountain walls that outline its basin remain about the same distance apart. The river flows through the middle of a lowland which indirectly represents the deeply-filled western part of Melville basin. The wide Pleistocene lowland through which the Hamilton flows below Muskrat falls extends eastward along the south shore of lake Melville 6 or 8 miles east of Carter basin. On the north shore of the lake the same plain extends eastward to the vicinity of Sebaskachu river. The outlet of Grand lake and the basin at Northwest river are cut in it.

Traverspine river enters the Hamilton from the south 5 miles above Goose bay. It is a small, rapid stream, said to be navigable for boats for 5 miles.

Mr. Leroy Bowes gives the following data concerning Hamilton river near Goose bay. "The Hamilton river at its junction with Goose bay is about three-quarters of a mile wide. This section of the river is filled with small islands around which small streams wind through sandy shoals. From the northeastern point of the river mouth, which is well wooded, there extends a long, sandy spit for more than a mile in the direction of Rabbit island and a series of sandy shoals, some awash at high water, block the southeastern side of the river. But there is a good channel up to the Mud Lake entrance and a vessel drawing 7 or 8 feet can ascend the Hamilton a mile or more. The sand-spit and shoals mentioned above are made extremely conspicuous by the drift material, comprising huge tree roots and trunks, caught on their surface. These trees, it is reported, are brought down by the ice in the spring break-up of the river and stranded there by heavy easterly gales. A curious feature is that the roots are always to the westward with the trunks pointing in an easterly direction.

The shoals at the mouth of Hamilton river have a tendency to divide it into many channels. The main channel is close to the northerly shoal.

From the mouth of the Hamilton the river gradually widens out and above the Mud Lake entrance it is about 1½ miles in width. The river is full of sand-bars and navigable only with difficulty or by local knowledge.

The river current is not stopped or reversed by the lake tide even when the tide is flowing into the bay outside or when the water was rising there in a strong out current."

The outlet channel at Northwest River is some 300 yards long. By this channel the waters of Grand lake reach lake Melville (Plate II A). The upper end expands abruptly into the shallow basin of Little lake some 2 miles in length, which is connected by another short channel with Grand lake.

The Sebaskachu and Mulligan rivers (Plate XIII A) are the two largest streams which enter the north side of lake Melville east of Northwest river. The first enters the lake between two steep-sided rock-ribbed hills. Mulligan river outlets by two channels at the head of a bay. The mouth of the western channel affords good launch anchorage. Canoes can ascend the river about 1½ miles. Boulders render canoeing impossible higher up. About 1½ miles from its mouth Mulligan river passes between two Precambrian hills, some 600 feet high; the lower part of its valley below this is excavated in Pleistocene sands.

A low gap or valley strikes through the mountains from a point about one mile east of the mouth of Mulligan river to Double Mer which lies about 20 miles to the northeast.

Only three streams of notable size join Grand lake. These are Beaver, Susan, and Naskaupi rivers, all of which enter the lake near its head, the deeply incised lake valley splitting into a tripartite division. Each of the three resulting valleys is of the broad and mature type. The two smallest streams, the Beaver and Susan, enter at the head of the lake. These two streams unite in a small, bulb-shaped lake about 1½ miles long and 1⅓ miles wide, which enters the head of Grand lake by a very short outlet channel a few rods in length. Susan and Beaver rivers occupy well-developed valleys on opposite sides of a mountain ridge which terminates about 1½ miles northwest of the head of Grand lake. The sand-terrace at the head of the lake prevents the Beaver from entering Grand lake directly, diverting it to the north and causing its junction with the Susan before leaving the small lake referred to above. Both of these streams are small and not very satisfactory canoe streams. The ill-fated Leonidas Hubbard expedition[1] ascended the Susan under the misapprehension that it was the much larger Naskaupi river.

The Naskaupi joins Grand lake about 5 miles below the head of the lake. The Naskaupi is about 280 yards wide at the mouth. Higher up it is seldom less than 150 or 200 yards wide for several miles. It is navigable for launches as far as Red river, a distance of 16 miles (Plate XIII B). The Naskaupi flows out of a broad valley flanked with ridges rising in gentle slopes to 800 feet or more.

---

[1] Hubbard, Mrs. L., "A Woman's Way through Unknown Labrador," The Maclure Co., 1908.

Little river joins the Naskaupi less than a mile above its mouth. This stream parallels the Naskaupi for a few miles and is separated from it by a series of Pleistocene sand-terraces which reach a maximum elevation of 100 feet. The width of the old preglacial valley, which for a few miles holds these two streams, is about 6 miles. Ten miles above its mouth Naskaupi valley narrows to about one mile. The surface of the land between the mountain walls of the valley is in many places quite irregular through the erosion of the sand and clay-terraces which border the stream. At the forks of Red and Naskaupi rivers a remnant of the sand-terrace has a height of 200 feet above the river. Red river is commonly closely bordered by sand-terraces. The highest elevation measured for these is 280 feet about 6 miles above the forks of Red and Naskaupi rivers. Red river was ascended by canoe to a point about 10 miles above the Naskaupi, where it has, within a year or two, cut through an oxbow in the Pleistocene beds, exposing a very good section.

The sand-bars along Red river show in some cases an irregular and deeply-pitted surface of unusual character. This kind of surface is probably produced during the spring floods and may be connected with currents developed in connexion with ice-jams.

Waterpower. When the pulpwood industry is developed in eastern Labrador, as it will be eventually, some of the abundant waterpower of the country will no doubt be utilized. Hamilton river, a stream at least the size of Ottawa river at Ottawa, has, within 25 miles of lake Melville, two falls with a combined drop of 70 feet. The lower fall is shown in Plate XII A. A half dozen other streams entering this lake descend in the course of a few miles 1,000 feet or more, and some of them offer waterpower possibilities.

Hamilton falls, the greatest water falls in Canada, are located about 250 miles above the mouth of Hamilton river. The river here makes a total descent of 760 feet in 12 miles, terminating with a single plunge of 302 feet. According to Low the roar of these falls can be heard for more than 10 miles and the "cloud of mist is visible from any eminence within a radius of 20 miles."

INTERIOR EXTENT OF THE INTERTIDAL FAUNA

It might appear upon casual consideration a very simple matter to define for any region the limits or boundaries between the seacoast, on the one hand, and the banks of confluent lakes and rivers, on the other. This, however, is far from true. The banks of rivers with wide, trumpet-shaped mouths, like the St. Lawrence in Canada and the Potomac in the United States, merge into the coast-line of the sea without producing the sharp, angular interruption in the shore-line which defines the mouths of ordinary rivers. The tide in such streams in many places reaches far up that part of the channel which everyone would agree is that of a river rather than the arm of a bay. No one, for example, would question the fact that Quebec and Washington cities are located respectively on the St. Lawrence and Potomac rivers, although the tides run well above these cities.

It is evident from these considerations that neither configuration of the shore-line nor extent of tidal influence affords in some cases dependable criteria for delimiting the seacoast from the shore of river or lake. Brackish water with a considerable degree of salinity often extends, like the tidal influence, up channels universally regarded as rivers.

There is apparently no single criterion which taken alone, would be generally accepted as an adequate and conclusive test or index of the limit of seashore or river mouth. Salinity, however, is one factor to be considered. Both the plant and animal life of sea-water are delicately adjusted to the salinity of normal sea-water. The seashore and the waters adjacent to it are everywhere characterized by assemblages of animals and plants which cannot live in fresh or brackish water. Where tidal waters extend a long distance inland, as they do in Lake Melville region, a dependable method of ascertaining where salinity changes occur is to note the limit of marine life.

Examination of the shore-line at Rigolet, when the tide is out, discloses a typical marine fauna in the shallow pools and attached to the rocks. The species collected on the south side of The Narrows opposite Rigolet are indicated in the following list:

Marine Invertebrates from The Narrows opposite Rigolet[1]*—Field No. 7*

HYDROIDEA

Thuiaria similis (Clark)—7 pieces
Thuiaria similis (?) (Clark)—1 piece. Differs from Nutting's description in that each node of main stem bears two branches (one on each side) and one hydrotheca on each side. Sub-branches agree with description

AMPHIPODA

Ischyrocerus latipes (Kryer)—19 specimens and fragments
Ischyrocerus anguipes (Kryer)—12 specimens
Erichthonius rubricornis (Stimpson)—6 specimens and fragments
Dulichia porrecta (Bate)—2 fragments
Metopa spectabilis Sars—1 specimen
Stenopleustes malmgreni (Boeck)—6 specimens
Caprella stimpsoni (Bate)—many specimens
Caprella linearis (Linn) (?)—10 small specimens including 3 females
Jassa sp. (near *J. minutus* (Sars)—3 (females only)
Jassa sp.—1 small specimen
Atylus carinatus (Fabr.)—1 specimen
Acanthonotozoma inflatum (Kryer)—1 fragment

CIRRIPEDIA

Balanus crenatus—3, and fragments of 1 (?) more

GASTROPODA

Littorina palliata (Say)—1 specimen
Acmaea testudinalis—1 specimen
Littorina rudis var. *groenlandica* (Mörch)
Molleria costulata (Möller)—1 (?) small broken shell

AMPHINEURA

Amicula vestita (Sowerby)—1 specimen
Tonicella marmorea (O. Fabr.)—2 specimens

BRACHIOPODA

Hemithyris psittacea (Gmelin)—half shell

PELECYPODA

Mya truncata L.—1 half shell
Mytilus edulis L.—6 shells, and 1 fragment
Saxicava arctica (L.) about 2 dozen shells and fragments (incomplete)

[1] The species in this list have been determined by Prof. A. G. Huntsman.

ECHINODERMATA

Strongylocentrotus drobachiensi (O. F. Müll.)—1 specimen

SPONGIAE

Halichondria panicea Johnston—1 specimen, and several fragments, apparently the same

ASCIDIACEA

Synoicum haeckeli (Gottsch.)—Several colonies

The strictly marine character of the fauna found in The Narrows will be evident on comparison of the above list with the fauna collected from the sea at Indian Harbour.

Indian Harbour, Labrador. Small Coves in 1 Foot to 5 Feet of Water[1]*—Field No. 14*

AMPHIPODA

Gammarus locusta (L.)—2 specimens (large)

Ischyrocerus anguipes Kryer?—2 females and 2 young. Agree with *anguipes* in antennæ, gnathopods, and postero-lateral corners of pleon 3. Agree with latipes in telson and uropod 3

Pontogenia inermis (Kryer)—3 specimens

CIRRIPEDIA

Balanus balanoides (Linnaeus)—20 specimens, and fragments

GASTROPODA

Acmaea testudinalis (L.)—1 specimen

Mass of egg capsules—1 specimen

Littorina palliata Say—5 specimens

Littorina littorea L.—1 specimen

Buccinum undatum L. of the variety figured by Packard as *B. undulatum*—13 specimens

Littorina rudis var. *groenlandica* (Mörch)—23 specimens

Margarites helicinus (Fabr.) (of the type formerly called *M. campanulata*)—17 specimens

PELECYPODA

Mytilus edulis L.—3 specimens

Mya arenaria L. (incomplete)—1 shell

Crenella sp.—1 half shell

DECAPODA

Hyas areneus (L.)—1 specimen (5·1 cm.)

ECHINODERMATA

Strongylocentrotus drobachiensis (O. F. Müll.)—several broken specimens

The extension of the marine fauna inland beyond Rigolet is most easily ascertained by noting the changes in the molluscan fauna of the intertidal zone as it is traced toward Henrietta island. The two most abundant and persistent of these species are the barnacle *Balanus balanus* (L.) and the gastropod *Littorina rudis* var. *groenlandica* Mörch. They were found to persist farther toward the interior than any other species of the intertidal zone. Plate XII B indicates the wealth of individuals by which these species are represented on nearly every boulder or rock outcrop on the intertidal zone in the vicinity of Rigolet, where from fifty to a hundred individuals to the square foot is not an unusual number. This gastropod, and the barnacle which is generally associated with it, are found everywhere on the Labrador seacoast in abundance.

The distribution of these two abundant and characteristic species of the intertidal zone was very carefully investigated along the shores of The Narrows and lake west of Rigolet. Barnacles were found on the east

[1] Specific determinations were made by Prof. A. G. Huntsman.

shore one mile west of an old house standing nearly opposite Rigolet or one mile east of the long boulder point near Summer cove. Only three individuals were found here and none farther west. Littorina, however, extends to within one mile of Henrietta island on the east shore of the inlet. Neither barnacles not Littorina appear to be present on the west shores of The Backway.

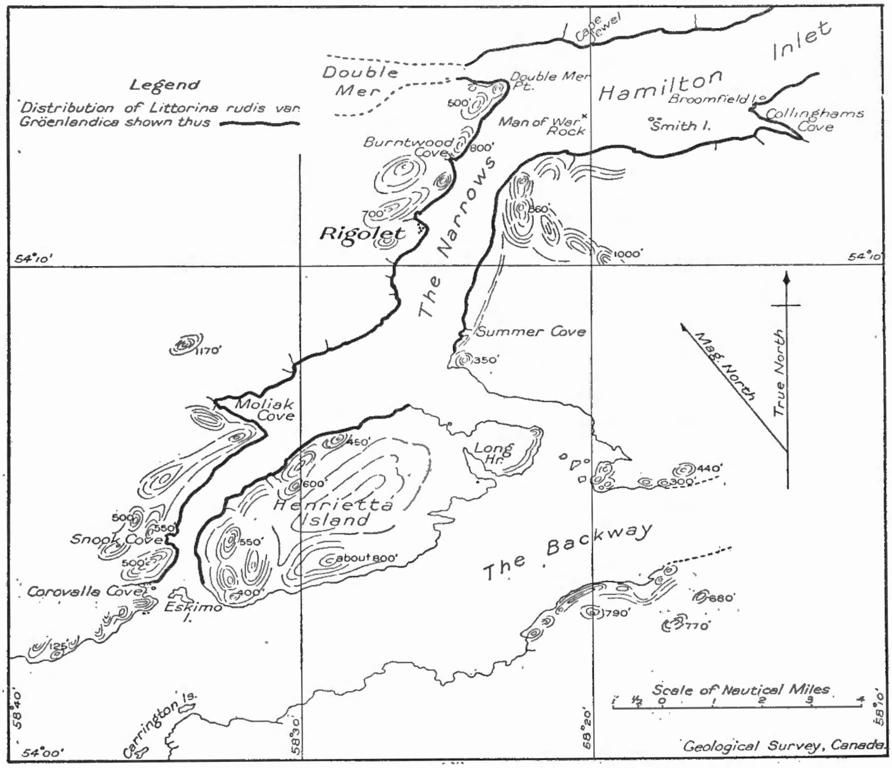


Figure 6. Map showing the distribution of *Littorina rudis* var *groenlandica.*

On the west shore of The Narrows, Littorina continues abundant to a point 4 miles west of Rigolet, but it is rare in Mullioch bay and Caravalla cove, where only two specimens were found. It is present on the north shore of Henrietta island. West of Henrietta island and Caravalla cove neither Littorina nor barnacles were found. On the west, as on the east shore, barnacles fail to extend as far west as Littorina. The species commonly associated with these typical intertidal shells are likewise absent from the shores to the westward of this island, which fact indicates the decreased salinity of the waters to the westward of Henrietta island (Figure 6).

A consideration of the fish fauna of these waters leads to a similar conclusion. The cod, which is a typical salt-water fish, is not known west of Rigolet. The caplin, which are extensively used as codfish bait, are common at Rigolet, but were not seen west of Henrietta island. West of this island salmon trout are the only fish taken by the fishermen.

The absence of typical marine fishes west of Henrietta island, and the disappearance of the marine intertidal fauna in that vicinity, both indicate the considerable change in the composition of the water which occurs near the eastern end of lake Melville. West of Henrietta island the waters of lake Melville, though somewhat saline, are too fresh to support a marine fauna in the intertidal zone.

Double Mer is a deep fiord valley which joins Hamilton inlet 3 miles east of Rigolet. An examination of the shores of Double Mer has shown that the fauna represented by Littorina and the barnacle *Balanus balanus* (L.) persists nearly to the head of this inlet, although the species are represented by greatly diminished numbers in the upper part of the waterway, indicating the decreasing salinity and the nearly complete disappearance of seashore conditions. The relatively small amount of fresh water entering Double Mer, and its wide outlet as compared with lake Melville, explain the much greater extension inland around its shores of a seashore fauna. Seashore conditions may be considered to extend nearly to the head of this waterway.

TEMPERATURE AND DENSITY

In the following table, which shows the temperature and the relative salinity of the water, as indicated by hydrometer readings, the several stations from 1 to 15 are arranged in a geographical order starting at the outer or sea end of Hamilton inlet and extending inland about 160 miles to station 15. Stations 1 to 4 may be regarded as representing the outside marine conditions, the other stations show the higher temperatures and lower densities of lake Melville and its connecting waters.

Table of Specific Gravity and Temperature of Waters

No.	Stations	Date	Water temp.		Spec. gravity		Remarks
			Top	Bottom	Top	Bottom	
1	Indian Harbour........	July 13...........	35° F.	....	1·0182		
	Indian Harbour........	Aug. 20..........	47° F.	....	1·0188		
2	Rigolet..............	July 20..........	43° F.	....	1·0185		
	Rigolet..............	July 20..........	....	41° F.	....	1·0194	
3	East side inlet opposite Rigolet............	July 21..........	42° F.	31° F.	1·0201	1·0219	
4	East side Henrietta island..............	July 20..........	42° F.	....	1·0185		
5	The Backway, 6 miles up.................	July 18, 12.45 p.m.	47° F.	....	1·0149	....	Low tide
	The Backway, 6 miles up.................	July 19, 7.45 a.m.	56° F.	....	1·0066	....	Three-fourths flood
6	The Backway, 15 miles up...........	July 19, 11.30 a.m.	57° F.	....	1·0097		

Table of Specific Gravity and Temperature of Waters—Continued

No.	Stations	Date	Water temp.		Spec. gravity		Remarks
			Top	Bottom	Top	Bottom	
7	The Backway, near head...............	Aug. 15, 7.00 a.m.	53° F.	....	1·0095	....	Low tide
8	West of Caravalla point, 8 miles.......	July 26, 8.45 a.m.	56° F.	....	1·0096		
9	Pelters cove..........	Aug. 14...........	54° F.	....	1·0094		
10	Mulligan bay, 1½ miles off mouth of river...	July 28...........	53° F.	....	1·0063	1·0211	
11	East side of Long point in bay.............	Aug. 13, 5.15 a.m.	54° F.	....	1·0003		
12	Epinette point........	Aug. 12, 8.00 a.m.	50° F.	....	0·9995		
13	Northwest river, one mile outside mouth of river............	July 31, 7.30 p.m.	....	....	1·0005	1·0105	
14	Northwest river, just inside outlet to Little lake..........	July 30, 3.15 p.m.	55° F.	....	0·9998		
15	Grand lake, opposite cape Blanc.........	Aug. 4............	51½° F.	37° F.	....	....	Fresh water, depth 90 fathoms
16	Double Mer, 4 miles from head..........	Aug. 18, 2.00 p.m.	54° F.	....	1·0099		

The densities shown above represent hydrometer readings reduced to specific gravities at a temperature of 60 degrees F. Knudsen's hydrographic tables were used by E. J. Whittaker in adjusting the density figures to this common temperature base. The temperatures of the waters were taken with a Nigretti and Zambra thermometer.

These figures very effectively supplement and confirm the evidence furnished by the distribution of the marine fauna concerning the decreasing salinity of the waterways westward from Indian harbour.

The first station in the table shows the density of an average example of sea-water taken 40 miles from the head of Hamilton inlet. The figures for the water at Rigolet do not differ notably from those of this typical sea-water. After passing west of Henrietta island, however, the figures all depart widely from those representing the densities at Indian Harbour and Rigolet. At Station 13, the density of the water, although taken a mile from the mouth of the river, shows a close approach to that of fresh water. At Station 14, the water, which represents Grand Lake outflow, is perfectly fresh. The water of Carter basin, which is a bay with a narrow outlet on the south side of lake Melville, was not tested for salinity, but the water, though somewhat brackish, is fresh enough to make tea with and was so used by the writer.

It is reported by residents of the region that the waters of Goose bay, although they are brackish in midsummer, are perfectly fresh in spring.

The figures of density represent midsummer conditions when the rivers are at a relatively low stage, as compared with spring conditions. During the spring, when the rivers are in flood, the entire lake would no doubt be much less saline than these figures indicate. They suffice, however, to show clearly the sharp contrast in the physical characters of the water west of Henrietta island as compared with that of Hamilton inlet to the east of it. This contrast indicates that the former represents an inland lake with direct marine connexions, rather than a bay or inlet of the sea.

Lake Melville belongs, with reference to salinity, in the same class as lake Pontchartrain, Louisiana, which is also a tidal lake with waters which are not entirely fresh.

STRATIGRAPHIC GEOLOGY

PRECAMBRIAN

Undifferentiated Rocks. Precambrian rocks cover most of the region and include a variety of rock types. Gneisses of various kinds are perhaps the most commonly and widely distributed of these. Muskrat falls flow over ledges of gneiss and the valley of Grand lake is cut in rocks which are in large part gneisses. Typical banded gneisses occur on the west side of the lake. At one point they show a strike of north 25 degrees west magnetic, and a dip to southwest of 60 degrees to 70 degrees. On the east side of Grand lake, 5 miles below the mouth of the Naskaupi, thick beds of garnetiferous hornblende gneiss occur.

A biotite gneiss is a conspicuous element of the rock section 11 miles above the mouth of Naskaupi river.

Specimens were seen of a pure white crystalline limestone from Hamilton River valley above Muskrat falls, but no limestones were noted within the limits of the map-area.

On the south side of lake Melville the shore is encumbered for some distance with enormous boulders of labradorite, some of them 15 to 20 feet in diameter, which have evidently been derived from the mountain slopes above them. This and other feldspathic rocks appear to form a large part of the mountain mass south and southeast of Long point. East of Long point, schistose rocks comprise most of the shoreline. Gneisses and schists constitute the country rock about the eastern end of Lake Melville basin generally, except where cut by dykes.

The relationship of these undifferentiated schists and gneisses to the beds shown on the map as Domino gneiss is unknown.

Domino Gneiss. Packard[1] described a series of gneisses, quartzites, and trap-rocks which he states have their best development at Domino island in latitude 53° 30′—the Domino gneiss of Leiber[2]. Packard describes these rocks as they occur at localities within or near Hamilton Inlet district as follows: "Occasionally an island is seen half black and half white, one side being composed of the dark trap-rock, and the other of the light-coloured quartzite. Such is 'Black and White', a very prominent island near 'Indian Tickle,' a harbour at the northern side of Hamilton inlet. Here are some remarkable dykes which ascend the gneiss hills in huge, irregular, zigzag crests, often crossing each other at right angles."[3]

[1] Packard, A. S., "Observations on the Glacial Phenomena of Labrador and Maine with a View of the Recent Invertebrate Fauna of Labrador," Boston, Soc. Nat. Hist., Memoirs, vol. 1, 1869, p. 216.
"The Labrador Coast," p. 286, 1891.

[2] Leiber, O. M., Rept. U.S. Coast and Geod. Surv., 1860, p. 402.

[3] Packard, A. S., "Observations on the Glacial Phenomena of Labrador and Maine with a View of the Recent Invertebrate Fauna of Labrador," Boston, Soc. Nat. Hist., Memoirs, vol. 1, 1869, p. 217.

The writer has seen these beds only at Indian Harbour. The dykes there are very conspicuous features (Plate XIV A), and many develop by erosion, either as prominent wall-like masses standing above the adjacent rocks or as trenches cut below them according to their relative hardness or resistance to erosion.

Bell[1] referred these rocks to the Huronian.

This set of beds has been grouped on Low's[2] map (No. 586) with the red sandstones of lake Melville, but they have no resemblance to these rocks, and appear to belong to a much older series. Their distribution, as shown on Figure 4, is based on the information recorded by Packard.

Daly[3] has described the characteristics of these rocks as developed near Indian Harbour.

PALÆOZOIC SANDSTONE

Double Mer Sandstone. The Palæozoic rocks are represented in this region by a single formation—a coarse red sandstone. It was first described by Low[4] from outcrops on the north side of lake Melville under the caption of Cambrian sandstone.

In Double Mer basin, about 25 miles northeast of the sandstone area which Low mapped on the north shore of lake Melville, a new area of this sandstone has been discovered. The exposures on the north shore of Double Mer afford much better views and a thicker section than the Lake Melville area and it is, therefore, proposed to name this formation the Double Mer sandstone. The type section is located about 8 miles east of the head of Double Mer. About 150 feet are exposed in the best section. The rock is a firmly-cemented, dull red, arkose sandstone of coarse texture throughout, with numerous small pebbles in some layers. Crossbedding is common. The beds dip to the east at 5 degrees. Outcrops occur for 2 miles along the shore, and indicate a total thickness of more than 500 feet.

Loose pieces of the sandstone are abundant on the north shore as far east as the narrow part of the waterway and they occur within a couple of miles of the west end of Double Mer. The loose shore fragments and the lowland type of topography (*See* Figure 7) characterizing the sandstone area are the criteria by which the distribution of the formation shown on Figure 4 has been inferred.

The best outcrop of the Double Mer sandstone seen in Lake Melville basin occurs on the north shore of Mulligan bay. It is there a coarse, dark-red sandstone with small quartz pebbles. The sandstone is highly crossbedded and shows a thickness of about 75 feet dipping northwest at about 25 degrees. A trip up Mulligan river into Mulligan hills failed to discover any outcrops of this sandstone away from the immediate vicinity of the shoreline. The nature of its relationship to the Precambrian schists lying northwest of it is unknown. The junction of the sandstone with the Precambrian rocks is so effectively concealed by Pleistocene deposits that it has not yet been observed. The topographic features of Lake Melville

[1] Bell, Robt., "The Labrador Peninsula," Scot. Geog. Mag., vol. 11, 1895, p. 349.
[2] Low, A. P., Geol. Surv., Can., vol. VIII, map of Labrador peninsula, 1895.
[3] Daly, R. A., "Geology of Northeast Coast of Labrador," Bull. Mus. Comp. Zool., vol. 38, 1902, pp. 212-213.
[4] Geol. Surv., Can., Ann. Rept., vol. VIII, 1895.

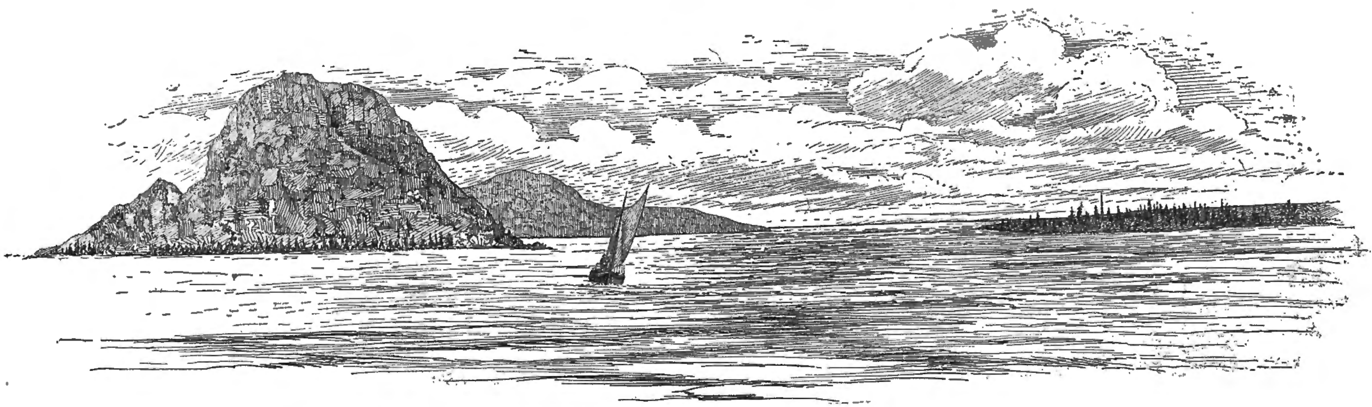


Figure 7. View at the narrowest part of Double Mer showing the contrasting topography of opposite shores. Precambrian rocks form the rugged mountainous shore and Palæozoic sandstones the featureless right-hand shore.

basin, however, lead to the view that the basin represents a fault block as outlined in the discussion of the drainage history.

Neither the top nor the bottom of this formation has been seen. None of the known outcrops show it in contact with the Precambrian. No fossils have been found in it, but it is believed to represent the oldest Palæozoic formation in the basins where it occurs. The feldspathic character of the coarse sandstones leaves little doubt that it represents the earliest phase of sedimentation after the first submergence of the Precambrian land surface of the region.

It seems probable that Palæozoic formations of later age than the Double Mer sandstone were deposited in this region, but no such beds are known and if laid down they have doubtless been removed by erosion.

QUATERNARY

Glacial Deposits. The visible Quaternary deposits of Lake Melville basin are confined almost entirely to postglacial clays and sands, if the glacial boulders, which are everywhere in evidence, be excepted. Glacial till may, and probably does, underlie the later marine and estuarine deposits over large areas in the deeper valleys, but it is seldom exposed. The basal 12 feet of the Mulligan River section given on a later page appears to be glacial till. On the hill and mountain slopes, subaerial erosion on the higher levels, and marine currents and waves on the lower, have removed nearly all the glacial debris except the boulders.

Glacial striæ were no doubt widely—even universally—distributed over the region at the close of the Glacial period. Scaling or breaking up of the Precambrian rock surface has resulted in their general destruction except on recently uncovered rock surfaces. Near the mouth of a creek entering the head of Caravalla cove, glacial striæ were seen trending north 45 degrees west. Well-preserved lunoid furrows, or chatter marks, are associated with them, the horns of the crescent pointing northwest.

Water-laid Sediments. The Labrador Pleistocene beds exposed in Lake Melville district may be divided into three horizons. The base of the series consists of laminated, fine-textured, marine clays containing at many points an abundant marine fauna. These are followed by beds of similar appearance, but with more perfect and conspicuous lamination, which are nearly if not quite, barren of fossils. The uppermost beds of this series are Pleistocene sands. The lowest of these beds may be seen at a few points along the west shore of The Backway and along the south shore of lake Melville.

The only extensive deposits of Pleistocene beds known near the seashore of the map-area are those of the long, narrow coastal plain extending northward from cape Porcupine to Tub harbour. This area was not seen by the writer. Daly[1] describes it as follows: "The plain averages nearly 4 miles in breadth. It is covered with a thick growth of scrub timber which does not conceal its well-graded character. The upper limit of the plain surface was estimated from a distance to be about 250 feet above the sea; thence the smooth slope descends to the straight cliffs now being driven back by the actively encroaching sea. The plain has apparently lost rather more than a mile of its breadth in this way. There was a com-

[1] Daly, R. A., "The Geology of the Northeast Coast of Labrador," Bull. Mus. Comp. Zool., Harvard College vol. XXXVIII, Feb., 1902, p. 266.

paratively long halt in the process of elevation when the sea-level was about 35 feet above its present position; at that time there was developed a distinct bench that is visible in West bay. The plain is underlain by stratified sands and clays in which there are embedded a great number of large boulders, including anorthosite from the interior. The clays of the coastal plain seemed to promise that in them, if anywhere on the coast, fossiliferous beds might be discovered; but, even after prolonged search, the hope was destined to disappointment."

Pleistocene Fauna. At many localities along the inland waterways fossils were found in abundance, as will be seen from the following details of sections studied.

Six miles west of Long point, the lake-shore section shows 45 feet of ash-grey clay overlaid with 2 feet of peat. Along Kenemich river, the clay outcrops at frequent intervals and contains many fossil shells. *Portlandia arctica* Grey was collected at a point 5 miles above the mouth of the river. Another collecting station on this stream furnished the following species.

Kenemich river, Labrador, 10 miles above mouth

Macoma calcarea Gmelin
Portlandia arctica Grey
Nucula proxima Say
Saxicava rugosa L.
Cylichna occulta (Mighels and Adams)

The specimens all come from marine clay beds or from concretions in these beds and constitute a typical marine clay fauna.

At Muskrat falls, the following section is exposed along the trail near the lower fall:

	Feet
Sand and covered	145
Laminated clay with marine fossils	35

The clay beds of this section furnished the following fossils:

Portlandia arctica Grey
Mytilus edulis L.
Saxicava rugosa L.
Cryptodon gouldii Phillipi

The concretions and clays in which they occur have furnished the fauna[1] listed below:

Portlandia arctica Grey
Mytilus edulis L.
Saxicava rugosa L.
Cryptodon gouldii Phillipi
Macoma calcarea Gmelin
Nucula proxima Say
(See *N. proxima* Say var. *trunculus* D.)
Cylichna occulta (Mighels and Adams)

This is a characteristic Pleistocene fauna. The same fauna has been found by Packard[2] at Caribou island, Hopedale, and some other Labrador coast points. It is identical with the well-known fauna of the Pleistocene

[1] The species have been determined by E. J. Whittaker.
[2] Packard, A. S., "The Glacial Phenomena of Labrador and Maine," Bost. Soc. Nat. Hist., Memoirs, vol. 1, 1869, pp. 229-236.

clays which extend up St. Lawrence and Ottawa valleys. All the species in it are still living in the sea along the Labrador coast. The barren clays and sand of Red river, lying higher in the section, appear to indicate a facies of sedimentation where the water was too fresh to support marine life.

Long and careful search of the sands and gravels of the terraces at many localities failed to disclose a single fossil.

Sands and Laminated Clays. On the north side of lake Melville a section was examined on Mulligan river, which shows well the alternating character of the beds observed there.

Section of terrace 2¼ miles above mouth of Mulligan river:

	Feet	Inches
Forest bed and soil................................		2
White, marly bed................................		2
Yellow sand...	2	
Fine, white, grey, and yellow sand interbedded, some gravel..	2	
Coarse, crossbedded sand..........................	7	
Sand and sandy fine clay, interbedded................	12	
Orange-brown sand and grey clayey sand interbedded..	1	
White sand interbedded with ¼-inch bands of blue clay	10	
Sand and some clay bands..........................	16	
Blue, mottled clay not laminated, some rounded pebbles	12	
Covered to river..................................	6	

No fossils were seen in these beds. The basal clay of the section is probably glacial till. The lower sand beds exposed on this river are shown on Plate XIII A.

A section showing the beautifully laminated clays lying above the fossiliferous marine clays and below a heavy bed of sand was measured on Red river, which joins Naskaupi river 18 miles above Grand lake.

Ten miles above the mouth of Red river the stream has recently cut through an oxbow, exposing a fine, fresh section of the lowest beds of the river section. Above this point 400 yards, at the bend of the river, the entire section is exposed—the best in the whole region.

Section of Postglacial terrace, Red river:

	Feet
Sand and laminated silt....................................	100+
Coarse gravel..	6 to 0
Clay, fine-textured and laminated. Colour alternating from pale chocolate to grey or bluish grey.....................	35

The laminæ vary greatly in thickness; some are ⅛ inch or less; others 3 inches or more, in thickness. The laminæ, counted in 10 feet of these clays, numbered one hundred and seventy-eight.

The straight, narrow channels cut in these clays by water trickling down the face of the clay bed are shown in Plate XV.

Small, coffee-coloured concretions with no traces of fossils in them abound in certain of the clay beds. At one point these basal clays are highly contorted. At others dips of 5 degrees to 15 degrees are seen.

The beds of this section, and most of those of Mulligan river and certain other sections, represent a phase of Pleistocene sedimentation in Lake Melville basin, in some cases later than that of the clays with marine fossils, but in others a shallow-water, near-shore phase where marine life could not live. The conditions of deposition will be discussed under terraces. The very perfect development of lamination in the clays of the Red River section, as well as the absence of marine fossils, indicates hydrographic conditions when the water was too fresh to admit marine life.

Concretions. As noted in the section, small concretions occur in the beautifully laminated clays which represent the upper part of the Pleistocene clay beds of Red River section. These concretions were noted at a single locality only—on Red river, about 25 miles northwest of Grand lake. They are pale chocolate-brown colour and do not show any considerable variety of form. These concretions are without the organic nuclei so commonly found in the concretions of the lower clays. Their chocolate-brown colour also distinguishes them from the concretions in the marine or older clays.

Concretions were found at a number of localities in the lower clays. Their general appearance is indicated by Plates XVI and XVII. The principal localities from which concretions were collected in Lake Melville district are: the lower end of Muskrat portage; the south bank of the Hamilton, about 7 miles below Muskrat falls; the banks of Kenemich river; and the exposure of the clays west of Long point. Slightly different horizons are probably represented in these different localities and afford a large variety of forms, some of which are shown on Plate XVI. The concretions from Muskrat Falls locality are mostly of a sub-spherical, symmetrical type. At another locality 7 miles below Muskrat falls, no concretions of this type are seen. The concretions there are all of an elongated type, some of them roughly resembling slightly flattened cylinders, others of rib-like shape with rounded ends; these and many other peculiar elongate shapes are represented (Plate XVI, figures 5-8). Some of the Kenemich River localities also have types of concretions peculiar to themselves.

The Labrador concretions from certain localities are characterized by sharp contrasts between the composition of the outer shell and the interior part. The elongate forms on the south bank of the Hamilton are composed chiefly of argillaceous calcium carbonate. A thin shell of limonite surrounds this interior portion of the concretion. Many of the concretions consist of a hard, well-indurated material encased in a thin shell, in some cases a sixteenth of an inch or more in thickness, consisting of a very soft material easily indented by a knife point. At one locality on the Kenemich all the concretions consist of sand cemented by iron which has accumulated along small roots. Some of the roots are visible in the sections of these pipe-like concretions of sand and iron, and when broken into sections the central opening left by the root gives the pipes the appearance of large, disk-shaped beads.

The Lake Melville concretions show every possible relationship to the fossil Pleistocene shells, from that with the shell occupying the position of a typical centrally placed nucleus as in Plate XVII, figures 1 and 2, to examples in which the shell is entirely on the surface of the concretion as in Plate XVII, figure 3. Other specimens show opposite ends of shells like *Mytilus* extending out on either side of an irregular-shaped concretion which has completely enveloped the middle part of the shell (Plate

XVII, figure 4). Many examples occur in which the concretion is attached to a small portion of a granite pebble (Plate XVI, figures 2 and 3), and others have pieces of fine gravel projecting from their sides. The numerous rings which mark the surface of many of the subspherical concretions at right angles to the shorter axis represent the lamination of the beds in which they occur. Such concretions, when ground, show the lamination planes continuing through the concretion in line with the encircling rings on the surface (Plate XVII, figures 7 and 9). In grinding the specimen will in some cases split along the lamination plane, showing the weakness and imperfect cohesion characterizing these lines. Some of the marine clay on the shore of lake Melville is without any trace of lamination. The section 6 miles west of Long point exposes 4 feet of clay without lamination, in which subspherical concretions occur. The fine lamination of some of these clays, however, is indicated as already noted by the fine, elevated lines shown on Plate XVII, figures 7 and 9.

A noteworthy feature of the Labrador concretions is the large percentage of specimens with an organic nucleus. Concretions with a visible nucleus of any kind are said to be rare in the Pleistocene clays of the Connecticut valley. Professor Hitchcock states that "In no case in Massachusetts have I seen an organic relic as a nucleus."[1] In speaking of the same concretions Professor B. K. Emerson remarks that the "initiating cause entirely eludes our observation."[2]

The Labrador specimens figured show different species of Pleistocene fossils filling the rôle of nucleus in various stages of envelopment by the concretions. Plate XVII, figures 1 and 2, shows a symmetrical concretion with a small shell precisely at the centre, and Plate XVII, figure 4, shows a shell partly covered by a very unsymmetrical concretion.[3]

Boulder Beaches. In contrast with the wide distribution of the Pleistocene clays the boulder beaches have a comparatively limited distribution. Beaches require very special conditions for their perfect development. Daly has pointed out the important fact that beaches do not, as sometimes assumed, represent a halt in the rise of the land. "In most cases an ancient beach has been composed and located where it is because of special local conditions of formation and not because there occurred a halt in the uplifting process. Deposition takes place wherever the required protection against under-tow and shore-ice, in the presence of appropriate off-shore depth, is afforded."[4]

On the east side of the entrance to The Backway there are seven well-developed boulder beaches, one above another, the highest being 55 feet A.T. An interesting feature of these beaches is that the upper four are connected by a sloping boulder way. A very small boulder beach occurs on the east side of the island at Indian Harbour.

Daly[5] has figured an elevated beach on the south side of the entrance to Indian harbour at West bay.

---

[1] Hitchcock, Edward, "Final Report on the Geology of Massachusetts," 1841, p. 410.

[2] Emerson, Benj. K., Mon. U.S. Geol. Surv., 29, 1898, pp. 711-720.

[3] Note.—Plate XVII, figures 10 and 11, represents the two halves of a concretion from Alberta, in which a bit of fossil wood serves as the nucleus. It is included here in order to show a type of nucleus distinctly different from any found in Labrador concretions. The specimen was sent to the Geological Survey by a man who supposed it to be a fossil duck egg.

[4] Daly, R. A., "The Geology of the Northeast Coast of Labrador," Bull. Mus. Comp. Zool., Harvard College, vol. XXXVIII, Feb., 1902, p. 253.

[5] Daly, R. A., Ibid., pl. 10 A.

The point at the right of the entrance to Double Mer shows a double terrace. The lower one of shingle is 35 to 40 feet above sea-level. The second terrace is a boulder beach with a steep front and sloping top lying between 100 and 160 feet A.T. At an elevation of 320 feet on this point there is a perched erratic 7 feet high which is visible from a considerable distance in the inlet. Between this and the boulder beach boulders are rare.

On the hill back of Rigolet, boulders are common above 270 feet. Below that they are rare, except in the valley bottom and at certain levels representing probable beach accumulations. A hill-slope on the west side of The Backway showed boulders common above 390 feet A.T. and rare or wanting at lower levels.

A fine example of a boulder barricade occurs just east of the entrance to Double Mer (*See* Plate XIV B).

The evidence of these and other localities in Hamilton inlet with respect to the amount of maximum subsidence appears to show that the testimony of boulder-free hill-slopes indicates a total submergence amounting to 300 feet or more. This, however, is a criterion of subsidence which should be used only with considerable caution save in hills with exceptional uniformity of slope and located where the removal of boulders by late valley glaciers is improbable.

Along the seashore, elevated beaches which justify Packard's characterization of "a truly noble beach" occur all the way from Hamilton inlet to the western end of the strait of Belle Isle where Twenhofel[1] observed at one locality eight beaches, the highest of which was 350 feet A.T.

Many of the older fishermen are convinced from their own observations on the shoaling of harbours familiar to them that the coast is still rising.

Terraces. The terraces of sand and gravel are, in many places, conspicuous features of the valley topography (*See* Figures 2, 8, 9). Their maximum height can be confidently taken as being very nearly equivalent to the amount of maximum submergence of the region. These terraces in some localities consist of a series of great steps, the lowest being under water. Many of the best-developed terraces occupy the sides of stream valleys and show considerable width. But none of these represent the work of "a meandering and swinging stream slowly degrading a previously aggraded valley."[2] Neither are they wave-cut or wave-built terraces. They have been formed in lake-like expansions of river valleys in which tidal currents were the chief factors in the movement and deposition of the sediments.

The disposition of the lower or younger terraces at the head of Mulligan bay, lake Melville, parallel with the shoreline at the head of the bay and at right angles to the direction of the river entering it, illustrates the entire independence of river activities which ordinarily characterize the terraces. Here, ten terraces occur within a quarter mile of the lake shore on the east side of the river, the highest lying about 25 feet above the lake.

[1] Twenhofel, W. H., "Physiography of Newfoundland," Am. Jour. Sci., vol. XXXIII, N.S., 1912, p. 22.
[2] Davis, W. M., "River Terraces in New England," Bull. Mus. Comp. Zool., vol. XXXVIII, Feb., 1902, p. 284.

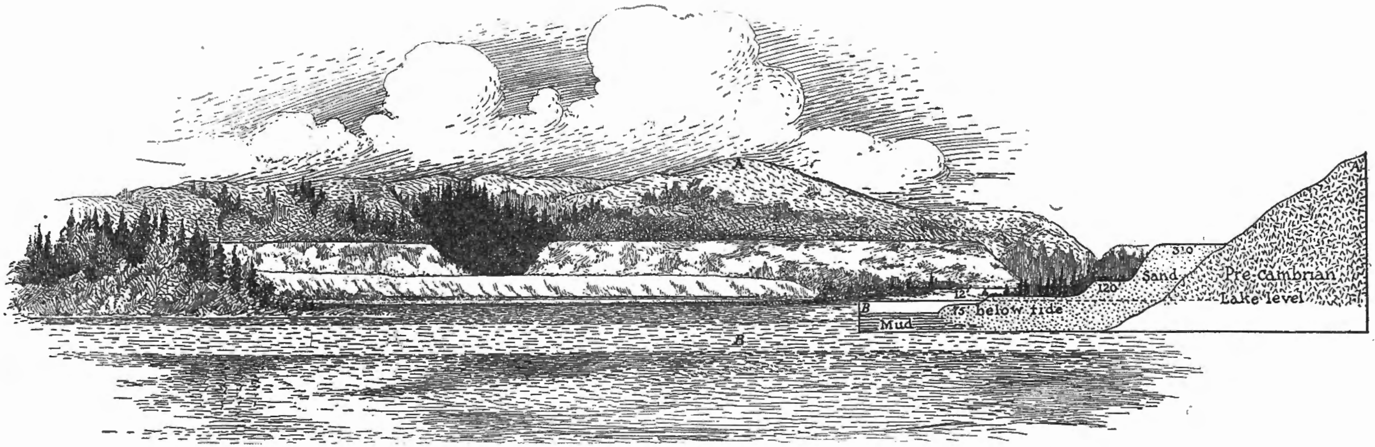


Figure 8. Sand-terraces at Moliak cove, lake Melville. Diagrammatic section of lake-bottom mud and sand-terraces at the right of the picture illustrates the contemporaneous development of mud and terrace deposits and progressive overlap of the former by the latter.

When the higher terraces were being formed, tidal currents reached up Hamilton and Naskaupi valleys far beyond the limits of the map-sheet (Plate XIII B). The terraces were built under the direct influence of tidal currents which were then active far up Naskaupi and Hamilton rivers, as they now are up to the western end of lake Melville.

In order to analyse the process of terrace building three factors may be considered. These are the sediments contributed by the small side streams to the trunk streams of the wide valleys, the tidal currents, and the river currents. Much of the sand drops to the bottom near the small valley mouths where the current velocity is reduced by contact with a larger stream, and moves along the shore chiefly under the influence of tidal currents, and the fine sediment of the tributaries remains long in suspension and has a correspondingly wide and uniform distribution. Where the shore contours have been most favourable to early checking of the near-shore flood currents by the ebb current, terraces have been formed, if an abundant supply of sand was available. It is in the narrow near-shore zone along which much of the coarse sediments travel and where the reversal of the tidal current first occurs that most of the sand load is dropped and the broad, flat-topped embankments are built up. "The flood current begins to run up the sides of a river while the ebb is still running down the centre."[1]

In The Narrows at Rigolet the tidal currents attain a velocity of 6 to 7 knots in mid-channel at spring tides with very little slack water. In mid-channel the tidal streams run 3½ hours after high water by the shore.[2] This indicates the relatively long periods of slack water along favourably located parts of the shore where the tidal-current sand-load may come to rest during most of the tidal cycle.

The complexities of current behaviour result often in the building of a splendid series of terraces on one side of a valley and none at all on the opposite side. This has occurred at The Narrows (Figure 4) where on the southeast side a series of terraces, the highest 210 feet above tide (Figure 2), border the shore, whereas the northwest shore is without a single terrace (Plate IX). Throughout most of the late Pleistocene and recent uplift of the region a deep bight persisted, and the development of terraces continued as a result of greatly reduced current velocity in this expanded part of The Narrows. Uplift and terrace growth have now reduced the former bight to a nearly straight shoreline interrupted only by one or two small spits, and terrace building is at an end on this particular stretch of shore. The youngest terrace comes to the edge of the water, but a rock reef lies below the surface instead of a growing terrace, such as many localities show. The highest terrace south of The Narrows rises about 1¼ miles back from the shore and has an elevation of 210 feet A.T. In front of it is the wide top of the next lower terrace, partly forested and with one or more shallow lakes and some muskeg on its approximately flat surface, which slopes gently toward the north. The front of this terrace rises gradually from 20 feet A.T. at the mouth of a brook opposite Rigolet to a maximum of 90 feet some 2 miles south of this. In following the face of this 90-foot terrace south from the brook mouth it is seen to split up into smaller terraces,

[1] Wheeler, W. H., "A Practical Manual of Tides and Waves," 1906, p. 96.
[2] Br. Admiralty—Newfoundland and Labrador Pilot, 3rd ed., 1897, pp. 643–648.

the latest of which approaches the present shoreline. Ten of these small terraces are recognizable at one point. Study of such a terrace as this, where a single terrace-face splits into several minor terraces, should dispel the inference, which a cursory examination of stair-step terraces might suggest, that minor terraces represent pauses in the uplift of the region. Such terraces record modified conditions of terrace development through which changes in depth, shape of shoreline, supply of material, or other factors have initiated a new terrace along some part of the front of the older one.

One of the finest and most instructive sets of terraces in the region may be seen at Moliak cove near the southwest end of The Narrows. Here, as in The Narrows, the terraces are confined to one side of the valley. Beyond the head of the bay they continue inland an unknown distance along a through valley now occupied only by a small lake and brook (Figure 8). At this locality three well-developed terraces rise respectively 12 feet, 120 feet, and 310 feet A.T. A fourth, poorly-defined terrace stands about 20 feet A.T. A fifth, the youngest of this series, is now being built just below or partly below low tide. It extends out from the foot of the first subaerial terrace from 10 to 75 yards, and then descends to deep water and mud bottom with the same steep grade as the fossil terraces inshore from it.

Underwater terraces are now forming along parts of the bottom of The Backway. At one point the water shoals abruptly from 53 fathoms with a soft mud bottom, to 3 fathoms over a sand flat which shoals shorewards.

Most of the terrace building along The Backway basin has taken place on the south side of the waterway. Its best development is seen a few miles below the entrance. Figure 9 shows at this locality a main or highest sand-terrace rising 310 feet A.T. connecting together in bar fashion two Precambrian hills. Below this major terrace, which stands back from the shore several hundred yards, about six minor terraces are recognizable. Some of these are modified by sandspits developed during the withdrawal of the water. Sand-terraces of considerable height may be seen above Mulligan and English rivers a short distance above their mouths. A section of a part of the terrace exposed near the Mulligan has already been given.

From the lower part of Hamilton river a terrace, perhaps 200 feet high, can be seen far back near the base of the mountains. Terraces are present in the broad lowland surrounding Carter basin. Heavy forests, however, obscure their outlines and location.

At Muskrat falls cutting has exposed a section in which 175 feet of sand overlies 35 feet of clay with marine fossils. One or more low dune ridges give some irregularity to the surface of this terrace, which swings off to the northeast, keeping away from the river below the falls. For several miles below Muskrat falls the river channel is in many places near the margin of a lower and younger terrace which rises above it.

Goose bay is being rapidly filled by the sand which the Hamilton pours into it during the flood season. Tidal currents distribute this sand around the margin of the basin, forming a continuous subsurface shelf

Figure 9. Sand-terraces connecting hills of Precambrian rocks on the west side of The Backway.

½ to 2 fathoms under water and from ¼ to 2 miles wide. This growing terrace surrounds a basin which ranges in depth from 8 to 34 fathoms. If the present stage of emergence be long maintained Goose bay will be filled to a level sand-plain, with Hamilton river flowing through the middle and joining the lake some 15 miles to the eastward of the present mouth. At the eastern end of Goose bay the 16,000-foot passage into lake Melville has already been closed by the encroaching underwater terraces which now leave a channel only about 2,500 feet wide and 2½ miles long. If emergence continue as during late Pleistocene time the building of a series of terraces will accompany the extinction of Goose bay. In either case the extinction of Goose bay, Carter basin, and the filling of the shallow basin between Epinette point and Northwest point, with the consequent reunion of the Hamilton, Kenamu, and Kenemich in a single trunk stream is an inevitable development of the present geological cycle.

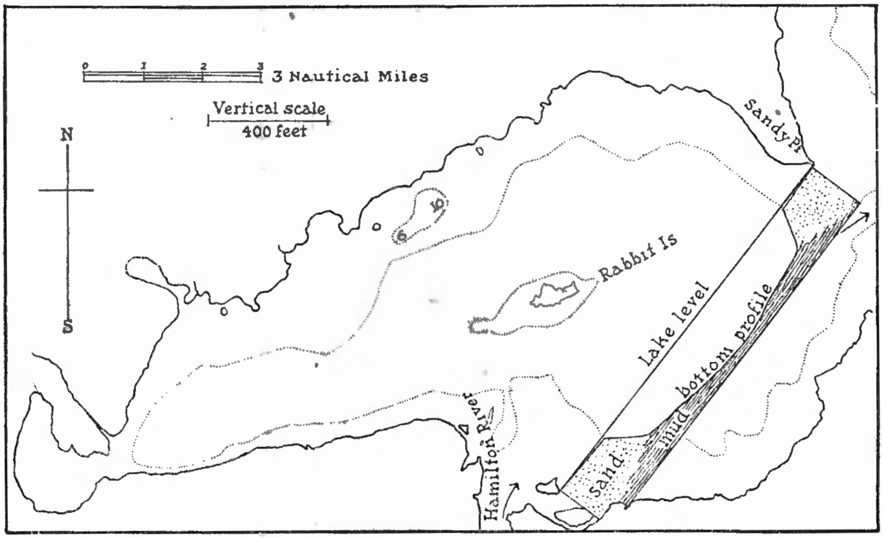


Figure 10. Outline map and cross-section of Goose bay based on soundings by Leroy Bowes. Dotted line indicates inner margin of wide sand-terrace shelf covered by ½ to 2½ fathoms of water.

Neither Double Mer nor Grand lake shows any notable terrace. Two terraces, respectively 20 and 40 feet above the lake, border the western end of the lake south of the mouth of Susan river.

Along the valleys of the Naskaupi and its western tributary, the Red, terraces are well developed in places. A short distance above the mouth of the Naskaupi a mid-valley or island-terrace area has developed as a result of the junction of Little River and Naskaupi River valleys. Four terraces mark this island, rising above low water in the river 8, 58, 78, and 103 feet. Another great sand-terrace with an elevation of 200 feet above the rivers, rises just above the junction of Red and Naskaupi valleys.

The highest terrace observed at a considerable distance from the coast was seen west of Naskaupi river a few miles up Red river. If allowance be made for the grade of the river valley, the elevation of this terrace—280 feet above the river—is very close to the elevation of the Moliak and Backway terraces which are the oldest and highest terraces observed in Lake Melville basin.

The underwater terraces now forming in Moliak cove, The Backway, and elsewhere in the deep waterways have a stratigraphic significance which should not be overlooked. These subsurface sand deposits are contemporaneous in age with the topmost layers of the soft muds of the adjacent but much lower part of the lake bottom. They represent also the youngest member of a terrace series, the oldest member of which occupies the highest position in a set of deposits which have been built laterally and at progressively lower levels. It follows that the two series of parallel deposits—the deep-water muds and the near-shore terrace beds, represent two sharply contrasted facies, one of which, the sands, tends constantly to overlap the other. The relative ages of the sediments in a series of current-built terraces on a rising coast are just the reverse of that which obtains in a series of stair-step terraces developed in an aggraded valley by degradation.

The conditions which have been shown to control the development of terraces in this region are local in character, consequently the correlation of terraces other than those representing the maximum submergence is impracticable. Terraces formed at different stages of uplift represent only terrace conditions which appear and disappear in conformity with certain topographic adjustments to the water-level.

The two maximum terrace measurements (aneroid) made in the region are both 310 feet. It is probable that the maximum submergence did not exceed this figure more than 15 feet, so that 325 feet may be considered a close approximation to the maximum submergence which this region has experienced during Pleistocene time. This figure is a little higher than Daly's estimate[1] of the maximum amount of the emergence in the Hamilton Inlet district, which was based on other kinds of evidence.

ECONOMIC GEOLOGY

The region is one in which the fuel minerals, coal, oil, and gas, cannot be expected to occur. A variety of other minerals, however, which will be of economic value if found in sufficient quantities, occur in Lake Melville region and the valleys connected with it.

Labradorite is conspicuously abundant. Enormous boulders of this mineral encumber the shoreline on the south side of lake Melville, west of Long point, at the foot of the mountain slopes from which they have been derived. It lacks, however, the fine colouring shown by the best specimens from Nain, Labrador.

Low's work has shown that iron ore occurs at various localities in the interior of Labrador. No noteworthy examples of this ore, however, were observed in the district traversed by the writer.

[1] Daly, R. A., "The Geology of the Northeast Coast of Labrador," Bull. Mus. Comp. Zool., vol. XXXVIII, Feb., 1902, p. 259.

A little prospecting has been done by men living in the region. Specimens obtained by a local prospector, Joseph Michelin, have been reported on by H. V. Ellsworth as follows:

No. 1—Monis rapid, Grand river—Chalcocite associated with quartz. There are some greenish stains and thin coatings of malachite.

No. 2—Muskrat lake, Grand river—Peridotite, rich in pyroxene, much altered. The olivine has altered to serpentine, the pyroxenes to bastite and chlorite.

No. 3—Naskaupi river—Biotite gneiss bearing considerable rusty pyrrhotite with a very little pyrite and chalcopyrite. The pyrrhotite carries nickel in appreciable amount.

It is important to note, in connexion with the copper ore represented by No. 1 of these lists, that the man who discovered it has secured from the Newfoundland Government a patent to the claim, although it is located about 100 miles west of the head of lake Melville. The current practice of the Newfoundland Government in the matter of granting mineral rights in the territory far to the west of the boundary claimed by Canada makes an early settlement of the boundary question a matter of importance, especially as it is possible that important mineral deposits may be discovered in Hamilton and Naskaupi valleys.

Davies, who was in charge of Northwest River post in 1840, reported "A specimen of native copper was procured from the natives to the north of Esquimaux bay (Hamilton inlet)—it was part of a large piece, found by an Esquimaux, on the beach, about 15 miles to the south of Hopedale; it was very much water worn."[1]

Robert Bell[2] records having received good specimens of copper pyrites from Indian island off the entrance of Hamilton inlet.

Clays which have the appearance of being good brick-clays occur abundantly on the south side of lake Melville west of Long point, and elsewhere. They have, of course, no economic value at present.

Specimens of very pure crystalline limestone obtained by prospectors from a Hamilton River locality were seen at Muskrat portage.

SUMMARY

A summarized review may now be given of the several classes of data which have been presented in the preceding pages.

The coast of Labrador, with its innumerable inlets, bays, islands, and fiords, presents what is known to geologists and geographers as a "drowned coastline."

The main physiographic features of the region—Lake Melville basin, The Backway, and Double Mer—are in their essential features the products of subaerial and river erosion modified by glaciation and directed in some degree by important structural features (Figure 5 C). These great valleys have suffered some deepening by glacial action, but their mai features were developed in Preglacial time when the Labrador coast stood considerably higher than at present and when much or all of Hamilton inlet was a land surface. These waterways cannot, therefore, be regarded

[1]Davies, W. H. A., "Notes on Esquimaux Bay and the Surrounding Country," Trans. Lit. and Hist. Soc. Quebec, vol. IV, Feb., 1843, p. 83.
[2]Bell, Robt., "The Labrador Peninsula," Scot. Geog. Mag., vol. XI, 1895, p. 355.

as representing in any degree the work of the sea in cutting back or eroding the coast along lines of least resistance.

Mealy mountains are shown to reach a maximum elevation of 3,800 feet—more than twice the height previously ascribed to them.

The physiographic history of the region indicates that the old preglacial Hamilton river probably emptied into the sea at some point near West bay through The Backway valley. Some time during the Glacial period glacial damming of The Backway valley forced the Hamilton drainage through The Narrows valley into Hamilton inlet. The eastern end of this valley, which has at Rigolet about the same width as Hamilton river a short distance above lake Melville, may be regarded as the mouth of Hamilton river, lake Melville representing an expansion of that stream which was developed in late geological time. Lake Melville is, geologically speaking, a temporary feature which coastal uplift, if continued, and river filling together will eventually obliterate. Uplift has already raised the region 325 feet higher than it was when Pleistocene submergence reached its maximum.

The shape of Hamilton inlet appears to justify its classification as a *ria.* This disposition or classification of Hamilton inlet places it in a category of coast-line features which includes both river estuaries and indentations of the seacoast with sides which diverge seawards. The implications of this classification of the shore and coastal forms known as The Narrows and Hamilton inlet as regards the junction of the river mouth and seacoast are not very definite or specific. They appear, however, to preclude placing it farther inland than the junction of Double Mer and The Narrows valleys. Some geographers might consider it simpler to regard Hamilton inlet as a river estuary, and place the union of seacoast and river much farther eastward, where the coast-line takes its normal trend toward the north and south.

The sharp contrast between the coastal and interior climates is without parallel in any other near-shore region known to the writer. Floating ice may be found on the waters of Hamilton inlet throughout the summer, but ice is unknown in The Narrows or Double Mer after early July. The contrasts between the sub-Arctic climate of the coast and the summer climate of the interior are due to the Labrador current and the floe-ice which it bears southward along the Labrador shore. A journey from the eastern part of Hamilton inlet up lake Melville is, as Holme remarked, "like passing from winter to summer."

The forests also afford a fairly definite index to the climatic change in passing from the icebound coast to the much milder interior. The seacoast is either entirely barren or characterized by small patches of forest with dwarfed trees.

Some of the plants furnish in their distribution important evidence from the botanical viewpoint on the question of the western limit of salt water. This evidence is reflected in the distribution of the halophytes or salt-loving plants.

Perhaps the most striking evidence relating to the western limit of marine conditions is furnished by the distribution (Figure 6) of two of the most abundant sea-shells known on the Labrador coast, *Balanus balanus* (L.) and *Littorina rudis* var. *groenlandica.*

The table of specific gravity and temperature of the waters supplement the biological evidence in showing the great change which the physical character of the water undergoes west of Indian Harbour.

The rocks of the region belong chiefly to Precambrian terrains. Differentiation of these has not been attempted beyond recognizing the very distinctive character of Packard's Domino gneiss.

The Palæozoic sandstone which Low considered to be of Cambrian age was found in Double Mer basin where its occurrence was previously unknown (Figure 4), and the name Double Mer sandstone given to it.

A Pleistocene fauna hitherto unrecognized in this region was found at various points in Lake Melville basin. Many of the fossils in it are partly or completely enclosed in concretions (Plates XVI and XVII). Well-developed terraces were found as far inland as the reconnaissance extended —about 165 miles from the coast (See Figures 4, 8, 9, and 10, and Plate XIII B). Beautifully laminated Postglacial clay occurs in certain inland sections (Plate XV). The stratigraphic equivalence of the fine muds and the sand-terraces now forming and the tendency of the latter to overlap the former was observed at various localities (Figure 10).

The evidence of the terraces is interpreted to indicate an elevation of the coast since the Postglacial submergence amounting to about 325 feet.

APPENDIX

METEOROLOGICAL OBSERVATIONS AT CARTER BASIN[1]

By Leroy T. Bowes

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.[2]	Cloud[2]	Remarks
1921 July 18......	6.00	29·98	52	(79)	(52)	S	1	....	Bright and clear
	8.00	30·00	55			W	2	....	" "
	12.00	30·00	62			SW	1	....	" "
	6.00	29·93	64			E	3	....	Overcast, 9.00 quite overcast
July 19......	6.00	29·81	57	51	68	......	0	N 9	Dull and cloudy
	8.00	29·81	59			ESE	1	N 10	Dark and overcast
	12.00	29·76	63			E	1	N 10	
	6.00	29·73	64			E	1	C 6	Brighter
July 20......	6.15	29·86	55	66	54	......	0	N 9	Dark
	8.00	29·92	54			N	1	Cu 8	Clearing
	12.00	29·94	61			E	1	Cu 2	Bright
	6.00	29·96	64				0	Cu 2	Bright
July 21......	6.15	29·96	65	66	51	W	1	....	Bright
	8.00	29·98	66			S	2	....	Bright
	12.00	29·93	70			W	3	....	Becoming cloudy and very smoky
	6.00	29·81	68			W	2	....	
July 22......	6.15 (a.m.)	29·99	63	77	56	E	1	C 4	Becoming cloudy after 1.30 and very smoky
	7.30 (p.m.)	30·00	64			S	1	N 10	Raining
	Clear at 6 a.m. with a light breeze from the southeast. Gradually clouded over after 1.30, becoming very smoky, raining at 7.00. A light breeze from the south at 7.30 p.m.								
July 23......	6.15	29·90	61	76	57	E	1	N 10	Dull
	12.50	29·95	55			E	1	N 10	Very smoky. Dark yellow
	7.00	29·98	55			E	1	N 10	" "
	Very overcast with a gentle breeze from the east. Very smoky and a very weird and overcast appearance. At 2.30 it was as dark as night, and the whole country had a peculiar yellowish appearance.								
July 24......	8.35	29·95	58	62	53	Calm	..	....	Very smoky
	12.00	29·94	64			"	..	....	"
	6.00	29·92	60			"	..	....	"
	Calm most of the day and very smoky.								

[1] Observation Station. Approx. lat. 53° 29′ Approx. long. 59° 52′.

[2] Percentage of sky covered indicated by figures. Type of cloud by letters: N, nimbus; C, cirrus; Cu, cumulus; S, stratus. Numbers in wind velocity column refer to Beaufort's scale: 0=calm; 1=1 m. per hour; 2=4 m. per hour; 3=9 m. per hour; 4=14 m. per hour; 5=20 m. per hour; 6=26 m. per hour; 7=33 m. per hour.

APPENDIX—*Continued*

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
July 25......	6.30	29·84	68	72	54	W	1	....	Very smoky
	7.15	29·87	68			N	1	....	"
	Very smoky all day. Practically calm all day.								
July 26......	6.15	29·87	59	78	57	..	0	....	Very smoky
	12.00	29·78	60			.	0	....	Smoky. Rain 12.30 to 4
	6.00	29·64	57			NW	7	N 9	Smoky
	Calm and very smoky until noon. Heavy rain 12.30 to 4 p.m., then clearing somewhat. Blowing a moderate gale and becoming overcast from 5 p.m.								
July 27......	6.30	29·92	55	67	54	NW	3	N 9	Clear
	12.00	29·94	56			W	3	N 10	Clear
	6.00	29·92	63			..	0	C 2	Fair
	Strong northwest wind (3) at 6 a.m. clear and bright. Veered to west at noon, blowing steadily until 4 p.m. Calm and fair at 6.								
July 28......	6.00	29·55	52	63	48	..	0	N 10	Rain
	2.00	29·27	54			E	4	N 10	"
	6.00	29·24	48			F	7	N 10	"
	Light air from the south at 6 a.m., but mostly calm all morning with heavy rain. Wind increased about noon, blowing a moderate gale from east. Heavy rainfall and very thick.								
July 29......	6.15	29·59	44	54	43	N	4	N 10	Slight mist
	12.45	29·65	50			W	1	N 10	Overcast
	6.15	29·74	53			W	1	S 9	Clearing
	Northwest wind (moderate breeze) calming down by noon to a westerly air.								
July 30......	6.15	29·88	48	56	42	E	1	N 10	Rain 8–3
	6.15 (p.m.)	29.78	53			..	0	N S	Rain 5–6
	In the morning westerly air increasing to a strong easterly breeze from noon to 4 p.m.								
July 31......	8.00	29·77	66	69	47	S	1	C 10	Misty
	12.00	29·75	78			SW	3	2 Cu	Clear
	6.30	29·70	76			SW	3	2 Cu	Clear
Aug. 1......	6.00	29·69	58	79	57	S	1	8 Stratus	
	Overcast with rain. Heavy showers. Mostly calm all day, but light air from the south and east. Rain 2 p.m. to 7 p.m.								
Aug. 2......	7.00	29·00	51	58	50	E	5	N 10	Raining until 10.30 Clearing
	12.00	29·41	56			N	1	C 7	Clear. Rain at 2 p.m.
	6.00	29·42	57			N	1	N 8	Overcast, followed by showers

APPENDIX—*Continued*

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Aug. 3......	6.15	29·56	45	59	44	..	0	N 10	Raining
	12.45	29·68	48			NE	5	N 10	"
	6.15	29·78	40			NE	5	N 10	"
	Calm with heavy rain.								
Aug. 4......	6.00	30·03	45	59	44	N	1	N 10	Showers, clearing at 10 a.m.
	12.00	30·05	64			N	4	C 5	Fair
	8.00	30·12	56			..	0	C 5	Fair. Wind dropped at 6
	Raining at 6 and 7 a.m. Overcast but clearing by 10. Wind, a light air from the north, increased to a gentle breeze by 10 a.m., and a moderate breeze by noon, which blew until 6 p.m., gradually dying down to a dead calm by 8.15 p.m.								
Aug. 5......	6.00	30·02	47	66	46	SW	4	Cu 8	Fair
	12.00	30·04	60			SW	5	Cu 8	Fair
	6.00	29·87	63			S	3	N 8	Overcast and rain
	At 6 p.m. it started to rain, with a gentle breeze from the south. This changed to southeast, and during the night and early morning blew a moderate gale (7 or 8).								
Aug. 6.......	6.15	29·36	52	65	45	SE	6	C 7	Threatening
	12·00	29·36	59			S	5	N 7	Showers 10-2.30
	6·00	29·67	53	..	..	N	5	N 8	Overcast
	Early morning, moderate gale from the southeast. At 6 a.m. wind veered to southeast, blowing a strong breeze. Threatening weather. Heavy showers from 12 to 2.30 with a fresh breeze from the south. In mid-afternoon this changed to the north, blowing with the same velocity. At 6 p.m. wind from the north, blowing a fresh breeze. Overcast. At 8 p.m. wind from the northeast, blowing a little fresher.								
Aug. 7.......	8.00	29·95	47	65	44	E	1	N 8	Overcast
	12·00	29·98	55			E	2	N 10	Showers 1-6
	6·00	29·95	48			E	6	CS 10	
	Weather. The day started in with a light air from the east, cloudy and overcast. Heavy showers from 1 to 6 p.m. with the wind gradually increasing in velocity until it blew a strong breeze from the east about five o'clock. The wind blew steadily from that quarter and with that velocity all night.								
Aug. 8.......	6·30	29·68	48	60	45	E	4	N 10	Showers
	6·30 (p.m.)	29·56	54			N	3	N 10	Raining since 2.30 p.m.
	Wind blowing a moderate breeze from the east with heavy showers. Rain started at 2.30 p.m. and kept on steadily during evening. Overcast and threatening. At 6 p.m. the wind was from a northerly direction and blowing a gentle breeze.								

APPENDIX—*Continued*

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Aug. 9.......	6.30	29·52	53	56	48	E	1	N 10	Rain at 6.00
	12.00	29·52	72			NW	4	Cu 6	Showers at 11 a.m.
	6.00	29·62	62			W	3	C 2	

Raining at 6 a.m. with light air from the east. A heavy shower at 11 o'clock with the wind veering to the northwest and blowing a moderate breeze. At 6 p.m. there was a gentle breeze blowing from the west.

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Aug. 10......	6.25	29·65	52	78	52	W	4	C 7	Fair
	12.00	29·82	70			W	3	C 7	Fair
	6.00	29·83	53			W	2	C 2	Bright

Fair but moderate breeze which in The Narrows and Goose bay was blowing a strong breeze. In the afternoon the breeze died down until calm at night.

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Aug. 11......	6.30	29·83	53	76	52	S	1	N 10	Rain
	12.00	29·76	62			W	6	N 10	Rain
	6.00	29·72	60			W	3	N 8	Showers threatening. Rain 7 p.m.

At 6.30 southerly air overcast and raining. Rain until noon. Strong breeze from the west. Between 12 and 6 heavy showers. At 7 p.m. raining again with wind blowing a moderate (4) westerly breeze.

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Aug. 12......	6.15	30·00	49	76	48	W	2	N 6	Fair
	12.00	30·00	70			W	1	C 0	Fair
	7.30	29·94	57			SW	1	C 6	Fair

Mostly fair, with westerly breeze dying from a moderate one to a light air at noon. Warm. The wind changed to the southwest and was blowing a light air at 8 p.m.

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Aug. 13......	6.00	29·91	60	62	47	S	1	C 3	Fair, but becoming overcast
	12.00	29·92	72				0	N 10	Raining
	7.30	29·94	57			W	1	C 6	Clearing
Aug. 14......	8.00	29·84	56	72	46		0	N 10	
	12.00	29·82	62			S	1	N 10	Rain
	6.00	29·66	57			S	5	N 10	Rain

Morning calm and overcast. At noon southerly air and heavy shower. Afternoon wind increasing until 6 p.m., until blowing a fresh breeze from the south with very heavy rain. In the evening the wind blew strongly from the south (6) with continued heavy rainfall.

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Aug. 15......	6.15	29·37	54	66	46	S	1	N 7	
	12.00	29·35	62				0	N 10	Rain
	8.00	29·32	56			SW	2	N 8	Rain
Aug. 16......	6.15	29·30	49	64	47	SW	3	N 8	
	12.00	29·32	63			NW	2	N 10	Rain
	8.00	29·34	56			W	2	C 8	

Heavy showers from 11 to 6.30 with clearing weather after 6 p.m. and at 8 p.m. a light breeze blowing from the west.

APPENDIX—*Continued*

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Aug. 17......	6.15	29·70	45	63	45	W	1	N 10	Overcast but clearing
	12.00	29·80	72			W	1	C 6	Fair. Rain at 5 p.m.
	8.00	29·90	50			W	1	C 2	Clearing
Aug. 18......	6.15	29·92	52	60	46		0	C 2	Fair
	12.00	29·77	62			SW	5	N 10	Rain
	6.15	29·64	60			SW	6	N 9	Clearing in early evening

Scattered showers. Clearing at 11 a.m. with wind slackening. At noon wind freshened to a fresh breeze (5) with heavy rain about 1 p.m. Wind slackened until 3.30 p.m. when it started to clear up. Wind then freshened to a strong southwest breeze (6). Continued to blow all evening and during the night.

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Aug. 19......	6.15	29·50	54	64	46	NE	3	N 10	Rain
	12.00	29·52	50			NW	5	C 7	Clearing
	6.00	29·66	56			NW	2	C 5	Fair
Aug. 20......	6.15	29·78	52	64	44	W	2	C 5	Fair
	12.00	29·80	62			SW	1	C 6	Fair
	6.00	29·78	56			0		C S 8	Fair

A light breeze from the west was blowing at 6 a.m. This gradually changed to the southwest, decreasing in velocity to a light air by noon and calm at 6 p.m.

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Aug. 21......	8 a.m.	29·58	51	62	48	Calm		N 10	Clearing
	12.00	29·62	56			NW	2		Clearing
	6.00	29·71	48			NW	3		Fair
Aug. 22......	6.15	29·82	52	58	46	W	2	C 2	Fine
	12.00	29·83	63			SW	3	C 2	Fine
	6.00	29·90	56				0	C 2	Fine
Aug. 23......	6.15	30·10	54	63	42	S	1	C 4	Fine
	12.00								
	6.00	30·12	56	......	......	......	......	....	Fine

Weather fine and mostly calm.

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Aug. 24......	6.15	30·22	49	62	42	NW	1	N 10	Raining early Clearing
	12.00	30·22	58			NE	4	C 8	Fair
	6.00	30·20	54			NE	1	C 3	Fair
Aug. 25......	6.15	30·28	51	61	43	S	1	C 2	Fine
	12.00	30·28	63			S	1	C 2	Fine
	6.00	30·30	56			S	1	C 2	Fine

Bright and clear all day with a light air from the south.

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Aug. 26......	6.15	30·26	54	66	44	S	1	C 2	Fine
	12.00	30·22				S	1	C 2	Fine
	6.00	30·28				SW	4	C 2	Showers. Fair

Fine until afternoon, then heavy wind and showers. Light air from the south until noon. Then veering to the southwest, increasing to a fresh breeze by 4 p.m. and dying down to a moderate breeze by 6 p.m.

APPENDIX—*Continued*

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Aug. 27......	6.15	30·04	57	76	54	SW	2	C 2	Fair. Showers
	12.00	29·92	63			..	..	N 8	Fair. Overcast
	6.00	29·86	58			SW	2	N 10	Rain
	Light breeze from the southwest at 6 a.m. In Goose bay this blew steadily, being a gentle or moderate breeze by noon. Around Epinette and northwest it was a dead calm at this time. At 6 p.m. the wind had dropped and was blowing a light breeze from the southwest with rain at 6 to 8 p.m. and showers afterwards.								
Aug. 28......	8.15	29·82	69	76	57	W	3	N 10	Overcast. Showers
	12.00	29·80	72			SW	2	N 8	Fair
	6.00	29·80	60			SW	1	C 5	Fine
	Gentle breeze from the west all morning, with squalls from the same quarter in the afternoon. Showers in the afternoon, but bright and clear at night with light or gentle westerly breeze after 8 p.m.								
Aug. 29......	6.15	29·98	50	72	54	W	2	C 1	Fair and clear
	12.00	30·00	66				0		"
	6.00	29·82	58				0		"
Aug. 30......	6.15	29·63	60	68	44	SW	5	C 6	Overcast and showers
	12.00	29·63	65			SW	4	C 6	Showers
	6.00	29·62	57			SW	5	Cu 7	Clearing but unsettled
						NW	7		
	Wind veered to northwest in early evening, blowing a moderate gale all night with heavy rain. Wind increased gradually to strong gale from the same quarter (northwest).								
Aug. 31......	6.15	29·62	57	68	44	NW	9	C S 6	Fair
	12.00	29·64	44			NW	9	C S 7	Fair
	6.00	29·62	48			W	3	N 10	Hail at 4.30
	Mostly fair with a strong gale from the northwest that blew steadily until 4 p.m., gradually dying down to a fresh breeze from the west. Showers at scattered intervals and hail at 4.30 p.m.								
Sept. 1......	6.15	29·52	51	60	44	W	6	N 8	Very dull. Rain
	12.00	29·49	52			W	5	Cu 10	Dull, threatening
	6.00	29·44	49			W	4	Cu 6	Clearing
Sept. 2......	6.35	29·50	50	54	46	NW	1	C 2	Clear
	12.00	29·47	60			E	1	C 5	Clear
	6.00	29·38	50			E	5	C S 9	Dull. Rain during evening
	A wind sprang up from the east about 6 p.m. and in a few minutes was blowing a fresh breeze which increased during the night and blew a strong breeze at last with heavy rain.								
Sept. 3......	6.15	29·33	40	60	40	E	5	N 10	Rain
	12.00	29·58	42			E	4	N 10	Dull, showers
	6.00	29·68	44			..	..	N 16	Dull
	Rain in the morning with a strong breeze (5) from the eastward. Dull and threatening all day with occasional showers. The wind blew from the same direction and with the same velocity until 6 p.m. when it died down to almost a dead calm.								

APPENDIX—*Continued*

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Sept. 4......	8.00	29·64	42	50	39	W	2	C 6	Dull
	12.00	29·76	52			W	2	C 8	Overcast
	6.00	29·82	50			W	3	C 10	Showers. Dull
Sept. 5......	6.15	29·88	44	50	40	NW	3	C Cu 10	Dull
	12.00	29·87	44			W	5	C 15	Clear
	6.35	29·85	48			W	3	C S 10	Fair
Sept. 6......	6.15	29·76	46	39	49	S	1		Fair.
	12.00	29·65	56			Calm		N	Overcast 1.30–3. Rain
	6.30	29·64	58			Calm		C Cu 10	Fair

Light southerly air at 6.15. Fair. Calm all day, 10–12 a.m. becoming overcast and threatening, 1.30–3 p.m. rain, becoming fair again by 6.30.

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Sept. 7......	6.00	29·64	48	48	60	Calm		C Cu 5 C S 10	Fair
	12.00	29·64				"		Cu	Fair 3-4, showers after 4 p.m. Thunder-storms in p.m. N.E. 3
	6.30	29·64	57			NE	3	N	Overcast and threatening. Thunderstorms to westward. Later in evening rain
Sept. 8......	6.00	29·75	53	49	68	W	2	C Cu	Fine
	12.00	29·76	56			W	5	C Cu	"
	6.30	29·84	55			NW	6	C Cu	"

At 6 a.m. fair with a light westerly breeze which soon increased to a fresh breeze. Fair all day, with the wind blowing steadily and by 4.30 increasing to a strong breeze and changing more to a northwest direction. This breeze gradually diminished later in the evening.

Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Sept. 9......	6.00	29·89	49	49	59	W	2	C and C Cu	Fair. Showers
	12.00	29·90	54			W	1	C Cu	Fair. Showers
	6.10	30·00	50			W	2	N	Rain
Sept. 10.....	6·15	30·00	42	41	56	NW	2	C 7	Dull
	12·00	30·12	52			NE	3	C 7	Fair
	6.00	30·12	57			SE	2	C 6	Fair
Sept. 11......	6.00	30·16	41	58	38	W	2	C 3	Bright and clear
	12.00	30·14	52			W	2	C 5	" "
	6.00	30·14	49			W	2	C 3	" "

Date	Time	Bar.	Ther.	Max.	Min.	Wind.	Vel.	Cloud	Remarks
Sept. 12.....	6.00	29·34	44	54	36	W	2	C 2	Bright
	12.00	30·06	65			W	2	C 6	Rain at 5.30 p.m.
	6.00	30·04	61			W	3	C 4	Threatening

Light westerly wind in lake Melville, a gentle breeze in Goose bay. Bright and clear in the early day with weather becoming threatening in Lake Melville area. Scattered showers in the afternoon in Goose bay, passing mostly from Grove bay over entrance of Hamilton river. Threatening in both localitites, with the wind increasing slightly but blowing from the same quarter.

Date	Time	Bar.	Ther.	Max.	Min.	Wind.	Vel.	Cloud	Remarks
Sept. 13.....	6.00	29·70	51	64	36	NE	1	N 10	Threatening
	12.00	29·80	60			NE	3	N 10	Threatening rain 11–1.30
	6.00	29·44	57				0	C 8	Rain 2–3 p.m.
Sept. 14.....	6.00	29·40	44	62	44	N	6	N 10	Rain
	12.00	29·54	61			N	3	N 10	Rain
	6.00	29·53	59			N	1	C Cu 7	Clearing

At Hamilton river, Goose bay, heavy rain in the morning, clearing by noon, with scattered showers in the afternoon. The wind blew a strong breeze from the north all day.

Date	Time	Bar.	Ther.	Max.	Min.	Wind.	Vel.	Cloud	Remarks
Sept. 15.....	6.00	29·61	45	62	42	NW	4	C 4	Bright
	12.00	29·58	50			NW	3	N 10	Rain
	6.00	29·54	48				0	N 6 Cu2	Rain at 5.30 p.m.

At Hamilton river, Goose bay, overcast and very cold with scattered showers and a strong breeze blowing from the northwest, which decreased to a moderate breeze by noon and a light breeze by 6 p.m. Raining at 5 p.m.

Date	Time	Bar.	Ther.	Max.	Min.	Wind.	Vel.	Cloud	Remarks
Sept. 16.....	6.00	29·44	44	50	42	N	2	N 10	Rain
	12.00	29·50	48			N	2	N 10	Rain
	6.00	29·50	47			..	0	C Cu 8	Rain 3–5

Goose bay, heavy rain in the morning, light breeze from the north. Clearing by 10 a.m., with wind increasing to gentle breeze from the northeast. Scattered showers. In the p.m. scattered showers and wind, gradually decreasing.

Date	Time	Bar.	Ther.	Max.	Min.	Wind.	Vel.	Cloud	Remarks
Sept. 17.....	6.00	29·32	41	50	41	SW	2	N 10	Rain
	12.00	29·30	45			N	5	N 10	"
	6.00	29·55	44			N	4	N 10	"
Sept. 18.....	8.00	29·66	41	48	36	NE	2	C Cu 7	Bright
	12.00	29·78	46			N	1	C Cu 7	Bright
	6.00	29·76	46			NE	2	N 8	Becoming overcast
								C Cu 2	Rain

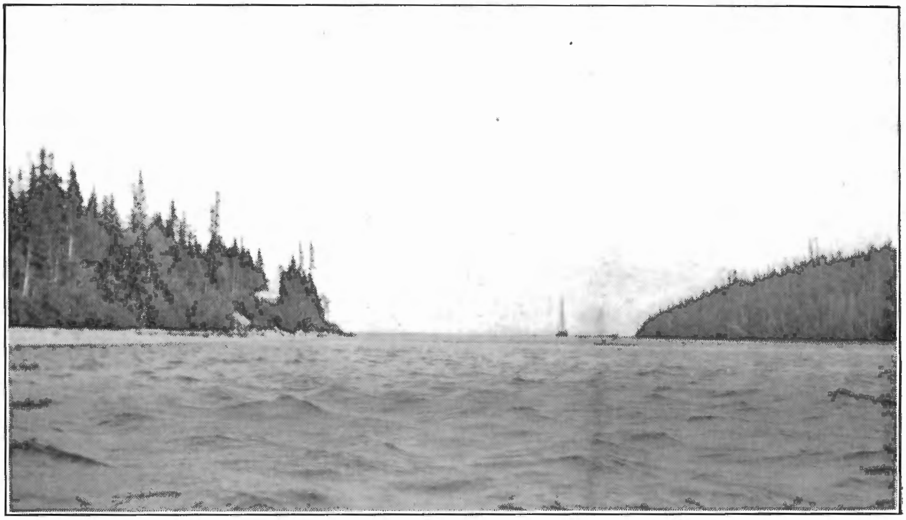
After 6 p.m. gradually overcast, with increasing wind and rain by 8 p.m.

Date	Time	Bar.	Ther.	Max.	Min.	Wind.	Vel.	Cloud	Remarks
Sept. 19.....	6.00	29·81	42	46	38	N	2	C 2	Dull
	12.00	29·81	44			N	2	C 5	Bright
	6.00	29·84				..	..	C Cu 8	Dull

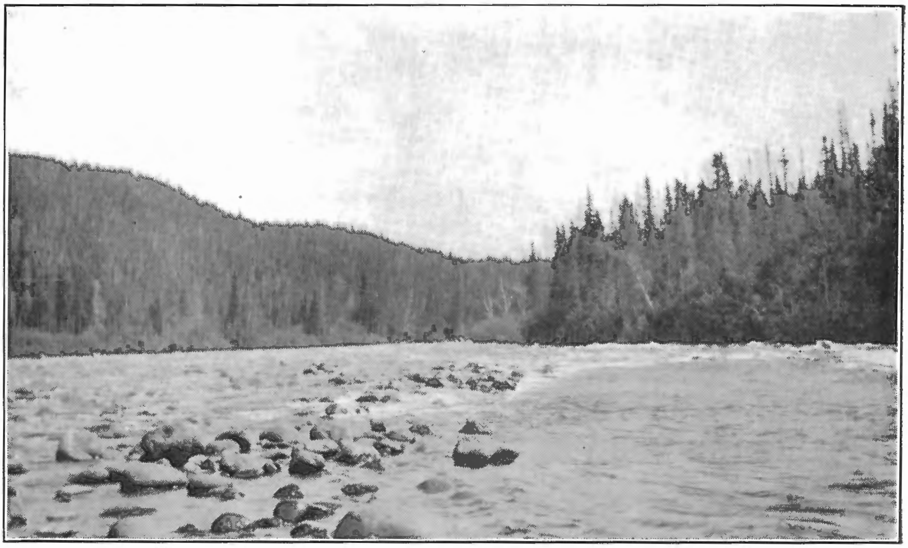
In the morning light breeze from the north. This wind gradually died down in the afternoon to calm by evening.

APPENDIX—*Continued*

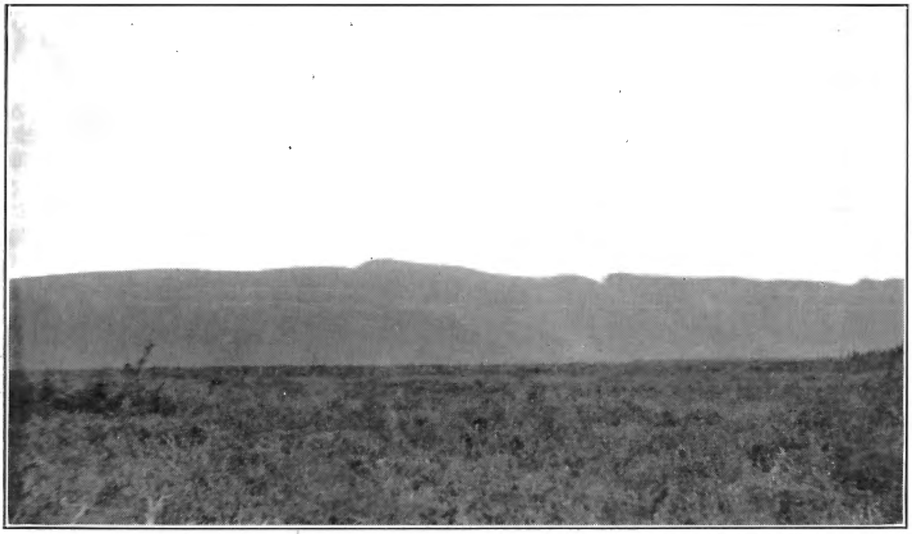
Date	Time	Bar.	Ther.	Max.	Min.	Wind	Vel.	Cloud	Remarks
Sept. 20.....	6.00	29·97	38	46	38	E	7	N 10	Threatening, snow flurry at 8 and 10.30 a.m.
	12.00	30·08	40			NE	6	Cu 8	
	6.00	30·12	40			NE	6	N 10	Snow at 3 p.m.
	Blowing a moderate gale from the east. A heavy snowfall had occurred in the night and the mountain tops and ground were covered with snow. By noon the wind veered to the northeast and blew a strong breeze all day.								
Sept. 21.....	6.00	30.18	38	40	35	NE	3	C Cu 7	Bright
	12.00	30·12	43			SE	3	C 5	Bright
	6.00	29·95	48			SE	1	C 6	Bright
Sept. 22.....	6.00	29·66	44	54	38	S	3	N 10	Rain
	12.00	29·44	49			S	1	N 10	Rain
	6.00	29·44	50				0	N 10	Rain
Sept. 23.....	6.00	29·39	44	52	42	W	2	N 10	Rain. Wind changed to northeast.
	12.00	29·46	52			NE	4	N 10	Rain
	6.00	29·49	48			NE	4	N 10	Rain
	Raining all day with the exception of the period 9 a.m. to 11 a.m. The wind in the early morning was blowing a light breeze from the west. Before 9 a.m. this changed to a gentle breeze from the northeast, increasing in velocity to a moderate breeze by noon and blowing from that direction and with that velocity for the remainder of the day.								
Sept. 24.....	6.00	29·73	40	51	40	E	5	N 10	Dull
	12.00	29·80	40			E	7	N 10	Dull
	6.00	29·92	40			E	6	N 10	Dull
	Blowing a fresh breeze at 6 a.m. with the wind steadily increasing to a moderate gale by noon and decreasing to a strong breeze by 6 p.m. Dull and cold all day.								



A. View of Northwest river looking toward lake Melville. (Pages 10, 45, 48.)



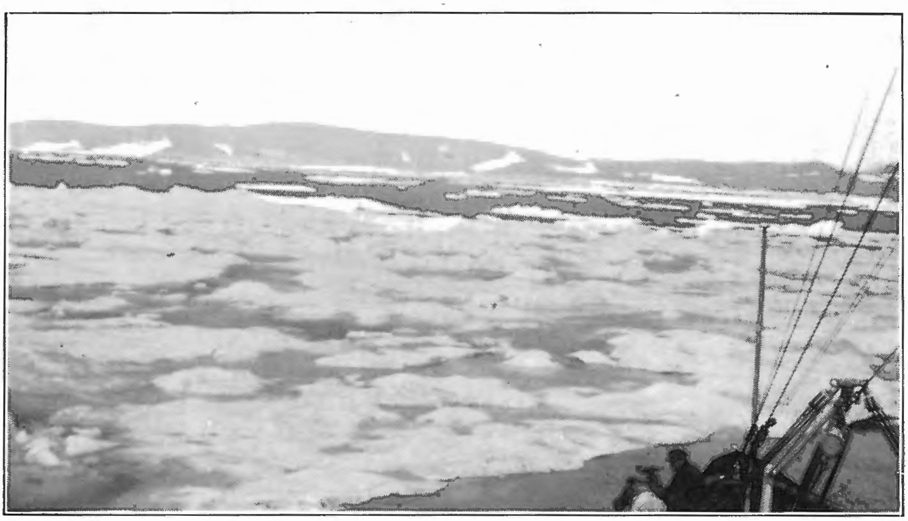
B. Boulder rapids near mouth of English river. (Page 45.)



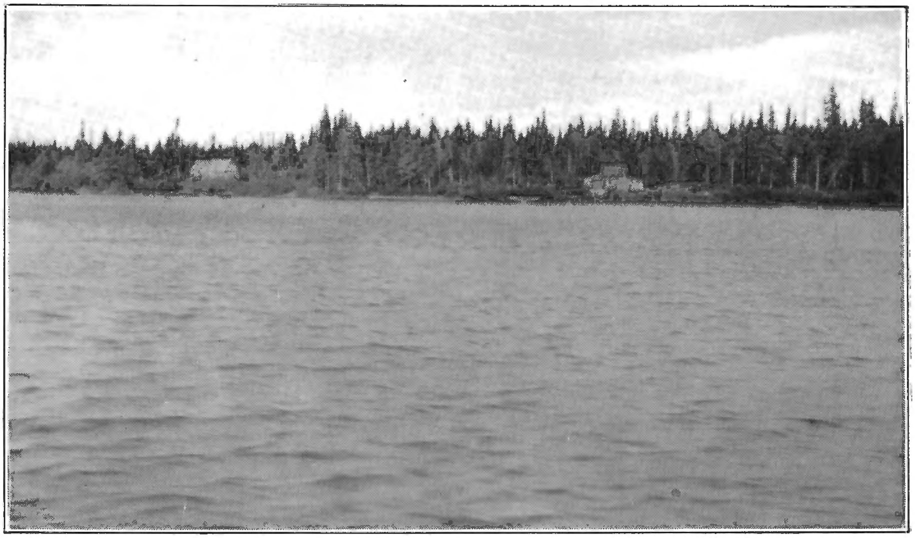
A. Mealy mountains looking across muskeg from the south side of lake Melville. (Page 11.)

B. Forested lowland at the foot of Mealy mountains, west of Long point. (Page 11.)

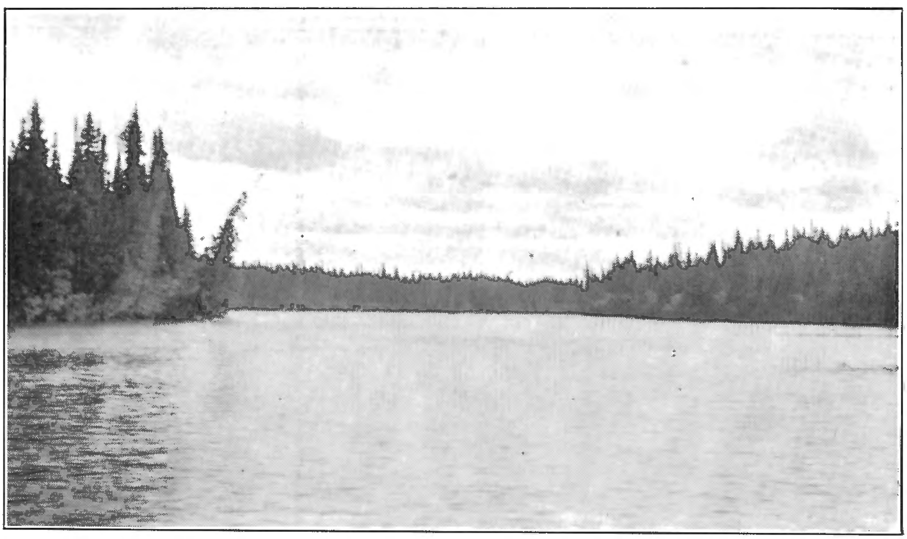
A. Eskimo family and home, mouth of Double Mer. Note dwarf forest at the left in background. (Pages 33, 39.)



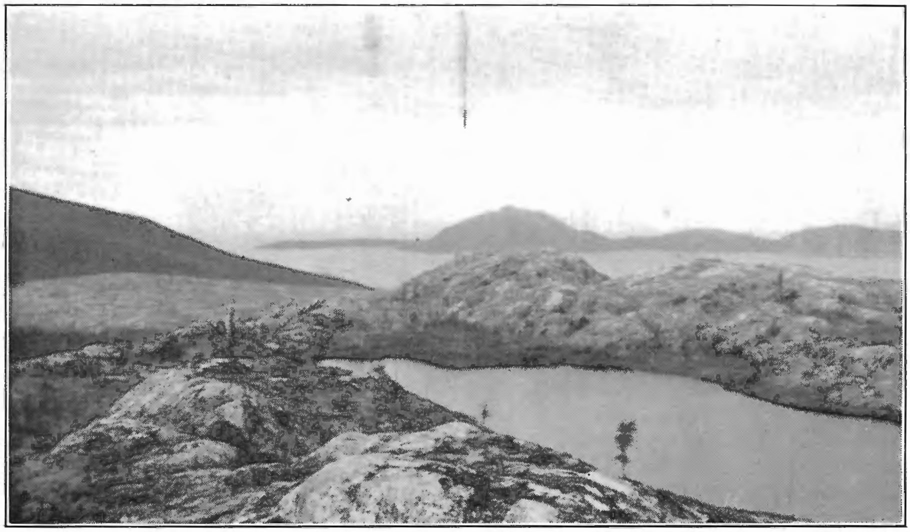
B. Floe ice, Hamilton inlet, July 13, 1921. (Pages 20, 23.)



A. Spruce forest at Mud lake. (Pages 23, 33.)



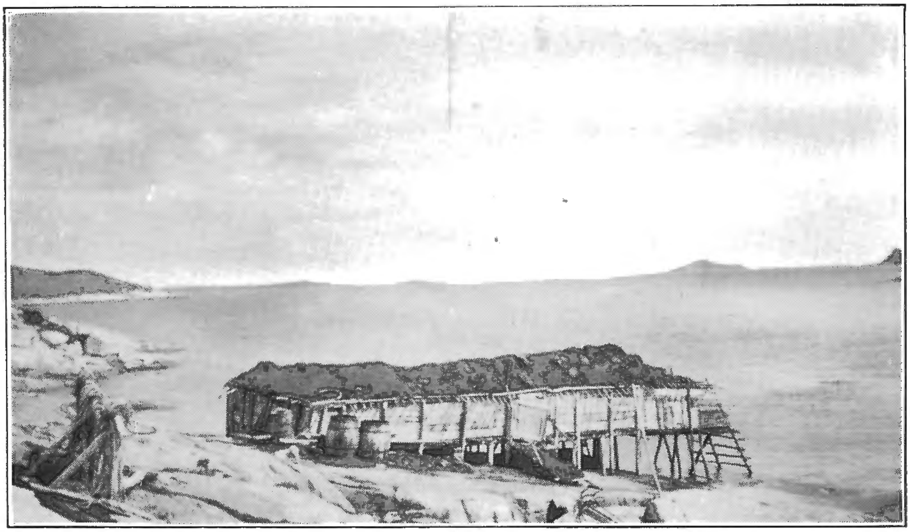
B. Spruce forest near mouth of Kenemich river. (Pages 23, 33, 45.)



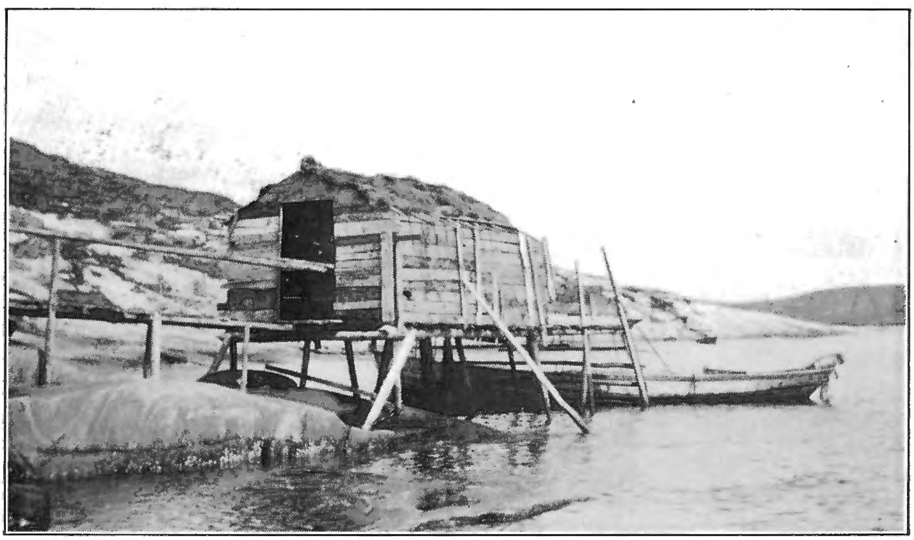
A. View toward the northwest across small rock basin lake on hill top, showing St. John island in the distance. (Page 36.)

B. Sawmill, mouth of English river, lake Melville. (Pages 36, 37.)

PLATE VII



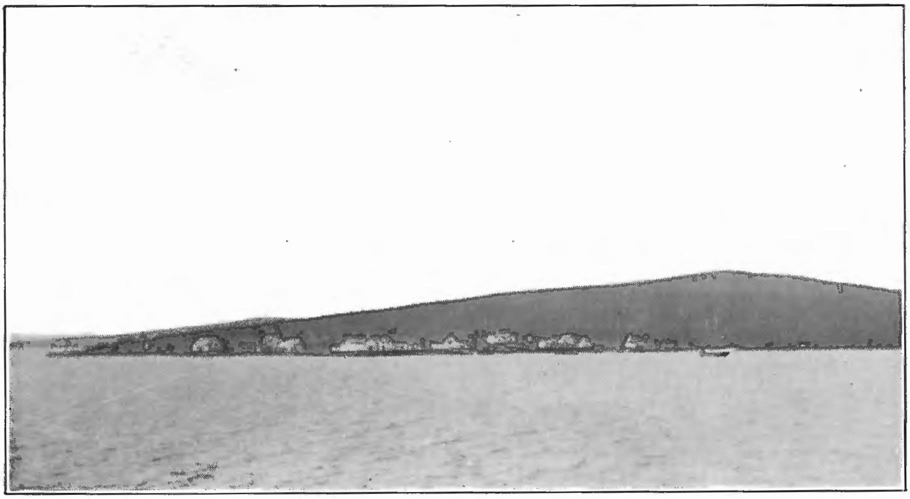
A. Fish house at Indian Harbour. (Page 38.)



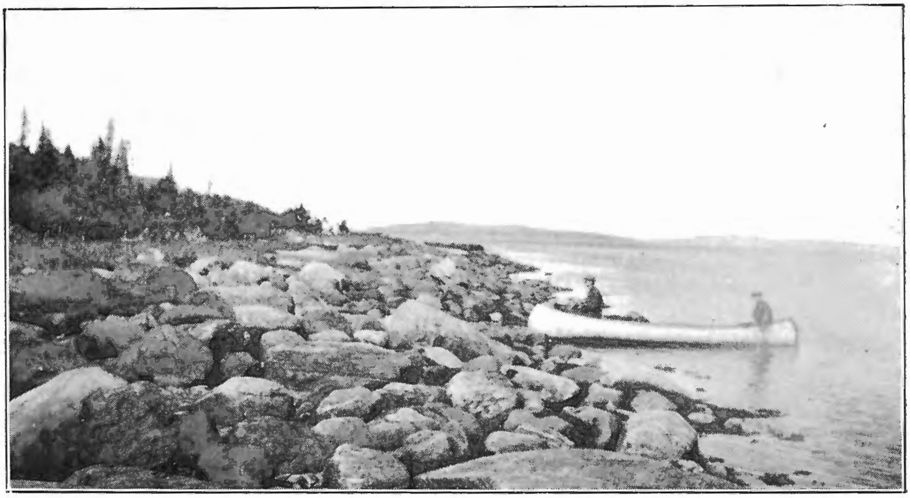
B. Fishing boat and fish house at Indian Harbour. (Page 38.)

A. Hudson's Bay Company's pier, store, and warehouse at Northwest River. (Page 39.)

B. Hudson's Bay Company's residence at Northwest River. (Page 39.)



A. View of Rigolet, from The Narrows. (Pages 10, 39, 42, 65.)



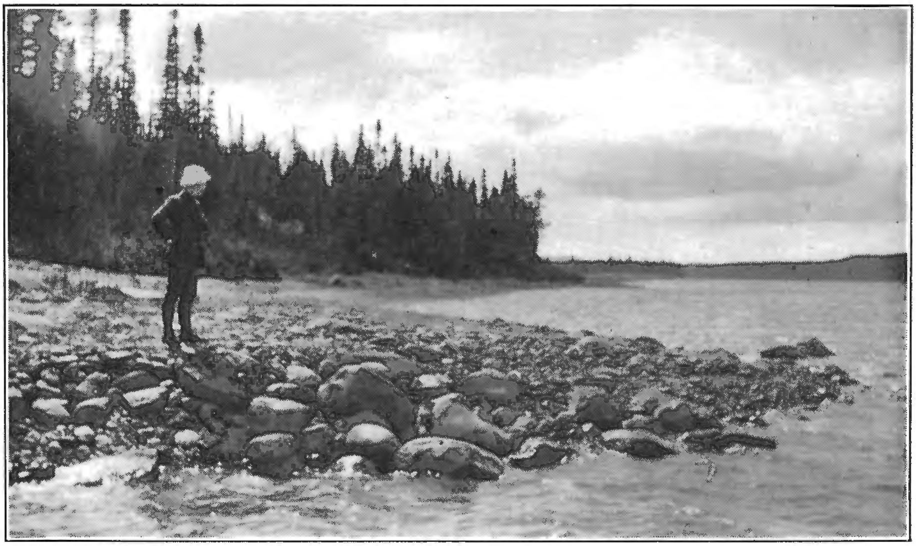
B Boulder-covered shoreline of The Narrows west of Rigolet. (Page 65.)

A. Indians around camp fire at Northwest River. (Page 39.)

B. Indian mother and children at Northwest River. (Page 39.)

PLATE XI

A. An Indian canoe factory at Northwest River (Page. 39.)



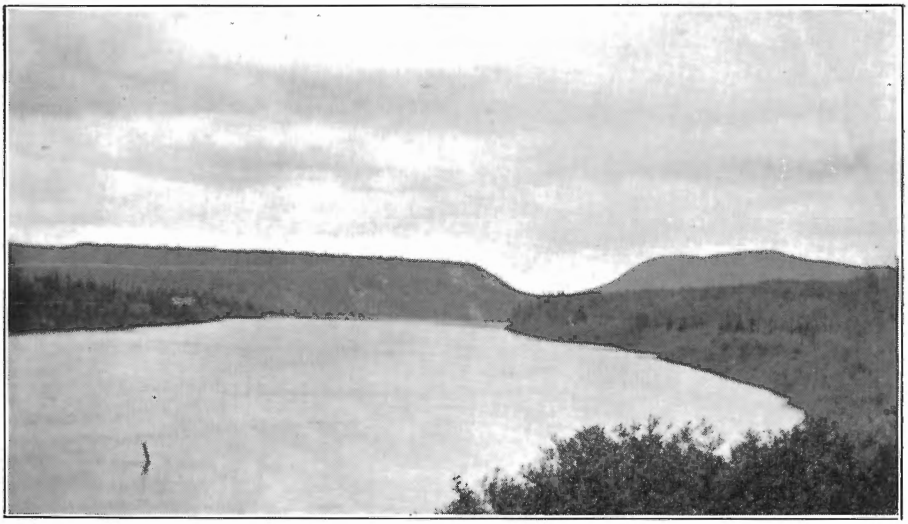
B. Boulder bar, Hamilton river. (Page 47.)

A. View of Muskrat falls looking down stream. (Pages 47, 49.)

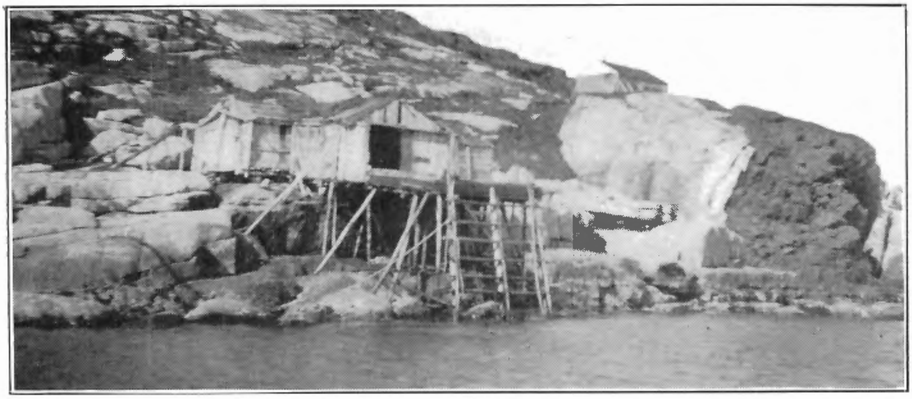
B. *Littorina rudis* var. *groenlandica* on the intertidal zone, Rigolet. (The small white specks are the shells of *Littorina*.) (Page 51.)

PLATE XIII

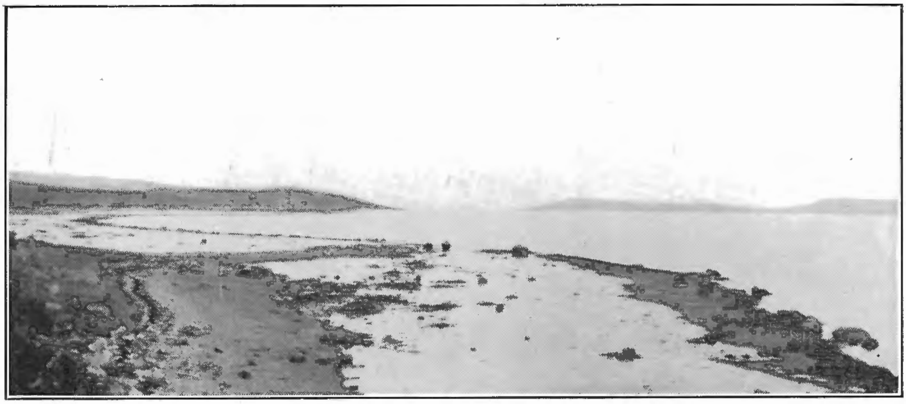
A. Bank of Mulligan river, north shore of lake Melville, showing lowest sand-terrace and fossil tree trunk. (Page 48.)



B. Naskaupi river opposite mouth of Red river, at the head of launch navigation. Sand-terrace on the left in the distance. (Pages 48 65.)

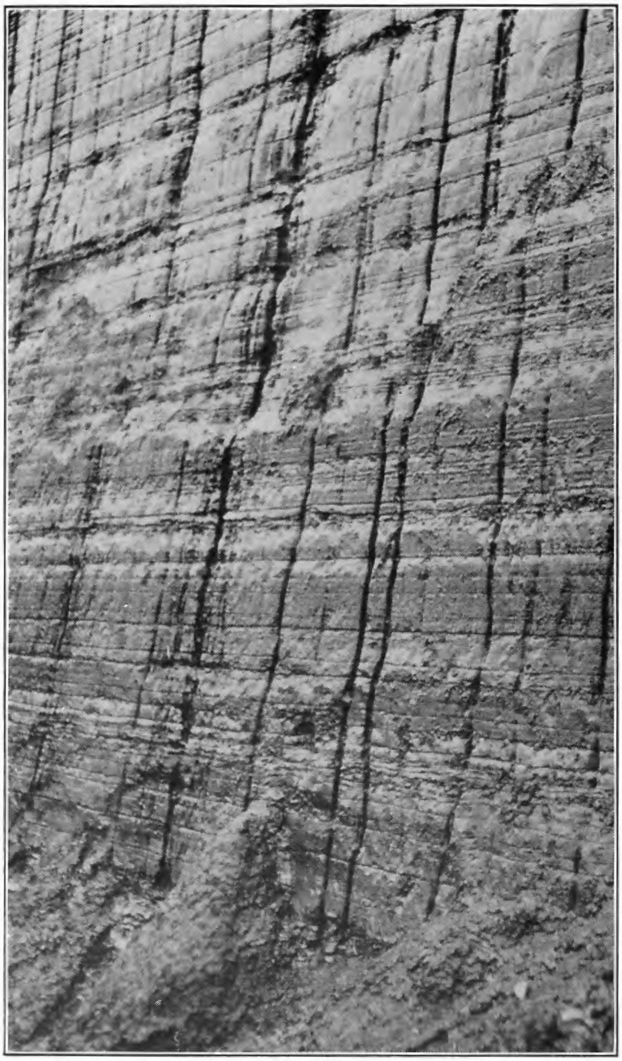


A. Domino gneiss with trap dyke at the right. (Page 56.)



B. Boulder barricade, just east of entrance to Double Mer. (Page 63.)

PLATE XV



Laminated clay trenched by trickling rain water. (Page 60.)

PLATE XVI

Figure 1. Concretion of cemented sand and fine gravel, Kenemich river, Labrador. (Page 61.)

Figures 2 and 3. Concretions attached to pebbles, Kenemich river, Labrador. (Pages 61, 62.)

Figures 4 to 8. Concretions of irregular shape with thin outer shell of ferruginous material. (Page 61.)

Figure 9. Subspherical concretion with outer shell of non-indurated material, Kenemich river, Labrador. (Page 61.)

Figures 10 and 11. Concretions with median constriction, south side lake Melville, Labrador. (Page 61.)

Figure 12. Concretion with constrictions, south side of lake Melville. (Page 61.)

PLATE XVI

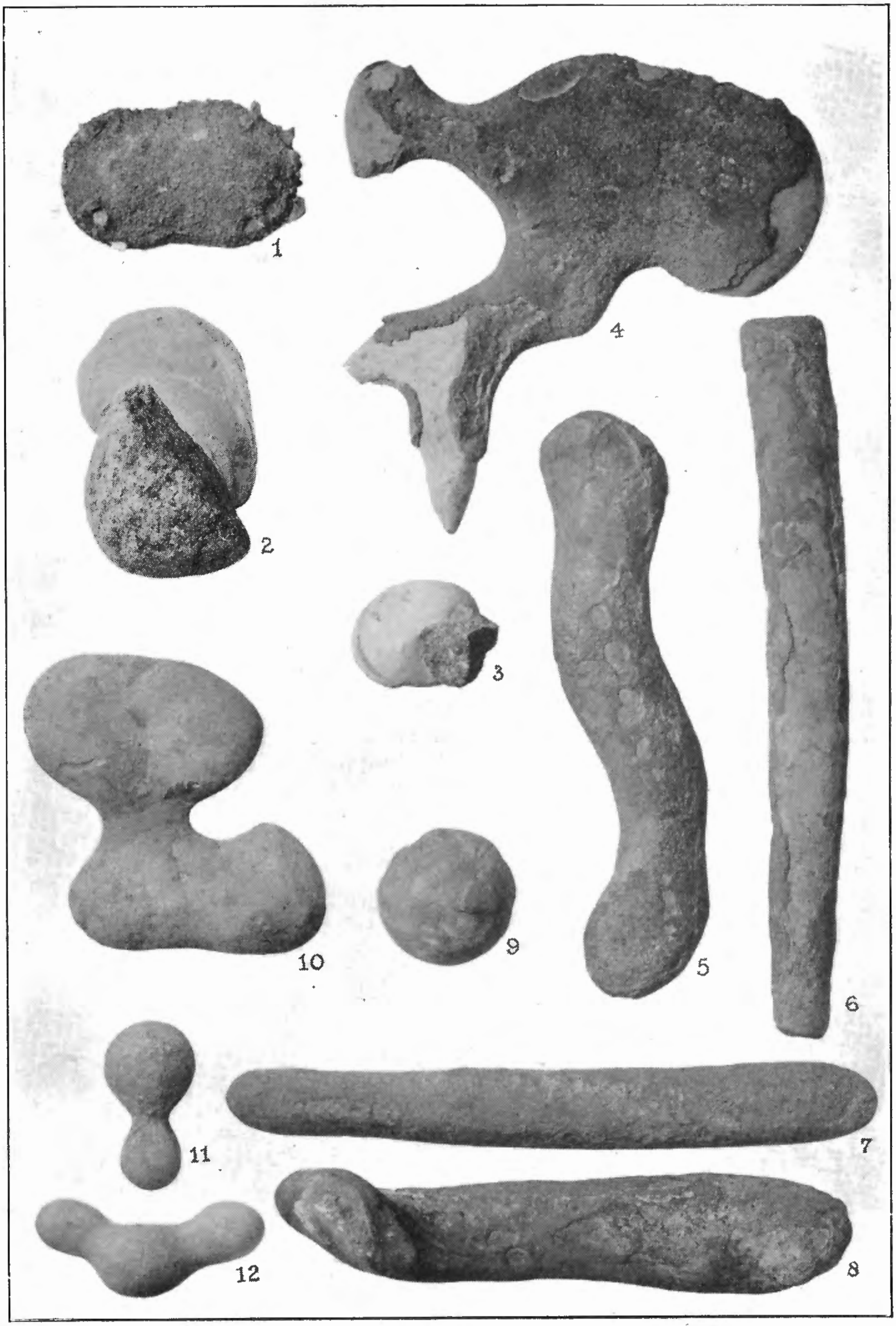


Plate XVII

Figures 1 and 2. View of the two halves of a concretion showing the shell of a *Yoldia* as the nucleus. (Pages 61, 62.)

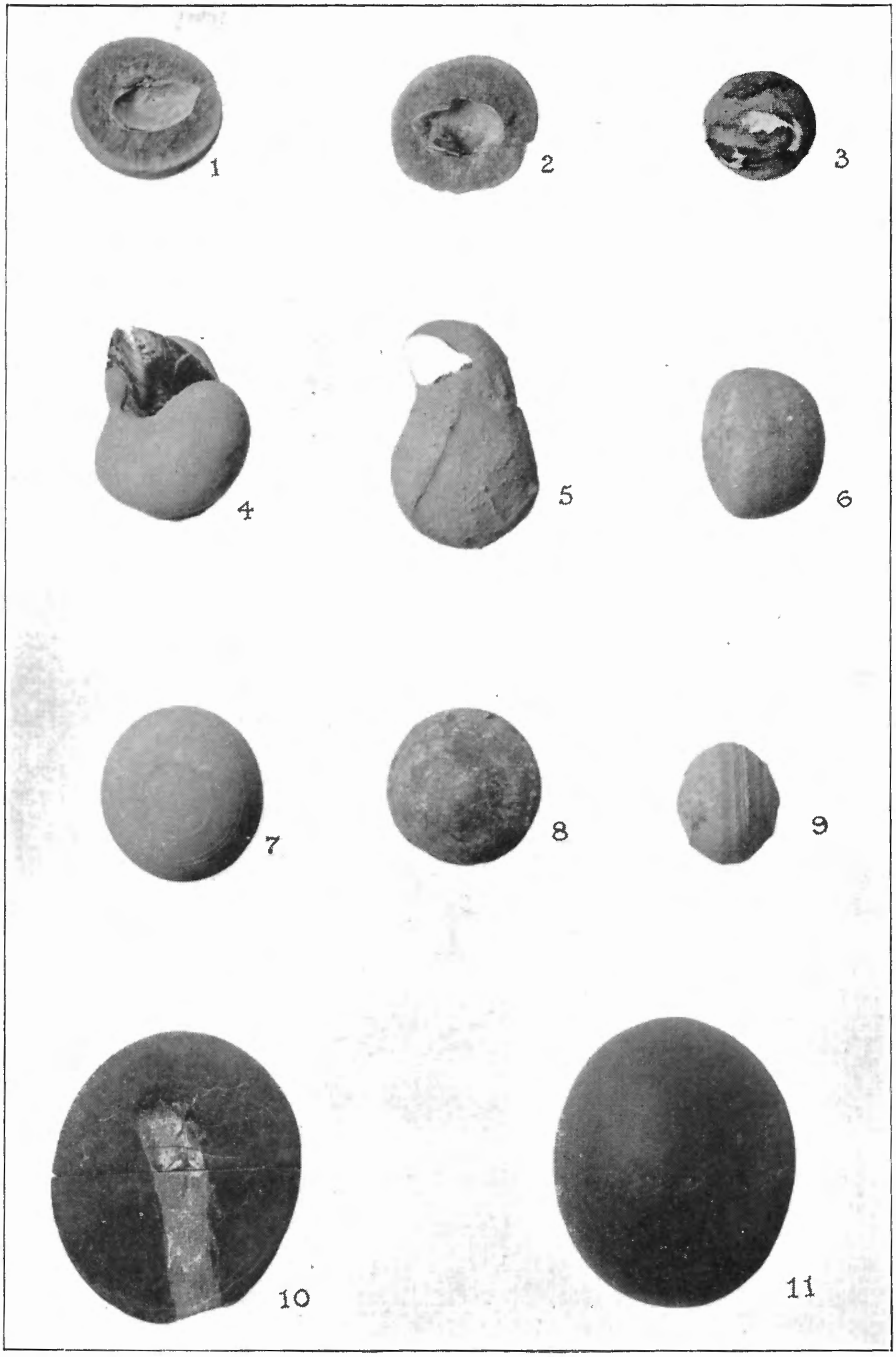
Figure 3. Concretion with a marine shell attached to the surface, Kenemich river, Labrador. (Pages 61, 62.)

Figures 4 and 5. Concretions with shells partly enclosed, Kenemich river, Labrador. (Page 62.)

Figures 6, 7, and 9. Concretions with thread-like ridges corresponding to the lamination of the clays in which they were formed, Kenemich river, Labrador. (Page 62.)

Figure 8. Concretion with iron-stained surface, Kenemich river, Labrador. (Page 61.)

Figures 10 and 11. Views of the two halves of an egg-shaped concretion from Macleod, Alberta. Figure 10 shows a piece of fossil wood acting as nucleus, and figure 11 indicates the external appearance of the opposite half. (Page 61.)


1
2
3
4
5
6
7
8
9
10
11

INDEX

PAGE

Altitudes....11, 13
Anderson, Capt. F....1, 21

Backway, The—
  Beaches....62, 66, 69
  Boulders....63
  Depth....13
  Fauna....38
  Flora....29, 30
  Water, character....53

Beaches—
  See Terraces

Beaver r....18, 48
Bibliography....5
Bigelow, H. B....4
Blanc cape....54
Bowes, Leroy....20, 21, 46, 47, 73
Brick-clays....70
Bryant, H. G....4, 36
Cabot, John....3
Cabot, W. B....5, 39, 46
Canoe factory....92
Caravalla bay....29–31
Caribou moss....34
Carter basin....21, 54, 66, 73
Cartier, Jacques....3

Clay—
  See also Brick-clays
  Laminated, photo....96

Climate....20–23, 73–81
Communication....10
Concretions....61, 97, 99
Cook, Capt. James....4
Copper ore....70
Davies, W. H. A....3, 11, 23, 35, 36
Davis, W. M....15
Davis bay....43
Delabarre, E. B....4
Delisle, Guillaume....3
Domino gneiss....55, 95

Double Mer—
  Boulder barricade, photo....95
  Cross-section....17
  Depth....13
  Flora....24–31
  Glaciation....19
  Hanging valley....15
  Navigation....37
  Rocks....56
  Terrace....63
  Topography....57
  Water, character....53, 54

Double Mer sandstone....16, 19
Drainage system....15
Ellsworth, H. V....70
English r....36, 87
Epinette pt....31, 54
Eskimos....39, 40, 43, 85
Esquimo is....42
Fauna....38
Fernald, Prof. M. L....24
Fisheries....3, 39
Floe ice, Hamilton inlet, photo....85

PAGE

Flora....23–37
Forest fires....35
Forests....32
Fossils....59
French Co....42
Frobisher, M....3
Geology, economic....69–70
  Historical....8–10
  Stratigraphic....55–69
Glaciation....18, 19

Goose bay—
  Map and cross-section....68
  Rainfall....21
  Silting sand....47
  Timber....35
  Water, character....54, 66

Gosling, W. G....4

Grand falls—
  See Hamilton falls

Grand l.
  Climate....23
  Depth....13, 19
  Flora....29–35
  Water, temperature....54

Grand r....32, 70
Gregory, J. W....14
Grenfell, W. T....5, 45
Groswater bay. *See* Melville l.
Hamilton falls....4, 49
Hamilton inlet
  Character....14, 44
  Climate....20
  Floe ice, photo....85
  Flora....24–32
  Sketch map of waters connected with....14
Hamilton r.
  Boulder bar, photo....92
  Description....47
  Glaciation....19
  Terrace....66
  Trees....35
Hanging valleys....14
Henrietta is....19, 38, 52, 53, 72
Historical notes....3, 4
Holme, R. F....4, 20, 23
Hubbard, Mrs. L....5, 35
Hudson's Bay Co....4, 42
Hydrography....43
Indians....39, 42, 91, 92
Indian is....70

Indian Harbour—
  Climate....21
  Fish houses, photos....88
  Flora....23–32
    forests....33
  Marine invertebrates....51
  Rocks....56
  Store....42
  Water, character....53

Inhabitants....39
Insect pests....41
Invertebrates, marine....50, 51
Iron ore....69

INDEX—(*Continued*)

PAGE

Kenamu r. 14, 15, 18, 45, 46
Kenaston, C. A. 4

Kenemich r.—

Concretions, photo 61, 97, 99
Flora 31, 32
Location 45
Pleistocene clay 59
Trees, photo 86

Labrador (peninsula)—

Boundaries undetermined 1
Meaning of name 3
Labrador current 20
Labradorite 69
Lakes, area and character 13
Limestone, crystalline 70
Little l. 45
Little r. 45, 49

Littorina rudis var *groenlandica*

Map shoring distribution 52
Rigolet, photo 93
"Liviers" 41
Long pt. 54
Low, A. P. 4
Lowland pt. 13
Mabelle is. 35
McLean, John 4
Macleod, Alta 99

Maps—

Goose bay 68
Index 2
Showing distribution of *Littorina* 52
Marine conditions, interior extent 49–50
Mealy mts. 11–16, 71, 84
Melville l.
Character 14, 15
Concretions, photos 61, 98
Cross-section 17
Depth 13
Description 44
Flora 24–32
forest 33, 34
Map, early 4
Navigation 37
Rocks 19
Salinity 55
Meteorological observations. *See* Climate
Mokami hill 13
Moliak cove 64, 66, 69
Monis rapid 70
Montagnais Indians 40
Mud l. 35, 86
Mulligan bay 13, 17, 54, 56, 63
Mulligan hills 13
Mulligan r.
Flora 29–34
Rocks 48, 56
Soundings 16
Terrace, section 60
photos 94

Muskrat falls—

Flora and fauna 30, 35, 38
Fossils 66

PAGE

Muskrat falls (Continued)
Photo 93
Rocks 47, 70
Muskrat l. 70

Narrows, The—

Boulders, photo 90
Depth 14
Flora 28–31
Illustrated 9
Marine invertebrates 50–52
Terraces 66
Tides 65
Width 44
Naskaupi r.
Flora 29–35
Nickel 70
Terraces 68, 69
Valley of, notes 16, 18
Width 48
Natashkwan valley 36
Navigation 23
Nickel 70
Nomenclature 43
Northwest r. 83
Northwest River
Canoe factory, photo 92
Climate 20, 22
Flora and fauna 30–38
Hospital 42
Inhabitants 39, 91
Notes 44
Photos 89
Packard, A. S. 4
Palæozoic, sketch map showing areal distribution . . . . . . Facing 14
Patch, C. L. 38
Patterson, J. 22
Pelters cove 54
Penck, A. 14
Plants 23–27
Porter Co. 42
Precambrian 55
Quaternary 58
Red r. 35, 49, 68, 69

Rigolet—

Climate 20
Flora 28–33
Hudson's Bay Company's post 4
Littorina, photo 93
Marine invertebrates opposite 50
Photos 90
Tides 65
Water, character 53
Rivers 45
Robertson, S. 40
St. John, H. 28
St. John is. 87
Sandstone. *See* Double Mer Sandstone
Sandwich bay 19
Sandy pt. 21
Sawmills 37, 87
Sebaskachu r. 16, 30, 32, 47, 48
Sparhawk, W. N. 37
Sphagnum moss 33, 34
Stag islds 19

INDEX—(*Continued*)

PAGE

Summer cove........................... 52
Susan r............................... 18, 48
Tarr, R. S............................ 20
Temperature of waters................. 53
Terraces...........................45, 63–69, 72
  illustration........................ 9, 94
Tides..............................49, 50, 65
Timber. *See* Trees
Topography............................ 10
Townsend, C. W........................ 36

PAGE

Transportation........................ 10
Traverspine r......................... 47
Trees................................. 32–36
Valleys, through...................... 15
Wallace, W. S......................... 4
Waterpower............................ 49
West bay.............................. 59, 62
Wetmore, R. H......................3, 24, 29
Winikapau l........................... 13
Zon, Raphael.......................... 37