

PERMAFROST IN CENTRAL LABRADOR-UNGAVA

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WORK done by the Iron Ore Company of Canada and members of the McGill Sub-Arctic Research Laboratory since 1957 has indicated that permafrost is much more extensive south of the 55th parallel than has hitherto been believed.

The thickness of permafrost locally exceeds 80 m. This has been attested by E.M.F. measurements on thermocouples installed in diamond-drill holes, and has since been partially substantiated by actual excavation of ore and overburden.

During the summer of 1959, the McGill Sub-Arctic Research Laboratory, assisted by the Iron Ore Company of Canada and by members of the Division of Building Research, National Research Council of Canada, began a detailed programme of permafrost research. The following statement of permafrost characteristics is taken largely from the early results of this work.



Fig. 1. Dotted line shows approximate southern limit of permafrost as depicted on the Glacial map of Canada, 1958

Local relief exceeds 300 m. and the natural vegetation ranges from patches of closed-crown spruce forest in the more sheltered parts of the valleys to lichen heath and bare rock (tundra), with active frost-heave features, on the more exposed areas above about 680 m. above sea-level. This contrast in vegetation type is an indication of the range of exposure between the valley bottoms and the hill tops, and also reflects the contrasts in the occurrence of permafrost. The mean annual air temperature, based upon an 11-year period of observations at a height of 507.7 m. above sea-level, is -4.6° C. Lichen heath and bare rock above 680 m. is almost everywhere underlain by permafrost exceeding 60 m. in thickness. Exceptions to this have been related to lee slopes and deep gullies which are well insulated in winter by more than one metre's accumulation of snow. In these areas the permafrost is thin, or even entirely lacking where the deep snow covers an extensive area. An indication of the

effectiveness of the snow cover as an insulator is given by the fact that, beneath 1.6 m. of snow, frost had penetrated only 0.25 m. by 13 January 1960, whereas in areas blown free of snow, frost had penetrated 2 m. to reach the permafrost table on hill-top sites.

It is concluded that much of the local permafrost is not relic but is compatible with the climatic regime of the last few decades. At high altitudes the active layer is about 2 m. deep and it is highly probable that no talik (unfrozen bedrock) exists between the seasonally frozen ground and the permafrost table over substantial areas.

There is a loose correlation between vegetation type and permafrost thickness. With increasing shelter and density of arboreal vegetation and decreasing altitude, the permafrost becomes thinner, patchy, and finally, only scattered relic masses have been found below heights of 680 m. Generally speaking, permafrost does not appear to exist beneath open lichen woodland, except as relic patches. Perhaps one of the more important influences in this respect is the increased accumulation of snow in the wooded areas.

As the permafrost thins and becomes patchy in distribution, the depth of the permafrost table beneath the surface increases and becomes separated from the seasonally-frozen ground by a talik of increasing thickness. From this it appears that permafrost was at one time more extensive than today, and it is possible that this was shortly after the disappearance of the ice from the local area (approx. 4000 B.C.¹) and before the present arboreal vegetation had become firmly established.

Exploratory diamond drilling in the Lake Wabush area, 130 miles (210 km.) south of Schefferville, has revealed the existence of permafrost at least 60 m. in thickness. These occurrences of permafrost are found at an altitude of 830 m. and higher, which lie above the tree line in lichen heath and bare rock areas. From this it is postulated that permafrost probably exists beneath most of the exposed hill tops which rise above the tree line and that it extends as far south as the Laurentian Scarp.

It is interesting to note that many of the ore bodies in the Schefferville vicinity lie on the height-of-land between Quebec and Newfoundland in the lichen heath and bare rock areas. A rough estimate places nearly one-half of the proven ore reserves of the Iron Ore Company of Canada in the permafrost category. No actual measurements have yet been taken in the more extensive upland areas some 30-35 km. north-north-west of the town, although it is probable that the maximum local thickness of the permafrost will exceed 110 m. Local open-pit excavation of ore on a large scale provides ideal conditions for the study of permafrost. An ambitious research programme, involving climatological, botanical, geological and geographical aspects, is being prepared at the McGill Sub-Arctic Research Laboratory.

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REFERENCE

1. Grayson, John F. *The postglacial history of vegetation and climate in the Labrador-Quebec region as determined by palynology*. Unpublished Ph.D. thesis presented to the University of Michigan, 1956, p. 205-11.