

## **CIM Permafrost Workshop, Yellowknife, N.W.T.**

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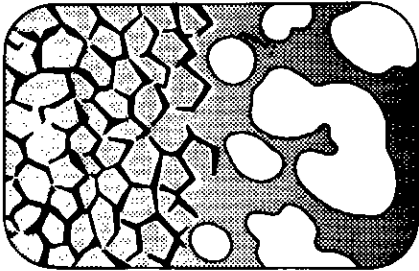
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# Conference Reports



## CIM Permafrost Workshop, Yellowknife, N.W.T.

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A permafrost workshop sponsored by the Yellowknife Branch of the Canadian Institute of Mining was held in conjunction with the eighth annual Geoscience Forum, Yellowknife, N.W.T., December 2-4, 1980. The following is a summary account of this workshop, which emphasized the importance of permafrost with respect to mineral exploration and development. Walter Gibbins (IAND) and Martin Parnell (Cominco) organized and chaired the sessions.

The workshop was officially opened by Mr. George Aaltonen, chairman of the Yellowknife CIM, who welcomed the participants and briefly outlined the importance of mining technology and costs and Dr. Hugh French (University of Ottawa) who gave an overview of permafrost in Canada and other parts of the world.

Alan Judge (Earth Physics Branch, Energy Mines and Resources) presented a paper on the thermal aspects of permafrost. Using basic thermal data collected

from deep bore holes with the cooperation of various industrial organizations, it has been possible to develop theoretical models which can be used in solving practical problems. In a second presentation, he demonstrated the significance of the ice-water phase change on various aspects of open pit mining operations of the Iron Ore Company of Canada at Schefferville.

A paper by Udo Weyer (Department of Environment), on ground water considerations for tailing disposal sites in the High Arctic, concentrated on a practical hydrological problem related to Garrow Lake, a proposed tailing site for the Polaris Mine being developed on Little Cornwallis Island. Using groundwater geochemistry, he demonstrated that a ground water seep in the area is not from a surface source, but rather a deep seated one.

William Shilts (Geological Survey of Canada) showed how mapping surficial geology could be used to determine the relationship between surface forms and the texture and nature of surficial material. Once this relationship is firmly established, it is then possible to use satellite imagery to determine the permafrost characteristics of a region with similar properties. This greatly simplifies preliminary studies and reduces costs significantly.

William Scott (Hardy Associates Ltd.) gave a lucid presentation on geophysical techniques in permafrost conditions. He described the changes in properties of various materials with change in temperature and related these to the physical properties measured with various geophysical equipment. Some types of surveys (e.g., magnetic surveys) are unaffected while others (seismic or resistivity surveys) may be drastically altered. Although the latter may become useless in the search for metallic mineralization, they may be applicable to the discovery and mapping of the permafrost itself.

Larry Aspler (Carleton University) gave a paper on the permafrost in the Yellowknife area. He discussed the relationship

between the glacial history of the area and the distribution of surficial deposits and the distribution of permafrost. The latter is linked to certain types of surficial deposits. Thus, it is possible, in the Yellowknife area, to predict the importance of permafrost in a given area if the nature of the surficial deposits is known.

Permafrost engineering case histories were presented by Mike Horne (Giant) - open pit operations at Giant Yellowknife Mines Ltd.; Hank Geigrich (Cominco) - Polaris Mine; and Ted Hewit (Strathcona Mineral Services Ltd.) - Nanisivik Mine. Hewit pointed out the economic and technical disadvantages of permafrost mining at Nanisivik including problems with electrical detonators, supplying dry air in the summer and the need for extra clothing. Advantages include the lack of water - eliminating the need for pumps and drainage and the lack of heat which tends to produce harder working miners.

Don Irwin of IAND's Mining Inspection Office explained problems caused by differential settling under the Nanisivik mill. Due to melting of part of a 30 to 40 centimeter thick ice lenses in dolomitic bedrock beneath the mill, it has settled. Corrective measures include mining under the mill and constructing concrete pillars.

Fred Buller (Automated Diamond Drilling Ltd.) talked about bedrock drilling in permafrost. He outlined the costs related to various types of drilling systems in the north. The advantages and disadvantages of various salt solutions and other media were compared and contrasted with dry drilling techniques. Kurt Stangl (EBA Engineering Consultants) reviewed drilling equipment and techniques used to drill frozen overburden in geotechnical studies for construction sites and proposed pipeline routes.

Nat Rutter (University of Alberta) presented the results of his studies on permafrost in the Yukon and the Mackenzie Valley. Showing how the distribution of surficial deposits can be an invaluable help in mapping the distribution of ice content in surficial materials, he outlined the nature and importance of ice con-

tents in various types of material including organic silt, till, sand and gravel. He showed that the amount of ice will vary with latitude but that the relative amount of ice from one material to the next remains fairly constant in any given area.

Larry Dyke (Terrain Sciences Division of the Geological Survey of Canada) illustrated the impact of vehicle movement on various types of surficial materials in permafrost areas. Till is least affected by heavy vehicle traffic, while peat tends to lose its cohesive strength and liquify. Dyke continued with a second talk of bedrock frost heave, showing field examples, explaining experiments designed to measure frost heave and discussing possible mechanisms.

In the evening Mel Brown, IAND's mining inspector, reviewed his considerable experience with mining and permafrost in the Northwest Territories. This ranges from inspecting curling rinks and cold storage areas mined out of pingos to development of the innovative dry mining techniques in use at the Nanisivik and Polaris mines.

A second northern veteran, John Denison, showed a movie about winter road construction and operation and gave a list of do's and don'ts of winter road construction. A narrative of one of John's winter road operations, "Denison's Ice Road, by Edith Iglauer, is scheduled to be reprinted in a paperback edition in the near future.

A volume of proceedings of the meeting is planned and will be available by late summer, 1981. Contact: The Yellowknife Workshop committee c/o Geology Office, IAND, Box 1500, Yellowknife, N.W.T. X0E 1H0.

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## Third Annual Geoscience Research Seminar

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Over 500 Geoscientists from industry, government and universities attended the Ontario Geological Survey (OGS) Geoscience Research Seminar, December 10-11, 1980 in Toronto. Among the individual research presentations were 20 Ontario university progress reports of ongoing research projects funded by the Ontario Ministry of Natural Resources. The Geoscience Research Grant Program, initiated in 1978, provides a total of \$500,000 per annum to Ontario university faculty members for mission-oriented geoscience research projects, complementary to the activities of OGS and ultimately intended to reduce uncertainty by industry in mineral exploration programs.

As a number of these university projects are currently in the final year of funding, some interesting results were presented. E.G. Pye, OGS Director of the grant program, cited some of the research accomplishments to date:

- 1) development of new guidelines to exploration in terms of metallogenic concepts and also in the field of litho-geochemistry;
- 2) development of modelling techniques as an aid to interpreting electro-magnetic survey data;
- 3) demonstration that high resolution aeromagnetic and paleomagnetic surveys can be used as effective tools to aid stratigraphic mapping in drift-covered areas;
- 4) development of the 'collector' system to delineate Ra anomalies in U prospecting;
- 5) demonstration of the use of horizontal deep drains in reducing ground-water pressures and thereby increasing the stability of clay slopes;
- 6) development of an ion laser in argon geochronology and microanalysis at mineral grains; and finally
- 7) experimental work showing that U-Th-Ra levels in mine wastes can be effectively controlled by treating tailings with phosphates.

This latter project, is directed by W.S. Fyfe (University of Western Ontario), and received special mention by the Ontario Minister of Natural Resources, James A.C. Auld, in his seminar address. The University of Western Ontario research team's concept is based on the well-known observation that radium and uranium are concentrated in organisms and particularly those which secrete phosphate bearing skeletons. Thus many large phosphate deposits are also uranium deposits.

In these experiments, the very stable and insoluble phosphate mineral, apatite, is precipitated in the mine wastes by adding calcium carbonate and phosphate solutions. Glacial clays are added to reduce permeability of the matrix. After such treatment, the waters from the mine wastes (samples provided by Rio Algom Ltd., Elliot Lake, Ontario) have radium levels similar to those found in normal ocean water and clean river waters, (and much lower than in some well waters) . . . "The results show clearly that the radium levels can be reduced to near global background levels (given our sample sizes, we only have the detection limit <1.0; data now being collected will allow lower levels to be determined)." (OGS Geoscience Research Seminar 1980, Abstract).

Fyfe also outlined a scenario for a plan to treat the waste and concluded his talk by underlying the principles on which any waste treatment should be based—with one's sights set on the next thousand years, rather than on the next ten years.

Among the OGS staff presentations were 10 special papers, as well as a Symposium on the Kirkland Lake Initiatives Program (KLIP), a \$2.5 million, 5-year program ending in 1983-84. This comprehensive geoscientific survey program sponsored by the Federal Department of Regional Economic Expansion and the Ontario Ministry of Northern Affairs, was designed by the Ontario Geological Survey. The overall objective is to stimulate mineral exploration by private industry in the area. Ian Thomson, the symposium co-ordinator, gave a historical overview of the Kirkland Lake Area which was at its peak of mine production in the late 1930s and saw its population rise to 25,000 (more than double the present figure). By the 1960s, the town's basic industry was moribund, and at present only two mines are operating in the area. However, Thomson stressed that the Kirkland Lake Area is still a good place to look for gold, has good base metal potential and real possibilities for talc, asbestos and diamonds.