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geochemical exploration in permafrost terrain of the Yukon – Tanana Upland of Alaska and analyzed five sample media: – 1) panned concentrates, 2) the clastic, minus-80-mesh stream sediment, 3) the oxalic-acid-leachable fraction of the stream sediment, 4) the stream bank sod, and 5) aquatic bryophytes. The last three media act as scavenging agents of ions in stream waters. The results indicate that these scavenging agents delineate mineral potential areas better than the stream sediments although panned concentrates also produced good results. It is obvious that in order to conduct the most useful and productive type of geochemical exploration, a thorough knowledge of the physiography and the overburden is desirable, and this again stresses the need for close cooperation between the exploration geologist, geochemist, and geomorphologist.

C. Godwin discussed supergene enrichment of a copper-molybdenum deposit in the Yukon Territory stressing its uniqueness as it is the only known example in the Canadian Cordillera of leached capping and a supergene enrichment zone that was neither modified by glaciation nor preserved by burial under younger rocks. Finally three papers were delivered dealing with uranium deposits. Although the relation to geomorphology at first glance seems tenuous all three speakers, H. R. Wynne-Edwards, Frank Armstrong and K. Tapaninen related uranium deposits to palaeosurfaces which are paleogeomorphological landforms.

In conclusion, one might state that the symposium was eminently successful in its aims: – 1) to create a better understanding among those working in widely varied earth science disciplines and to demonstrate that all had knowledge to gain and dispense and 2) to demonstrate the advantages of integrated studies resulting in maximum gains to society.

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The Fourth Annual Conference of Environmental Earth Sciences Division of the GAC again sponsored this informal meeting of Central Canada geologists, engineers, environmental scientists and other interested professionals. As in previous years, the conference was ably arranged by a volunteer, this year by W. R. Cowan and his associates at the Ontario Ministry of Natural Resources.

The meeting held on November 29, 1975 in the Ontario Room at Queen's Park was attended by some 120 registrants.

Following opening remarks by E. G. Pye, Director of the Geological Branch of the Ministry of Natural Resources, eight papers, each of one-half hour in length, including discussions were presented.

Q. H. J. Gwyn of the Ministry of Natural Resources, Division of Mines, outlined studies carried out in 1975 on the Champlain Sea Clays in the Hawkesbury area. Dr. Gwyn, who had previously mapped the quaternary geology of the area, carried out an eight hole drilling programme which included some 600 feet of boring, 122 in situ shear strength measurements and the collection of 122 samples in thin wall Shelby tubes. The samples were examined by R. M. Quigley and J. E. Haynes at the University of Western Ontario to assess the variability of the engineering properties, pore water chemistry and clay mineralogy. It was

determined that the sediments showed preconsolidation and less variability in their properties than has been reported in other studies. Further studies will compare the characteristics of these clays with those of other areas where retrogressive failures have occurred.

J. S. Gardner, Department of Geography, University of Waterloo, described the geomorphic impacts of the 1974 Grand River (Ontario) flood which had a magnitude with a recurrence interval of about once in 500 years and had catastrophic property damage effects. Gardner found that, insofar as landform modification and the creation of obvious features are concerned, the flood had relatively minor effects. Large amounts of fine sediment were undoubtedly carried in suspension, however, the steep stream and flood-plain gradient prevented deposition in the studied area. Small scale features such as chutes, scour pits, chute bars and splay deposits were observed throughout the affected area; however, the major geomorphic effects were associated with man-made structures and related flood-plain modifications.

Following this description of the effects of a major flood, E. F. Anderson, Ministry of Natural Resources, Ontario, outlined government criteria for the designation of hazard lands. These lands defined as susceptible to flooding or erosion, instable or hazardous because of other conditions, when identified, are included in all official plans as a designated land use with appropriate developmental control policies. The emphasis, according to Mr. Anderson, is on the prevention of development of hazard lands since the costs of remedial measures to overcome damage usually exceed the opportunity lost through regulation or prohibition of development.

C. J. Acton, Head of the Ontario Soil Survey summarized the programme of the survey which involves both soil inventory and research studies. The inventories, Acton outlined, are intended to document the nature, extent and distribution of the soil resources of the province to provide a basis for land-use decision making. Research activities are aimed at extending the usefulness of this resource information for agricultural as well as non-agricultural purposes. Some of the present research involves

estimation of sheet erosion, determination of agricultural run-off, characterization of sediments eroded from agricultural lands and soil mitigation measures to reduce pipeline construction damage.

Following lunch, S. E. Yundt of the Proctor and Redfern Group, discussed the apparent mineral aggregate crisis. The main problem, she outlined, is not the lack of resources but the sociological and environmental problems linked to restrictions at Provincial and Municipal levels. Some of the recommendations made during the paper are strengthening of the Pits and Quarries Control Act, development of a provincial mineral-aggregate policy, effective pre-planning by Municipalities to set out areas for mineral resources extraction, improved environmental responsibilities by the industry, enlightenment of the public, control of public participation and a review of the effectiveness of the OMB.

W. J. Wolfe, Cominco Ltd., described the natural occurrence of anomalous metal concentrations. It was noted that these occurrences may exceed levels considered to be polluting by environmentalists. Several case studies of high concentrations were presented and the ability of plants to adapt to or reject the uptake of such concentrations discussed. Geochemical orientation surveys by the extractive industry prior to development are necessary to establish baseline data in order to protect the company should litigation arise concerning suspected pollution.

The groundwater contamination problems associated with bulk storage of road salting compounds in Ontario were outlined by G. Funk of the Ministry of Environment. Mr. Funk described storage methods, structures and handling of road salting compounds and then described an investigation into contamination of a water well and damage to vegetation by salt from an uncovered pile. Hydrogeologic, geophysical and water-quality studies were described in order to show the method of proving the source of the problem.

Grant Anderson of Gartner Lee Associates Limited described the role of the hydrogeologist in the evaluation of potential sites for sanitary landfills. Mr. Anderson described the approach used in regional site selection studies and

then described a detailed site investigation at Canadian Forces Base Borden. The study outlined the need for the detailed evaluation of a site even if it appears to have a simple stratigraphy. Once the evaluation is complete, the data can be used to properly design the landfilling techniques, leachate and gas control, monitoring and closure measures.

The conference was, as in previous years, well received by those present. Discussions after the presentations were of great value and indicated an interested, well-informed audience. The fifth conference will again be held in Toronto in November of 1976; further information can be obtained from the author.

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Soil-Water Problems in Cold Regions

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A conference on soil-water problems in cold regions was held in Calgary, May 6-7, 1975, sponsored by the Special Task Force of the Division of Hydrology, American Geophysical Union. Heat and moisture transfer in soils of cold regions was the central theme of this conference, which was attended by 82 Canadian, one Japanese, and 19 U.S.A. participants. Regrettably, U.S.S.R. representation was lacking. Although the preponderance of Canadian participants was doubtless influenced by the locale of the conference, it nevertheless reflects major interest by Canadian researchers and practising engineers in problems of freezing soils and the associated problem of heaving. Much of the interest is clearly engendered by current planning and design of oil and gas pipelines and highways in Mackenzie Valley; at least 20 of the participants are affiliated with consulting firms active in such projects. The program and the affiliations of the various authors reflected the broad range of disciplines contributing to current research in soil-water problems of cold regions, including physics, engineering, meteorology, hydrology, agronomy and geomorphology; even dendrochronology appeared, as an adjunct to geomorphology.

The opening paper, by Sam I. Outcalt and John H. Carlson, described a computer-based mathematical model designed to simulate surface soil energy budget and soil thermal evolution.