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**A GEOLOGICAL ORIENTATION SURVEY FOR
URANIUM OF THE MONTREAL RIVER AREA,
DISTRICT OF ALGOMA, ONTARIO**

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A GEOCHEMICAL ORIENTATION SURVEY FOR URANIUM OF THE MONTREAL RIVER AREA, DISTRICT OF ALGOMA, ONTARIO.

Abstract

Detailed geochemical studies were carried out in 1975 to determine the distribution and dispersion patterns of uranium, the base metals, and associated elements in bedrock, surficial overburden, and lake and stream waters and sediments in an area covering Slater, Smilsky, Rix, Peever, Labelle and Labonte townships, District of Algoma, Ontario. Sampled media were selectively analyzed, by a variety of techniques, for Zn, Cu, Pb, Ni, Co, Ag, Mn, As, Mo, Fe, Hg, Sr, Ba, Ti, Al, Ca, Mg, K, V, Cr, Be, La, Y and U.

Multielement regional distribution patterns within lake and stream waters and sediments were indicative of uranium mineralization associated with diabase dykes, chemical variations in bedrock lithologies, and differences in aquatic physicochemistry. A definite value was found in interpreting hydrogeochemical dispersion patterns in terms of elemental associations based on trace and minor element assemblages outlined for known mineralization, bedrock lithologies and different aquatic physicochemistry within the study area.

Reconnaissance exploration for combined uranium and base metal mineralization can be accomplished most efficiently utilizing lake sediments as the sample media. Supporting data for reconnaissance uranium exploration can be obtained from lake waters. Detailed exploration for uranium mineralization can be carried out employing lake waters and sediments and/or stream waters and sediments. Lake and/or stream sediments are best used for detailed base metal exploration.

Résumé

On a effectué en 1975 des études géochimiques détaillées, pour déterminer le mode de distribution et les auréoles de dispersion de l'uranium, des métaux de base, et des éléments associés qui pourraient se trouver dans la roche en place, les terrains de couverture, les eaux lacustres et fluviatiles, et enfin dans les sédiments d'un secteur englobant les townships de Slater, Smilsky, Rix, Peever, Labelle et Labonté (district d'Algoma, Ontario). Dans une série d'échantillons, on a dosé sélectivement, par diverses méthodes, les éléments suivants: Zn, Cu, Pb, Ni, Co, Ag, Mn, As, Mo, Fe, Hg, Sr, Ba, Ti, Al, Ca, Mg, K, V, Cr, Be, La, Y, et U.

Le mode de distribution à l'échelle régionale des divers éléments contenus dans les eaux et sédiments lacustres, fluviatiles, indique que les minéralisations uranifères sont associées aux dykes de diabase, à des variations chimiques de la lithologie du sousbasement, ainsi qu'à des variations physicochimiques des eaux de la région étudiée. On a constaté qu'il était plutôt avantageux d'interpréter les auréoles de dispersion hydrogéoquímiques d'après les associations d'éléments définies en fonction d'assemblages minéraux secondaires et accessoires, une fois connus les minéralisations, la lithologie de la roche en place, et les caractéristiques physicochimiques des eaux de la région.

On peut effectuer avec un maximum d'efficacité l'exploration des minéralisations uranifères et en métaux de base, en utilisant les sédiments lacustres comme matériau d'échantillonnage. L'analyse des eaux lacustres apportera des indications supplémentaires lors de l'exploration préliminaire des minéralisations uranifères. Pour l'exploration détaillée, on examinera les eaux et sédiments lacustres ou fluviatiles. Les sédiments lacustres et fluviatiles conviennent le mieux à l'exploration détaillée des métaux de base.

INTRODUCTION

A geochemical orientation survey to determine the distribution and dispersion patterns of uranium, the base metals, and associated elements in bedrock, surficial overburden and lake and stream waters and sediments was carried out in an area covering Slater, Smilsky, Rix, Peever, Labelle and Labonte townships in the Montreal River area, District of Algoma (41 N/02, 07), Ontario (Coker, 1975).

The survey was designed to permit testing of geochemical methods with regard to their responses to typical geological and environmental influences within a portion of the Superior Province on the eastern shore of Lake Superior. The information obtained is used to assess the

effectiveness of geochemistry for reconnaissance surveys in this and similar nearby terrains as a basis for regional geochemical surveys.

Acknowledgments

Assistance with the field work during 1975 was provided by S. Earle. Preparation of base maps and the computer listings in the appendixes was carried out by C. Crosby. D. Ellwood provided guidance with computer programming. Sample preparation at the Geological Survey was carried out by P. Lavergne and S. Earle. Analyses carried out in the GSC laboratories were performed by A. Jones, R. Horton, G. Gauthier, and E. Moore.

DESCRIPTION OF THE STUDY AREA

Location and Access

The study area comprises the townships of Slater, Smilsky, Rix, Peever, Labelle, and Labonte, an area of 390 km² in the District of Algoma, Ontario. The area is located on the east shore of Lake Superior approximately 115 km north of Sault Ste.-Marie. The Trans-Canada Highway (Highway 17) runs approximately north-south, along the shore of Lake Superior, through the study area. A number of secondary roads run east from Highway 17.

Physiography

The survey area, on the east shore of Lake Superior, is perhaps one of the most rugged portions of Ontario. Some hills rise to elevations of 270 m above Lake Superior which is 200 m above sea level. The hills are commonly composed of granitic rocks although diabase dykes, which are in some cases more resistant to weathering than the associated granitic rocks, do form prominent ridges. In general, however, the depressions in the area are characterized by diabase dykes or by fault zones and glacial deposits. Along the shore of Lake Superior steep-walled gorges, which mark the site of former diabase dykes or fault zones, may extend inland for several hundred metres.

Drainage is well developed in the area, although lakes and streams are not overly abundant. The thick Pleistocene sand and gravel deposits along abandoned beach lines and in depressions evidently permit free underground drainage. This results in many streams disappearing underground for significant portions of their drainage courses.

The area is heavily wooded with deciduous trees, maple, birch and poplar, and on rocky slopes with coniferous trees, pine and spruce. Cedar is plentiful in low-lying swampy areas.

General Geology

The geology of that portion of the survey area including Slater, Rix, and a part of Peever townships was mapped by E.W. Nuffield (1955). The geology of the remainder of the area was taken from Giblin and Leahy (1967). A generalized version of the geology of the area is illustrated in Figure 1.

The bedrock in the area is Precambrian in age; most of the area is underlain by Archean granitic intrusive rocks consisting of granite, granite gneiss, and minor syenite, which are cut by pegmatite dykes and quartz veins. The pegmatites occur as ill-defined dykes and irregular masses. The Proterozoic (Keweenawan) is represented in the area by a series of diabasic flows, red-and-black weathered fine grained basalt and amygdaloidal basalt with calcite fillings, and a vast number of diabase dykes which strike mainly west to northwest and dip steeply north.

Glacial till was deposited throughout the area during glaciation. During the recession of the ice, the Lake Superior basin was occupied by a succession of lakes which reached elevations as much as 130 m above the present lake level. As a result a series of beach terraces were formed at different levels that in some cases are still clearly marked. At high lake levels the glacial till that covered much of the area was removed and redeposited in depressions on the lake bottom as stratified clay, sand and gravel.

Mineralization

Metallic mineralization in the area consists primarily of concentrations of copper and uranium minerals. The occurrences of copper mineralization are associated with the Keweenawan volcanic rocks at Pointe aux Mines (Fig. 1).

Several types of mineralized veins containing various combinations of native copper, chalcopyrite, chalcocite, bornite, hematite, sphalerite, calcite, quartz, mica, and barite are described by Nuffield (1955). Traces of native copper were also observed in the amygdaloidal basalts (Nuffield, 1955).

Radioactive occurrences of two types were noted by Nuffield (1955) in the area. The first type is confined to granite or pegmatite, whereas the second type is localized in or near and structurally related to diabase. The radioactive occurrences in the granites and pegmatites were considered to be of little economic value by Nuffield (1955) who identified the mineral microlite-pyrochlore (ellsworthite) in one highly radioactive specimen of granite. The radioactive mineral identified in the diabase-type showings is pitchblende accompanied at the surface by numerous secondary uranium minerals (Nuffield, 1955). All occurrences of pitchblende in the area have been found in structural features related to diabase; the various occurrences of uranium mineralization in the area are described in detail by Nuffield (1955).

The prime objective of this study was to correlate surficial geochemical responses in relation to known geology, primarily, with regard to the occurrence of uranium in the area.

SAMPLING TECHNIQUES AND ANALYTICAL PROCEDURES

Sample Collection

Lake sediment samples were obtained using a GSC lake bottom sampler from a float-equipped Hughes 500-C turbo helicopter. Surficial (top 5-10 cm) sediment at the sediment-water interface was avoided (Coker and Nichol, 1975). Organic-rich sediments were collected from the central-deepest part (profundal basins) of permanent lakes and ponds. The physical nature of the sediment, commonly a brown thixotropic gel sometimes having a hydrogen sulphide odour, did not vary much from lake to lake. No difficulty was experienced in collecting such samples.

Surface lake waters, which were generally very clear were collected directly into polyethylene bottles and acidified (250 µL of HNO₃ per 125 mL of water) on the day of collection. Waters were collected approximately 50 cm below the lake surface.

Measurements of the surface and bottom water pH, dissolved oxygen content, temperature and conductivity were made using a Martek Mark V Water Quality Analyzer. Lake water depth was also recorded at each sample site.

A number of standard observations, as well as the Martek data, was recorded on lake water (Appendix 2) and lake sediment (Appendix 3) field data cards for the corresponding sample taken at each sample site (Appendix 1).

The lake sediment, lake water, stream water and sediment, bedrock and surficial overburden field data cards employed in this survey have been described by Garrett (1974).

Generally clear or brown transparent waters and inorganic clastic sediments were collected from the central portion of active stream channels (Appendix 1). Stream waters were collected and treated exactly as were lake waters. A number of standard observations, including water pH, as measured using a GSC model pH meter, were recorded on field cards for stream waters (Appendix 4) and stream sediments (Appendix 5).

Bedrock, composite chip, samples were collected from the various bedrock lithologies in the area (Appendix 6). Various petrographic observations, as well as the average radioactivity over the exposed extent of the sampled outcrop measured using an Exploranium GRS-101 scintillometer, were recorded on field cards (Appendix 7).

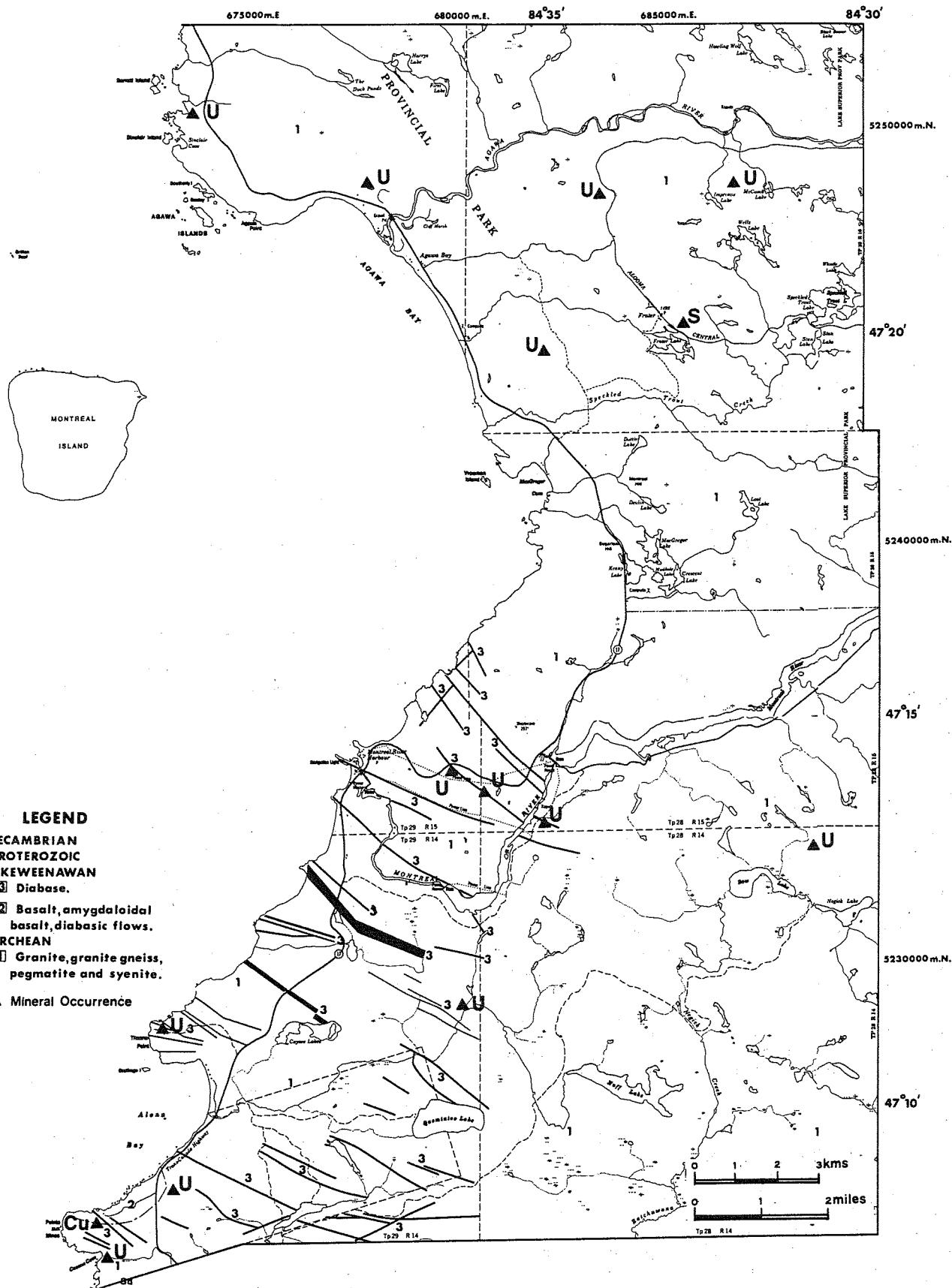


Figure 1. Generalized geology

At each bedrock sample site a surficial overburden sample was also collected (Appendix 6). Most overburden in the area is characterized by podzolic soil development except in swampy poorly-drained regions where gleysoil soil development is common. In most instances the B soil horizon was sampled. Standard observations were recorded on field cards (Appendix 8).

Preparation

Air drying generally resulted in the organic-rich lake and stream sediments becoming extremely hard. These samples were disaggregated, using a mortar and pestle and a ceramic ball mill, to obtain a fine powder which could pass a minus 80-mesh (180 μm) sieve. Lake sediment sample preparation was carried out under contract by Golder Associates, Ottawa. All other sample preparation was carried out in the Geological Survey laboratories.

Overburden and inorganic clastic stream sediment samples were dried and sieved through an 80 mesh (180 μm) sieve to obtain the minus 80-mesh fraction.

Bedrock samples were crushed to about 1 cm in size in a jaw crusher fitted with steel plates. The crushed material was coarse sieved to remove fines in order to prevent possible contamination due to metal chips from the jaw crusher. The sample was then ground to approximately 10 mesh size in a disc mill fitted with ceramic plates. The resultant material was coned and quartered to obtain a sample of about 10 to 15 grams. This sample was ground again to about 100 mesh (150 μm) by mechanical agitation in a small ceramic ball mill.

Analyses

Analyses of lake sediment samples for Zn, Cu, Pb, Ni, Co, Ag, Mn, As, Mo, Fe, Hg and loss-on-ignition (L.O.I.) were carried out under contract by Chemex Labs. Inc., Vancouver, British Columbia, and for U by Atomic Energy of Canada Ltd., Ottawa.

A 1 g sample of minus 80- mesh lake sediment was digested in a test tube with 6 mL of a mixture of 4M HNO_3 -1M HCl overnight. After digestion the test tube was immersed in a hot water bath at room temperature and brought up to 90°C and held at this temperature for 2 hours with periodic shaking. The sample solution was cooled to room temperature and diluted to 20 mL with distilled water and mixed. The contents of Zn, Cu, Mn, Fe, Pb, Ni, Co and Ag in each sample were determined by atomic absorption spectroscopy using an air-acetylene flame. Analyses for the last four elements were carried out using simultaneous, automatic background correction.

Arsenic in the lake sediment was determined colorimetrically using silver diethyldithiocarbamate. Decomposition was accomplished by heating a 1 g sample with 20 mL of 6M HCl at 90°C for 1.5 hours. Colorimetric measurements were made at 520 nm.

For molybdenum analyses a 500 mg sample of minus 80-mesh lake sediment was decomposed in 1.5 mL conc. HNO_3 at 90°C for 30 minutes. At this point 0.5 mL conc. HCl was added and the digestion was continued at 90°C for an additional 90 minutes. After cooling, 8 mL of a 1250 ppm Al solution were added and the volume of the solution was made up to 10 mL with distilled water. Mo was estimated by direct aspiration of the sample solution into the nitrous oxide-acetylene flame of an atomic absorption spectrophotometer.

Mercury contents of the lake sediment samples were determined by the Hatch and Ott procedure, with some modifications, as described by Jonasson et al. (1973).

Loss-on-ignition (L.O.I.) was determined on a 500 mg sample of lake sediment by ashing during a three hour time-temperature controlled rise to 500°C. The organic carbon content of a lake sediment sample is proportional to the per cent weight loss-on-ignition (Coker and Nichol, 1975).

The delayed neutron activation counting method of analyses, by which the lake sediment samples were analyzed for the total U, was developed by Atomic Energy of Canada Ltd., Commercial Products Division and is described in some detail by Boulanger et al. (1975).

All other analytical work was carried out in the laboratories of the Geochemistry Section, Resource Geophysics and Geochemistry Division, Geological Survey of Canada, Ottawa.

A 50 mL aliquot of acidified water sample (lake and stream water) was extracted in 6 mL of MIBK with 3 mL of 1% APDC. The contents of Zn, Cu, Pb, Ni, and Co in the concentrate were estimated by atomic absorption spectrophotometry. The contents of Mn and Fe in the water samples were determined by direct atomic absorption spectrophotometry.

The fluorometric method of analysis for acid extractable uranium of the lake and stream water samples, and of the stream sediment, surficial overburden, and bedrock samples, was based on that described by Smith and Lynch (1969).

The Zn, Cu, Mn, Fe, Pb, Ni, and Co contents of the stream sediment and surficial overburden samples were estimated employing identical digestion, leach and atomic absorption spectrophotometric techniques, including background correction for Pb, Ni, and Co, as used by Chemex Labs for lake sediments.

A 1 g sample of prepared bedrock material (\sim 100 mesh) was digested in a platinum dish with 7 mL of 50% HF. This was taken to dryness and a mixture of 5 mL conc. HNO_3 -2 mL conc. HClO_4 added and evaporated until fumes of HClO_4 were produced. The resultant material was then taken up in 20mL of 1M HCl. The contents of Zn, Cu, Fe, Mn, Pb, Ni, and Co were estimated by atomic absorption spectrophotometry using an air-acetylene flame. Analyses of the last three elements were carried out using simultaneous, automatic background correction.

Analyses of the molybdenum content of the stream sediment, surficial overburden and bedrock samples were carried out in an identical manner to that employed by Chemex Labs for lake sediments.

The D.C. arc emission spectrographic method used to analyze the lake sediment, surficial overburden and bedrock samples for Sr, Ba, Mn, Ti, Al, Ca, Mg, Fe, K, Pb, Zn, V, Mo, Cr, Cu, Co, Ni, Be, La, and Y is described by Timperley (1974).

Detection limits for the analytical methods used are given with the analytical data in the appendixes. The actual number used for reporting values below the lower detection limit, usually approximately one-half the lower detection limit, and upper detection limit, usually equal to upper detection limit, are also given. Analytical data for surface lake waters, lake sediments, stream waters, stream sediments, bedrock and overburden are listed in Appendixes 2, 3, 4, 5, 7, and 8 respectively.

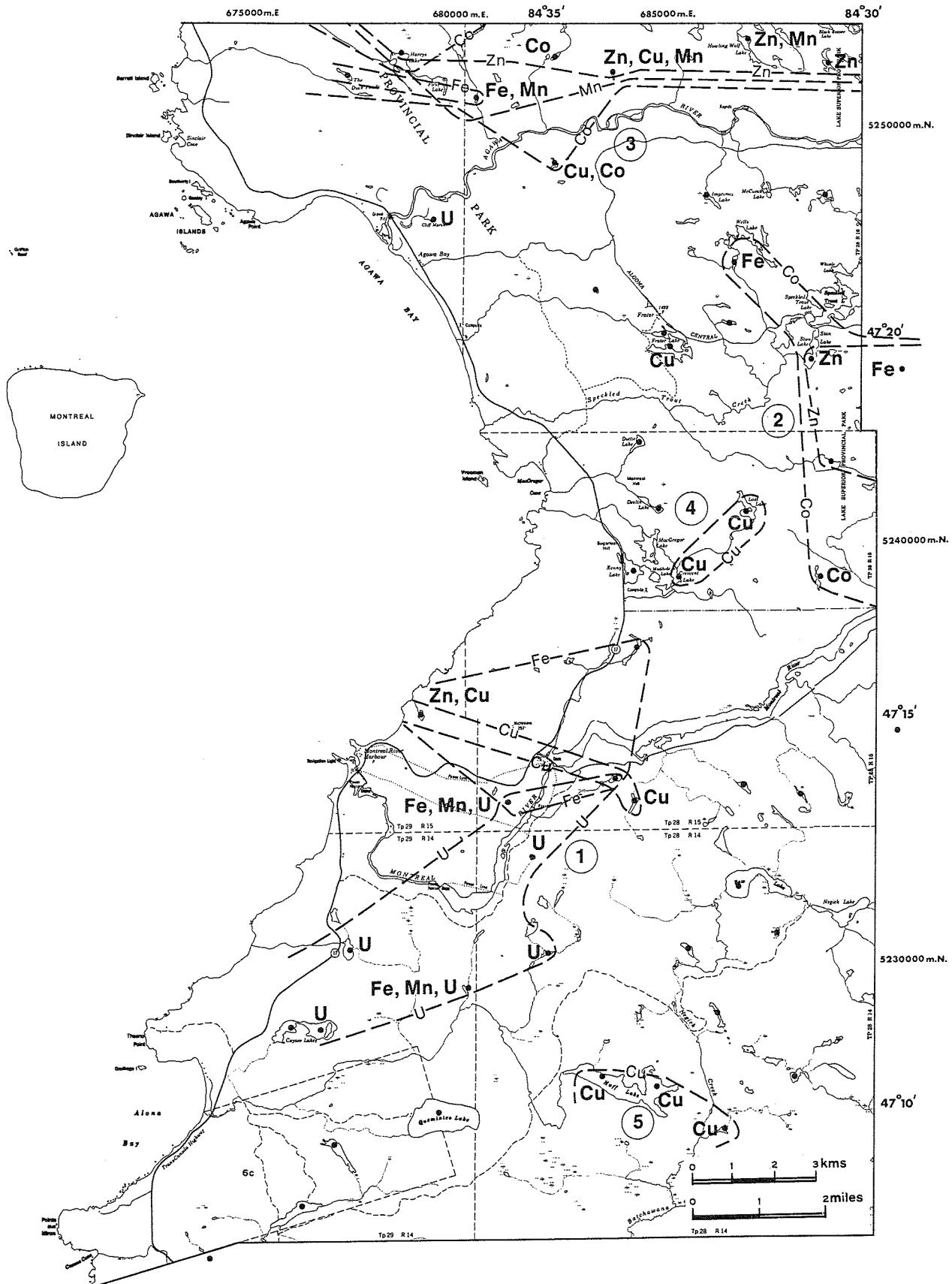


Figure 2. The regional distributions of Zn, Cu, Pb, Co, Ni, Fe, Mn, and U in surface lake waters. When at least two or more adjacent samples have trace element concentrations in excess of the $\bar{x} + 1s$ level for a given element these samples have been grouped together (eg.—U—, —Zn—, —Fe—, etc.). These $\bar{x} + 1s$ groupings, derived using an empirical form of cluster analysis, are indicative of regional trends in the trace element concentrations of the surface lake waters in the area. Within these trends, or as isolated occurrences, samples having trace element concentrations in excess of the $\bar{x} + 2s$ level for any element are indicated by U, Fe, Mn, Zn, etc. Circled numbers indicate regional trends (see text).

Evaluation of quality of the analytical data was based on a blind duplicate and reference control sample system. Each of these samples were present on a random 5 per cent frequency basis. In each block of 20 samples there were 17 routine field samples, one field duplicate sample, one blind duplicate, and one reference control sample. The field duplicate sample was collected at one of the 17 routine field sites, the blind duplicate is a split of one of the 18 field samples, and the reference control sample is a split from one of several reference bulk samples available. Rejection or acceptance of data for each block of 20 samples was determined by statistical criteria involving the blind duplicate and reference control sample data. Rejected data were replaced by new data after repeat analyses.

RESULTS AND DISCUSSION

Lake Waters and Sediments

A summary of the analytical data for the surface lake water samples (Appendix 2) is presented in Table 1. Both physical and chemical measurements are given. As the surface lake water sample population is small (total sample population equals 57) no attempt has been made to transform the data before statistical analyses. Rather, by examination of the histograms and statistics of the total data population highly anomalous values for any individual parameter can be identified. These highly anomalous values (e.g. 13.1 ppb for Zn, 7.5, 5.6 and 4.3 ppb for Co, 0.86 and 0.68 ppb for U, etc.) were removed to help normalize the data population for each individual parameter in order to prevent the final statistical computation (i.e. \bar{x} and s) from being influenced by a few highly anomalous values.

Table 1
Surface Lake Waters: Summary Statistics

	n	\bar{x}	s	min	max ¹	max ²
Temp. (°C)	57	18	1.5	11	20	
pH	57	6.0	0.6	4.6	7.4	
Cond (umhos/cm)	52	11	7	3	85	33(5)
O ₂ (ppm)	57	7.2	0.8	4.6	9.6	
Zn (ppb)	56	2.6	2.8	0.2*	13.1	10.8(1)
Cu (ppb)	48	0.2	0.2	0.2*	3.4	0.9(9)
Pb (ppb)	57	2.0		2.0*	2.0	
Co (ppb)	54	1.5	0.8	1.0*	7.5	3.2(3)
Ni (ppb)**						
Fe (ppb)	53	54	66	10*	802	219(4)
Mn (ppb)	55	17	15	5*	94	56(2)
U (ppb)	55	0.10	0.12	0.02*	0.86	0.46(2)

n = number of samples. (In some cases highly anomalous samples removed before final statistical parameters determined ie: Cond, Zn, Cu, Co, Fe, Mn, U)

\bar{x} = arithmetic mean

s = standard deviation

min = minimum value (* indicates values equal to one half the lower detection limit)

max¹ = maximum value

max² = maximum value after highly anomalous samples removed (i.e. Co: max¹ = 7.5, max² = 3.2(3); the (3) indicates three values greater than 3.2 (i.e. 7.5, 5.6 and 4.3) removed to normalize the data population before calculation of \bar{x} and s values).

** All Ni values were below the detection limit of 2.0 ppb (quoted in Appendix 2 as 1.0 ppb).

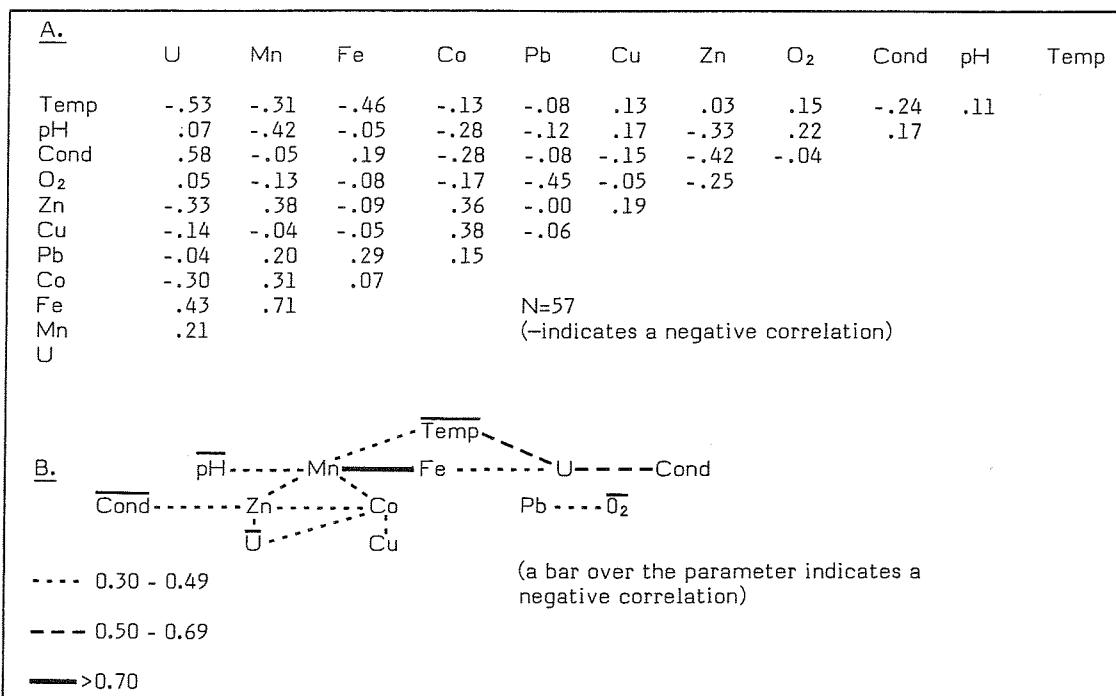


Figure 3. Correlation matrix and schematic representation of the significant chemical associations in surface lake waters.

Surface lake waters were found to be generally acid in nature ($\text{pH}:\bar{x} = 6.0$, $s = 0.6$). Conductivity measurements of surface lake waters in the area were relatively low ($\bar{x} = 11$ umhos/cm, $s = 17$ umhos/cm) indicative of the granitic terrane present. Surface lake waters were all relatively warm ($\bar{x} = 18^\circ\text{C}$) and oxygenated ($\bar{x} = 7.2$ ppm dissolved oxygen).

The regional distributions of Zn, Cu, Pb, Co, Ni, Fe, Mn, and U in surface lake waters are illustrated in Figure 2. A series of regional trends has been outlined by this simplistic cluster analysis (Fig. 2). Three major zones occur: (1) U extends from the most northerly dam on the Montreal River, within the surveyed area, southwest to Caysee Lake. Cu and Fe are associated with U in the northeastern part of this zone where there are several known U occurrences (eg. Ranwick Mine). (2) Co and Zn occur on the east edge of the area extending from Wells Lake south to the Montreal River. (3) Zn, Co, Fe and Mn occur across the north of the area, north of the Agawa River. Less extensive zones of Cu are also present in the Crescent-Lost Lakes area and encompassing Huff Lake (4 and 5 respectively, Fig. 2).

Some of the variation in the trace element contents of the surface lake waters can be explained by examining the correlations existing between the measured surface lake water parameters (Fig. 3). The associations of Mn with Fe, Mn, Zn, and Co with one another, Mn with negative temperature (Temp) and negative pH, and Zn with negative conductivity (Cond), are all basically interrelated. These associations are possibly indicating that Mn, Fe, Zn and Co will tend to stay in solution in ionic form in waters with relatively low temperature, low pH (i.e. acid), low conductivity, and, although not indicated in the correlations, low amounts of dissolved oxygen (see Appendix 2). If the lake waters should become enriched in oxygen, Fe and then Mn would tend to form complexes with oxygen, hydroxides and/or oxide precipitates, and be taken out of solution most likely complexing and coprecipitating elements such as Zn and Co. The association of U with conductivity (Cond) perhaps indicates that at higher conductivities, usually indicative of increased carbonate content, as bicarbonate, at the pH levels recorded (i.e. 6.0 to 7.0), U can stay in solution as hydrated carbonate complexes. In contrast, Zn appears to occur in relatively higher amounts in waters with lower conductivities and hence lower U contents in this area as indicated by the association of Zn with negative conductivity (Cond) and negative U.

In general, data from water samples are best viewed with complimentary sediment data (Table 2). As with the water data the sediment data (Appendix 3), because of the small sample population ($n = 56$), have had highly anomalous values removed (see Table 2) to help normalize the data population for each individual parameter in order to prevent the final statistical computations (i.e. \bar{x} and s) from being influenced by a few highly anomalous values.

In the majority of cases lake bottom waters were acid ($\text{pH}:\bar{x} = 5.5$, $s = 0.9$) and oxidizing (dissolved oxygen (ppm): $\bar{x} = 5.6$, $s = 2.7$), generally indicative of oligotrophic lakes. However, several deeper lakes had depleted levels of dissolved oxygen (<1.0 ppm) in their bottom waters likely tending towards eutrophic or dystrophic conditions. Bottom water conductivities were predominantly low ($\bar{x}=12$ umhos/cm, $s=9$ umhos/cm). Most lakes were relatively shallow (<9 m) with warm bottom waters ($>13^\circ\text{C}$). The few deeper lakes present (9 to 21 m) had relatively cold bottom waters (9 to 4°C).

Table 2
Lake Sediments: Summary Statistics

	n	\bar{x}	s	min	max ¹	max ²
Depth (metres)	56	6	5	1	21	
Temp ($^\circ\text{C}$)	56	15	5	4	19	
pH	56	5.5	0.9	3.6	7.2	
Cond(umhos/cm)	54	12	9	2	85	43(2)
O ₂ (ppm)	56	5.6	2.7	0.30	9.67	
Zn (ppm)	56	81	37	30	184	
Cu (ppm)	53	27	10	10	200	46(3)
Pb (ppm)	55	12	5	5	29	25(1)
Ni (ppm)	54	11	3	5	28	19(2)
Co (ppm)	55	5	3	1*	15	12(1)
Mn (ppm)	51	91	48	40	650	230(5)
As (ppm)	56	2.0	1.0	0.5	5.0	
Mo (ppm)	54	2	1	1*	6	3(2)
Fe (%)	56	0.72	0.40	0.30	1.80	
Hg (ppb)	55	123	55	20	330	250(1)
U (ppm)	45	6.9	2.3	2.7	55.4	11.7(11)
Loss-on-ignition(%)	56	36.9	10.6	18.8	59.1	

n = number of samples. (In some cases highly anomalous samples removed before final statistical parameters determined i.e.: Cond, Cu, Pb, Ni, Co, Mn, Mo, Hg, and U)

\bar{x} = arithmetic mean

s = standard deviation

min = minimum value (* indicates values equal to one half the lower detection limit)

max¹ = maximum value

max² = maximum value removed (i.e. Cu: max¹=200, max²=46(3); the (3) indicates three values greater than 46 (i.e. 82, 64 and 200) were removed to normalize the data population before calculation of \bar{x} and s values.

The physical data (Temp, pH, Cond and O₂) refer to lake bottom waters about 1 m above the water-sediment interface.

Table 3
Stream Waters: Summary Statistics

pH	n	\bar{x}	s	min	max ¹	max ²
	26	6.9	0.7	4.5	7.6	
Zn (ppb)	26	1.9	2.2	0.2*	7.5	
Cu (ppb)	26	0.4	0.4	0.2*	1.3	
Pb (ppb)	25	2.0		2.0*	5.0	2.0(1)
Co (ppb)	22	1.0		1.0*	3.7	1.0(4)
Ni (ppb)	26	2.1	1.8	1.0*	7.1	
Fe (ppb)	25	168	163	10*	2439	562(1)
Mn (ppb)	24	16	17	5*	337	60(2)
U (ppb)	26	0.16	0.13	0.02*	0.54	

n = number of samples. (In some cases highly anomalous samples removed before final statistical parameters determined ie: Pb, Co, Fe and Mn)

\bar{x} = arithmetic mean

s = standard deviation

min = minimum value (* indicates values equal to one half the lower detection limit)

max¹ = maximum value

max² = maximum value after highly anomalous samples removed (i.e. Mn: max¹=337, max²=60(2); the (2) indicates two values greater than 60 (i.e. 337 and 91) removed to normalize the data population before calculation of \bar{x} and s values.

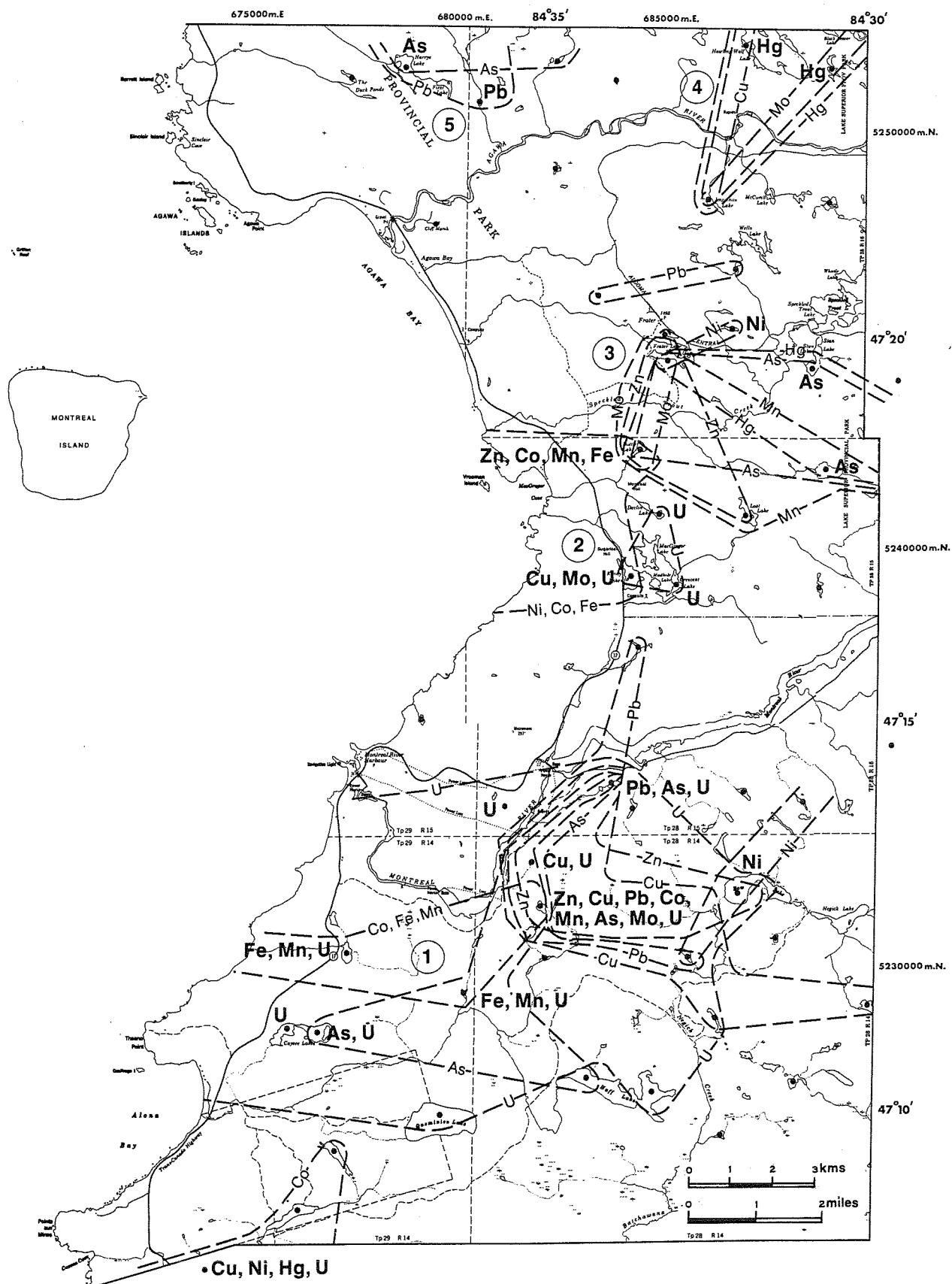


Figure 4. The regional distributions of Zn, Cu, Pb, Ni, Co, Mn, As, Mo, Fe, Hg, and U in lake sediments. When two or more adjacent samples exceed the $x + 1s$ level for a given element these samples are grouped together (eg.—U—, —Zn—, etc.) to illustrate regional trends in the data. Samples having trace element concentrations in excess of the $x + 2s$ level for any element are indicated by U, Pb, As, Fe, etc. Circled numbers indicate areas of regional trends (see text).

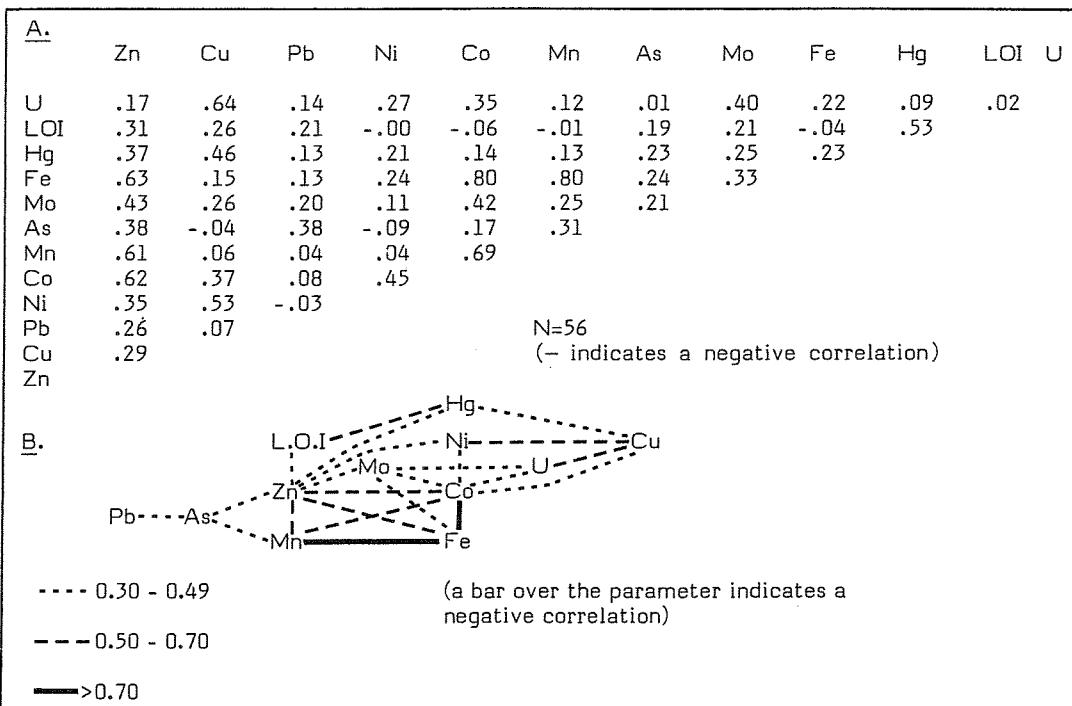


Figure 5. Correlation matrix and schematic representation of the significant chemical associations in lake sediments.

The regional distributions of Zn, Cu, Pb, Ni, Co, Mn, As, Mo, Fe, Hg, and U in lake sediments are illustrated in Figure 4. Exact correspondence of sediment and water data is missing although taken together the respective data reinforce each other and direct attention to the area of known uranium occurrences (Fig. 1) in the southwest of the surveyed area (Fig. 2,4).

Five zones of interest are highlighted by the lake sediment data (Fig. 4). The first zone (1), encompassing the region demarcated by Theano Point, Huff Lake, Bow Lake, and Montreal River Harbour, is characterized by elevated levels of U. The central part of this zone has lake sediments with elevated levels of Zn, Cu, Pb, and As as well as U. This zone is a reflection of the known pitchblende occurrences associated with diabase dykes in the Montreal River area. The second zone (2) in the Kenny-Crescent-Devlin Lakes region is characterized by lake sediments with elevated levels of U possibly indicative of U-bearing pegmatites. A third zone (3) of lake sediments with enhanced concentrations of Zn, Mn, As, Hg, and to a lesser extent Ni and Mo occurs in a region south of Frater outlined by Lost Lake, Dottie Lake, Frater Lake and Stan Lake. In the fourth zone (4) elevated levels of Hg, with Cu and Mo, occur in lake sediments in the Howling Wolf Lake, Imprimus Lake, Black Beaver Lake region. The fifth zone (5) extending east from Harrys Lake has enhanced levels of Pb and As.

Correlations existing between the measured lake sediment parameters (Fig. 5) can possibly explain some of the variations apparent in the trace element contents of the lake sediments. The association of Zn and Hg with L.O.I. (loss-on-ignition) illustrates the affinity of these elements to form complexes with, and be concentrated by, organic matter. The level of concentration is a function of

trace element availability (i.e. overburden, bedrock and/or mineralization) and the amount and type of organic matter present in the lacustrine and surrounding environments. The associations of Zn with Hg and As, and to a lesser degree of Hg with Cu, of Zn with Ni, and of Pb with As, are most likely indicative of the presence of sulphide mineralization such as occurs in the area south of Frater (lake sediment zone (3), Fig. 4). The association of Ni, Cu, and Co is illustrative of the chemical influence on lake sediment composition of the diabasic and basaltic rocks present in the area (Table 5). Also the relationship of U with the diabase dykes in the area is perhaps reflected by the association of U with Cu and Co. Trace metal scavenging by Fe and Mn oxide and hydroxide complexes is indicated by the association of Fe, Mn, Co, Zn, and to a lesser extent Mo and As.

Examination of the D.C. arc emission spectrographic data for lake sediments (Appendix 3) reveals that the distribution of some of the other elements may also be indicative of the bedrock lithologies (Appendix 7) or mineralization in the area. Elevated levels of a wide range of elements (Sr, Ba, Ti, Al, Ca, Mg, K, V, Cr, Be, La, and Y) occur in lake sediments in the region between Caysee Lake and Bow Lake, the region of U enrichment in lake sediments from mineralization associated with diabase dykes. These elevated levels appear indicative of both the granitic rocks (Sr, Ba, K, and Be) and of the diabase (Ti, Ca, Mg, V and Y) present in this region. In this region, and throughout the Montreal River area several of the lakes with high levels of Fe and Mn in their sediments also have relatively elevated levels of Ba, Sr, Al and Ca. The Kenny-Crescent-Devlin area of elevated U in lake sediments is also characterized by elevated levels of Be and Cr and to a lesser degree V, La, and Y, perhaps related to pegmatites.

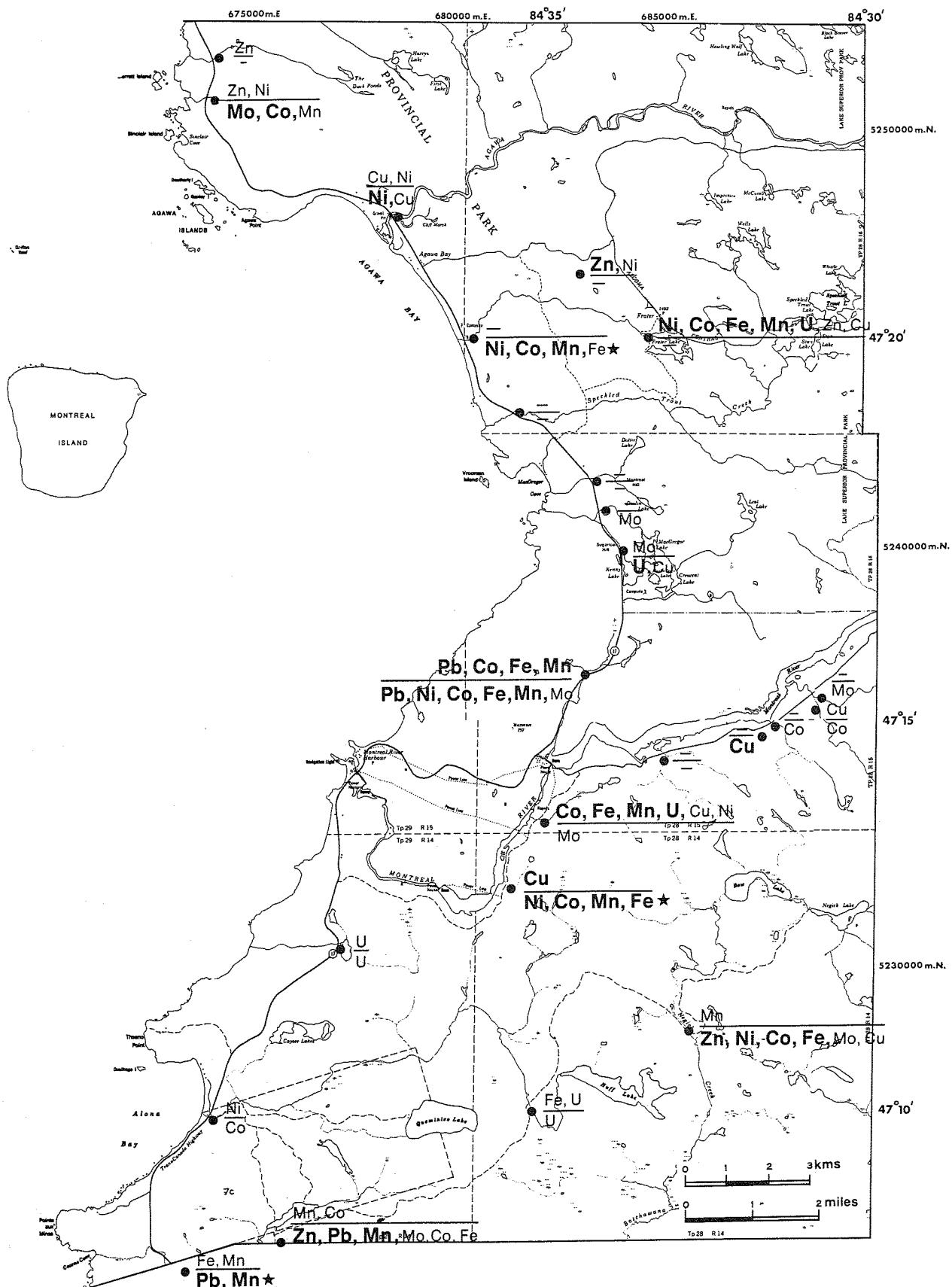


Figure 6. The regional distribution of Zn, Cu, Pb, Ni, Co, Fe, Mn and U in stream waters and stream sediments, with the addition of Mo. Stream water data are presented above stream sediment data. In the case of both stream waters and sediments, samples having trace element concentrations in excess of the $\bar{x} + 1s$ level for any element are indicated by Zn, Ni, U, Mn, etc.; those in excess of the $\bar{x} + 2s$ level by U, Zn, Pb, etc. Organic-rich stream sediments are identified by a *.

Stream Waters and Sediments

The Montreal River area is particularly rugged, the highest point being approximately 270 m above Lake Superior. As a result, the majority of streams in the area have steep gradients, generally clear, moderate to fast flowing water, and inorganic-clastic sediments. In low-lying flat regions streams may stagnate and/or flow slowly. These streams are usually characterized by clear to brownish water, and organic-rich sediments.

Stream water and sediment sample populations, both being small (total population equals 26 in both cases), have therefore been statistically analyzed as were the lake water and sediment sample populations (see Tables 1, 2). However, in the case of stream sediments, organic-rich sediments ($> 10\%$ loss-on-ignition) were excluded before the commencement of any computations. Summaries of the analytical data for stream waters (Appendix 4) and stream sediments (Appendix 5) are presented in Tables 3 and 4 respectively.

The pH of stream waters in the Montreal River area are on average close to neutral ($\bar{x} = 6.9$, $s = 0.7$) although acid stream water (4.5 and 5.5) and slightly alkaline stream water (7.6) do exist. In general the concentrations of Zn, Cu, Pb, Co, Ni, Mn, and U in both lake waters (Table 1) and stream waters (Table 3) are similar. The stream waters however, do have notably higher concentrations of Fe (i.e. stream waters: $\bar{x} = 168$ ppb, $s = 163$ ppb; lake waters: $\bar{x} = 54$ ppb, $s = 66$ ppb).

A comparison of the concentrations of Zn, Cu, Pb, Ni, Co, Mn, Mo, Fe, and U in lake sediments (Table 2) and stream sediments (Table 4) reveals that levels of Pb, Ni, Co, and Fe are similar; of Zn, Cu, Mo, and U enhanced (2 to 3X) in the organic-rich lake sediments; and of Mn enhanced (4X) in the inorganic clastic stream sediments. Organic-rich stream sediments also show enhanced (2 to 3X) concentrations of Zn, Cu, Mo, and U relative to the inorganic clastic stream sediments. The enhanced concentrations of Zn, Cu, Mo, and U in the organic-rich materials illustrates the affinity of these elements to form complexes with, and be concentrated by, organic matter. This feature also illustrates that sampling should be confined to one type of stream sediment, either organic ($> 10\%$ loss-on-ignition) or inorganic ($< 10\%$ loss-on-ignition). If this is not possible then the various types of materials collected should be divided into separate sample populations before any interpretation of chemical data is made. In the case of stream sediments collected in the Montreal River area the inorganic clastic sediments ($n=23$, loss-on-ignition $< 10\%$) have been separated into one population and statistically analyzed as summarized in Table 4. Organic-rich stream sediments ($n = 3$, loss-on-ignition $> 10\%$) have been separated into a second population. The organic-rich stream sediment population is too small to statistically analyze and therefore has been interpreted utilizing the \bar{x} and s values calculated for organic-rich lake sediments (see Table 2).

The regional distributions of Zn, Cu, Pb, Ni, Co, Fe, Mn, and U in stream waters and stream sediments, with the addition of Mo, are illustrated in Figure 6. Streams in the Montreal River area were sampled at an extremely broad and uneven density and any interpretation of their geochemistry should be viewed accordingly. However, it is evident that even at the density of sampling employed the area enclosed within Caysee Lake, Huff Lake, and the upper dam on the

Table 4
Stream Sediments: Summary Statistics

	n	\bar{x}	s	min	max ¹	max ²
Zn (ppm)	23	36	21	14	83	
Cu (ppm)	23	9	3	6	18	
Pb (ppm)	23	8	6	1*	25	
Ni (ppm)	23	10	3	6	19	
Co (ppm)	21	5	2	3	28	8(2)
Mn (ppm)	22	359	314	75	2344	1157(1)
Mo (ppm)	23	0.6	0.2	0.3	1.1	
Fe (ppm)	23	0.83	0.27	0.47	1.60	
U (ppm)	23	2.2	0.9	1.0	4.5	
Loss-on-ignition (%)	23	3.5	1.8	1.3	7.0	

n = number of samples. (In some cases highly anomalous samples removed before final statistical parameters determined ie: Co and Mn)
 \bar{x} = arithmetic mean
s = standard deviation
min = minimum value (* indicates values equal to one half the lower detection limit)
max¹ = maximum value
max² = maximum value after highly anomalous samples removed (i.e. Mn: max¹=2344, max²=1157(1); the (1) indicates one value greater than 1157 (i.e. 2344) removed to normalize the data population before calculation of \bar{x} and s values. In addition samples with loss-on-ignition values greater than 10% were removed before any computations of \bar{x} or s (see Appendix 5).

Montreal River, within the surveyed area, and also the area in the vicinity of Kenny Lake, have stream sediments and/or waters with enhanced levels of U (Fig. 6) as do the lake sediments and/or waters from both these areas (Fig. 4, 2). The predominant association of Mn and/or Fe with any one or combination of Zn, Ni, or Co in both the waters and sediments of streams in the area is most likely a reflection of the complexation and coprecipitation, in the case of the sediments, of Zn, Ni and/or Co by Mn and Fe hydroxide and/or oxide precipitates. The association of Fe, Mn, Zn, Ni, Co, and Cu could also be a reflection of the diabase dykes present in the area.

The utilization of detailed stream water and sediment surveys to follow-up reconnaissance scale lake water and sediment surveys is definitely a viable geochemical exploration method in terrain such as exists in the Montreal River area.

Bedrock

The analytical data for bedrock samples (Appendix 7) are summarized in Table 5. Although bedrock sample populations are small, sometimes only one sample of a given rock type to a maximum of 29 samples, some variation in metal concentrations between different bedrock lithologies is evident.

Relative to granitic rocks, diabase dykes in the area are enriched in Zn, Cu, Co, Fe, Mn, and to a lesser degree Ni, whereas basalts are enriched in Zn, Cu, Co, Ni (notably so), Fe and Mn. The one sample of paragneiss collected had enhanced levels of Zn, Cu, Co, and Ni relative to granitic rocks but generally somewhat lower levels of these metals compared to either the diabase dykes or basalts in the area.

Table 5
Bedrock: Trace Element Concentrations

Rock Type	n ¹	Zn ppm	Cu ppm	Pb ppm	Co ppm	Ni ppm	Fe %	Mn ppm	U ppm	Mo ppm
Granitic gneiss	5	59 ² 39-83 ³	22 4-54	22 13-33	10 5-16	25 4-52	2.16 1.29-3.00	306 180-385	1.6 0.9-2.6	3.4 2.7-4.5
Granite pegmatite	5	17 8-25	5 2-8	40 -	3 1-4	10 4-15	0.58 0.40-0.76	99 46-151	8.6 2.7-14.5	2.7 2.3-3.0
Granite	29	37 4-73	9 2-53	23 2-38	5 1-11	11 1-33	1.31 0.20-2.40	188 24-383	4.7 0.4-24.0	3.0 2.0-6.8
Paragneiss	1	77 -	53 -	15 -	21 -	73 -	3.45 -	452 -	1.6 -	3.8 -
Basalt	3	97 78-112	116 89-144	24 13-36	44 43-45	188 135-241	7.64 7.27-7.81	1314 1225-1420	0.2 0.1-0.3	3.6 3.3-4.2
Diabase	10	115 81-145	122 56-175	7 3-11	42 36-48	41 18-96	9.34 7.39-10.69	1624 653-2500	1.3 0.1-6.0	3.7 2.8-4.3

¹ n = number of samples

² 59 = arithmetic mean

³ 39-83 = range (minimum-maximum)

Although relative to granitic rocks, diabase is present in far less volume the characteristic chemistry of the diabase has left its imprint on the composition of the lake and stream sediments in the area. This is particularly noticeable where the diabase dykes are most prevalent in the southern half of the surveyed area. Granitic rocks, in the area particularly the pegmatites, are relatively enriched in U and Pb.

Examination of the D.C. arc emission spectrographic data for bedrock samples (Appendix 7) showed that in addition to the metals already examined diabase is relatively enriched in Ti, Ca, Mg, V and Y; basalt in Ti, Ca, Mg, Fe, V, and Cr; paragneiss in Sr, Ti, Cr and Be; and granitic rocks in Ba, Be and to a certain extent in Sr and K. Some of these chemical characteristics are reflected in the associated lake sediments.

The degree to which the metal contents of the lake waters and sediments reflect those in the bedrock lithologies with which they are associated depends on many factors. The nature of the bedrock itself, its mineralogy and grain size, the degree of exposure and susceptibility to weathering and erosion are examples of some factors. Superimposed on, and sometimes overshadowing, the chemical characteristics of the bedrock is the presence or absence of mineralization its texture (disseminated or massive) its nature (sulphide, oxide, carbonate, etc.) its exposure and susceptibility to weathering and erosion, and its effect on the chemical environment (Eh and pH). In addition one must consider the nature of the overburden and of the lacustrine environment (as previously discussed). In total the relationship between the chemistry of the bedrock and that of the associated lake sediments is extremely complex requiring an awareness of the various

physical and chemical processes operative in the various environments in order to interpret the lake and stream sediment data and focus on areas of possible economic mineral potential.

Overburden

Although the glacial till in the area has been subjected to reworking during periods of submergence, it appears that the chemistry of the B₂ horizon podzol or regosol developed within the till profile does give some indication of the chemical characteristics of the underlying bedrock lithology (Table 6). Relative to soils overlying the granitic rocks in the area, those overlying basalt are clearly enhanced in Zn, Cu, Co, Ni, Fe, Mn, and to a lesser degree U, whereas those overlying the diabase dykes are enhanced in Zn, Cu, Co, Ni, Fe, Mn and U but to lesser extent than basalt. Soils over granitic gneiss in the area display somewhat elevated levels of Mo, Mn, and to a lesser degree Zn whereas those over both the granites and paragneiss have elevated U concentrations in relation to the soils overlying the other bedrock lithologies in the area.

It should be noted that above the highest point of historic lake water cover, as indicated by the ancient beach terraces, the till is relatively undisturbed, except possibly by down slope creep, and generally locally derived. The till cover, except in the major river and stream valleys, where there are thick alluvial deposits, is fairly thin (a few metres). Therefore, the use of overburden sampling, either clay-sized material (for hydromorphic dispersion) or the heavy mineral fraction (for mechanical dispersion) for detailed surveys for U mineralization may well prove of value in an area such as Montreal River.

Table 6
Overburden: Trace Element Concentrations

Underlying Rock Type	n ¹	Zn ppm	Cu ppm	Pb ppm	Co ppm	Ni ppm	Fe %	Mn ppm	U ppm	Mo ppm
Granitic gneiss	5	72 ² 32-229 ³	23 7-38	23 14-46	13 2-29	23 6-36	2.77 0.70-5.64	1004 192-3699	1.8 1.0-2.6	2.8 0.1-8.7
Granite pegmatite	2	35 33-36	13 7-18	13 9-16	8 4-11	16 7-25	2.11 1.97-2.25	337 254-420	1.5 0.9-2.0	1.0 0.1-1.9
Granite	28	43 20-95	16 4-51	24 9-88	9 2-22	20 5-66	2.42 0.34-4.37	336 72-880	3.5 0.7-13.2	1.3 0.1-7.4
Paragneiss	1	36 -	8 -	9 -	4 -	9 -	2.46 -	234 -	3.4 -	0.4 -
Basalt	3	149 127-163	114 60-144	21 18-23	51 39-71	252 167-403	7.43 5.57-9.27	1103 839-1183	2.6 0.3-7.0	0.9 0.1-1.3
Diabase	9	68 25-150	60 14-218	22 9-61	20 8-51	33 10-86	3.96 2.25-7.77	878 280-2622	3.4 0.4-8.0	1.3 0.1-4.2

¹ n = number of samples
² 72 = arithmetic mean
³ 32-229 = range (minimum-maximum)

CONCLUSIONS

The application of geochemical methods and their responses to typical geological and environmental influences within this portion of the Superior geologic province of northwestern Ontario has been demonstrated.

At the sampling densities employed both the lake and stream water and sediment data provide information which is indicative of uranium mineralization associated with diabase dykes, chemical variations in bedrock lithologies, and differences in the physicochemistry of aquatic environments. Although the data are complex and at times difficult to interpret, a definite value is found in interpreting hydrogeochemical dispersion patterns in terms of elemental associations which are based on a knowledge of trace and minor element assemblages related to known mineralization, bedrock lithologies and aquatic physicochemistry in the study area.

Both waters and sediments provide meaningful data although each sample type has its own advantages. Whereas waters can be collected anywhere, sediments can yield further useful data on many additional elements, presently undetectable in waters, which may prove to be accessories in economic mineral assemblages or favourable host rocks. The areal extent of the lake sediment uranium distribution patterns indicates that reconnaissance scale sampling, one

lake sediment sample every 13 km², would be successful in locating most zones containing uranium mineralization related to diabase dykes in the area. However, one lake sediment sample every 2 to 5 km² in the search for sulphide or other types of mineralization is suggested by the nature of the base metal distribution patterns in lake sediments in this geologic environment. Therefore, in the Montreal River area, lake sediments can be utilized for detailed and reconnaissance exploration for uranium and base metal mineralization. Lake waters, useful for reconnaissance and detailed exploration for uranium mineralization, are of restricted use for base metal exploration.

The use of stream waters and sediments for uranium and base metal exploration in this area would likely be far more costly and provide little additional information, at the reconnaissance scale, than the use of lake sediments and waters. However, the application of stream waters for uranium, and stream sediments for uranium and base metal follow-up, is definitely a viable geochemical exploration method in this terrain.

The chemistry of the overburden (B horizon soils) present did, in some instances, correlate with that of the underlying bedrock lithologies. The use of detailed overburden surveys for uranium mineralization may well prove of value but local glacial and postglacial history must be considered.

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APPENDIX 1

Sample Numbers and Locations for Surface Lake Waters and Lake Sediments, and for Stream Waters and Sediments, Montreal River Area, District of Algoma (41 N/2, 7), Ontario

At each lake sample site a surface lake water (41N02 or 41N07 75XXX) and lake sediment (41N02 or 41N07 756XXX) sample were collected. Only the last three significant digits of each sample number are plotted at each site. The surface lake water and lake sediment have, therefore, the same last digits at each site. Sample numbers underlined (e.g. 9, 14, etc.) indicate where a water sample was obtained at the sample site but no sediment was collected.

The field observations and analytical data for the lake water samples (identified by a 5 in digit eight of the eleven digit sample number - 41N02 or 41N07 75XXX) and the lake sediment sample identified by a 6 in digit eight of the eleven digit sample number - 41N02 or 41N07 756XXX) are listed in Appendixes 2 and 3 respectively.

At each stream sample site a stream water (41N02 or 41N07 753XXX) and stream sediment (41N02 or 41N07 754XXX) sample were collected. Only the last three significant digits of each sample number are plotted at each site. The stream water and sediment have, therefore, the same last three digits at each site.

The field observations and analytical data for the stream water samples (identified by a 3 in digit eight of the eleven digit sample number - 41N02 or 41N07 753XXX) and the stream sediment sample (identified by a 4 in digit eight of the eleven digit sample number - 41N02 or 41N07 754XXX) are listed in Appendixes 4 and 5 respectively.

(Figure 1.1 over)

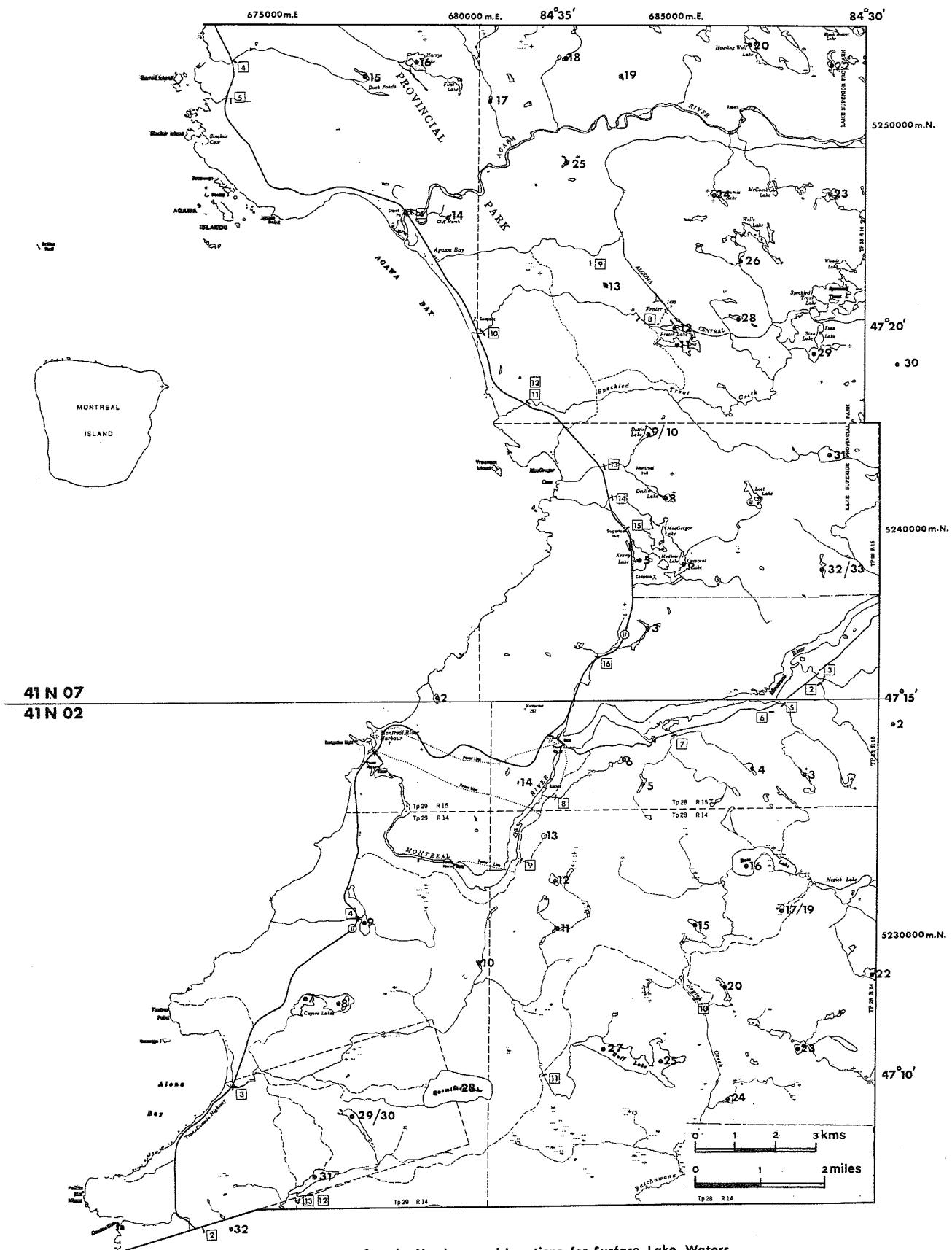


Figure 1.1 Samples numbers and locations for surface lake waters and lake sediments and for stream waters and sediments.

APPENDIX 2

Surface Lake Waters
Field Observations and Analytical Data

GEOCHEMICAL ORIENTATION SURVEY FOR URANIUM, MONTREAL RIVER AREA (41/N/02 AND 41/N/07), ONTARIO, 1975.
SURFACE LAKE WATERS
ACIDIFIED (250 MICROLITRES OF NITRIC ACID PER 125 MILLILITRES OF WATER) ON DAY OF COLLECTION

MAP SHEET	SAMPLE NUMBER	UTM COORDINATES			CATCH ¹ BASIN ROCK TYPE	COL ²	TEMP DEG C	COND μMHO PH	DIS CM PPM	ZN PPB	CU PPB	PB PPB	CO PPB	NI PPB	FE PPB	MN PPB	U PPB		
		ZONE	EAST	NORTH															
41N02	755002	16	691100	5235200	GRNT	0	18	5.5	4	7.04	3.8	0.2	2.0	1.0	1.0	111	34	0.20	
41N02	755003	16	688900	5233900	GRNT	0	18	5.3	3	6.84	1.5	0.2	2.0	1.0	1.0	83	32	0.02	
41N02	755004	16	687600	5234000	GRNT	0	18	5.5	6	7.37	3.8	0.2	2.0	1.0	1.0	36	19	0.06	
41N02	755005	16	684900	5233500	GRNT	0	18	5.7	6	6.60	3.7	0.9	2.0	1.0	1.0	43	14	0.08	
41N02	755006	16	684400	5234200	GRNT	0	18	5.9	12	7.61	3.7	1.1	2.0	1.0	1.0	161	10	0.34	
41N02	755007	16	676700	5228000	GRNT	0	19	6.1	69	7.47	0.2	0.2	2.0	1.0	1.0	10	5	0.20	
41N02	755008	16	677500	5227900	GRNT	0	20	6.4	12	7.69	0.2	0.2	2.0	1.0	1.0	58	17	0.40	
41N02	755009	16	678100	5229300	GRNT	0	19	6.5	28	7.70	0.2	0.2	2.0	1.0	1.0	69	5	0.38	
41N02	755010	16	681000	5229000	GRNT	0	13	6.4	21	8.97	0.2	0.2	2.0	1.0	1.0	802	94	0.68	
41N02	755011	16	682900	5229900	GRNT	0	15	6.8	37	9.67	0.2	0.2	2.0	1.0	1.0	128	5	0.36	
41N02	755012	16	682800	5231100	GRNT	0	19	6.2	12	7.72	0.2	0.2	2.0	1.0	1.0	27	5	0.08	
41N02	755013	16	682500	5232200	GRNT	0	19	4.6	10	6.93	4.5	0.2	2.0	1.0	1.0	111	31	0.44	
41N02	755014	16	681500	5232800	GRNT	0	18	5.5	85	6.03	0.2	0.2	2.0	1.0	1.0	516	68	0.46	
41N02	755015	16	686300	5230100	GRNT	0	19	6.3	11	7.30	0.2	0.2	2.0	1.0	1.0	48	14	0.06	
41N02	755016	16	687500	5231600	GRNT	0	19	6.3	8	7.18	0.2	0.2	2.0	1.0	1.0	21	5	0.02	
41N02	755017	16	688400	5230600	GRNT	0	19	6.3	6	7.13	0.2	0.2	2.0	1.0	1.0	31	5	0.04	
41N02	755019	16	684400	5230600	GRNT	0	19	6.3	6	7.13	0.2	0.2	2.0	1.0	1.0	34	5	0.10	
41N02	755020	16	687100	5228600	GRNT	0	19	6.1	14	7.25	0.2	0.2	2.0	1.0	1.0	37	12	0.08	
41N02	755022	16	690800	5229000	GRNT	0	19	6.3	5	7.30	7.0	0.2	2.0	1.0	1.0	10	20	0.12	
41N02	755023	16	689000	5227100	GRNT	0	19	5.8	15	8.18	0.2	0.2	2.0	1.0	1.0	36	5	0.04	
41N02	755024	16	687300	5225800	GRNT	0	19	6.2	8	7.68	2.7	1.5	2.0	1.0	1.0	169	17	0.24	
41N02	755025	16	685600	5226700	GRNT	0	19	6.1	12	7.84	0.2	0.8	2.0	1.0	1.0	10	5	0.02	
41N02	755027	16	684300	5227000	GRNT	0	19	6.3	12	8.00	0.2	1.1	2.0	2.0	1.0	10	5	0.04	
41N02	755028	16	680600	5226000	GRNT	0	19	6.6	33	7.75	1.5	0.2	2.0	1.0	1.0	10	5	0.14	
41N02	755029	16	678000	5225100	GRNT	0	19	6.7	14	7.03	0.2	0.2	2.0	3.0	1.0	97	13	0.16	
41N02	755030	16	678000	5225100	GRNT	0	19	6.7	14	7.03	0.2	0.2	2.0	1.0	1.0	81	12	0.10	
41N02	755031	16	677100	5223600	GRNT	0	19	6.6	18	7.18	0.2	0.5	2.0	1.0	1.0	64	24	0.14	
41N02	755032	16	675100	5222200	GRNT	0	19	6.5	32	7.37	2.9	0.2	2.0	1.0	1.0	72	5	0.08	
41N07	755002	16	675600	5235600	GRNT	0	19	7.4	7	5.78	13.1	1.3	2.0	1.0	1.0	160	27	0.02	
41N07	755003	16	684800	5237500	GRNT	0	17	6.3	13	5.80	2.9	0.2	2.0	1.0	1.0	160	5	0.02	
41N07	755005	16	684700	5239100	GRNT	0	19	6.3	43	7.42	0.2	0.2	2.0	1.0	1.0	26	5	0.08	
41N07	755006	16	685700	5239000	GRNT	0	19	6.6	17	7.15	0.2	2.0	1.0	1.0	1.0	36	5	0.12	
41N07	755007	16	687300	5240600	GRNT	0	19	6.5	12	7.52	6.5	2.3	2.0	2.0	1.0	26	5	0.02	
41N07	755008	16	685200	5240600	GRNT	0	18	6.3	27	6.87	0.5	0.2	2.0	1.0	1.0	114	5	0.06	
41N07	755009	16	684700	5242200	GRNT	0	19	6.7	14	7.54	1.5	0.2	2.0	1.0	1.0	10	5	0.04	
41N07	755010	16	684700	5242200	GRNT	0	19	6.7	14	7.54	1.7	0.2	2.0	1.0	1.0	10	5	0.02	
41N07	755011	16	685700	5244400	GRNT	0	18	6.6	10	7.25	3.0	1.2	2.0	1.0	1.0	10	5	0.02	
41N07	755012	16	684700	5244800	GRNT	0	17	6.2	13	7.25	0.2	0.2	2.0	3.0	1.0	82	5	0.02	
41N07	755013	16	683500	5245800	GRNT	0	15	6.1	12	5.70	3.0	0.2	2.0	2.0	1.0	55	11	0.18	
41N07	755014	16	675500	5247400	GRNT	0	11	6.0	67	5.44	0.2	0.2	2.0	1.0	1.0	35	5	0.86	
41N07	755015	16	677400	5250300	GRNT	0	18	7.2	10	7.72	3.1	0.6	2.0	2.5	1.0	130	31	0.06	
41N07	755016	16	676600	5251200	GRNT	0	18	5.9	5	7.43	6.5	0.2	2.0	1.0	1.0	32	34	0.02	
41N07	755017	16	680500	5250400	GRNT	0	17	5.5	6	4.60	3.0	0.2	5.0	3.0	1.0	401	48	0.08	
41N07	755018	16	682300	5251400	GRNT	0	17	5.7	5	7.35	6.1	0.2	2.0	4.3	1.0	113	46	0.02	
41N07	755019	16	683700	5251000	GRNT	0	17	5.0	8	6.05	10.8	1.2	2.0	2.5	1.0	115	56	0.02	
41N07	755020	16	686900	5251900	GRNT	0	18	4.9	5	7.32	9.0	0.2	2.0	3.0	1.0	25	54	0.02	
41N07	755022	16	685000	5251400	GRNT	0	18	4.8	5	7.57	10.0	0.2	2.0	3.0	1.0	24	46	0.02	
41N07	755023	16	689000	5248300	GRNT	0	18	4.5	6	7.20	4.8	0.2	2.0	2.1	1.0	58	24	0.02	
41N07	755024	16	686100	5248200	GRNT	0	18	5.5	14	7.60	3.0	0.2	2.0	1.0	1.0	35	5	0.04	
41N07	755025	16	682400	5248800	GRNT	0	18	5.8	9	6.79	4.7	3.4	2.0	7.5	1.0	93	32	0.02	
41N07	755026	16	686800	5246500	GRNT	0	15	5.7	12	7.24	1.5	0.5	2.0	3.0	1.0	437	31	0.10	
41N07	755028	16	687800	5245100	GRNT	0	17	6.0	8	7.24	3.0	0.2	2.0	2.0	1.0	10	5	0.02	
41N07	755029	16	688700	5244300	GRNT	0	18	5.8	7	7.34	10.0	0.2	2.0	3.0	1.0	10	24	0.02	
41N07	755030	16	691900	5244100	GRNT	0	18	5.6	4	6.80	7.5	0.2	2.0	2.9	1.0	219	33	0.02	
41N07	755031	16	685200	5241800	GRNT	0	18	5.5	5	7.26	7.0	0.2	2.0	3.0	1.0	40	18	0.02	
41N07	755032	16	689100	5239000	GRNT	0	18	5.5	5	6.56	2.3	0.2	2.0	3.2	1.0	154	26	0.02	
41N07	755033	16	689100	5239000	GRNT	0	18	5.5	5	6.56	2.7	0.2	2.0	5.6	1.0	151	23	0.02	
Lower detection limits												0.5	0.5	5.0	2.0	2.0	20	10	0.04
Value recorded for the lower detection limit is equal to approximately one-half the actual detection limit												0.2	0.2	2.0	1.0	1.0	10	5	0.02
¹ Catchment basin rock type : lake entirely within bedrock unit and drainage into lake also predominantly from within same bedrock unit.																			
GRNT - granite																			
² Colour: 0 - clear 1 - brown transparent 2 - white cloudy 3 - brown cloudy																			

APPENDIX 3

Lake Sediments Field Observations and Analytical Data

GEOCHEMICAL ORIENTATION SURVEY FOR URANIUM, MONTREAL RIVER AREA (41/N/02 AND 41/N/07), ONTARIO, 1975.
ORGANIC LAKE CENTRE SECTIONS
U BY NEUTRON ACTIVATION: ZN, CU, PB, NI, CO, AG, MN, AS, MO, FE AND HG BY ATOMIC ABSORPTION TECHNIQUES

MAP SHEET NUMBER	SAMPLE	UTM COORDINATES	ROCK TYPE	(BOTTOM WATER CONDITIONS)												FE %	HG PPB	LOI %	U PPM			
				TEMP COND DIS			DEG C	PH	CM	PPM	ZN PPM	CU PPM	PB PPM	NI PPM	CO PPM	AG PPM	MN PPM	AS PPM	MO PPM			
				DEP	COMP ²	COLOUR ³																
41N02 756002	16	691100 5235200	GRNT	5 -31 ---1	6 4.3	14 0.62	42	14	8	7	3 0.1	80	2.0	1	0.55	120	29.4	7.2				
41N02 756003	16	688900 5233900	GRNT	3 -31 ---1	18 4.7	3 6.62	48	18	10	17	3 0.1	50	2.0	2	0.40	130	37.1	6.3				
41N02 756004	16	687600 5234000	GRNT	15 -31 ---1	5 4.1	4 0.30	104	40	15	11	4 0.1	160	2.0	2	0.85	210	57.3	7.1				
41N02 756005	16	684900 5233500	GRNT	2 -31 ---1	18 5.7	6 6.60	50	16	12	9	2 0.1	60	2.0	1	0.40	50	32.5	9.7				
41N02 756006	16	684400 5234200	GPNT	6 -31 ---1	7 4.6	10 0.25	124	40	29	10	3 0.1	100	5.0	3	0.65	160	42.4	26.1				
41N02 756007	16	676700 5228000	GRNT	3 -31 ---1	19 6.1	69 7.47	84	26	10	10	3 0.1	50	2.0	3	0.35	80	36.5	20.9				
41N02 756008	16	677500 5227900	GRNT	4 -31 ---1	19 6.1	13 7.63	90	42	11	12	4 0.1	90	4.0	2	0.40	140	49.0	26.0				
41N02 756009	16	678100 5229900	GRNT	5 -31 ---1	13 6.8	22 6.83	98	26	11	16	10 0.1	230	2.0	2	1.75	120	19.8	11.7				
41N02 756010	16	681000 5229000	GRNT	1 -3 ---1	13 6.4	21 8.97	76	32	12	7	11 0.1	595	3.0	1	1.75	130	36.1	29.9				
41N02 756011	16	682900 5229900	GRNT	1 -13 ---1	15 6.8	37 9.67	50	14	7	8	4 0.1	120	2.0	2	0.75	60	18.8	9.4				
41N02 756012	16	682400 5231100	GRNT	21 -31 ---1	5 3.9	15 0.50	156	82	24	11	15 0.1	360	4.0	5	1.25	140	54.9	24.7				
41N02 756013	16	682500 5232200	GRNT	7 -31 ---1	6 3.7	8 0.71	142	46	22	12	3 0.1	120	3.0	1	1.20	170	59.1	17.7				
41N02 756014	16	681750 5233500	GRNT	1 -13 ---1	18 5.5	85 6.03	64	22	14	9	1 0.1	70	2.0	1	0.35	100	37.2	18.3				
41N02 756015	16	686300 5230100	GRNT	4 -31 ---1	19 6.1	11 7.13	76	40	17	14	3 0.1	50	2.0	1	0.40	80	40.5	10.2				
41N02 756016	16	687500 5231600	GRNT	4 -31 ---1	19 5.9	9 7.01	130	30	9	23	11 0.1	120	2.0	2	1.10	90	36.8	11.3				
41N02 756017	16	688400 5230600	GRNT	1 -22 ---1	19 6.3	6 7.13	26	18	6	10	1 0.1	45	0.5	1	0.35	20	25.9	7.5				
41N02 756019	16	688400 5230600	GRNT	1 -22 ---1	19 6.3	6 7.13	30	16	9	9	1 0.1	45	2.0	1	0.35	80	29.5	6.6				
41N02 756020	16	687100 5228600	GRNT	4 -3 ---1	18 5.9	13 7.00	64	40	13	6	4 0.1	65	3.0	1	0.45	100	36.2	9.3				
41N02 756022	16	690800 5229000	GRNT	21 -31 ---1	4 3.6	3 0.54	148	44	13	11	4 0.1	165	3.0	2	0.75	210	55.2	5.2				
41N02 756023	16	689000 5227100	GPNT	7 -31 ---1	15 5.5	15 8.05	56	32	7	9	4 0.1	70	2.0	1	0.55	100	30.5	9.9				
41N02 756024	16	687300 5225800	GRNT	1 -3 ---1	19 6.2	8 7.68	26	20	8	8	1 0.1	50	2.0	1	0.35	50	45.2	6.3				
41N02 756025	16	685600 5226700	GRNT	13 -31 ---1	9 5.3	11 1.30	86	30	22	11	4 0.1	130	2.0	2	0.70	70	35.0	10.3				
41N02 756027	16	684300 5227000	GRNT	11 -31 ---1	18 6.2	12 7.52	84	24	11	9	5 0.1	180	3.0	1	0.85	60	25.0	8.7				
41N02 756028	16	680600 5226600	GRNT	9 -31 ---1	14 6.5	34 5.62	84	32	5	5	3 0.1	110	1.0	2	0.30	40	50.8	9.3				
41N02 756029	16	678000 5225100	GRNT	2 -31 ---1	19 6.7	14 7.03	88	30	10	14	7 0.1	80	2.0	1	0.75	90	44.6	5.0				
41N02 756030	16	678000 5225100	GRNT	2 -31 ---1	19 6.7	14 7.03	80	30	9	13	8 0.1	85	0.5	1	0.75	140	44.5	4.9				
41N02 756031	16	677100 5223600	GRNT	8 -31 ---1	8 5.3	16 0.66	126	32	16	13	8 0.1	220	1.0	1	1.35	220	41.1	6.5				
41N02 756032	16	675100 5222200	GRNT	2 -31 ---1	19 6.5	32 7.37	84	200	10	28	8 0.1	60	1.0	1	0.60	260	38.7	43.4				
41N07 756002	16	679600 5235600	GRNT	3 -3 ---1	19 6.1	8 5.52	34	14	12	10	3 0.1	40	0.5	1	0.40	100	50.6	7.5				
41N07 756003	16	684800 5237500	GRNT	1 -13 ---1	17 6.3	13 5.80	44	16	20	6	2 0.1	40	2.0	1	0.35	80	27.7	5.3				
41N07 756005	16	684700 5239100	GRNT	7 -31 ---1	19 6.2	43 7.53	82	84	15	14	9 0.2	80	1.0	6	1.25	130	32.3	55.4				
41N07 756006	16	685700 5239000	GRNT	9 -31 ---1	9 5.3	16 0.85	64	34	9	3	0.01	50	0.5	2	0.50	150	29.6	15.5				
41N07 756007	16	687300 5240600	GRNT	11 -31 ---1	8 5.1	8 3.35	130	34	14	10	5 0.1	160	2.0	2	0.80	140	40.2	F.0				
41N07 756008	16	685200 5240600	GRNT	3 -3 ---1	18 6.1	27 6.75	76	22	8	10	5 0.1	75	2.0	1	0.45	105	30.6	22.5				
41N07 756009	16	684700 5242200	GRNT	3 -31 ---1	19 6.3	15 7.44	182	26	5	16	11 0.1	650	3.0	3	1.70	120	22.7	8.3				
41N07 756010	16	684700 5242200	GRNT	3 -31 ---1	19 6.3	15 7.44	184	28	7	16	12 0.1	620	3.0	3	1.80	130	22.5	9.1				
41N07 756011	16	685300 5244400	GRNT	14 -31 ---1	8 5.2	7 0.90	132	34	20	12	7 0.1	340	3.0	3	1.00	220	46.1	5.1				
41N07 756012	16	685250 5244400	GRNT	2 -31 ---1	17 6.2	13 7.25	108	24	13	16	7 0.1	100	2.0	1	0.65	90	24.4	10.3				
41N07 756013	16	683500 5245800	GRNT	1 -22 ---1	15 6.1	12 5.70	46	14	20	6	2 0.1	50	3.0	1	0.45	100	14.3	7.6				
41N07 756015	16	677400 5250900	GRNT	1 -13 ---1	18 7.2	10 7.72	78	18	15	13	4 0.1	45	2.0	3	0.40	110	33.2	7.7				
41N07 756016	16	678600 5251200	GRNT	13 -31 ---1	7 4.0	3 3.12	82	30	19	11	5 0.1	120	4.0	2	0.85	190	45.8	6.0				
41N07 756017	16	680500 5250400	GRNT	2 -12 ---1	17 5.5	6 4.60	64	10	25	12	7 0.1	130	2.0	1	0.90	65	25.7	3.9				
41N07 756018	16	682700 5251400	GRNT	3 -31 ---1	17 5.3	6 7.22	78	22	10	13	5 0.1	70	3.0	2	0.65	110	33.4	3.7				
41N07 756019	16	683700 5251000	GRNT	2 -3 ---1	17 5.0	8 6.05	56	16	9	10	6 0.1	60	2.0	1	0.50	80	26.8	4.8				
41N07 756020	16	686900 5251900	GRNT	15 -31 ---1	6 3.6	3 3.69	64	44	8	5	2 0.1	55	2.0	2	0.35	330	52.8	6.5				
41N07 756022	16	689000 5251400	GRNT	15 -31 ---1	6 3.8	2 1.50	88	34	13	11	3 0.1	90	2.0	3	0.70	250	54.3	3.9				
41N07 756023	16	689000 5248300	GRNT	4 -31 ---1	18 4.1	7 7.13	46	20	12	13	2 0.1	50	3.0	2	0.45	140	43.8	4.5				
41N07 756024	16	686100 5248200	GRNT	7 -31 ---1	12 5.2	19 9.58	98	38	10	9	8 0.1	175	2.0	3	1.20	180	40.7	5.1				
41N07 756025	16	682400 5248800	GRNT	2 -3 ---1	18 5.8	9 6.79	56	16	13	13	2 0.1	40	2.0	1	0.50	150	44.1	2.7				
41N07 756026	16	686800 5246500	GRNT	1 -3 ---1	15 5.7	12 7.24	48	18	19	10	2 0.1	60	2.0	2	0.40	130	38.9	4.3				
41N07 756028	16	686900 5245100	GRNT	4 -31 ---1	17 5.6	8 7.00	96	42	13	19	6 0.1	50	2.0	2	0.40	170	38.2	8.1				
41N07 756029	16	688700 5244300	GRNT	9 -31 ---1	18 5.3	7 7.38	84	30	7	10	4 0.1	110	4.0	2	0.80	180	34.5	3.7				
41N07 756030	16	690900 5244100	GRNT	5 -31 ---1	18 5.1	5 6.70	68	28	8	11	3 0.1	85	2.0	2	0.50	110	38.6	3.3				
41N07 756031	16	686900 5241400	GRNT	15 -31 ---1	6 3.6	3 4.83	78	32	11	13	6 0.1	145	4.0	2	1.05	210	38.5	7.7				
41N07 756032	16	689100 5239000	GRNT	3 -31 ---1	18 5.3	5 6.34	50	20	8	11	3											

GEOCHEMICAL ORIENTATION SURVEY FOR URANIUM, MONTREAL RIVER AREA (41/N/02 AND 41/N/07), ONTARIO, 1975.

ORGANIC LAKE CENTRE SEDIMENTS

THE DATA LISTED BELOW (SR TO Y) WERE ESTIMATED BY EMISSION SPECTROMETRY

MAP SHEET	SAMPLE NUMBER	SP FPM	DA PPM	MN PPM	TI PPM	AL %	CA %	MG %	FE %	K %	PR PPM	ZN PPM	V PPM	MO FPM	CR FPM	CU PPM	CC PPM	NI PPM	BE PPM	LA FPM	Y PPM	
41N02	756002	156	363	50	1885	4.3	0.8	0.1	1.2	0.6	11	71	36	1.0	32	17	5	11	1.0	56	14	
41N02	756003	58	263	50	1221	3.3	0.2	0.1	0.5	0.1	12	102	17	1.0	18	17	5	19	1.0	50	14	
41N02	756004	54	313	50	1284	3.5	0.5	0.0	1.0	0.1	13	117	48	2.0	23	35	5	11	1.0	135	31	
41N02	756005	127	332	50	1517	3.8	0.6	0.2	0.7	0.4	13	93	21	1.0	23	16	5	12	1.0	90	16	
41N02	756006	47	220	50	1624	3.7	0.4	0.1	0.8	0.1	28	148	43	2.0	28	40	5	11	1.0	156	26	
41N02	756007	39	190	50	864	3.0	0.3	0.1	0.5	0.1	11	138	28	1.0	21	30	6	12	1.0	107	26	
41N02	756008	42	218	50	1002	3.2	0.3	0.1	0.5	0.1	10	123	40	1.0	24	47	7	13	1.0	71	28	
41N02	756009	180	419	375	3042	5.9	1.1	0.7	2.6	1.2	17	111	71	2.1	54	32	16	23	1.0	63	32	
41N02	756010	105	323	556	1930	3.7	0.6	0.1	2.2	0.4	14	114	48	2.0	46	59	14	22	2.0	223	91	
41N02	756011	232	390	189	1928	5.1	1.1	0.3	1.6	0.8	12	87	40	1.0	43	24	10	19	1.0	35	15	
41N02	756012	30	241	241	874	3.3	0.2	0.1	1.4	0.1	19	168	97	2.0	31	91	18	11	2.3	167	65	
41N02	756013	43	243	50	831	2.8	0.4	0.1	1.5	0.1	13	137	54	1.0	48	70	5	16	1.0	136	29	
41N02	756014	57	219	50	858	2.6	0.3	0.1	0.5	0.1	14	101	16	1.0	22	29	5	11	1.0	70	16	
41N02	756015	64	197	50	1121	2.9	0.4	0.1	0.6	0.1	14	126	19	1.0	37	40	5	15	1.0	139	33	
41N02	756016	127	281	178	1723	4.8	0.7	0.3	1.7	0.5	14	161	37	2.9	37	32	18	27	2.4	96	30	
41N02	756017	57	250	50	1261	3.2	0.2	0.1	0.5	0.2	9	75	14	1.0	29	30	3	17	2.3	86	22	
41N02	756018	50	238	50	1088	2.7	0.2	0.1	0.4	0.1	10	73	15	1.0	19	20	3	14	1.0	84	20	
41N02	756019	43	142	50	861	2.6	0.3	0.1	0.6	0.1	13	112	28	1.0	19	42	8	8	1.8	165	41	
41N02	756020	46	223	50	1299	4.1	0.3	0.1	0.9	0.1	13	182	41	2.4	27	47	7	13	2.3	106	33	
41N02	756023	72	202	50	1141	3.3	0.4	0.1	0.8	0.2	7	102	23	1.0	23	38	7	10	1.0	245	57	
41N02	756024	82	235	50	1528	2.9	0.4	0.1	0.5	0.2	9	81	20	2.0	31	29	5	20	1.0	85	28	
41N02	756025	68	203	50	1342	3.3	0.4	0.1	1.0	0.2	27	211	27	2.2	24	48	8	12	1.0	103	37	
41N02	756027	129	280	214	1690	4.4	0.6	0.2	1.3	0.4	14	142	31	2.4	31	25	8	12	1.0	83	29	
41N02	756028	64	182	50	1197	3.0	0.7	0.1	0.9	0.2	18	108	37	2.3	34	37	6	13	1.0	62	21	
41N02	756029	56	238	50	1409	3.3	0.4	0.1	0.9	0.1	10	120	28	2.0	30	38	9	16	1.0	114	32	
41N02	756030	56	229	50	1323	3.5	0.4	0.1	1.0	0.2	11	128	27	1.0	24	36	10	16	1.0	96	28	
41N02	756031	69	259	143	1516	4.1	0.6	0.1	1.6	0.3	17	159	42	2.2	31	40	10	17	1.0	125	35	
41N02	756032	64	256	50	1252	3.3	0.6	0.1	0.8	0.3	11	140	39	1.0	44	227	11	33	1.0	283	78	
41N07	756002	35	174	50	726	2.5	0.2	0.1	0.4	0.0	8	90	16	1.0	13	20	3	9	1.0	107	20	
41N07	756003	60	249	50	996	2.4	0.2	0.1	0.4	0.2	18	102	14	1.0	16	18	3	9	1.0	87	16	
41N07	756005	34	135	50	968	2.5	0.3	0.1	1.5	0.1	15	145	139	3.7	90	98	12	24	3.5	444	153	
41N07	756006	40	166	50	905	3.0	0.3	0.1	0.6	0.1	9	104	22	2.0	48	42	5	25	1.0	156	27	
41N07	756007	41	199	50	1018	3.6	0.4	0.1	0.9	0.1	14	169	41	2.1	26	35	6	11	1.0	117	34	
41N07	756008	55	172	50	1071	2.8	0.5	0.1	0.7	0.1	7	105	39	2.0	43	25	4	20	2.0	97	20	
41N07	756009	46	211	717	1047	4.3	0.4	0.1	2.1	0.2	11	234	42	2.5	30	29	16	19	1.0	211	49	
41N07	756010	44	205	691	956	4.1	0.3	0.1	2.0	0.1	8	226	38	2.0	27	28	13	17	1.0	213	47	
41N07	756011	37	216	284	1073	4.1	0.4	0.1	1.2	0.1	20	176	43	2.9	25	34	9	13	1.0	107	29	
41N07	756012	63	288	50	1302	4.0	0.4	0.1	0.9	0.2	17	196	27	2.0	25	23	9	18	1.0	113	32	
41N07	756013	194	467	127	3226	5.7	0.6	0.3	0.9	1.0	25	100	27	2.2	33	16	3	10	1.0	36	11	
41N07	756015	41	158	50	830	3.6	0.4	0.1	0.4	0.1	14	125	19	1.0	19	18	5	14	1.0	105	19	
41N07	756016	60	331	50	1276	3.5	0.7	0.1	1.3	0.1	16	97	44	1.0	46	40	7	23	1.0	156	27	
41N07	756017	229	441	241	1597	5.4	1.0	0.7	1.6	1.0	29	102	41	1.0	51	50	10	9	20	1.0	41	5
41N07	756018	58	266	50	1292	3.6	0.3	0.1	0.7	0.1	10	100	29	1.0	24	21	5	15	1.0	99	10	
41N07	756019	147	330	50	1437	4.2	0.6	0.1	1.0	0.5	13	102	33	1.0	31	25	9	16	1.0	53	11	
41N07	756020	76	261	50	1276	4.1	0.4	0.1	0.8	0.1	14	103	35	1.0	27	39	4	11	1.0	92	21	
41N07	756022	44	238	50	1205	4.1	0.2	0.1	0.7	0.2	12	121	29	1.0	23	33	3	11	1.0	75	20	
41N07	756023	50	288	50	1343	3.2	0.2	0.1	0.5	0.2	13	107	18	1.0	20	22	3	14	1.0	47	14	
41N07	756024	112	244	124	1634	4.3	0.6	0.1	1.6	0.3	12	121	51	2.5	33	37	12	15	1.0	132	29	
41N07	756025	48	203	50	858	2.6	0.3	0.1	0.3	0.1	10	95	14	1.0	20	19	4	16	1.0	74	11	
41N07	756026	86	305	50	1446	3.1	0.3	0.1	0.6	0.2	18	95	16	1.0	21	17	4	11	1.0	81	12	
41N07	756028	38	195	50	930	3.3	0.3	0.1	0.4	0.1	11	143	22	1.0	21	39	8	19	1.0	105	24	
41N07	756029	45	207	50	1047	4.2	0.3	0.1	1.0	0.1	8	111	33	2.1	23	28	8	12	1.0	70	19	
41N07	756030	73	272	50	1336	3.9	0.5	0.2	0.7	0.3	6	115	25	1.0	24	31	6	14	1.0	60	16	
41N07	756031	74	299	115	1560	4.3	0.5	0.1	1.4	0.3	15	121	35	2.1	30	32	9	16	1.0	86	24	
41N07	756032	142	356	50	1704	4.2	0.5	0.2	1.0	0.5	12	90	22	1.0	29	22	5	15	1.0	77	18	
41N07	756033	168	344	110	1932	4.9	0.7	0.3	1.1	0.5	12	89	25	1.0	30	21	6	15	1.0	65	17	
Lower detection limits		30	50	100	100	0.5	0.2	0.2	0.2	0.2	2	25	10	2.0	10	4	2	4	2.0	10	10	
Upper detection limits		15	25	50	50	0.2	0.1	0.1	0.1	0.1	1	13	5	1.0	5	2	1	2	1.0	5	5	

(Value recorded for the lower detection limit is equal to approximately one-half the actual lower limit)

Upper detection limits 1300 2100 1800 6500 10.0 4.0 8.0 15.0 9.0 100 1200 250 20.0 200 250 150 150 25.0 350 300

APPENDIX 4
Stream Waters
Field Observations and Analytical Data

GEOCHEMICAL ORIENTATION SURVEY FOR URANIUM, MONTREAL RIVER AREA (41/N/02 AND 41/N/07), ONTARIO, 1975.
 STREAM WATERS
 ACIDIFIED (250 MICROLITRES OF NITRIC ACID PER 125 MILLILITRES OF WATER) ON DAY OF COLLECTION

MAP SHEET NUMBER	SAMPLE	UTM COORDINATES	ROCK ¹ TYPE	WIDTH CM	DEPTH CM	BANK ⁴ TYPE	STREAM WATER ³		FLOW ⁶ COL ⁵	RATE PPT ⁷	PH ⁸	7N PPM	CU PPM	PB PPM	CO PPM	NI PPM	FE PPM	MN PPM	U PPB		
							M	TYPE													
41N02 753002	16	674300	5222200 GRNT	3	5	3	1	0	7.0	0.2	0.8	2.0	1.0	1.0	360	33	0.02				
41N02 753003	16	675000	5225400 GRNT	6	3	3	1	3	0	7.6	0.2	0.2	2.0	1.0	4.0	223	5	0.14			
41N02 753004	16	677900	5230000 GRNT	2	1	3	1	2	1	7.1	0.2	0.2	2.0	1.0	1.0	110	15	0.38			
41N02 753005	16	688200	5235600 GRNT	3	2	3	0	2	0	7.2	1.5	0.2	2.0	1.0	1.0	63	5	0.02			
41N02 753006	16	687800	5235400 GRNT	1	1	3	0	3	0	6.6	0.2	0.2	2.0	1.0	1.0	26	5	0.10			
41N02 753007	16	685600	5234400 GRNT	3	4	3	0	2	0	7.2	0.2	0.2	2.0	1.0	1.0	10	5	0.14			
41N02 753008	16	682600	5233200 GRNT	2	4	3	0	2	0	7.2	3.8	1.2	2.0	3.7	4.0	562	55	0.54			
41N02 753009	16	681900	5231600 GRNT	2	3	3	0	2	0	7.3	0.2	1.3	2.0	1.0	1.0	100	5	0.20			
41N02 753010	16	686500	5222200 GRNT	6	5	3	0	2	0	6.8	3.8	0.2	2.0	1.0	1.0	138	36	0.14			
41N02 753011	16	682700	5226300 GRNT	2	10	4	0	2	0	7.0	1.0	0.2	2.0	1.0	1.0	369	14	0.36			
41N02 753012	16	676700	5223000 GRNT	1	2	3	0	2	0	7.3	4.0	0.8	2.0	1.0	1.0	397	91	0.06			
41N02 753013	16	676700	5223000 GRNT	1	2	3	0	2	0	7.3	3.2	0.2	2.0	2.5	3.1	219	48	0.06			
41N07 753002	16	689100	5236300 GRNT	2	2	3	0	2	0	7.1	0.2	1.2	2.0	1.0	1.0	50	5	0.04			
41N07 753003	16	689200	5236300 GRNT	3	3	3	0	2	0	7.1	1.0	0.2	2.0	1.0	1.0	261	5	0.06			
41N07 753004	16	674100	5251200 GRNT	2	2	3	1	2	0	7.0	5.5	0.2	2.0	1.0	1.0	10	5	0.12			
41N07 753005	16	674000	5252000 GRNT	2	1	3	1	2	0	6.2	6.0	0.2	2.0	1.0	4.4	24	5	0.24			
41N07 753006	16	5786500	5247500 GRNT	25	5	3	1	2	0	7.5	3.2	1.2	2.0	1.0	4.4	77	12	0.04			
41N07 753008	16	684300	5245100 GRNT	1	2	3	1	3	1	7.1	4.7	1.2	2.0	2.5	7.1	2439	337	0.44			
41N07 753009	16	683200	5246500 GRNT	1	1	4	1	1	0	7.0	7.5	0.2	2.0	1.0	4.4	176	18	0.08			
41N07 753010	16	680400	5244600 GRNT	2	1	4	1	1	0	7.0	0.2	0.2	2.0	1.0	1.0	295	11	0.16			
41N07 753011	16	681600	5242900 GRNT	5	2	4	0	2	0	7.3	1.0	0.2	2.0	1.0	1.0	42	5	0.08			
41N07 753012	16	681600	5242900 GRNT	5	2	4	0	2	0	7.3	0.5	0.2	2.0	1.0	1.0	29	5	0.08			
41N07 753013	16	683600	5241400 GRNT	2	2	3	1	2	0	5.5	0.5	0.2	2.0	1.0	1.0	69	5	0.20			
41N07 753014	16	683800	5246600 GRNT	2	2	3	1	2	0	4.5	0.5	0.2	2.0	1.0	1.0	21	5	0.14			
41N07 753015	16	684200	5239900 GRNT	3	3	3	1	3	1	6.6	0.2	0.2	2.0	1.0	5.1	64	5	0.20			
41N07 753016	16	683600	5236700 GRNT	2	5	3	1	1	1	6.6	0.5	0.2	5.0	3.4	1.0	504	60	0.16			
Lower detection limits												0.5	0.5	5.0	2.0	2.0	20	10	0:04		
Value recorded for the lower detection limit is equal to approximately one-half the actual detection limit												0.2	0.2	2.0	1.0	1.0	10	5	0.02		
¹ The major rock-type of the catchment area or hydrological system is recorded. GRNT - granite																					
² The width of the stream at the sample site is recorded to the nearest metre.																					
³ The water depth is recorded to the nearest centimetre.																					
⁴ The general nature of the bank material is described here.																					
1 - alluvial 2 - colluvial (bare rock, residual or mountain soils) 3 - glacial till 4 - glacial outwash sediments																					
⁵ The general colour and suspended load of the water is noted.																					
0 - clear 1 - brown transparent 2 - white cloudy 3 - brown cloudy																					
⁶ Water flow rate: 0 - stagnant 1 - slow 2 - moderate 3 - fast 4 - torrent																					
⁷ Precipitate or stain: The presence of any coatings on pebbles, boulders or stream bottoms is recorded.																					
0 - none 1 - red, brown or black 2 - white or buff																					
⁸ The pH of the stream water.																					

APPENDIX 5
Stream Sediments
Field Observations and Analytical Data

GEOCHEMICAL ORIENTATION SURVEY FOR URANIUM, MONTREAL RIVER AREA (41/N/02 AND 41/N/07), ONTARIO, 1975.
 STREAM SEDIMENTS
 U BY FLUORIMETRY : NO, Zn, Cu, Pb, Ni, Co, Mn AND Fe BY ATOMIC ABSORPTION TECHNIQUES

MAP SHEET NUMBER	SAMPLE ZONE	LTM	COORDINATES	STR ²		WATER ³		ROCK ¹ TYPE	WIDTH CM	DEPTH CM	BANK ⁴ TYPE	FLOW ⁶		NO PPM	ZN PPM	CU PPM	PB PPM	NI PPM	CO PPM	Mn PPM	FE %	U PPM	LOI %	
				EAST	NORTH	COL ⁵	RATE					POT ⁷	COMP ⁸	FH ⁹										
41N02	754002	16	674300	5222200	GRNT	3	E	3	1	1	0	-13	7.0	0.6	82	22	29	12	1	259	1.04	5.9	21.7	
41N02	754003	16	675000	5225500	GRNT	6	S	3	1	3	0	-31	7.6	0.5	19	6	1	3	7	113	0.56	2.0	1.6	
41N02	754004	16	677900	5230000	GRNT	2	S	1	3	1	2	1	-31	7.1	0.5	45	8	10	11	3	472	1.04	3.1	3.1
41N02	754005	1F	658200	5275600	GRNT	3	S	2	3	0	2	0	-22	7.2	0.3	24	6	8	9	7	188	0.73	2.1	2.9
41N02	754006	16	687800	5275400	GRNT	1	S	1	3	0	3	0	-12	6.6	0.5	14	14	3	12	3	75	0.73	2.5	1.9
41N02	754007	16	685600	5234600	GRNT	3	S	4	3	0	2	0	-22	7.2	0.5	17	6	5	6	5	105	0.47	1.2	1.3
41N02	754008	16	682600	5233200	GRNT	2	S	4	3	0	2	0	-22	7.2	0.4	27	7	5	8	5	268	0.67	3.0	2.9
41N02	754009	16	681900	5231600	GRNT	2	S	3	3	0	2	0	-121	7.3	1.6	82	32	15	23	15	650	3.49	7.6	13.0
41N02	754010	16	686500	5228200	GRNT	6	S	3	0	2	0	-22	6.8	1.1	70	15	10	14	8	286	1.20	2.0	6.0	
41N02	754011	16	682700	5226700	GRNT	2	S	10	4	0	2	0	-121	7.0	0.5	18	7	7	12	3	105	0.73	3.2	3.0
41N02	754012	16	676700	5223000	GRNT	1	S	2	3	0	2	0	-31	7.3	0.6	43	10	20	12	7	1157	1.30	1.7	6.0
41N02	754013	16	676700	5223000	GRNT	1	S	2	3	0	2	0	-31	7.3	0.5	41	8	20	7	8	1157	1.16	1.5	5.5
41N07	754002	16	689100	5236300	GRNT	2	S	2	3	0	2	0	-31	7.1	0.5	25	10	6	7	7	191	0.68	1.1	1.7
41N07	754003	16	689200	5236300	GRNT	3	S	3	3	0	2	0	-13	7.1	0.8	17	6	4	8	3	108	0.59	1.1	1.8
41N07	754004	16	674100	5251200	GRNT	2	S	2	3	1	2	0	-31	7.0	0.5	27	8	6	8	4	297	0.68	1.3	2.4
41N07	754005	16	674000	5250200	GRNT	2	S	1	3	1	2	0	-31	6.2	1.1	36	6	7	7	14	790	0.68	3.0	6.7
41N07	754006	16	57A500	5247500	GRNT	25	S	5	3	1	2	0	-31	7.5	0.5	22	12	4	19	4	123	0.76	1.2	2.1
41N07	754008	16	684300	5245100	GRNT	1	S	2	3	1	3	0	-22	7.1	0.2	23	6	7	7	4	297	0.70	2.2	1.5
41N07	754009	16	683200	5246500	GRNT	1	S	1	4	1	1	0	-13	7.0	0.3	17	9	4	10	6	183	0.62	1.0	2.2
41N07	754010	16	680400	5244600	GRNT	2	S	1	4	1	1	0	-31	7.0	1.1	46	16	11	19	14	895	1.18	3.7	18.5
41N07	754011	16	681100	5242900	GRNT	5	S	2	4	0	2	0	-22	7.3	0.5	38	9	6	10	6	264	0.72	2.1	3.9
41N07	754012	16	681600	5242900	GRNT	5	S	2	4	0	2	0	-22	7.3	0.5	41	10	6	11	6	313	0.84	2.2	4.1
41N07	754013	16	683600	5241400	GRNT	2	S	3	1	2	0	-22	5.5	0.5	41	6	7	8	4	378	0.78	2.6	4.2	
41N07	754014	16	683800	5240600	GRNT	2	S	2	3	1	2	0	-22	4.5	0.8	50	7	9	9	6	415	0.94	3.0	4.7
41N07	754015	16	684200	5239900	GRNT	3	S	3	3	1	3	1	-12	6.6	0.5	39	12	11	11	6	654	0.84	4.5	2.8
41N07	754016	16	683600	5236700	GRNT	2	S	5	3	1	1	1	-31	6.6	0.8	64	6	25	18	28	2344	1.60	3.0	7.0

Lower detection limits

0.3 2 2 2 2 2 10 0.02 0.4 1.0

Value recorded for the lower detection limit is equal to approximately one-half the actual lower detection limit

0.2 1 1 1 1 1 5 0.01 0.2 0.5

¹ See explanation Stream Waters

² The width of the stream at the sample site is recorded to the nearest metre.

³ The water depth is recorded to the nearest centimetre.

⁴ The general nature of the bank material is described here.

- 1 - alluvial
- 2 - colluvial (bare rock, residual or mountain soils)
- 3 - glacial till
- 4 - glacial outwash sediments

⁵ The general colour and suspended load of the water is noted.

- 0 - clear
- 1 - brown transparent
- 2 - white cloudy
- 3 - brown cloudy

⁶ Water flow rate: 0 - stagnant

- 1 - slow
- 2 - moderate
- 3 - fast
- 4 - torrent

⁷ Precipitate or stain: The presence of any coatings on pebbles, boulders or stream bottoms is recorded.

- 0 - none
- 1 - red, brown or black
- 2 - white or buff

⁸ The three columns are used to describe the bulk mechanical compositions of the collected sample on scales of 0 to 3.

The three size fractions are divided as follows and designated by columns.

- 1 - >0.125mm, sand
- 2 - <0.125mm, fines, silt and clay
- 3 - organics

The total of the columns must add to 3 or 4.

- 0 - absent
- 1 - minor, <33%
- 2 - medium, 33-67%
- 3 - major, >67%

⁹ The pH of the stream water.

APPENDIX 6

Sample Numbers and Locations for Bedrock and Overburden Samples, Montreal River Area, District of Algoma (41N/02, 07), Ontario

At each site a bedrock, composite chip sample, (41N02 or 41N07 752XXX) and overburden (41N02 or 41N07 751XXX) sample were collected. Only the last three significant digits of each sample number are plotted at each site. The bedrock and overburden samples have, therefore, the same last three digits at each site.

The field observations and analytical data for the bedrock samples (identified by a 2 in digit eight of the eleven digit sample number 41N02 or 41N07 752XXX) and the overburden samples (identified by a 1 in digit eight of the eleven digit sample number 41N02 or 41N07 751XXX) are listed in Appendices 7 and 8 respectively.

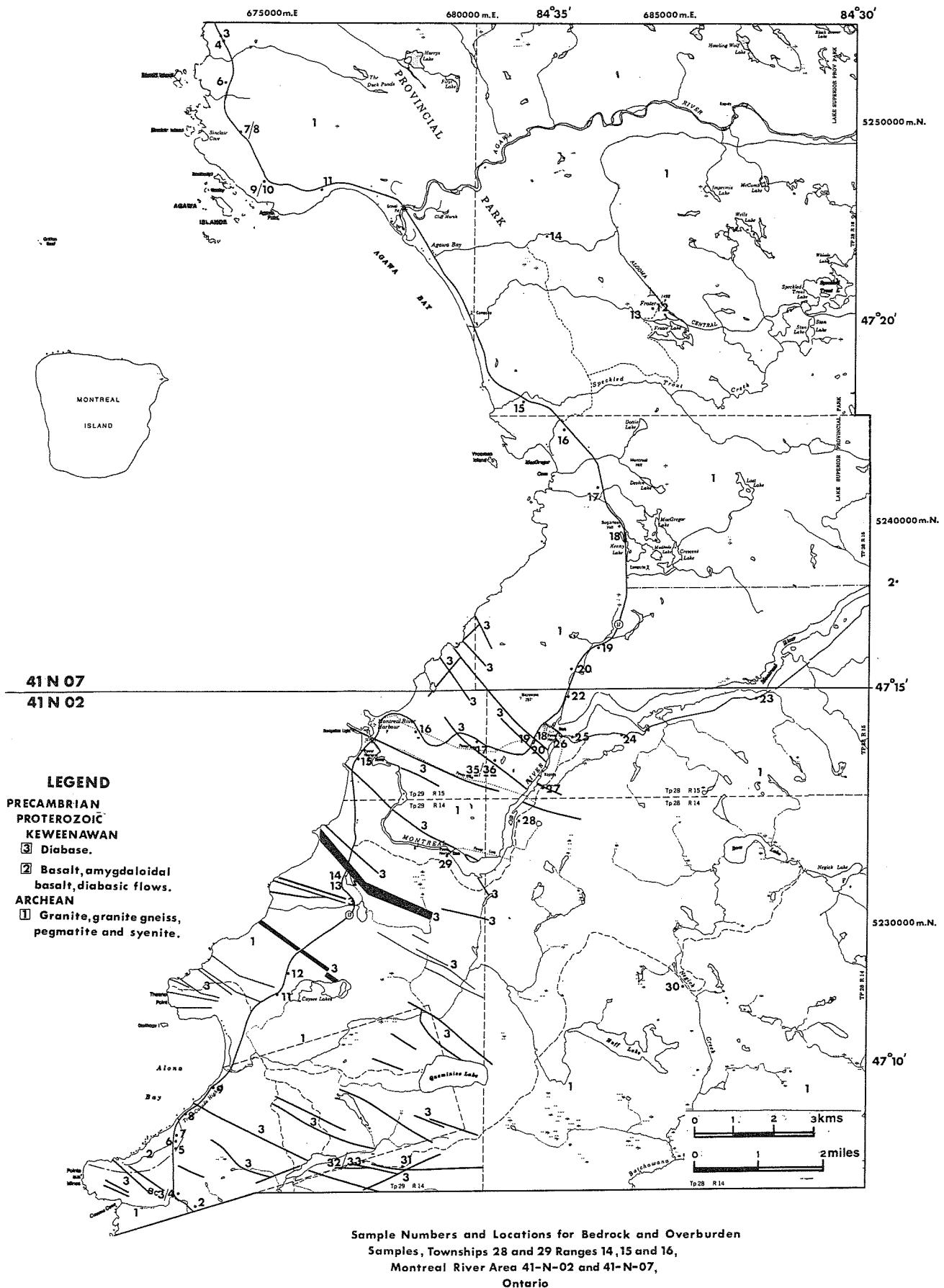


Figure 6.1 Samples numbers and locations for bedrock and overburden samples.

APPENDIX 7

Bedrock (Composite Chip Samples) Field Observations and Analytical Data

GEOCHEMICAL ORIENTATION SURVEY FOR URANIUM, MONTREAL RIVER AREA (41/N/02 AND 41/N/07), ONTARIO, 1975.
BEDROCK (COMPOSITE CHIP SAMPLES)
U BY FLUORIMETRY : ZN, CL, PB, CO, NI, FE, MN, AND MO BY ATOMIC ABSORPTION TECHNIQUES

MAP SHEET	SAMPLE NUMBER	UTM ZONE	COORDINATES EAST NORTH	ROCK ¹ TYPE	C ³ AGE ²	T ⁵ LTH	RAD ⁸ O/C	ACTUAL								RADON								
								C	G ⁴	E	OR L	ACT CPS	LTH M	ZN PPM	CU PPM	PR PPM	CO PPM	NI PPM	FE PPM	MN PPM	U PPM	MC PPM		
41N02	752002	16	674100	5222300	GRNS	01 9	7	1	5	0	50	15	59	13	13	5	4	16533	343	1.30	2.7			
41N02	752003	16	673700	5222600	DIRS	01 4	2	0	0	0	30	5	108	128	3	40	35	84494	2500	.37	4.1			
41N02	752004	16	673700	5222600	DIRS	01 4	2	0	0	0	30	5	107	126	7	39	36	85742	2500	.50	4.3			
41N02	752005	16	673600	5223700	BSLT	01 4	0	9	0	4	25	5	100	116	36	43	135	78182	1420	.34	4.2			
41N02	752006	16	673600	5223900	BSLT	01 4	0	9	0	4	20	5	78	144	13	45	188	72727	1297	.18	3.3			
41N02	752007	16	673600	5224100	BSLT	01 4	0	9	0	4	30	5	112	89	22	45	241	78182	1225	.14	3.3			
41N02	752008	16	673900	5224700	DIRS	01 4	2	1	0	0	25	15	135	170	5	47	55	97978	1908	.19	3.9			
41N02	752009	16	674500	5225400	GRNT	01 1	7	1	0	0	50	20	59	9	10	3	4	18667	371	1.30	2.9			
41N02	752011	16	676100	5227800	DIRS	01 4	3	1	0	0	65	15	115	114	7	36	46	97978	1506	1.30	3.7			
41N02	752012	16	676200	5228300	GRNT	01 0	8	1	0	0	60	20	56	10	32	8	26	18667	274	4.30	2.0			
41N02	752013	16	677900	5230800	GRNT	01 0	7	1	0	0	150	15	50	5	28	8	23	18667	331	24.00	2.3			
41N02	752014	16	677900	5230800	DIRS	01 4	2	1	0	0	80	5	145	77	10	36	26	106966	1528	6.00	2.8			
41N02	752015	16	677800	5233700	GRNT	01 8	7	0	0	0	250	15	56	4	30	6	18	16267	343	13.00	2.5			
41N02	752016	16	679400	5234400	GRNT	01 0	8	1	0	0	200	20	31	3	38	3	6	8727	168	4.80	2.8			
41N02	752017	16	680900	5234200	GRNT	01 0	8	1	0	0	175	10	8	2	18	1	2	2727	46	5.00	2.0			
41N02	752018	16	682200	5234100	PRGS	01 3	4	1	5	0	125	20	77	53	15	21	73	34545	452	1.60	3.8			
41N02	752019	16	682200	5234100	GRPG	01 9	9	3	0	0	275	20	25	5	40	4	15	7579	151	14.50	3.0			
41N02	752020	16	682200	5234100	DIRS	01 4	2	0	0	0	90	5	130	154	3	48	18	106966	1441	3.40	3.8			
41N02	752022	16	683100	5235500	GRNT	01 9	7	2	0	0	225	10	10	4	5	1	3	1371	63	5.50	2.3			
41N02	752023	16	687900	5235500	GRNT	01 0	6	1	0	1	50	25	73	15	24	11	23	24000	383	12.45	3.2			
41N02	752024	16	684500	5234500	GRNT	01 0	6	1	0	1	60	30	66	24	30	7	20	24000	331	2.00	2.3			
41N02	752025	16	683100	5234200	GRNT	01 9	7	1	0	1	100	30	8	6	28	2	4	3455	54	3.90	2.8			
41N02	752026	16	683000	5234400	DIRS	01 4	4	0	0	1	45	30	83	106	11	42	96	73947	1283	.25	3.9			
41N02	752027	16	682500	5233500	GRNT	01 9	7	0	0	1	150	35	26	9	35	4	7	8909	145	6.00	2.7			
41N02	752028	16	682000	5232200	GRNT	01 0	7	1	0	1	100	25	22	6	27	3	2	9273	151	3.30	2.8			
41N02	752029	16	686300	5231400	GRNT	01 2	5	1	5	1	150	40	40	7	25	7	22	14000	209	3.00	3.6			
41N02	752030	16	686300	5228300	GRNT	01 0	5	1	0	1	50	15	17	3	16	2	2	6080	107	1.80	2.8			
41N02	752031	16	675100	5223500	GRNT	01 0	6	0	0	1	35	25	10	2	4	6	5	12182	47	1.10	2.0			
41N02	752032	16	674400	5223700	GRNT	01 0	6	0	0	1	50	20	39	6	13	7	5	18537	197	.75	2.9			
41N02	752033	16	674400	5223700	GRNT	01 0	6	0	0	1	50	20	39	7	10	7	5	16585	162	1.20	2.7			
41N02	752035	16	691300	5233800	GRNT	01 9	8	2	0	0	3000	1	4	4	25	1	1	3684	70	2.80	2.9			
41N02	752036	16	681300	5233800	DIRS	01 4	1	0	0	0	2500	1	110	175	9	48	24	92308	653	.55	2.8			
41N07	752002	16	695200	5236500	GRNT	01 0	7	1	0	1	60	10	35	53	27	10	18	19516	618	1.20	3.4			
41N07	752003	16	673700	5251900	GRNT	01 1	6	1	0	0	100	10	39	6	20	9	10	17756	309	.84	2.8			
41N07	752004	16	673700	5251800	DIRS	01 4	2	0	0	0	40	5	81	56	7	48	46	85385	1422	.08	4.2			
41N07	752006	16	674000	5249200	GRNT	01 9	7	1	5	0	175	20	50	16	44	9	11	14182	188	4.30	6.8			
41N07	752007	16	674400	5249200	GRNT	01 8	7	1	0	0	100	15	26	5	18	2	4	7360	113	14.60	2.7			
41N07	752008	16	674400	5249200	GRNT	01 8	7	1	0	0	100	15	30	6	20	3	4	8000	116	.39	3.2			
41N07	752009	16	675000	5248100	GRNT	01 1	6	0	0	0	110	20	55	7	20	6	3	17171	233	.93	3.0			
41N07	752010	16	675000	5248100	DIRS	01 4	2	0	0	0	80	5	138	117	9	40	27	101538	1496	.19	3.8			
41N07	752011	16	676800	5248000	GRNS	01 1	6	1	0	0	70	10	83	54	20	16	52	30000	385	.87	3.3			
41N07	752012	16	684900	5245000	GRNT	01 0	6	1	0	0	125	15	64	6	34	9	33	21073	282	7.35	3.8			
41N07	752013	16	684300	5245000	GRNT	01 0	6	1	0	0	110	10	33	6	23	7	15	12000	174	2.20	4.6			
41N07	752014	16	682100	5246900	GRNT	01 1	6	1	0	0	90	5	44	3	26	4	6	12364	191	3.60	2.5			
41N07	752015	16	681600	5242300	GRNS	01 8	6	1	5	0	60	10	39	4	23	5	7	12909	180	2.10	4.5			
41N07	752016	16	682800	5242100	GRNT	01 1	6	1	0	0	60	15	65	11	27	7	11	23610	303	1.50	3.3			
41N07	752017	16	683700	5240300	GRPG	01 9	9	3	0	0	200	15	8	2	40	1	4	4038	46	2.65	2.3			
41N07	752018	16	684200	5239800	GRNS	01 1	5	1	5	0	80	10	69	17	23	12	28	26000	345	1.30	3.1			
41N07	752019	16	683400	5236700	GRNS	01 3	7	1	0	0	150	15	47	24	33	12	33	22634	276	2.60	3.3			
41N07	752020	16	683200	5236100	GRNT	01 1	6	1	0	0	60	15	5	2	2	1	13	2053	29	1.90	2.5			
Lower detection limits																2	2	2	2	2	20	10	0.10	0.2
Value recorded for the lower detection limit is equal to one-half the actual lower detection limit																1	1	1	1	1	10	5	0.05	0.1
¹ Bedrock type: BSLT - basalt DIBS - diabase GRNS - granitic gneiss																⁵ Texture: 0 - uniform grain size 1 - variable grain 2 - megacrystic 3 - pegmatitic 4 - miarolitic								
² Precambrian undivided.																⁵ - pyroclastic 6 - cataclastic 7 - bioclastic 8 - oolitic 9 - other								
³ Colour: 0 - white, <20% dark minerals 1 - white and black, 20-40% 2 - white equals black, 40-60% 3 - black and white, 60-80% 4 - black, >80%																⁶ Banding or bedding: 0 - massive 1 - bedded 2 - crossbedded 3 - slump structures 4 - schistose or foliated								

GEOCHEMICAL ORIENTATION SURVEY FOR URANIUM, MONTREAL RIVER AREA (41/N/02 AND 41/N/07), ONTARIO, 1975.
 BEDROCK (COMPOSITE CHIP SAMPLES)
 THE DATA LISTED BELOW (SR TO Y) WERE ESTIMATED BY EMISSION SPECTROMETRY

MAP SHEET	SAMPLE NUMBER	SR FPM	RA PPM	MN PPM	TI PPM	AL %	CA %	MG %	FE %	K %	PB PPM	7N PPM	AG PPM	V PPM	MO PPM	CR PPM	CU PPM	CC PPM	NI PPM	RE PPM	LA PPM	Y PPM
41N02	752002	302	946	404	2119	7.2	1.7	0.4	2.4	2.4	8	55	0.2	42	1.8	9	15	4	7	1.7	40	5
41N02	752003	267	471	1800	6500	7.8	6.2	3.2	10.3	1.4	7	84	0.2	390	5.8	80	146	46	48	1.2	35	34
41N02	752004	226	443	1237	6500	6.6	5.5	2.0	10.0	1.3	5	46	0.2	400	4.6	77	182	50	49	0.5	37	26
41N02	752005	244	823	1178	4589	6.9	4.2	3.7	8.5	4.0	23	56	0.2	357	3.7	150	152	47	125	0.5	68	11
41N02	752006	139	456	1005	5047	5.7	4.1	3.9	6.9	2.7	13	74	0.2	256	2.5	150	137	44	125	0.5	55	10
41N02	752007	128	470	966	4499	6.0	4.0	3.6	8.3	1.7	15	79	0.2	394	5.2	150	108	55	125	0.5	69	13
41N02	752008	186	205	1331	6500	6.2	4.4	2.3	9.1	0.8	12	90	0.2	262	2.7	91	200	46	43	0.5	37	39
41N02	752009	321	664	456	2744	7.2	2.0	0.5	2.6	1.9	10	66	0.2	50	2.3	10	23	4	9	2.7	46	5
41N02	752011	208	247	1216	6500	8.3	5.3	2.6	10.9	2.3	6	38	0.2	400	3.7	129	142	38	59	0.5	49	29
41N02	752012	90	38	50	228	7.4	0.3	0.3	0.3	0.1	1	45	0.2	20	0.5	5	10	1	4	3.0	28	23
41N02	752013	204	230	468	2119	8.2	1.5	0.8	2.7	2.0	21	57	0.2	52	2.1	51	9	8	26	2.9	31	5
41N02	752014	45	77	539	5849	6.0	3.0	2.6	11.9	0.4	10	41	0.2	400	3.0	22	95	42	42	0.5	97	36
41N02	752015	401	1359	204	1878	6.5	1.3	0.3	2.7	4.5	15	59	0.2	62	8.5	56	6	4	22	1.0	52	5
41N02	752016	356	1077	50	956	6.9	1.4	0.1	1.5	5.1	19	43	0.2	34	0.5	16	8	1	9	1.2	34	5
41N02	752017	96	223	50	289	7.7	0.4	0.2	0.4	2.5	14	41	0.2	15	1.4	5	2	1	4	2.5	23	5
41N02	752018	446	555	811	4395	7.6	1.8	1.8	5.0	2.5	13	91	0.2	138	3.0	150	56	23	72	2.3	46	16
41N02	752019	201	693	50	840	6.3	0.7	0.1	1.0	3.0	38	60	0.2	34	0.5	23	13	1	12	3.0	40	14
41N02	752020	169	214	1153	6500	6.3	4.5	2.3	10.7	1.2	6	138	0.5	400	5.1	99	192	45	61	0.5	43	27
41N02	752022	466	1544	129	1603	6.4	1.1	0.4	3.1	4.9	16	57	0.2	73	1.3	71	13	7	30	1.3	44	5
41N02	752023	1300	1500	428	3944	7.3	2.3	0.7	3.4	2.7	12	74	0.2	78	2.2	46	16	9	23	1.4	72	11
41N02	752024	424	420	216	2203	5.8	1.4	0.4	3.3	3.2	13	71	0.2	57	1.4	42	31	5	18	0.5	48	5
41N02	752025	251	1188	50	321	6.6	0.4	0.1	0.6	5.4	10	39	0.2	17	0.5	6	10	1	5	1.1	49	5
41N02	752026	179	247	1090	6096	6.5	5.7	3.0	9.5	0.8	8	64	0.2	336	4.6	150	136	51	125	0.5	24	31
41N02	752027	215	861	50	1006	6.5	1.0	0.1	1.6	4.4	18	35	0.2	40	1.1	36	22	2	11	1.5	26	5
41N02	752028	220	1496	123	1143	7.2	0.8	0.2	1.5	3.8	14	48	0.2	26	1.8	7	11	2	5	1.9	35	5
41N02	752029	554	1050	145	2059	6.8	1.8	0.4	2.5	2.3	10	54	0.2	64	1.2	51	13	5	25	1.5	50	5
41N02	752030	255	799	50	839	7.7	0.9	0.1	1.1	2.8	6	50	0.2	22	1.4	8	4	1	5	2.2	18	5
41N02	752031	24	26	50	3103	8.5	0.2	2.3	2.5	0.3	1	40	0.2	74	2.2	17	4	6	10	1.1	44	5
41N02	752032	172	196	207	2832	7.5	0.9	0.6	3.0	1.4	3	51	0.2	64	1.6	15	16	7	10	1.5	43	5
41N02	752033	183	325	204	3016	7.1	0.8	0.6	2.7	1.3	3	58	0.2	55	2.0	13	12	6	8	1.5	48	5
41N02	752035	143	1500	50	100	6.8	0.1	0.1	0.6	7.5	11	35	0.2	26	1.0	4	12	1	3	1.3	18	5
41N02	752036	244	302	675	6500	7.1	2.5	2.2	10.6	1.0	5	85	0.2	381	3.7	5	200	48	31	1.0	57	24
41N07	752002	377	1562	695	2168	7.1	1.6	0.5	3.0	3.8	11	52	0.2	65	1.9	30	67	9	20	1.1	37	5
41N07	752003	596	873	394	2060	7.2	2.2	0.8	2.8	3.4	12	46	0.2	68	2.0	17	12	9	13	2.0	25	5
41N07	752004	337	522	1096	5962	7.1	6.7	2.5	11.1	2.2	5	30	0.2	359	4.6	117	87	53	57	0.5	27	5
41N07	752006	426	1053	179	2008	7.7	1.9	0.4	2.4	3.3	24	36	0.2	56	2.3	28	34	5	14	1.7	71	5
41N07	752007	289	693	50	1207	7.2	1.1	0.2	1.4	2.4	9	28	0.2	32	1.0	8	10	2	6	1.3	32	5
41N07	752008	314	656	108	1233	7.4	1.3	0.2	1.4	1.7	12	46	0.2	29	1.4	7	14	2	6	1.8	31	5
41N07	752009	422	936	308	3002	7.4	2.0	0.4	2.8	2.5	12	59	0.2	50	1.9	8	15	5	7	2.0	32	5
41N07	752010	215	357	1800	6500	7.1	4.2	2.8	11.0	1.0	8	126	0.2	312	6.0	39	135	41	36	1.2	32	51
41N07	752011	480	847	641	3477	7.9	2.1	1.5	4.4	2.2	21	91	0.2	94	2.1	150	66	17	43	3.1	63	17
41N07	752012	388	1556	246	2273	6.5	1.5	0.5	3.6	3.9	22	71	0.2	81	1.7	86	14	11	40	1.3	64	5
41N07	752013	413	839	195	1556	7.3	1.8	0.4	1.9	2.1	13	48	0.2	50	2.3	48	8	6	19	1.6	30	5
41N07	752014	242	583	50	1370	7.4	1.4	0.2	1.9	2.3	7	12	0.2	56	0.5	26	2	1	9	0.5	111	5
41N07	752015	458	1342	213	1763	8.1	1.7	0.3	2.1	2.8	13	61	0.2	38	2.1	13	8	3	9	1.3	30	5
41N07	752016	719	1317	320	2655	7.6	2.2	0.4	3.6	3.1	13	65	0.2	66	1.8	26	20	4	13	1.1	106	5
41N07	752017	203	847	50	100	6.4	0.7	0.1	0.4	5.5	25	12	0.2	14	0.5	4	4	1	2	1.8	29	5
41N07	752018	401	983	457	2839	7.0	1.7	1.3	3.5	2.4	7	25	0.2	122	0.5	79	23	5	33	0.5	114	5
41N07	752019	340	638	293	2303	6.3	1.2	0.8	3.5	3.5	19	47	0.2	84	1.6	100	44	11	39	1.7	35	5
41N07	752020	126	46	50	2938	7.0	0.5	0.7	0.4	0.2	1	39	0.2	66	1.1	59	6	1	14	1.4	35	5
Lower detection limits		2	2	100	200	0.5	0.2	0.2	0.2	0.2	2	25	0.5	10	1.0	2	2	2	2	1.0	10	10
Upper detection limits		1	1	50	100	0.2	0.1	0.1	0.1	0.1	1	13	0.2	5	0.5	1	1	1	1	0.5	5	5

(Value recorded for the lower detection limit is equal to approximately one-half the actual lower detection limit)

APPENDIX 8

Overburden
Field Observations and Analytical DataGEOCHEMICAL ORIENTATION SURVEY FOR URANIUM, MONTREAL RIVER AREA (41°N/002 AND 41°N/071), ONTARIO, 1975.
OVERBURDEN

U-RAY FLUORIMETRY : Zn,Cu,PP,CO,Ni,Fe,Mn, AND MO-RAY ATOMIC ABSORPTION TECHNIQUES

MAP SHEET NUMBER	SAMPLE NUMBER	UTM COORDINATES	ZONE EAST NORTH	Lying ROCK TYPE	Slope ²	E DCM ⁴ VEG ⁵ SOIL ⁶ DEP ⁷ THK ⁸ C ⁹ O ¹⁰ S ¹¹ N ¹² S ¹³ R ¹⁴	CM CM RLX TRG	ZN CU PR CO NT FF PPM PPM PPM PPM	MN DPM DPM	U PPM PPM	MC PPM	
41N32	751002	16 674400	5222300	GRNS SW05	1	3M 2	35 10	10 6 5 1	61 3 2	32 21	14 12	34 34
41N32	751003	16 673700	5222600	GRNS S10	2	3A 2	51 10	5 6 6 1	61 3 2	42 35	9 19	52 52
41N32	751004	16 673700	5222600	GRNS S10	2	3A 2	51 10	5 6 6 1	61 3 2	47 33	18 19	52 52
41N32	751005	16 673600	5223700	BSLT S00	1	2A 3	51 10	5 6 8 1	53 2 2	158 137	18 39	52 52
41N32	751006	16 673600	5223900	BSLT W10	1	2A 3	51 10	5 6 6 1	61 3 2	127 144	23 71	403 403
41N32	751007	16 673600	5224100	BSLT BSLT	00	1	3F 3	51 20	10 6 6 1	61 3 2	163 60	23 43
41N32	751008	16 6739000	5224700	GRNS H20	2	2A 3	51 15	15 6 6 1	61 3 2	150 120	27 37	33 33
41N32	751009	16 674500	5225400	GRNT 00	2	3A 3	51 5	19 1 8 1	61 3 2	42 18	3 7	10000 10000
41N32	751011	16 676100	5227100	DIRS N05	1	3C 1	35 5	10 6 5 1	61 3 2	25 22	9 10	15 15
41N32	751012	16 676200	5228100	GRNT 00	1	2H 2	35 10	5 6 5 2	61 3 2	25 18	9 15	16440 16440
41N32	751013	16 677900	5233800	GRNT W05	1	3C 1	51 10	5 6 6 1	61 3 2	47 23	18 9	17 17
41N32	751014	16 677900	5233800	GRNT H05	1	3C 2	51 5	5 6 6 1	61 3 2	60 60	35 35	14 14
41N32	751015	16 677900	5233700	GRNT 00	1	2A 2	51 5	5 6 6 1	61 3 2	95 95	37 37	4 4
41N32	751016	16 679400	524400	GRNT N05	1	3H 3	51 15	5 6 6 1	61 3 2	66 11	23 4	8 8
41N32	751017	16 680900	5244200	GRNT N05	1	2P 3	35 50	10 6 5 1	61 3 2	23 9	14 9	16 16
41N32	751018	16 682200	52334100	PRGS 00	1	2H 3	35 15	10 6 5 1	61 3 2	36 8	9 4	9 9
41N32	751019	16 682200	52334100	GRPG 00	1	2H 3	35 15	10 6 5 1	61 3 2	33 7	4 7	19692 19692
41N32	751020	16 682200	5233700	GRNT N05	1	2H 3	35 15	10 6 5 1	61 3 2	57 14	18 9	15 15
41N32	751022	16 683100	5235000	GRNT H20	2	2B 2	35 5	5 6 5 1	61 3 2	28 7	9 8	21 21
41N32	751023	16 687900	5235500	GRNT N05	2	2H 3	35 5	5 6 5 2	53 2 2	41 14	9 14	23 23
41N32	751024	16 684500	5233500	GRAT SW05	2	2H 3	35 15	5 6 5 2	53 2 2	25 8	14 5	6 6
41N32	751025	16 683100	5233200	GRNT NE15	2	2H 3	35 25	10 6 5 2	53 2 2	40 24	38 14	26 26
41N32	751026	16 683100	5233400	DTBS NE20	2	2H 3	35 25	10 6 5 2	53 2 2	137 137	216 216	51 51
41N32	751027	16 682500	5233500	GRNT N05	2	3H 3	51 5	5 6 6 1	61 3 2	57 57	18 18	9 9
41N32	751028	16 682000	5233200	GRNT N10	2	3H 3	51 5	5 6 6 1	61 3 2	51 51	15 15	33 33
41N32	751029	16 690300	5233100	GRNT NE15	2	2A 3	35 25	5 6 6 1	61 3 2	37 37	20 16	30 30
41N32	751030	16 686300	5223300	GRNT N05	1	3A 3	35 10	5 6 5 1	53 2 2	46 8	14 11	25 25
41N32	751031	16 675100	5233500	GRNT N05	1	2H 3	35 10	5 6 5 2	53 2 2	32 18	16 9	19 19
41N32	751032	16 674800	5223700	GRNT N15	1	2H 3	35 10	5 6 5 2	53 2 2	28 28	16 7	14 14
41N32	751033	16 674800	5223700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	37 16	16 8	19 19
41N32	751028	16 673700	5233400	GRNT N05	1	3F 3	35 15	5 6 6 2	53 2 2	36 36	16 16	8 8
41N32	751029	16 673700	5233400	GRNT SH10	2	2P 2	51 10	5 6 6 2	53 2 2	36 36	14 14	7 7
41N32	751030	16 673700	5233400	GRNT NW20	1	2H 2	51 10	5 6 5 1	53 2 2	65 65	12 12	22 22
41N32	751031	16 674800	5233500	GRNT W05	1	2A 2	80 10	5 6 5 2	53 2 2	56 36	11 8	8 8
41N32	751032	16 674800	5233700	GRNT N15	1	2H 3	35 10	5 6 5 2	53 2 2	32 32	18 16	9 9
41N32	751033	16 674800	5233700	GRNT N15	1	2H 3	35 10	5 6 5 2	53 2 2	32 32	18 16	9 9
41N32	751034	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	28 28	16 16	7 7
41N32	751035	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	37 37	16 16	8 8
41N32	751036	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751037	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	37 37	16 16	8 8
41N32	751038	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751039	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	37 37	16 16	8 8
41N32	751040	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751041	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751042	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751043	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751044	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751045	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751046	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751047	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751048	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751049	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751050	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751051	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751052	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751053	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751054	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751055	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751056	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751057	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751058	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751059	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751060	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751061	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751062	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751063	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751064	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751065	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751066	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751067	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751068	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751069	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8
41N32	751070	16 674800	5233700	GRNT N15	1	2H 3	35 15	5 6 5 2	53 2 2	36 36	16 16	8 8</td

1 Underlying bedrock type: See explanation Appendix 7

2 The slope of the ground at the sample site is recorded in two parts: direction of slope, towards the direction, i.e. N slopes away to north, SW slopes away to the southwest; magnitude of slope, to the nearest 5 degrees, i.e. 05°5'; 25-25°.

3 Relief: 0 - flat

1 - low, 0 - 50 feet

2 - gentle, 50 - 200 feet

3 - moderate, 200 - 1000 feet

4 - high, > 1000 feet

4 Dominant vegetation: 0 - no trees

1 - conifers

2 - deciduous

3 - mixed conifers and deciduous

M - moss

G - grass

L - Labrador tea

S - Spruce

N - Pine

C - Cedar

T - Tamarak

P - Poplar

H - Hemlok

M - Maple

B - Birch

O - Oak

A - Alder

W - Willow

5 Soil Type:

	10 - undifferentiated	10 - white
	11 - brown	1 - buff
	12 - dark brown	2 - yellow
	13 - black	3 - orange
	14 - dark grey	4 - pink
	15 - undifferentiated	5 - red
	16 - dark grey	6 - brown
	17 - undifferentiated	7 - dark brown
	18 - Solonetz	8 - black
	19 - undifferentiated	9 - grey
	20 - Chernozem	
	21 - solonetz	
	22 - Solodd	
	23 - Podzolic	
	24 - humic Podzol	
	25 - Podzol	
	26 - undifferentiated	
	27 - grey brown	
	28 - dark grey wooded	
	29 - grey wooded	
	30 - grey brown	
	31 - grey brown	
	32 - dark grey wooded	
	33 - grey wooded	
	34 - Porzol	
	35 - undifferentiated	
	36 - brown forest	
	37 - brown wooded	
	38 - acid brown wooded	
	39 - acid brown forest	
	40 - concrete brown	
	41 - alpine brown	
	42 - undifferentiated	
	43 - brown wooded	
	44 - acid brown wooded	
	45 - concrete brown	
	46 - alpine brown	
	47 - undifferentiated	
	48 - Regosolic	
	49 - Regosol	
	50 - undifferentiated	
	51 - Podzol-Regosol	
	52 - undifferentiated	
	53 - humic Gleysol	
	54 - Gleysol	
	55 - elevated Gleysol	
	56 - undifferentiated	
	57 - Regosol	
	58 - Podzol	
	59 - undifferentiated	
	60 - humic Gleysol	
	61 - Gleysol	
	62 - elevated Gleysol	
	63 - undifferentiated	
	64 - Fibrisol	
	65 - Mesisol	
	66 - Humisol	
	67 - local till	
	68 - undifferentiated	
	69 - transported till	
	70 - glacial-lacustrine sediment	
	71 - esker sediment	
	72 - weakly cemented	
	73 - strongly cemented	
	74 - indurated	
	75 - organic	
	76 - peat	
	77 - mineral	
	78 - undifferentiated	
	79 - mineral	
	80 - undifferentiated	
	81 - local till	
	82 - transported till	
	83 - glacial-lacustrine sediment	
	84 - esker sediment	

6 Soil Type:

	10 - Chernozem	0 - white
	11 - dark brown	1 - buff
	12 - black	2 - yellow
	13 - dark grey	3 - orange
	14 - undifferentiated	4 - pink
	15 - dark grey	5 - red
	16 - undifferentiated	6 - brown
	17 - solonetz	7 - dark brown
	18 - Solodd	8 - black
	19 - undifferentiated	9 - grey
	20 - grey brown	
	21 - grey brown	
	22 - Solonetz	
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