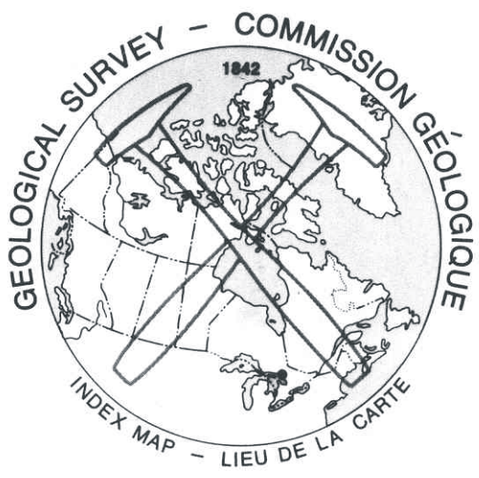
GEOLOGICAL SURVEY OF CANADA OPEN FILE 1640
(41P, part of 31M)
CANADA –ONTARIO MINERAL DEVELOPMENT AGREEMENT (1985-1990)

REGIONAL LAKE SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA, GOGAMA AREA, ONTARIO



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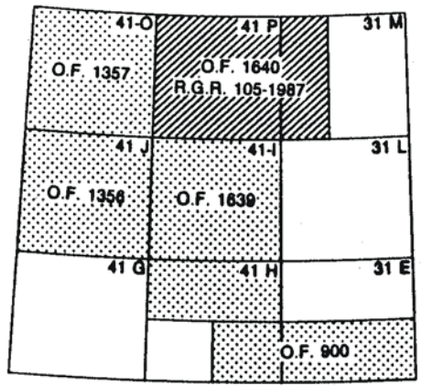
NATIONAL GEOCHEMICAL RECONNAISSANCE LAKE SEDIMENT AND WATER GEOCHEMICAL DATA, ONTARIO 1988, GSC OPEN FILE 1640, NGR 105 – 1988, NTS 41P, part of 31M



NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO ADJOINING GEOLOGICAL SURVEY OF CANADA MAPS

SYSTÈME NATIONAL DE RÉFÉRENCE CARTOGRAPHIQUE ET INDEX DES CARTES ATTENANTES PUBLIÉES PAR LA COMMISSION GÉOLOGIQUE DU CANADA

Open File 1640 represents a contribution to the Canada – Ontario Mineral Development Agreement (1985-1990), a subsidiary agreement under the Economic and Regional Development Agreement. This project was funded and managed by the Geological Survey of Canada.

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INTRODUCTION

Open File 1640 is one of two regional geochemical open files covering parts of Central Ontario which were sampled in 1987 as part of the Canada – Ontario Mineral Development Agreement. Open File 1640 represents analyses of lake sediment material and waters for 28 elements.

The reconnaissance survey was undertaken in 1987 by the Geological Survey of Canada in conjunction with the Ontario Department of Mines under the Canada – Ontario Mineral Development Agreement (1985 - 1990).

The data base of the survey contributes to a national geochemical reconnaissance and is used for resource assessment, mineral exploration and geological mapping. Regional survey sample collection and preparation procedures, analytical methods and repeatability of results are therefore strictly specified and controlled. In this way, consistent data can be systematically obtained in different areas in different years from different analytical laboratories

CREDITS

E.H.W. Hornbrook directed the survey.

P.W.B. Friske coordinated the operational activities of contract and Geological Survey of Canada staff.

Contracts were let to the following companies for sample collection, preparation and analysis and were managed by the following staff of the Exploration Geochemistry Subdivision:

Collection: SIAL Geophysique, Montreal, P.Q.
E.H.W. Hornbrook
P.W.B. Friske

Preparation: Golder Associates, Ottawa, Ontario
J.J. Lynch

Analysis: Bondar Clegg and Company Ltd., Ottawa
Chemex Labs Limited, Vancouver, B.C. (waters and Au)
J.J. Lynch

H.R. Schmitt and M. McCurdy coordinated and edited open file production.

A.C. Galletta and D. Wright managed the digital geochemical data, provided computer processing support, and developed software to plot the open file, symbol and regional trend maps. Computing services were provided by the Computer Science Centre, EMR. The plotting was done by Canada Lands Data Systems staff at Environment Canada, Hull, Quebec.

H. Gross developed microcomputer software to produce data listings and summary statistics

J. Yelle and F. Williams of the Geological Information Division supervised the preparation of open file base maps by Cartography Unit A-2 and Terra Surveys Ltd., Ottawa.

M. McCurdy, S. Cook and C.C. Durham provided technical assistance.

J.C. Daniel provided word processing support.

DESCRIPTION OF SURVEY AND SAMPLE MANAGEMENT

Helicopter supported sample collection was carried out during the summer of 1987.

Lake sediment and water samples were collected at an average density of one sample per 13 square kilometres throughout the 20,900 square kilometres of the central Ontario survey.

Sample site duplicate samples were routinely collected in each analytical block of twenty samples.

In Ottawa, field dried samples were air-dried, crushed, ball milled and sieved. The minus 80 mesh (177 microns) fraction was used for subsequent analyses. At this time, control reference and blind duplicate samples were inserted into each block of twenty sediment samples. For the water samples, only control reference samples were inserted into the block. There were no blind duplicate water samples.

On receipt, field and analytical data were processed with the aid of computers.

The field data were recorded by the field contract staff on standard lake sediment field cards (Rev. 74) used by the Geological Survey of Canada (Garrett, 1974).

The sample site positions were marked on appropriate 1/250,000 scale NTS maps in the field. These maps were digitized at the Geological Survey in Ottawa to obtain the sample site UTM coordinates.

The sample site coordinates were checked as follows: a sample location map was produced on a Calcomp 1051 drum plotter using the digitized coordinates; the field contractor's sample location map was then overlayed with the Calcomp map; the two sets of points were checked for coincidence. The dominant rock types in the lake catchment basins were identified on appropriate geological maps used as the bedrock geological base on RGR maps.

Thorough inspections of the field and analytical data were made to check for any missing information and/or gross errors.

Quality control and monitoring of the geochemical data was undertaken by a standard method used by the Exploration Geochemistry Subdivision at the Geological Survey of Canada.

ANALYTICAL PROCEDURES

Atomic Absorption Spectroscopy (AAS) and Other Analyses

For the determination of Zn, Cu, Pb, Ni, Co, Ag, Mn, Fe, Cd, and As a 1 gram sample was reacted with 6 mL of a mixture of 4 M HNO_3 and M HCl in a test-tube overnight at room temperature. 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 then diluted to 20 mL with metal free water and mixed. Zn, Cu, Pb, Ni, Co, Ag, Mn, Fe and Cd were determined by atomic absorption spectroscopy using an air-acetylene flame. Background corrections were made for Pb, Ni, Co, Ag and Cd.

Arsenic was determined by atomic absorption using a hydride evolution method wherein the hydride (AsH3) is evolved and passed through a heated quartz tube in the light path of an atomic absorption spectrophotometer. The method is described by Aslin (1976). Detection limit = 1 ppm.

Molybdenum and vanadium were determined by atomic absorption spectroscopy using a nitrous oxide acetylene flame. A 0.5 gram sample was reacted with 1.5 mL concentrated HNO_3 at 90° C for 30 minutes. At this point 0.5 mL concentrated HCl was added and the digestion was continued at 90° C for an additional 90 minutes. After cooling, 8 mL of 1250 ppm Al solution were added and the sample solution was diluted to 10 mL before aspiration. Detection limit: Mo - 2 ppm; V - 5 ppm.

Mercury was determined by the Hatch and Ott Procedure with some modifications. The method is described by Jonasson *et al*. (1973). A 0.5 gram sample was reacted with 20 mL concentrated HNO_3 and 1 mL concentrated HCl in a test-tube for 10 minutes at room temperature prior to 2 hours of digestion with mixing at 90° C in a hot water bath. After digestion, the sample solutions were cooled and diluted to 100 mL with metal free water. The Hg present was reduced to the elemental state by the addition of 10 mL 10% w/v $SnSO_4$ in M H_2SO_4. The Hg vapour was then flushed by a stream of air into an absorption cell mounted in

the light path of an atomic absorption spectrophotometer. Absorption measurements were made at 253.7 nm. Detection limit = 10 ppb.

Loss on ignition was determined using a 500 mg sample. The sample, weighed into 30 ml beaker, was placed in a cold muffle furnace and brought up to 500° C over a period of 2 - 3 hours. The sample was left at this temperature for 4 hours, then allowed to cool to room temperature for weighing. Detection limit = 1.0 pct.

Uranium was determined using a neutron activation method with delayed neutron counting. A detailed description of the method is provided by Boulanger *et al*. (1975). In brief, a 1 gram sample is weighed into a 7 dram polyethylene vial, capped and sealed. The irradiation is provided by the Slowpoke reactor with an operating flux of 10** 12 neutrons/sq cm/sec. The samples are pneumatically transferred from an automatic loader to the reactor, where each sample is irradiated for 60 seconds. After irradiation, the sample is again transferred pneumatically to the counting facility where after a 10 second delay the sample is counted for 60 seconds with six BF3 detector tubes embedded in paraffin. Following counting, the samples are automatically ejected into a shielded storage container. Calibration is carried out twice a day as a minimum, using natural materials of known uranium concentration. Detection limit = 0.5 ppm.

Antimony was determined in lake sediments as described by Aslin (1976). A 500 mg sample is placed in a test tube; 3 mL concentrated HNO_3 and 9 mL concentrated HCl are added and the mixture is allowed to stand overnight at room temperature. The mixture is heated slowly to 90° C and maintained at this temperature for at least 90 minutes. The solution is cooled and diluted to 10 mL with 1.8 M HCl. The antimony in an aliquot of this dilute solution is then determined by hydride evolution - atomic absorption spectrometry. Detection limit = 0.2 ppm.

Fluorine was determined in lake sediments as described by Ficklin (1970). A 250 mg sample is sintered with 1 g of a flux consisting of two parts by weight sodium carbonate and one part by weight potassium nitrate. The residue is then leached with water. The sodium carbonate is neutralized with 10 mL 10% (w/v) citric acid and the resulting solution is diluted to 100 mL with water. The pH of the resulting solution should be from 5.5 to 6.5. The fluoride content of the test solution is then measured using a fluoride ion electrode. Standard solutions contain sodium carbonate and citric acid in the same quantities as the sample solution. Detection limit = 40 ppm.

Gold was usually determined on a 10 g lake sediment sample; depending on the amount of sample available, lesser weights were sometimes used. This resulted in a variable detection limit: 2 ppb for a 5 g sample, 1 ppb for a 10 g sample... The sample was fused to produce a lead button, collecting any gold in the sample, which was cupelled in a muffle furnace to produce a silver (dore) bead. The silver beads were irradiated in a neutron flux for one hour, cooled for four hours, and counted by gamma ray spectrometry. Calibration was carried out using standard and blank beads.

Fluoride in lake water samples was determined using a fluoride electrode. Prior to measurement an aliquot of the sample was mixed with an equal volume of TISAB II buffer solution (total ionic strength adjustment buffer). The TISAB II buffer solution is prepared as follows: to 50 mL metal-free water add 57 mL glacial acetic acid, 58 gm NaCl and 4 gm CDTA (cyclohexylene dinitrilo tetraacetic acid). Stir to dissolve and cool to room temperature. Using a pH meter, adjust the pH between 5.0 and 5.5 by slowly adding 5 M NaOH solution. Cool and dilute to one litre in a volumetric flask. Detection limit = 20 ppb.

Hydrogen ion activity (pH) was measured with a combination glass-calomel electrode and a pH meter.

Uranium in waters was determined by a laser-induced fluorometric method using a Scintrex UA-3 uranium analyser. A complexing agent, known commercially as fluran and composed of sodium pyrophosphate and sodium monophosphate (Hall, 1979) is added to produce the uranyl pyrophosate species which fluoresces when exposed to the laser. Since organic matter in the sample can cause unpredictable behaviour, a standard addition method was used. Further, there have been instances at the GSC where the reaction of uranium with fluran is either delayed or sluggish; for this reason an arbitrary 24 hour time delay between the addition of the fluran and the actual reading was incorporated into this method. In practice 500 µL of fluran solution were added to a 5 mL sample and allowed to stand for 24 hours. At the end of this period fluorescence readings were made with the addition of 0.0, 0.2 and 0.4 ppb U. For high samples the additions were 0.0, 2.0 and 4.0 (20 µL aliquots of either 55 or 550 ppb U were used). All readings were taken against a sample blank. Detection limit = .05 ppb.

Alkalinity in waters was determined by titrating a 25 mL aliquot of the sample with 0.02 N H_2SO_4 using a Corning combination electrode and a Corning model 135 pH meter. The end point was pH 4.5. Detection level = 1 ppm.

Calcium and magnesium in waters were determined by inductively coupled plasma emission spectroscopy (ICP). An aliquot from the sample bottle was transferred to a separate container and aspirated directly into the ICP spectrometer (Instrumentation Laboratory model 200). Measurements were made at 317.9 nm for Ca and 279.8 nm for Mg. The instrument was calibrated with aqueous standards. Detection level = Ca - 0.5 ppm; Mg 0.05 ppm.

Table 1 provides a summary of analytical data and methods.

PRESENTATION AND INTERPRETATION OF GOLD DATA

The following discussion reviews the format used to present the Au geochemical data and outlines some important points to consider when interpreting this data. This discussion is included in recognition of the special geochemical behaviour and mode of occurrence of Au in nature and the resultant difficulties in obtaining and analyzing samples which reflect the actual concentration level at a given site.

To correctly interpret Au geochemical data from regional stream sediment or lake sediment surveys requires an appreciation of the unique chemical and physical characteristics of Au and its mobility in the surficial environment. Key properties of Au that distinguish its geochemical behaviour from most other elements include (Harris, 1982):

(1) Au occurs most commonly in the native form which is chemically and physically resistant. A high proportion of the metal is dispersed in micron-sized particulate form. Gold's high specific gravity results in heterogeneous distribution, especially in stream sediment and clastic-rich (low LOI) lake sediment environments. Au distribution appears to be more homogeneous in organic-rich fluviatile and lake sediment environments.

(2) Gold typically occurs at low concentrations in the ppb range. Whereas gold concentrations of only a few ppm may represent economic deposits, background levels encountered from stream and centre-lake sediments seldom exceed 10 ppb, and commonly are near the detection limit of 1 ppb.

These factors result in a particle sparsity effect wherein very low concentrations of Au are heterogeneously enriched in the surficial environment. Hence, a major problem facing the geochemist is to obtain a representative sample. In general, the lower the actual concentration of Au the larger the sample size, or the smaller the grain size required to reduce uncertainty over whether subsample analytical values truly represent actual values. Conversely, as actual Au concentrations increase or grain size decreases, the number of Au particles to be shared in random subsamples increases and the variability of results decreases (Clifton *et al.*, 1969; Harris, 1982). The limited amount of material collected during the rapid, reconnaissance-style regional surveys and the need to analyze for a broad spectrum of elements, precludes the use of a significantly large sample weight for the Au analyses. Therefore, to the extent that sample representivity can be increased, sample grain size is reduced by sieving and ball milling of all samples.

The following control methods are currently employed to evaluate and monitor the sampling and analytical variability which are inherent in the analysis of Au in geochemical mediums:

(1) For each block of twenty samples:

   (a) random insertion of a standard reference sample to control analytical accuracy and long-term precision;

   (b) collection of a field duplicate (two samples from one site) to control sampling variance;

   (c) analysis of a second subsample (blind duplicate) from one sample to control short-term precision.

(2) For both stream sediments and lake sediments, routine repeat analyses on a second subsample are performed for all samples having values that are statistically above approximately the 90^{th} percentile of total data set. This applies only to gold analyses by fire assay preconcentration followed by neutron activation. **Such routine repeat analyses are not performed for INA analyses of archived samples.**

(3) For lake sediments only, a routine repeat analysis on a second subsample is performed on those samples with LOI values below 10%, indicating a large clastic component. On-going studies suggest that the Au distribution in these samples is more likely to be variable than in samples with a higher LOI content. **Again, routine repeat analyses are performed only when the fire assay preconcentration/neutron activation method is used.**

Au data presentation, statistical treatment and the value map format are different than for other elements. Au data listed in the open file may include initial analytical results, values determined from repeat analyses, together with sample weights and corresponding detection limits for all analyzed samples. The gold, statistical parameters and regional symbol trend plots are determined using the following data population selection criteria:

(1) Only the first analytical value is utilized.

(2) Au values determined from sample weights less than 10 g are excluded, except where determined by instrumental neutron activation analyses.

(3) Au values less than the detection limit (<1 ppb) for 10 g samples are set to 0.5 ppb.

On the value map, repeat analysis values, where determined (not field duplicates), are placed in brackets following the initial value determination. All values determined on a sample less than 10 g are denoted by an asterisk. Actual sample weight used can be determined from the text. Following are possible variations in data presentation on a value map:

*	No data
+ 27	Single analysis, 10 g sample weight
+ 27*	single analysis, < 10 g sample weight
+ 27 (14)	Repeat analysis, both samples 10 g
+ 27 (14*)	Repeat analysis, first sample 10 g, repeat < 10 g
+ <1	Single analysis, 10 g sample, less than detection limit of 1 ppb

In summary, geochemical follow-up investigations for Au should be based on a careful consideration of all geological and geochemical information, and especially a careful appraisal of gold geochemical data and its variability. In some instances, prospective follow-up areas may be indirectly identified by pathfinder element associations in favourable geology, although a complementary Au response due to natural variability may be lacking. Once an anomalous area has been identified, field investigations should be designed to include detailed geochemical follow-up surveys and collection of large representative samples. Subsequent repeat subsample analyses will increase the reliability of results and permit a better understanding of natural variability which can then be used to improve sampling methodology and interpretation.

LAKE SEDIMENT DATA LIST LEGEND AND DIGITAL FIELD RECORD FORMAT

Table 2 lists both the field and map information which is recorded at each sample site and is listed in the accompanying data listings, and the digital record format for the tape or diskette version of the open file. For the digital record A = alpha; X = numeric, unless indicated otherwise.

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Clifton, H.E., Hunter, R.E., Swanson, F.J., and Phillips, R.L. (1969) Sample size and meaningful gold analysis; U.S. Geological Survey Professional Paper 625-C.

Garrett, R.G. (1974) Field data acquisition methods for applied geochemical surveys at the Geological Survey of Canada; Geol. Surv. Can. Paper 74-52.

Hall, G.E.M. (1979) A study of the stability of uranium in waters collected from various geological environments in Canada; In Current Research, Part A, Geological Survey of Canada Paper 79-1A, p. 361-365.

Harris, J.F. (1982) Sampling and analytical requirements for effective use of geochemistry in exploration for gold; *In* Levinson, A.A., Editor, Precious Metals in the Northern Cordillera, proceedings of a symposium sponsored by the Association of Exploration Geochemists and the Cordilleran Section of the Geological Association of Canada, pp. 53-67.

Jonasson, I.R., Lynch, J.J., and Trip, L.J. (1973) Field and laboratory methods used by the Geological Survey of Canada in geochemical surveys; No. 12, Mercury in Ores, Rocks, Soils, Sediments and Water, Geological Survey of Canada Paper 73-21.

TABLE 1. Summary of Analytical Data and Methods

Element		Detection level		Method(s)
SEDIMENTS:				
Zn	Zinc	2	ppm	AAS
Cu	Copper	2	ppm	AAS
Pb	Lead	2	ppm	AAS
Ni	Nickel	2	ppm	AAS
Co	Cobalt	2	ppm	AAS
Ag	Silver	0.2	ppm	AAS
Mn	Manganese	5	ppm	AAS
As	Arsenic	1	ppm	AAS
Mo	Molybdenum	2	ppm	AAS
Fe	Iron	0.02	pct	AAS
Hg	Mercury	10	ppb	AAS
LOI	Loss-on-ignition	1.0	pct	GRAV
U	Uranium	0.5	ppm	NADNC
V	Vanadium	5	ppm	AAS
Cd	Cadmium	0.2	ppm	AAS
Sb	Antimony	0.2	ppm	AAS
F	Fluorine	20	ppm	ISE
Au	Gold	1	ppb	FA - NA

TABLE 1 – Continued

Element		Detection level		Method(s)
WATERS:				
F	Fluoride	20	ppb	ISE
pH	Hydrogen ion activity			GCM
U	Uranium	0.05	ppb	LIF
Ca	Calcium	0.5	ppm	ICP-ES
Mg	Magnesium	0.05	ppm	ICP-ES
T-Alk	Total Alkalinity	1	ppm	TIT

AAS - Atomic absorption spectrometry
GRAV - Gravimetry
FA - NA - Fire assay preconcentration – neutron activation
ISE - Ion selective electrode
GCM - Glass Calomel electrode and pH meter
LIF - Laser-induced fluorescence
NADNC - Neutron Activation delayed neutron counting
ICP-ES - Inductively coupled plasma emission spectroscopy
TIT - Titration

TABLE 2. DATA LIST AND DIGITAL FORMAT LEGEND
Record 1 – Field Data

FIELD RECORD	DEFINITION	TEXT CODE	DIGITAL RECORD COLUMN AND CODE
MAP	National topographic system (NTS): lettered quadrangle (1:250,000 scale) or (1:50,000 scale). Part of sample number		1-6 "XXXAXX"
SAMPLE ID	Remainder of sample number: Year Field Crew Sample sequence number	 19XX 1, 3, 5, 7 001 - 999	7 – 12 "XX " " X " " XXX"
UTM COORDINATES	Universal Transverse Mercator (UTM) Coordinate system; digitized sample location coordinates.		
ZN	Zone 7 to 22		13 – 14 "XX"
EASTING	UTM Easting in metres		15 – 20 "XXXXXX"
NORTHING	UTM Northing in metres		21 – 27 "XXXXXXX"
ROCK TYPE	Major rock type of lake catchment area: Cenozoic Surficial deposits Paleozoic Limestone, shale Carbonatites, syenites Precambrian Mafic intrusives Carbonatites, alkalic rocks Grenville Province Mafic, ultramafic intrusives Alkalic, nepheline syenite Quartz monzonite Anorthositic intrusives Middle-late Precambrian Mafic, ultramafic intrusives Felsic intrusives Metasediments Superior and Southern Provinces Granophyre (Sudbury) Norite, Gabbro (Sudbury) Sediments and volcanics (Whitewater)	 QUS OSCP CAC LAPD LAPC LPGB LPGA LPGF LPGX MPBN MPGF MPS MPSG MPSN MPWG	28 – 31 "QUS" "OSCP" "CAC" "LAPD" "LAPC" "LPGB" "LPGA" "LPGF" "LPGX" "MPBN" "MPGF" "MPS" "MPSG" "MPSN" "MPWG"

TABLE 2 - Continued

FIELD RECORD	DEFINITION	TEXT CODE	DIGITAL RECORD COLUMN AND CODE
ROCK TYPE	Nipissing diabase Sediments (Cobalt Gp) Sediments (Quirke Lk Gp) Sediments (Hough Lk Gp) Sediments (Elliot Lk Gp) Volcanics (Elliot Lk Gp) Mafic intrusives (Elliot Lk Gp) Archean Felsic to intermediate intrusives-massive Felsic to intermediate intrusives-gneissic Syenite, monzonite Mafic, ultramafic intrusives Metasediments Alkalic metavolcanics Ultramafic metavolcanics	MPND MPC MPQL MPHL MPEL MPVB MPB AGM AGN AGY AUB ACSP AMVA AMVU	"MPND" "MPC" "MPQL" "MPHL" "MPEL" "MPVB" "MPB" "AGM" "AGN" "AGY" "AUB" "ACSP" "AMVA" "AMVU"
LAKE AREA	The area of the water body sampled: Pond ¼ to 1 sq km 1 to 5 sq km greater than 5 sq km	 POND .25 - 1 1 - 5 >5	32 - 35 "1 " " 1 " " 1 " " 1"
LAKE DEP	Sample depth from surface of water body to lake bottom in metres	1 – 999	36 - 38 "XXX"
RS	Replicate status; the relationship of the sample to others within the analytical block of 20: Routine regional sample First of field duplicate Second of field duplicate	 00 10 20	39 – 40 "00" "10" "20"
RLF	Relief of the lake catchment basin: Low Medium High	 Lw Md Hi	41 - 43 "1 " " 1 " " 1"
CNT	Contamination; human or natural: None Work Camp Fuel Gossan	 Wo Ca Fu Go	48 - 51 " " "1 " " 1 " " 1 " " 1"

TABLE 2 – Continued

FIELD RECORD	DEFINITION	TEXT CODE	DIGITAL RECORD COLUMN AND CODE
COLR	Sediment sample colour; up to two colours may be selected:		52 – 57
	Tan	Tn	"1 "
	Yellow	Yl	" 1 "
	Green	Gn	" 1 "
	Grey	Gy	" 1 "
	Brown	Br	" 1 "
	Black	Bk	" 1"
SUSP	Suspended matter in water:		58 – 59
	None		
	Heavy	Hvy	"1 "
	Light	Lgt	" 1"
AGE	Stratigraphic age of dominant rock type in catchment basin:		70 - 71
	Pleistocene to Recent	64	"64"
	Ordovician – Silurian	19	"19"
	Cambrian	10	"10"
	Proterozoic	04	"04"
	Archean	02	"02"

Record 2 – Atomic Absorption Spectrometry and Other Data

FIELD RECORD	DEFINITION	UNITS	DETECTION LEVEL	DIGITAL RECORD COLUMN AND CODE
Zn - SEDS	Zinc in lake sediments	ppm	2	16 - 20
Cu – SEDS	Copper in lake sediments	ppm	2	21 - 25
Pb - SEDS	Lead in lake sediments	ppm	2	26 – 30
Ni - SEDS	Nickel in lake sediments	ppm	2	31 – 35
Co – SEDS	Cobalt in lake sediments	ppm	2	36 – 40
Ag – SEDS	Silver in lake sediments	ppm	0.2	41 – 47
Mn – SEDS	Manganese in lake sediments	ppm	5	48 – 53
As – SEDS	Arsenic in lake sediments	ppm	1	54 – 60
Mo – SEDS	Molybdenum in lake sediments	ppm	2	61 – 65
Fe – SEDS	Iron in lake sediments	pct	0.02	66 – 70
Hg – SEDS	Mercury in lake sediments	ppb	10	71 – 75
LOI – SEDS	Loss-on-ignition	pct	1	76 - 80

Record 3 – Atomic Absorption Spectrometry and Other Data

FIELD RECORD	DEFINITION	UNITS	DETECTION LEVEL	DIGITAL RECORD COLUMN AND CODE
U - SEDS	Uranium in lake sediments	ppm	0.5	16 - 22
F – SEDS	Fluorine in lake sediments	ppm	20	23 - 27
V - SEDS	Vanadium in lake sediments	ppm	5	28 – 32
Cd - SEDS	Cadmium in lake sediments	ppm	0.2	33 – 39
Sb – SEDS	Antimony in lake sediments	ppm	0.2	40 – 46

Record 4 – Atomic Absorption Spectrometry and Other Data

FIELD RECORD	DEFINITION	UNITS	DETECTION LEVEL	DIGITAL RECORD COLUMN AND CODE
F - WATERS	Fluoride in lake waters	ppb	20	16 - 20
pH – WATERS	pH of lake waters			21 - 25
U - WATERS	Uranium in lake waters	ppb	0.05	26 – 30
Au – SEDS	Gold in lake sediments	ppb	variable	31 – 35
REPEAT Au	Gold in lake sediments - repeat analysis	ppb	variable	36 – 40
Au WEIGHT	Sample weight for first gold analysis	grams		41 – 44
REPEAT Au WEIGHT	Sample weight for repeat gold analysis	grams		45 – 48

Record 5 – Atomic Absorption Spectrometry and other Data

FIELD RECORD	DEFINITION	UNITS	DETECTION LEVEL	DIGITAL RECORD COLUMN AND CODE
Ca - WATERS	Calcium in lake waters	ppm	0.5	26 - 30
Mg – WATERS	Magnesium in lake waters	ppm	0.05	31 - 35
T-Alk - WATERS	Total alkalinity in lake waters	ppm	1	36 – 40