

REGIONAL LAKE SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA, LABRADOR 1978. GSC-OF 560, NGR 40-1978, PARTS OF NTS 23G,H,I,J

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OPEN FILE 560 IS ONE OF FOUR OPEN FILES (557,558,559, AND 560) COVERING THE TOTAL CENTRAL LABRADOR SURVEY AREA.

THE RECONNAISSANCE SURVEY WAS UNDERTAKEN BY THE GEOLOGICAL SURVEY OF CANADA IN CONJUNCTION WITH THE NEWFOUNDLAND DEPARTMENT OF MINES AND ENERGY UNDER THE TERMS OF THE CANADA-NEWFOUNDLAND AGREEMENT ON A URANIUM RECONNAISSANCE PROGRAM. THE PROVINCIAL FUNDING WAS FINANCED THROUGH THE CANADA-NEWFOUNDLAND DEVELOPMENT SUBSIDIARY AGREEMENT (1976-1982). THIS AGREEMENT WAS SPONSORED BY THE DEPARTMENTS OF REGIONAL ECONOMIC EXPANSION AND ENERGY, MINES AND RESOURCES AND THE PROVINCE OF NEWFOUNDLAND.

E.H.W. HORN BROOK DIRECTED GEOLOGICAL SURVEY OF CANADA ACTIVITIES. CONTRACTS LET FOR SAMPLE COLLECTION, PREPARATION AND ANALYSIS WERE SUPERVISED AND/OR MONITORED BY STAFF OF THE GEOCHEMISTRY SECTION AS FOLLOWS:

COLLECTION	- MARSHALL MACKLIN MONOGHAN LIMITED, TORONTO.
	- E.H.W. HORN BROOK, Y.T. MAURICE
PREPARATION	- GOLDER ASSOCIATES, OTTAWA.
	- J.J. LYNCH
ANALYTICAL	- CHEMEX LABS. LIMITED, VANCOUVER.
	- BARRINGER MAGENTA LIMITED, TORONTO.
	- ATOMIC ENERGY OF CANADA LIMITED, OTTAWA.
	- J.J. LYNCH

AT THE GEOLOGICAL SURVEY OF CANADA, N.G. LUND WAS RESPONSIBLE FOR OPEN FILE PRODUCTION AND DATA MANAGEMENT AND WAS SUPPORTED BY F. WILLIAMS OF THE CARTOGRAPHIC SECTION WHO SUPERVISED MAP PREPERATION. DIRECT PHOTO-HEAD PLOTTING FACILITIES WERE MADE AVAILABLE THROUGH THE GEOLOGICAL SURVEY OF CANADA AND THE COMPUTOR SCIENCE CENTRE OF E.M.R.

PROVINCIAL LIASON WAS WITH P.H. DAVENPORT AND B.A. GREENE, DEPARTMENT OF MINES AND ENERGY, NEWFOUNDLAND.

LAKE SEDIMENT AND WATER SAMPLES WERE COLLECTED AT AN AVERAGE DENSITY OF ONE SAMPLE PER 13 SQUARE KILOMETRES (5 SQUARE MILES) THROUGH THE 61100 SQUARE KILOMETRE 23600 SQUARE MILE) TOTAL EASTERN LABRADOR SURVEY AREA. THE HELICOPTER SUPPORTED SAMPLE COLLECTION WAS CARRIED OUT DURING THE SUMMER OF 1978. SAMPLE SITE AND GRID CELL DUPLICATE SAMPLES WERE ROUTINELY COLLECTED IN EACH ANALYTICAL BLOCK OF TWENTY SAMPLES.

IN OTTAWA, FIELD DRIED SAMPLES WERE AIR-DRIED, CRUSHED AND BALL MILLED. THE MINUS 80 MESH (177 MICRONS) FRACTION WAS OBTAINED AND USED FOR SUBSEQUENT ANALYSES.

AS REQUIRED, AT THIS TIME, CONTROL REFERENCE AND BLIND DUPLICATE SAMPLES WERE INSERTED INTO EACH ANALYTICAL BLOCK OF TWENTY SEDIMENT AND WATER SAMPLES. NO OTHER SAMPLE PROCESSING IN OTTAWA WAS CARRIED OUT ON THE WATER SAMPLES.

THE DETERMINATION OF ZU, CU, PB, NI, CO, AG, MN, FE, MO, AS, F AND LOSS ON IGNITION IN LAKE SEDIMENTS WAS CARRIED OUT BY CHEMEX LABS LIMITED.

THE DETERMINATION OF U IN LAKE SEDIMENTS WAS CARRIED OUT BY ATOMIC ENERGY OF CANADA LIMITED.

THE DETERMINATION OF U, F AND PH IN LAKE WATERS WAS CARRIED OUT BY BARRINGER MAGENTA LIMITED.

FOR THE DETERMINATION OF ZN, CU, PB, NI, CO, AG, MN AND FE, A 1 GRAM SAMPLE WAS REACTED WITH 6 ML OF A MIXTURE OF 4M HCL AND M HNO<sub>3</sub> IN A TEST-TUBE OVERNIGHT AT ROOM TEMPERATURE. AFTER THE OVERNIGHT DIGESTION THE TEST-TUBE WAS IMMERSSED IN A HOT WATER BATH AT ROOM TEMPERATURE AND BROUGHT UP TO 90C 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 AND FE WERE DETERMINED BY ATOMIC ABSORTION SPECTROSCOPY USING AN AIR-ACETYLENE FLAME. BACKGROUND CORRECTIONS WERE MADE FOR PB, NI,CO AND AG.

ARSENIC WAS DETERMINED BY ATOMIC ABSORPTION USING A HYDRIDE SOLUTION METHOD WHEREIN THE ARSENIC IS EVOLVED AS ASH<sub>3</sub>, PASSED THROUGH A HEATED QUARTZ TUBE IN THE LIGHT PATH OF AN ATOMIC ABSORPTION SPECTROPHOTOMETER. THE METHOD IS DESCRIBED BY ASLIN (1976).

MOLYBDENUM WAS DETERMINED BY ATOMIC ABSORPTION SPECTROSCOPY USING A NITROUS OXIDE ACETYLENE FLAME. A 0.5 GRAM SAMPLE WAS REACTED WITH 1.5 ML CONCENTRATED HNO<sub>3</sub> AT 90C FOR 30 MINUTES. AT THIS POINT 0.5 ML CONCENTRATED HCL WAS ADDED AND THE DIGESTION WAS CONTINUED AT 90C 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.

FLUORINE WAS DETERMINED IN LAKE SEDIMENTS AS DESCRIBED BY FICKLIN (1970). A 250 MG SAMPLE IS SINTERED WITH 1 GRAM OF A FLUX CONSISTING OF TWO PARTS BY WEIGHT SODIUM CARBONATE AND 1 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.  
A DETECTION LIMIT OF 40 PPM IS ACHIEVED.

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 500C 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.

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 PARRAFIN.  
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.

URANIUM, FLUORIDE AND PH WERE DETERMINED IN LAKE WATER SAMPLES.  
UPON RECEIVING A BATCH OF SAMPLES, FLUORIDE AND PH WERE DETERMINED BY SPECIFIC ION ELECTRODE AND GLASS-CALOMEL COMBINATION ELECTRODE RESPECTIVELY.  
AFTER THESE TWO DETERMINATIONS WERE COMPLETED, THE REMAINING WATER IN THE SAMPLE BOTTLE (APPROX. 225 ML) WAS ACIDIFIED WITH 3 ML CONCENTRATED HNO<sub>3</sub>.

TWO WEEKS AFTER ACIDIFICATION, A 5 MICROLITRE ALIQUOT OF THE SAMPLE WAS THEN REMOVED FOR THE DETERMINATION OF URANIUM BY FISSION TRACK ANALYSES.  
THE TWO WEEK WAITING PERIOD WAS TO INSURE THAT ALL PRECIPITATED URANIUM WAS REDISSOLVED.  
TO DETERMINE URANIUM, SAMPLE ALIQUOTS WERE PLACED ON A POLYCARBONATE TAPE AND DRIED.  
THE TAPE WAS THEN IRRADIATED IN A NUCLEAR REACTOR AT MCMASTER UNIVERSITY FOR 1 HOUR IN A FLUX OF  $10^{13}$  NEUTRONS/SQ. CM./SEC.  
THE TAPE WAS SUBSEQUENTLY ETCHED WITH 25% NAOH SOLUTION AND THE FISSION TRACKS WERE COUNTED WITH AN OPTICAL COUNTER FITTED TO A MICROSCOPE.  
THE NUMBER OF TRACKS WAS PROPORTIONAL TO THE URANIUM CONCENTRATION.  
EACH TAPE CONTAINED ITS OWN CALIBRATION STANDARDS, BLANKS AND SAMPLE DUPLICATES.

FLUORIDE IN LAKE WATER SAMPLES WAS DETERMINED USING AN ORION FLUORIDE ELECTRODE AND A MODEL 401 ORION SPECIFIC ION METER.  
PRIOR TO MEASUREMENT AN ALIQUOT OF THE SAMPLE WAS MIXED WITH AN EQUAL VOLUME OF A MODIFIED TISAB SOLUTION (TOTAL IONIC STRENGTH ADJUSTMENT BUFFER).

THE MODIFICATION CONSISTED OF ADDING 60 ML 8M KOH SOLUTION TO THE BUFFER. THIS PERMITTED THE RE-ANALYSIS OF FLUORIDE IN ACIDIFIED WATER SAMPLES WHEN REQUIRED. WHEN THIS ANALYSIS WAS REQUIRED , ACIDIFIED STANDARD SOLUTIONS WERE USED FOR CALIBRATION.

HYDROGEN ION ACTIVITY (PH) WAS MEASURED WITH A BECKMAN COMBINATION ELECTRODE AND A MODEL 401 ORION SPECIFIC ION METER.

ON RECEIPT, FIELD AND ANALYTICAL DATA WERE PUNCHED ONTO 80 COLUMN CARDS AND ALL SUBSEQUENT PROCESSING WAS CARRIED OUT WITH THE AID OF COMPUTERS. THE FIELD DATA WERE RECORDED BY THE FIELD CONTRACT STAFF ONTO 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 DOMINANT ROCK TYPES IN THE LAKE CATCHMENT BASINS WERE IDENTIFIED ON APPROPRIATE GEOLOGICAL MAPS USED AS THE BEDROCK GEOLOGICAL BASE ON NGR MAPS.

THE ANALYTICAL DATA WERE RECORDED AS FOLLOWS (SEE GARRETT, 1974, FOR DETAILS) AND FOR CONVENIENCE THE DETECTION LIMITS OF THE ANALYTICAL METHODS USED ARE ALSO GIVEN-

ELEMENT	ANAL. CARD	COLUMNS	DETECTION LIMIT	
SEDIMENT				
ZN	1	21-25	2	1
CU	1	26-30	2	1
PB	1	31-35	2	1
NI	1	36-40	2	1
CO	1	41-45	2	1
AG	1	46-50	0.2	0.1
MN	1	51-55	5	2
AS	1	56-60	1	0.5
MO	1	61-65	2	1
FE %	1	66-70	0.02	0.01
F	1	71-75	40	20
LOI %	1	76-79	1.0	0.5
U	2	21-25	0.2	0.1
WATER				
U PPB	3	21-25	0.01	0.005
F PPB	3	26-30	20	10
PH	3	31-35		

UNLESS OTHERWISE NOTED THE UNITS OF MEASUREMENT FOR THE ANALYSES ARE PPM. THE SECOND FIGURE UNDER DETECTION LIMIT IS THE FIGURE TO WHICH VALUES WERE ARBITRARILY SET IF THEY FELL BELOW THE DETECTION LIMIT.

GENERAL INSPECTIONS OF THE FIELD AND ANALYTICAL DATA WERE MADE TO CHECK FOR ANY MISSING INFORMATION AND/OR GROSS ERRORS. THE SAMPLE SITE COORDINATES WERE CHECKED BY PLOTTING SAMPLING LOCATION MAPS ON A FLAT-BED PLOTTER FROM THE DIGITIZED COORDINATES AND THEN OVERLAYING THESE OVER THE FIELD CONTRACTOR'S SAMPLE LOCATION BASE MAPS.

QUALITY CONTROL AND MONITORING OF THE GEOLOGICAL DATA WAS UNDERTAKEN BY A STANDARD METHOD USED BY THE RESOURCE GEOCHEMISTRY SUBDIVISION AT THE GEOLOGICAL SURVEY OF CANADA.

#### REFERENCES

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- FICKLIN, W.H. (1970) A RAPID METHOD FOR THE DETERMINATION OF FLUORIDE IN ROCKS AND SOILS, USING AN ION SELECTIVE ELECTRODE. U.S. GEOL. SURV. PAPER 700C PP. C186-188.
- GARRETT, R.G. (1974) FIELD DATA ACQUISITION METHODS FOR APPLIED GEOCHEMICAL SURVEYS AT THE GEOLOGICAL SURVEY OF CANADA: GEOL SURV. CAN. PAPER 74-52.
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DATA LIST LEGEND

MAP-	NATIONAL TOPOGRAPHIC SYSTEM(NTS)- LETTERED QUADRANGLE (SCALE 1:250000). PART OF SAMPLE NUMBER	ROCK TYPE:	SLTE- SLATE PXGD- PYROXENE*GRANODIORITE GRNG- GRANITE GNEISS ARKS- ARKOSE = ARKOSIC ARENITE QZMZ- QUARTZ MONZONITE = ADAMELLITE ANRS- ANORTHOSITE GRNT- GRANITE GRNL- GRANULITE = LEPTITE GBBR- GABBRO AMPB- AMPHIBOLITE PXGL- PYROXENE*GRANULITE SMRK- SEDIMENTARY*ROCK QRTZ- QUARTZITE BSLT- BASALT UFMC- ULTRAMAFIC
ID-	REMAINDER OF SAMPLE NUMBER- YEAR(2), FIELD CREW(1), SAMPLE SEQUENCE NUMBER(3)		
UTM COORDINATES-	UNIVERSAL TRANVERSE MERCATOR(UTM) COORDINATE SYSTEM- SAMPLE COORDINATES		
ZN-	ZONE		
EAST-	EASTING (METERS)		
NORTH-	NORTHING (METERS)		
ROCK TYPE-	MAJOR ROCK TYPE OF LAKE CATCHMENT AREA		
LAKE AREA-	AREA OF LAKE SAMPLED	LAKE AREA:	POND- POND LT 1- 1/4 TO 1 SQ KM 1-5- 1 TO 5 SQ KM GT 5- GREATER THAN 5 SQ KM
SMP DTH-	SAMPLE DEPTH MEASURED TO THE NEAREST FOOT		
RP ST-	REPLICATE STATUS- RELATIONSHIP OF WITH RESPECT TO OTHERS WITHIN THE SURVEY	RP ST:	00- ROUTINE REGIONAL SAMPLE 10- FIRST OF FIELD DUPLICATE 20- SECOND OF FIELD DUPLICATE 70- CELL DUPLICATE SAMPLE
REL-	RELIEF OF THE SURROUNDING LAKE CATCHMENT BASIN	REL:	L- LOW H- HIGH M- MEDIUM
GEL-	PRESENCE OF AN ORGANIC GEL OR GYTTJA		
CONT-	CONTAMINATION- HUMAN OR NATURAL(WORK-DRILL/TRENCH, CAMP,FUEL OR GOSSAN)		
SAMPL COLOR-	SEDIMENT COLOUR	GEL:	BLANK- ABSENT
SUSP-	SUSPENDED MATTER		
		CONT:	BLANK- NONE 1- PRESENT
ZN-	ZINC BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)		
CU-	COPPER BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)		
PB-	LEAD BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)		
NI-	NICKEL BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)		
CO-	COBALT BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)	SAMPL COLOR:	TN- TAN YL- YELLOW GN- GREEN GY- GREY BR- BROWN BK- BLACK
AG-	SILVER BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)		
MN-	MANGANESE BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)		
AS-	ARSENIC COLORIMETRICALLY (PPM)		
MO-	MOLYBDENUM BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)		
FE-	IRON BY ATOMIC ABSORPTION SPECTROSCOPY (%)		
F-	FLOURINE BY SPECIFIC ION ELECTRODE (PPM)		
LOI-	LOSS ON IGNITION BY WEIGHT DIFFERENCE (%)	SUSP:	BLANK- NONE L- LIGHT H- HEAVY
U-	URANIUM BY DELAYED NEUTRON ACTIVATION (PPM)		
U-W-	URANIUM IN WATERS BY FISSION TRACK (PPB)		
F-W-	FLUORINE IN WATERS BY SPECIFIC ION ELECTRODE (PPB)		
PH-	PH BY COMBINATION GLASS - CALOMEL ELECTRODE		