DEPARTMENT OF ENERGY, MINES AND RESOURCES

GOLD IN LAKE SEDIMENTS (PART OF NTS 64D) – REGIONAL LAKE SEDIMENT GEOCHEMICAL RECONNAISSANCE DATA, EAST-CENTRAL SASKATCHEWAN

OPEN FILE 683

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GOLD IN LAKE SEDIMENTS (PART OF NTS 64D) – REGIONAL LAKE SEDIMENT GEOCHEMICAL RECONNAISSANCE DATA, EAST-CENTRAL SASKATCHEWAN

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GEOLOGICAL SURVEY OF CANADA OPEN FILE 683

GOLD IN LAKE SEDIMENTS (PART OF NTS 64D)

LAKE SEDIMENT SAMPLES WERE SELECTED FROM AN AREA OF APPROXIMATELY 2400 SQUARE MILES IN NTS 64D AND ANALYZED FOR GOLD TO APPRAISE THE UTILIZATION OF ORGANIC LAKE-CENTRE SEDIMENTS IN THE GEOCHEMICAL EXPLORATION FOR GOLD IN THIS REGION OF SASKATCHEWAN (SEE COKER ET. AL., 1980). THE SAMPLE SELECTION AND GOLD ANALYSES, CARRIED OUT UNDER CONTRACT BY NUCLEAR ACTIVATION SERVICES LTD., WERE SUPERVISED BY DR. W.B. COKER. GEOLOGICAL SURVEY OF CANADA.

THE MAJORITY OF THE DATA IN THIS OPEN FILE WERE RELEASED AS OPEN FILE 266, AUGUST 5, 1975 (HORNBROOK ET. AL., 1975). ADDITIONAL DATA FOR MERCURY AND URANIUM, DETERMINED BY DELAYED NEUTRON COUNTING, WERE RELEASED AS OPEN FILE 488, OCTOBER 5, 1977 (HORNBROOK ET. AL., 1977). THIS HARD COPY RELEASE OF OPEN FILE 683 DISPLAYS DATA FOR 14 ELEMENTS (ZN,CU,PB,NI,CO,AG,MN,AS,MO,FE,HG,U-F,U-N AND AU) AND LOSS-ON-IGNITION. A SAMPLE LOCATION MAP OF NTS 64D, FROM OPEN FILE 266, IS INCLUDED WITH OPEN FILE 683.

THE ORIGINAL REGIONAL LAKE SEDIMENT GEOCHEMICAL RECONNAISSANCE PROJECT (NTS,63M, 64D AND PARTS OF 63K, 63L, 63N, 73I, 73O, 73P AND 74A) WAS JOINTLY UNDERTAKEN AND PLANNED BY THE GEOLOGICAL SURVEY OF CANADA AND THE SASKATCHEWAN GEOLOGICAL SURVEY UNDER THE AUSPICES OF THE CANADA-SASKATCHEWAN AGREEMENT ON MINERAL EXPLORATION AND DEVELOPMENT IN NORTHERN SASKATCHEWAN.

MR. E.H.W. HORNBROOK DIRECTED GEOLOGICAL SURVEY OF CANADA ACTIVITIES AND SUPERVISED THE FIELD SAMPLING CONTRACT LET TO TRIGG, WOOLLETT & ASSOCIATES LTD., UNDER G.S.C. FIELD PROJECT 740079, 'REGIONAL SURVEYS (LAKE SEDIMENTS)'. DR. L.S. BECK COORDINATED ACTIVITIES AT THE SASKATCHEWAN GEOLOGICAL SURVEY. THE CHEMICAL ANALYSES WERE ALSO CARRIED OUT UNDER CONTRACT BY BARRINGER RESEARCH LTD. AND AECL COMMERCIAL PRODUCTS DIVISION, THE CONTRACTS BEING SUPERVISED FROM THE GEOLOGICAL SURVEY OF CANADA BY MR. J.J. LYNCH. DATA MONITORING, COMPILATION AND MAP PRODUCTION WAS CARRIED OUT AT THE GEOLOGICAL SURVEY OF CANADA IN THE GEOCHEMISTRY AND GEOLOGICAL CARTOGRAPHY SECTIONS UNDER THE DIRECTION OF DR. R.G. GARRETT. THE DATA PLOTTING WAS CARRIED OUT USING PHOTO-HEAD PLOTTING FACILITIES FOR DIRECT PHOTOGRAPHIC PLOTTING MADE AVAILABLE BY THE MAP PRODUCTION DIRECTORATE, SURVEYS AND MAPPING BRANCH.

THE ORIGINAL GEOCHEMICAL LAKE SEDIMENT RECONNAISSANCE SURVEY WAS PART OF THE RECONNAISSANCE GEOSCIENCE SURVEYS PROJECT OF THE AFOREMENTIONED FEDERAL-PROVINCIAL AGREEMENT. THE AGREEMENT IS A COST SHARED VENTURE DESIGNED TO IMPROVE THE ECONOMIC BASE OF NORTHERN SASKATCHEWAN BY CONDUCTING SCIENTIFIC SURVEYS THAT COULD LEAD TD THE DISCOVERY OF NEW MINERAL DEPOSITS, OR THE FURTHER DEVELOPMENT OF KNOWN DEPOSITS.

THE LAKE SEDIMENT SURVEY WAS UNDERTAKEN TO OBTAIN INFORMATION ON THE DISTRIBUTION AND CONCENTRATION OF TRACE METALS IN THE LAKE SEDIMENTS. THE AIM WAS TO DELINEATE BROAD BELTS OF INCREASED METAL CONTENT, POSSIBLY CORRELATIVE WITH FEATURES OF ECONOMIC INTEREST, WORTHY OF FURTHER FIELD INVESTIGATION. THE PROJECT HAS BEEN DESCRIBED BY HORNBROOK AND GARRETT (1976) AND ASPECTS OF THE DATA BY GARRETT AND HORNBROOK (1976) AND GARRETT AND LYNCH (1976). THE LATTER PAPER MAKES A COMPARISON OF THE TWO SETS OF URANIUM DATA.

CENTRE-LAKE BOTTOM ORGANIC-RICH SAMPLES WERE COLLECTED AT AN AVERAGE DENSITY OF 1 SAMPLE PER 5 SQUARE MILES THROUGHOUT THE 20,000 SQUARE MILE SURVEY AREA. THE SAMPLING WAS CARRIED OUT BY 2 TWO MAN TEAMS IN A HELICOPTER SUPPORTED PROGRAM DURING THE PERIOD JULY 30 TO SEPTEMBER 4, 1974. A SAMPLING RATE OF 15 SAMPLE SITES PER HOUR WAS ACHIEVED AND MAINTAINED DURING THE PROGRAM, WHICH WAS UNDERTAKEN THROUGH A CONTRACT TO TRIGG, WOOLLETT AND ASSOCIATES LTD. OF EDMONTON, ALBERTA.
SAMPLE DRYING AND PROCESSING OPERATIONS WERE CARRIED OUT AT LA RONGE, SASKATCHEWAN, BY STAFF OF THE SASKATCHEWAN GEOLOGICAL SURVEY. SAMPLES WERE AIR DRIED AND SIEVED TO MINUS 80 MESH. AT THIS TIME CONTROL REFERENCE SAMPLES AND BLIND DUPLICATES WERE INSERTED AT A FREQUENCY OF 5%, I.E. IN EACH BLOCK OF 18 FIELD SAMPLES TO YIELD ANALYTICAL BLOCKS OF 20. THE PROCESSED SAMPLES WERE THEN SHIPPED TO THE ANALYTICAL CONTRACTORS FOR THE DETERMINATION OF 13 TRACE METALS.

WITH THE EXCEPTION OF LOSS ON IGNITION, URANIUM BY DELAYED NEUTRON COUNTING, AND GOLD BY PRECONCENTRATION, NEUTRON ACTIVATION/GAMMA-RAY SPECTROSCOPY ALL ANALYSES WERE CARRIED OUT BY BARRINGER RESEARCH LTD., TORONTO, ONTARIO ON A CONTRACTUAL BASIS WITH THE GEOLOGICAL SURVEY OF CANADA. LOSS-ON-IGNITION WAS DETERMINED IN THE GEOCHEMISTRY SECTION LABRATORIES OF THE GEOLOGICAL SURVEY IN OTTAWA. THE URANIUM DETERMINATIONS WERE CARRIED OUT BY A.E.C.L., OTTAWA, ONTARIO AND THE GOLD DETERMINATIONS WERE CARRIED OUT BY NUCLEAR ACTIVATION SERVICES LTD., HAMILTON, ONTARIO UNDER SIMILAR CONTRACTS FOR ANALYTICAL SERVICES.

FOR THE DETERMINATION OF ZN, CU, PB, NI, CD, AG, MN, FE AND U, A 1 GRAM SAMPLE WAS REACTED WITH 6 ML OF A MIXTURE OF 4M HCL AND M HN03 IN A TEST-TUBE OVERNIGHT AT ROOM TEMPERATURE. AFTER THE OVERNIGHT DIGESTION THE TEST-TUBE WAS IMMERSED IN A HOT WATER BATH AT ROOM TEMPERATURE AND BROUGHT UP TD 90C AND HELD AT THIS TEMPERATURE FOR 1 HOUR WITH PERIODIC SHAKING. THE SAMPLE SOLUTION WAS THEN DILUTED TO 20 ML WITH METAL FREE WATER AND MIXED. ZN, CU, PB, NI, CD, AG, MN AND FE WERE DETERMINED BY ATOMIC ABSORPTION SPECTROSCOPY USING AN AIR-ACETYLENE FLAME. BACKGROUND CORRECTIONS WERE MADE FOR PB, NI, CO AND AG. A 0.1 ML ALIQUOT OF THE ABOVE SAMPLE SOLUTION WAS USED TO DETERMINE U BY A FLUOROMETRIC METHOD DESCRIBED BY SMITH AND LYNCH (1969). A TURNER FLUOROMETER WAS USED FOR THE FLUORESENCE MEASUREMENTS IN PLACE OF THE JARREL-ASH DESCRIBED IN THE SMITH AND LYNCH PAPER.

ARSENIC WAS DETERMINED COLORIMETRICALLY USING SILVER DIETHYLDITHIOCARBAMATE. DECOMPOSITION WAS ACCOMPLISHED BY HEATING A 0.5 GRAM SAMPLE WITH 10 ML OF 6 M HCL AT 90C FOR 1 HOUR. COLORIMETRIC MEASUREMENTS WERE MADE AT 520 NM. 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 HN03 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.

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 HN03 AND 1 ML CONCENTRATED HCL IN A TEST-TUBE FOR 10 MINUTES AT ROOM TEMPERATURE PRIOR TD 2 HOURS OF DIGESTION WITH MIXING AT 90C 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 TD THE ELEMENTAL STATE BY THE ADDITION OF 10 ML OF 10% W/V SNS04 IN M H2SO4. 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.

LOSS-ON-IGNITION WAS DETERMINED USING A 200 MG SAMPLE; SHORTAGE OF' MATERIAL DICTATED THIS RELATIVELY SMALL SAMPLE WEIGHT. THE SAMPLE, CONTAINED IN A 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.

GOLD WAS DETERMINED ON A 5 TD 10 GRAM LAKE SEDIMENT SAMPLE, DEPENDING ON AMOUNT OF SAMPLE AVAILABLE. 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 BEAD. THE SILVER BEADS WERE IRRADIATED IN A NEUTRON FLUX FOR 1 HOUR, COOLED FOR 4 HOURS, AND COUNTED BY GAMMA RAY SPECTROMETRY. CALIBRATION WAS CARRIED OUT USING STANDARD AND BLANK BEADS.

ON RECIEPT 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 COORDINATES WERE RECORDED IN THE FIELD USING A PLASTIC ROAMER AND THE APPROPRIATE 1/250000 SCALE NTS MAP. THE DOMINANT ROCK TYPES IN THE LAKE CATCHMENT BASINS WERE PICKED OFF THE SASKATCHEWAN GEOLOGICAL SURVEY'S 1 INCH TO 20 MILE GEOLOGICAL COMPILATION MAP OF THE PROVINCE. 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
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)
U (F)	1	56-60	0.5	(0.2)
AS	1	61-65	1	(0.5)
MO	1	66-70	2	(1)
FE	1	71-75	0.02	(0.01)
HG PPB	1	76-79	10	(5)
LOI %	2	21-25		
U (N)	3	21-25	0.2	(0.1)
AU PPB	4	26-30	2	(1)

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 SET IF THEY FELL BELOW THE DETECTION LIMIT. LOSS-ON-IGNITION WAS A GRAVIMETRIC DETERMINATION AND THERE WAS NO DETECTION LIMIT ESTABLISHED.

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 FIELD RECORDED COORDINATES AND THEN OVERLAYING THESE OVER THE FIELD CONTRACTOR'S FINAL REPORT SAMPLE LOCATION MAPS.

QUALITY CONTROL AND MONITORING OF THE GEOCHEMICAL DATA WAS UNDERTAKEN USING A STANDARD METHOD USED BY THE GEOCHEMISTRY SECTION AT THE GEOLOGICAL SURVEY OF CANADA WHICH IS BASED ON DUPLICATE AND REPLICATE SAMPLES AND ANALYSES. THIS REQUIRES THAT FIELD DUPLICATED, BLIND (ANALYTICAL) DUPLICATED AND CONTROL REFERENCE SAMPLES BE INSERTED AT A 5% FREQUENCY. IN PRACTICE THAT REQUIRED EXTRA SAMPLES ARE INSERTED RANDOMLY IN EACH BLOCK OF 20 TOTAL SAMPLES, I.E. EACH BLOCK WILL CONTAIN 17 REGIONAL SAMPLES, 1 FIELD DUPLICATE TAKEN AT ONE OF THE 17 REGIONAL SITES, 1 BLIND DUPLICATE OF ONE OF THE 18 FIELD SAMPLES AND A CUT OF A CONTROL REFERENCE SAMPLE. IN THE CASE OF THE REANALYSIS OF THE SELECTED LAKE SEDIMENT SAMPLES FOR GOLD CONTROL REFERENCE SAMPLES WERE INSERTED AT APPROXIMATELY 10% FREQUENCY. BOTH CONTROL REFERENCE SAMPLES WERE ANALYSED 14 TIMES GIVING THE FOLLOWING DATA:

CR	ARITH. MEAN	ARITH. STD. DEV.	MINIMUM	MAXIMUM
1	562	50	520	670
2	88	9	70	110

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DATA LIST LEGEND

MAP- NATIONAL TOPOGRAPHIC SYSTEM(NTS)- LETTERED QUADRANGLE (SCALE 1:250000). PART OF SAMPLE NUMBER
ID- REMAINDER OF SAMPLE NUMBER- YEAR(2), FIELD CREW(1)- SAMPLE SEQUENCE NUMBER(3)

UTM COORDINATES- UNIVERSAL TRANSVERSE 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
SMPL DPTH- SAMPLE DEPTH MEASURED TO THE NEAREST FOOT

RP ST- REPLICATE STATUS- RELATIONSHIP OF SAMPLE WITH RESPECT TO OTHERS WITHIN THE SURVEY

RELF- RELIEF OF THE SURROUNDING LAKE CATCHMENT BASIN
SMPL COMP- SAMPLE COMPOSITION- BULK MECHANICAL COMPOSITION OF SAND, FINES, ORGANICS AND GEL RESPECTIVELY
CONT- CONTAMINATION- HUMAN OR NATURAL (WORK-DRILL/TRENCH, CAMP, FUEL OR GOSSAN
SAMPLE COLOUR- SEDIMENT COLOUR
SUSP- SUSPENDED MATTER

ZN- ZINC BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)
CU- COPPER BY ATOMIC ABSORPTION SPACTROSCOPY (PPM)
PB- LEAD BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)
NI- NICKEL BY ATOMIC ABSORPTION SPECTOSCOPY (PPM)
CO- COBALT BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)
AG- SILVER BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)
MN- MN BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)
AS- ARSENIC BY COLORIMETRY (PPM)
MO- MOLYBDENUM BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)
FE- IRON BY ATOMIC ABSORPTION SPECTROSCOPY (%)
HG- MERCURY BY FLAMELESS SPECTROSCOPY (PPB)
U-F- URANIUM BY FLUOROMETRY (PPM)
U-N- URANIUM BY DELAYED NEUTRON COUNTING (PPM)
AU- GOLD BY PRECONCENTRATION, NEUTRON ACTIVATION/GAMMA-RAY SPECTROSCOPY (PPB)

LOI- LOSS-ON-IGNTION BY WEIGHT DIFFERENCE (%)

ROCK TYPE: PSCS-PELETIC SCHIST
AMPB- AMPHIBOLITE
MVCC- METAVOLCANIC
GRNT- GRANITE
UMFC- ULTRAMAFIC
MGMT- MIGMATITE
MARK- META-ARKOSE
MSDM- METASEDIMENT
MRVLT- MARBLE

LAKE AREA: POND- POND
LT 1- ¼ TO 1 SQ KM
1-5- 1 TO 5 SQ KM
GT 5– GREATER THAN 5 SQ KM

REP ST: 00- ROUTINE REGIONAL SAMPLE
10- FIRST OF FIELD DUPLICATE
20- SECOND OF FIELD DUPLICATE
32- ROUTINE SAMPLE-LAYERED WITH LAYED POSITION

RELF: L- LOW
M- MEDIUM
H- HIGH

SMPL COMP: BLANK- ABSENT
1- MINOR- LESS THAN 33%
2- MEDIUM- 33% to 67%
3- MAJOR- GREATER THAN 67%

GEL: BLANK- ABSENT
1- PRESENT

CONT: BLANK- NONE
1- PRESENT

SAMPLE COLOUR: TN- TAN
YL- YELLOW
GN- GREEN
GY- GREY
BR- BROWN
BK- BLACK

SUSP: BLANK- NONE
L- LOW
H- HIGH