

REGIONAL LAKE SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA, MANITOBA 1985, GSC-OF 1288, NGR 87-1985, NTS 64C

```
*****  
*  
*      OPEN FILE    1288      *  
*  
*****
```

| | PAGE |
|--------------------|------|
| SURVEY NOTES | 1 |
| DATA LIST | 11 |
| SUMMARY STATISTICS | 69 |

REGIONAL LAKE SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA, MANITOBA 1985, GSC-OF 1288, NGR 87-1985, NTS 64C

GEOLOGICAL SURVEY OF CANADA OPEN FILE 1288.
REGIONAL LAKE SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA,
NORTHWESTERN MANITOBA 64C.

OPEN FILE 1288 IS AN UPDATE OF OPEN FILE 999 CONTAINING NEW DATA FOR
GOLD AND ANTIMONY IN LAKE SEDIMENTS.
THE NEW LAKE SEDIMENT DATA WAS ACQUIRED UNDER THE CANADA-MANITOBA MINERAL
DEVELOPMENT AGREEMENT (1984-1989).

THE ORIGINAL RECONNAISSANCE SURVEY WAS UNDERTAKEN BY THE GEOLOGICAL SURVEY OF
CANADA IN CONJUNCTION WITH THE MANITOBA DEPARTMENT OF MINES AND ENERGY UNDER
THE CANADA-MANITOBA INTERIM MINERAL AGREEMENT (1983-1984).

E.H.W. HORN BROOK DIRECTED THE GEOLOGICAL SURVEY OF CANADA ACTIVITIES(1983,1985).

P.W.B. FRISKE COORDINATED THE OPERATIONAL ACTIVITIES OF THE GEOLOGICAL
SURVEY OF CANADA STAFF THROUGHOUT THE SURVEY (1985).

THE W.M. WARD TECHNICAL SERVICES LABORATORY, ENVIRONMENTAL MANAGEMENT
SERVICES BRANCH OF THE MANITOBA DEPARTMENT OF ENVIRONMENT AND WORKPLACE
SAFETY AND HEALTH (WARD TSL) PRODUCED THE LAKE WATER DATA (1984).

CONTRACTS LET FOR COLLECTION, SAMPLE PREPARATION AND ANALYSIS WERE THE
RESPONSIBILITY OF, AND WERE SUPERVISED AND/OR MONITORED BY THE STAFF OF
THE RESOURCE GEOCHEMISTRY SUBDIVISION AS FOLLOWS:

COLLECTION: - WOLLEX EXPLORATION, CALGARY. (1983)
- E.H.W. HORN BROOK (GSC 1983), N.G. LUND (GSC 1983)

PREPARATION: - GOLDR ASSOCIATES, OTTAWA, ONTARIO (1983)
- J.J. LYNCH (GSC 1983)

ANALYSIS: - BARRINGER MAGENTA LTD., REXDALE, ONTARIO (SB -1985)
- ACME ANALYTICAL LABORATORIES LTD. TORONTO (1983)
- CHEMEX LABS LTD., VANCOUVER, B.C. (1983, AU - 1985)
- WARD TSL (COND, HCO₃, CA, MG, FE - 1984)
- J.J. LYNCH (GSC 1983)

H.R. SCHMITT (1985) AND N.G. LUND (1983) COORDINATED OPEN FILE PRODUCTION.

A.C. GALLETTA (1983,1985) WAS RESPONSIBLE FOR DATA MANAGEMENT, AND FOR THE
PREPARATION OF THE REGIONAL TREND MARGINAL MAP UTILIZING A PROGRAM
DEVELOPED BY D.J. ELLWOOD.

J. YELLE (1983,1985) SUPERVISED MAP PREPARATION.
COMPUTING AND PLOTTING FACILITIES WERE PROVIDED BY THE COMPUTER SCIENCE
CENTER, E.M.R.

OPEN FILE TEXT WAS MANUFACTURED BY K.G. CAMPBELL CORPORATION LASER PRINTING,
OTTAWA.

HELICOPTER SUPPORTED SAMPLE COLLECTION WAS CARRIED OUT DURING THE SUMMER
OF 1983.
LAKE SEDIMENT AND WATER SAMPLES WERE COLLECTED AT AN AVERAGE DENSITY OF ONE

SAMPLE PER 13 SQUARE KILOMETERS IN THE SOUTH HALF OF 64C AND ONE SAMPLE PER 6.5 SQUARE KILOMETERS IN THE NORTH HALF. TOTAL SURVEY AREA IS 13,700 SQUARE KILOMETERS.

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 CONTRACTORS'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 WERE UNDERTAKEN BY A STANDARD METHOD USED BY THE RESOURCE GEOCHEMISTRY SUBDIVISION AT THE GEOLOGICAL SURVEY OF CANADA.

FOR THE DETERMINATION OF ZN, CU, PB, NI, CO, AG, MN, FE, CD, AS AND SB A 1 GRAM SAMPLE WAS REACTED WITH 6 ML OF A MIXTURE OF 4M HNO₃ AND M HCL IN A TEST-TUBE OVERNIGHT AT ROOM TEMPERATURE. AFTER 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, 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.

AS WAS DETERMINED BY ATOMIC ABSORPTION USING A HYDRIDE EVOLUTION METHOD WHEREIN THE HYDRIDE (ASH₃) IS EVOLVED, PASSED THROUGH A HEATED QUARTZ TUBE IN THE LIGHT PATH OF AN ATOMIC ABSORPTION SPECTROPHOTOMETER. THE METHOD IS DESCRIBED BY ASLIN (1976).

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 HNO₃ 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 HNO₃ AND 1 ML CONCENTRATED HCL IN A TEST-TUBE FOR 10 MINUTES AT ROOM TEMPERATURE PRIOR TO 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 TO THE ELEMENTAL STATE BY THE ADDITION OF 10 ML 10% W/V S₂O₄ 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 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.
WITH THE EXCEPTION OF THE IRRADIATION FACILITY, THE METHOD IS VERY SIMILAR TO THAT USED BY AECL IN PREVIOUS YEARS, A DETAILED DESCRIPTION OF WHICH IS PROVIDED BY BOULANGER AT AL (1975).
A TWO GRAM SAMPLE WAS IRRADIATED FOR 10 SECONDS.
THE OPERATING FLUX WAS 8×10^{13} NEUTRONS/SQUARE CM/SECOND.
AFTER A 10 SECOND DELAY, THE SAMPLE WAS COUNTED FOR 10 SECONDS.
THE COUNTING EQUIPMENT WAS OF AECL DESIGN. CALIBRATION WAS DONE TWICE A DAY OR AS REQUIRED.
ONE STANDARD WAS ANALYSED AFTER EVERY 20 SAMPLES.

FLUORINE(1985) 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.

GOLD(1985) WAS USUALLY DETERMINED ON A 10 GRAM LAKE SEDIMENT SAMPLE, ALTHOUGH DEPENDING ON THE AMOUNT OF SAMPLE AVAILABLE, LESSER AMOUNTS WERE SOMETIMES USED. THIS RESULTED IN A VARIABLE DETECTION LIMIT; 1 PPB WITH A TEN GRAM SAMPLE, 2 PPB WITH A 5 GRAM 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 1 HOUR, COOLED FOR 4 HOURS, AND COUNTED BY GAMMA RAY SPECTROMETRY. CALIBRATION WAS CARRIED OUT USING STANDARD AND BLANK BEADS.

ANTIMONY(1985) WAS DETERMINED IN LAKE SEDIMENTS AS DESCRIBED BY ASLIN (1976). A 500 MG SAMPLE IS PLACED IN A TEST TUBE; 3 ML CONCENTRATED HNO₃ AND 9 ML CONCENTRATED HCL ARE ADDED AND THE MIXTURE IS ALLOWED TO STAND OVERNIGHT AT ROOM TEMPERATURE. THE MIXTURE IS HEATED SLOWLY TO 90C AND MAINTAINED AT THIS TEMPERATURE FOR AT LEAST 90 MINUTES. THE SOLUTION IS COOLED AND DILUTED TO 10 ML. A 400 UL ALIQUOT OF THIS TEST SOLUTION IS REMOVED 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.

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 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 NA₂CO₃ AND 4 GM CDTA(CYCLOHEXYLENE DINITRILE 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 LITER IN A VOLUMETRIC FLASK.

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 COMMERCIALY AS FLURAN AND COMPOSED OF SODIUM PYROPHOSPHATE AND SODIUM MONOPHOSPHATE, (HALL, G.E.M., 1979) IS ADDED TO PRODUCE THE URANYL PYROPHOSATE SPECIES WHICH FLUORESCES WHEN EXPOSED TO THE LASER.

SINCE ORGANIC MATTER IN THE SAMPLE CAN CAUSE UNPREDITCABLE BEHAVIOUR, A STANDARD ADDITION METHOD WAS USED.

FURTHER, THERE HAVE BEEN INSTANCES AT THE G.S.C. 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 UL 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 UL ALIQUOTS OF EITHER 55 OR 550 PPB U WERE USED).

ALL READINGS WERE TAKEN AGAINST A SAMPLE BLANK.

CONDUCTIVITY WAS MEASURED USING A RADIOMETER CONDUCTIVITY METER TYPE CDM 2F EQUIPPED WITH ELECTRODE CD 104. WATER SAMPLES WERE STORED AT ROOM TEMPERATURE UNTIL ANALYSED.

ALKALINITY WAS TITRATED TO PH 4.5 END POINT WITH 0.02 N SULPHURIC ACID USING A RADIOMETER SEMI-AUTOMATIC TITRATOR 11/PH METER M28 EQUIPPED WITH GLASS ELECTRODE G202C AND CALOMEL ELECTRODE K401. WATER SAMPLES WERE STORED AT ROOM TEMPERATURE UNTIL ANALYSED.

CALCIUM CASE1- FOR VALUES GREATER THAN 0.5 PPM --- INDUCTIVELY COUPLED PLASMA EMISSION (ICP)

CASE2- FOR VALUES LESS THAN 0.5 PPM ---- ATOMIC ABSORPTION WITH AN AIR-ACETYLENE FLAME

MAGNESIUM CASE1- FOR VALUES GREATER THAN 0.5 PPM --- ICP

CASE2- FOR VALUES LESS THAN 0.5 PPM ---- ATOMIC ABSORPTION WITH AN AIR-ACETYLENE FLAME

IRON --- ICP

REGIONAL LAKE SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA, MANITOBA 1985, GSC-OF 1288, NGR 87-1985, NTS 64C

THE FOLLOWING TABLES DISPLAY THE DATA RECORD FORMAT SPECIFICATIONS.
 THE DETECTION LIMITS OF THE ANALYTICAL METHODS ARE GIVEN.
 THE SECOND FIGURE UNDER THE DETECTION LIMIT HEADING IS USED
 ARBITRARILY TO DENOTE VALUES BELOW THE DETECTION LIMIT (USUALLY
 1/2 DETECTION LIMIT).

| ELEMENT | CARD | COLUMNS |
|----------------------|------|---------|
| FIELD | | |
| MAP | 1 | 01-06 |
| ID | 1 | 07-12 |
| UTM ZONE | 1 | 13-14 |
| UTM EAST (METER) | 1 | 15-20 |
| UTM NORTH (METER) | 1 | 21-27 |
| ROCK TYPE | 1 | 28-31 |
| LAKE AREA | 1 | 32-35 |
| SAMPLE DEPTH (METER) | 1 | 36-38 |
| REPLICATE STATUS | 1 | 39-40 |
| RELIEF | 1 | 41-43 |
| CONTAMINATION | 1 | 48-51 |
| SAMPLE COLOUR | 1 | 52-57 |
| SUSPENDED MATTER | 1 | 58-59 |

THE ANALYTICAL DATA WERE RECORDED AS FOLLOWS:

| ELEMENT | UNITS | CARD | COLUMNS | DETECTION LIMIT |
|------------------|----------|------|---------|-----------------|
| S E D I M E N T | | | | |
| ZN | PPM | 2 | 21-25 | 2 1 |
| CU | PPM | 2 | 26-30 | 2 1 |
| PB | PPM | 2 | 31-35 | 2 1 |
| NI | PPM | 2 | 36-40 | 2 1 |
| CO | PPM | 2 | 41-45 | 2 1 |
| AG | PPM | 2 | 46-50 | 0.2 0.1 |
| MN | PPM | 2 | 51-55 | 5 2 |
| AS | PPM | 2 | 56-60 | 1 0.5 |
| MO | PPM | 2 | 61-65 | 2 1 |
| FE | PCT | 2 | 66-70 | 0.02 0.01 |
| HG | PPB | 2 | 71-75 | 10 5 |
| LOI | PCT | 2 | 76-80 | 1.0 0.5 |
| AU-WT1 (WEIGHT1) | | 3 | 13-16 | |
| AU-WT2 (WEIGHT2) | | 3 | 17-20 | |
| U | PPM | 3 | 21-25 | 0.5 0.2 |
| F | PPM | 3 | 26-30 | 40 20 |
| V | PPM | 3 | 31-35 | 5 2 |
| CD | PPM | 3 | 36-40 | 0.2 0.1 |
| AU | PPB | 3 | 41-45 | VARIABLE |
| SB | PPM | 3 | 56-60 | 0.2 0.1 |
| AU-REPEAT | PPB | 3 | 76-80 | VARIABLE |
| W A T E R | | | | |
| F | PPB | 4 | 26-30 | 20 10 |
| PH | | 4 | 31-35 | |
| U | PPB | 4 | 36-40 | 0.05 0.02 |
| COND | UMHOS/CM | 5 | 21-25 | |
| HCO3 | PPM | 5 | 26-30 | 20 10 |
| CA | PPM | 5 | 31-35 | |
| MG | PPM | 5 | 36-40 | |
| FE | PPB | 5 | 41-45 | 0.02 0.01 |

PRESENTATION OF GOLD DATA AND COMMENTS REGARDING

INTERPRETATION OF RESULTS

THE FOLLOWING DISCUSSION REVIEWS THE FORMAT USED TO PRESENT THE AU GEOCHEMICAL DATA AND OUTLINES SOME IMPORTANT POINTS TO CONSIDER WHEN INTERPRETING THESE 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.

UNDERSTANDING 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 ENSURES 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. GOLD CONCENTRATIONS OF A FEW PPM MAY REPRESENT ECONOMIC DEPOSITS. BACKGROUND LEVELS ENCOUNTERED FOR STREAM AND CENTRE-LAKE SEDIMENTS SELDOM EXCEED 10 PPB, AND COMMONLY ARE NEAR THE DETECTION LIMIT OF 1 PPB.

THE MANY FOREGOING 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 OBTAINING 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.

GOLD DATA DISCUSSION CONTINUED

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, REPEAT ANALYSES ON A SECOND SUBSAMPLE ARE PERFORMED FOR ALL SAMPLES HAVING VALUES THAT ARE STATISTICALLY ABOVE APPROXIMATELY THE 90TH PERCENTILE OF THE TOTAL DATA SET;
- 3) FOR LAKE SEDIMENTS ONLY, 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 HIGHLY VARIABLE THAN IN SAMPLES WITH A HIGHER LOI CONTENT.

AU DATA PRESENTATION, STATISTICAL TREATMENT AND THE VALUE MAP FORMAT ARE SOMEWHAT DIFFERENT THAN FOR OTHER ELEMENTS. AU DATA LISTED IN THIS OPEN FILE INCLUDES INITIAL ANALYTICAL RESULTS, VALUES DETERMINED FROM REPEAT ANALYSES, TOGETHER WITH SAMPLE WEIGHTS AND CORRESPONDING DETECTION LIMITS FOR ALL ANALYZED SAMPLES.

THE GOLD HISTOGRAM, STATISTICAL PARAMETERS, AND REGIONAL TREND MAP ARE DETERMINED USING THE FOLLOWING DATA POPULATION SELECTION CRITERIA:

- 1) ONLY THE FIRST VALUE OF A REPEAT ANALYSIS IS UTILIZED;
- 2) AU VALUES DETERMINED FROM SAMPLE WEIGHTS LESS THAN 10 G ARE EXCLUDED.
- 3) AU VALUES LESS THAN THE DETECTION LIMIT(<1PPB) FOR 10 G SAMPLES ARE SET TO 0.5 PPB.

GOLD DATA DISCUSSION CONTINUED

ON THE VALUE MAPS, REPEAT ANALYSIS VALUES (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.

REFERENCES

- ASLIN, G.E.M. (1976) THE DETERMINATION OF ARSENIC AND ANTIMONY IN GEOLOGICAL MATERIALS BY FLAMELESS ATOMIC ABSORPTION SPECTROPHOTOMETER
JOURNAL OF GEOCHEMICAL EXPLORATION, VOL. 6, PP. 321-330.
- BOULANGER, A., EVANS, D.J.R. AND RABY, B.F. (1975) URANIUM ANALYSIS BY NEUTRON ACTIVATION DELAYED NEUTRON COUNTING: PROC. OF THE 7TH ANNUAL SYMP. OF CANADIAN MINERAL ANALYSTS. THUNDER BAY, ONTARIO, SEPT. 22-23, 1975.
- 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.
- 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.
- 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, GEOL. SURV. CAN. 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: GEOL. SURV. CAN. PAPER 73-21.

REGIONAL LAKE SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA, MANITOBA 1985, GSC-OF 1288, NGR 87-1985, NTS 64C

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 COORDINATS- 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

SMP DTH- SAMPLE DEPTH MEASURED TO THE NEAREST FOOT

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

REL- RELIEF OF THE SURROUNDING LAKE CATCHMENT BASIN

CONT- CONTAMINATION- HUMAN OR NATURAL(WORK-DRILL/TRENCH,
CAMP,FUEL OR GOSSAN)

SMPL COLOR- SEDIMENT COLOUR

SUSP- SUSPENDED MATTER

L A K E S E D I M E N T

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)

AG- SILVER BY ATOMIC ABSORPTION SPECTROSCOPY(PPM)

MN- MANGANESE BY ATOMIC ABSORPTION SPECTROSCOPY(PPM)

AS- ARSENIC BY COLOURIMETRY(PPM)

MO- MOLYBDENUM BY ATOMIC ABSORPTION SPECTROSCOPY(PPM)

FE- IRON BY ATOMIC ABSORPTION SPECTROSCOPY(%)

HG- MERCURY BY FLAMELESS SPECTROSCOPY(PPB)

LOI- LOSS ON IGNITION BY WEIGHT DIFFERENCE(%)

U- URANIUM BY DELAYED NEUTRON ACTIVATION(PPM)

F- FLUORINE BY SPECIFIC ION ELECTRODE(PPM)

V- VANADIUM BY ATOMIC ABSORPTION SPECTROSCOPY(PPM)

CD- CADMIUM BY ATOMIC ABSORPTION SPECTROSCOPY(PPM)

SB- ANTIMONY BY HYDRIDE EVOLUTION-ATOMIC ABSORPTION
SPECTROMETRY(PPM)

L A K E W A T E R

F-W- FLUORIDE IN WATER BY FISSION TRACK(PPB)

PH- PH BY COMBINATION GLASS-CALOMEL ELECTRODE

U-W- URANIUM IN WATERS BY SCINTREX(PPB)

COND- CONDUCTIVITY (UMHOS/CM)

HCO3- ALKALINITY (PPM)

CA-W- CALCIUM BY INDUCTIVELY COUPLED ARGON PLASMA (PPB)

MG-W- MAGNESIUM IN WATERS BY AIR-ACETYLENE (PPM)

FE-W- IRON BY INDUCTIVELY COUPLED ARGON PLASMA (PPB)

G O L D A N A L Y S I S

AU- GOLD BY FIRE ASSAY PRECONCENTRATION -
NEUTRON ACTIVATION(PPB)

AU-R- REPEAT GOLD BY FIRE ASSAY PRECONCENTRATION -
NEUTRON ACTIVATION(PPB)

AU WT1- WEIGHT OF ORIGINAL GOLD SAMPLE(GRAMS)

AU WT2- WEIGHT OF GOLD SAMPLE RE-ANALYZED(GRAMS)

DL1- GOLD DETECTION LIMIT BASED ON 1ST ANALYSIS WEIGHT

DL2- GOLD DETECTION LIMIT BASED ON RE-ANALYZED WEIGHT

REGIONAL LAKE SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA, MANITOBA 1985, GSC-OF 1288, NGR 87-1985, NTS 64C

ROCK TYPE:

AHIU- GRANITIC INTRUSIVE ROCKS,
POST-SICKLE (HUDSONIAN)

AHIA- LEUCOTONALITE PLUS MAGNETITE

AHIB- MEGACRYSTIC GRANITE

AHIC- GRANITE, GRANODIORITE
PLUS HORNBLLENDE

AHID- LEUCOGRANITE, GRANODIORITE

AHIE- MONZONITE, SYENITE

AHIF- PEGMATITE

AHIG- GRANITE, GRANODIORITE

AHIT- TONALITE, GRANODIORITE,
QUARTZ DIORITE

AHIP- PYROXENE TONALITE

AHIR- GABBRO, MINOR ULTRAMAFIC ROCK

ATIQ- QUARTZ DIORITE, DIORITE

ASAC- CONGLOMERATE

ASAS- ARKOSIC SANDSTONE

ASAN- SANDSTONE-DERIVED GNEISS,
MIGMATITE

APIR- GABBRO, NORITE, ULTRAMAFIC ROCK

APIT- TONALITE, GRANODIORITE, DIORITE

APIG- GRANITE

AGMC- CONGLOMERATE, GREYWACKE

ABMM- MAFIC GNEISS, VOLCANIC ROCK,
GREYWACKE, QUARTZITE, MARBLE

AIMA- AMPHIBOLITE, TUFF

ROCK TYPE: (CONT.)

AWSW- GREYWACKE, CONGLOMERATE,
MAFIC MUDSTONE

ABSW- GREYWACKE-DERIVED GNEISS, MIGMATITE

AISW- GREYWACKE-DERIVED GNEISS,
AND MIGMATITE

AWVI- FELSIC, INTERMEDIATE VOLCANICS

AWVD- DACITE, RHYOLITE

AWVM- MAFIC, INTERMEDIATE VOLCANICS

AWVA- BASALT, ANDESITE

AWVB- BASALT

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

RP ST: 00- ROUTINE REGIONAL SAMPLE
10- FIRST OF FIELD DUPLICATE
20- SECOND OF FIELD DUPLICATE

RELF: L- LOW
M- MEDIUM
H- HIGH

CONT: BLANK- NONE
1- PRESENT

SMPL COLOR: TN- TAN
YL- YELLOW
GN- GREEN
GY- GREY
BR- BROWN
BK- BLACK

SUSP: BLANK- NONE
L- LIGHT
H- HEAVY