

REGIONAL STREAM SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA, YUKON 1985, GSC-OF 1217, NGR 82-1985, NTS 105C

```
*****  
*                                     *  
*          OPEN FILE    1217        *  
*                                     *  
*****
```

	PAGE
SURVEY NOTES	1
DATA LIST	12
SUMMARY STATISTICS	54

GEOLOGICAL SURVEY OF CANADA OPEN FILE 1217.
REGIONAL STREAM SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA,
SOUTHERN YUKON 1985, NTS 105C.

OPEN FILE 1217 IS ONE OF FOUR OPEN FILES RELEASED IN 1986 (1217, 1218, 1219, 1220)
COVERING NTS 105C, 105D, 115H AND 115I RESPECTIVELY.

THE RECONNAISSANCE SURVEY WAS UNDERTAKEN BY THE GEOLOGICAL SURVEY OF CANADA IN
CONJUNCTION WITH THE DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT,
AND THE GOVERNMENT OF THE YUKON UNDER THE CANADA-YUKON MINERAL DEVELOPMENT
AGREEMENT (1985-1989).

E.H.W. HORN BROOK DIRECTED THE GEOLOGICAL SURVEY OF CANADA ACTIVITIES.

P.W.B. FRISKE COORDINATED THE OPERATIONAL ACTIVITIES OF THE CONTRACTING
AND GEOLOGICAL SURVEY OF CANADA STAFF THROUGHOUT THE SURVEY.

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: - ROGERS EXPLORATION SERVICES, YUKON
- P.W.B. FRISKE, H.R. SCHMITT
- W.D. GOODFELLOW LET THE CONTRACT AND WITH BRENT MCINNES
ASSISTED IN MONITORING FIELD OPERATIONS.

PREPARATION: - GOLDR ASSOCIATES, OTTAWA, ONTARIO
- J.J. LYNCH

ANALYSIS: - BARRINGER MAGENTA LTD., REXDALE, ONTARIO
- BARRINGER MAGENTA (ALBERTA) LTD., CALGARY, ALBERTA
- CHEMEX LABS LTD., NORTH VANCOUVER, B.C.
- J.J. LYNCH

H.R. SCHMITT AND N.G. LUND COORDINATED OPEN FILE PRODUCTION.

B.E. ELLIOTT WAS RESPONSIBLE FOR DATA MANAGEMENT AND FOR THE PREPARATION
OF THE REGIONAL TREND MARGINAL MAPS UTILIZING A PROGRAM DEVELOPED BY
D. J. ELLWOOD.

J. YELLE 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 AND TRUCK SUPPORTED SAMPLE COLLECTION WAS CARRIED OUT DURING
THE SUMMER OF 1985.
STREAM SEDIMENT AND WATER SAMPLES WERE COLLECTED AT AN AVERAGE DENSITY OF ONE
SAMPLE PER 13 SQUARE KILOMETERS THROUGHOUT THE 12,200 SQUARE KILOMETERS OF THE
SURVEY AREA (105C).

SAMPLE SITE DUPLICATE SAMPLES WERE ROUTINELY COLLECTED IN EACH ANALYTICAL BLOCK OF TWENTY SAMPLES.

IN OTTAWA, FIELD DRIED SAMPLES WERE AIR-DRIED, SIEVED THROUGH AN 80 MESH SCREEN AND BALL MILLED. THE BALL MILLED 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 STREAM WATER AND SEDIMENT FIELD CARDS (REV. 74) USED BY THE GEOLOGICAL SURVEY OF CANADA (GARRETT, 1974).

THE SAMPLE SITE POSITIONS WERE MARKED ON APPROPRIATE 1/50,000 SCALE NTS MAPS IN THE FIELD, AND LATER TRANSFERRED TO 1/250,000 SCALE NTS MAPS.

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 STREAM 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 RESOURCE GEOCHEMISTRY SUBDIVISION AT THE GEOLOGICAL SURVEY OF CANADA.

FOR THE DETERMINATION OF ZN, CU, PB, NI, CO, AG, MN, FE, CD, AND AS A 1 GRAM SAMPLE WAS REACTED WITH 3 ML CONC. HNO₃ 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 30 MINUTES WITH PERIODIC SHAKING. 1 ML CONC. HCL WAS ADDED AND HEATING WAS CONTINUED FOR ANOTHER 90 MINUTES.

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 SnSO₄ 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.
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 5×10^{11} NEUTRONS/SQ.CM./SEC.
THE SAMPLES ARE PNEUMATICALLY TRANSFERRED FROM AN AUTOMATIC LOADER TO THE REACTOR, WHERE EACH SAMPLE IS IRRADIATED FOR 20 SECONDS.
AFTER IRRADIATION, THE SAMPLE IS AGAIN TRANSFERRED PNEUMATICALLY TO THE COUNTING FACILITY WHERE AFTER A 10 SECOND DELAY THE SAMPLE IS COUNTED FOR 20 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.

TUNGSTEN WAS DETERMINED AS FOLLOWS: A 0.2 GRAM SAMPLE OF STREAM SEDIMENT WAS FUSED WITH 1 GRAM K₂S₂O₇ IN A RIMLESS TEST TUBE AT 575C FOR 15 MINUTES IN A WATER BATH HEATED TO 85C. AFTER THE SOLUBLE MATERIAL HAD COMPLETELY DISSOLVED, THE INSOLUBLE MATERIAL WAS ALLOWED TO SETTLE AND AN ALIQUOT OF 5 ML WAS TRANSFERRED TO ANOTHER TEST TUBE. 5 ML OF 20% SNCL₂ SOLUTION WERE THEN ADDED TO THE SAMPLE ALIQUOT, MIXED AND HEATED FOR 10 MINUTES AT 85C IN A HOT WATER BATH. A 1 ML ALIQUOT OF DITHIOL SOLUTION (1% DITHIOL IN ISO-AMYL ACETATE) WAS ADDED TO THE TEST SOLUTION AND THE TEST SOLUTION WAS THEN HEATED FOR 4-6 HOURS AT 80-85C IN A HOT WATER BATH. THE TEST SOLUTION WAS THEN REMOVED FROM THE HOT WATER BATH, COOLED AND 2.5 ML OF KEROSENE ADDED TO DISSOLVE THE GLOBULE. THE COLOUR INTENSITY OF THE KEROSENE SOLUTION WAS MEASURED AT 630 NM USING A SPECTROPHOTOMETER.
A DETAILED DESCRIPTION OF THE METHOD IS GIVEN BY QUIN AND BROOKS (1972)

BARIUM WAS DETERMINED AS FOLLOWS: A 0.25 GRAM SAMPLE WAS HEATED WITH 5 ML CONC. HF, 5 ML CONC. HClO₄ AND 2 ML CONC. HNO₃ TO FUMES OF HClO₄; 3 ML OF CONC. HClO₄ WERE ADDED AND HEATED TO LIGHT FUMES; 5 ML OF WATER WERE ADDED AND THE SOLUTION WAS TRANSFERRED TO A CALIBRATED TEST TUBE AND DILUTED TO 25 ML WITH WATER. BARIUM WAS DETERMINED BY ATOMIC ABSORPTION SPECTROSCOPY USING A NITROUS OXIDE ACETYLENE FLAME.

FLUORINE WAS DETERMINED IN STREAM 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.

ANTIMONY WAS DETERMINED IN STREAM 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 MICRO L ALIQUOT OF THIS TEST SOLUTION IS REMOVED AND DILUTED TO 10 ML WITH 1.8M HCL. THE ANTIMONY IN AN ALIQUOT OF THIS DILUTE SOLUTION IS THEN DETERMINED BY HYDRIDE EVOLUTION-ATOMIC ABSORPTION SPECTROMETRY .

TIN IN STREAM SEDIMENTS WAS DETERMINED AS FOLLOWS: A 200 MG SAMPLE IS HEATED WITH NH₄I; THE SUBLINED SNI₄ IS DISSOLVED IN ACID AND THE TIN DETERMINED BY HYDRIDE-ATOMIC ABSORPTION SPECTROMETRY.

GOLD WAS USUALLY DETERMINED ON A 10 GRAM STREAM SEDIMENT SAMPLE, ALTHOUGH DEPENDING ON THE AMOUNT OF SAMPLE AVAILABLE, LESSER WEIGHTS WERE SOMETIMES USED. THIS RESULTED IN A VARIABLE DETECTION LIMIT: 2 PPB FOR A 5 GRAM SAMPLE, 1 PPB FOR A 10 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.

FLUORIDE IN STREAM 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 NaCl 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 UNPREDICTABLE 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.

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
 AS AN ARBITRARY SET VALUE IF THE RESULTS FALL BELOW THE
 DETECTION LIMIT. (USUALLY 1/2 THE DETECTION LIMIT)

TABLE 1

ELEMENT FIELD	CARD	COLUMNS
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
SAMPLE MATERIAL	1	32
STREAM WIDTH (DECIMETER)	1	33-35
STREAM DEPTH (DECIMETER)	1	36-38
REPLICATE STATUS	1	39-40
CONTAMINATION	1	41
BANK TYPE	1	42
WATER COLOUR	1	43
FLOW RATE	1	44
SEDIMENT COLOUR	1	45
SAMPLE COMPOSITION	1	46-48
PRECIPITATE IN STREAM	1	49
DISTINCTIVE PRECIPITATE	1	50
GENERAL PHYSIOGRAPHY	1	55
DRAINAGE PATTERN	1	56
STREAM TYPE	1	57
STREAM CLASS	1	58
SOURCE OF WATER	1	59
AGE	1	72-73

TABLE 2

THE ANALYTICAL DATA WERE RECORDED AS FOLLOWS:

ELEMENT	UNITS	CARD	COLUMNS	DETECTION LIMIT	
SEDIMENT					
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	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 WEIGHT		3	13-16		
REPEAT AU WEIGHT		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
W	PPM	3	46-50	2	1
SN	PPM	3	51-55	1	0.5
SB	PPM	3	56-60	0.2	0.1
BA	PPM	3	61-65	40	20
REPEAT AU	PPB	3	76-80	VARIABLE	
WATER					
F	PPB	4	26-30	20	10
PH		4	31-35		
U	PPB	4	36-40	0.05	0.02

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 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.

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 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.
- QUIN, B.F. AND BROOKS, R.R. (1972) THE RAPID DETERMINATION OF TUNGSTEN IN SOILS, STREAM SEDIMENTS, ROCKS AND VEGETATION. ANAL. CHIM. ACTA. 58 PP 301-309.

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 THE CATCHMENT AREA

AGE- STRATIGRAPHIC AGE OF ROCK TYPE

WD- WIDTH OF STREAM(DECIMETER) AT NEAREST SAMPLE SITE

DT- DEPTH OF STREAM SAMPLED TO NEAREST DECIMETER

SAMP- TYPE OF MATERIAL SAMPLED

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

CONT- CONTAMINATION

BANK- BANK TYPE

WCOL- WATER COLOUR AND SUSPENDED LOAD

RATE- WATER FLOW RATE

SCOL- PREDOMINANT SEDIMENT COLOUR

SMP CMP- SAMPLE COMPOSITION- BULK MECHANICAL COMPOSITION OF
SAND, FINES AND ORGANICS RESPECTIVELY

PPPS- PRECIPITATE OR STAIN ON SEDIMENTS AT SAMPLE SITE

PRPB- DISTINCTIVE PRECIPITATE, STAIN, WEATHERING, BLOOMS
ON ROCKS IN IMMEDIATE CATCHMENT AREA

PHYS- GENERAL PHYSIOGRAPHY

PATT- DRAINAGE PATTERN

TYPE- STREAM TYPE

CLSE- STREAM CLASS

SRCE- SOURCE OF WATER

ROCK TYPE:

TERTIARY

LATE TERTIARY

(LTG 62) - RHYOLITE PORPHYRY, GRANITE, GRANODIORITE.

CRETACEOUS AND TERTIARY

(KTVD 56) - ANDESITE AND DACITE PORPHYRY.

CRETACEOUS

(KY 52) - SYENITE, MONZONITE.

(QOM 52) - QUARTZ MONZONITE, GRANODIORITE; CASSIAR
QUARTZ MONZONITE, ALASKITE.

(KGD 52) - GRANODIORITE.

JURASSIC AND CRETACEOUS

(JKDI 51) - DIORITE, HORNBLende DIORITE.

(JKB 51) - GABBRO, DIORITE, SOME ULTRAMAFIC ROCKS.

TRIASSIC AND JURASSIC

(TJS 46) - ARGILLITE, SANDSTONE, SILTSTONE.

(TJSV 46) - VOLCANIC AND SEDIMENTARY ROCKS.

(TJVP 46) - AUGITE, HORNBLende FELDSPAR PORPHYRY.

TRIASSIC

(TV 42) - BASALTIC GREENSTONE.

UPPER TRIASSIC

(UTLW 45) - LEWES RIVER GROUP: GREYWACKE, ARGILLITE,
CONGLOMERATE.

MESOZOIC UNDIVIDED

(MGD 41) - GRANODIORITE, QUARTZ MONZONITE.

(MGDN 41) - FOLIATED HORNBLende GRANODIORITE,
QUARTZ MONZONITE.

ROCK TYPE (CONTINUED):

PALEOZOIC UNDIVIDED

(PC 09) - LIMESTONE.

(PGDN 09) - Pelly GNEISS: FOLIATED TO GNEISSIC
GRANODIORITE.

PERMIAN

(PT 36) - TESLIN: LIMESTONE.

CARBONIFEROUS AND PERMIAN

(CPH 35) - HORSEFEED: LIMESTONE.

(CPC 35) - LIMESTONE.

(CPK 35) - KEDAHDA: CHERT, ARGILLITE.

(CPV 35) - ANDESITE, BASALT, CHERT, TUFF.

(CPSN 35) - SCHIST, GNEISS; INCLUDES BIG SALMON
METAMORPHIC COMPLEX.

(CPUB 35) - SERPENTINITE, DIORITE, PYROXENITE,
PERIDOTITE.

PENNSYLVANIAN

(PCG 33) - LIMESTONE.

MISSISSIPPIAN

(MC 34) - LIMESTONE.

CARBONIFEROUS

(CC 30) - LIMESTONE.

(CE 30) - ENGLISHMANS GROUP: QUARTZITE, PHYLLITE, SCHIST,
CHERT, CONGLOMERATE, LIMESTONE.

(CTP 30) - CHERT, ARGILLITE, PHYLLITE, QUARTZITE.

SILURIAN AND DEVONIAN

(SDCQ 24) - DOLOMITE, QUARTZITE, ARGILLITE.

AGE:

- 62 - LATE TERTIARY
- 56 - CRETACEOUS AND TERTIARY
- 52 - CRETACEOUS
- 51 - JURASSIC AND CRETACEOUS
- 46 - TRIASSIC AND JURASSIC
- 42 - TRIASSIC
- 45 - UPPER TRIASSIC
- 41 - MESOZOIC UNDIVIDED
- 09 - PALEOZOIC UNDIVIDED
- 36 - PERMIAN
- 35 - CARBONIFEROUS AND PERMIAN
- 33 - PENNSYLVANIAN
- 34 - MISSISSIPPIAN
- 30 - CARBONIFEROUS
- 24 - SILURIAN AND DEVONIAN

SAMP:

- 1 - STREAM BED SEDIMENT
- 6 - SIMULTANEOUS STREAM WATER AND SEDIMENT

RP ST:

- 00 - ROUTINE REGIONAL SAMPLE
- 10 - FIRST OF FIELD DUPLICATE

CONT:

- 0 - NONE
- 1 - POSSIBLE
- 4 - MINING ACTIVITY
- 8 - FORESTRY ACTIVITY

BANK:

- 0 - UNDEFINED UNCONSOLIDATED MATERIAL
- 1 - ALLUVIAL
- 2 - COLLUVIAL
- 5 - BARE ROCK
- 6 - TALUS, SCREE
- 7 - ORGANIC PREDOMINANT

WCOL:

- 0 - CLEAR
- 1 - BROWN TRANSPARENT
- 2 - WHITE CLOUDY
- 3 - BROWN CLOUDY

RATE:

- 0 - STAGNANT
- 1 - SLOW
- 2 - MODERATE
- 3 - FAST
- 4 - TORRENTIAL

SCOL:

- 1 - RED, BROWN
- 2 - WHITE, BUFF
- 3 - BLACK
- 4 - YELLOW
- 6 - GREY, BLUE GREY
- 8 - BUFF TO BROWN

SMP CMP:

PORTION OF EACH COMPONENT IS INDICATED AS A FRACTION OF THE TOTAL OF ALL THREE COLUMNS.

EXAMPLES:

- 013-NO SAND, 25% FINES, 75% ORGANICS
- 122-20% SAND, 40% FINES, 40% ORGANICS
- 030-NO SAND, 100% FINES, NO ORGANICS

PPPS:

- 0 - NONE
- 1 - RED, BROWN
- 2 - WHITE, BUFF
- 4 - YELLOW

PRPB:

- 1 - RED, BROWN
- 4 - YELLOW

PHYS:

- 0 - PLAIN
- 1 - MUSKEG, SWAMPLAND
- 2 - PENEPLAIN, PLATEAU
- 3 - HILLY, UNDULATING
- 4 - MOUNTAINOUS, MATURE
- 5 - MOUNTAINOUS, YOUTHFUL (PRECIPITOUS)

PATT:

- 0 - POORLY DEFINED, HAPHAZARD
- 1 - DENDRITIC
- 5 - DISCONTINUOUS SHIELD TYPE (CHAINS OF LAKES)

TYPE:

- 0 - UNDEFINED
- 1 - PERMANENT, CONTINUOUS
- 2 - INTERMITTENT

CLSE:

- 1 - PRIMARY
- 2 - SECONDARY
- 3 - TERTIARY

SRCE:

- 1 - GROUNDWATER
- 2 - SNOWMELT OR SPRING RUNOFF

F-W- FLUORIDE IN WATERS BY SPECIFIC ION ELECTRODE (PPB)
 PH- PH BY COMBINATION GLASS-CALOMEL ELECTRODE
 U-W- URANIUM IN WATERS BY SCINTREX (PPB)
 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)
 W- TUNGSTEN BY COLORIMETRY USING DITHIOL (PPM)
 SN- TIN BY HYDRIDE GENERATION-ATOMIC
 ABSORPTION SPECTROMETRY (PPM)
 SB- ANTIMONY BY HYDRIDE EVOLUTION-ATOMIC
 ABSORPTION SPECTROMETRY (PPM)
 BA- BARIUM BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)
 AU- GOLD BY FIRE ASSAY PRECONCENTRATION-NEUTRON
 ACTIVATION (PPB)
 AU-R- GOLD REPEAT ANALYSIS BY FIRE ASSAY PRECONCENTRATION-
 NEUTRON ACTIVATION (PPB)
 AU WT1- WEIGHT IN GRAMS OF ORIGINAL GOLD SAMPLE ANALYZED
 AU WT2- WEIGHT IN GRAMS OF REPEAT GOLD SAMPLE ANALYZED
 DL1- GOLD DETECTION LIMIT BASED ON ANALYSIS SAMPLE WEIGHT
 FOR INITIAL GOLD ANALYSIS
 DL2- GOLD DETECTION LIMIT BASED ON ANALYSIS SAMPLE WEIGHT
 FOR REPEAT GOLD ANALYSIS