

REGIONAL STREAM SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA, YUKON TERRITORY 1977. GSC-OF 519, NGR 30-1977, NTS 116A, 116H

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* OPEN FILE 519 *  
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OPEN FILE 519 IS ONE OF THREE OPEN FILES (518, 519 AND 520) COVERING THE TOTAL CENTRAL YUKON TERRITORY SURVEY AREA. IN ADDITION TO 1977 SURVEY DATA, THE OPEN FILES INCLUDE MOST OF THE PREVIOUSLY PUBLISHED DATA FROM THE 1976 SURVEYS (OPEN FILES 418, 419 AND 420) AND SOME NEW DATA FROM THE KENO HILL AREA. THE RECONNAISSANCE SURVEY WAS UNDERTAKEN BY THE GEOLOGICAL SURVEY OF CANADA UNDER THE FEDERAL URANIUM RECONNAISSANCE PROGRAM. FISHERIES AND ENVIRONMENT CANADA PROVIDED FUNDS FOR THE DETERMINATION OF MERCURY.

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 - STAFF AND EQUIPMENT PROVIDED BY STOKES EXPLORATION MANAGEMENT COMPANY, VANCOUVER.
VIKING HELICOPTERS LIMITED.
- W. GOODFELLOW.

PREPARATION - GOLDBER ASSOCIATES, OTTAWA.
- J.J. LYNCH

ANALYTICAL - CHEMEX LABS. LIMITED, VANCOUVER.
- ATOMIC ENERGY OF CANADA LIMITED, OTTAWA.
- BONDAR - CLEGG AND COMPANY LIMITED.
- 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 PREPARATION. DIRECT PHOTO-HEAD PLOTTING FACILITIES WERE MADE AVAILABLE BY THE MAP PRODUCTION DIRECTORATE, SURVEYS AND MAPPING BRANCH, E.M.R.

STREAM SEDIMENT AND WATER SAMPLES WERE COLLECTED AT AN AVERAGE DENSITY OF ONE SAMPLE PER 13 SQUARE KILOMETRES (5 SQUARE MILES) THROUGHOUT THE 63,000 SQUARE KILOMETRE (24,300 SQUARE MILE) TOTAL CENTRAL YUKON SURVEY AREA. THE HELICOPTER SUPPORTED SAMPLE COLLECTION WAS CARRIED OUT DURING THE SUMMER OF 1976 AND 1977 OVER 17,600 SQUARE KILOMETRE (6,800 SQUARE MILE) AND 42,800 SQUARE KILOMETRE (16,500 SQUARE MILE) RESPECTIVELY. THE KENO HILL AREA WAS SAMPLED IN 1964. SAMPLE SITE DUPLICATE SAMPLES WERE ROUTINELY COLLECTED IN EACH ANALYTICAL BLOCK OF TWENTY SAMPLES.

IN OTTAWA, FIELD DRIED SAMPLES WERE AIR-DRIED AND THE MINUS 80 MESH (177 MICRONS) FRACTION WAS OBTAINED AND THEN BALL MILLED FOR SUBSEQUENT ANALYSES. AS REQUIRED, AT THIS TIME, CONTROL REFERENCE AND BLIND DUPLICATE SAMPLE POSITIONS IN EACH ANALYTICAL BLOCK OF TWENTY SEDIMENT SAMPLES WERE FILLED. THE CONTROL REFERENCE AND BLIND DUPLICATE SAMPLE POSITIONS IN EACH ANALYTICAL

BLOCK OF TWENTY WATER SAMPLES WERE FILLED IN THE YUKON AT THE BASE CAMP.

THE DETERMINATION OF ZN, CU, PB, NI, CO, AG, MN, FE, MO, BA, W AND HG IN STREAM SEDIMENTS WAS CARRIED OUT BY CHEMEX LABS LIMITED.

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

THE DETERMINATION OF U, F AND PH IN STREAM WATERS WAS CARRIED OUT BY BONDAR - CLEGG AND COMPANY LIMITED.

FOR THE DETERMINATION OF ZN, CU, PB, NI, CO, AG, MN AND FE, A 1 GRAM SAMPLE WAS REACTED WITH 3 ML OF CONCENTRATED HNO₃ IN A TEST-TUBE FOR 30 MINUTES AT 90C. AT THIS POINT, 1 ML CONCENTRATED HCL WAS ADDED AND THE DIGESTION WAS CONTINUED AT 90C FOR AN ADDITIONAL 90 MINUTES. 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 ABSORPTION SPECTROSCOPY USING AN AIR-ACETYLENE FLAME. BACKGROUND CORRECTIONS WERE MADE FOR PB, NI, CO AND AG.

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 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 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.

BARIUM WAS DETERMINED BY ATOMIC ABSORPTION SPECTROSCOPY USING A NITROUS OXIDE-ACETYLENE FLAME. A 0.5 GRAM SAMPLE WAS DECOMPOSED WITH 5 ML CONCENTRATED HF, 5 ML CONCENTRATED HClO₄ AND 2 ML CONCENTRATED HNO₃. THE SAMPLE WAS THEN HEATED TO FUMES OF PERCHLORIC ACID AND THEN TO DRYNESS. 3 ML CONCENTRATED HClO₄ WERE ADDED TO THE RESIDUE, HEATED TO LIGHT FUMES AND THEN 5 ML OF WATER WERE ADDED.

THE SAMPLE SOLUTION WAS THEN TRANSFERRED TO A TEST TUBE CALIBRATED AT 25 ML, CONTAINING 0.5 ML IONIZATION BUFFER SOLUTION (0.05 GRAM NA₂CO₃/ML). THE SAMPLE SOLUTION WAS DILUTED AND 25 ML, MIXED AND ANALYSED.

TUNGSTEN WAS DETERMINED AS FOLLOWS: A 0.2 GRAM SAMPLE OF STREAM SEDIMENT WAS FUSED WITH 1 GRAM KH₂SO₄ IN A RIMLESS TEST TUBE AT 575C FOR 15 MINUTES IN A FURNACE. THE COOLED MELT WAS THEN LEACHED WITH 10 ML CONCENTRATED HCL 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 CONTAINING THE TUNGSTEN-DITHIOL COMPLEX. THE ABSORBANCE OF THE KEROSENE SOLUTION WAS MEASURED AT 630 NM USING A SPECTROPHOTOMETER.

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 10¹² 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 WAS DETERMINED IN THE WATER SAMPLES BY A FLUOROMETRIC METHOD. THE URANIUM WAS INITIALLY PRECONCENTRATED BY EVAPORATION. THE RESIDUE AFTER EVAPORATION WAS FUSED WITH A MIXTURE OF NAF AND LIF IN A PLATINUM DISH, AFTER COOLING THE FLOURESCENCE OF THE FUSED PELLETT WAS MEASURED USING A JARREL-ASH FLUOROMETER MODEL 26-000.

FLUORIDE IN STREAM WATER SAMPLES WAS DETERMINED USING A SPECIFIC ION ELECTRODE. AN ALIQUOT OF THE SAMPLE WAS MIXED WITH AN EQUAL VOLUME OF A TISAB SOLUTION (TOTAL IONIC STRENGTH ADJUSTMENT BUFFER). THE FLUORIDE WAS MEASURED INITIALLY WITH A CHEMTRIX AND SUBSEQUENTLY WITH A FISHER ACCUMET EXPANDED SCALE METER USING AN ORION FLUORIDE ELECTRODE.

FOR THE DETERMINATION OF PH AN ALIQUOT OF THE WATER SAMPLE WAS TRANSFERRED TO A CLEAN DRY BEAKER. THE PH WAS MEASURED USING A CHEMTRIX EXPANDED SCALE PH METER WITH A CORNING COMBINATION ELECTRODE.

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 GEOCHEMICAL STREAM WATER AND SEDIMENT SAMPLE FIELD CARDS (REV. 77) USED BY THE GEOLOGICAL SURVEY OF CANADA. 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 STREAM CATCHMENT BASINS WERE IDENTIFIED ON A GEOLOGICAL MAPS WITH MODIFIED LEGENDS COMPILED BY W. GOODFELLOW GEOLOGICAL SOURCES ARE GIVEN IN THE REFERENCES.

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
FE %	1	56-60	0.02	0.01
BA	1	61-65	40	20
MO	1	66-70	2	1
W	1	71-75	4	2
HG PPB	1	76-79	10	5
U	2	21-25	0.2	0.1
WATER				
U PPB	3	21-25	0.05	0.02
F PPB	3	26-30	20	10

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 GEOCHEMISTRY SECTION AT THE GEOLOGICAL SURVEY OF CANADA.

REFERENCES

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DATA LIST LEGEND

MAP- NATIONAL TOPOGRAPHIC SYSTEM(NTS)- LETTERED QUADRANGLE
(SCALE 1:250000). PART OF SAMPLE NUMBER

SAMPLE- 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 CATCHMENT AREA

AGE- STRATIGRAPHIC AGE OF ROCK TYPE

WD- WIDTH OF STREAM (FEET) AT THE SAMPLE SITE

DT- DEPTH OF STREAM SAMPLED TO NEAREST TENTH OF FOOT

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, ORGANICS RESPECTIVELY

PRPS- PRECIPITATE OR STAIN ON SEDIMENTS AT SAMPLE SITE

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

* PHYS- GENERAL PHSYIOGRAPHY

* PATT- DRAINAGE PATTERN

* TYPE- STREAM TYPE

* CLSS- STREAM CLASS

* SRCE- SOURCE OF WATER

* THIS FIELD OBSERVATION WAS RECORDED FOR THE 1977 SURVEY ONLY

DATA LIST LEGEND (CONT'D)

ROCK TYPE:	GLCM- GLACIAL MATERIAL	RATE:	0- ZERO
	ARGL- ARGILLITE		1- SLOW
	SNDS- SANDSTONE		2- MODERATE
	SHLE- SHALE		3- FAST
	LMSN- LIMESTONE		4- TORRENTIAL
	QRTZ- QUARTZITE	SCOL:	1- RED, BROWN
	DLMT- DOLOMITE		3- BLACK
	SLSN- SILTSTONE		4- YELLOW
	UKNN- UNKNOWN		6- GREY, BLUE-GREY
AGE:	04- PROTEROZOIC (600 - 2400 M.Y.)	SMP CMP:	0- ABSENT
	11- PROTEROZOIC-PALEOZOIC		1- MINOR <33%
	12- CAMBRIAN		2- MEDIUM 33-67%
	15- ORDOVICIAN-SILURIAN		3- MAJOR >67%
	17- SILURIAN-DEVONIAN	PRPS:	0- NONE
	18- DEVONIAN		1- RED, BROWN
	19- DEVONIAN-MISSISSIPPIAN		2- WHITE, BUFF
	20- CARBONIFEROUS		4- YELLOW
	23- PENNSYLVANIAN-PERMIAN	PRPB:	0- FEATURELESS
	24- PERMIAN		1- RED, BROWN
	34- JURASSIC		4- YELLOW
	36- CRETACEOUS		
	44- QUATERNARY		
SAMP:	1- STREAM BED SEDIMENT	PHYS:	4- MOUNTAINOUS MATURE
	4- STREAM WATER		5- MOUNTAINOUS YOUTHFUL
	6- SIMULTANEOUS STREAM WATER AND SEDIMENT	PATT:	1- DENDRITIC
RP ST:	00- ROUTINE REGIONAL SAMPLE	TYPE:	1- PERMANENT, CONTINUOUS
	10- FIRST OF FIELD DUPLICATE		2- INTERMITTENT, SEASONAL
	20- SECOND OF FIELD DUPLICATE	CLSS:	1- PRIMARY
CONT:	0- NONE		2- SECONDARY
	1- POSSIBLE		3- TERTIARY
	2- PROBABLE	SRCE:	1- GROUNDWATER
	3- DEFINITE		2- SNOW MELT OR SPRING RUN-OFF
BANK:	1- ALLUVIAL		3- RECENT PRECIPITATION
	2- COLLUVIAL		
WCOL:	0- CLEAR		
	1- BROWN TRANSPARENT		
	2- WHITE CLOUDY		
	3- BROWN CLOUDY		

DATA LIST LEGEND (CONT'D)

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)
FE- IRON BY ATOMIC ABSORPTION SPECTROSCOPY (PCT)
BA- BARIUM BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)
MO- MOLYBDENUM BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)
W- TUNGSTON BY COLORIMETRY USING ZINC DITHIOL (PPM)
* HG- MERCURY BY FLAMELESS SPECTROSCOPY (PPB)
U- URANIUM BY DELAYED NEUTRON ACTIVATION (PPM)
U-W- URANIUM IN WATERS FLUOROMETRICALLY (PPB)
F-W- FLUORINE IN WATERS BY SPECIFIC ION ELECTRODE (PPB)
PH- PH BY COMBINATION GLASS - CALOMEL ELECTRODE

* THIS ELEMENT WAS ANALYSED FOR THE 1977 SURVEY ONLY