

REGIONAL STREAM SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA, YUKON TERR. 1978. GSC-OF565 (REV.80) NGR 45-1978 NTS 117A,B,C,D

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OPEN FILE 565 (REVISED, 1980) COVERS THE TOTAL NORTHERN YUKON AND NORTHWEST TERRITORIES SURVEY AREA.
THE REVISED FILE INCLUDES URANIUM CONTENT IN WATERS.
THE RECONNAISSANCE SURVEY WAS UNDERTAKEN BY THE GEOLOGICAL SURVEY OF CANADA UNDER THE FEDERAL URANIUM RECONNAISSANCE PROGRAM.

E.H.W. HORN BROOK DIRECTED GEOLOGICAL SURVEY OF CANADA ACTIVITIES.
W.D. GOODFELLOW, REGIONAL GEOCHEMIST WAS RESPONSIBLE FOR PLANNING,
COORDINATING AND SUPERVISING FIELD OPERATIONS.
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 BEMA INDUSTRIES LIMITED, LANGLEY, BRITISH COLUMBIA LIFTAIR INTERNATIONAL, CALGARY - W.D. GOODFELLOW
PREPARATION	- GOLDER ASSOCIATES, OTTAWA. - J.J. LYNCH
ANALYTICAL	- CHEMEX LABS. LIMITED, VANCOUVER. - ATOMIC ENERGY OF CANADA LIMITED, OTTAWA. - BARRINGER MAGENTA LIMITED, TORONTO - 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.
PLOTING FACILITIES WERE MADE AVAILABLE THROUGH THE GEOLOGICAL SURVEY OF CANADA AND THE COMPUTER SCIENCE CENTER OF 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 28,500 SQUARE KILOMETRE (11,000 SQUARE MILE) TOTAL NORTHERN YUKON AND NORTHWEST TERRITORIES SURVEY AREA.
THE HELICOPTER SUPPORTED SAMPLE COLLECTION WAS CARRIED OUT DURING THE SUMMER OF 1978.
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 AND W 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 BARRINGER MAGENTA 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.

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 NaCl/ML). THE SAMPLE SOLUTION WAS DILUTED AND 25 ML, MIXED AND ANALYSED. SAMPLES WITH HIGH BA CONCENTRATIONS WERE ANALYSED USING EMISSION SPECTROSCOPY BY THE CLAS SPECTROCHEMICAL LABORATORIES, G.S.C.

TUNGSTEN WAS DETERMINED AS FOLLOWS: A 0.2 GRAM SAMPLE OF STREAM SEDIMENT WAS FUSED WITH 1 GRAM KHSO₄ IN A RIMLESS TEST TUBE AT 575C FOR 15-20 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 OVERNIGHT 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 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 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 Na₂CO₃, K₂CO₃ AND NAF IN A PLATINUM DISH, AFTER COOLING THE FLOURESCENCE OF THE FUSED PELLET WAS MEASURED USING A TUNER FLUOROMETER MODEL 111.

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 USING ORION SELECTIVE AND REFERENCE ELECTRODES AND AN ORION ELECTROMETER.

FOR THE DETERMINATION OF PH AN ALIQUOT OF THE WATER SAMPLE WAS TRANSFERRED TO A CLEAN DRY BEAKER. THE PH WAS MEASURED USING GLASS AND CALOMEL ELECTRODES WITH AN ORION ELECTROMETER.

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.D. 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
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
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

NORRIS, D.K. (1978) GEOLOGICAL MAPS OF THE YUKON AND NORTHWEST TERRITORIES
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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.

GARRETT, R.G. (1974) FIELD DATA ACQUISITION METHODS FOR APPLIED GEOCHEMICAL
SURVEYS AT THE GEOLOGICAL SURVEY OF CANADA: GEOL SURV. CAN. PAPER 74-52

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

DATA LIST LEGEND (CONT'D)

ROCK TYPE:	LMSN- LIMESTONE CGLM- CONGLOMERATE QRTZ- QUARTZITE CCRK- CLASTIC ROCK SHLE- SHALE SNDS- SANDSTONE SLSN- SILTSTONE ALVM- ALLUVIUM GLCM- GLACIAL MATERIAL ALNT- ALNOITE MDSN- MUDSTONE PLLT- PHYLLITE GRNT- GRANITE UKNN- UNKNOWN	CONT: 0- NONE 4- MINING ACTIVITY INCLUDING PITTING, TRENCHING 7- DOMESTIC OR HOUSEHOLD SOURCES, GARBAGE 9- BURNED AREAS	PRPS: BLANK- NOT RECORDED 0- NONE 1- RED, BROWN 2- WHITE, BUFF 4- YELLOW 5- GREEN 6- GREY 8- BUFF TO BROWN
AGE:	06- HELIKIAN 12- CAMBRIAN MIDDLE 19- ORDOVICIAN - SILURIAN 26- DEVONIAN LOWER 30- CARBONIFEROUS 36- PERMIAN 42- TRIASSIC 47- JURASSIC 51- JURASSIC - CRETACEOUS 52- CRETACEOUS 53- CRETACEOUS LOWER 55- CRETACEOUS UPPER 57- TERTIARY UNDIVIDED 63- TERTIARY - QUATERNARY 64- QUATERNARY	BANK: 0- UNDEFINED UNCONSOLIDATED MATERIAL 1- ALLUVIAL 2- COLLUVIAL (RESIDUAL & MOUNTAIN SOILS) 3- GLACIAL TILL, TILLITE 4- GLACIAL OUTWASH, MORaine 5- BARE ROCK 6- TALUS, SCREE 7- ORGANIC PREDOMINANT	PRPB: 0- FEATURELESS 1- RED, BROWN PHYS: 0- FEATURELESS 1- PLAIN 3- HILLY UNDULATING 4- MOUNTAINOUS MATURE 5- MOUNTAINOUS YOUTHFUL
		WCOL: 0- CLEAR 1- BROWN TRANSPARENT 2- WHITE CLOUDY 3- BROWN CLOUDY	PATT: 0- POORLY DEFINED, HAPHAZARD 1- DENDRITIC 2- HERRING BONE 3- RECTANGULAR (JOINTED) 5- DISCONTINUOUS SHIELD TYPE (CHAINS OF LAKES, SWAMPS)
		RATE: BLANK- NOT RECORDED 0- ZERO 1- SLOW 2- MODERATE 3- FAST 4- TORRENTIAL	TYPE: 0- UNDEFINED 1- PERMANENT, CONTINUOUS 2- INTERMITTENT, SEASONAL 3- RE-EMERGENT, DISCONTINUOU
SAMP:	1- STREAM BED SEDIMENT 4- STREAM WATER 6- SIMULTANEOUS STREAM WATER AND SEDIMENT	SCOL: BLANK- NOT RECORDED 1- RED, BROWN 2- WHITE, BUFF 3- BLACK 4- YELLOW 5- GREEN 6- GREY, BLUE-GREY 8- BUFF TO BROWN	CLSS: 0- UNDEFINED 1- PRIMARY 2- SECONDARY 3- TERTIARY 4- QUATERNARY
RP ST:	00- ROUTINE REGIONAL SAMPLE 10- FIRST OF FIELD DUPLICATE 20- SECOND OF FIELD DUPLICATE	SMP CMP: BLANK- NOT RECORDED 0- ABSENT 1- MINOR <33% 2- MEDIUM 33-67% 3- MAJOR >67%	SRCE: BLANK- NOT RECORDED 0- UNKNOWN 1- GROUNDWATER 2- SNOW MELT OR SPRING RUN-OFF

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)
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