

REGIONAL STREAM SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA, BRITISH COLUMBIA 1977. GSC-OF 514 (REV.79) NGR 25-1977,NTS 82F

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OPEN FILE 514 (REVISED,1979) IS ONE OF THREE OPEN FILES (514, 515 AND 516) COVERING THE TOTAL SOUTHEASTERN BRITISH COLUMBIA SURVEY AREA.

THE RECONNAISSANCE SURVEY WAS UNDERTAKEN BY THE GEOLOGICAL SURVEY OF CANADA IN CONJUNCTION WITH THE BRITISH COLUMBIA DEPARTMENT OF ENERGY, MINES AND PETROLEUM RESOURCES UNDER THE TERMS OF THE CANADA-BRITISH COLUMBIA AGREEMENT ON A URANIUM RECONNAISSANCE PROGRAM.
FISHERIES AND ENVIRONMENT CANADA PROVIDED FUNDS FOR THE DETERMINATION OF MERCURY.
BRITISH COLUMBIA MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES HAVE PROVIDED THE TIN AND TUNGSTEN DATA.

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.
- S.B. BALLANTYNE, T.E. KALNINS (B.C.D.E.M.P.R).

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

ANALYTICAL - CHEMEX LABS. LIMITED, VANCOUVER.
- ATOMIC ENERGY OF CANADA LIMITED, OTTAWA.
- J.J. LYNCH
- W.M. JOHNSON (TIN AND TUNGSTON, ONLY) (B.C.D.E.M.P.R)

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.

PROVINCIAL LIASON WAS WITH N.C. CARTER, BRITISH COLUMBIA DEPARTMENT OF ENERGY, MINES AND PETROLEUM RESOURCES.

STREAM SEDIMENT AND WATER SAMPLES WERE COLLECTED AT AN AVERAGE DENSITY OF ONE SAMPLE PER 13 SQUARE KILOMETRES (5 SQUARE MILES) THROUGHOUT THE 37,700 SQUARE KILOMETRE (14,600 SQUARE MILE) TOTAL SOUTHEASTERN BRITISH COLUMBIA SURVEY AREA. THE HELICOPTER AND 4-WHEEL DRIVE TRUCK SUPPORTED SAMPLE COLLECTION WAS CARRIED OUT DURING THE SUMMER OF 1977.
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 BRITISH COLUMBIA AT THE BASE CAMP.

THE DETERMINATION OF ZN, CU, PB, NI, CO, AG, MN, FE, MO, W, HG AND SN 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 CHEMEX LABS LIMITED UNDER THE TERMS OF A SECOND CONTRACT.

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 ABSORTION SPECTROSCOPY USING AN AIR-ACETYLENE FLAME. BACKGROUND CORRECTIONS WERE MADE FOR PB, NI, CO AND AG.

MOLYBDENUM WAS DETERMINED BY ATOMIC ABSORTION 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.

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 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.

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 ABSORTION CELL MOUNTED IN THE LIGHT PATH OF AN ATOMIC ABSORTION SPECTROPHOTOMETER. ABSORTION MEASUREMENTS WERE MADE AT 253.7 NM.

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.

TIN WAS DETERMINED IN STREAM SEDIMENT SAMPLES BY A METHOD WHICH WAS ONLY SLIGHTLY MODIFIED FROM THAT DESCRIBED BY E.P. WELSCH AND T.T. CHAO (1976). A 1.0 GRAM SAMPLE IS HEATED WITH NH₄I IN A MODIFIED PYROPOT FURNACE FOR 15 MINUTES AT 500C. THIS REACTION WHICH CONVERTS THE TIN IN THE SAMPLE TO SNI₄, IS DONE IN A 25 X 200 MM TEST TUBE. AFTER COOLING, THE RESIDUE IS LEACHED WITH 20 ML OF A SOLUTION WHICH IS 5% V/V IN HCL AND 6% W/V IN ASCORBIC ACID. AFTER LEACHING, THE SAMPLE IS COOLED TO ROOM TEMPERATURE AND 5 ML OF 4% W/V TRIOCTYLPHOSPHINE OXIDE IN METHYL ISOBUTYL KETONE (MIBK) ARE ADDED. THE TEST TUBE IS CAPPED AND SHAKED FOR 60 SECONDS. THE SOLVENT LAYER IS THEN TRANSFERRED TO A SMALL TUBE AND CENTRIFUGED. THE TIN IN THE SOLVENT LAYER IS THEN DETERMINED BY ATOMIC ABSORPTION SPECTROSCOPY USING A NITROUS-OXIDE ACETYLENE FLAME AT 2863 ANGSTROM UNITS. STANDARDS ARE PREPARED IN A MANNER SIMILAR TO THE SAMPLES.

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 TURNER 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 A CORNING 101 ELECTROMETER WITH 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 FISHER ACCUMET PH METER.

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 MAP WITH A MODIFIED LEGEND COMPILED BY T.E. KALNINS AND S.B. BALLANTYNE FOR THE NGR GEOCHEMICAL MAPS. 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
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
SN	2	26-30	2	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 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

DATA LIST LEGEND (CONT'D)

ROCK TYPE:	TILL- TILL SYNT- SYENITE GRNT- GRANITE ANDS- ANDESITE ARGL- ARGILLITE SCST- SCHIST SLTE- SLATE GNSS- GNEISS SHLE- SHALE LMSN- LIMESTONE QRTZ- QUARTZITE CGLM- CONGLOMERATE DLMT- DOLOMITE	BANK:	0- UNDEFINED 1- ALLUVIAL 2- COLLUVIAL 3- GLACIAL TILL, TILLITE 4- GLACIAL OUTWASH, MORaine 5- BARE ROCK 6- TALUS, SCREE 7- ORGANIC PREDOMINANT	PHYS:	0- PLAIN 1- MUSKEG, SWAMPLAND 3- HILLY, UNDULATING 4- MOUNTAINOUS MATURE 5- MOUNTAINOUS YOUTHFUL
AGE:	42- TERTIARY 35- JURASSIC-CRETACEOUS 34- JURASSIC 33- TRIASSIC-JURASSIC 32- TRIASSIC 30- MESOZOIC UNDIVIDED 12- CAMBRIAN 10- PALEOZOIC UNDIVIDED 46- HADRYNIAN (WINDERMERE) 45- HELIKIAN (PURCELL)	WCOL:	0- CLEAR 1- BROWN TRANSPARENT 2- WHITE CLOUDY 3- BROWN CLOUDY	PATT:	0- POORLY DEFINED, HAPHAZARD 1- DENDRITIC 2- HERRING BONE 4- TRELLISED (FOLDED) 5- DISCONTINUOUS SHIELD TYPE (CHAINS OF LAKES, SWAMPS) 6- BASINAL (CLOSED) 7- OTHER
SAMP:	1- STREAM BED SEDIMENT 6- SIMULTANEOUS STREAM WATER AND SEDIMENT	RATE:	0- ZERO 2- MODERATE 3- FAST 4- TORRENTIAL	TYPE:	0- UNDEFINED 1- PERMANENT, CONTINUOUS 2- INTERMITTENT, SEASONAL 3- RE-EMERGENT, DISCONTINUOUS
RP ST:	00- ROUTINE REGIONAL SAMPLE 10- FIRST OF FIELD DUPLICATE 20- SECOND OF FIELD DUPLICATE	SCOL:	1- RED, BROWN 2- WHITE, BUFF 3- BLACK 4- YELLOW 6- GREY, BLUE-GREY	CLSS:	0- UNDEFINED 1- PRIMARY 2- SECONDARY 3- TERTIARY 4- QUATERNARY
CONT:	0- NONE 1- POSSIBLE 2- PROBABLE 3- DEFINITE 4- MINING ACTIVITY, INCLUDING PITTING, TRENCHING 5- INDUSTRIAL SOURCES 6- AGRICULTURE (FARMING, CHEMICAL FERTILIZERS) 7- DOMESTIC, HOUSEHOLD SOURCES 8- FORESTRY ACTIVITY	SMP CMP:	0- ABSENT 1- MINOR <33% 2- MEDIUM 33-67% 3- MAJOR >67%	SRCE:	0- UNKNOWN 1- GROUNDWATER 2- SNOW MELT OR SPRING RUN-OFF 3- RECENT PRECIPITATION 4- ICE-CAP OR GLACIER MELT WATER
		PRPS:	0- NONE 1- RED, BROWN 2- WHITE, BUFF 6- GREY		
		PRPB:	0- FEATURELESS 1- RED, BROWN 2- WHITE, BUFF 3- BLACK 4- YELLOW 5- GREEN 6- BLUISH		

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)
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)
SN- TIN BY ATOMIC ABSORPTION SPECTROSCOPY (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