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*          OPEN FILE    561          *  
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OPEN FILE 561 (REVISED, 1980) IS ONE OF TWO OPEN FILES (561 AND 562) COVERING THE TOTAL NORTHERN BRITISH COLUMBIA SURVEY AREA. REVISED FILE INCLUDES URANIUM CONTENT OF WATERS.

THE RECONNAISSANCE SURVEY WAS UNDERTAKEN BY THE GEOLOGICAL SURVEY OF CANADA IN CONJUNCTION WITH THE BRITISH COLUMBIA DEPARTMENT OF MINES AND PETROLEUM RESOURCES UNDER THE TERMS OF THE CANADA-BRITISH COLUMBIA AGREEMENT ON A URANIUM RECONNAISSANCE PROGRAM.

E.H.W. HORN BROOK DIRECTED GEOLOGICAL SURVEY OF CANADA ACTIVITIES. S.B. BALLANTYNE, 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  
- S.B. BALLANTYNE.  
- G. NORDIN (BRITISH COLUMBIA MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES)

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

ANALYTICAL - CHEMEX LABS. LIMITED, VANCOUVER.  
- ATOMIC ENERGY OF CANADA LIMITED, OTTAWA.  
- BARRINGER MAGENTA LTD., 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. PLOTTING FACILITIES WERE MADE AVAILABLE THROUGH THE GEOLOGICAL SURVEY OF CANADA AND COMPUTER SCIENCE CENTER OF E.M.R.

PROVINCIAL LIASON WAS WITH N.C. CARTER, BRITISH COLUMBIA MINISTRY 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 25,900 SQUARE KILOMETRE (9,600 SQUARE MILE) TOTAL NORTHERN BRITISH COLUMBIA SURVEY AREA. THE HELICOPTER AND 4-WHEEL DRIVE TRUCK SUPPORTED SAMPLE COLLECTION WAS CARRIED OUT DURING THE SUMMER OF 1978. A TOTAL OF 80 LAKE SEDIMENTS AND WATERS WERE ALSO COLLECTED DURING THE SURVEY. LAKES ARE SHOWN ON THE MAPS BY A DOT (.) RATHER THAN BY A PLUS SIGN (+). A SEPERATE STATISTICAL EVALUATION WAS CARRIED OUT ON THE LAKE SEDIMENT AND WATER DATA. 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 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 LOSS ON IGNITION WAS CARRIED OUT BY THE GEOLOGICAL SURVEY OF CANADA.

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 HNO<sub>3</sub> 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 HNO<sub>3</sub> 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.

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 HEAT 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.

LOSS ON IGNITION OF LAKE SEDIMENTS WAS DETERMINED USING A 500 MG SAMPLE. THE SAMPLE, WEIGHED INTO A 30 ML BEAKER WAS PLACED IN A COLD MUFFLE FURNACE AND HEATED 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.

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 3.0 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 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 PELLETT 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 MAP WITH A MODIFIED LEGEND COMPILED BY G.D. NORDIN 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
LOI %	1	76-79	1	0.5
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
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.

THOROUGH INSPECTIONS OF THE FIELD AND ANALYTICAL DATA WERE MADE TO CHECK FOR ANY MISSING INFORMATION AND/OR 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.

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G.S.C. OPEN FILE 214 (JUNE, 1974) ISKUT RIVER BRITISH COLUMBIA.

## 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 LMSN- LIMESTONE GNSS- GNEISS DLMT- DOLOMITE CHRT- CHERT TUFF- TUFF GRNS- GREENSTONE SRPN- SERPENTINITE QZMZ- QUARTZ MONZONITE PLLT- PHYLLITE QRZD- QUARTZ DIORITE GRNT- GRANITE GRCK- GRAYWACKE	RATE:	0- ZERO 1- SLOW 2- MODERATE 3- FAST
		SCOL:	1- RED, BROWN 2- WHITE, BUFF 3- BLACK 6- GREY, BLUE-GREY
		SMP CMP:	0- ABSENT 1- MINOR <33% 2- MEDIUM 33-67% 3- MAJOR >67%
AGE:	08- PROTEROZOIC - CAMBRIAN 25- DEVONIAN 29- DEVONIAN - CARBONEFEROUS 30- CARBONIFEROUS 46- TIRASSIC - JURASSIC 48- JURASSIC LOWER 51- JURASSIC - CRETACEOUS 52- CRETACEOUS 53- CRETACEOUS LOWER 57- TERTIARY UNDIVIDED 63- TERTIARY - QUATERNARY 64- QUATERNARY	PRPS:	0- NONE 1- RED, BROWN 6- GREY
		PRPB:	0- FEATURELESS 1- RED, BROWN 4- YELLOW 5- GREEN
		PHYS:	2- PENEPLAIN, PLATEAU 3- HILLY UNDULATING 4- MOUNTAINOUS MATURE 5- MOUNTAINOUS YOUTHFUL
SAMP:	1- STREAM BED SEDIMENT 6- SIMULTANEOUS STREAM WATER AND SEDIMENT	PATT:	0- POORLY DEFINED, HAPHAZARD 1- DENDRITIC 2- HERRING BONE 5- DISCONTINUOUS SHIELD TYPE (CHAINS OF LAKES, SWAMPS)
RP ST:	00- ROUTINE REGIONAL SAMPLE 10- FIRST OF FIELD DUPLICATE 20- SECOND OF FIELD DUPLICATE	TYPE:	1- PERMANENT, CONTINUOUS 2- INTERMITTENT, SEASONAL 3- RE-EMERGENT, DISCONTINUOUS
CONT:	0- NONE 1- POSSIBLE	CLSS:	0- UNDEFINED 2- SECONDARY 3- TERTIARY 4- QUATERNARY
BANK:	2- COLLUVIAL (RESIDUAL & MOUNTAIN SOILS) 3- GLACIAL TILL, TILLITE 5- BARE ROCK 6- TALUS, SCREE 7- ORGANIC PREDOMINANT	SRCE:	1- GROUNDWATER 2- SNOW MELT OR SPRING RUN-OFF
WCOL:	0- CLEAR 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)  
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