

REGIONAL STREAM, LAKE SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA, BRITISH COLUMBIA 1986, GSC OF1360, NGR 96-1986, NTS 93E

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*      OPEN FILE    1360            *  
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GEOLOGICAL SURVEY OF CANADA OPEN FILE 1360.  
BRITISH COLUMBIA REGIONAL GEOCHEMICAL SURVEY RGS-16.  
REGIONAL STREAM SEDIMENT, LAKE SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE  
DATA, CENTRAL BRITISH COLUMBIA NTS 93E.

THE RECONNAISSANCE SURVEY WAS UNDERTAKEN BY THE BRITISH COLUMBIA MINISTRY OF  
ENERGY, MINES AND PETROLEUM RESOURCES (MEMPR) IN CONJUNCTION WITH THE GEOLOGICAL  
SURVEY OF CANADA UNDER THE CANADA-BRITISH COLUMBIA MINERAL DEVELOPMENT  
AGREEMENT (1985-1990).

W.M. JOHNSON DIRECTED THE BRITISH COLUMBIA MINISTRY OF ENERGY, MINES AND  
PETROLEUM RESOURCES ACTIVITIES.

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

P.W.B. FRISKE COORDINATED THE ACTIVITIES OF THE GEOLOGICAL SURVEY OF CANADA  
STAFF.

CONTRACTS LET FOR COLLECTION, SAMPLE PREPARATION AND ANALYSIS WERE THE  
RESPONSIBILITY OF, AND WERE SUPERVISED AND/OR MONITORED BY THE STAFF OF THE  
BRITISH COLUMBIA GEOLOGICAL SURVEY BRANCH OR EXPLORATION GEOCHEMISTRY  
SUBDIVISION AS FOLLOWS:

COLLECTION: - MCELHANNY ENGINEERING SERVICES LIMITED, VANCOUVER B.C.  
- P. MATYSEK, S. ZASTAVNIKOVICH (MEMPR)

PREPARATION: - KAMLOOPS RESEARCH AND ASSAY LABORATORIES, KAMLOOPS B.C.  
- W.M. JOHNSON (MEMPR)

ANALYSIS: - CHEMEX LABS LIMITED, VANCOUVER B.C.  
- BONDAR CLEGG AND COMPANY LTD., VANCOUVER B.C. (WATERS)  
- W.M. JOHNSON (MEMPR)

H.R. SCHMITT COORDINATED OPEN FILE PRODUCTION. (GSC)

A.C. GALLETTA MANAGED THE DIGITAL GEOCHEMICAL DATA AND PROVIDED COMPUTER  
PROCESSING SUPPORT. (GSC)

D.J. ELLWOOD DEVELOPED SOFTWARE TO RASTER PLOT OPEN FILE VALUE, SYMBOL AND  
REGIONAL TREND MAPS. THE PLOTTING WAS DONE BY CANADA LANDS DATA SYSTEMS  
STAFF AT ENVIRONMENT CANADA, HULL QUEBEC. (GSC)

COMPUTING, PLOTTING, AND OPEN FILE TEXT LASER PRINTING SERVICES, WERE  
PROVIDED BY THE COMPUTER SCIENCE CENTER, E.M.R.

J. YELLE AND F. WILLIAMS OF THE GEOLOGICAL INFORMATION DIVISION  
SUPERVISED THE PREPARATION OF OPEN FILE MAPS BY CARTOGRAPHY UNIT A-2. (GSC)

TRUCK, HELICOPTER, AND BOAT SUPPORTED SAMPLE COLLECTION WAS CARRIED OUT DURING THE SUMMER OF 1986. STREAM SEDIMENT AND WATER SAMPLES WERE COLLECTED AT AN AVERAGE DENSITY OF ONE SAMPLE PER 16 SQUARE KILOMETERS THROUGHOUT THE 14,770 SQUARE KILOMETERS OF THE CENTRAL BRITISH COLUMBIA SURVEY AREA NTS 93E. LAKE SEDIMENT AND WATER SAMPLES WERE COLLECTED AT AN AVERAGE DENSITY OF ONE SAMPLE PER 56 SQUARE KILOMETERS THROUGHOUT THE 93E SURVEY AREA. SAMPLE SITE DUPLICATE SAMPLES WERE ROUTINELY COLLECTED IN EACH ANALYTICAL BLOCK OF TWENTY SAMPLES.

IN KAMLOOPS, FIELD DRIED SAMPLES WERE AIR-DRIED. STREAM SEDIMENT SAMPLES WERE SIEVED THROUGH A MINUS 80 MESH (177 MICRON) SCREEN AND PULVERIZED IN A CERAMIC DISC PULVERIZER. THE PULVERIZED FRACTION WAS USED FOR SUBSEQUENT ANALYSES. FIELD DRIED LAKE SEDIMENT SAMPLES WERE AIR DRIED, CRUSHED AND PULVERIZED IN A CERAMIC DISC PULVERIZER TO AT LEAST MINUS 100 MESH. THE PULVERIZED FRACTION WAS USED FOR ANALYSIS.

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, LAKE WATER AND SEDIMENT FIELD CARDS (REV. 74) USED BY THE GEOLOGICAL SURVEY OF CANADA (GARRETT, 1974). THE SAMPLE SITE POSITIONS WERE MARKED ON APPROPRIATE 1/250,000 SCALE NTS MAPS IN THE FIELD. THESE MAPS WERE DIGITIZED AT THE GEOLOGICAL SURVEY IN OTTAWA TO OBTAIN THE SAMPLE SITE UTM COORDINATES.

THE 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 EXPLORATION GEOCHEMISTRY SUBDIVISION AT THE GEOLOGICAL SURVEY OF CANADA.

STREAM SEDIMENTS AND LAKE SEDIMENTS WERE ANALYZED FOR ZN, CU, PB, NI, CO, AG, MN, AS, MO, FE, HG, LOI, U, CD, W, BA, AND SB. THE SAMPLE DIGESTION PROCEDURE FOR STREAM AND LAKE SEDIMENTS WAS DIFFERENT FOR ZN, CU, PB, NI, CO, AG, MN, FE, CD, AND AS. ANALYTICAL METHODS FOR THESE ELEMENTS AS WELL AS SAMPLE DIGESTION AND ANALYTICAL METHODS FOR MO, HG, U, LOI, AND SB WERE SIMILAR FOR LAKE AND STREAM SEDIMENTS.

FOR THE DETERMINATION OF ZN, CU, PB, NI, CO, AG, MN, FE, CD, AND AS IN STREAM SEDIMENTS A 1 GRAM SAMPLE WAS REACTED WITH 3 ML CONC. HNO<sub>3</sub> 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.

FOR THE DETERMINATION OF ZN, CU, PB, NI, CO, AG, MN, FE, CD, AND AS IN LAKE SEDIMENTS A 1 GRAM SAMPLE WAS REACTED WITH 6 ML OF A MIXTURE OF 4M HNO<sub>3</sub> AND M HCL 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 2 HOURS WITH PERIODIC SHAKING.

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 (ASH<sub>3</sub>) IS EVOLVED, PASSED THROUGH A HEATED QUARTZ TUBE IN THE LIGHT PATH OF AN ATOMIC ABSORPTION SPECTROPHOTOMETER. THE METHOD IS DESCRIBED BY ASLIN (1976).

AS WAS DETERMINED BY ATOMIC ABSORPTION USING A HYDRIDE EVOLUTION METHOD WHEREIN THE HYDRIDE (ASH<sub>3</sub>) 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 WAS DETERMINED BY ATOMIC ABSORPTION 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.

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 HNO<sub>3</sub> 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 SnSO<sub>4</sub> IN M H<sub>2</sub>SO<sub>4</sub>. 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 WAS WEIGHED INTO A 7 DRAM POLYETHYLENE VIAL, CAPPED AND SEALED. THE IRRADIATION WAS PROVIDED BY THE SLOWPOKE REACTOR WITH AN OPERATING FLUX OF  $5 \times 10$  NEUTRONS/SQ.CM./SEC. THE SAMPLES WERE PNEUMATICALLY TRANSFERRED FROM AN AUTOMATIC LOADER TO THE REACTOR, WHERE EACH SAMPLE WAS IRRADIATED FOR 20 SECONDS. AFTER IRRADIATION, THE SAMPLE WAS AGAIN TRANSFERRED PNEUMATICALLY TO THE COUNTING FACILITY WHERE AFTER A 10 SECOND DELAY THE SAMPLE WAS COUNTED FOR 20 SECONDS WITH SIX HELIUM DETECTOR TUBES EMBEDDED IN PARAFFIN. FOLLOWING COUNTING, THE SAMPLES WERE AUTOMATICALLY EJECTED INTO A SHIELDED STORAGE CONTAINER. CALIBRATION WAS CARRIED OUT ONCE 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 K<sub>2</sub>S<sub>2</sub>O<sub>7</sub> 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% SNCL<sub>2</sub> 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. THE METHOD IS DESCRIBED BY QUIN AND BROOKS (1972).

TIN IN STREAM SEDIMENTS ONLY WAS DETERMINED AS FOLLOWS: A 200 MG SAMPLE WAS HEATED WITH NH<sub>4</sub>I; THE SUBLINED SNI<sub>4</sub> WAS DISSOLVED IN ACID AND THE TIN DETERMINED BY ATOMIC ABSORPTION SPECTROMETRY.

ANTIMONY WAS DETERMINED AS DESCRIBED BY (ASLIN, 1976). A 500 MG SAMPLE WAS PLACED IN A TEST TUBE; 3 ML CONCENTRATED HNO<sub>3</sub> AND 9 ML CONCENTRATED HCL ARE ADDED AND THE MIXTURE WAS ALLOWED TO STAND OVERNIGHT AT ROOM TEMPERATURE. THE MIXTURE WAS HEATED SLOWLY TO 90C AND MAINTAINED AT THIS TEMPERATURE FOR AT LEAST 90 MINUTES. THE SOLUTION WAS COOLED AND DILUTED TO 10 ML. A 400 MICRO L ALIQUOT OF THIS TEST SOLUTION WAS REMOVED AND DILUTED TO 10 ML WITH 1.8M HCL. THE ANTIMONY IN AN ALIQUOT OF THIS DILUTE SOLUTION WAS THEN DETERMINED BY HYDRIDE EVOLUTION-ATOMIC ABSORPTION SPECTROMETRY .

BARIUM WAS DETERMINED AS FOLLOWS: A 0.25 GRAM SAMPLE WAS HEATED WITH 5 ML CONC. HF, 5 ML CONC. HClO<sub>4</sub> AND 2 ML CONC. HNO<sub>3</sub> TO FUMES OF HClO<sub>4</sub>; 3 ML OF CONC. HClO<sub>4</sub> 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.

FLUORIDE IN 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 WAS PREPARED AS FOLLOWS: 58 GM NaCl AND 5 GM CDTA (CYCLOHEXYLENE DINITRILE ACETIC ACID) WERE DISSOLVED IN A MIXTURE OF 50 ML METAL FREE WATER AND 57 ML GLACIAL ACETIC ACID. THE SOLUTION WAS COOLED TO ROOM TEMPERATURE AND THE PH ADJUSTED TO BETWEEN 5.0 AND 5.5 BY THE SLOW ADDITION OF 5M NaOH SOLUTION. THE SOLUTION WAS COOLED AND DILUTED TO 1 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) WAS ADDED TO PRODUCE THE URANYL PYROPHOSPHATE 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.

TABLE -1 DISPLAYS THE DETECTION LIMITS OF THE ANALYTICAL METHODS.  
 THE FIGURE TO THE RIGHT OF THE EQUAL SIGN UNDER DETECTION LIMIT HEADING  
 CORRESPONDS TO AN ARBITRARILY SET VALUE IF THE RESULTS FALL BELOW THE  
 DETECTION LIMIT (USUALLY 1/2 THE DETECTION LIMIT) AND ARE USED FOR  
 MATHEMATICAL CALCULATIONS.  
 THE ANALYTICAL DATA WERE RECORDED AS FOLLOWS:

TABLE -1

FIELD	UNITS	RECORD	CHARACTERS	DETECTION LIMIT
SEDIMENT				
ZN	PPM	2	16-20	<2=1
CU	PPM	2	21-25	<2=1
PB	PPM	2	26-30	<2=1
NI	PPM	2	31-35	<2=1
CO	PPM	2	36-40	<2=1
AG	PPM	2	41-47	VARIABLE
MN	PPM	2	48-52	<5=3
AS	PPM	2	54-60	<1=.5
MO	PPM	2	61-65	VARIABLE
FE	PCT	2	66-70	<0.02=0.01
HG	PPB	2	71-75	<10=5
LOI	PCT	2	76-80	<1.0=.5
U	PPM	3	16-22	<0.5=0.3
CD	PPM	3	33-39	VARIABLE
SB	PPM	3	40-46	VARIABLE
W	PPM	3	47-51	<2=1
BA	PPM	3	52-56	<40=20
WATER				
F	PPB	4	26-30	<20=10
PH	LOG	4	31-35	
U	PPB	4	36-40	<0.05=0.03

REFERENCES

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DATA LIST LEGEND STREAMS

MAP-	NATIONAL TOPOGRAPHIC SYSTEM(NTS)- LETTERED QUADRANGLE (SCALE 1:50000). 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 SAMPLE SITE
DT-	DEPTH OF STREAM SAMPLED TO NEAREST DECIMETER
SAMP-	TYPE OF MATERIAL SAMPLED
RP ST-	REPLICATE STATUS- RELATIONSHIP OF SAMPLE TO OTHERS WITHIN THE THE BLOCK OF 20
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

DATA LIST LEGEND STREAMS (CONTINUED)

AGE:	RATE:	PATT:
44 - QUATERNARY	0 - ZERO	0 - POORLY DEFINED, HAPHAZARD
42 - TERTIARY	1 - SLOW	1 - DENDRITIC
41 - LOWER CENOZOIC/UPPER MESOZOIC	2 - MODERATE	2 - HERRINGBONE
36 - CRETACEOUS	3 - FAST	3 - RECTANGULAR
34 - JURASSIC	4 - TORRENTIAL	5 - DISCONTINUOUS SHIELD TYPE (CHAINS OF LAKES)
32 - PERMIAN		
10 - PALEOZOIC UNDIVIDED	SCOL:	TYPE:
	1 - RED, BROWN	1 - PERMANENT, CONTINUOUS
SAMP:	2 - WHITE, BUFF	2 - INTERMITTENT, SEASONAL
1 - STREAM BED SEDIMENT	3 - BLACK	3 - RE-EMERGENT, DISCONTINUOUS
6 - SIMULTANEOUS STREAM WATER AND SEDIMENT	4 - YELLOW	
	5 - GREEN	
	6 - GREY, BLUE GREY	CLSE:
RP ST:	SMP CMP:	1 - PRIMARY
00 - ROUTINE REGIONAL SAMPLE	PORTION OF EACH COMPONENT IS	2 - SECONDARY
10 - FIRST OF FIELD DUPLICATE	INDICATED AS A FRACTION OF THE	3 - TERTIARY
20 - SECOND OF FIELD DUPLICATE	TOTAL OF ALL THREE COLUMNS.	4 - QUATERNARY
	EXAMPLES:	SRCE:
CONT:	013-NO SAND, 25% FINES, 75% ORGANICS	0 - UNKNOWN
0 - NONE	122-20% SAND, 40% FINES, 40% ORGANICS	1 - GROUNDWATER
1 - POSSIBLE	030-NO SAND, 100% FINES, NO ORGANICS	2 - SNOW MELT OR SPRING RUNOFF
2 - PROBABLE		3 - RECENT PRECIPITATION
6 - AGRICULTURAL	PPPS:	4 - ICE CAP OR GLACIER MELT WATER
8 - FORESTRY ACTIVITY	0 - NONE	
	1 - RED, BROWN, BLACK	
BANK:	2 - WHITE OR BUFF	
0 - UNDEFINED, UNCONSOLIDATED MATERIAL	PRPB:	
1 - ALLUVIAL	0 - FEATURELESS	
2 - COLLUVIAL		
3 - GLACIAL TILL, TILLITE	PHYS:	
4 - GLACIAL OUTWASH SEDIMENTS	1 - MUSKEG, SWAMPLAND	
5 - BARE ROCK	2 - PENEPLAIN, PLATEAU	
6 - TALUS, SCREE	3 - HILLY, UNDULATING	
7 - ORGANIC PREDOMINANT	4 - MOUNTAINOUS, MATURE	
	5 - MOUNTAINOUS, YOUTHFUL (PRECIPITOUS)	
WCOL:		
0 - CLEAR		
1 - BROWN TRANSPARENT		
2 - WHITE CLOUDY		
3 - BROWN CLOUDY		

DATA LIST LEGEND LAKES

MAP-	NATIONAL TOPOGRAPHIC SYSTEM (NTS) - LETTERED QUADRANGLE (SCALE 1:50000). 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 LAKE CATCHMENT AREA	
AGE-	STRATIGRAPHIC AGE OF ROCK TYPE	
LAKE AREA-	AREA OF LAKE SAMPLED	
SMP DTH-	LAKE DEPTH AT SAMPLE SITE MEASURED TO THE NEAREST METER	
RP ST-	REPLICATE STATUS- RELATIONSHIP OF SAMPLE TO OTHERS WITHIN THE BLOCK OF TWENTY	
RELF-	RELIEF OF THE SURROUNDING LAKE CATCHMENT BASIN	
CONT-	CONTAMINATION- HUMAN OR NATURAL (WORK-DRILL/TRENCH, CAMP, FUEL OR GOSSAN)	
SMPL COLOR-	SEDIMENT COLOUR	
SUSP-	SUSPENDED MATTER	
LAKE AREA:	POND- POND LT 1- 1/4 TO 1 SQ KM 1-5- 1 TO 5 SQ KM GT 5- GREATER THAN 5 SQ KM	
RP ST:	00- ROUTINE REGIONAL SAMPLE 10- FIRST OF FIELD DUPLICATE 20- SECOND OF FIELD DUPLICATE	
RELF:	L- LOW M- MEDIUM H- HIGH	
CONT:	BLANK- NONE 1- PRESENT	
SMPL COLOR:	TN- TAN	GY- GREY
	YL- YELLOW	BR- BROWN
	GN- GREEN	BK- BLACK
SUSP:	BLANK- NONE L- LIGHT H- HEAVY	

ROCK TYPES:

NOTE: ROCK MNEMONICS AND AGE CODES ON THE  
LEFT (E.G. BSLT 42) WERE RECORDED ON THE  
FIELD CARDS, ARE LISTED IN THE DATA  
LISTINGS, AND WERE USED FOR STATISTICAL  
SUMMARIES.  
ROCK MNEMONICS ON THE RIGHT (E.G. UTCV)  
CORRESPOND TO THE ROCK UNIT LABEL ON THE  
OPEN FILE GEOLOGY BASE.

STRATIFIED ROCKS  
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QUATERNARY

PLEISTOCENE AND RECENT  
(TILL 44) - Q - GLACIAL, ALLUVIAL AND FLUVIAL DEPOSITS.

TERTIARY

CHILCOTIN GROUP  
(BSLT 42) - UTC - OLIVINE BASALT  
(BSLT 42) - UTCV - OLIVINE BASALT FLOWS; BRECCIA AND SEDIMENT.

ENDAHO GROUP  
(ANDS 42) - EMV - BASALT AND ANDESITE; MINOR BRECCIA AND TUFF.

CRETACEOUS (?) AND TERTIARY

OOTSJA LAKE GROUP  
(RYLT 41) - ER - RHYOLITE, QUARTZ FELDSPAR PORPHYRY.  
(RYLT 41) - UKEV - RHYOLITE AND DACITE FLOWS, BRECCIA AND TUFF;  
MINOR ANDESITE, BASALT AND CONGLOMERATE.

CRETACEOUS

(RYLT 41) - UKV - DACITIC TO BASALTIC VOLCANICS UNDIVIDED; FLOWS,  
TUFF AND BRECCIA.

KASALKA GROUP  
(RYLT 41) - UKK - RHYOLITE TO ANDESITE FLOWS, BRECCIA, TUFF, AND  
LAHAR; MINOR RED CONGLOMERATE AND SANDSTONE.

SKEENA GROUP  
(SLSN 36) - LKS - MICACEOUS SANDSTONE, SILTSTONE, SHALE; MINOR  
CONGLOMERATE.

GAMBIER GROUP  
(SLSN 36) - LKG - ANDESITE TO RHYOLITE FLOWS, TUFF, AND BRECCIA;  
MINOR CONGLOMERATE, SANDSTONE AND SILTSTONE.

ROCK TYPES (CONTINUED) :

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JURASSIC

(SHLE 34) - MJA - ASHMAN FORMATION: SHALE, SILTSTONE, SANDSTONE,  
GREYWACKE, LIMY SHALE; MINOR CHERT PEBBLE  
CONGLOMERATE AND TUFF.

LOWER AND MIDDLE JURASSIC

HAZELTON GROUP

(TUFF 34) - MJS - SMITHERS FORMATION: FELDSPATHIC VOLCANIC  
SANDSTONE, GREYWACKE, TUFF, BRECCIA, TUFFACEOUS  
SEDIMENTS; MINOR CONGLOMERATE, LIMESTONE AND  
FLOWS.  
(TUFF 34) - MJW - WHITESAIL FORMATION: RHYOLITE FLOWS, BRECCIA AND  
TUFF; MINOR SILTSTONE, SANDSTONE.  
(TUFF 34) - LJR - RED TUFF MEMBER: VARIEGATED BRECCIA AND TUFF.  
(TUFF 34) - LJT - TELKWA FORMATION: VARIEGATED BASALTIC TO  
RHYOLITIC TUFF, BRECCIA AND FLOWS; LESSER  
VOLCANIC SEDIMENTS.  
(TUFF 34) - LJTA - TELKWA FORMATION: RHYOLITIC TO DACITIC BRECCIA  
AND TUFF.

TRIASSIC

(VCCB 32) - UTRV - BASALTIC TO ANDESITIC BRECCIA AND TUFF; LESSER  
VOLCANIC SANDSTONE, ARGILLITE.

PERMIAN AND/OR OLDER

(GNSS 10) - PPH - FELSIC AND MAFIC TUFF AND VOLCANOGENIC SANDSTONE,  
PHYLLITE, AMPHIBOLITE, MARBLE, SKARN, FLASER GNEISS,  
MYLONITE AND SCHIST.

ROCK TYPES (CONTINUED) :

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STRATIFIED ROCKS

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PALEOZOIC

GAMSBY GROUP

(GNSS 10) - PG - FELSIC AND MAFIC TUFF AND VOLCANOGENIC SANDSTONE,  
PHYLLITE, AMPHIBOLITE, MARBLE, SKARN, FLASER GNEISS,  
MYLONITE AND SCHIST.

(GNSS 10) - PS - QUARTZ FELDSPAR + OR - BIOTITE, + OR - HORNBLENDE  
SCHIST, AMPHIBOLITE; LESSER GRANITOID GNEISS, MARBLE  
AND SKARN.

CENTRAL GNEISS COMPLEX

(GNSS 10) - PCG - GRANITOID GNEISS, MIGMATITE, AMPHIBOLITE, SCHIST.

ROCK TYPES (CONTINUED) :

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AN (\*) DENOTES A LOWER CASE MNEMONIC CHARACTER.

GRANITOID ROCKS

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TERTIARY

EOCENE

- (GRNT 42) - EG - GOOSLY LAKE INTRUSIONS: PORPHYRITIC GABBRO  
AND DIABASE.
- (GRNT 42) - EG\* - GRANITE, QUARTZ MONZONITE, QUARTZ PORPHYRY,  
FELSITE; PARTLY EQUIVALENT TO NANIKA INTRUSIONS.

PALEOCENE AND EOCENE

- (GRNT 42) - ETG - GRANITE TO QUARTZ DIORITE FELDSPAR PORPHYRY;  
PARTLY EQUIVALENT TO QUANCHUS INTRUSIONS.
- (GRNT 42) - TG - GRANODIORITE, QUARTZ MONZONITE, GRANITE; LESSER  
GNEISS AND MIGMATITE.

CRETACEOUS AND/OR TERTIARY

- (GRDR 36) - KTD - DIORITE, GABBRO, MICRODIORITE, SYENODIORITE;  
PARTLY EQUIVALENT TO KASALKA INTRUSIONS.
- (GRDR 36) - KTG - GRANODIORITE, QUARTZ MONZONITE, QUARTZ DIORITE.

CRETACEOUS

- (GRDR 36) - LKG - GRANODIORITE, QUARTZ DIORITE, MONZODIORITE, AND  
MONZONITE; PARTLY EQUIVALENT TO BULKLEY  
INTRUSIONS.

MESOZOIC AND/OR CENOZOIC

- (QRZD 41) - MTG - GRANODIORITE, QUARTZ MONZONITE, QUARTZ DIORITE,  
LESSER GRANITOID GNEISS, MIGMATITE.
- (QRZD 41) - MG - GREEN, CHLORITIZED QUARTZ DIORITE AND  
GRANODIORITE.
- (QRZD 41) - MGF - QUARTZ DIORITE; LESSER AUGEN GNEISS AND CHLORITE  
SCHIST.

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GRANITOID ROCKS

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JURASSIC

(QZMZ 34) - EJT - TOPLEY INTRUSIONS: PORPHYRITIC QUARTZ MONZONITE,  
GRANODIORITE; QUARTZ MONZODIORITE.

PALEOZOIC(?)

(DORT 10) - PMS - THIN BEDDED, RUSTY-WEATHERING SILICEOUS  
PORPHYRITIC VOLCANICS, RHYOLITE, SEDIMENTS;  
MINOR ARGILLITE, LIMESTONE (MAY ALSO BE CODED  
AS (QRZD 41) ).

(DORT 10) - PD - DIORITE, QUARTZ DIORITE AND GABBRO COMPLEXES;  
LESSER MAFIC DYKES, AMPHIBOLITE AND GREENSTONE;  
INCLUDES TAHTSA AND BLACKDOME COMPLEXES.

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 HYDRIDE EVOLUTION-ATOMIC ABSORPTION SPECTROSCOPY (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 NEUTRON ACTIVATION - DELAYED NEUTRON COUNTING (PPM)
CD-	CADMIUM BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)
W-	TUNGSTEN BY COLORIMETRY USING DITHIOL (PPM)
SB-	ANTIMONY BY HYDRIDE EVOLUTION-ATOMIC ABSORPTION SPECTROSCOPY (PPM)
BA-	BARIUM BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)
F-W-	FLUORIDE IN WATERS BY SPECIFIC ION ELECTRODE (PPB)
PH-	PH BY COMBINATION GLASS-CALOMEL ELECTRODE
U-W-	URANIUM IN WATERS BY LASER INDUCED FLUORESCENCE (PPB)