



Energy, Mines and
Resources Canada Énergie, Mines et
Ressources Canada



Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

Geological Survey of Canada
Commission géologique du Canada

Geological Survey Branch
Mineral Resources Division
Applied Geochemistry Subsection

Funded in part by the Canada/British Columbia Mineral Development Agreement

NATIONAL GEOCHEMICAL RECONNAISSANCE

1 : 250 000 MAP SERIES

TULSEQUAH, BRITISH COLUMBIA

(NTS 104K)

GSC
Open File 1647

MEMPR
BC RGS 20

1988

1987 Regional Geochemical Survey
104K - Tulsequah

BC MEMPR RGS 20, GSC OF 1647

ERRATA

Page 8, Paragraph 1

- 2) REPEAT ANALYSES ON A SECOND SAMPLE ARE PERFORMED ON 19% (N=168) OF THE SAMPLES. SEVENTY-SIX ARE RANDOMLY SELECTED AND THE REMAINDER (N=92) ARE SAMPLES HAVING VALUES THAT ARE STATISTICALLY ABOVE APPROXIMATELY THE 90TH PERCENTILE (>26 ppb Au) OF THE TOTAL DATA SET.

**NATIONAL GEOCHEMICAL RECONNAISSANCE
1:250,000 MAP SERIES**

**TULSEQUAH, BRITISH COLUMBIA
(NTS 104K)**

**MEMPR BC RGS 20, GSC OF 1647
1988**

SURVEY NOTES	PAGE 1
DATA LIST	PAGE 16
SUMMARY STATISTICS	PAGE 52

1987 Regional Geochemical Survey 104K - Tulsequah

British Columbia Regional Geochemical Survey RGS-20 Geological Survey of Canada Open File 1647 National Geochemical Reconnaissance 1:250 000 Map series NGR-112

INTRODUCTION

Regional stream sediment and water geochemical reconnaissance data of northwestern British Columbia is one of three open files released in 1988 (RGS 18,19 and 20) covering NTS 104B+C, 104F+G and 104K respectively.

The 1987 reconnaissance survey was undertaken by the British Columbia Ministry of Energy, Mines and Petroleum Resources in conjunction with the Geological Survey of Canada. Funding was provided in part by the GSC under a "Letter of Understanding" for a co-operative project and by the Canada -British Columbia Mineral Development Agreement (1985 - 1989).

P.F. Matysek, directed the British Columbia Ministry of Energy, Mines and Petroleum Resources activities.

E.H.W. Hornbrook 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 the staff of the Applied Geochemistry Subsection of the British Columbia Ministry of Energy, Mines and Petroleum Resources (MEMPR).

- COLLECTION** - McElhanney Engineering Services Limited, Vancouver, B.C.
- J.L. Gravel (MEMPR)
- SAMPLE PREPARATION** - Kamloops Research and Assay Lab, Kamloops, B.C.
- Wes Johnson (MEMPR)
- ANALYSIS** - Bondar Clegg and Company Ltd., North Vancouver (stream sediments)
- Barringer Magenta, Calgary, Alta. (stream waters)
- P.F. Matysek (MEMPR)
- DATA PREPARATION** - Elan Data Makers Ltd., Victoria, B.C. (keypunching data cards)
- British Columbia Geological Survey (data compilation and verification)
- S.J. Day, P.F. Matysek and J.L. Gravel (MEMPR)
- OPEN FILE PRODUCTION** - P.F. Matysek, S.J. Day, J.L. Gravel and W. Jackaman (MEMPR)

REGIONAL STREAM SEDIMENT AND WATER DATA, BRITISH COLUMBIA, 1987, BC RGS 20, GSC OF 1647, NTS 104K - TULSEQUAH

SAMPLE COLLECTION

Helicopter (97%) and truck (3%) supported sample collection was carried out during the summer of 1987. Stream sediment and water samples were collected from 847 sites at an average density of one site per 11.7 square kilometres throughout the 9,900 square kilometres of NTS map sheet 104K in northwestern British Columbia. Stream sediment samples ideally comprise 2 - 4 kg of sand size and finer inorganic material collected from low energy sites within the stream. Due to the rapid paced style of RGS sampling, large (6" X 5" with 2" gussets) Kraft paper sample bags were used to ensure sufficient (>40 gm) minus 80 mesh (<177 microns) fines were collected. Stream waters were taken using 250 ml nalgene plastic bottles flushed out with water from the stream prior to collection of the sample. Duplicate samples were routinely collected from a site once in each analytical block of twenty samples. To aid in the follow-up of survey results, highly visible aluminum tags (5 by 10 centimetres) bearing a unique RGS sample number were used to mark every sample site.

SAMPLE PREPARATION

Sediment samples were air dried, first on open air racks, and then within a heated (50C) drying shed. Dried samples were sieved to minus 18 mesh (approximately 1 mm) to reduce sample weight and to determine the fines content. Sample quality checks were ran by routinely sieving to minus 80 mesh (<177 microns) 1 sample in each block of 20, plus any samples suspected of low fines content. Samples found to be deficient in fines (<40 gm), were resampled. Field prepared samples were then shipped to Kamloops Research and Assay Labs for further sieving to minus 80 mesh (<177 microns). At this time, control reference samples 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 duplicates for water samples.

ANALYTICAL DETERMINATIONS

Stream Sediments

The prepared minus 80 mesh (<177 microns) fraction of sediment samples were sent to Bondar Clegg and Company Ltd. of North Vancouver for analytical determinations of elements listed in Table 1.

Stream Waters

Water samples were sent to Barringer Magenta Ltd. of Calgary, Albert for analysis of elements listed in Table 2.

REGIONAL STREAM SEDIMENT AND WATER DATA, BRITISH COLUMBIA, 1987, BC RGS 20, GSC OF 1647, NTS 104K - TULSEQUAH

TABLE 1 - Stream Sediment Analyses (N=896)

Element	Units	Method	Detection Limit	No. of Samples Detection at Limit	Percentage at Detection Limit
Zinc	PPM	ATOMIC ABSORPTION SPECTROSCOPY (AAS)	< 2 = 1	0	0.0
Copper	PPM	ATOMIC ABSORPTION SPECTROSCOPY	< 2 = 1	8	0.9
Lead	PPM	ATOMIC ABSORPTION SPECTROSCOPY	< 2 = 1	128	14.3
Nickel	PPM	ATOMIC ABSORPTION SPECTROSCOPY	< 2 = 1	122	13.6
Cobalt	PPM	ATOMIC ABSORPTION SPECTROSCOPY	< 2 = 1	49	5.5
Silver	PPM	ATOMIC ABSORPTION SPECTROSCOPY	< 0.1 = 0.1	526	58.7
Managanese	PPM	ATOMIC ABSORPTION SPECTROSCOPY	< 5 = 5	0	0.0
Arsenic	PPM	HYDRIDE EVOLUTION AAS	< 1 = 1	47	5.2
Molybdenum	PPM	ATOMIC ABSORPTION SPECTROSCOPY	< 1 = 1	300	33.5
Iron	PCT	ATOMIC ABSORPTION SPECTROSCOPY	< 0.02 = 0.01	0	0.0
Mercury	PPB	FLAMELESS AAS	< 5 = 5	192	21.4
LOI	PCT	LOSS ON IGNITION (WEIGHT DIFFERENCE)	<0.2 = 0.1	9	1.0
Uranium	PPM	DELAYED NEUTRON ACTIVATION	< 0.5 = 0.1	42	4.7
Fluorine	PPM	SPECIFIC ION ELECTRODE	< 40 = 20	14	0.2
Vanadium	PPM	ATOMIC ABSORPTION SPECTROSCOPY	< 5 = 5	0	0.0
Cadmium	PPM	ATOMIC ABSORPTION SPECTROSCOPY	< 0.2 = 0.1	513	57.3
Antimony	PPM	HYDRIDE EVOLUTION AAS	< 0.2 = 0.1	186	20.8
Tungsten	PPM	COLORIMETRY	< 2 = 1	275	30.7
Barium	PPM	ENERGY DISPERSIVE XRF	< 20 = 10	20	2.2
Tin	PPM	ATOMIC ABSORPTION SPECTROSCOPY	< 2 = 1	737	82.3
Gold	PPB	FIRE ASSAY - DCP	Variable = 1	168	18.7

TABLE 2 - Water Analyses

Element	Units	Method	Detection Limit
Uranium	PPB	LASER-INDUCED FLUOROMETRY	< 0.05 = 0.02
Fluorine	PPB	SPECIFIC ION ELECTRODE	< 20 = 10
pH	LOG	SPECIFIC ION ELECTRODE	

Tables 1 and 2 display the detection limits of the analytical methods used to determine the above elements. The figure to the right of the detection limit heading corresponds to an arbitrarily set value if the results fall below the contracted commercial laboratory's detection limit (usually 1/2 the detection limit) and are used for the mathematical calculations and the listings.

REGIONAL STREAM SEDIMENT AND WATER DATA, BRITISH COLUMBIA, 1987, BC RGS 20, GSC OF 1647, NTS 104K - TULSEQUAH

ANALYTICAL METHODS 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. HNO₃ in a test tube overnight at room temperature. After digestion, the test tube was immersed 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 diluted to 20 ml with metal-free water, mixed and allowed to stand for two hours.

Zn, Cu, Pb, Ni, Co, Ag, Mn, Fe and Cd were measured by aspirating the test solution into an atomic absorption spectrophotometer using an air-acetylene flame. Background corrections were made for Pb, Ni, Co, Ag and Cd.

As was determined using a hydride evolution method wherein the hydride (ASH₃) is evolved and passed through a heated quartz tube in the light path of an atomic absorption spectrophotometer. The method is described by Aslin (1976).

Molybdenum and Vanadium were 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 using a modified Hatch and Ott procedure. 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 10% w/v SnSO₄ in 1M H₂SO₄. The Hg vapour was then swept 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 Atomic Energy of Canada's Slowpoke II reactor. Calibration was carried out once a day as a minimum, using natural materials of known uranium concentration.

REGIONAL STREAM SEDIMENT AND WATER DATA, BRITISH COLUMBIA, 1987, BC RGS 20, GSC OF 1647, NTS 104K - TULSEQUAH

Fluorine was determined as described by Ficklin (1970). A 250 mg sample was sintered with 1 gram of a flux consisting of two parts by weight sodium carbonate and 1 part by weight potassium nitrate. The residue was then leached with water, the sodium carbonate was neutralized with 10 ml 10% (w/v) citric acid and the resulting solution was diluted to 100 ml with water. The pH of the resulting solution was 5.5 to 6.5. The fluoride content of the test solution was then measured using a fluoride ion electrode. Standard solutions contain sodium carbonate and citric acid in the same quantities as the sample solution. A detection limit of 40 ppm was achieved.

Antimony was determined as described by Aslin (1976). A 500 mg sample was placed in a test tube; 3 ml concentrated HNO₃ 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 ul aliquot of this test solution was removed and diluted to 10 ml with 1.8 M HCL. The antimony in an aliquot of this dilute solution was then determined by hydride evolution-atomic absorption spectrometry.

Tungsten was determined as follows: A 0.2 gm sample of stream sediment was fused with 1 gm K₂S₂O₇ in a rimless test tube at 575C for 15 minutes in a furnace. The mixture was then leached with water. Tungsten was reduced with stannous chloride and complexed with thiocyanate. The tungsten was selectively extracted into a carbon tetrachloride-tri-n-butyl phosphate mixture whereby the concentration was determined by comparison of the resulting color of the sample solution with known standards prepared at the same time.

Barium was determined in sediments using energy-dispersive X-Ray fluorescence according to the method described by Bright (1983). A 5 gm sample of sediment is placed in a 10 ml plastic vial. The sample is exposed to a radioactive source and the intensities of X-rays emitted are measured. The amount of barium is measured by comparison to standards. Corrections are made for inter-element interferences.

Tin in stream sediments was determined as follows: A 200 mg sample was heated with NH₄I; the sublimed SnI₄ was dissolved in acid and the tin determined by atomic absorption spectrometry.

Gold in stream sediments was determined by mixing a 10 gram sample with a flux which is composed mainly of lead oxide. The proportions of the flux components are adjusted depending on the nature of the sample. Silver is added to help collect the gold. The samples are fused at 1950 F until a clear melt is obtained. The lead button which also contains the precious metals is then separated from the slag. Heating in the cupellation furnace separates the lead from the noble metals. The precious metal beads that remain are transferred to test tubes and dissolved with aqua-regia. The solution is analysed using Plasma Emission Spectrograph by comparing the readings for these solutions with readings of standard solutions.

Depending on the amount of sample available, lesser weights were sometimes used (minimum 5 grams). This resulted in a variable detection limit, 1 ppb Au for a 10 gram sample and 2 ppb Au for a 5 gram sample. In addition, the test tubes and cupels are used only once, so that there is no possibility of cross contamination. The fusion crucibles are cleared before re-use by discarding any which had high samples in them. During analysis a blank solution is run between each sample to ensure that there is no carry-over.

REGIONAL STREAM SEDIMENT AND WATER DATA, BRITISH COLUMBIA, 1987, BC RGS 20, GSC OF 1647, NTS 104K - TULSEQUAH

ANALYTICAL METHODS Stream Waters

Fluoride ion complexes in water samples were 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 dinitrilo 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 litre 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. All readings were taken against a sample blank.

Quality control and monitoring of the geochemical data was undertaken by a standard method used by the Applied Geochemistry Subsection.

COMMENTS REGARDING INTERPRETATION OF GOLD RESULTS

The following discussion reviews the format used to present the gold geochemical data and outlines some important points to consider when interpreting this data. This discussion is included in recognition of the special geochemical behaviour and mode of occurrence of gold in nature and the resultant difficulties in obtaining and analyzing samples which reflect the actual concentration level at a given site.

Understanding Au geochemical data from regional stream sediment requires an appreciation of the unique chemical and physical characteristics of Au and its mobility in the surficial environment. Key properties that distinguish the geochemical behaviour of gold from most other elements include:

- 1) AU OCCURS MOST COMMONLY IN THE NATIVE FORM. IT IS CHEMICALLY AND PHYSICALLY RESISTANT AND A HIGH PROPORTION OF THE METAL IS DISPERSED IN MICRON-SIZED PARTICULATE FORM. GOLD'S HIGH SPECIFIC GRAVITY RESULTS IN HETEROGENEOUS DISTRIBUTIONS, ESPECIALLY IN STREAM SEDIMENTS.
- 2) AU TYPICALLY OCCURS AT LOW CONCENTRATIONS IN THE PPB RANGE. AU CONCENTRATIONS OF A FEW PPM MAY REPRESENT ECONOMIC DEPOSITS. BACKGROUND LEVELS ENCOUNTERED FOR STREAM SEDIMENTS SELDOM EXCEED 10 PPB, AND COMMONLY ARE NEAR THE DETECTION LIMIT OF 1 PPB.

The many foregoing factors can result in a particle sparsity or 'nugget' effect, wherein very low concentrations of Au are heterogeneously distributed in the surficial environment. Hence, a major problem facing explorationists is obtaining a representative sample. In general, the lower the concentration of Au, the larger the sample size required to reduce uncertainty over whether subsample analytical values truly represent actual values. Conversely, as Au concentrations increase the number of Au particles to be shared in random subsamples increases and the variability of results decreases (Clifton et al., 1969; Harris, 1982).

The limited amount of material collected during the rapid, reconnaissance-style regional surveys and the need to analyze for a broad spectrum of elements, precludes the use of a significantly large sample weight for the Au analyses (usually 10.0 grams). Consequently, results from these analyses tend to be highly variable and qualitative rather than quantitative. To evaluate and monitor the sampling and analytical variability which are inherent in the analysis of gold in geochemical mediums, the following control methods are currently employed:.

- 1) FOR EACH BLOCK OF TWENTY SAMPLES:
 - A) RANDOM INSERTION OF A STANDARD REFERENCE SAMPLE TO MONITOR AND CONTROL ANALYTICAL ACCURACY AND LONG-TERM PRECISION;
 - B) COLLECTION OF A FIELD DUPLICATE (TWO SAMPLES COLLECTED SEPARATELY FROM ONE SITE) TO MONITOR SAMPLING VARIANCE; AND
 - C) ANALYSIS OF A SECOND SUBSAMPLE (BLIND DUPLICATE) FROM ONE SAMPLE TO MONITOR AND CONTROL SHORT-TERM PRECISION.

- 2) REPEAT ANALYSES ON A SECOND SUBSAMPLE ARE PERFORMED ON 20% (N=155) OF THE SAMPLES. THIRTY NINE SAMPLES ARE RANDOMLY SELECECTED AND THE REMAINDER ARE SAMPLES HAVING VALUES THAT ARE STATISTICALLY ABOVE APPROXIMATELY THE 85TH PERCENTILE (> 40 PPB AU) OF THE TOTAL DATA SET.

Gold data presentation, statistical treatment and the map format are somewhat different than for the other elements. Gold data listed in this open file include initial analytical results, values determined from repeat analyses, together with sample weights and corresponding detection limits for all analysed samples. The gold histogram, and statistical parameters were determined using the following data population selection criteria:

- 1) ONLY THE FIRST VALUE OF A REPEAT ANALYSIS WAS UTILIZED
- 2) AU VALUES LESS THAN THE THE VARIABLE DETECTION LIMIT WERE SET TO 1 PPB

On the gold symbol and value map, repeat analysis values (not field duplicates) for those samples initially having concentrations greater than the 85th percentile are placed in brackets following the initial value determination. Following are possible variations in the way data is presented on the gold symbol and value map:

NO POINT PLOTTED, NO GOLD DATA, INSUFFICIENT SAMPLE FOR ANALYSIS

+ 27 SINGLE ANALYSIS

+ 27 (42) REPEAT ANALYSIS

In summary, geochemical follow-up investigations should be based on a careful consideration of all geological and geochemical information, and especially a careful appraisal of gold geochemical data and its variability. In some cases, prospective follow-up areas may be indirectly identified by pathfinder element associations in favourable geology, although an anomalous Au response due to natural variability may be lacking. Once an anomalous area has been identified, field investigations should be designed to include detailed geochemical follow-up surveys and collection of large representative samples. Subsequent repeat subsample analyses will increase the reliability of results and permit a better understanding of natural variability which can then be used to improve sampling methodology and interpretation.

DATA PREPARATION

Field data comprising sample identification, location, and both sample and site descriptions, were recorded during collection by the contract field crew onto field cards (REV. 74) used by the Geological Survey of Canada (Garrett, 1974). The field data were then keypunched and generated into computer files by Elan Data Makers Ltd. of Victoria, B.C. The files were subsequently verified for accuracy by the staff of the Applied Geochemistry Subsection.

Sample locations, marked on 1:50 000 scale NTS maps while in the field, were transferred to a 1:250 000 scale map in the base camp. The map was digitized by the British Columbia Geological Survey to obtain the sample site UTM coordinates needed for the production of 1:250 000 scale sample location and geochemical symbol and value maps. The four 1:100 000 scale sample location maps covering map sheet 104K were produced by the Applied Geochemistry Subsection using site coordinates digitized from the original 1:50 000 scale NTS field maps. Sample site coordinates were checked as follows: A sample location map was produced on a Houston Instruments DMP-40 plotter using the digitized coordinates; the field contractor's sample location map was then overlaid with the computer plotted map; the two sets of points were checked for coincidence. Dominant rock types in the stream catchment basins were identified using the GSC 1:1 000 000 scale Geological Atlas series map 1418A, ISKUT RIVER - Sheet 104, 114, compiled by Souther et al. (1979). A portion of this same map, enlarged and combined with the Tulsequah - 1:250 000 scale NTS map, forms the base for the geochemical maps in this open file. Surficial geology for part of 104K derived from Ryder (1984) has been included with the geochemical maps. Computer files consisting of field observations, sample location co-ordinates, geological data and analytical data were combined into one file. Software programs developed at Applied Geochemistry Subsection by K. Talvila, S.J Day and P.F. Matysek were used to produce the detailed listings, univariate statistics, open file value and symbol maps and floppy diskettes.

DATA LIST LEGEND - STREAMS

- MAP** - National Topographic System (NTS)
lettered quadrangle (scale 1:50 000).
part of sample number
- ID** - Remainder of sample number
YEAR (first 2 digits),
FIELD CREW (3rd digit) -
SAMPLE SEQUENCE NUMBER (last 3 digits)
- UTM** - Universal Transverse Mercator (UTM)
COORDNATES coordinate system - sample coordinates
- ZN** - UTM zone
- EAST** - UTM easting coordinate (in metres)
- NORTH** - UTM northing coordinate (in metres)
- FORMATION** - Rock unit label on geology base map
- ROCK TYPE** - Major rock type at the sample site
- AGE** - Stratigraphic age of the rock type
- WD** - Width of stream at sample site (in decimetres)
- DT** - Depth of stream at sample site (in decimetres)
- SAMP** - Type of material sampled
- RP ST** - Replicate status- relationship of sample
to others within the block of 20
- CONT** - Contamination at site or within the
drainage basin
- BANK** - Bank type
- WCOL** - Water colour and suspended load
- RATE** - Water flow rate
- SCOL** - Predominant sediment colour
- SMP CMP** - Sample Composition- proportional
volume of sand, inorganic 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)

SAMP:

- 1 - Stream Sediment only
- 2 - Spring Sediment
- 3 - Heavy Mineral Concentrate
- 4 - Stream Water
- 5 - Spring/Well Water
- 6 - Stream Sediment and Water collected at site

RP ST:

- 00 - Routine Sample
- 10 - First of Field Duplicate
- 20 - Second of Field Duplicate

CONT:

- 0 - None
- 1 - Possible
- 2 - Probable
- 3 - Definite
- 4 - Mining Activity
- 5 - Industrial Sources
- 6 - Agricultural
- 7 - Domestic, Household Sources
- 8 - Forestry
- 9 - Burned areas

BANK:

- 0 - Undefined
- 1 - Alluvial
- 2 - Colluvial
- 3 - Glacial Till
- 4 - Glacial Outwash
- 5 - Exposed Bedrock
- 6 - Talus, Scree
- 7 - Organic

WCOL:

- 0 - Clear
- 1 - Brown Transparent
- 2 - White Cloudy
- 3 - Brown Cloudy

RATE:

- 0 - Stagnant
- 1 - Slow
- 2 - Moderate
- 3 - Fast
- 4 - Torrent

SCOL:

- 1 - Red to Brown
- 2 - White to Buff
- 3 - Black
- 4 - Yellow
- 5 - Green
- 6 - Blue to Grey

SMP CMP:

Proportional Volume of Sand, Inorganic Fines and Organics, based on thirds

- 0 - Absent
- 1 - Less than 1/3
- 2 - Between 1/3 and 2/3
- 3 - Greater than 2/3

EXAMPLES:

- 013 = 0% Sand, 25% Fines and 75% Organics
- 220 = 50% Sand and 50% Fines
- 030 = 100% Fines

PPPS:

- 0 - None (otherwise SCOL scale)

PRPB:

- 0 - None (otherwise SCOL scale)

PHYS:

- 1 - Muskeg, Swampland
- 2 - Peneplain, Plateau
- 3 - Hilly, Undulating
- 4 - Mountainous, Mature
- 5 - Mountainous Youthful

PATT:

- 0 - Poorly Defined
- 1 - Dendritic
- 2 - Herringbone
- 3 - Rectangular
- 5 - Discontinuous

TYPE:

- 1 - Permanent
- 2 - Seasonal

CLSE:

- 1 - Primary
- 2 - Secondary
- 3 - Tertiary
- 4 - Quaternary

SRCE:

- 0 - Unknown
- 1 - Groundwater
- 2 - Spring Runoff
- 3 - Recent Precipitation
- 4 - Glacier Melt Water

ROCK MNEMONICS AND AGES FOR 104K - TULSEQUAH

Note 1: Rock Mnemonics must always be used in conjunction with age as the mnemonic may be repeated.

Note 2: The column with heading "FORMATION" contains the rock unit label on the open file geology base.

<u>ROCK</u>	<u>AGE</u>	<u>FORM- ATION</u>	<u>DESCRIPTION</u>
-------------	------------	------------------------	--------------------

STRATIFIED ROCKS

PLEISTOCENE TO EOCENE

TRCH	63	PPHP	Heart Peaks: trachyte, rhyolite
BSLT	63	PPLM	Level Mountain Group: basalt
RYLT	59	ESL	Sloko Group: rhyolite, trachyte, andesite, basalt

JURASSIC

GRCK	49	JL	Laberge Group: greywacke, conglomerate
LMSN	49	JIC	Inklin: limestone
CGLM	49	JT	Takwahoni: conglomerate, grit, greywacke

TRIASSIC

GRCK	45	uTKS	King Salmon: greywacke
LMSN	45	uTSI	Sinwa: limestone
ANBT	45	uTv	Andesite, basalt

PERMIAN

LMSH	36	Pc	Limestone, minor calcareous shale
------	----	----	-----------------------------------

REGIONAL STREAM SEDIMENT AND WATER DATA, BRITISH COLUMBIA, 1987, BC RGS 20, GSC OF 1647, NTS 104K - TULSEQUAH

ROCK MNEMONICS AND AGES FOR 104K - TULSEQUAH (continued)

CARBONIFEROUS AND PERMIAN

CHRT	35	CPK	Kedahda: chert, argillite, volcanic sandstone
LIME	35	CPc	Limestone
SCST	35	CPsn	Schist, gneiss
GRNS	35	CPsv	Greenstone, limestone, shale, clastic sedimentary rocks

MISSISSIPPIAN

BSLT	34	Mn	Nakin: meta-basalt, tuff
------	----	----	--------------------------

PLUTONIC ROCKS

CRETACEOUS AND TERTIARY

FLSP	56	KTfp	Felsite, feldspar porphyry
QTMZ	56	KTqm	Quartz monzonite

JURASSIC AND CRETACEOUS

GRDR	52	JKgd	Granodiorite
DORT	51	JKdi	Diorite

TRIASSIC

DORT	42	Tdi	Diorite
DORT	42	Tb	Diorite

REGIONAL STREAM SEDIMENT AND WATER DATA, BRITISH COLUMBIA, 1987, BC RGS 20, GSC OF 1647, NTS 104K - TULSEQUAH

ROCK MNEMONICS AND AGES FOR 104K - TULSEQUAH (continued)

MISSISSIPPIAN

GRBR	31	Mb	Gabbro, diorite
PRDT	31	Mub	Peridotite, serpentite, pyroxenite

AGE UNKNOWN

GRDR	65	gd	Granodiorite
DORT	65	din	Diorite gneiss, amphibolite, migmatite

REGIONAL STREAM SEDIMENT AND WATER DATA, BRITISH COLUMBIA, 1987, BC RGS 20, GSC OF 1647, NTS 104K - TULSEQUAH

REFERENCES:

- Aslin, G.E.M. (1976) The determination of arsenic and antimony in geological materials by flameless atomic absorption spectrophotometer: Journal of Geochemical Exploration, Vol. 6, pp. 321-330.
- Bright, K. (1983) Semiquantitative methods for lithochemical samples: Bondar Clegg Internal Report.
- 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.
- Clifton, H.E., Hunter, R.E., Swanson, F.J. and Phillips, R.L. (1969) Sample size and meaningful gold analysis. U.S. Geol. Surv. Professional Paper 625-C.
- Ficklin, W.H. (1970) A rapid method for the determination of fluoride in rocks and soils, using an ion selective electrode. U.S. Geol. Surv. Paper 700C pp. C186-188.
- Garrett, R.G. (1974) Field data acquisition methods for applied geochemical surveys at the Geological Survey of Canada: Geol. Surv. Can. Paper 74-52.
- Hall, G.E.M. (1979) A study of the stability of uranium in waters collected from various geological environments in Canada; in current Research, Part A, Geol. Surv. Can. Paper 79-1A, p. 361-365.
- Harris, J.F. (1982) Sampling and analytical requirements for effective use of geochemistry in exploration for gold. In Levinson, A.A., Editor; Precious metals in the northern Cordillera, Proceedings of a symposium sponsored by the Association of Exploration Geochemists and the Cordilleran Section of the Geological Association of Canada, pp. 53-67.
- Jonasson, I.R., Lynch, J.J. and Trip, L.J. (1973) Field and laboratory methods used by the Geological Survey of Canada in Geochemical Surveys: No. 12, Mercury in Ores, Rocks, Soils, Sediments and Water: Geol. Surv. Can. Paper 73-21.
- Quin, B.F. and Brooks, R.R. (1972) The rapid determination of tungsten in soils, stream sediments, rocks and vegetation. Anal. Chim. Acta. 58 pp 301-309.
- Ryder, J.M. (1984) Inventory for the Stikine-Iskut Area (NTS 104F, 104G and parts of 104B and 104H), British Columbia Ministry of Environment Technical Report 11.
- Souther, J.G., Brew, D.A. and Okulvitch, A.V. (1979): Iskut River (104), Geological Survey of Canada, Map 1418A.