

REGIONAL STREAM SEDIMENT AND WATER GEOCHEMICAL RECONNAISSANCE DATA, BRITISH COLUMBIA, 1983. GSC-OF 1000, NGR 65-1983, NTS 93M

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	PAGE
SURVEY NOTES	1
DATA LIST	7
SUMMARY STATISTICS	54

OPEN FILE 1000 IS ONE OF TWO OPEN FILES 1000 AND 1001 COVERING THE CENTRAL BRITISH COLUMBIA SURVEY, COMPRISING OF NTS 93M AND 93N RESPECTIVELY.

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 JOINT CANADA-BRITISH COLUMBIA PROJECT.

W.J. MCMILLAN (B.C. GOV'T) DIRECTED B.C. DEPT. OF MINES, ENERGY AND PETROLEUM RESOURCES ACTIVITIES.

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

N.G. LUND AND A.C. GALLETTA WERE RESPONSIBLE FOR DATA MANAGEMENT.

N.G. LUND CO-ORDINATED OPEN FILE PRODUCTION.

J.YELLE SUPERVISED MAP PREPERATION.

COMPUTER AND PLOTTING FACILITIES WERE PROVIDED BY THE COMPUTER SCIENCE CENTER OF E.M.R.

CONTRACTS LET FOR SAMPLE COLLECTION, PREPARATION AND ANALYSIS WERE SUPERVISED AND/OR MONITORED BY THE STAFF OF THE GEOCHEMISTRY SUBDIVISION AND THE B.C. DEPT. AS FOLLOWS :

COLLECTION	- BEMA INDUSTRIES LTD., LANGELY, B.C.
	- W.J. MCMILLAN, B.C. DEPT.
PREPARATION	- GOLDER ASSOCIATES, OTTAWA.
	- J.J. LYNCH
ANALYTICAL	- CHEMEX LABS. LIMITED, VANCOUVER.
	- ACME ANALYTICAL LABORATORIES LTD, TORONTO.
	- J.J. LYNCH

OPEN FILE TEXT WAS MANUFACTURED BY CAMPBELL LAZER PRINTING, OTTAWA.

HELICOPTER SUPPORTED SAMPLE COLLECTION WAS CARRIED OUT DURING THE SUMMER OF 1983. STREAM SEDIMENT AND WATER SAMPLES WERE COLLECTED AT AN AVERAGE DENSITY OF ONE SAMPLE PER 13 SQUARE KILOMETERS THROUGHOUT THE 28,000 SQUARE KILOMETER CENTRAL B.C.

SAMPLE SITE DUPLICATE SAMPLES WERE ROUTINELY COLLECTED IN EACH ANALYTICAL BLOCK OF TWENTY SAMPLES.

IN OTTAWA, FIELD DRIED SAMPLES WERE AIR-DRIED, CRUSHED, BALL MILLED AND SEIVED. THE MINUS 80 MESH (177 MICRONS) FRACTION WAS USED FOR SUBSEQUENT ANALYSES. AS REQUIRED, AT THIS TIME, CONTROL REFERENCE AND BLIND DUPLICATE SAMPLES WERE INSERTED INTO EACH BLOCK OF TWENTY SEDIMENT SAMPLES. NO OTHER SAMPLE PROCESSING IN OTTAWA WAS CARRIED OUT ON THE WATER SAMPLES. BLIND DUPLICATE SAMPLES WERE NOT USED IN WATER ANALYSIS.

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 LAKE 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 BY PLOTTING SAMPLING LOCATION MAPS ON A CALCOMP 1051 DRUM PLOTTER FROM THE DIGITIZED COORDINATES AND THEN OVERLAYING THESE OVER THE FIELD CONTRACTOR'S SAMPLE LOCATION BASE MAPS. THE DOMINANT ROCK TYPES IN THE LAKE CATCHMENT BASINS WERE IDENTIFIED ON APPROPRIATE GEOLOGICAL MAPS USED AS THE BEDROCK GEOLOGICAL BASE ON NGR 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 GEOLOGICAL DATA WAS UNDERTAKEN BY A STANDARD METHOD USED BY THE RESOURCE GEOCHEMISTRY SUBDIVISION AT THE GEOLOGICAL SURVEY OF CANADA.

FOR THE DETERMINATION OF ZN, CU, PB, NI, CO, AG, MN AND FE, A 1 GRAM SAMPLE WAS REACTED WITH 6 ML OF A MIXTURE OF 4M HCL AND M HNO<sub>3</sub> IN A TEST-TUBE OVERNIGHT AT ROOM TEMPERATURE. AFTER DIGESTION, THE TEST-TUBE WAS IMMERSUED 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 ABSORTION SPECTROSCOPY USING AN AIR-ACETYLENE FLAME. BACKGROUND CORRECTIONS WERE MADE FOR PB, NI, CO, AG AND CD.

ARSENIC WAS DETERMINED BY ATOMIC ABSORPTION USING A HYDRIDE EVOLUTION METHOD WHEREIN THE ARSENIC IS EVOLVED AS ASH<sub>3</sub>, 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  $\text{HN}_3$  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  $\text{HNO}_3$  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  $\text{SnSO}_4$  IN M  $\text{H}_2\text{SO}_4$ .

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.

ABSORPTION MEASUREMENTS WERE MADE AT 253.7 NM.

URANIUM WAS DETERMINED USING A NEUTRON ACTIVATION METHOD WITH DELAYED NEUTRON COUNTING.

WITH THE EXCEPTION OF THE IRRADIATION FACILITY, THE METHOD IS VERY SIMILAR TO THAT USED BY AECL IN PREVIOUS YEARS, A DETAILED DESCRIPTION OF WHICH IS PROVIDED BY BOULANGER ET AL (1975).

A TWO GRAM SAMPLE WAS IRRADIATED FOR 10 SECONDS IN THE TRIGA REACTOR LOCATED AT WASHINGTON STATE UNIVERSITY.

THE OPERATING FLUX WAS  $8 \times 10^{13}$  NEUTRONS/SQUARE CM/SECOND.

AFTER A 10 SECOND DELAY, THE SAMPLE WAS COUNTED FOR 10 SECONDS.

THE COUNTING EQUIPMENT WAS OF AECL DESIGN. CALIBRATION WAS DONE TWICE A DAY OR AS REQUIRED.

ONE STANDARD WAS ANALYSED AFTER EVERY 20 SAMPLES.

TUNGSTEN WAS DETERMINED AS FOLLOWS: A 0.2 GRAM SAMPLE OF STREAM SEDIMENT WAS FUSED WITH 1 GRAM  $\text{KHSO}_4$  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%  $\text{SnCl}_2$  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 FFOR 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 SOLUTION WAS MEASURED AT 630 NM USING A SPECTROPHOTOMETER.

FOR THE DETERMINATION OF ANTIMONY A 2-GRAM SAMPLE WAS DIGESTED WITH CONCENTRATED HCL IN A HOT WATER BATH. THE IRON WAS REDUCED TO FE (II) AND THE SB EXTRACTED WITH TRIOCTYL PHOSPHINE OXIDE MIBK AND MEASURED WITH ATOMIC ABSORPTION SPECTROSCOPY WITH BACKGROUND CORRECTION.

FLUORIDE IN LAKE WATER SAMPLES WAS DETERMINED USING AN ORION FLUORIDE ELECTRODE AND A MODEL 404 ORION SPECIFIC ION METER. PRIOR TO MEASUREMENT AN ALIQUOT OF THE SAMPLE WAS MIXED WITH AN EQUAL VOLUME OF TISAB SOLUTION (TOTAL IONIC STRENGTH ADJUSTMENT BUFFER).

HYDROGEN ION ACTIVITY (PH) WAS MEASURED WITH A BROADLEY-JAMES COMBINATION ELECTRODE AND A MODEL 404 ORION SPECIFIC ION 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) IS ADDED TO PRODUCE THE URANYL PYROPHOSATE SPECIES WHICH FLUORESCES WHEN EXPOSED TO THE LASER. SINCE ORGANIC MATTER IN THE SAMPLE CAN CAUSE UNPREDICABLE 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 DELEAY BETWEEN THE ADDITION OF THE FLURAN AND THE ACTUAL READING WAS INCORPORATED INTO THIS METHOD. IN PRACTICE, 500UL FLURAN SOLUTION WAS ADDED TO A 5ML 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 (20UL ALIQUOTS OF 55 OR 550 PPB U WERE USED). ALL READINGS WERE TAKEN AGAINST A SAMPLE BLANK.

THE FOLLOWING TABLE DISPLAYS THE DATA RECORD FORMAT SPECIFICATIONS.  
 THE DETECTION LIMITS OF THE ANALYTICAL METHODS ARE ALSO GIVEN WITH  
 THE SECOND FIGURE UNDER DETECTION LIMIT USED AS AN ARBITRARILY SET VALUE  
 IF THE RESULT FELL BELOW THE DETECTION LIMIT.

FIELD	ELEMENT	CARD	COLUMNS
	MAP	1	01-06
	ID	1	07-12
	UTM ZONE	1	13-14
	UTM EAST (METER)	1	15-20
	UTM NORTH (METER)	1	21-27
	ROCK TYPE	1	28-31
	SAMPLE MATERIAL	1	32
	STREAM WIDTH (DECIMETER)	1	33-35
	STREAM DEPTH (DECIMETER)	1	36-38
	REPLICATE STATUS	1	39-40
	CONTAMINATION	1	41
	BANK TYPE	1	42
	WATER COLOUR	1	43
	FLOW RATE	1	44
	SEDIMENT COLOUR	1	45
	SAMPLE COMPOSITION	1	46-48
	PRECIPITATE IN STREAM	1	49
	DISTINCTIVE PRECIPITATE	1	50
	GENERAL RHYSIOGRAPHY	1	55
	DRAINAGE PATTERN	1	56
	STREAM TYPE	1	57
	STREAM CLASS	1	58
	SOURCE OF WATER	1	59
	AGE	1	70-71

THE ANALYTICAL DATA WERE RECORDED AS FOLLOWS:

ELEMENT	UNITS	CARD	COLUMNS	DETECTION LIMIT
SEDIMENT				
ZN	PPM	2	21-25	2 1
CU	PPM	2	26-30	2 1
PB	PPM	2	31-35	2 1
NI	PPM	2	36-40	2 1
CO	PPM	2	41-45	2 1
AG	PPM	2	46-50	0.2 0.1
MN	PPM	2	51-55	5 2
AS	PPM	2	56-60	1.0 0.5
MO	PPM	2	61-65	2 1
FE	PCT	2	66-70	0.02 0.01
HG	PPB	2	71-75	10 5
U	PPM	3	21-25	0.2 0.1
W	PPM	3	26-30	2 1
SB	PPM	3	36-40	0.2 0.1
F-W	PPB	4	26-30	20 10
PH		4	31-35	
U-W	PPB	4	36-40	0.05 0.002

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DATA LIST LEGEND

MAP- NATIONAL TOPOGRAPHIC SYSTEM(NTS)- LETTERED SIXTEENTH  
(SCALE 1:500000). 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- EASTINGS (METERS)

NORTH- NORTHINGS (METERS)

ROCK TYPE- MAJOR ROCK TYPE OF CATCHMENT AREA

AGE- STRATIGRAPHIC AGE OF ROCK TYPE

WD- WIDTH OF STREAM (DECIMETER) AT NEAREST SAMPLE SITE

DT- DEPTH OF STREAM SAMPLED TO NEAREST DECIMETER

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

PPPS- 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

CLSE- STREAM CLASS

SRCE- SOURCE OF WATER

ROCK TYPE :	(TILL 44) - TILL, GRAVEL, SAND, SILT, ALLUVIUM	CONT :	0- NONE 1- POSSIBLE 2- PROBABLE 3- DEFINITE 6- AGRICULTURAL 8- FORESTRY ACTIVITY
	(ANDS 42) - ENDAKO GROUP : ANDESITE, BASALT, DACITE		
	(RYLT 41) - OOTSA LAKE GROUP : RHYOLITE, DACITE, TRACHYTE, SANDSTONE, SHALE, CONGLOMERATE		
	(CGLM 41) - SUSTUT GROUP: CONGLOMERATE, SHALE, GREYWACKE	BANK :	0- UNDEFINED UNCONSOLIDATED MATERIAL 1- ALLUVIAL 2- COLLUVIAL 3- GLACIAL TILL, TILLITE 4- GLACIAL OUTWASH, MORaine 5- BARE ROCK 6- TALUS, SCREE 7- ORGANIC PREDOMINANT
	(SHLE 36) - SKEENA GROUP, RED ROSE FORMATION : SHALE, GREYWACKE, CONGLOMERATE, COAL, VOLCANIC BRECCIA		
	(TUFF 36) - BRIAN BORU FORMATION : ANDESITIC TO RHYOLITIC TUFF, BRECCIA, FLOWS		
	(SHLE 35) - BOWSER LAKE GROUP : MAINLY UNDIVIDED MARINE SEDIMENTARY ROCKS	WCOL :	0- CLEAR 1- BROWN TRANSPARENT 2- WHITE CLOUDY 3- BROWN CLOUDY
	(SHLE 34) - HAZELTON GROUP, SMITHERS AND ASHMAN FORMATION : SHALE, GREYWACKE, CONGLOMERATE, BRECCIA, TUFF		
	(BSLT 34) - TELKWA AND NILKITKWA FORMATIONS : BASALT, ANDESITE, BRECCIA, TUFF, SHALE, SILTSTONE	RATE :	0- ZERO 1- SLOW 2- MODERATE 3- FAST 4- TORRENTIAL
	(ANDS 32) - TAKLA GROUP : ANDESITE, BASALT, TUFF, BRECCIA, CONGLOMERATE, GREYWACKE, SHALE, LIMESTONE		
	(LMSN 23) - CACHE CREEK GROUP : RIBBON CHERT, BLACK ARGILLITE, LIMESTONE, GREENSTONE	SCOL :	0- UNKNOWN 1- RED, BROWN 2- WHITE, BUFF 3- BLACK 5- GREEN 6- GREY, BLUE-GREY
	(QTMZ 41) - QUARTZ MONZONITE, GRANODIORITE, QUARTZ DIORITE; PORPHYRITIC AND APHANITIC EQUIVALENTS		
	(GBBR 41) - GABBRO		
AGE :	23- PENNSYLVANIAN - PERMAIN 32- TRIASSIC 34- JURASSIC 35- JURASSIC - CRETACEOUS 36- CRETACEOUS 41- MESOZOIC - CENOZOIC 42- TERTIARY 44- QUATERNARY	SMP CMP :	0- ABSENT 1- MINOR <33% 2- MEDIUM <33-67% 3- MAJOR > 67%
SAMP :	1- STREAM BED SEDIMENT 6- SIMULTANEOUS STREAM WATER AND SEDIMENT	PPPS :	0- NONE 1- RED, BROWN
RP ST :	00- ROUTINE REGIONAL SAMPLE 10- FIRST OF FIELD DUPLICATE 20- SECOND OF FIELD DUPLICATE	PRPB :	0- FEATURELESS 1- RED, BROWN
		PHYS :	1- MUSKEG, SWAMPLAND 3- HILLY, UNDULATING 5- MOUNTINOUS YOUTHFUL

DATA LEGEND CONT.

PATT :           0- POORLY DEFINED, HAPHAZARD  
                 1- DENDRITIC  
                 2- HERRING BONE  
                 6- BASINAL (CLOSED)

TYPE :           0- UNDEFINED  
                 1- PERMANENT, CONTINUOUS  
                 2- INTERMITTENT, SEASONAL  
                 5- UNKNOWN

CLSE :           2- SECONDARY  
                 3- TERTIARY  
                 4- QUARTERNARY

SRCE :           1- GROUNDWATER  
                 2- SNOW MELT OR SPRING RUN-OFF

  

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 ATOMIC ABSORPTION SPECTROSCOPY (PPM)  
MO- MOLYBDENUM BY ATOMIC ABSORPTION SPECTROSCOPY (PPM)  
FE- IRON BY ATOMIC ABSORPTION SPECTROSCOPY (%)  
HG- MERCURY BY ATOMIC ABSORPTION SPECTROSCOPY (PPB)  
  U- URANIUM BY DELAYED NEUTRON ACTIVATION (PPM)  
  W- TUNGSTON BY COLORIMETRY USING DITHIOL (PPM)  
SB- ANTIMONY MIBK SOLVENT EXTRACTION ATOMIC ABSORPTION SPECTROSCOPY (PPM)  
F-W- FLOURINE IN WATERS BY FISSION TRACK (PPB)  
  PH- PH BY COMBINATION GLASS - CALOMEL ELECTRODE  
U-W- URANIUM IN WATERS BY SCINTREX (PPB)