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Geological Fieldwork 1986

A NEW LOOK FOR REGIONAL GEOCHEMICAL SURVEY DATA*

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INTRODUCTION

Reconnaissance stream sediment sampling data published during the last 10 years has helped delineate regional geochemical patterns throughout much of the province, and provided a comprehensive data set that can be used as baseline information for more detailed studies. The database represents an investment of more than $3 million but because it has only been available on magnetic tape, only a few researchers and explorationists have had the facilities to realize its full potential. To make the data more readily accessible to a wider segment of the exploration industry, it has now been made available on floppy diskettes.

THE REGIONAL GEOCHEMICAL SURVEY DATABASE: A SUMMARY

The Geological Survey Branch of the British Columbia Ministry of Energy, Mines and Petroleum Resources has been involved in regional geochemical sediment surveys since 1976. The database represents multi-element determinations and field observations of reconnaissance stream sediment and water sampling of twenty-two 1:250 000 National Topographic System (NTS) map sheet areas. Figure 6-2-1 illustrates the areal distribution of these surveys.

The objectives of the British Columbia Regional Geochemical Survey (RGS) and its predecessor, the joint Federal/Provincial Uranium Reconnaissance Program (URP) are threefold, and are summarized as follows:

(1) To provide industry with high-quality reconnaissance exploration data to aid in the search for uranium and up to 19 other metals, particularly precious and base metals;

(2) To provide a consistent national database for these metals to serve as a basis for resource appraisal;

(3) To provide a comprehensive data set that will delineate the regional geochemical patterns throughout the province and be used as baseline information for more detailed studies.

Program design, based on preliminary orientation studies,[1] requires collection of sediments with an average density of one sample per 13 square kilometres from secondary or tertiary drainages. One kilogram of active stream sediment and 0.25 litre of water are collected at each site. Field observations on characteristics of the drainage catchment, sample site and sediment sample are also recorded. Samples are field-dried and the -80 mesh (<177 microns) fraction is routinely analysed for zinc, copper, lead, nickel, cobalt, silver, manganese, iron, molybdenum, tungsten, and uranium. Water samples are analysed for uranium, fluorine and pH. In response to industry demand, additional elements have been added to the surveys and include mercury, tin, arsenic, antimony, barium, cadmium, vanadium and loss-on-ignition.

Sample collection, sample preparation and water and sediment analyses are carried out by separate contractors. Personnel from the Geological Survey Branch have been responsible for supervision, management and quality control of the program since 1978. Data entry, digitizing, plotting, listings, and compilation for statistics have been done by the Geological Survey of Canada.

Results are usually released in May or June of the year following sample collection. A considerable effort is made to ensure that the data is secure until released. The data packet typically includes a sample location map, detailed listings, statistical summaries, and in some instances, maps for individual elements showing range symbols or values. The packet is available for purchase at a nominal price from the Publication Distribution centre at the British Columbia Ministry of Energy, Mines and Petroleum Resources in Victoria, or from Campbell's Reproduction in Ottawa. Results from the RGS can also be accessed for reference at all libraries of the Geological Survey of Canada, the Map Library at The University of British Columbia, and the Ministry Library in Victoria.

A great many new mineral prospects have been discovered, old ones have been re-evaluated, and a number of areas previously thought to have little mineral potential have been investigated as a result of the regional geochemical surveys. Information extracted from the RGS database has been useful not only for exploration work[2], but also for identifying the reliability of the data[3], for use in regional metallogenic studies[4], and as a database for land use decisions[5], environmental studies[6], and geological interpretations and projections[7].

THE PROBLEM: ACCESSIBILITY

The nature of such large multi-element surveys leads to the accumulation of enormous amounts of data; the RGS database contains information on both field and analytical data for more than 23 000 samples (Table 6-2-1). The means to store and access the data effectively must be examined carefully, if for no other reason than the high cost of its acquisition. More important, from the point of view of the exploration community, are the limitations inherent in a simple visual and manual interpretation of such complex and voluminous data. Subtle but significant information is likely to remain undetected. Processing by mathematical and statistical procedures can provide a more detailed interpretation and because of the volume of data involved, use of computers is essential. In response to this demand, RGS data were made available in digital form on high density magnetic tape in a format compatible with a wide range of mainframe installations.

Numerous processing and interpretative techniques have been developed to evaluate the RGS database[8]. In each case, computer manipulation and processing were essential for the efficient extraction of useful information. Unfortunately only a relatively small part of the mining community has the appropriate computer facilities (mini or mainframe installations with tape drives) to access and make use of this extensive and valuable database. Furthermore, the

[1] Ballantyne and Bottriel, 1975, Ballantyne, 1976, Ballantyne *et al.*, 1978, and Boyle and Ballantyne, 1980.
[2] Church, 1980, Panteleyev, 1980, Christopher, 1980, Boronowski, 1985.
[3] Matysek, 1985
[4] Sutherland Brown, 1980, Johnson, 1984, National Geochemical Reconniassance 1:2 000 000 coloured compilation map series (1981).
[5] McLaren, 1985
[6] Sutherland Brown *et al.*, 1979.
[7] Panteleyev, 1980, Matysek *et al.*, 1984.
[8] Sinclair and Fletcher, 1980, Matysek *et al.*, 1981, 1982, Addie, 1982, and Johnson, 1984.
* This project is a contribution to the Canada/British Columbia Mineral Development Agreement.

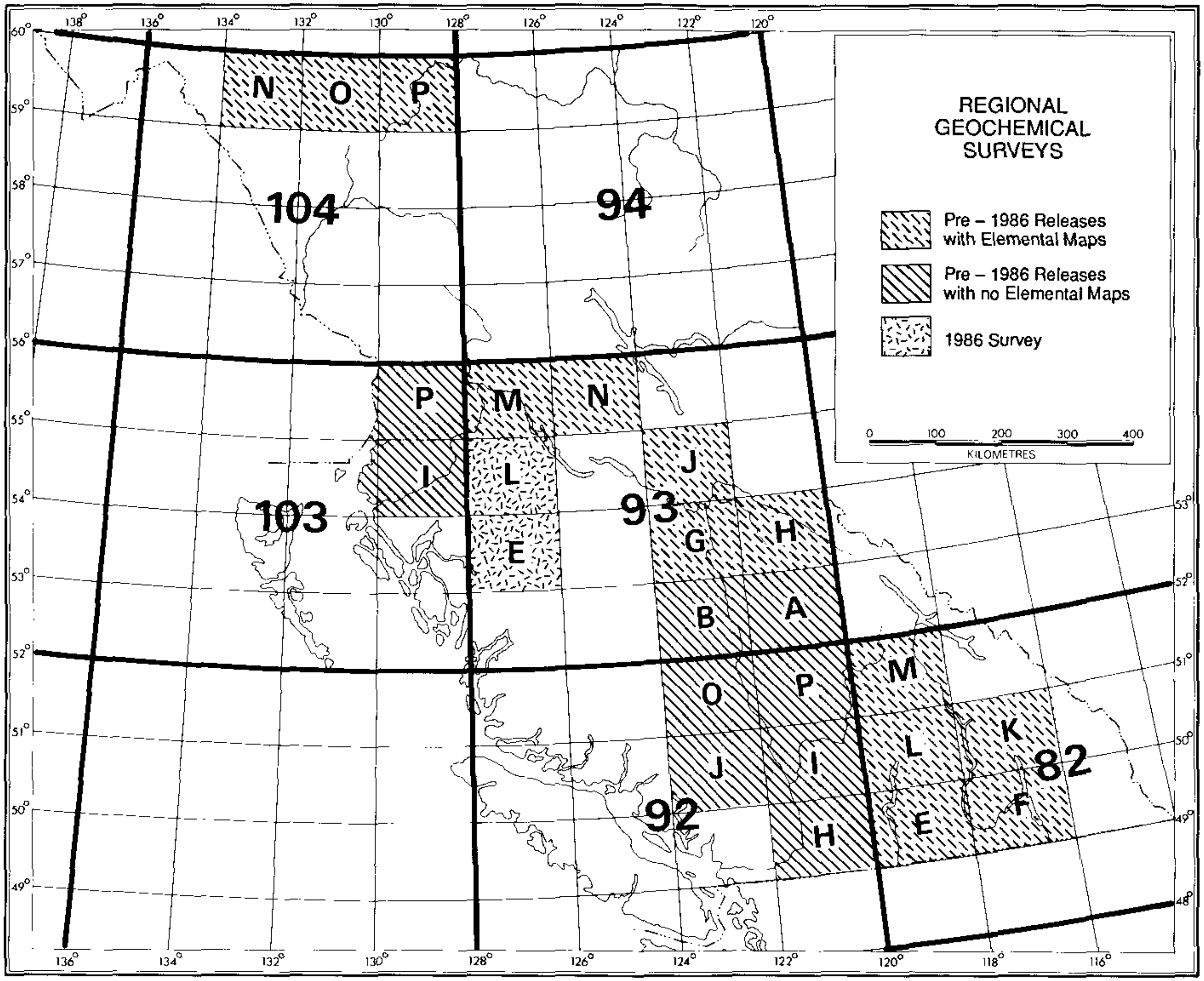

Figure 6-2-1. Areal Distribution of Regional Geochemical Survey Program.

TABLE 6-2-1
SUMMARY STATISTICS OF COMPUTER ACCESSIBLE RGS DATABASE

CANADA — BRITISH COLUMBIA
REGIONAL STREAM SEDIMENT AND WATER SAMPLING PROGRAM

NTS MAPSHEET	BRITISH COLUMBIA RELEASE AND GEOLOGICAL SURVEY OF CANADA OPEN FILE		COLLECTION YEAR	AREA SQ KM	SAMPLE SITES	DENSITY SITES/10 SQ KM	DENSITY SITE/SQ KM	ROUTINE ELEMENT SUITE	ADDITIONAL ELEMENTS							
									Sn	Hg	As	Sb	Ba	Cd	V	LOI
82E	NGR 05	OF 409	1976	16 000	1631	1.0	9.8	•								
82L	NGR 06	OF 410	1976	15 700	1385	0.9	11.3	•								
82F	NGR 25	OF 514	1977	16 000	1394	0.9	11.4	•	•	•						
82K	NGR 26	OF 515	1977	15 700	1297	0.8	12.1	•	•	•						
82M	NGR 27	OF 516	1977	15 400	1219	0.8	12.6	•	•	•						
104N	NGR 28	OF 517	1977	12 500	936	0.7	13.3	•	•	•						
104O	NGR 41	OF 561	1978	12 500	946	0.8	13.2	•		•	•					
104P	NGR 42	OF 562	1978	12 500	848	0.7	14.7	•		•	•					
103I	BC RGS 01	OF 772	1978	14 300	1908	1.3	7.5	•		•	•					
103J	BC RGS 01	OF 772	1978	1 500	326	2.1	4.6	•		•	•					
103P	BC RGS 02	OF 773	1978	14 000	1796	1.3	7.8	•		•	•					
103O	BC RGS 02	OF 773	1978	800	87	1.1	9.2	•		•	•					
92O	BC RGS 03	OF 774	1979	15 400	935	0.6	16.5	•		•	•					
92P	BC RGS 04	OF 775	1979	15 700	914	0.6	17.2	•		•	•					
93A	BC RGS 05	OF 776	1980	15 000	1299	0.9	11.5	•		•	•	•				
93B	BC RGS 06	OF 777	1980	15 000	757	0.5	19.8	•		•	•	•				
92H	BC RGS 07	OF 865	1981	16 000	995	0.6	16.1	•		•	•	•				
92I	BC RGS 08	OF 866	1981	15 700	606	0.4	25.9	•		•	•	•				
92J	BC RGS 09	OF 867	1981	15 700	853	0.5	18.4	•		•	•	•				
93M	BC RGS 10	OF 1000	1983	14 000	1100	0.8	12.7	•		•	•	•				
93N	BC RGS 11	OF 1001	1983	14 000	1124	0.8	12.4	•		•	•	•				
93G (E/2)	BC RGS 12	OF 1107	1984	7 300	585	0.8	12.5	•		•	•	•	•	•	•	•
93H (W/2)	BC RGS 12	OF 1107	1984	7 300	650	0.9	11.2	•		•	•	•	•	•	•	•
TOTAL				298 000	23 591	0.8	12.6									

Note: Routine Element Suite consists of analyses of stream sediment for Zn, Cu, Pb, Ni, Co, Ag, Mn, Fe, Mo, U, W and of analyses of stream waters for U F and pH. Open Files 517 and 561 also contain lake sediment data.

database which is currently available on magnetic tape requires considerable inputting and editing to ensure complete, consistent and systematic organization of the data.

THE SOLUTION: RGS DATABASE ON FLOPPY DISKETTES

The advent of inexpensive microcomputers has provided the majority of mineral exploration companies with the power to apply sophisticated data management and analysis techniques to geochemical and geological field data. To make the RGS data accessible to this new group of users, the entire database has been downloaded onto floppy diskettes. The increased accessiblity will promote a more thorough and refined assessment, and bring about a closer realization of the data's full potential.

THE PRODUCT: DETAILS

The RGS database has been split into separate datafiles, corresponding to 1:250 000 NTS map sheets, and stored on standard MS-DOS, double-sided, double-density, 5 1/4-inch floppy diskettes. Two text files are also included: a "Preamble" file describing the logistical details of the survey, and a "Format" file describing the nature and organization of the data. All files are stored in standard ASCII format.

In most cases, a single floppy diskette provides sufficient space (360 kilobytes) for data for one map-sheet and related text files. The total size of the RGS database, as it resides on floppy diskettes, is approximately 6 megabytes.

RGS DATAFILE

For greater manageability, individual map sheets have been split into an east and west half and are stored as two separate sequential files. Information pertaining to each sample is stored on three fixed-length 80-character records. Record one contains the field data; records two and three contain the analytical data.

All records for each sample have certain features in common: the first 12 columns always contain the NTS map sheet and sample number, and the last column of the record, column 80, contains an "X", which denotes the end of the record.

Sequential files are the simplest form to handle, being fully provided for in nearly all programming implementations, and requiring no special processing techniques. Fixed length data records are simple to manipulate and are readily transferred between computers.

PREAMBLE TEXT FILE

The "Preamble" file describes all relevant historical and technical details of the project. It identifies the supervisory personnel responsible for technical aspects of the survey and the contractors selected for sample collection, preparation, chemical analyses, and data preparation. It also describes the field, analytical and data preparation methods used, and lists relevant geological references.

TABLE 6-2-2.
RECORD FORMAT FOR INDIVIDUAL SAMPLES

Record 1: Field Information

Field	Description	Record	Columns	Length	Example
01	Map Sheet	1	01-06	6	104N16
02	ID (Year, Crew, Number)	1	07-12	6	841102
03	UTM Zone	1	14-15	2	10
04	UTM Easting (Metres)	1	16-21	6	544654
05	UTM Northing (Metres)	1	22-28	7	5911939
06	Rock Type	1	30-33	4	GRNT
07	Stratigraphic Age	1	34-35	2	36
08	Stream Width (Decimetres)	1	37-39	3	35
09	Stream Depth (Decimetres)	1	40-42	3	3
10	Elevation (Metres)	1	43-46	4	750
11	Sample Material	1	47	1	6
12	Replicate Status	1	48-49	2	00
13	Contamination	1	51	1	1
14	Bank Type	1	52	1	3
15	Water Colour	1	53	1	2
16	Water Flow Rate	1	54	1	2
17	Sediment Colour	1	55	1	6
18	Sediment Composition	1	56-58	3	013
19	Stream Precipitate	1	60	1	2
20	Local Precipitate	1	61	1	3
21	Physiography	1	62	1	2
22	Drainage Pattern	1	63	1	2
23	Stream Type	1	64	1	1
24	Stream Class	1	65	1	3
25	Stream Source	1	66	1	4
26	Date Collected (Day, Month)	1	68-71	4	1908

Record 2: (Map Sheet) ID and Analytical Data

Field	Description	Record	Columns	Length	Example
01	Map Sheet	2	01-06	6	104N16
02	ID (Year, Crew, Number)	2	07-12	6	841102
03	Zinc (PPM)	2	16-20	5	70
04	Copper (PPM)	2	21-25	5	39
05	Lead (PPM)	2	26-30	5	2
06	Nickel (PPM)	2	31-35	5	50
07	Cobalt (PPM)	2	36-40	5	19
08	Silver (PPM)	2	41-45	5	0.1
09	Manganese (PPM)	2	46-50	5	680
10	Iron (PCT)	2	51-55	5	3.00
11	Molybdenum (PPM)	2	56-60	5	2
12	Tungsten (PPM)	2	61-65	5	10
13	Tin (PPM)	2	66-70	5	4
14	Barium (PPM)	2	71-75	5	250
15	Loi (PCT)	2	76-79	4	23.2

Record 3: (Map Sheet) ID and Remainder of the Analytical Data

01	Map Sheet	3	01-06	6	104N16
02	ID (Year, Crew, Number)	3	07-12	6	841102
03	Arsenic (PPM)	3	16-20	5	3.0
04	Antimony (PPM)	3	21-25	5	4.2
05	Mercury (PPB)	3	26-30	5	10
06	Optional Element 1	3	31-35	5	
07	Optional Element 2	3	36-40	5	
08	Optional Element 3	3	41-45	5	
09	Optional Element 4	3	46-49	4	
10	Cadmium (PPM)	3	50-54	5	2.5
11	Vanadium (PPM)	3	55-59	5	125
12	Uranium (PPM)	3	60-64	5	2.0
13	Uranium in Water (PPB)	3	65-69	5	0.46
14	Fluorine in Water (PPB)	3	70-74	5	62
15	pH of Stream Water	3	75-79	5	8.3

FORMAT TEXT FILE

The "Format" file describes the nature and organization of the data. The format for each record is described in Table 6-2-2. Table 6-2-3 lists the field observation codes for characteristics of the drainage catchment, sample site and sediment sample.

THE EXTRAS

A number of enhancements are available to further increase the flexibility and accessiblity of the data. A public domain database management system, designed specifically for the RGS database, is available at a nominal cost. The system is written in BASIC, and provides selective retrieval and display capabilities.

The format of the data file was originally designed to produce an easily readable listing. However, some users' applications may require that all information for each sample is stored on the same record. A small application program is available which reformats the data into a fixed record length file with one sample per record. The program is available in both BASIC and FORTRAN.

Tables 6-2-4 and 6-2-5 list major rock types and stratigraphic ages of sampled catchment areas. These compilations are useful in assisting in the selection of map sheets on a geological basis.

THE COSTS

Floppy diskettes are available from the Publications Distribution Section of the Ministry. The cost to acquire individual 1:250 000 RGS datafiles is $12. Interested parties should direct their requests and queries in writing to:

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Parliament Buildings
Victoria, British Columbia
V8V 1X4

THE BENEFITS

(1) RGS database is stored in a complete and consistent format.
(2) It can be accessed by a significantly larger group of explorationists and research scientists.
(3) RGS data can now be evaluated by available microcomputer software to suit the user's specific needs.
(4) Detailed analysis of the database will lead to renewed interest in previously sampled areas.
(5) Future updates (new analyses and interpretations) can be inexpensively distributed to the public.

TABLE 6-2-3
EXPLANATION OF CODES FOR FIELD OBSERVATIONS LISTED IN RECORD 1

Field	Columns	Description
1	01 – 06	MAP SHEET: National Topographic System (NTS) Lettered Quadrangle (1:50 000 or 1:250 000 Scale)
2	07 – 12	ID / SAMPLE NUMBER: Consists of three parts, last two digits of the Collection Year (COL 7- 8) then Field Party Number (COL 9) then a sequential Number (COL 10-12)
	14 – 28	SAMPLE SITE LOCATION: Utilizes the Universal Transverse Mercator (UTM) System and consists of three parts,
3		A UTM Zone (COL 14-15)
4		then UTM Eastings (COL 16-21)
5		then UTM Northings (COL 22-28)
6	30 – 33	ROCK TYPE: Major rock type of catchment area Four character mnemonic employed For example: BSLT = Basalt SCST = Schist CHRT = Chert TILL = Till
7	34 – 35	AGE: Stratigraphic age of major rock type Two digit system employed For example: 16 = Silurian 36 = Cretaceous 24 = Permian 42 = Tertiary
8	37 – 39	STREAM WIDTH: Width of the stream at the sample site to the nearest decimetre
9	40 – 42	STREAM DEPTH: Depth of the stream at the sample site to the nearest decimetre
10	43 – 46	ELEVATION: Elevation at the sample site to the nearest metre
11	47	SAMPLE MATERIAL: Nature of media sampled 1 — Stream Sediment 4 — Stream Water 2 — Spring Sediment 5 — Spring/Well Water 3 — Heavy Mineral Concentrate 6 — Simultaneous Stream Water and Sediment
12	48 – 49	REPLICATE STATUS: Relationship of the current sample to others in the Project 00 — Routine sample site 10 — First of a field duplicate pair 20 — Second of a field duplicate pair
13	51	CONTAMINATION: Degree or type of Human Contamination 0 — None 4 — Mining activity 1 — Possible 6 — Agricultural 2 — Probable 7 — Domestic sources 3 — Definite 8 — Forestry activity
14	52	BANK-TYPE: General Nature of the Bank Material 0 — Undefined 4 — Glacial outwash 1 — Alluvial 5 — Bare rock 2 — Colluvial 6 — Talus, Scree 3 — Glacial Till 7 — Organic
15	53	WATER COLOUR: General Colour and Suspended Load of the Water 0 — Clear 2 — White cloudy 1 — Brown transparent 3 — Brown cloudy
16	54	WATER FLOW RATE: 0 — Stagnant 3 — Fast 1 — Slow 4 — Torrent 2 — Moderate
17	55	SEDIMENT COLOUR: 1 — Red, Brown 5 — Green 2 — White, Buff 6 — Grey 3 — Black 7 — Pink 4 — Yellow
18	56 – 58	SEDIMENT COMPOSITION: Bulk composition of the collected sample as a function of abundance of sand, fines and organics 0 — Absent 2 — Medium 33-67% 1 — Minor < 33% 3 — Major > 67% Sand > 0.125 mm (COL 56) Fines, Silt and Clay < 0.125 mm (COL 57) Organics (COL 58)
19	60	SEDIMENT PRECIPITATE OR STAIN: Presence of any coatings on pebbles, boulders or stream bottoms near the sample site 0 — None 4 — Yellow 1 — Red, Brown 5 — Green 2 — White, Buff 6 — Grey 3 — Black
20	61	LOCAL PRECIPITATE: Presence of stain, weathering; bloom on rocks in immediate catchment area 0 — Featureless 4 — Yellow 1 — Red, Brown 5 — Green 2 — White, Buff 6 — Grey 3 — Black
21	62	PHYSIOGRAPHY: 0 — Plain 3 — Hilly, undulating 1 — Muskeg, Swampland 4 — Mountainous, mature 2 — Peneplain, Plateau 5 — Moutainnous, youthful
22	63	DRAINAGE PATTERN: 0 — Poorly Defined 4 — Braided 1 — Dendritic 5 — Discontinuous 2 — Herringbone 6 — Basinal 3 — Rectangular 7 — Other
23	64	STREAM TYPE: 0 — Undefined 2 — Intermittent, seasonal 1 — Permanent 3 — Re-emergent, discontinuous
24	65	STREAM CLASS: 0 — Undefined 3 — Tertiary 1 — Primary 4 — Quaternary 2 — Secondary
25	66	STREAM SOURCE: 0 — Unknown 3 — Recent precipitation 1 — Groundwater 4 — Glacier melt water 2 — Spring run-off
26	68 – 71	SAMPLE COLLECTION DATE: Day (2 Digit) and Month (2 Digit)

Table 6-2-4. MAP-SHEET DISTRIBUTION OF MAJOR ROCK-TYPES IDENTIFIED OR INFERRED FOR SAMPLED CATCHMENT AREAS

1:250 000 MAP-SHEET LOCATION

FIELD CODE	DESCRIPTION	82E	82F	82K	82L	82M	92H	92I	92J	92O	92P	93A	93B	93G	93H	93M	93N	103I	103J	103O	103P	104N	104O	104P
AGCL	— Argillaceous Limestone																							•
AGLM	— Agglomerate											•												
ALSK	— Alaskite																					•		
ANDS	— Andesite	•	•	•			•	•	•	•	•			•		•	•					•		
ARGL	— Argillite		•	•				•	•						•									
BSLT	— Basalt						•			•	•	•	•	•	•	•	•				•	•		
CGLM	— Conglomerate	•	•	•			•	•					•	•	•	•	•							•
CHRT	— Chert											•		•								•	•	
DCIT	— Dacite							•		•	•													
DLMT	— Dolomite		•	•											•								•	•
FPCA	— Feldspathic Sandstone														•									
GBBR	— Gabbro															•								
GNSS	— Gneiss	•	•	•	•	•												•	•				•	
GRCK	— Graywacke								•													•	•	
GRDR	— Granodiorite Gneiss			•								•	•	•										
GRNG	— Granitoid Gneiss																•							
GRNS	— Greenstone	•			•		•	•	•		•						•						•	•
GRNT	— Granite	•	•		•	•	•	•	•	•	•						•	•	•	•	•	•	•	
IEXV	— Intermediate Extrusive						•																	
LMSN	— Limestone		•	•				•		•	•	•	•			•	•					•	•	•
LMDM	— Limestone, Dolomite																•							
MSDM	— Metasediment								•									•	•					
MVCC	— Metavolcanic																	•		•	•	•		
OLVB	— Olivine Basalt	•			•	•																•		
PCLC	— Pyroclastic																					•		
PLLT	— Phyllite											•		•	•		•						•	
PRDT	— Peridotite						•																	
QRTZ	— Quartzite		•	•	•	•						•			•									•
QRZD	— Quartz Diorite																						•	
QTMZ	— Quartz Monzonite			•										•		•							•	
RDCT	— Rhyodacite								•															
RYLT	— Rhyolite												•	•		•	•							
SCST	— Schist		•	•	•	•		•																
SHLE	— Shale		•						•					•	•	•	•							
SLSN	— Siltstone									•	•							•			•			
SLTE	— Slate		•	•			•																	
SMRK	— Sedimentary Rock																					•		
SRPN	— Serpentinite							•	•								•						•	•
SNDS	— Sandstone						•							•										
SYNT	— Syenite	•	•		•																			
TILL	— Till	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•
TUFF	— Tuff															•							•	
UMFC	— Ultramafic	•				•																•		
		82E	82F	82K	82L	82M	92H	92I	92J	92O	92P	93A	93B	93G	93H	93M	93N	103I	103J	103O	103P	104N	104O	104P

Table 6-2-5. MAP-SHEET DISTRIBUTION OF THE STRATIGRAPHIC AGE OF SAMPLED CATHMENT AREAS

1:250 000 MAP-SHEET LOCATION

FIELD CODE DESCRIPTION	82E	82F	82K	82L	82M	92H	92I	92J	92O	92P	93A	93B	93G	93H	93M	93N	103I	103J	103O	103P	104N	104O	104P
04 — Proterozoic			●								●					●							
06 — Helikian		●	●																				
07 — Hadrynian		●	●										●	●									●
10 — Paleozoic undivided		●	●			●	●	●								●	●	●					
11 — Proterozoic-Paleozoic										●												●	●
12 — Cambrian		●	●								●			●									●
13 — Cambrian-Ordivician			●																				●
14 — Ordovician																							
15 — Ordovician-Silurian			●																				
16 — Silurian														●									
17 — Silurian-Devonian																●							
18 — Devonian														●								●	●
19 — Devonian-Mississippian																						●	●
20 — Carboniferous																						●	●
21 — Mississippian													●	●									
22 — Pennsylvanian										●													
23 — Pennsylvanian-Permian													●		●	●							
24 — Permian							●		●	●	●	●											
30 — Mesozoic undivided		●					●		●		●												
31 — Paleozoic-Mesozoic						●	●																
32 — Triassic		●	●			●	●	●	●	●			●	●	●	●							
33 — Triassic-Jurassic		●										●	●				●	●	●	●		●	
34 — Jurassic		●				●				●			●		●	●						●	
35 — Jurassic-Cretaceous		●	●			●		●							●		●	●	●	●		●	
36 — Cretaceous						●	●	●	●				●		●	●						●	●
40 — Cenzoic undivided																							
41 — Mesozoic-Cenzoic						●	●	●	●	●	●	●	●		●	●	●	●	●	●			●
42 — Tertiary		●				●	●	●	●	●	●	●	●		●							●	●
43 — Tertiary-Quaternary								●			●	●										●	
44 — Quaternary						●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●
50 — Unknown																●							
	82E	82F	82K	82L	82M	92H	92I	92J	92O	92P	93A	93B	93G	93H	93M	93N	103I	103J	103O	103P	104N	104O	104P

NOTE: Stratigraphic ages of sampled catchment areas not determined for map-sheets 82E, 82L, 82M and 104N.

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