



# Data Systems

# THE SEARCH-AND-REPORT POWER OF MINFILE/pc<sup>®\*</sup>

By L.D. Jones

**KEYWORDS:** MINFILE, mineral inventory, MINFILE/pc, search program, mineral deposit, commodity, MINGRAPH, Tulsequah, Golden Bear, terrane, query, computer database.

## INTRODUCTION

MINFILE/pc, Version 2.0, is a search-and-report program that operates on a set of files containing locational, mineralogical, geological, reserve and production information, all related to a unique mineral occurrence. There are over 10 000 documented occurrences within British Columbia, ranging from small showings to large producing deposits. The complete mineral occurrence file is collectively known as MINFILE.

MINFILE/pc is one of the tools used to interrogate the MINFILE database and may be used to compile information on known mineral occurrences in the province. The program provides answers on the relationships between economic and geologic features of an area, thus providing a basis for further investigation.

MINFILE is a compilation of historic and current exploration data and is thus sometimes limited by incomplete or inaccurate reporting. It is, at the same time, one of the most extensive mineral occurrence databases available. Users of the MINFILE system should understand how the data are collected and stored before attempting to "navigate" and query the database.

The purpose of this article is to describe the MINFILE/pc system, the type of information available, how it may be used, and how the results of a search may be expressed quantitatively and qualitatively. Its usefulness as a searching tool will be demonstrated using examples from a selected area.

## THE MINFILE/pc SYSTEM

MINFILE/pc is a stand-alone, menu-driven program, operating in the MS-DOS environment of personal computers. The program requires at least 512 kilobytes of RAM, a 5¼ inch floppy-disk drive, and a hard-disk drive with sufficient space to accommodate the set of distributed data files and their subsequent configuration. A 1000-occurrence subset of ASCII data requires about 4 megabytes of disk space, the configured dataset requires another 4 megabytes of disk space, and the MINFILE/pc system program requires 0.35 megabytes, for a total of 8.35 megabytes. The 10 000-occurrence ASCII dataset for the province of British Columbia is presently about 20 megabytes and contains updated data for only 50 per cent of the known occurrences. The province-wide database, when completed, is expected to

reside on a hard drive of at least 40 megabytes, or preferably a 70-megabyte drive, to allow for supporting software.

MINFILE/pc has the ability to interrogate the provincial mineral database as a series of manageable subsets. The locational subset includes data such as latitude and longitude, UTM coordinates, NTS map number, mining division, tectonic belt, physiographic region or terrane. Subsequent search criteria could include: commodity, status, deposit name, mineralogy, host rock/mineral age, deposit character and classification, lithology, formal/informal host names, deposits with production, and deposits with reserves. On most of the screens, search parameters are presented to the program using Boolean algebra (AND, OR, NOT) expressions.

Several fields in the MINFILE database are ranked; these include the occurrence status, commodity, mineral, and lithology fields. The status, or stage of development, of the occurrence is ranked as showing, prospect, developed prospect, producer or past producer.

Commodities are ranked in decreasing order of importance, based on perceived economic significance and amount of significant minerals. Ranking is sometimes biased, commodity listings for a deposit tend to use such conventions as gold-silver and lead-zinc rather than silver-gold and/or zinc-lead regardless of the relative abundance or value of the metals. Such paired commodities may be better dealt with by combining them in a search. Commodities recorded in the database may be present in any amount and do not have to be economically recoverable.

The variety of deposit models and classifications presents difficulties in attempting to describe deposit types. Occurrences in MINFILE are categorized according to "deposit character", which is derived from field observations, and "deposit classification", which is an interpretation of the genesis of an occurrence. More than one character and classification of an occurrence may be listed in the database.

An appreciation of the way MINFILE data are recorded permits the user to draw meaningful conclusions regarding the significance of the occurrence and the recorded data.

Reports resulting from a MINFILE/pc search may include standard data format files, tabular reports, capsule geology and bibliography reports and a master report. A standard data format (SDF file) is used in a plotting program known as MINGRAPH. The SDF file includes the MINFILE number, occurrence name, commodities, status, latitude/longitude, UTM coordinates and NTS map number. The tabular reports may be sorted by commodity, name, NTS map sheet and MINFILE number. A capsule geology and bibliography report presents summary information on the occurrence and the master report provides the complete data on the occurrence. These reports are generated using a runtime module of R&R Relational Report Writer.

\* This project is a contribution to the Canada/British Columbia Mineral Development Agreement. British Columbia Ministry of Energy, Mines and Petroleum Resources, Geological Fieldwork, 1988, Paper 1989-1.

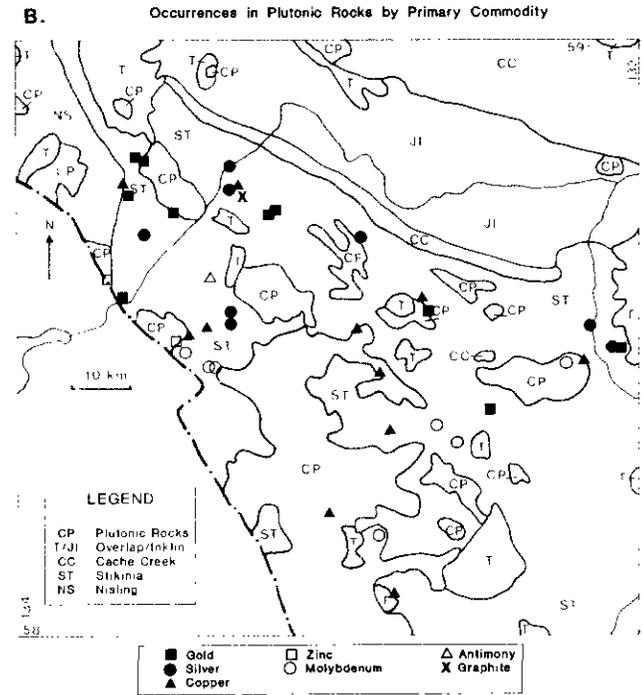
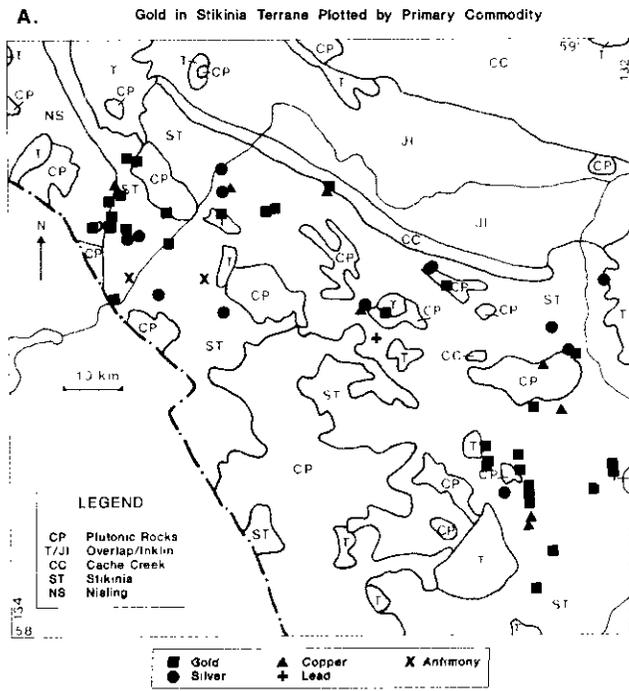


Figure 6-1-1. Plots generated by MINGRAPH on terrane base map of 104K.

## HOW MINFILE/pc CAN BE USED

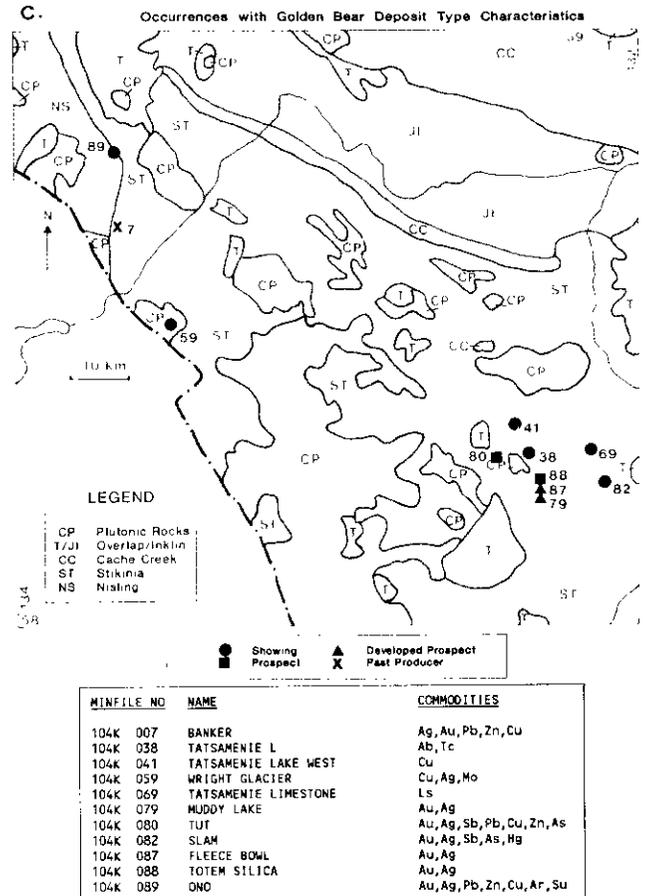
Statistical graphs and plots of the search, such as histograms, bar and pie charts, and tables may be displayed using a presentation graphics package. In this case Harvard Graphics was used. The companion graphics program, MINGRAPH, generates MINFILE occurrence location plots based on the results of a MINFILE/pc search. These plots, referred to as commodity maps, thematic maps, dot density, or even scatter plots, illustrate mineral distribution patterns and their relationships to regional geology. The maps may show single, multiple, or dominant commodities and can be displayed at a variety of scales, using a variety of symbols and labels.

Presently MINGRAPH is used to plot mineral inventory maps at a 1:250 000-scale, with 1:50 000-scale inserts when required. These will be available on a geological base map. Geochemical distribution maps are also available at the same scale. Representation of the data as histograms, statistical charts, tabular reports and maps, provides a quantitative and qualitative analysis of the frequency and distribution of mineral occurrences and ranking of information.

These MINFILE tools are an invaluable aid in developing exploration strategies, evaluating resource potential, land-use planning and carrying out metallogenic studies.

## TEST CASE — THE TULSEQUAH MAP SHEET (104K)

The Tulsequah map sheet (104K) is used here as an example to show the power of MINFILE/pc. Questions were asked to illustrate the frequency and distribution of known commodities and deposit types within the different terranes of the



area. Also some specific queries are listed with examples of MINFILE/pc reports. The 116-occurrence dataset available for this map sheet limits the scope of the analysis; a larger dataset would allow a more meaningful interpretation. Histograms and maps are presented to document the results of the searches.

The 104K map area covers parts of the Coast and Intermontane belts. The east half of the area is underlain by intensely folded and regionally metamorphosed Permian, Triassic and older strata of the Stikine terrane. These rocks host epigenetic gold deposits, such as the Golden Bear. The west half of the map sheet covers the Tulsequah Chief and Big Bull volcanogenic massive sulphide deposits. These occur within Upper Triassic volcanics of the Stikine terrane, in a wedge between the Cache Creek terrane and Coast plutonic complex.

Lithotectonic terranes are areas with rock assemblages distinct from their neighbours. They are generally bounded by major faults, although these may be interrupted by overlap assemblages or intrusions. The Nisling, Stikine, and Cache Creek terranes are represented in the 104K map area. Although the overlap assemblages and intrusive bodies do not constitute a terrane in the normal definition, they are treated as such in MINFILE. Gold, silver, copper, lead, zinc, molybdenum and antimony were searched and the frequency and distribution of occurrences charted and plotted by terrane (Figures 6-1-1A and 1B, and 6-1-2). The distribution of anomalous stream sediments determined by the Regional Geochemistry Survey (RGS) were also noted within each terrane.

The deposit character and classification fields were searched to derive the number and distribution of deposit types associated with each terrane (Figure 6-1-2B). The deposit-type search included vein, skarn, porphyry and stratabound/stratiform, including volcanogenic. A search of occurrences by terrane will often produce duplication as many lie near terrane boundaries. Isolating these duplicates will highlight occurrences associated with this geological setting.

The Nisling terrane is a metamorphosed Proterozoic to lower Paleozoic passive continental margin assemblage, with carbonaceous and siliceous offshore sediments. This terrane, which underlies only a small area in the northwest quadrant of the 104K map area, contains three documented mineral occurrences; all are veins containing gold, with some containing silver, copper and antimony.

The Stikine terrane consists of Devonian to Permian arc volcanics and platform carbonates, overlain by Triassic and Lower Jurassic arc volcanics, volcanoclastics and chert, and intruded by comagmatic plutonic rocks. Over 80 per cent of the known occurrences in 104K lie within this terrane which underlies about half the map area. The ordered frequency of commodities is silver, gold, copper, lead, zinc, antimony and molybdenum. However, a search of the dominant or primary commodity reveals a ranking order of gold, silver, copper, molybdenum, antimony, zinc and lead. The distribution map (Figure 6-1-1A) shows that the Stikine terrane apparently hosts primarily polymetallic mineralization in the western part of the map area and dominantly gold, silver, and copper mineralization in the east. Stream sediments reflect a dis-

tribution of anomalous lead in the Tulsequah area, copper in the east part of the Stikine terrane, and gold, silver and arsenic scattered throughout this terrane.

The Stikine terrane also displays the greatest variety of deposit types. The ranked order is vein, stratabound, and a roughly equal number of skarn, porphyry and volcanogenic occurrences.

The Cache Creek terrane consists of Mississippian to Upper Triassic oceanic volcanics and sediments, including radiolarian chert, argillite and basalt, shallow-water carbonate and alpine ultramafics. It underlies approximately 10 per cent of the map area in its northeast corner and contains about 13 per cent of the known mineral occurrences. Ranked commodities are silver, gold, equal lead, antimony and zinc, and equal nickel and copper. None of the commodities are dominant except nickel, which is also concentrated within stream sediments in the Cache Creek terrane and its overlap assemblage (Inklin). Known deposits in this terrane are mainly vein and stratabound types and a skarn deposit.

Post-terrane-accretion overlap assemblages include the Jurassic Inklin on the Cache Creek terrane and other undifferentiated Jurassic to Tertiary assemblages, which occur largely on the Stikine terrane. The commodities present are mainly copper and silver, with minor lead and gold. In the

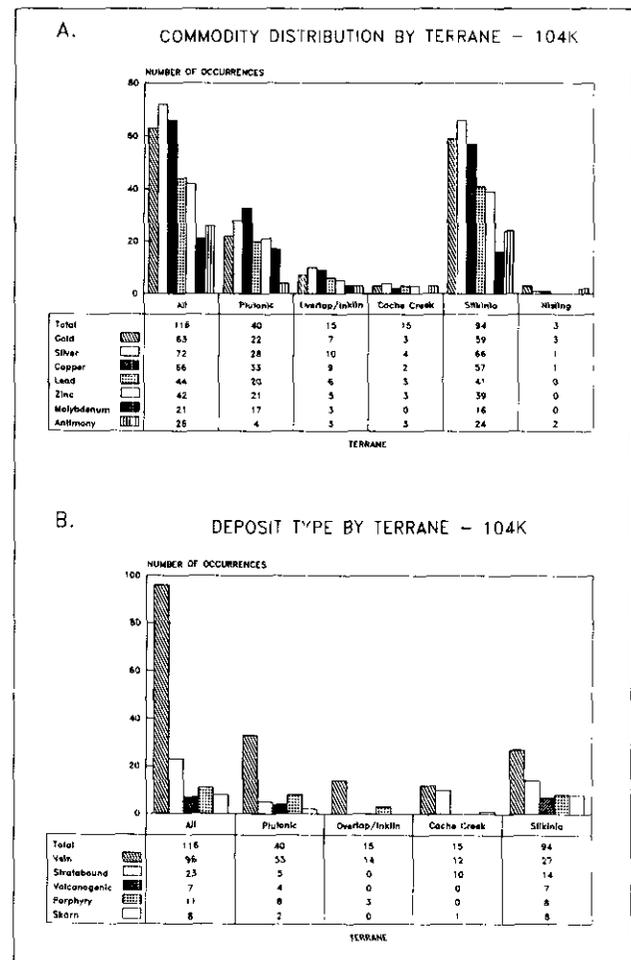


Figure 6-1-2. Histogram charts of number of occurrences within terranes resulting from MINFILE/pc searches.

A. NTS MAP NUMBER-INDEX REPORT FROM QUERY NUMBER 1										
NAME	MINFILE NO	NTS	COMMODITIES	LATITUDE	LONGITUDE	UTM	NORTH	EAST	R	P
BIG BULL	104K	008	104K12E AG AU CU ZN PB BA	58 40 08	133 32 48	08	6503900	584300	Y	Y
ERIKSEN-ASHBY	104K	009	104K11W AG PB ZN AU	58 39 30	133 28 23	08	6502800	588600	Y	
ERIKSEN-ASHBY ZONE B	104K	021	104K11W AG PB ZN RO	58 40 05	133 28 12	08	6503900	588750	Y	
TULSEQUAH CHIEF	104K	002	104K12E AU AG ZN CU PB CD	58 44 10	133 35 57	08	6511300	581100	Y	Y
YELLOW BLUFF	104K	049	104K11W AU PB ZN AG CU	58 42 26	133 27 50	08	6508250	589000		

B. COMMODITY-INDEX REPORT FROM QUERY NUMBER 2										
NTS	MINFILE NO	NAME	COMMODITIES	LATITUDE	LONGITUDE	UTM	NORTH	EAST	R	P
OCCURRENCES CONTAINING COMMODITY -- AG Silver										
104K10W	104K	107	BARB AU AS SB AG	58 45 01	132 53 42	08	6513950	621800	Y	
104K14W	104K	054	KING SALMON CREEK PB AG	58 47 54	133 12 48	08	6518750	603250		
OCCURRENCES CONTAINING COMMODITY -- AS Arsenic										
104K10W	104K	107	BARB AU AS SB AG	58 45 01	132 53 42	08	6513950	621800	Y	
OCCURRENCES CONTAINING COMMODITY -- AU Gold										
104K10W	104K	107	BARB AU AS SB AG	58 45 01	132 53 42	08	6513950	621800	Y	
OCCURRENCES CONTAINING COMMODITY -- PB Lead										
104K14W	104K	054	KING SALMON CREEK PB AG	58 47 54	133 12 48	08	6518750	603250		
OCCURRENCES CONTAINING COMMODITY -- SB Antimony										
104K10W	104K	107	BARB AU AS SB AG	58 45 01	132 53 42	08	6513950	621800	Y	

C. SDF FILE REPORT FROM QUERY NUMBER 3										
104K	006	POTLATCH	AUAGPBZNCU	SHOW085820006504500104K12E584013335						
104K	007	BANKER (L.6169)	AGAUPBZNCU	PAPR085826006503900104K12E584013334						
104K	017	COUNCIL	SBAUAGNI	SHOW085828006496000104K12E583513334						

Figure 6-1-3. Reports generated by MINFILE/pc.

Inklin assemblage zinc is anomalous in stream sediments but zinc is not the dominant metal in any recorded occurrences. This perhaps reflects the higher chemical mobility of zinc relative to the other metals. These overlap assemblages are host mainly to vein and porphyry deposits.

The Coast plutonic rocks, which include post-terranic accretion Jurassic to Cretaceous intrusives, underlie about 25 per cent of the map area and contain 40 occurrences. The plutonics are represented by a ranked copper-silver-gold-zinc-lead-molybdenum-antimony metallogenic signature. A search on the dominant or primary commodities reveals a ranked copper-gold-silver-molybdenum association with lead and zinc being very minor. The molybdenum association with the plutonics is supported by anomalous molybdenum in stream sediments. The deposits are recorded mainly as vein and porphyry types.

A comparison of Figures 6-1-1A and 6-1-1B shows that a third of the gold occurrences in the Stikine terrane coincide with occurrences in plutonic rocks. This duplication of occurrence distribution highlights the localization of gold occurrences around the margins of plutonic intrusions.

### SPECIFIC SEARCH QUERIES

The following list of specific questions posed to MINFILE/pc and the responses presented in a MINFILE/pc report format or MINGRAPH map, demonstrate the power of the programs.

- (1) **List the mineral occurrences representative of Kuroko-style stratiform, volcanogenic, massive sulphide deposits.**

Here deposit classification (volcanogenic) then character (stratiform) were searched, resulting in the five occurrences listed by NTS map number in Figure 6-1-3A. The "R" and "P" in the heading indicate that reserve and production data are in the database.

- (2) **List the gold or silver occurrences reported to be associated with limestone of the Sinwa Formation of the Upper Triassic Stuhini Group.**

A search on the Sinwa Formation, followed by limestone, then gold or silver, produced two occurrences. These are listed in Figure 6-1-3B, which is an example of the commodity index report.

- (3) **What gold occurrences are associated with mariposite?**

A gold commodity search, followed by a mineralogy search for mariposite produces the SDF file in Figure 6-1-3C, which may be used in MINGRAPH for plotting.

- (4) **How many porphyry copper-molybdenum occurrences are associated with the boundary between the Coast and Intermontane belts?**

The parameters listed in the request may be obtained from MINFILE/pc, however, the relationship with the tectonic belt boundary is presently unavailable as the

location search may be carried out only once with the entire database, not a subset of the data. However, an appreciation of the distribution of the occurrences can be obtained from viewing a plot on a map containing these belts. There are nine porphyry copper-molybdenum occurrences, five of which lie within 5 kilometres of the belt boundary.

- (5) **The Golden Bear deposit, which is considered to be epithermal, is described in MINFILE as containing quartz, dolomite and pyrite as alteration minerals within tuff, limestone and breccia of Permian age. Are there similar occurrences in the map area?**

Here, 116 occurrences in 104K containing one or all of the alteration minerals are searched; 63 occurrences are reported. Then the rock types are searched, reducing the listing to 34 occurrences. Finally, the search is confined to rocks of Permian age to produce a list of 11 occurrences, all in the Stikine terrane. These are plotted on Figure 6-1-1C.

One is indeed the Golden Bear deposit and two others are nearby deposits, the "developed" Fleece Bowl and the "undeveloped" Totem Silica. Two silicified limestone showings with gold and silver, the Tut and Slam, may also have epithermal characteristics. Two of the results were polymetallic deposits, occurring to the northwest, and two were minor copper occurrences. The vein mineralization in these occurrences has a similar geological setting to the Golden Bear. An asbestos prospect and a limestone occurrence have a similar geological setting but contain no precious or base metals. These results illustrate how the MINFILE/pc search module can be used to identify known occurrences similar to the Golden Bear.

## CONCLUSIONS

A quantitative study of the data resulting from MINFILE/pc searches reveals differences in the number of occurrences from one terrane to the next. These differences may be due to such variables as geology, intensity of exploration, outcrop density and area of the terrane.

The Stikine terrane has a polymetallic signature and hosts several types of deposits, small precious metal veins, skarn deposits, and large precious and base metal volcanogenic

deposits. The plutonic rocks host similar commodities and deposit types, however, copper-molybdenum porphyry deposits are dominant.

An examination of the thematic maps reveals an uneven distribution of mineral occurrences within the terranes. However, clustering is observed in the Tulsequah area and a gold-vein mineral trend is seen along the north-northwest-trending fault in the Golden Bear area. Many occurrences are located along terrane margins and plutonic contacts.

Only three parameters, commodities, deposit types and terranes were used to provide this simple quantitative and qualitative analysis. The many searchable parameters of MINFILE/pc can provide a meaningful starting point in the evaluation of mineral resource potential in an area. The more explored, exposed and geologically understood areas may be used as models for the less known areas.

## ACKNOWLEDGMENTS

I would like to acknowledge and thank the contributions to the MINFILE project by G. Lowe, B. Grant, A. Wilcox and the MINFILE team, consisting of C. Borsholm, E. Kneffel, G. Payie, L. Duffett, D. Jakobsen, W. Vanderpoll, S. Dumais, J. Rouse, G. McGee, and K. Aheirs.

## REFERENCES

- Grant, B. (1988): MINFILE Coding Manual, Version 3.2, B.C. Ministry of Energy, Mines and Petroleum Resources.
- ESL Environmental Sciences Limited (1983): MINGRAPH/pc User's Guide.
- Wilcox, A.F. (1988): New MINFILE - A Mainframe and Personal Computer Based Mineral Inventory Database, B.C. Ministry of Energy, Mines and Petroleum Resources, Geological Fieldwork, 1987, Paper 1988-1.
- Sinclair, A.J., Wynne-Edwards, H.R. and Sutherland Brown, A. (1978): An Analysis of Distribution of Mineral Occurrences in British Columbia, B.C. Ministry of Energy, Mines and Petroleum Resources, Bulletin 68.
- Wheeler, J.O., Brookfield, A.J., Gabrielse, H., Monger, J.W.H., Tipper, H.W., and Woodsworth, G.J. (1988): Terrane Map of the Canadian Cordillera, Geological Survey of Canada, Open File 1894.

## NOTES