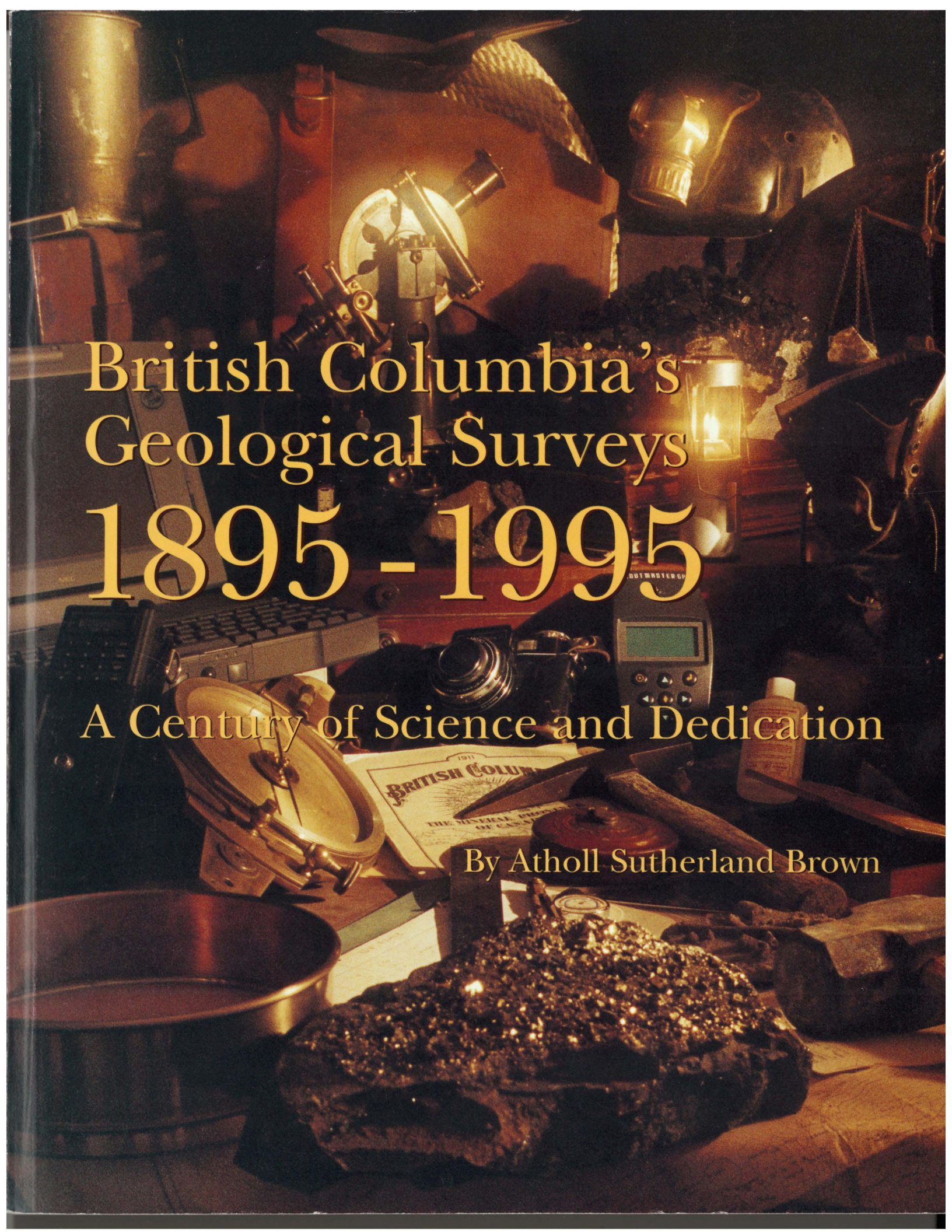
British Columbia's
Geological Surveys
1895 - 1995
A Century of Science and Dedication
By Atholl Sutherland Brown

DEDICATION —

To the generations of committed members of that continuum - the British Columbia Bureau of Mines, the Mineral Survey, the Mineralogical Branch, the Geological Division and the Geological Survey Branch. Though their work was arduous they pursued their objectives with resolute spirits and enquiring minds to produce truly useful information about the geology, resources and geological hazards of the Province without much personal reward.

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The *B.C. Heritage Trust* has provided financial assistance to this project to support conservation of our heritage resources, gain further knowledge and increase public understanding of the complete history of British Columbia.

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The territory that was to become the Province of British Columbia started to develop after the signing of the *Oregon Treaty of 1846* which resolved the conflicting claims of the United States and British North America. For a brief period there were two colonies, Vancouver Island and British Columbia, as well as the Queen Charlotte Islands and Stikine Territory in the north. These were consolidated into the single colony of British Columbia in 1866 (Figure 1). The spur for these political developments was the perceived potential mineral wealth of the northern Cordilleran region following the discovery of coal on Vancouver Island in 1835, lode gold on the Queen Charlotte Islands in 1850 and placer gold on many interior rivers from 1855 forward. The colony became a Canadian province by joining Confederation in 1871 at a time when the science of geology was in the flush of its development and geological surveys were being established in many countries.

After the major gold discoveries on the Fraser River and in the Cariboo, British Columbia's first responses to the incursion of prospectors from California was to establish law and order followed by the introduction of regulations for the control of ownership and mineral rights. However the need for geological studies was clearly recognized before Union with Canada as the terms for union required Canada to "*assume and defray the charges for the following service*: ... *The Geological Survey*, (Appendix III). In spite of this requirement, the province and the federal government jointly funded initial studies such as Amos Bowman's geological mapping of the Cariboo goldfields in 1885. The need for more focused geological data and ready advice was soon recognized, resulting in the appointment of a Provincial Mineralogist and a Provincial Assayer and Analyst in 1895. A Government Assayer had been

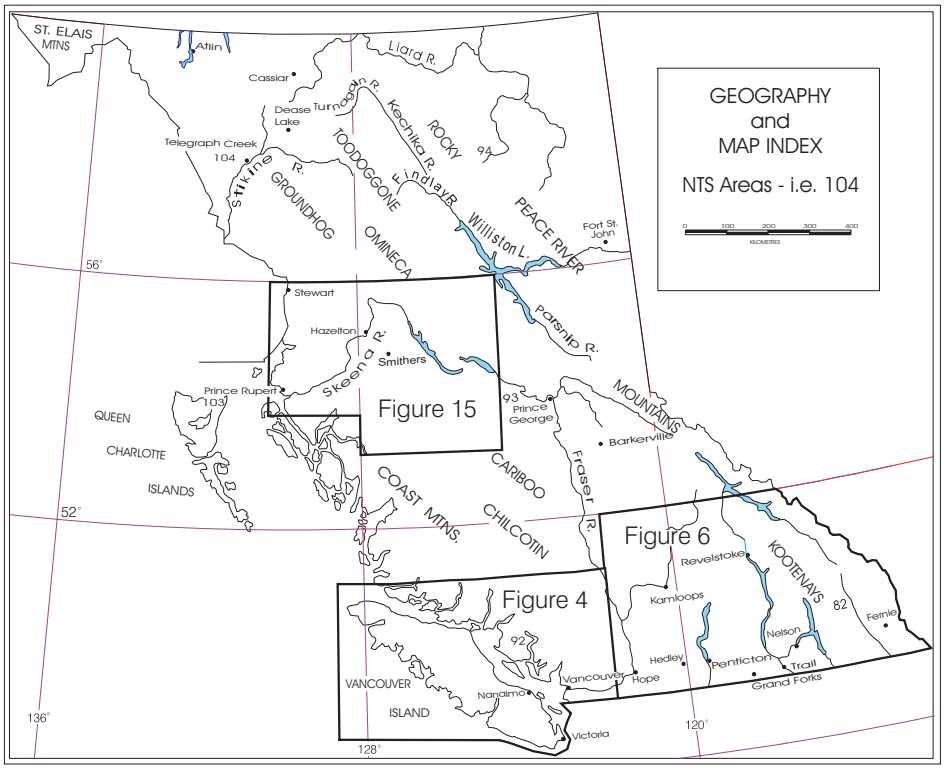

Figure 1. British Columbia geography showing main districts and communities cited in the text and Map Index

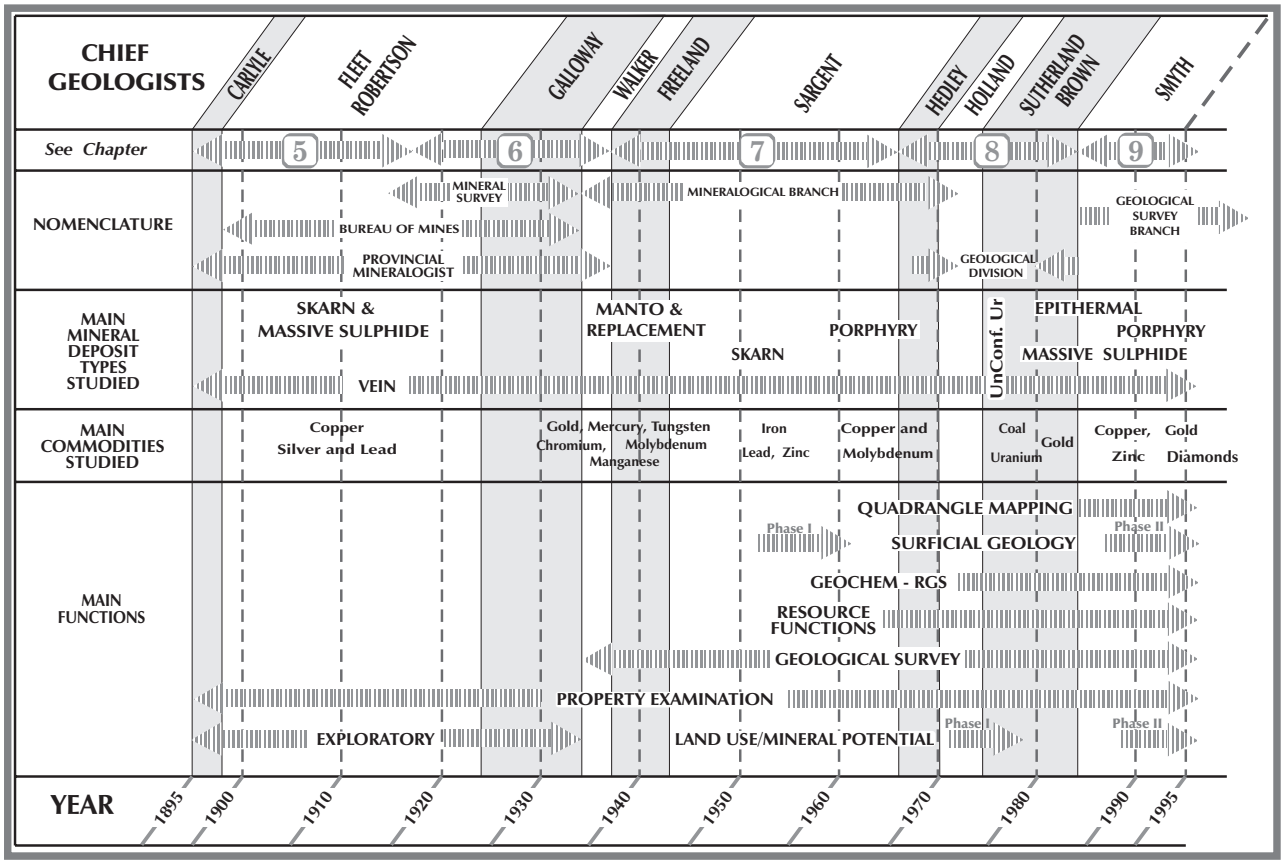

Figure 2. Chronology of Chief Geologists, nomenclature, chapters of this history, survey functions, and main commodities and deposit types studied.

previously authorized in 1859 and offices had been established in New Westminster and Barkerville which were consolidated in Victoria in 1885. From this small beginning the provincial geological survey developed.

The historical development of the Survey occurred in stages that were related to the changes in legislative mandate, to the tenure of a succession of Provincial Mineralogists (Appendix I, Biographies of Provincial Mineralogists and successors), to the titles the organization has been called and to the development of mining and particularly exploration. Perhaps not surprisingly there was a deal of coincidence between the successive changes in these fields (Figure 2).

The application of geology to the management of mineral resources was the first use of the science in the BC government service but geosciences are now applied within many ministries including Environment, Forestry, and Transportation and Highways. Mineral resource development is still the dominant application of the geosciences in the government and the focus of this history.

The development of the BC Geological Survey Branch parallels that of many other provincial and state surveys but with some differences. These range from the trivial, like its persistence with the name Mineralogical Branch until 1973, to the more substantive, such as the bias toward engineering backgrounds for its staff through most of its history, its unconcern with quadrangle mapping until 1985 or to its singleness of purpose, devoting almost all its efforts to aiding the mineral industry. A title applied in its mid history, the Mineral Survey, is in many respects particularly appropriate. With this focus there has been little overlap with work of the Geological Survey of Canada.

Figure 3. BC cartoon, recognizing a title when he sees it (with apologies to Johnnie Hart).

The mineral resource oriented geological unit has had many changes in name, function and scope since its inception, as has the ministry of which it formed a part. In this account the geological unit will generally be called by the applicable name for the period or informally, the survey, a recent but appropriate change, and the ministry will generally be called the Ministry of Energy, Mines and Petroleum Resources although it was styled the Department of Mines (BCDM) through much of its history (Appendix II, Figure 3).

Consideration of the lives and training of the chiefs (Appendix I) draws attention to the question of what was a geologist and what caused the engineering bias of the survey throughout most of its history. The early Provincial Mineralogists had degrees in natural sciences as well as mining and metallurgy, the normal way to become either a geologist or a mining engineer in the Canada of the day. They also worked as undergraduates or graduates with the early Geological Survey of Canada. In fact they were geological engineers although the third chief, Jack Galloway, was the first that would call himself a mining geologist. The resident engineers of the Mineral Survey era (1917-1937) were mainly mining engineers but most had some geological training or skills. A few like Douglas Lay, a chemical engineer, carried out major geological research projects in the line of their work and developed innovative geological concepts. In the Mineralogical Branch era (1937-1973) most geologists hired had engineering degrees, partly because many Canadian universities of the period, including The University of British Columbia, shepherded their geological students toward these degrees and partly because study of the geology of underground mines required it. As the survey became less involved in underground studies and as most universities changed to granting science degrees in geology, the emphasis on engineering decreased to where it is a rarity today.

Throughout its history the Survey has been staffed by a small group of enthusiastic, talented and well-trained people who have done much to advise the government and inform the public as well as to assist the mineral industry and develop the province; their names are well known to the cognoscenti through their masterful publications. As Yorath (1991) says of Cordilleran geologists, "*Their altars are rocks, their season is summer and their children tend to have birthdays in June... In public they are mostly quiet and unassuming; however, among themselves they are gregarious and love to argue... What distinguishes them from most others is their consuming passion for what they do. They long for summer when the mountains will ring with the blows of their hammers, when helicopters will carry them through the sky. They will gaze from windswept peaks and see continents in collision,*

entire oceans created and destroyed. They will lose themselves in time." They live double lives - one intellectual and office bound; the other in the field, bush, and mountain peaks - free, athletic and not without danger. Except for a few dandies they look like tramps in the field but their office dress, especially in the past, is inclined to be sober (see the photographs).

The early geologists, as well as those of today, were avid and skilled photographers and they all had wide access to the hinterland of British Columbia even when this was an arduous task. As a result they have left a superb record of the development of the mineral industry, the Province, its physiography, and geology which is sampled in this volume. The photographs illustrate the coincident evolution of exploration, mine and smelter development, survey methods, field transportation, office and field accommodation and staff. It is appropriate that this volume be dedicated to the Survey personnel.

ACKNOWLEDGMENTS

I have received much help in writing this history, notably from: the late Stuart Holland who was an important source of information and encouragement; Roz Moir who completed my set of Annual Reports on my retirement; Jim Fyles, Nick Carter, Brian Grant, Bill McMillan and John Newell who all provided me with ideas, positive comments, and editorial advice; Ron Smyth who provided me with the opportunity. In addition Dick Player and the British Columbia Archives and Record Service provided critical help to illustrate this work. The text was developed in stages. A first draught was completed at the end of 1990 and this was augmented in 1994 by research on the colonial and early provincial precursors of the survey. The manuscript was revised again in 1997 to bring it up to the end of the hundredth year of survey history.

Writing a history of an organization you were part of for thirty-three years is not as easy as it might seem. The difficulties are greatest for that part of the story for which you were seemingly in charge because it is difficult to make balanced assessments of this period, impossible to be adequately inclusive and close to libelous to introduce some of the incidents and anecdotes. I would like to thank all my colleagues for the help I freely received, then and now.

Publication of this history has been facilitated by generous grants from the Canadian Geological Foundation and the Heritage Trust in Victoria.

SOURCES AND REFERENCES

The principal source for the history of the Survey and data on the mineral industry is the sequence of Annual Reports of the Minister of Mines from 1874 to 1979 and the somewhat equivalent Summary of Operations 1980 to 1984. Where specific reference to these publication is needed it is indicated, for example, as AR 1914. All the other publications of the Survey provide additional references, notably the bulletins and the yearly series Geology, Exploration and Mining in British Columbia 1969 and following; and Geological Fieldwork 1974 and subsequent years.

The British Columbia Archives and Record Service contain an extensive but random collection of files on the early Department of Mines, its personnel and colonial history. Of special importance is the sequence of letters from the Deputy Provincial Mineralogist to the Chief in 1907; the correspondence to the Minister in 1917 decrying the possible discontinuance of the Annual Report; and that regarding the division of labour between the Geological Survey of Canada (GSC) and the BC Mineralogical Branch between 1934 and 1941. An important recent addition to the Archives is correspondence and notes by J.F. Walker, Deputy Minister, regarding the Hedley Amalgamated scandal, difficulties with J.T. Mandy, the Wenner Gren epi-

sode and other previously confidential matters. The early photo albums of the Bureau and Mineral Survey are also in the Archives and most of the historical photographs came from this source. They are acknowledged by Archive Catalogue Number. Some articles in newspapers and magazines in the Archives were useful and quoted separately.

The mineral inventory of the Survey houses another random but informative collection of files, correspondence and photographs. The most pertinent material includes files on exploratory drilling by the Survey, the early history of the government assay office, a transcript of the meeting between J.F. Walker and his critics in the British Columbia and Yukon Chamber of Mines, and the conflict over right of access to the Cariboo Gold Quartz mine. The photo collection has been ravaged in the past but still contains prints available nowhere else.

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2 PRELUDE TO A GEOLOGICAL SURVEY

The development of the survey had preludes in Colonial and early Provincial times. The evolution towards it was entwined in the political development of the province and the growth of its mineral industry. All started simply and at a small scale. The need for geological work was recognized early but the costs were minimized, spun off or delayed.

As the mineral industry developed an overt separation between mining and exploration became apparent. Exploration generally anticipates markets and so its developments precede mining. The Survey's ties have always been strongest to exploration, providing much of the basic data to generate exploration activity, and receiving and collating exploration data in return. The interplay of developments in mining and exploration forms the backdrop against which the evolution of the Survey was staged. Each act of this history provides its own setting.

Precursors of geological survey work were apparent in the Colonial era, and these were strengthened and added to in the new Province but an actual organization directly linked to the present survey was not created until the Provincial Mineralogist was appointed under the *Bureau of Mines Act of 1895*. This Act created a very small group that was not substantially enlarged until the *Mineral Survey and Development Act of 1917* which created a regional organization of six mining engineers and geologists in addition to the Provincial Mineralogist's office. The complete reorganization, reorientation and centralization that followed from the *Department of Mines Act of 1938* created an organization that is recognizable, through succeeding changes, as the direct progenitor of today's Survey. These changes are substantially parallel to the changes in name: *Mineralogical Branch (1937-1966), Geological Division (1966- 1984)* and *Geological Survey Branch (1984-*). The preceding terms in italics are the sequence of titles by which this history is portrayed. The dates used are ones that best characterize major change but they may not exactly fit changes in title.

Survey Work and Methods

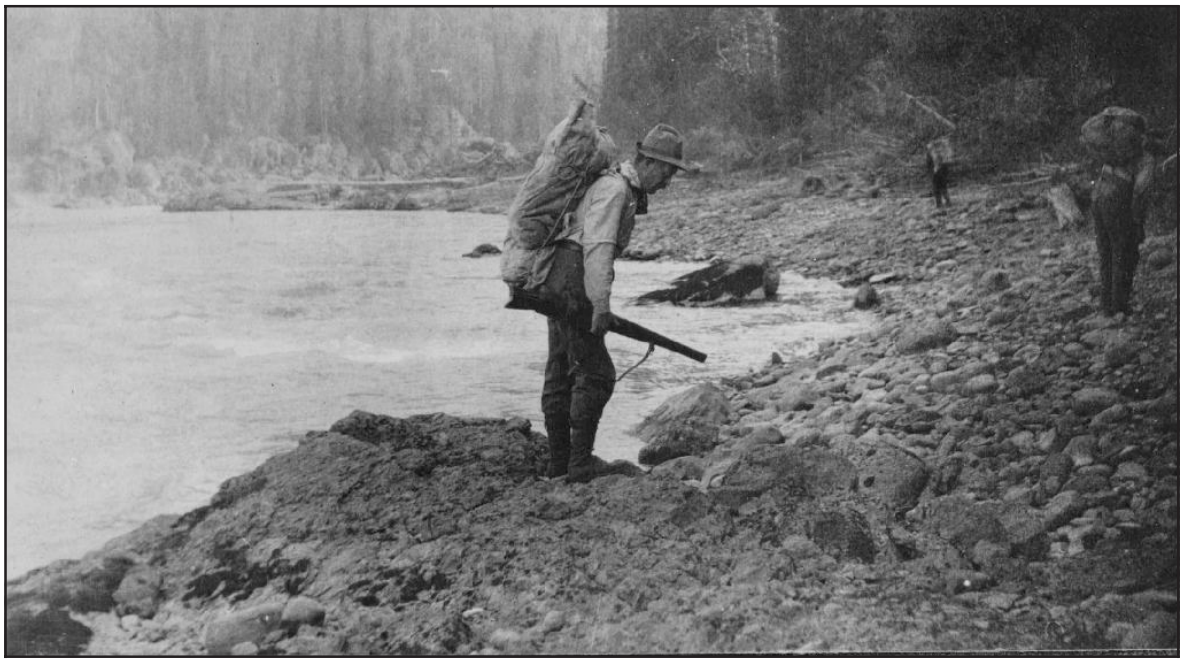


Photo A1. Survey work usually starts with fairly arduous travel by foot. William Fleet Robertson, second Provincial Mineralogist, and his canoemen, are show portaging down Deserters Canyon on the Finlay River in 1908. The canyon, which is now flooded by Lake Williston ponded behind the W.A.C. Bennett dam, is walled by Eocene conglomerates exposed in the foreground. The whole area was very remote at that time. Fleet Robertson traveled by packtrain, canoe and on foot from Hazelton through the Omineca to McConnell Creek to examine newly discovered placer gold occurrences there. He returned via the Finlay and Parsnip Rivers and Fort St. James. The journey took 90 days and covered 900 kilometres by packtrain and 975 by canoe and bateau. (BCARS HP 99014)

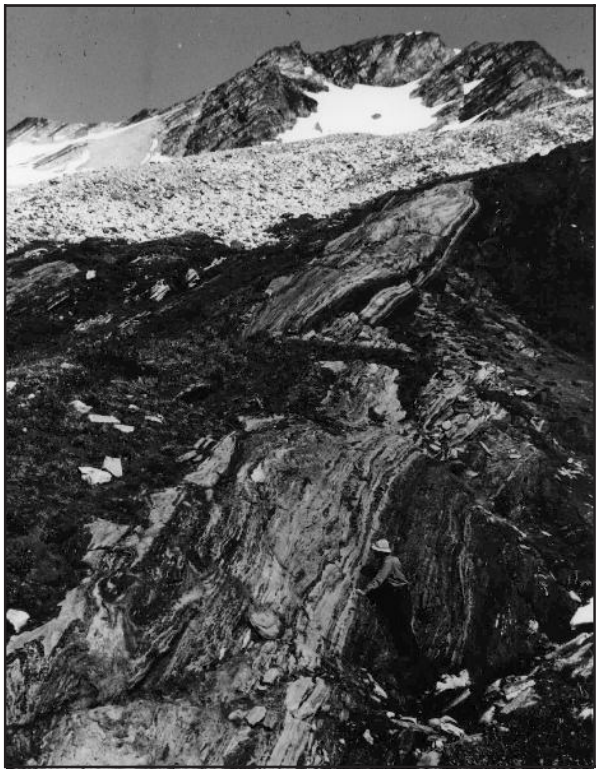


Photo A2. The fundamental purpose of geological fieldwork has always been accurate observation of the rocks: their nature, classification and structure. This photo shows Trygve Höy examining an unusual, drag-folded carbonatite marble band in the mantling gneiss sequence of the Frenchman Cap Dome in the Monashee Mountains in 1980. (P. Mustard)

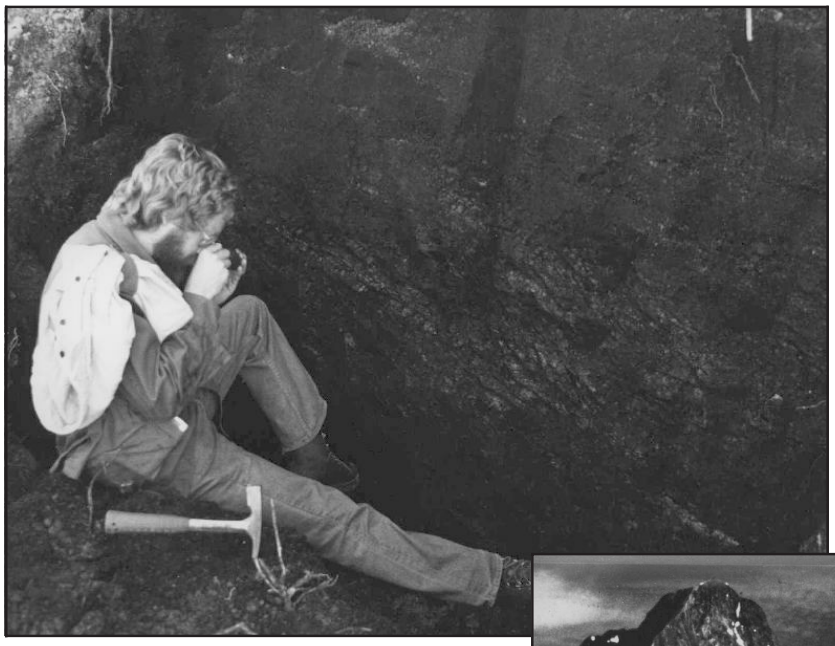


Photo A3. Detailed examination of specimens in the field for mapping and collection for further research requires use of a hand lens. Here Bob Gilchrist examines coal from a pit dug by his crew to obtain fresh samples for analysis during mapping of the coal measures in the Peace River district in 1978. (R.E. Player)

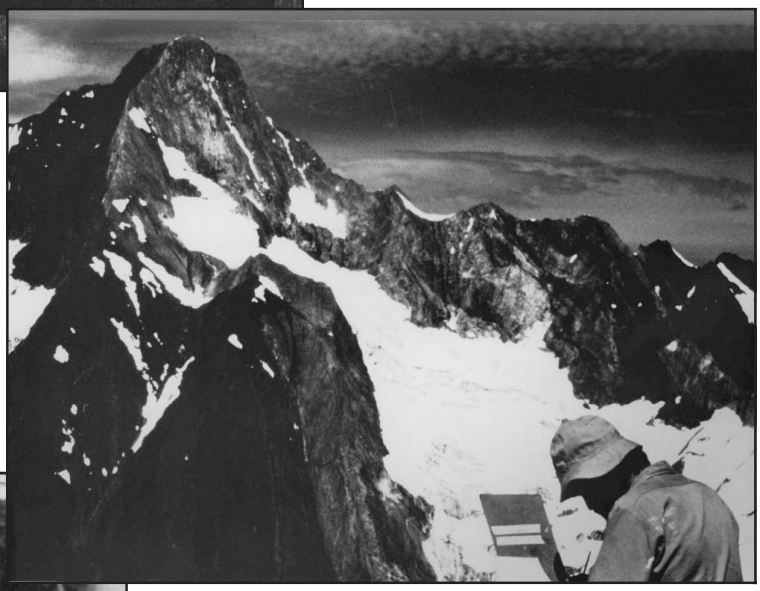


Photo A4. Observations and measurements must be meticulously recorded in the field. The photo shows Trygve Höy taking notes during a climb on the flanks of Downie Peak in the Selkirk Mountains in 1977. (Bull. 71)

Photo A5. Early surveys of prospects by the Bureau or Mineral Survey were conducted by pace and compass or, less commonly, by transit and chain as shown here at the portal of the Revenge mine at Beaverdell in 1921. Reconnaissance surveys were only crudely controlled geographically. (BCARS HP 99682)

Photo A6. Geological surveying in the Mineralogical Branch period. J.T. Fyles working near Zincton in 1948 sights an alidade on a plane table toward a geological observation point where an assistant holds a stadia rod. With this method topographic and geological maps could be developed at the same time. Relatively large areas were mapped in this manner before the days of abundant aerial photographs and topographic maps. (M.S. Hedley)

Photo A7. Vertical air photographs became the principal method of providing control for geological surveys during the later 1950s when photo coverage of the province became complete. Observation points on the ground were located on photographs and later transferred to base maps. The amount of effort required for geographic control was much less than for plane tabling. Here Bob Gilchrist and an assistant lay out photographs along flight lines prior to leaving camp on a day's traverse in the Peace River coalfield in 1978. (R.E. Player)

Photo A8. Geological assistant Jane Broach measuring the thickness of a sequence of bedded rocks that contain layers of coal, the compressed remnants of trees and organic debris of former tropical swamps. Measurements such as this are critical in determining the distribution and amount of coal in a bedded sequence of rocks and determining its environment of deposition and origin. (R.E. Player)

Photo A9. Exploration drilling by industry provides abundant information on the third dimension near prospects. Survey geologists expend much effort examining and logging diamond drill core. Here Bill McMillan is in the unusual situation of logging core while a helicopter waits at a porphyry copper prospect on Gambier Island in 1982.

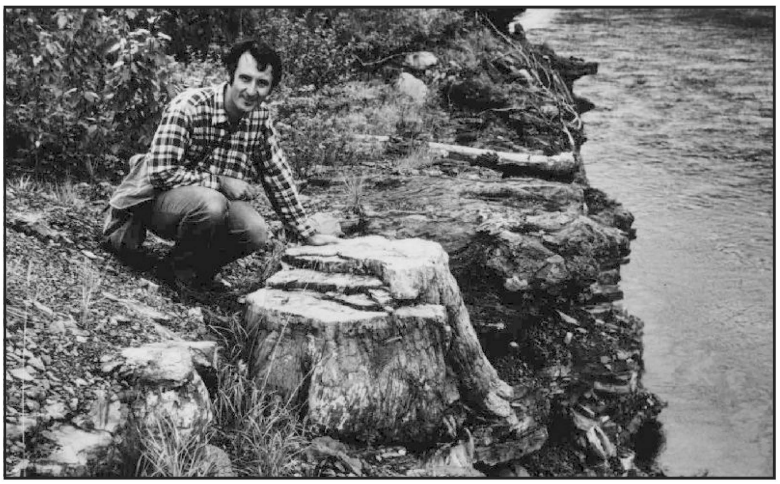


Photo A11. Fossils provide important information on the age and depositional environment of the sedimentary rocks in which they occur. District Geologist Andrew Legun is shown in 1982 with a fossilized stump of a Cretaceous tree (100 million years old) exposed by erosion in the Peace River canyon. The tree is rooted in its growing position in what were then sands and muds of a swampy delta and now are lithified to form the Gething Formation.

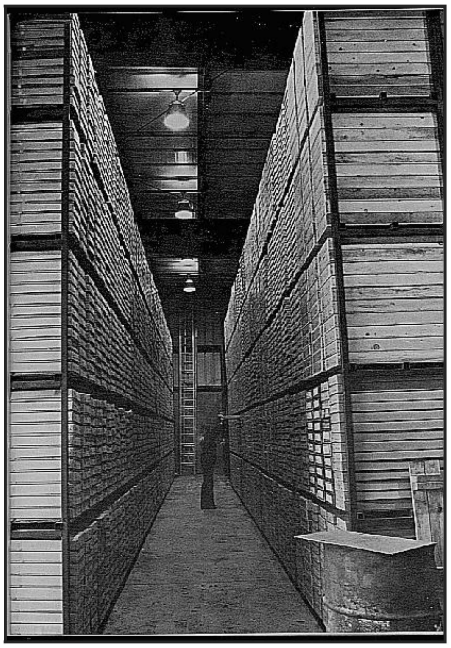


Photo A10. Core from the Peace River coalfield and elsewhere is stored in the Ministry facility at Charlie Lake near Fort St. John for continuing study by geologists and engineers. Examination of selected core, sampling for microfossils and analysis of company electrologs lead to precise correlation of stratigraphic units and coal seams as in Figure 18. (R.E. Player, AR 1977)

Photo A12. Regional geochemical surveys depend heavily upon helicopter access for coverage of remote areas. The photograph shows a sample of stream silt being collected in the northern Coast Mountains during the Geological Division's first independent survey in 1978. (G. Nordin, AR 1978)

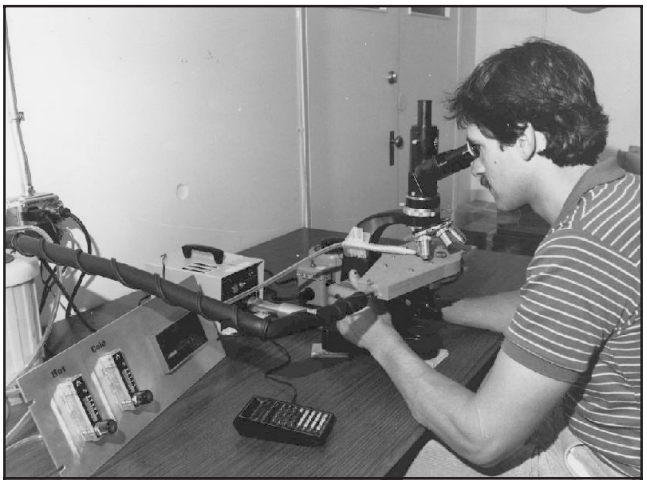


Photo A13. Observing minute details about the mineralogy and texture of rocks using a petrographic microscope has been an important aid to research geologists for more than sixty years. Characteristics of minerals and rocks that are invisible to the unaided eye can be seen in specimens sliced so thin that they are translucent, or are polished so the metallic minerals reflect light in unique ways. Developments in microscopy have been constant. One recently evolved technique employs a calibrated heated stage here being operated by Larry Diakow. The temperature at which veins of gold-quartz ore formed can be determined by observing when liquid and vapour in minute cavities in quartz homogenize as a sample is heated. These data can be used to help interpret the origins of deposits and so aid in the search for ore. (R.E. Player, AR 1984)

Photo A14. Field observations and data from office and laboratory studies are brought together on maps and cross-sections which are, in effect, models of the true nature of the earth's crust. Andre Panteleyev is shown working on manuscript maps. His bulletin board is a typical montage of maps, diagrams, photos and visitor's calling cards. (R.E. Player)

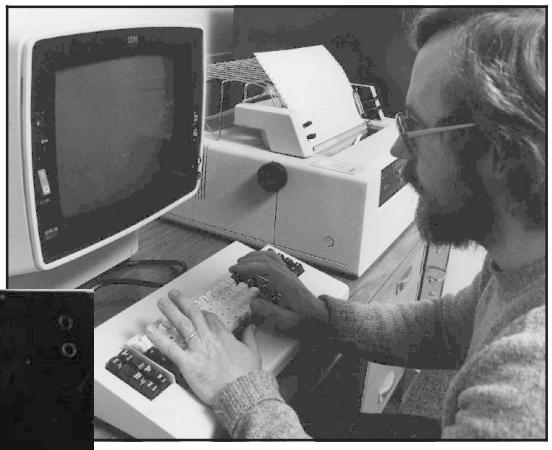


Photo A15. Handling the masses of numerical and geographic data generated in geological and resource work has been made much easier by the development of personal computers available to individual geologists. The photo shows Don MacIntyre working at a keyboard about 1984. In subsequent years the Branch has utilized advances in computer technology to improve products and data management, and to provide better services to clients. (R.E. Player)

Photo A16. In a rain forest setting, and in the alpine, streams flood and recede rapidly. which tends to wash away silt deposits. Moss mats along stream courses or areas that are periodically water-covered capture silt-sized particles and are an excellent source of material for regional geochemical sampling. In this example, the survey area is northern Vancouver Island (W. Jackaman).

Photo A17. The analytical laboratory passed through three main stages of development, the first emphasizing wet chemical analysis for metals and fire assays. The photo shows the lab as newly installed in the Birdcage building in 1898 under Herbert Carmichael, Provincial Analyst and Assayer. It was practically unchanged in 1937 at the start of the Mineralogical Branch era. (AR 1898)

Photo A18. In the Mineralogical Branch era the laboratory utilized some instrumental techniques for approximate analysis and for screening samples. It also conducted some rock analyses but principally ran batch wet chemical assays for metals as shown here. The Chief Analyst, Gene Cave-Brown-Cave, is shown separating precipitated solids from a liquid containing zinc in solution. (Bull.18)

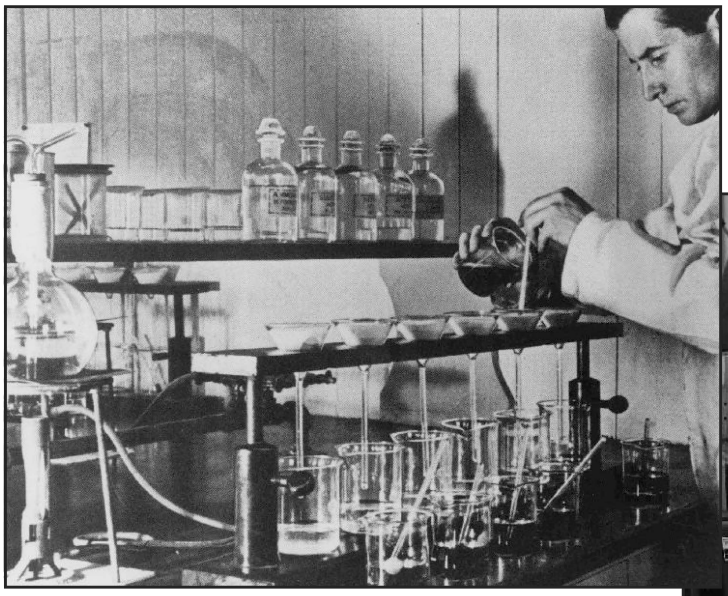


Photo A19. In its third stage of development, starting in the early 1970s, the laboratory depended on instrumental chemistry, principally atomic absorption spectrometry and x-ray fluorescence. Since then it has conducted a complete range of petrochemical and assay analyses and produced them in abundance. Mac Chaudhry is shown operating an atomic absorption spectroscope with an automated sample changer designed in-house by P.F. Ralph in the late 1970s. (R.E. Player, AR 1981)

Photo A20. In the Geological Survey Branch era geological work had many changes from new technology or from increasing use of technological aids: satellite positioning data, modern communications, helicopters, and computers but fieldwork has been as demanding and frequently as dangerous as ever. Mitch Mihalynuk is shown starting a steep climb with a heavy pack in the Tatsenshini area.

Photo A21. Geologist Kirk Hancock is shown making a traverse of a steep snow slope in the Tulsequah area.

Photos A22. The regional geochemical surveys required development of new techniques in different environments such as the moss mat techniques in the rain forest (Photo A16) and the alpine environment of torential streams. Here, Paul Matysek and Kirk Hancock are conducting an orientation survey to define the best method of sampling in the latter regime.

Photos A23. Industrial minerals will have an increasingly important role as the Province's industries mature and population increases. The Survey's expanded efforts to identify resources and markets has been led by Danny Hora (at right), shown here with an industry geologist at the silica processing plant for the Moberly deposit near Golden.

Photo A24. The MINFILE team, George Owsiaki, Gary Payie, Janet Holland and Larry Jones, display products illustrating the evolution of MINFILE from paper copy, to 5.25 inch floppy disks, to access through the Internet, and availability on CD ROMs.

Photo A25. Ward Kilby manages the mineral potential project of the Survey the data of which is in demand for land-use management and as a guide for exploration and prospecting. A key product produced by the project was a digital geological map of the province.

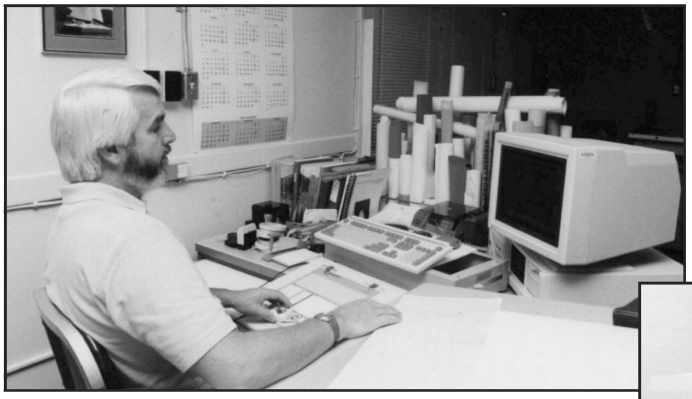


Photo A26. The application of computer technology in the Scientific Review Office completely changed production of maps and publications. Here, John Armitage prepares a new geological map using the CAD software with the result that manual drafting was abandoned, which led to increases in output and efficiency.

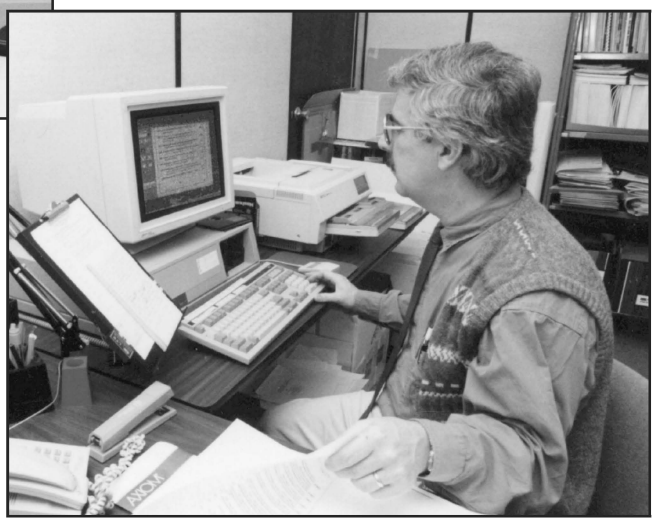


Photo A27. Brian Grant, manager of the Scientific Review Office, uses a computer to aid editing and manuscript preparation. The advent of effective desktop publishing technologies and digital information management provided the means for significant increases in productivity and flexibility in the production of geoscience reports. As the Survey became more self-reliant in manuscript preparation the technology also proved to be highly cost effective and resulted in significant budget savings.

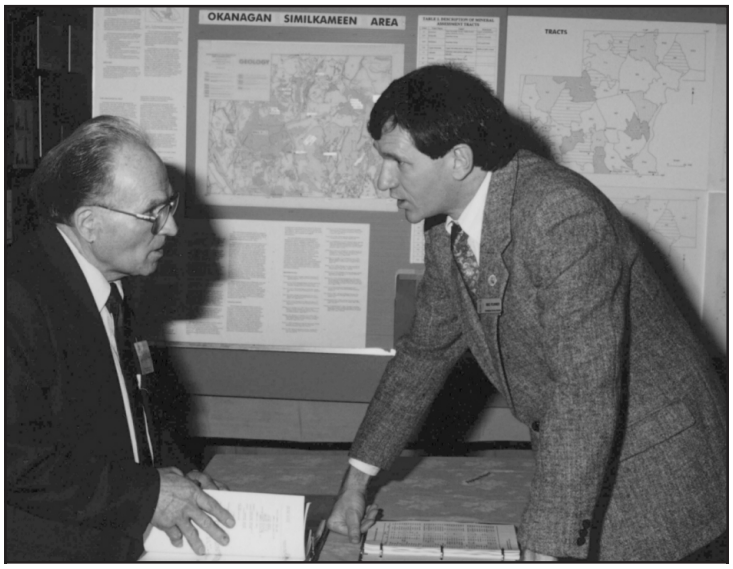


Photo A28. At Cordilleran Roundup, a major west coast mining industry trade show at which the Survey displays its new products and explains them to the interested public, Mike Fournier (at right) of the Survey discusses new work in the Okanagan-Similkameen area with an industry client.

Photo A29. Since the 1950s the Geological Survey has had the enthusiastic and very professional support of the 'Player' dynasty. Pictured at right is Dick Player who was responsible in the 70s, 80s and 90s for managing the petrographic lab and photographic services for the organization. Dick very capably took over the job from his father after demonstrating in a tough competition that he was one of the few who had the technical skills required to carry out the lab support functions required by the professional staff.

Photo A30. JoAnne Nelson, Project Geologist in the Mapping and Resource Evaluation section, studies bioclastic strata within a chert-limestone succession of the Stikine assemblage. Photo is taken in 1993 on Mount Eaton south of Atlin Lake near the Tulsequah Chief volcanogenic massive sulphide deposit.

TERRITORY TO CROWN COLONY (1835-1871): Placer Gold and Coal

3

The discovery of coal at Suquash on Vancouver Island in 1835, lode gold in the Queen Charlotte Islands in 1850 and placer gold in the Interior from 1855 onward triggered activities that propelled the territories that were to become British Columbia from Hudson's Bay lands through colonial status and on to provincehood.

The coal discovered at Suquash turned out to be thin and discontinuous but those found at Nanaimo in 1850, and subsequently at Comox, were soon shown to be of good quality and to occur in substantial quantities in thick seams. These coals thus had a lasting effect on the economic and political developments of the region. The extensive Cretaceous coalfields fueled the growth of shipping, railways, industry and international trade on the coast from the mid-1850s for a hundred years.

The discovery of lode gold at Mitchell Harbour on the west coast of the Queen Charlotte Islands was analogous to Suquash; it was not important in its own right but it targeted the territory for prospecting. Subsequently placer gold was discovered on the Pend-d'Oreille River in southern BC in 1855 as miners spread outwards in waves from California. Discoveries were then quickly made along the bars of the Fraser River from 1858 to a culmination at Williams Creek in the Cariboo in 1861. The gold rush had a more dramatic and immediate effect on the territory than the coal discoveries but it was ephemeral in many ways; the peak production was reached in 1863 and miners turned to a search for lode deposits. Nevertheless the rapid growth generated by placer mining was remarkable even though placer gold production decreased progressively. Coal and gold more than furs, lumber or land were the prime movers of the colonial economy and the government's attention was riveted on them. *"Trade follows the flag but the flag follows the pick*."

THE GOLD RUSH

Gold rush is an apt description of events that followed in the territory. In the decade of the 1850s, the future of the region was irrevocably changed. The Hudson's Bay Company had discouraged settlers and as a result the British Government had lost Oregon. The Company had not learned much for they continued to make colonists unwelcome on Vancouver Island and the mainland in spite of direct orders to the reverse from the Colonial Secretary in London. They were, however, authors of their own downfall.

Gold was collected in trade from natives by the Chief Traders at Kamloops and elsewhere after 1852. Eight hundred ounce were shipped to San Francisco on the HBC's ship *Otter* and news of its origin was the catalyst for the rush that followed in 1858 (Rickard, 1948). This was enough to cause the British government on the advice of Chief Factor James Douglas to introduce a bill that same year for the creation of a new Crown Colony on the mainland to be called British Columbia with James Douglas as Governor having had to sever his connection with the Company. The rich discoveries that followed in the Cariboo confirmed the wisdom and foresight of Douglas. By the end of the 1861 season $2 500 000 of gold had been shipped to Victoria. Most of this originated in Williams Creek and the vicinity of what became Barkerville.

Prospecting for gold was initiated by panning as in Photo D2. It is at least a Bronze Age technique but one still useful today. The photo is from a painting done in 1864 by W.G.R.Hind, a well known Canadian painter. He was a prospector in the Cariboo at the time, hence its authentic representa-

tion of the method and the site. Discovery was followed by a sequence of more productive techniques: rockers, long toms, and sluice boxes (Bull.21).

Photo D3 shows a placer mine on Williams Creek in 1867 that, unlike most by this date, was a surface mine. By then most were underground in the saturated, shallow river gravels or into the river banks with all the attendant problems of water removal, space, support, air and light. The photo shows the workings exposed with miners ready to shovel in gravels at the upper end of the flume and to clean up bedrock in the foreground below the sluice box. The problem of ever presence boulders was solved by stacking.

THE DISCOVERY AND EARLY DEVELOPMENT OF COAL

The history of the discovery of coal had parallels to that of gold. Black rocks similar to those imported from abroad for the company blacksmith at Fort McLoughlin on Milbanke Sound were reported by natives to occur on northern Vancouver Island (Rickard, 1948). The HBC's ship *Beaver* was directed to test the coal by Chief Factor John McLoughlin of Fort Vancouver on the Columbia River and the ship began using coal mined from shoreline outcrops at what became Fort Rupert (Suquash) on its northward voyages by about 1836.

In 1848 a group of Scottish coal miners were brought out by the Company but the conditions at Fort Rupert were not what they were promised; they expected an establish colliery and there was none, they had little idea of the exceedingly primitive conditions and they had not expected to be threatened by natives. Against the Company's wishes they slipped away by dugout after a year at Fort Rupert.

A second group was brought out in 1850 that included Robert Dunsmuir (Reksten, 1991). The attempt to establish a mine at Suquash was abandoned and the group was moved to Nanaimo where coal had been found as a result of a similar revelation by an old chief. Prospecting in 1850 by Factor Joseph McKay with the help of natives, resulted in the discovery of a major coal bed that became known as the Douglas seam. More coal was found in the vicinity and a pit started in 1851. The following year a bastion was erected after receipt of the letter from James Douglas telling McKay to take possession of the coalfield and to levy a royalty (see Appendix VIa). Coal was being shipped to Victoria by September that year (Photo D1). HBC's lease to the coal lands expired in 1859 but they purchased it and soon after sold out to an English company, the Vancouver Coal Mining and Land Company. Dunsmuir quickly established his capability with this company, among other things discovering the Wellington seam on Newcastle Island which occurs stratigraphically below the Douglas seam. He left this company to help develop the Harewood mine south of Nanaimo (Photo D4) but the company, owned mainly by titled, ex-navy remittance men, did not have enough capital to continue while government vacillated over access rights and other problems.

Dunsmuir recognized a sinking ship when he saw one and so left to become a small mine developer at Nanaimo in his own right. A few years later in 1864 his geological skills enabled him to identify the strata overlying the Wellington seam while walking to fish at a lake inland from Departure Bay. With great enterprise and risk he established the Wellington colliery by 1870.

GOVERNMENT ACTIONS

Vancouver Island was made a Colony in 1849 as a result of the discovery of coal and the administration was given to the Hudson's Bay Company. Richard Blanshard arrived from England as first Governor but he was made unwelcome by the company and its servants. He resigned in 1850 and Douglas was appointed the next year while still Chief Factor. Happily he was

the man for the time and was knighted for his actions in 1864 when he retired.

The two colonies followed different courses toward the development of mineral resources and government interaction. In British Columbia the initiative was in the hands of prospectors and entrepreneurs. The government followed with commendable speed to control and regulate the goldfields but took little action at first to guide, promote or develop. In precolonial and colonial times pragmatism and action rather than legal niceties governed the creation of the posts of the first mining officials. Two Gold Commissioners were appointed in 1858 before news of the creation of the Crown Colony of British Columbia reached Governor Douglas in Victoria and before the *Gold Fields Proclamation of 1859* with its legal authority and regulations. The Gold Commissioners issued licenses, registered claims, adjudicated disputes with the advice of locally elected mining boards and provided 'news' from the goldfields. Also a mint and an assay office were established in the then capital of British Columbia, New Westminster, under the authority of *Colonial Office dispatch No.22 of 1859*. The mint proved to be something of a failure as almost no coins were minted, and it was closed on entry to Confederation. The assay office survived and to some extent prospered. The Survey's analytical laboratory that existed until 1993 was directly linked to this assay office. The government assayer later became the Provincial Analyst and Assayer and today, the Chief Analyst. The government assayer was thus the first authorized member of what constitutes the present British Columbia Geological Survey Branch. In this sense the Survey started in 1859 prior to Confederation or Union with Canada.

THE VANCOUVER ISLAND EXPLORING EXPEDITION: A Reconnaissance Geological and Natural History Survey

On Vancouver Island, by contrast, prospecting for minerals was originally negligible and mining law and regulation non-existent. Governor Kennedy, who succeeded Douglas, attempted to correct these failings. He instituted laws parallel to those of British Columbia to regulate prospecting and mining and he initiated a Vancouver Island Exploration Committee to create an expedition to explore and assess the resources of the island. The consequence was something approximating a geological survey and unlike anything mounted in British Columbia. Funds for the expedition were raised by subscription with the government contributing two thirds of the cost.

Dr. Robert Brown (Photo E1) was appointed leader in 1864 although he was only twenty-two (BCArch. Vert. File; and Hayman, 1986). He had studied for four years at the University of Edinburgh and was said to have an MA, PhD and some medical training. He had already served as a surgeon on an Arctic whaler. He was on Vancouver Island carrying out botanical seed collections for a group in Edinburgh, aided by funding from the then Chief Factor, Wm. Fraser Tolmie. The expedition was organized rapidly to prospect the Island's interior for gold, metals and coal, explore it geographically, record its lumber, fur and agricultural potential; all this in only one year - a formidable agenda. The emphasis placed on the various objectives by the committee was probably different than by Brown; the former putting prospecting and mineral appraisal first and Brown thinking more of biology and geography.

Brown's colleagues were as unusual as himself. Initially the party totaled eleven men including the steady Lt. Peter Leech formerly of the Royal Engineers as his deputy, and the distinguished painter but tough traveler, Fredrick Whymper, present to record the scenery and other features. Another member was John Buttle, a botanist trained at the Royal Botanical Gardens (Kew). Several others had experience in geology and prospecting. The two native guides were also unique. One was an Iroquois named Tomo Antoine who had guided for Sir James Douglas and had recently been acquit-

ted of a charge of murdering his wife. The other was an old Cowichan chief called Kakalatza who habitually wore a top hat.

The expedition started at Cowichan Bay on June 7 and canoed up the river to the lake where they split up, Leech's group traversing southwest to Port San Juan while Brown's traveled up the lake and then down Nitinat River and Lake to the Pacific. They found and repaired an abandoned dugout to sail down Nitinat Lake to Whyac at its mouth where they were alarmed to encounter a painted war party. After a nervous start relations became friendly and they were eventually transported by the Nootka through the breakers and the tempestuous sea in one of their dugouts to Port San Juan, a trip almost as alarming as the first encounter at Whyac. From there they travelled with the other party to Sooke Harbour from where Leech and most the expedition traversed up the Sooke River and on to Cowichan Bay. It was on this leg that they panned the coarse gold at what was to become Leechtown. Meanwhile Brown went on to Victoria on 13 July to make his first report and, in a prelude of survey style, was lectured to by the committee to keep expedition expenses down. The whole party left again on 1 August for Nanaimo where they once more split up, with Leech's group again getting the rough go - traversing up the Nanaimo River and Lakes, then west of Cowichan Lake and on to Barkley Sound. Pretty well lost and starving they ran into natives near Sarita Lake who took them back up Alberni Inlet to the small sawmill at its head, even then called Alberni. Brown's party travelled by dugout to Comox. From there they canoed up the Puntledge and along Comox Lake but they lost their canoe on the upper Puntledge and the rest of the way they had to traverse and raft via Great Central and Sproat Lake and Somass River to Alberni. Unlike Leech's party they encountered abundant game and lived quite well. From Alberni the whole party crossed the end of the Beaufort Range travelling to Nanaimo and then by sea to Victoria, arriving 14 October. Throughout the season the parties were subject to hard living, rough water canoeing and rafting and generally tough going even though some of the travel through the mature forests could be relatively easy.

The expedition was a success by most measures. Leech discovered the placer gold on the river that was to bear his name - triggering a small gold rush. They found copper veins near Cowichan Lake and Alberni that within a decade were further prospected and also discovered many significant occurrences of coal. At the junction of the Puntledge River with a river that came to be named Brown's, they uncovered a seam some eight feet thick that is part of the Comox coalfield. In addition they recorded substantial new geographic and natural history information about the interior of the Island.

Robert Brown was a talented but difficult man. With his individualistic crew, his own inexperience, ego and emotionalism it is remarkable the expedition did not fly apart. Brown was principally a botanist, a science useful in coal studies, but he also had a broad scientific background. The next year he spent some time examining the Cretaceous rocks of Rupert Arm, Quatsino Inlet but the following year he returned to Scotland. It should be noted that by this time coal was being produced at Nanaimo at the rate of 120 tons a day.

Brown went on, with his usual bravado, to be an expert in marine mammals living in the arctic seas off Greenland and later to study the tropical flora of North Africa. He died of tuberculosis in his fifties.

THE END OF THE COLONIES

The crown colonies were combined in 1866 to save administrative costs as production from the placer mines had started to drop. Confederation of four of the eastern colonies occurred in 1867 and conveyed title of land and minerals to the provinces (Appendix III), an important consideration in Union. Debate about Confederation raged in combined Colony of British Columbia but the *Terms of Union* eventually agreed upon included another

important condition that Canada should assume and defray the cost of the Geological Survey (*ibid*.). Whatever was intended, this came to mean that the Geological Survey of Canada would carry out a major effort in the BC but the Province would also engage in geological and resource studies with emphasis on the latter.

The predecessors of the BC Geological Survey had another connection with the colonial past in that they occupied the last of the Birdcage buildings constructed by Sir James Douglas in 1858 for his capitol, the Legislative Assembly Building. The Bureau of Mines moved into this on its inception in 1895 and the laboratory was still there when the building burned down in 1957 (Photo C1).

Field Transportation

Photo B1. William Fleet Robertson, second Provincial Mineralogist, is shown on horseback at St. Mary's River in the East Kootenays in July 1898. Horseback and packtrains were the principal method of travel in the era of the Bureau of Mines, were still common in the 1940s and are occasionally used today. (BCARS HP 99011)

Photo B2. A packtrain getting under way at Fairview (Oliver) in the southern Okanagan in 1909. Fleet Robertson, second from the left, heads off with a small string of horses to examine a number of prospects. (BCARS HP 9802)

Photo B3. Inducing Fleet Robertson's packtrain to swim the swift Stikine River at Telegraph Creek on 17 July 1912 on the way to Dease Lake and then back through the Groundhog coalfield to Hazelton. (AR 1912, BCARS HP 99017)

Photo B4. Fleet Robertson's packtrain being rowed across Takla Lake on 27 June 1908, near the start of his expedition to McConnell Creek, then down the Finlay, up the Parsnip River and on to Fort St. James. (AR 1908, BCARS HP 99013)

Photo B5. Fleet Robertson's packtrain crossing Groundhog Mountain in late August 1912 during an early snowfall. He was returning to Hazelton after his trip from Wrangell, Alaska, to Telegraph Creek, Dease Lake and back through the Groundhog coalfield. These folded and metamorphosed coal measures containing anthracite were newly discovered at that time but, because of their remoteness, only recently have they been thoroughly evaluated. (AR 1912, BCARS HP 99019)

Photo B6. Helping prospectors has been a feature of the survey since its beginning. The photograph shows a prospector, L.T. Watson, encountered by Fleet Robertson at the head of the Klastline River in August 1912, while the river was in flood. He and his pack dogs were helped across the river after spending a night at Fleet Robertson's rough trail camp. (AR 1912, Arch.Cat.No.HP 73068)

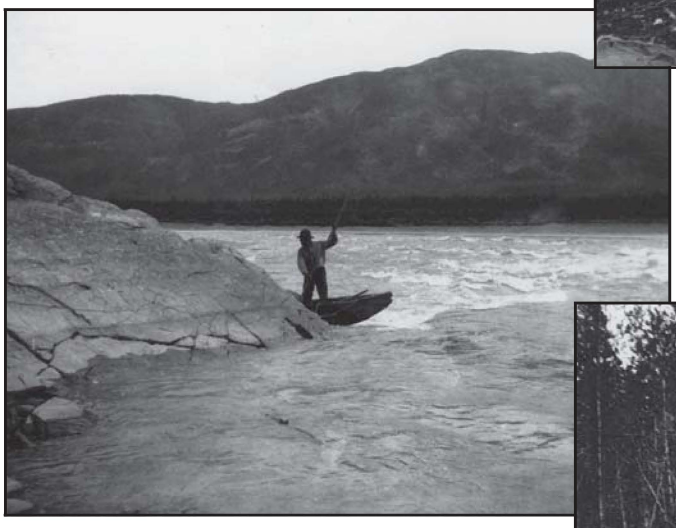


Photo B7. Fleet Robertson's dugout canoe being lined down the Ne-Parle-Pas rapids on the Peace River on 13 August 1906 on his trip from the mouth of the Skeena to the Peace River district. (H.T. Nation, Arch.Cat.No.HP 72948)

Photo B8. Fleet Robertson's crew building a flat bottomed boat at "Irish's" cabin at the head of the Finlay River to carry them to the Peace River in 1908. (BCARSC HP 99660)

Photo B9. River and lake steamboats were one of the principal means of travel at the turn of the century and were not always reliable. The sternwheeler "Caledonia" is shown ascending Kitselas canyon in 1900 on the way from Port Essington, at the mouth of the Skeena River, to Hazelton. This canyon, just up stream from where Terrace is today, was only passable at moderate heights of the Skeena River (AR 1900).

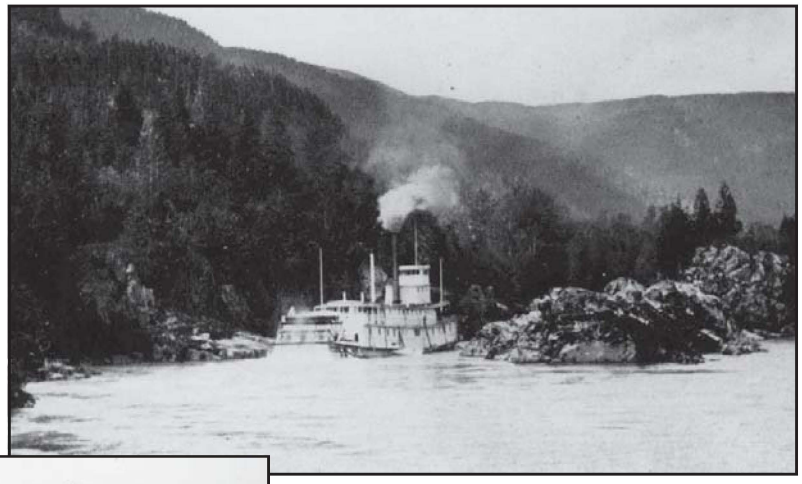


Photo B10. Wee Jeannie, the boat Fleet Robertson used to travel around Morseby Island in 1909, photographed at Skidegate Post Office, Q.C.I. (BCARS HP 88651).

Photo B11. Roads in the province were primitive and unconnected in the Mineral Survey era. A road from Telegraph Creek, head of navigation on the Stikine River, to Dease Lake was completed in 1923 by the Department of Mines and was one of the first in the north. This truck used by George Clothier, Resident Engineer, and probably the only one available, is shown bogged down on the Dease Lake road in 1924. (BCARS HP 73115).

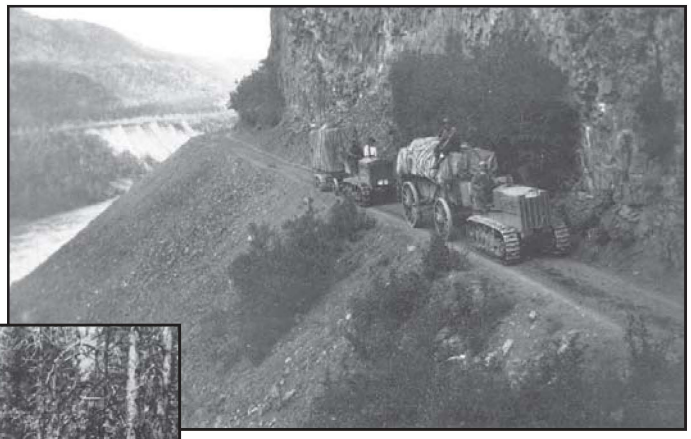


Photo B12. Caterpillar tractor trains, a surer way to travel the Dease lake road, are shown in the Stikine canyon in 1926. Columnar basalt flows line the canyon. (BCARS HP 99667).

Photo B13. Backpacking has been a constant of geological surveys but seldom of such demanding calibre as the journey shown here. In the early days of World War II, Matt Hedley and Stu Holland carried out a reconnaissance of the northern Rocky Mountain Trench and the Turnagain River as part of the process of route selection for the proposed Alaska Highway. They worked separately but in loose contact with two parties of topographic surveyors. The terrain was completely unknown geologically.

The photo shows Holland on the left and his assistant Ron G. McEachern, later an executive with Cominco Ltd., as they arrived in "civilization" at Dease Lake in September 1940.

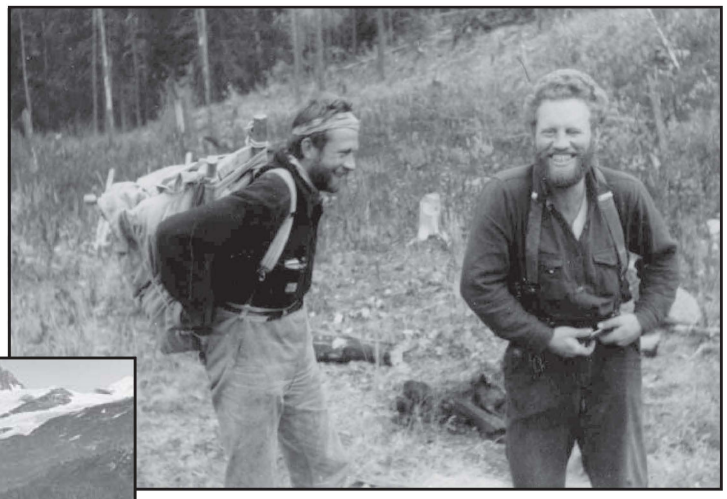


Photo B14. A Stranraer flying boat used to fly freight to the Morris Summit mine shown on Summit Lake in 1946. Note the small icebergs. Access to project areas by fixed wing aircraft was fairly common in the Mineralogical Branch era and was used here by the geologist, W.H. White. (J.T. Fyles).

Photo B15. Helicopters replaced horses as the main method of transport in remote areas during the 1960s. They are used to place crews in the field, bring in supplies, move camps and less commonly as a vehicle for traversing, as in this scene. Atholl Sutherland Brown and pilot, Roy Hepworth, are shown during a reconnaissance of the north coast of Graham Island in June 1961 at Pillar Rock. This sea-stack was photographed by George M. Dawson in his survey of the Queen Charlotte Islands in 1878 and the spruce on its top has grown greatly since. Note the inflatable pontoons and spare gas carried in cans on the Hiller 12E helicopter. (Jim Christie).

Photo B16. Trailbikes provided excellent mobility for field crews in the dry interior hills on and off the roads. Bill McMillan is shown during a traverse in Guichon Creek area in 1976.

THE NEW PROVINCE (1871-1895) : The Search for Lode Gold

4

After violent public and legislative debate British Columbia joined Confederation in 1871, extending Canada from sea to sea. Unfortunately one of the twin pillars of economic viability for British Columbia crumbled rapidly, leaving the success of the province in doubt. As placer gold production waned and discoveries fell off in the 1870s, various attempts were made by the government to encourage lode gold mining in the Cariboo and elsewhere, without great success. Gradually the major focus of explorers changed in the mid-1880s to silver and lead deposits in the Kootenays with increasing fulfillment. The government was slow to change its thinking or action as it continued to concentrate on the Cariboo.

After joining the Confederation some elaboration of legislation and organization followed. A Minister of Mines was created in 1874, but this was more symbolic than substantive as no new staff were added and the Minister was already the Provincial Secretary. The watchword was economy as during much of the history of the Survey and its ministry. The only major change that resulted from the new arrangement was development of the Annual Report of the Minister in 1874 which, within a couple of decades, blossomed into a substantial statistical and technical report, precursor of all other geological and technical publications of the Survey.

THE ANNUAL REPORT OF THE MINISTER OF MINES

The first Annual Report contained placer gold statistics; reports of the Gold Commissioners, dominantly about placer, containing mixed factual observation, hearsay and promotion; and production from the three coal col-

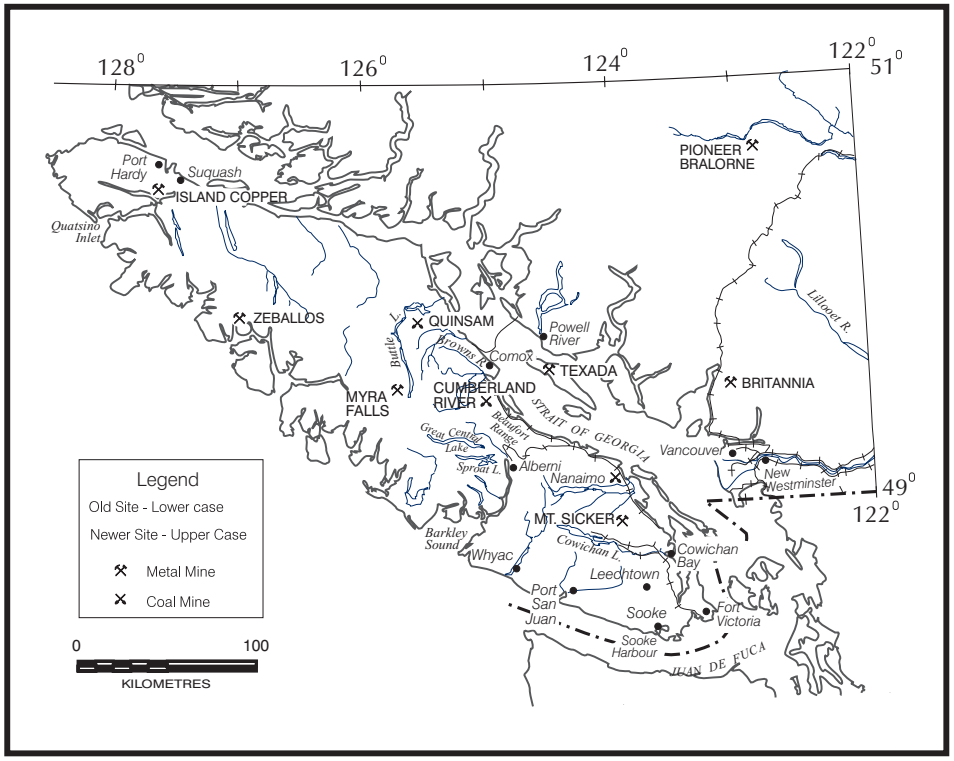


Figure 4. Geography of Vancouver Island and adjacent mainland showing localities and some important mines.

lieries, Nanaimo, Wellington and East Wellington reported by the managers. Also in the first Annual Report were extensive reprints from James Richardson's Geological Survey of Canada report on Vancouver Island geology, the Nanaimo coal measures and Texada iron ores. With the exception of the these items the pattern of the first report was followed with minor variation until the appointment of a Provincial Mineralogist in 1895.

Variations of the normal pattern of the early volumes included the following items. An Inspector of Mines was appointed in Nanaimo in 1877 who then wrote the coal mine development and accident reports although the managers continued to provide the production tables. Also in 1877 a Government Engineer, R.B. Harper, was appointed who wrote reports on lode deposits in the Cariboo and Howe Sound. He came from San Francisco highly recommended as 'skilled in quartz' but was said by some to be ignorant of auriferous pyritic ores and was let go, not to be replaced. In 1886 a mining expert, George A. Koch, was hired as a consultant to report on lode deposits, again mainly the quartz veins of the Cariboo. He focused on the problems of treating these ores but also recommended establishment of a Mineralogical Survey which would assist and guide prospectors and provide information which would attract attention and capital to the province. He also recommended an assay office which already existed and the employment of good surveyors to avoid title problems. In the same year Amos Bowman of the GSC contributed to the Annual Report a treatise on the lode deposits of the Cariboo, their relations to the placer deposits and the problems of evaluating oxidized pyritic quartz veins. His work 1885-86 on the geology of the Cariboo and his detailed maps of the placer creeks was funded by both the federal and provincial governments regardless of the Terms of Union. Unfortunately Bowman died before writing the report to accompany his placer maps.

Several other changes started to occur about this time. Lode deposits, especially silver and lead, occupied more space in the Gold Commissioners reports. Also the government analysts, W.J. Sutton and then Herbert Carmichael wrote reports most of which were geologically-oriented property examinations. Finally, claim and geographic maps with minor geological observations started to be included. Sutton was appointed in 1888 and previously had been a geologist with the Dunsmuir coal companies. His name is perpetuated in the Sutton limestone of Cowichan Lake and its unique fossil fauna. Herbert Carmichael was appointed Government Assayer in 1891 and like Sutton before him, he visited mining districts and wrote what can only be described as geological reports. Carmichael and Sutton both clearly recognized the importance of such appraisal and must have felt the need for a permanent geological establishment. It appears Carmichael was mostly responsible for the drafting of the *Bureau of Mines Act, 1895*.

Carmichael was appointed Provincial Analyst and Assayer in 1895 and later, Assistant Provincial Mineralogist, a title he deserved. He was a man of many facets; an innovative chemist, a knowledgeable geologist, a capable civil servant but at heart an entrepreneur. In the style of the times he conducted some business activities while a civil servant. He developed a process to make pulp and paper from wood fibre and was involved early on in a small mixed source paper plant at Alberni. Eventually he became an organizer and principal of the Powell River Company. He selected and secured the site, obtained the water rights and supervised the industrial process. He did some of these things before he left the government in 1912. He also encouraged his son, Maurice, to get a degree in chemistry at the Imperial College of Science and Technology, London, and the son, combining his knowledge with artistic skills inherited from his mother, went on to found the renowned Carmichael's Silversmiths of Victoria.

THE BURGEONING MINERAL INDUSTRY

The province attempted to facilitate lode mineral discovery and production by a number of methods including grubstaking which started intermittently from 1882, provision of bonuses for the operation of stamp mills

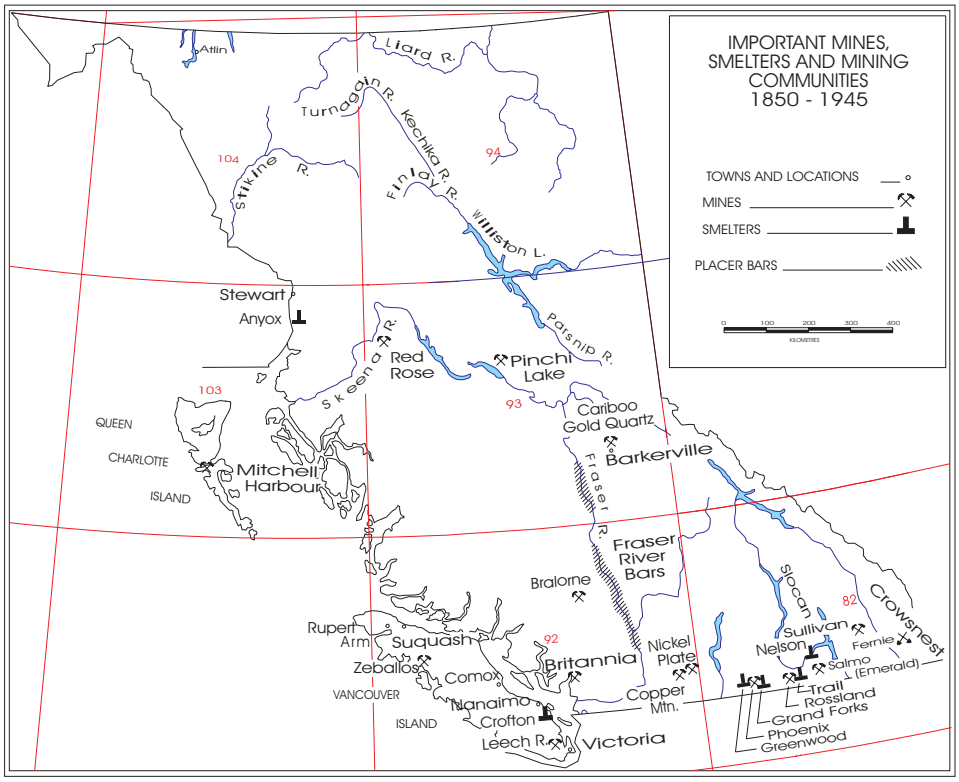


Figure 5. Location of some important mines, smelters and communities, 1850-1945.

and the erection in 1888 at Barkerville of a small reduction works (Photo D8). This plant was completed in January 1889 but testing only started in June with one to ten ton lots from local prospects: Proserpine, Lowhee, Black Jack and others. Roasting and amalgamation only recovered about 60 percent of the gold so a number of modifications were recommended including a chlorination plant. However the technology of the times was inadequate; stamp mills did not crush the ore fine enough to release the gold and cyaniding had not yet been developed.

These government efforts had mixed results. The consultants and government analysts provided useful data and their recommendations probably led to the creation of the Bureau of Mines. The stimulative measures, largely directed to the Cariboo, were ineffective. No mines resulted at the time. Transportation problems and refractory pyritic ores were commonly blamed. In addition the existing measures were not really pursued consistently or with vigour. This probably resulted because there was no person or agency to provide or execute plans nor to establish continuity.

In contrast lode deposits were being discovered, staked, prospected and developed in many parts of southeastern BC, particularly after 1880: silver and lead at the Bluebell at Kootenay Lake in 1882, gold at Rossland (Centre Star, War Eagle, Le Roi and others) in 1889, silver and lead in the Slocan (Slocan Star, Noble Five, Silver King and others) in 1891 and in the East Kootenays at Moyie Lake (St. Eugene) and Mark Creek (North Star and Sullivan) in 1890 to '92.

Transportation was the main problem inhibiting development as more and more significant prospects were tested from the Rockies (Monarch) to Greenwood (Motherlode, Photo D5). Shipping of small quantities of sacked silver-lead ore by rawhiding in winter to river banks and lakes probably started before 1887 but there is little record. Paddle wheelers were built in the mid 1880s to connect to primitive roads and the railways that followed. An explosion of activity occurred propelled by the application of American

money and the building of railways with the grain of the topography from Spokane. After 1887 silver and lead production increased sharply each year, particularly from Ainsworth in 1889, the Slocan and Moyie in 1892 , the Bluebell in 1895 and the Sullivan in 1896. Significant lode gold started to be produced from the Rossland mines in 1893 and copper a year later. All this development was virtually unaided by Victoria and poorly recorded before the appointment of the Provincial Mineralogist. Eventually a significant Canadian response occurred with development of the CPR southern line across the trend of the mountain ranges but through the newly discovered Crowsnest coalfield from the Northwest Territories, *i.e.*, now Alberta. Also the Dominion government instituted a bonus for Canadian smelters. This helped initiate the building of short lived plants at Pilot Bay on Kootenay Lake, Revelstoke and Golden but eventually more successful ones at Trail Creek (Photo D6), Grand Forks (Photo D7) and Phoenix. By 1894 the value of minerals shipped from the southeast totaled $781 342 and was increasing sharply every year.

Meanwhile the collieries of Vancouver Island were providing industrial muscle, foreign exchange and investment capital to the new province. Production in long tons for the period increased as shown:

	1874	**1884**	**1894**	
Nanaimo	51 728	133 858	394 624	(Vancouver Coal Co.)
Wellington	29 818	254 538	376 956	(Dunsmuir & Sons)
East Wellington (East Wellington Coal Co.)		5 672	5 672	—
Union (Comox) (James Dunsmuir)		—	—	241 372
Total output:	**87 218**	**394 068**	**1 012 952**	

About two-thirds of the output was sold to California, Washington and Oregon. British Columbia was on its way to becoming the Mineral Province and it was in need of, and ready for, a mineral- oriented geological survey.

THE PROVINCIAL MINERALOGIST & BUREAU OF MINES (1895-1917): Silver and Lead Mining in the Kootenays, Prospecting Everywhere

5

The passage of the *Bureau of Mines Act of 1895* created a small agency that was the incubus of the present Survey. All government offices dealing wholly with mining were gathered into the Department of Mines, including the Gold Commissioners, the Government Assay Office, the Inspector of Mines at Nanaimo, and the newly established Provincial Mineralogist and his office, the Bureau of Mines. The Bureau had a central role in the Department as the Provincial Mineralogist was charged with the management of the assay office and the "*collection of all official information relative to the various mines and mining projects of the Province, and for the publication and circulation of such information as may be deemed advisable for making the mineral wealth of the Province more widely known, and also for taking steps which would be likely to advance the development of the mining industry*". The Provincial Mineralogist was also initially *de facto* Deputy Minister. There was at last a central agency to conduct the government's role in mineral development, especially when the Department of Mines was separated from the Provincial Secretary's office under the *Department of Mines Act of 1899*.

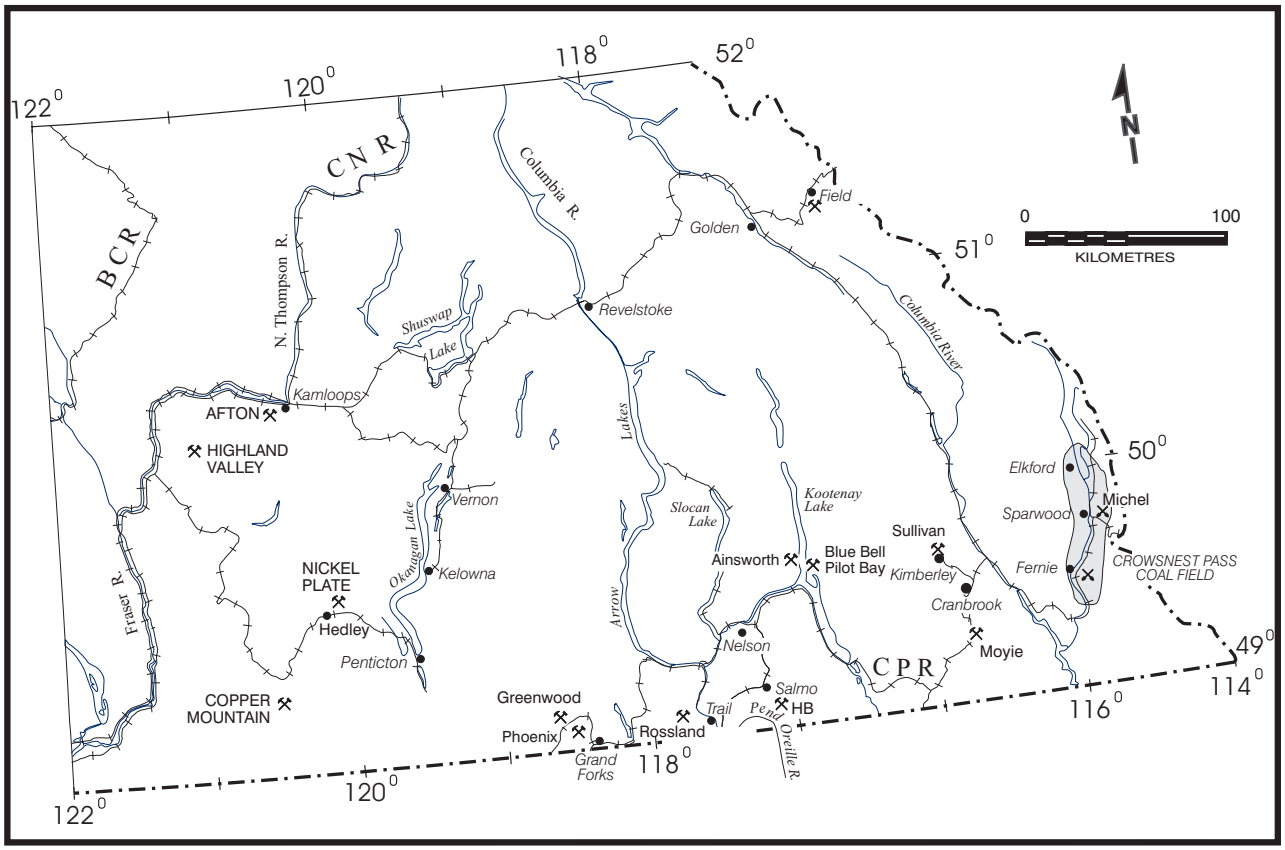


Figure 6. Geography of the Kootenays showing localities and some important mines.

INDUSTRY

The mineral industry meanwhile had swung dominantly to pursuing exploration and mining of silver and lead ores in the Kootenays, but prospecting for all metallic minerals expanded throughout the province, along its indented coastline and into the most remote hinterland. The booming developments in the Kootenays encouraged competition in railroad building from the south in the United States and through the Crowsnest Pass from eastern Canada. The supreme metal discovery of the period that dwarfed the many others in importance was that of the Sullivan mine (Photo D12), although its viability was not fully established until the introduction of successful flotation metallurgy in the 1920s. This one mine was the foundation on which Cominco became an international giant. Its history was by no means straight forward nor the outcome predictable. Initially only the lead and silver-rich core could be mined because zinc at that time was a serious contaminant. Its purchase by the CPR (Cominco) was to provide feed for the Trail Creek Smelter that was really bought as an incidental to railway right-of-way for the western part of the Crowsnest line. The Canadian Smelter (Photo D6) was built by Butte *wunderkind,* F. Augustus Heinze, to treat copper ore from the Le Roi mine but this custom was lost to a smelter built in competition just across the border in Washington. The Trail Creek plant was then converted to a lead smelter and was soon searching for ore, hence the purchase of the Sullivan.

The development of coal mines in the Crowsnest Pass of the Rocky Mountains was as important to the province as the development of the Sullivan mine and with just as complex a history. A first report of coal along the Elk River was made in 1845 but there was no serious prospecting of these Cretaceous coals until 1875 when Michael Phillips and Jim Morrissey discovered good seams at many sites in what soon became called the Fernie Basin. Transportation again was the problem but coal was the fuel for locomotives and the next two decades saw many potential deals, many test pits by William Fernie and others and as many proposed railways. Not until 1896-97 did the Crow's Nest Coal Co. and the CPR start construction of mines and railways through the pass. First production of coal and coke followed in 1898. The first mine on Coal Creek near Fernie did not look very different from Photo D13 taken much later. Coal in the small Tertiary basins of the Interior were also discovered and developed during this period (Photo D10).

During the first decade of the new century the widespread earlier mineral prospecting bore fruit. A series of major copper mines and smelters were developed in the southern interior and along the coast; the Howe Sound Company's Britannia mine, Granby Consolidated Mining and Smelting Company's Anyox mine and smelter and Copper Mountain mine, and others at Rossland, Phoenix and Mount Sicker. Also, before and after World War I, precious metal mines were developed at Stewart, notably the Premier mine, and at Hedley, the Nickel Plate. The outcome of these twenty years of prospecting, discovery and development was to establish British Columbia's claim to be *the* mineral province of Canada, a magnet for capital from Britain and the United States and a generator of export earnings.

THE BUREAU OF MINES

The role of the new Bureau of Mines in all this was to report on the potential behind the mining boom to an international audience through the Annual Report, to provide mineral displays at world fairs and to help prospectors and small developers in the field.

The first Provincial Mineralogist appointed was William A. Carlyle (Appendix I) and although he remained less than three years in the post, he set the manner of operation and the style of publication that was followed for the next two decades. This was done by extensive excursions through the Kootenays where activity was strongest during his tenure. On these trips he

visited and reported on the ownership, access, geology and processing plant at most mineral properties and left an excellent photographic record. This material was published as separate bulletins within the Annual Report of the Minister which was prepared by him. He also created for the same publication an accurate and much more extensive statistical record of the industry than previously, by cajoling data from the mine owners and by acquiring the smelter returns. He set up a library, established a mineral collection and gave public lectures on the geology and mineral resources of the province. All this was done with the technical help of only one professional staff member, the Provincial Assayer and Analyst, Herbert Carmichael. Unfortunately Carlyle left to pursue a successful career as mine manager at Rossland in British Columbia and Rio Tinto in Spain and then a consultant in London and New York. Clearly the remuneration offered as mine manager in Rossland was enough to tempt him to leave the challenge of Provincial Mineralogist and a city he enjoyed for he returned to Victoria to retire in 1924. Carlyle was an erudite, energetic and competent man held in high esteem by the mining industry. He would have made a major impact on industry and government had he stayed longer.

William Fleet Robertson, who succeeded Carlyle, was Provincial Mineralogist for twenty-seven years and so presided over most of two stages of Survey history. In his early years he continued the style established by Carlyle with little change but with great vigour. He carried out a remarkable program of exploration of the province and particularly the northern two thirds. In these times travel in this terrain was primitive. There were paddle-wheelers on the major navigable lakes and rivers and a few unconnected wagon roads elsewhere but most travel was by horse trail, canoe or bateau (a large flat bottomed lake boat). Only a few of the trails, such as the one along the telegraph line to Alaska, had any continuity or were in good condition. Most were local native trails complete with windfalls, encroaching brush, mud holes and dispersed obscure tracks where the going was difficult through swamps and forest blow-downs. Travel on the rivers and creeks was even more adventuresome and dangerous. Yet these were in the known parts of the region and much of Fleet Robertson's travel was in *terra nova*.

For fourteen years from 1898 to 1912 the Provincial Mineralogist covered the province with his exploratory trips (Figure 7 and Photos A1, B1 to 8, B10, C6, D11 & E2) and visited the active mining areas repeatedly. His most ambitious expeditions took place between 1905 and 1912 and included the following: Ashcroft to Hazelton via the Chilcotin (1905); a west to east tran-

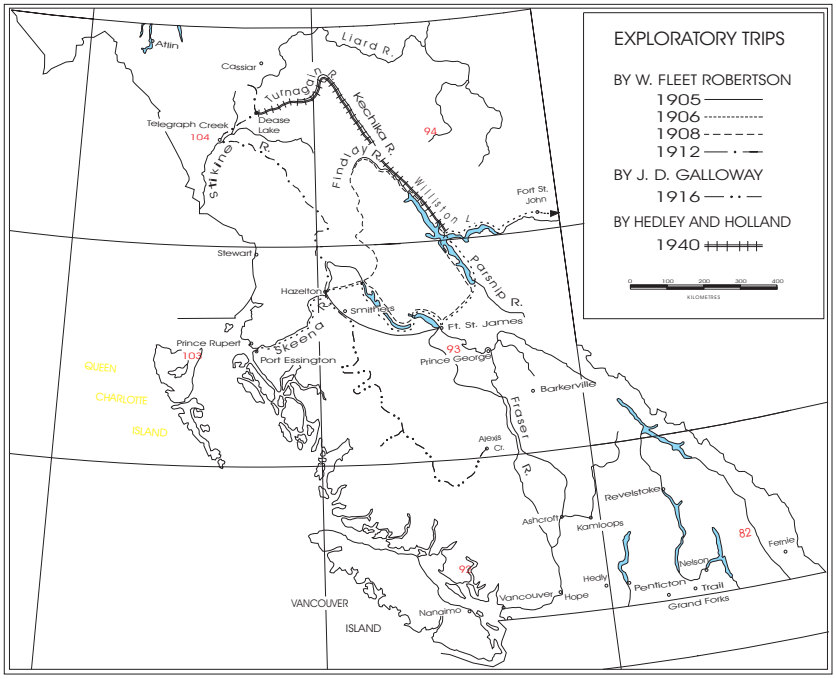


Figure 7. Exploratory journeys of Fleet Robertson, Galloway, and Hedley and Holland, 1905-1945.

sit of the central province from Port Essington at the mouth of the Skeena, up the river and through the Omineca and then down the Peace River and on to Edmonton (1906); a circuit from Hazelton through the Omineca to McConnell Creek and back via the Finlay and Parsnip Rivers and Fort St. James (1908); and from Wrangell, Alaska, up the Stikine River to Telegraph Creek, on to Dease Lake and the Cassiar and back through the Groundhog coalfield (1912).

Fleet Robertson's expeditions were rugged and truly exploratory. Although he was preceded by natives, traders and prospectors in most areas, few of these had traveled as widely and none had left a record. Wherever he went he prepared sketch maps, a diary, route information, notes on forest and agricultural potential and climate, together with a collection of outstanding photographs of the terrain. However, he never lost sight of his main objective which was to assess the mineral and coal potential of these large, scarcely known regions. He travelled light with a small party; commonly just Harold Nation, his assistant, and two canoemen or wranglers. Where necessary he cut new trails or built rafts or boats to proceed (Photo B8). Fleet Robertson was greatly helped by Nation in recording the geography and taking photographs but in those years when Nation was not with him the style and results were similar. These journeys were not like G.M. Dawson's great expeditions complete with a host of outriders, guides and assistants. Naturally Fleet Robertson formed only sketchy ideas of the geology during his rapid traverses and he relied on GSC information, where this existed, to amplify his reports which were basically a series of property examinations and resource evaluations.

In the provincial civil service style he commonly did it all on the cheap (Appendices IVc & d). Where possible he hired dead-heading pack trains with native packers and canoemen. Each expedition involved a medley of methods, and helpers (Table AR 1906). It needed foresight, organization and a sense of humour to cope with the exigencies of the wild. He never had a guide for the whole of a trip. He himself was the organizer and the overall guide.

Fleet Robertson's published diaries are replete with brief statements of the problems of traveling by pack train in forest, bush and alps; late starts because of dispersed horses, poor feed, high rivers, late or early snow, heavy rains, bad trails or none, and native guides with their own agenda. His travels by canoe or bateau were no easier because he was always a paddler and portager (Photo A1) and never just a passenger. Even journeys by commercial river boats was uncertain. You could be turfed off far short of your objective and left to your own devices if the state of the river made the passage of a rapid impossible (Photo B9). He does not make it clear whether he enjoyed or suffered through all this.

Fleet Robertson's fieldwork was augmented in many years by that of Carmichael who was sometimes styled, with good reason, Assistant Provincial Mineralogist. The latter's work was chiefly on Vancouver Island, the Queen Charlotte Islands or Portland Canal area. Nation, who had engineering training at the University of London, became the chief's regular field assistant and part-time office assistant in 1906 to 1908. In 1909 he went to Manchuria on a railway location job that did not pan out. He was hired permanently by the Bureau in 1910 (Appendix IVc, a letter by Fleet Robertson recommending his employment and which shows the talents expected of the chief's assistant - surveyor, geologist, photographer, draughtsman, statistician, clerk-typist, horseman, canoeist, camper and axeman - qualifications still needed by most field geologists). Carmichael also acquired a lab assistant in 1906.

During this period the chief's other duties in winter included writing for, editing and assembling the Annual Report and its mineral statistics, and also assembling extensive mineral collections with Carmichael to advertise British Columbia's wares at world fairs. In addition his winters were replete with short field journeys to report to the minister on such things as mine disasters and a welter of wild goose chases. He did break free for the odd min-

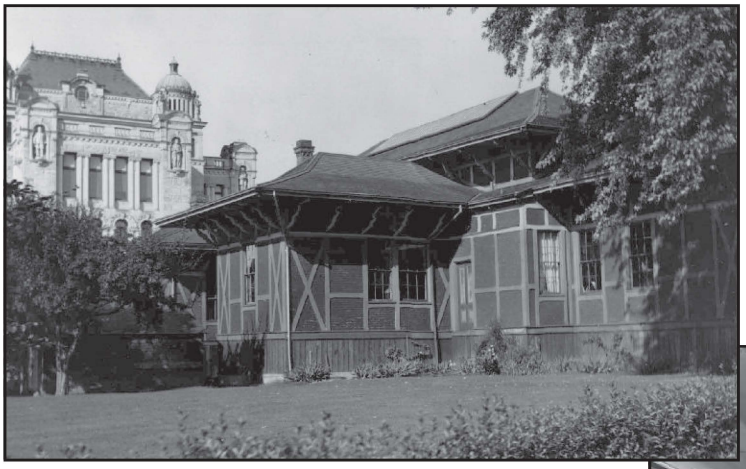
ing geological excursion which he enjoyed for intellectual and social stimulus (Photo E2). Both Carmichael and Nation appear to have been a great help to him. The assay office (Photo A17) carried out free assays for prospectors as well as for the Provincial Mineralogist, performed bullion assays and, after amendment of the *Bureau of Mines Act* in 1899, conducted examinations to accredit assayers in the province to the lasting benefit of the public and industry. Many of these duties were performed until recently.

The new Parliament Buildings were under construction at the time the Bureau was created and the Provincial Mineralogist moved into this building with his minister when it was completed. The rest of the Bureau, the mineral museum and lab moved into the original Legislative Assembly Building, the last of the 'Birdcage' buildings. These had been built in 1859 south of James Bay and away from the town at Sir James Douglas' insistence and without approval of the Assembly. Their appearance was exotic to North America but of a colonial Anglo-Asian style (Photo C1) that pleased some and provoked much criticism by others. The half timbering and roof lines did suggest birdcages and the association of government with Birdcage Walk in London made the title appropriate. The buildings were moved on rollers, an engineering feat in itself, to make room for the new Parliament Buildings. All were soon demolished except the former Legislative Assembly Building which was moved to have its main entrance on Superior Street. Only in 1913 did the Provincial Mineralogist move in to be with his small staff (Photo E4) in this building.

The Bureau of Mines started to change slightly prior to the introduction of a new act in 1917. In September 1913 John D. Galloway, a mining geologist, was appointed Assistant Provincial Mineralogist and he took over most of Fleet Robertson's field duties, travelling throughout the province examining properties with a new rigorous and more geological approach. Fleet Robertson's activities in 1913 were largely applied to the International Geological Congress in Ottawa and British Columbia. Galloway reported regularly to the chief on the stationary of the 'hotels' at which he stayed, giving information on industry activity, access and weather problems, unethical promotions and news (Appendix IVe). Thereafter the chief was largely content to let his deputy do the fieldwork. This included one epic exploratory trip along the poorly known eastern flank of the Coast Mountains to examine its prospects and assess its potential which Galloway theorized would be great. In 1916 he traversed by horse train and canoe from Burns Lake to Houston, along the flanking mountains to Bella Coola and back to the Chilcotin. The party consisted of himself, a field assistant, a packer and a cook. He gathered an incredible amount of geological and resource information in three months.

Other changes started in 1913. Carmichael resigned to attend to his own affairs and D.E. Whittaker, previously his assistant, was appointed with the downgraded title of Assistant Provincial Assayer and Provincial Analyst. Fleet Robertson retained the title Provincial Assayer. The Bureau also hired two full-time consulting engineers, W.M. Brewer (Photo E3) and D.G. Forbes as well as some temporary help. The Annual Report started to take on the appearance and depth of coverage that was characteristic of the oncoming era. In 1914 Harold Nation left for the army but returned in 1917 to be known henceforth as Major Nation. He then took over running the library and editing the Annual Report until he retired in 1947. Clearly the old exploratory, one-man-band era had come to an end and the aging Provincial Mineralogist was losing some of his vigour.

Accommodation



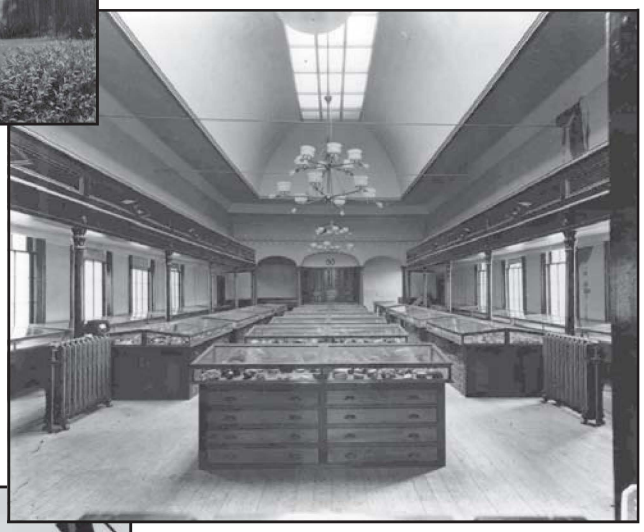


Photo C4. The Geological Survey Branch moved into the upper two floors of the Bank of British Columbia Building on Fort Street. Most of it was still there when the photo was taken in 1990. (R.E. Player)

Photo C5. The Jack Davis Building on Blanshard Street, Victoria, occupied by the Ministry in 1993, houses the GSB on its fifth floor (Fil Ferri).

Photo C6. Field camps are a feature of geologists' lives. Pictured is Fleet Robertson's trail camp a the head of Bugaboo Creek in the Purcell Mountains in 1898, in his first season as Provincial Mineralogist. It shows the whole crew, except himself as photographer, in a typical location, a gravely flat with abundant firewood. (AR 1898, BCARS HP 99012)

Photo C7. Trailer camps are a modern, more convenient variation of field tent camps. The photograph shows Bob Gilchrist's camp by Bullmoose Creek, Peace River District, in 1978, during mapping of the coal measures by road and helicopter. (R.E. Player)

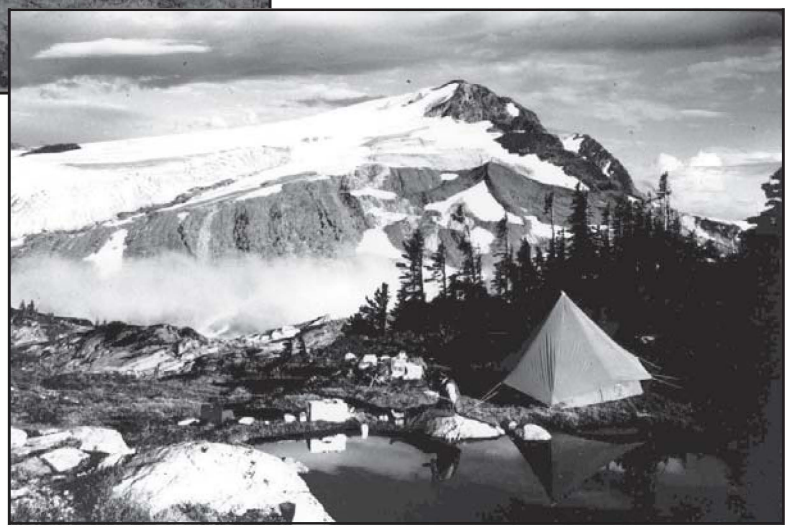


Photo C8. Fly camps are spartan, short-term camps, commonly in alpine settings with abundant rock outcrop. Access in the 1930s through the 1950s was commonly by backpacking, since then chiefly by helicopter. This camp is obviously helicopter supported judged by the abundance of baggage. Trygve Höy dines in alpine splendour at the head of Bews Creek in the Monashee Mountains, with the core gneisses of Frenchman's Cap dome in the background. (D. Johnson, Bull.80)

6 MINERAL SURVEY (1917-1937) : Mineral Pot-pourri

The new era was ushered in by a new act, the *Mineral Survey and Development Act of 1917*, which was intended to create, among other things, an on going survey of the province's mineral potential by creating six mineral districts with a Resident Engineer appointed to each. It was also intended to aid in "*the development of the mineral resources of the Province, including provision of aid to prospectors and miners and for the protection of wage-earners and investors*". The act was passed primarily to stimulate the mining industry and to promote exploration, and secondarily to keep the public informed and protected. It was a recognition that the Provincial Mineralogist's small office could not properly carry out the large role assigned to it with the burgeoning industry, but the act created problems of its own.

INDUSTRY

During World War I base metals commanded premium prices so that even with a shortage of miners, production advanced to new heights although exploration was virtually abandoned. However, after the war in 1919 prices tumbled and production collapsed as large stockpiles existed in the province and around the world. By 1922 prices had started to increase slightly and production in British Columbia advanced steadily towards new peaks in 1929. Generally it was a time when the bulk of metals and coal were produced by a handful of big mines; the Sullivan, Britannia, Anyox, Premier, Copper Mountain, Crows Nest and Canadian Collieries, although there were also a large number of small mines and prospects. The financial collapse of 1929 caused a major drop in base metal and coal prices followed by large decreases in production of all commodities and a sequence of mine closures. Gold, which shines most brightly in dark times, bucked the trend and its price advanced by stages. Exploration for lode and placer gold deposits flourished. By 1932 gold production edged upward, followed more sluggishly by lead, zinc and silver. The gold boom continued through the period with the opening of new mines such as Bralorne and Pioneer in the Bridge River district; the Cariboo Gold Quartz and Island Mountain at Wells, and others at Sheep Creek and Zeballos.

Most of the post-war period saw intensive prospecting and the staff of the Mineral Survey and the Bureau were closely involved in providing assistance and broadcasting the results. They also took the initiative through their drill program in attempts to define large, low-grade porphyry copper deposits before the provincial industry was prepared to do so.

ORGANIZATION OF THE MINERAL SURVEY AND BUREAU

The organization resulting from the *Mineral Survey Act* completely decentralized the survey by creating two entities, the Bureau of Mines and the Mineral Survey, and it left these units without a unified line of command. The principal author of this new act was apparently the Minister of Mines, William Sloan, with considerable advice from Frank E. Woodside of the British Columbia Chamber of Mines, an organization that represented prospectors and small developers. It seems unlikely that the Provincial Mineralogist had any role in its drafting considering the unfortunate structure it imposed. The resident engineers of the Mineral Survey were not civil servants but held office at the '*pleasure of the Crown*'. They reported directly to the Minister for many of their duties, to the Deputy Minister on such things as road and trail grants, but to the Provincial Mineralogist for the provision of technical material for the Annual Report. The Provincial Mineralogist and his small Victoria staff, on the other hand, were civil servants

and were responsible to the Deputy Minister. The organization was thus one that could not help but be inefficient or worse. Nevertheless the introduction of a new organization with new staff in wartime was a bold move by the government to forward mineral affairs.

The initial dispositions were as follows:

District	Headquarters	Resident Engineer
Northwestern	Prince Rupert	G.A. Clothier
Northeastern	Hazelton	J.D. Galloway
Central	Kamloops	R.W. Thomson
Southern	Grand Forks	P.B. Freeland
Eastern	Revelstoke	A.G. Langley
Western	Nanaimo	W.M. Brewer

These were a group of seasoned professionals who quickly gained the confidence of both prospectors and mining management by hard work and competence.

The Resident Engineers

Over the twenty years of the Mineral Survey, the staff changed, was augmented by several temporary assistants and a few of the base locations were moved but the output of the Bureau and Survey stayed uniform. The Annual Report was retained as the vehicle to circulate the information gathered. The statistics of the industry were assiduously gathered by the Bureau for the province which had the legal right to the data. The information was shared with the Federal Bureau of Statistics so as to limit the amount of paper required of industry. Mining and exploration activity and the work of the department were reviewed yearly by the Provincial Mineralogist. The resident engineers' reports constituted the main body of the volume together with occasional contracted reports or reproduced private reports. The volumes were completed by a section on the coal industry, the Chief Inspector's report and an index.

The resident engineers' reports attempted to cover all activities in their regions but normally concentrated on certain districts in rotation or where activity was most intense. District maps showing geography and sometimes simple geology were included. However, the reports were chiefly typical property examinations with description of ownership, access, workings, production, reserves, mineralogy, simple geology and potential. An excellent photographic record of properties, workings and terrain was a characteristic feature. The impact of repeated reviews of properties and developments gave the reports depth. Most resident engineers were not geologists although some produced remarkable geological studies. They commonly surveyed the vein deposits of the smaller properties that formed the bulk of their examinations (Photo A5) and helped prospectors and small developers with geometric, mining and geological problems. The engineers were able to apply only part of their time to these examinations as they were saddled with much work appraising applications for road and trail grants addressed to the government and regularly reviewing company reports for veracity or at the request of the Minister.

Transportation in the province was still haphazard. Three railways crossed the southern half of the province by 1917 and provided local passenger service. The river boats were gradually being supplanted as roads and railroads advanced. A sparse network of gravel roads existed in the main valleys of the interior but a journey by car from Vancouver to Prince George involved three or four dusty days. You could not drive to the East Kootenays without entering the U.S.A. North of the Grand Trunk Pacific Railway (*i.e.*, Prince George) or west of the Fraser River there were few places you could travel by public transport or car. Visits to prospects everywhere still involved travel on horseback or a hike. Consequently the resident engineers

spent much of their time traveling and even more assessing road and trail grants.

Some resident engineers were also involved in arranging and supervising exploration drilling. The government at one stage owned a Keystone drill that was used upon request to explore placer deposits. The Mineral Survey also contracted a few drilling programs as stimulation or to put into effect new ideas. The principal effort in diamond drilling was in the Highland Valley in 1919, to try to establish the potential for porphyry copper mineralization at the Snowstorm and Iona prospects that eventually became integral parts of Bethlehem Copper Corporation's porphyry copper open pit mine in the 1960s. The technology of 1919 could not properly core the broken and weathered breccias so the program was not considered a success at the time, but was the lead-in to Spud Huestis, the 'discoverer' at the later date.

The Bureau of Mines

The Provincial Mineralogist, Provincial Assayer and their assistants remained in Victoria; a head without a body or a tail. It seems likely that the Bureau was under some sort of attack from the Minister, William Sloan, or at least that the Annual Report was likely to be discontinued or curtailed. On this threat it is likely the Provincial Mineralogist solicited support because a flood of letters was directed to the Minister praising the Annual Report and decrying its rumoured demise. Authors of the letters included all the lions of the mineral industry throughout the western States from H.A. Guess, managing director of American Smelting and Refining; Reno Sales, president of Anaconda Copper (Appendix IVf); Dale Pitt, manager of the Tacoma smelter; and Milnor Roberts, to Dean of the College of Mines of the University of Washington. The Minister replied by denying the rumour and by writing to the Provincial Mineralogist directing him to get out the report with dispatch (*ibid*.).

THE COMBINED STAFF AND THEIR WORK

Fleet Robertson retired in 1925 after an eventful twenty-seven years. In his early years as Provincial Mineralogist he was very effective in all he did. His expeditions were conducted with a minimum of expenditure and a hard-living style that set a tradition while complying with provincial civil service strictures. His reward in his later years as a senior civil servant was to be badgered by accountants for taking such a small luxury as a railway compartment in a train to Ottawa instead of a berth (GSB Archive). As he approached retirement he remained gregarious and popular with the departmental staff, industry and prospectors but he seemed to lose some of his grip and his writings became somewhat pompous. On his retirement Carmichael described him as a practical man of shrewd common sense, and Mortimer Lamb compared him to a mastiff, "*a beast of great heart, loyal in friendship...confident...with a strong sense of duty... but not to be trifled with*" (Colonist, 1925).

Jack Galloway was chosen to succeed Fleet and by all accounts was a most accomplished mining geologist. He inherited the clumsy administrative apparatus but at a time when mining and exploration were thriving. The Survey's work was at the height of its acceptance and the Annual Report extended to more than 500 pages. The staff acknowledged Galloway as their leader as he had been a resident engineer. He fought their battles in Victoria and with industry mavericks like Fred Wells, discoverer of the Cariboo Gold Quartz mine. Photo E7 shows the resident engineers assembled with their Minister, his Deputy and the Provincial Mineralogist on the steps of the Legislature looking as they were, a group of successful professionals. In the field most looked more like prospectors but some affected the britches, boots and jackets of civil engineers of the period.

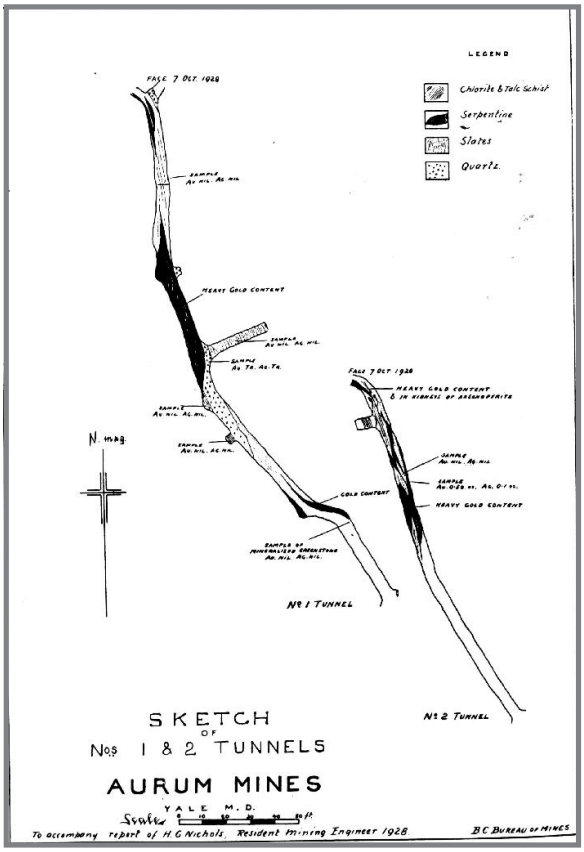


Figure 8. Early property examinations were mostly of vein deposits and commonly involved pace and compass surveys and less commonly geological mapping. The figure shows an example of the latter by H.G. Nichols in the Coquihalla gold belt (AR 1928).

Prominent individuals who occupied these positions after the initial staffing included Howard T. James, Douglas Lay, Joseph T. Mandy, H.G. Nichols, B.T. O'Grady and A.M. Richmond. These engineers and geologists were highly respected and competent men who made many contributions to the geological knowledge and economic welfare of the province. Among the original group, Galloway and Freeland went on to become Chiefs and the former a successful consultant. Freeland was not the most productive of the engineers but he did tackle reviewing major producing mines which the others mostly ignored. He was also a gentleman and born diplomat. Brewer had the perception (AR 1915, pp. 270-281) to see the Highland Valley as a potential porphyry copper district and to advocate and conduct a government drilling program. Among the later group of engineers, James went on to become President of Pioneer Mines Ltd. Lay developed a novel concept of the Tertiary drainage history of the Fraser River and its application to placer prospecting (Bull.3 and 11). Mandy was popular with a coterie of prospectors. He initially resisted the idea of the next Provincial Mineralogist, John F. Walker, to build a test mill and sampling plant at Prince Rupert to stimulate development in the northwest but later affected the role of mentor. The plant was operational from 1937 to 1945. At the end of his career Mandy became a bitter opponent of Walker. A.M. Richmond was in charge of the Bureau after Fleet Robertson's retirement and before Walker was appointed as Provincial Mineralogist. He was accused by Walker of attending to his own affairs more than his duties and he had already resigned when he was caught up in the Hedley Amalgamated scandal (see later) as the first examining engineer from the department. Like Mandy he became an outspoken opponent of Walker. O'Grady was a giant Irish gentleman who, to a considerable extent, was responsible for the discovery and development of the Cassiar asbestos mine. At the end of his career he was seconded to the Superintendent of Brokers to provide technical advice.

The resident engineer's job involved a delicate balancing act. They were responsible for reporting the truth respecting mineral prospects and

policing some undoubted rascals among the prospectors, brokers and promoters yet they needed the co-operation of all. They were subjected to some blatant attempts at bribery because their reports were valued as authoritative. One such case in the ministry history files involved attempts by promoters of Salmo Consolidated Mining Ltd. to influence B.T. O'Grady in 1928. The company certainly did not know its man as he was the soul of rectitude. The resident engineers were also occasionally treated as *persona non grata* if it was feared for any reason that their reports would not be favourable. The most notorious case was the refusal by Fred Wells in 1931 to grant entry to Douglas Lay into the new adit of the Cariboo Gold Quartz mine. Wells, the manager as well as discoverer of the mine, accused Lay of making critical statements about the property. Lay, a complete but tenacious gentleman, protested his innocence to Galloway and the Deputy Minister and the outcome was that the president of the company, Dr. Burnett, ordered that there should be no further obstruction of government engineers. In some ways this was an important test of the right of entry for the staff.

As mining production declined after the Great Depression so did the funding and productivity of the Bureau and the Mineral Survey. The size of the Annual Report was reduced to about 300 pages. External criticism and internal dissension arose and the Provincial Mineralogist, who had to work with an unmanageable system, was one of the targets. Some of the engineers were hard-drinking men, fairly typical of the times, and Jack Galloway was not the least of them. For whatever reason, he resigned in February 1934 to pursue a consulting career with considerable success. Although the organization continued until 1937, the appointment in 1934 of the feisty head of the Vancouver office of the Geological Survey of Canada, John Walker, as the new Provincial Mineralogist made it clear that major changes were coming.

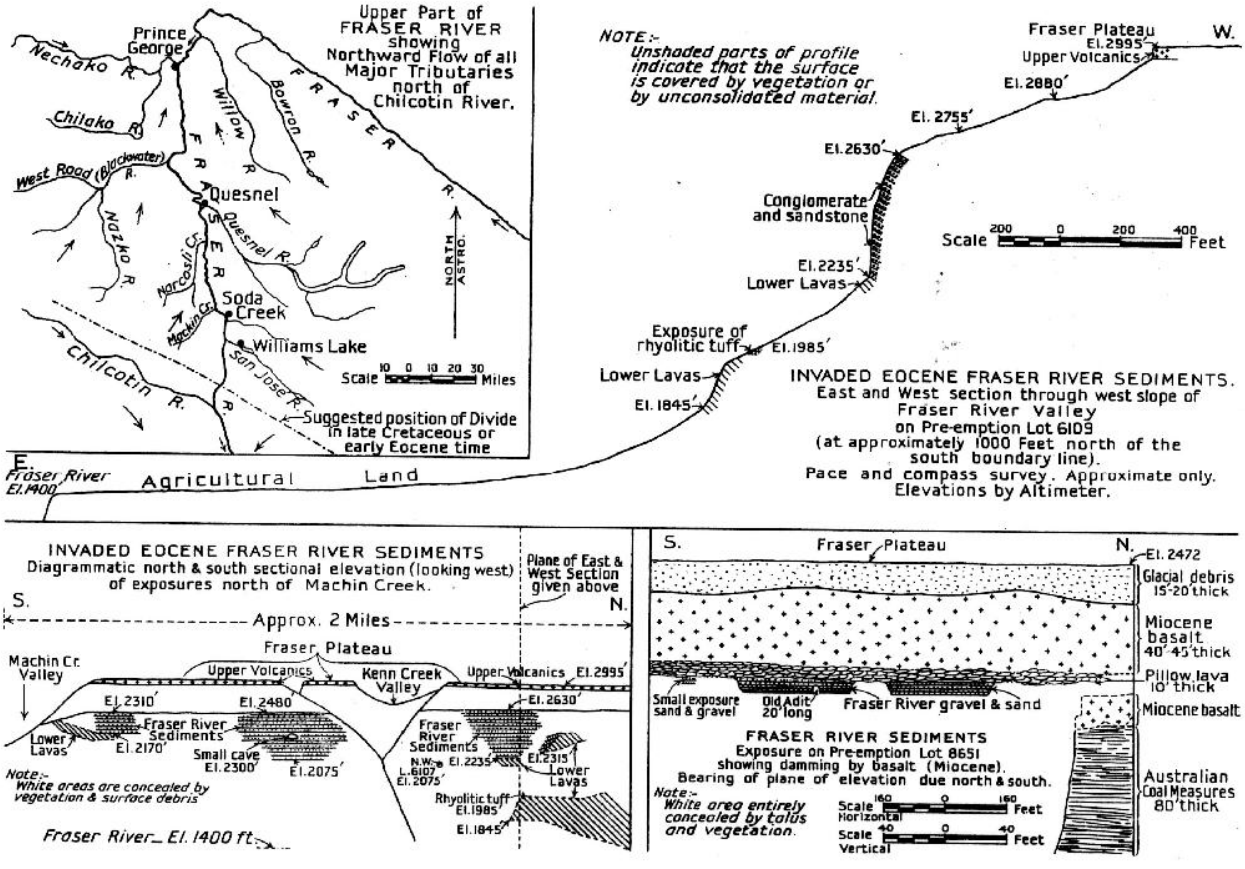


Figure 9. A few extensive geological studies were carried out in the Mineral Survey era such as the one by Douglas Lay in the line of his examination of placer gold deposits of the upper Fraser River. He hypothesized both that the Fraser was dammed by Miocene basalt floods and that the upper Fraser was captured from the Peace River.

The period 1934 to 1937 was one of almost continuous change, a period of transition that belongs with the Mineral Survey era because, although the Bureau was eliminated in 1934 the successor organization, the Mineralogical Branch, was not fully functional until 1939. However the resident engineers were promptly made civil servants who reported to the Provincial Mineralogist, thus correcting the worst of the previous organizational flaws. Responsibility for road and trail grants was shuffled off to mine inspectors and mining recorders. With time personnel changed and the replacements were all geological engineers, J.M. Cummings, Matthew S. Hedley, Hartley Sargent, Stuart S. Holland and John S. Stevenson. The Annual Report took on a more scientific look as geological mapping included the whole camp and not just some prospects. The research capability was improved by new library acquisitions and petrological equipment. An index volume was promptly published and the mineral museum sharply upgraded. Finally the offices of Provincial Mineralogist and Deputy Minister were combined in 1937 with Walker at the helm. A new ship had been built and there was no doubt who was the architect and the captain. John Fortune Walker had done it all in three years.

THE HEDLEY AMALGAMATED SCANDAL

Walker's first years however were not all smooth sailing. The first major storm of these transition years for him, the survey and the government was the Hedley Amalgamated scandal. This started unobtrusively enough after Galloway's resignation in February and before the appointment of Walker in September 1934. A very optimistic prospectus was issued by the company during the summer but the tonnage of high-grade gold ore claimed was small. In January 1935 an article in the Province daily newspaper claimed the property contained half a million tons of relatively high-grade ore. Immediately Walker asked Richmond, the Resident Engineer in Penticton, to make an examination with the help later of Johnnie Stevenson. Richmond had already resigned over differences with Walker and was gone almost as soon as his report was received. He stated that, although most of the core was crushed, there was no evidence of tampering. The check reserve calculations showed some differences from the company's but not much more than one might expect with an erratic high-grade gold deposit. However his opinion on salting was said to have changed after receiving the results of check assays (Financial News, 1937-05-14). Richmond's report was judged by Walker, who was not an admirer, to be in need of major editorial revision before it could be published. Walker wrote there was no one free to do this work so it lay fallow (Walker, private papers, BCARS). In fact Walker did not trust Richmond who had not carried out his orders the previous year. Because there was no great advance in stock prices the only action taken was an order to Matt Hedley, Richmond's replacement, to keep an eye on the property. The storm seemed to have passed.

Not so. A new front struck in January 1937, with Walker now Deputy Minister. He was alerted by the Superintendent of Brokers that something was wrong with the results of new drilling. Hedley was ordered to start another examination immediately and he sampled the split core during the next two days taking, in effect, one quarter of the total core in his examination. Hedley was assisted by an employee of the company in his sampling but under continuous supervision. The samples were kept locked in the trunk of his car until his return to Penticton where they were locked in his office until they were turned over to the express company for delivery to the lab in Victoria. The results of the assays were in most cases of the same order as the company's, with many high values, but there were some serious inconsistencies in intercepts. A daily stock newsletter in mid-February quoted reserves of about 3 million tons of very good grade in a report by an aged consultant to the company. The consultant later claimed that the report, as published, was not what he wrote. The stock started a major run-up. About the same time the assayer for the company revealed to the new President of Hedley Amalgamated that he thought his samples had been salted. On the 23 February the stock collapsed and the department and the government initiated major

inquiries. Investigations by Hedley and Walker showed Hedley's original sample bags had been treated with gold chloride solution. It had to have been done carefully to get reasonable values and so the perpetrator(s) must have had considerable time. It was suspected, but not proved, access was made to Hedley's car trunk. The government formed a commission of inquiry under George L. Fraser with R.H. Stewart as consulting engineer and Premier Pattullo released the report on the ninth of May, 1937 (New Westminster Columbian). It stated it was difficult to understand how the mine superintendent and the foreman would not have known that salting had occurred. They were duly charged with conspiracy to defraud the public and warrants issued for them and the former President of the company who had 'gone South'. The President and the mine superintendent were indicted but the foreman was not.

The fallout from the affair was that it was widely suspected some big fish got away and that the behaviour of some brokers was decidedly unethical. Walker was roundly castigated by some for not releasing Richmond's report and for being dilatory (Financial News). The whole scandal reinforced Walker's suspicious nature and his wariness of promoters. The Hedley Amalgamated scandal was never a topic thereafter discussed casually with superiors in the corridors of the department.

MINERALOGICAL BRANCH (1937-1966) : From Strategic Minerals through new Lead & Zinc Mines to Magnetite Skarns to Porphyry Exploration

7

The Mineralogical Branch existed for thirty-six years during which there were extensive changes in mining and particularly in exploration technology. The Branch itself was very stable throughout most of the period but evolved rapidly at the start and end of this era. The name, Mineralogical Branch, continued for seven years beyond 1966 but this was a period of transition that belongs better with the following era.

PRE-WAR YEARS

INDUSTRY

During the early years of Walker's tenure the mineral industry was on a roller coaster. The recovery in commodity prices and production volume accelerated as the mobilization for war stimulated the economy and both rose to new heights in 1943-44. World War II was a time of conflicting needs; more coal and metals were required but fewer men were available to mine them. Some mines had to close while others were able to achieve increased production with fewer miners. Minor metals such as mercury, tungsten, chromium, molybdenum and manganese became critical to industry because they were essential in special steels and other wartime uses. Traditional sources for North America were severed by the Battle of the Atlantic. Minor metals thus became strategic metals. In British Columbia mercury and tungsten deposits were soon in production at Pinchi Lake (mercury), Emerald Tungsten Mine at Salmo and Rocher Deboule (tungsten) and the other metals were intensively sought. The end of the war was anticipated by 1944 with severe drops in price and production of base as well as strategic metals.

The Mineralogical Branch had a vigorous response to these events and to a considerable extent led industry conceptually and guided it to a degree. The Branch's major effort early in the war was to stimulate discovery and production of strategic minerals, to initiate metals research and to a lesser extent prepare for peace with encouragement in the continuing search for gold. The Branch for the first time also took an active role in planning the Geological Survey of Canada's program in BC.

ORGANIZATION

The changes wrought by Walker culminated in a new *Department of Mines Act* in April 1938 that completed the process. The Mineralogical Branch was established by law, the Mineral Survey was eliminated, the technical staff centralized in Victoria in 1939 with a much broader geological mandate, a simple chain of command was established and the residual duties of the resident engineers were cast to the mines inspectors in the districts. The latter thus took on an important role in reporting exploration and mining activity. New mineral and placer acts completed the sweep. In fact Walker had transformed the agency into something he knew, a miniature GSC.

However, Walker did not leave things there. He went on to codify the division of labour between the Geological Survey of Canada (GSC) and the Mineralogical Branch, to get a commitment on the level of mapping effort by the GSC and to make sure that the Provincial officials had a major role in planning that effort. Letters written by Walker for his Minister's, the Dep-

uty's or his own signature were dispatched over seven years to the Prime Minister, R.B. Bennett, to Charles Camsell, Deputy Minister of Mines, and on an operational basis to Dr. G.A. Young, Chief Geologist of the GSC (BCARS, GR 1096, File 6). Appendix IVg, includes a copy of a letter from the BC Minister of Mines to the Prime Minister and a letter from Walker to Young. Walker wished to establish that the GSC should conduct its mapping at a scale of 4 miles to 1 inch while the Mineralogical Branch would work at 1 mile or more detailed scales, and that the primary responsibility of the provincial agency would be toward mineral resources. He also wished to have a prominent role in planning the GSC mapping program and at the same time he expected that the GSC would continue a level of activity commensurate with the *Articles of Union*. These initiatives may not have made him loved in Ottawa but they were among the most important things he did.

STAFF

Many changes in staff occurred just before and during World War II. In 1937 P.B. Freeland, always known by his initials, succeeded Walker as head of the Mineralogical Branch and was titled Chief Mining Engineer as he certainly could not be called a mineralogist. Whatever Freeland's assets were, he left little mark on the new order. Walker initially kept the title of Provincial Mineralogist but dropped it within a year, not ever to revive it. It is possible he thought his successors did not deserve it. He himself was *de facto* Chief Geologist as he continued to be personally involved in all management of the Branch until Hartley Sargent was appointed in 1943 and even much thereafter.

Whittaker had retired as Chief Analyst in 1938, after 31 years of service, to be replaced for only one year by his aging assistant, J.B. Adams, who in turn retired. Gene Cave-Brown-Cave was then appointed in 1940 with a mandate to upgrade the laboratory, a recurring theme with the survey. Stuart S. Holland joined the staff in January 1939 and K.DeP. Watson and W.H. Mathews in 1943. Douglas Lay died in 1941 while still on the staff.

POLITICAL IMPACTS

The changes made by Walker in such a short period were very extensive. It was too much for some. Considerable external criticism arose among some prospectors, encouraged apparently by two of the old engineers, Mandy and Richmond. Both of these men had had differences with Walker that eventually led to their having to resign. Some of the criticism was personal or trivial, but some was based on the new geological approach, the new organization and laws. Sargent, Hedley and Holland already had extensive mining as well as geological experience so that they escaped some of the wrath turned on the new geologists such as Johnnie Stevenson, who was called '*a callow youth*'. It took prospectors and miners only a short time to change their minds about Stevenson, long before he left the Branch to become Professor of Economic Geology at McGill in 1950.

The opposition festered during the war years when little could be done but came to a head in 1946. Mandy took to writing vitriolic letters concerning Walker to influential people including the Premier and the Minister of Mines, under his own and fictitious names with what was proven to be the same typewriter, (Walker papers, BCARS). Amidst some rational criticism in the letters he even made the unbelievable accusation that Walker was a communist. The suspicion was mutual. Mandy was interned in WWI because of his Afrikaner and German connections; Walker fought and was wounded with the Canadian army. On their own initiative, Mandy was watched by the RCMP prior to and during WWII. These two men could not have been more different in background, sympathies or nature.

Another facet of the protests against Walker was the setting up of an *ad hoc* group of prospectors in Vancouver in March 1946 that produced a

14-point critique of Walker, the department, the new organization and the new laws. This document was sent to the press where it was published in excerpt together with a short but strong statement of rebuttal by the then Minister, E.C. Carson.

As a result of the document a meeting with representatives of a broad spectrum of the mining community was called in Vancouver on May 13, 1946 by the new Minister of Mines, R.C. MacDonald, to address the critical brief and a request for Walker's removal. The complaints at the meeting included Walker's lack of consultation, the changes in staking and land tenure regulations, the emasculation of the Annual Report, the withdrawal of the resident engineers, the "too geological" work of the Mineralogical Branch, inadequate sampling of prospects and, in effect, the lack of promotion of properties. Walker defended himself and his objectives ably but with some circumspection although his sharpness showed through. When asked who advised the government in respect to policy on technical matters he replied, "The Chief Inspector, myself and the Premier". Walker, his policies and the Mineralogical Branch staff received strong and telling support from many of the influential mining men present and the matter rested.

The dispute was a tangled skein, being provoked by Walker's new approaches but intensified by resentment of the arbitrary outsider. The watershed was not recognized at the time but British Columbia's mineral and particularly exploration industry were, with the rest of North America, entering a radically different era. In the past the informal system relied on prospectors and developers to find mineral properties with minor help from government or major mining companies but they needed and expected that their discoveries would be appraised by government (Mineral Survey) and, in effect, promoted to the world through the Annual Report. Who indeed would send a geologist from New York, Salt Lake City or Toronto to the wilds of British Columbia on the basis of the notes of a prospector? Hence also the anguish expressed at the rumoured demise of the Annual Report in 1917 and the emasculation brought on by Walker in 1939. The new system emerging was one where government provided a better early scientific framework for exploration and companies developed extensive exploration arms based in mineralized regions to carry out exploration plays and examine prospects. Even some of the most capable and eventually famous prospectors such as Spud Huestis, Egil Lorentzen or Tommy McKay were reluctant to embrace the new system and certainly not its author.

ACCOMMODATION

The Mineralogical Branch continued to be housed in the old legislative Birdcage building until 1951. Although it became a priority of Walker's to have more suitable accommodation, nothing could be done until after World War II. The large central hall of the building, with its small horseshoe-shaped gallery, was substantiality unchanged from the days of its original use as the legislative chamber, except that it now housed on its floor an abundance of yellow cedar display cases with an array of mineral specimens virtually unchanged since it was organized by Fleet Robertson in 1898 (Photo C2). Welcoming visitors was a heroic bronze statue, purchased from the Dunsmuir estate in 1938, consisting of a coal miner stripped to the waist, carrying a safety lamp and coated at times with as much dust as its model. Instead of the discord of acrimonious debate, the hall was now largely silent except during periodic incursions of school children on a field trip. At such times the oratory of Major Nation, the quiet humour of Fraser Shepherd, his successor, or the uninformed prattle of the resident janitor would echo through the chamber and the gallery above where dead files and flies were stored. Tucked off the hall were the various geologist's cubby holes, the lab, the library and the stores.

Near the entrance the chief occupied a substantial office with a blue Axminster rug on the floor and an ornate Victorian oak desk with carved Corinthian columns. This desk, which was probably Fleet Robertson's, is still

used by the Chief Geologist although covetous eyes have been cast on it by Deputy Ministers and the like. Whether or not the desk has had any effect on the sequence of occupants, imbuing them with a sense of history or a Victorian work ethic, is not recorded, but it has survived several periods of attempted modernization.

Off the legislative balcony at the north end of the building, was a thin office that had probably been the original north-facing external balcony, its many windows commanding a view of the legislative precinct. This became the aerie where Hedley and Holland hatched their plans. The lab was a constant source of chemical and other odours that permeated the whole establishment. The worst of these occurred during some of the forensic work for the RCMP, specially when the analyst was involved in the distillation of horse flesh for data relative to some suspected crime.

PROGRAMS AND PUBLICATION

One of Walker's innovations during the depression in 1935 was to organize for the Department of Labour, camps for young men to learn the skills of prospecting and placer mining. These were conducted by permanent and temporary staff of the Branch. This project was a success on several basis. Several hundred men were trained each summer; many went prospecting with government grubstaking grants and others got jobs in the lode mining industry. Seeing its success, the Federal Department of Labour joined the scheme in 1938. The following year grubstakers were turned with some success to prospecting for strategic minerals: manganese, chromium, tungsten and mercury. With the war and full employment in 1940 the project was abandoned, to be reinstituted unsuccessfully for one year in 1946 as a veterans training course.

The principal change in direction wrought by Walker as Provincial Mineralogist and Deputy Minister was to strongly encourage applied geological mapping and research. Major areal and commodity field projects were initiated instead of just property examination and monitoring. The new direction was Walker's but the application was developed by Hedley and Holland. Although both were ex-GSC men they were hypercritical of the blob-like geological maps at a scale of 4 miles to 1 inch being issued at that time by the GSC which gave little sense of the structural grain of the Cordillera and less of its mineral resource. Unlike Walker, they regarded these maps as not only inadequately portraying the structure and stratigraphy of the province but of a scale virtually useless to prospectors and exploration geologists. Their approach was to map in detail at scales of 1 mile to 1 inch or greater in areas of mineral potential, and generally to carry the geology from areas of low alteration and structural disruption toward the normally complicated areas near mines. They scorned the quadrangle approach of the GSC as they tried to get the greatest bang for the few British Columbian bucks by mapping only areas that reconnaissance probes showed necessary to solve the relevant problems. They could take this approach because it was not the mandate of the Mineralogical Branch to fill in the map. Over the next 30 years the application of these methods had a major impact on exploration and the revelation of the complexity of Cordilleran geology. The chief problem in applying this approach was the totally inadequate topographic map base of the province at the time. Hence major projects were quite commonly carried out by extensive plane table surveys (Photo A6). After the War, air photos and maps showing photo centres, drainage patterns and ridges rapidly became available or were prepared for specific projects. Although these were imperfect they greatly speeded the work.

The Annual Report was not considered the proper vehicle for the output of the new geological studies so that a new series of sequential Bulletins was initiated in 1939 with sixteen issued by the end of 1941. These included such important reports as two Bulletins by Douglas Lay on the Fraser River Tertiary drainage history showing how the river above Williams Lake had been captured from the Peace River drainage. This had major implications

in regard to prospecting for placer gold. Three Bulletin series reports by Stevenson dealt with the geology and known occurrences of strategic metals in the province; mercury, molybdenum , and tungsten. These were the bible for these resources for over two decades to come. Other bulletins dealt with the geology and mineral resources of specific areas such as Sargent's two reports on the Bedwell River area, or with reconnaissance of large, poorly known regions such as Hedley and Holland's bulletin on the northern Rocky Mountain Trench. The Mineralogical Branch was now clearly a resource-oriented geological survey conducting systematic mapping and research. It was also set on a course of commodity and strategic mineral studies that was initiated before the outbreak of the war. Walker was a forward-thinking man and his preoccupation with strategic minerals was to show in many regards.

The obverse of the new bulletin series was the emasculation of the Annual Report which from 1939 to 1944 was reduced to about 140 pages that included production statistics, brief progress notes written by the mines inspectors and the Chief Inspector's report, but no geological studies, graphs or photographs. Although the war affected the Annual Report in that there was less exploration and departmental staff, it is clear that the intent was already present to change its nature. These changes were another source of dissatisfaction to some of Walker's critics and one that was corrected.

The strategic minerals thrust was begun principally by Walker before the war began. The program had many facets. Stevenson, Hedley, Holland and Sargent were all involved in study of known mercury, tungsten, chromium, molybdenum and manganese properties and supervising grubstake prospectors searching for these elements. Creation of a War Metals Research Board was initiated and funded in part by Walker and a lab was set up at The University of British Columbia to which Cummings was seconded until 1945. After the war this institute became the B.C. Research Council. Hedley was detached to expedite bringing the Emerald Tungsten mine at Salmo into production in 1942. Stevenson managed a program of drilling the then remote Boss Mountain molybdenite showings and established the reserve of the main breccia zone. The analytical laboratory acquired a large spectroscope and began a program of screening all samples submitted for analysis to look for strategic minerals as well as guide the analytical methods (Photo A18).

Other aspects of the Branch's war effort included loss of staff to the services by enlistment or loan for special purposes. J.R.A. Maconachie joined the RCAF and was killed on Mosquito bomber operations in 1945. B.T. O'Grady was on loan to the Army and Cummings to the War Metals Research Board during much of the war. Hedley and Holland were involved in a rugged reconnaissance of the northern Rocky Mountain Trench in 1940 as a prelude to route selection for the Alaska Highway (Photo B13). In total it was an important contribution and the Branch emerged at the end of the war as a stronger and more effective organization.

POST-WAR YEARS

The Mineralogical Branch was remarkably stable during the post-war years. There was little change in staff size, main types of field projects, publications or relations with industry. In some ways it could be said that at the beginning of the period the Branch was leading industry in conceptual thought but that by the end it was left behind by the great growth of company exploration departments in Vancouver and their new technology. The Mineralogical Branch was left playing catch-up with a small staff partly out of physical contact with its main client. That it performed as well as it did is a credit to the calibre and dedication of the geologists, the ready co-operation of explorationists and the freeing of funds from the meagre budget to expedite travel and communication to Vancouver.

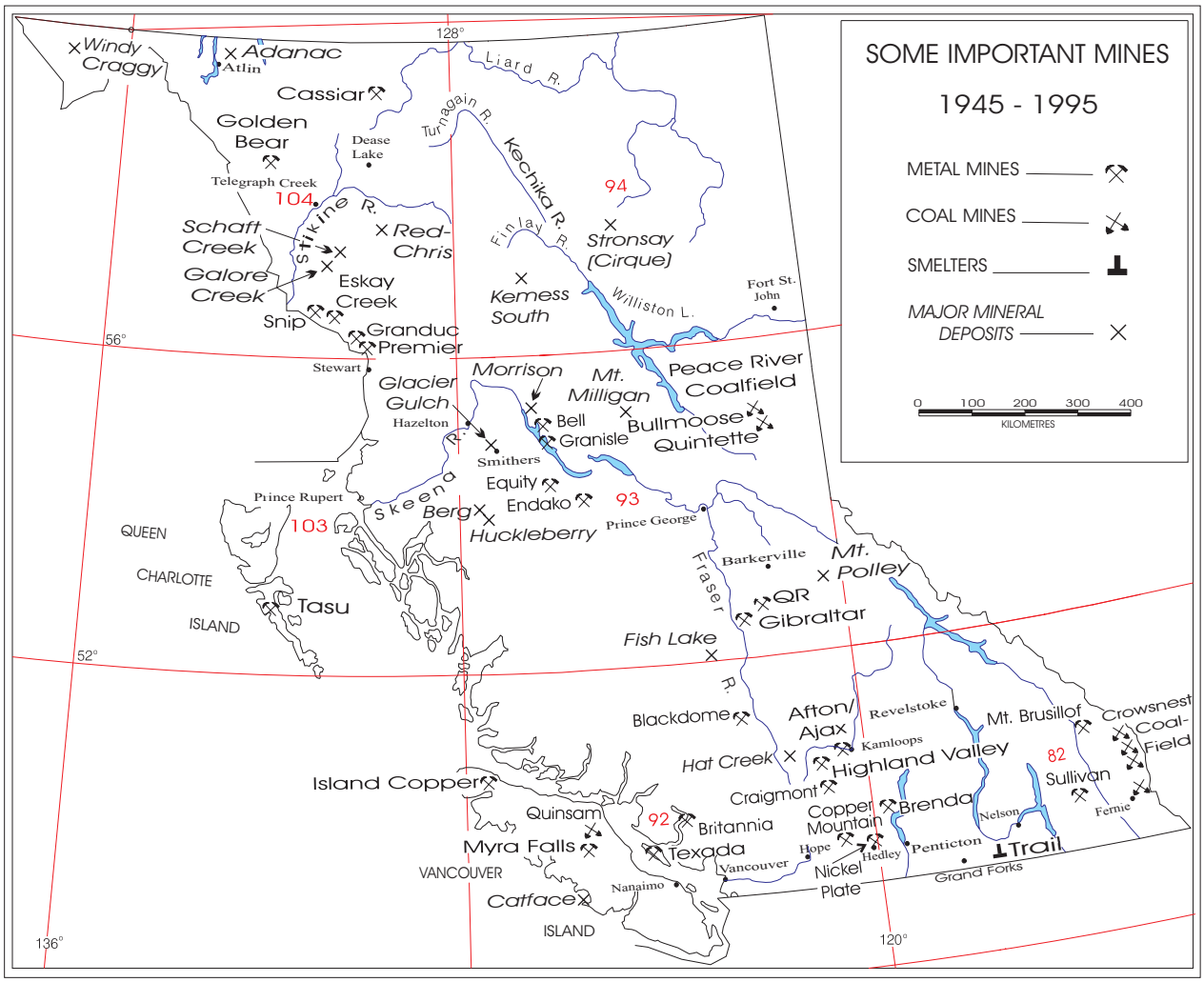


Figure 10. Location of some important mines, 1945-1980.

INDUSTRY

The period saw many changes in the production side of industry with the development of many new mines (Figure 10) but even more intense and rapid changes in exploration. Following the war, production of the major metals dropped by at least a third, with a subsequent irregular rise as prices rebounded and new deposits came on stream. Initially these were from previously known lead and zinc deposits in southeastern British Columbia like the Bluebell mine or the HB (Photo D18). The next development, in the 1950s and early 60s, was the creation of many small open-pit iron and iron-copper mines on skarn deposits along the coast, also mostly previously known. These mines had a high rate of production and consequently, except for Texada and Tasu, a short life. The magnetite iron ore produced was exported to Japan - the start of a major re-orientation of markets for British Columbian minerals. A unique event during the same period was the discovery and development of the remote Cassiar open-pit asbestos mine with resultant expansion of transportation and prospecting in the north.

In the late 1960s and early 70s the skills learned in planning and mining these open pits were applied to develop the major porphyry copper and molybdenum mines; Bethlehem, Island Copper (Photo D22), Endako, Brenda, Afton (Photo D21), Lornex, Gibraltar and others. Gold, silver and coal were in the doldrums through most of the period and strategic minerals were no longer an attractive target.

Cordilleran mining was moving strongly toward open-pit technology because high production rate and unselective bulk mining provided the economies of scale required to mine lower grade deposits as smaller, richer orebodies were becoming exhausted. The end of the period saw the initial moves that were to bring copper production to the fore, see molybdenum catapult ahead while lead and zinc, still mined entirely by underground techniques, dropped back. One other new development was that pig iron production was started by Cominco from the pyrrhotite-rich tailing of the Sullivan mine.

Over the same period exploration changed direction sharply and greatly expanded its methodology and productivity. The fundamental principals of exploration (initial reconnaissance of relatively large areas using low-cost techniques, followed by sharpened focus on sampling specific high-potential targets) did not change during the period, but the methods, speed and effectiveness of their application increased by an order of magnitude.

In the Shield areas of Canada the post-war period saw tremendous application of a spin-off of the antisubmarine war, aeromagnetic surveys, with resulting rapid discovery of iron formation and massive sulphide deposits. This technology was very much less effective in mountainous British Columbia so that many eastern-oriented companies wrote off this province as a land of small deposits, in spite of the evidence of the Sullivan and Britannia mines. Also the first wave of uranium exploration, of considerable amplitude on the Shield, was only a ripple in the Cordillera. Aeromagnetic surveys, however, did have application in the province for the discovery of magnetite skarn deposits along the coast and as a geological mapping tool elsewhere. However the new technology that was to recover B.C.'s place in the mineral world in the early 1960s was geochemistry, first with field colourometric methods (Photo D19) but mainly by the rapid development of reconnaissance silt geochemical surveys aimed principally at finding porphyry deposits. These surveys were made possible by the development of cheap, rapid multi-element instrumental analysis of samples. Surveys were quickly conducted all over the province, originally by major international companies such as Kennicott and American Smelting and Refining and by the brief fantasy of Wenner Gren along the northern Rocky Mountain Trench. Of equal importance in the successful exploration of the 1960s was the use of small piston-driven helicopters (Photo B15) that made the remotest sites accessible and enabled companies to accomplish more in a couple of weeks than they had previously been able to do in a season. Helicopters also made it possible for a few experienced exploration geologists to directly supervise many assistants covering a wide swath of country at the same time. Potential targets were then analyzed by a combination of detailed soil geochemistry, geological mapping and induced polarization geophysical surveys.

The 1960s witnessed a growing sequence of exploration successes in the province with the result that company staffs in Vancouver exploded, rising from less than a hundred to about 500 in a decade. Meanwhile the Mineralogical Branch plugged along with a geological field staff of about ten and an unchanged orientation until late in the period.

POLITICAL IMPACTS

Under the Liberal and Coalition governments of the 1930s and 1940s the Branch prospered because its role was recognized and Walker had generally good rapport with his various ministers. Nevertheless Walker's innovative changes and his pre-emptive style were called to question.

Under the new Social Credit government elected in 1951 the Branch was at first ignored but eventually was recognized as an integral part of the productive mining sector of the economy. The first Mines Minister, R.E. Sommers, also had the onerous Lands and Forest portfolio and so devoted little attention to Mines. He became involved in a scandal related to his for-

estry role, resigned and was replaced by W.K. Keirnan. On the latter's appointment, Walker asked the librarian, Fraser Shepherd, to supply the Minister with a complete set of Annual Reports. Shepherd, who had a whimsical mind, replied, *"What happened to the set we gave Sommers?"* Keirnan implemented with enthusiasm the government policy of budget restraint that extended to all departments except Highways. Restraint included such things as the departmental budgets for fieldwork and salaries although the latter had fallen badly behind industry and federal government levels. At a meeting of professional staff called by the Minister to address the problem, he informed them that if their salaries were raised it would price B.C. out of its mineral markets! It took a Royal Commission initiated at the insistence of the Association of Professional Engineers to get redress. The morale of the Branch was at its nadir during this period around 1957 as a result of the loss of a geologist in a climbing accident, the destruction by fire of the lab and the budget and salary restraint.

The government of this time was also unpopular with industry as a result of trying to tax mineral reserves in the ground. The law was proven *ultra vires* through all its appeals.

A curious political and resource interlude developed in the late 1950s when the W.A.C. Bennett government granted a mineral, forestry, hydro-power and transportation concession to the Wenner Gren Corporation of Sweden that included the land north of the Fraser River embracing the Rocky Mountain Trench and flanking ranges. The expectation was that the corporation would build its patented mono-railway up the Trench to provide transportation to the north and to extract resources. The inner Cabinet handled the details of the agreement with little contact or advice from the Departments involved. In mineral exploration two fledgling techniques were to be employed; regional silt geochemistry and two-aircraft electromagnetic surveys. Both techniques were at their early stages and proved unable to discover the zinc-lead-barite deposits, such as the Cirque (Stronsay), that were later found in the same terrain. The focus of the corporation then turned mainly to development of the hydro resources and these surveys and foundation drill results, they later sold to B.C. Hydro which then developed the WAC Bennett dam. Otherwise, the schemes collapsed leaving a lacuna in records and memory.

Toward the end of the Mineralogical Branch period, D.L. Brothers was Minister and more harmony and understanding were reached by the government with both industry and the department civil service staff.

ORGANIZATION AND PLANNING

Organization and Planning of the Branch were virtually the same throughout the period although they were more elaborate towards the end. Hedley and Holland were recognized informally as the senior geologists following the war but formal recognition was long delayed. Hedley was not acknowledged as Deputy Chief until 1965. He had long been Branch Editor and the main force behind the Annual Report. He and Holland assumed the principal role in planning the geological program, a facet Sargent was not well equipped to handle as he was more in touch with the production side of industry. As Hedley's and Sargent's personalities were not compatible, planning ended up as an exercise in which Hedley looked after southeastern British Columbia and Holland, in consultation with Sargent, planned projects for the remainder of the province. However it is generally true throughout the period that the experienced staff planned their own projects within an acknowledged general framework.

Walker, as Deputy Minister, continued to have some overview of operations but his main concerns were now political, regulatory and relations with industry. He continued to take a broad view and helped to develop the concept and funding for the creation of the Stewart-Cassiar Highway as both a shorter internal route to export Cassiar asbestos and as a spur to exploration

through better access. He advocated to Sargent, Hedley and Holland a program of 1 mile to 1 inch geological mapping along the route as an additional stimulus to exploration. The topographic maps were prepared as a prelude to route selection, not always the case at the time. Walker was opposed by Hedley and Holland mostly because it would pre-empt most of the resources of the Branch. Nevertheless a project was started in 1964 at Portland Canal that continued northward along the route and involved significant resources for a considerable time. The exploration industry by no means waited for the geological maps to be issued.

Walker and his successors pursued another road project over a longer time but with less money and vigour. The Omineca Road started as a winter road in the 1940s that was gradually upgraded and extended. It was always conceived as a stimulus to exploration rather than specific development. These two roads, unlike the B.C. Rail right-of-way, were properly sited relative to the belts of mineral potential, a fact stressed in the Geological Division's brief to Royal Commission on the B.C. Railway in 1977.

Transportation in British Columbia and in field project areas was transformed during the post-war period. The road network expanded under the Social Credit government at an incredible rate. Roads crossed the mountainous divides in the south, followed the Big Bend of the Columbia River to the Rocky Mountain Trench, through the northern Rockies to the Peace River district, and extended to the coast at Prince Rupert and Bella Coola. Paving got to Ashcroft by 1949 and to Prince Rupert and Fort St. John by the mid 1950s. If one cared to one could drive from Vancouver to Smithers in a long day.

Cars and trucks were standard for field transport on the hinterland dirt roads. Government purchasing presented field geologists some wonderful varieties including Ford sedans with truck wheels. These had a will of their own and traced out twin sine curves if driven at highway speeds. Later Land Rovers and then four-wheel-drive trucks became standard. Meanwhile the old horse trails fell into disuse and pack animals became a rarity so that off-road travel became more difficult. Back-packing with air supply was the arduous alternative. The Branch was slow to get funding necessary for helicopter use but by the 1960s was using casual charters.

Walker wished to consolidate all earth science resources in one department of government. In this he was mostly successful. In preparation for the wave of oil exploration that was expected to move northwest from Alberta into the Peace River district, new acts and regulations more encouraging to industry were promulgated under Walker's direction and the Petroleum and Natural Gas Commission was transferred to the Department of Mines from Lands and Forests in April 1953. Initially the Commission's two-man geological staff, Neil D. McKechnie and Steve S. Cosburn, were transferred to the Mineralogical Branch. In 1956 a Petroleum and Natural Gas Branch was created and Cosburn was transferred back to assume charge of petroleum geology. This was the start of the two separate geological agencies with different lines of command within the same ministry, a factor that continued to bedevil the development of a balanced Survey. Gas was produced for local needs in the Peace River in 1954. Significant production started at the end of 1957 and the Westcoast Transmission gas pipeline was completed to Vancouver in 1962. A small amount of oil was produced from 1954 but major production started in 1962. The department's name was changed in recognition of the facts to the Department of Mines and Petroleum Resources. Walker was not able to bring management of structural materials into the departmental orbit, a continuing source of confusion and irritation to much of industry and government administration.

The Analytical and Assay Laboratory continued as a separate branch but in close liaison with the Mineralogical Branch. In fact Sargent spoke for the laboratory at upper-level meetings. Under Cave-Brown-Cave the lab flourished to a degree, getting new instrumentation and developing a sound applied research program. In addition to its basic load of analytical work for geologists and engineering inspectors, and some free assays for prospectors,

the lab carried on remarkably diverse analyses for all parts of the government. Not the least of these was forensic work for the RCMP. The lab took over all of the old Birdcage legislative building when the Mineralogical Branch moved out in 1951. This historical building was an unlikely site for a chemical laboratory and its use an example of government penuriousness and lack of forethought. Sure enough the lab burnt down in 1957 and was crowded into the former Petroleum lab as a temporary measure. It was still there until its disbandment thirty-six years later. The frustration from this and other difficulties led a natural research chemist such as Cave-Brown-Cave to accept a position as a professor at McGill in the same year, 1957. He was succeeded by Stan W. Metcalfe, a precise but cigar-smoking chemist partial to wet methods, who maintained the status quo.

DREAMS OF HEAVY INDUSTRY

Walker and Sargent had dreams of a heavy industry being established in British Columbia. They believed from the evidence of previous exploration that British Columbia's iron reserves were limited and that it was necessary to preserve them for the time when heavy industry could be established in the province. They were iron Malthusians and children of their time in their belief in the desirability of heavy industry. They also thought that the magnetite-skarn deposits along the coast represented the bulk of the economic iron potential, and with the new aeromagnetic surveys, that these would all be quickly found, mined and the ore exported to the lasting detriment of the province. They were partly right.

The dream of a coastal heavy industry as the backbone of the provincial economy had been present since colonial times and the realization then that the Nanaimo and Comox basins contained substantial coal reserves. Several legislative initiatives were enacted during the first decades of the century to encourage establishment of an iron and steel industry on the coast, including the *Iron Ore Supply Act* and the *Iron and Steel Bounties Act*. These were enabling acts; *Order in Council No. 138/51*, produced as a result of Walker's and Sargent's concerns, had a similar title but was restrictive and conservatory. Mining of iron ore was to be restricted to mining claims held prior to 19 January 1951, a royalty was to be paid for export of ore from Crown-granted claims, and plans and calculations of ore reserves were to be presented to the department yearly by exporters so the potential decrease in reserves could be closely monitored. Actually the Branch was far too understaffed to adequately review or make other use of these data. In contrast, a bounty was to be paid to provincial producers of pig iron. These measures left a loop hole for iron export from reserves on other claims and in letters in 1956 from the Minister to C.D. Howe, Federal Minister of Trade and Commerce, they tried unsuccessfully to persuade the Canadian government to place an embargo on these exports. Howe, with typical centralist viewpoint, replied that, "*There is no shortage of iron ore in Canada and no demand for iron ore in BC at present. Under the circumstances I do not support a request for the Governor-in-Council to place iron ore under export covenant* (BC Arch., GR.1095, File 14). The chief beneficiary of all this was Cominco with its production of pig from the tailing of the Sullivan mine and the chief loser was Falconbridge with its sizable production from the Tasu mine on old crown-granted claims.

ACCOMMODATION

The Department was consolidated in the new Douglas Building, opposite the Legislature, at the beginning of 1951 (Photo C3). With the exception of the lab it was the first that the Victoria components of the agency were all well housed and together. Even the lapidary and technical storage were in the basement of the Douglas Building. This structure, although evocative of Soviet government architecture, provided good office accommodation. The

senior administration and Energy Division stayed there until the move to the new Jack Davis Building in 1993.

At first the department occupied the southern half of the fourth floor of the building in a symmetrical plan with the Department of Municipal Affairs; sharing a common Minister in the central office. The Mineralogical Branch occupied the southeast wing. The initial planning was curiously inadequate as all the consultation was done between Walker and the architects; the senior staff only saw the plans at the last moment. Hedley and Holland demonstrated that the allotted office spaces would not contain the basic needs of a research geologist: a drafting table, a rock cabinet, a file cabinet and a desk. Also the microscope lab occupied a prime location on the sunny south side, so the blinds had to be drawn during work. Furthermore there was to be no ladies' washroom on the fourth floor as Walker thought this was inappropriate. Some last-minute revisions were made but when the Branch moved in, its allotted space was completely full and some offices intended for single occupancy had to be shared. However the survey has never since been so well housed.

After the Petroleum and Natural Gas Commission joined the department the remainder of the fourth floor was progressively taken over. The Branch soon had to expand into the basement by expelling storage and eventually the lapidary so as to provide offices for staff returning from educational leave.

THE SENIOR STAFF

The senior staff and the Deputy Minister had very different personalities and talents. Walker, Sargent, Hedley and Holland were four proud and competent men, each in turn Chief Geologist. Walker was an imaginative, dynamic, impetuous, severe, and cock-sure man but he was also generous and sympathetic. He more than anyone shaped the Mineralogical Branch, the Department of Mines and, to a considerable extent, the mineral industry of the province. The products of his thought and activity are evident throughout the history of the Mineralogical Branch. He did not tolerate nonsense and was both outspoken and secretive. He tried to unmask a senior Deputy Minister who he was convinced claimed a fictitious Ph.D. from Heidelberg but his political bosses did not want to hear of it. In one incident he raised Holland's ire by trying to instruct him on methods of fieldwork when Walker had had less than half as many years of less varied field experience than Holland. He retired as Deputy Minister in 1958 to be replaced by P.J. Mulcahy, former Chief Gold Commissioner and a nontechnical man. For the rest of the period the Mineralogical Branch received little direction from above but was treated equitably.

Sargent was an engineer and statistician at heart, not readily given to abstruse geological thought. He was conservative, calvinistic and thrifty with his own and the government's money. He was the consummate civil servant, but one who delighted in revealing and circumventing the absurdities of government regulations. On receiving a general directive soon after a change of government that civil servants must not drive government vehicles after 17:00 hours he immediately followed it with one to his staff that not only may they, but that it was meritorious to do so. The civil service thought in terms of 5 o'clock quitting and unauthorized city use, Sargent in terms of field use and long working hours. It was in keeping with his talents and inclinations that he first introduced provincially funded aeromagnetic surveys of selected areas with potential for magnetite skarns from 1956 to 1959 and then initiated the Federal-Provincial co-operative regional aeromagnetic program in 1961.

Hedley was an enigma, a very good field and mining geologist who thought fieldwork should not have to be performed after the age of forty. Following this credo he devoted himself to editing and supervising publications. He was consummately good at this but did not seem to enjoy it as he did tech-

nical and general photography. He was a gregarious man but he and Sargent spoke only when it was needed. His concern for the lack of coverage of the exploration scene in the Annual Report following the explosion of exploration activity in the early 1960s led him to develop in 1964 the exploration form that companies had to fill out yearly. This became a fairly effective tool for monitoring and analyzing exploration trends.

Holland had great intellectual capacity which he seldom taxed. He was imaginative, innovative and adaptable but unambitious and laid back. His professional life shared a place with his other principal interests; his family, home and garden. He repeatedly turned down offers of advancement within or outside the Branch. He continued fieldwork until he was made Chief partly because he was interested in all natural history. He was also capable relatively late in his career of intensive work beyond his regular duties if he was intrigued, for example his study of the physiography of the province. He was concerned about ultimate mineral resources and so encouraged a number of initiatives to develop mineral inventory and analysis of potential resources such as MINDEP and the Mineral Deposit Land-use Map Series (*see* later). It is remarkable that these four disparate personalities worked together as well as they did.

STAFF

The authorized size of the professional staff did not vary throughout this period; it was fourteen of which ten or so were conducting full field programs. Hartley Sargent was the Chief for the whole period. Initially the Branch was seemingly unstructured but starting in 1953 Hedley and Holland were acknowledged as assisting in direction of the Branch and Hedley was also technical editor.

The array of the ten or so field geologists was slowly changing over the twenty years. Two former resident engineers, B.T. O'Grady and Joe Mandy, retired within two years of the end of the war. Many of the geologists of the

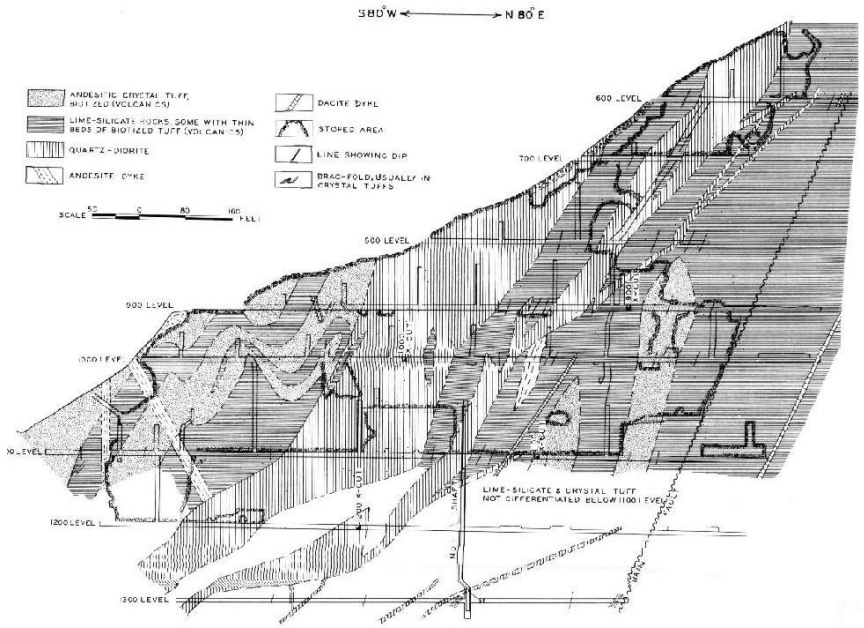


Figure 11. Geological mapping and deposit studies of mining camps were principal activities of the Mineralogical Branch. The figure shows mapping by J.S. Stevenson of the No.1 vein of the Privateer mine in the Zeballos camp (Bull3, 1940).

early part of the period completed several field projects and then left to teach at universities (W.J. Lynott, Bill Mathews, Johnnie Stevenson, Ken Watson, W.H. White). Some of these returned for a number of years conducting summer mapping projects (Stevenson, Mathews and Bill White). Others left after one or more projects for industry positions (W.R. Bacon, G.G.L. Henderson, C.B. Newmarch, R.A. Stuart), the GSC or CANMET (W.G. Jeffery, G.B. Leech, H.P. Trettin) or consulting (J.M. Black, J.M. Cummings, W.C. Jones, H.W. Nasmith). Most of the 'alumni' have had distinguished careers since leaving. Two of the Branch geologists were transferred to petroleum geology (S.S. Cosburn and J.E. Hughes). Cecil G. Hewlett, a geologist of great potential who had been with the staff for four years, was killed in a climbing accident in his project area near the Mineral King mine on 14 August, 1957. The remaining members of the staff served for ten or more years prior to 1966 (J.M. Carr, G.E.P. Eastwood, J.T. Fyles, J.W. McCammon, N.D. McKechnie, A. Sutherland Brown). Three others joined the staff late in the period, E.W. Grove in late 1963, N.C. Carter in early 1964 and R.V. Kirkham first as a temporary employee in 1963.

Curiously there are no known photos of the whole staff during this period. Photo F8 shows half of the field staff in 1953 during a brief field excursion.

The office staff during this period was considerably smaller than the field staff but they were effective beyond their numbers. They consisted of the following: A. Fraser Shepherd as office engineer, librarian and joker replacing Major Nation who retired in 1946 after forty years of nearly continuous service; an editor for English and manuscript preparation (Mrs. C.C. Judy Savage and then Mrs. Rosalyn J. Moir), a draftsman (Ken S. Crabtree), a lapidary W. (Bill) Player and then his son R. (Dick) Player, an assistant librarian, and the Chief's secretary.

PROGRAMS AND PUBLICATIONS

The major projects for this period are revealed substantially by the list of published bulletins with some lag for the preparation, editorial and publication processes. More than thirty bulletin projects came to fruition. However some important projects were published as parts of the Annual Report, and some, such as engineering and foundation studies for other government agencies, were not intended for publication and a few projects were never completed.

In keeping with the government's long history of underfunding the survey, these projects were all carried through with minimum field funds and office assistance. This led geologists to take risks and endure hardship in their field program. Risks included sometimes hiring inferior equipment at minimal rates that naturally had inadequate safety provisions and undertaking long backpacking trips to complete jobs that should have been done with horses or helicopters. Hardship included long field seasons with no leave or breaks and rather low budgets for food until late in the period. The tough-living field image of Hedley, Holland and their peers played into the government's hand in encouraging the low funding. Fortunately for the staff and the government there were no drownings or accidents due to these causes. In effect the geologists subsidized the government through their dedication. In retrospect, one of the fallouts from the lack of field funds seems amusing: with low budgets, a "careful" chief, and a 'frugal' geologist, the result of one summer's work with the Branch for one crew was that they all contracted scurvy.

Most of the projects were centred on known mineral districts and had a principal commodity basis, *e.g.* Kootenay Arc - lead and zinc, Queen Charlotte Islands - magnetite. The mapping was thus partly matched to existing or anticipated exploration developments. Mapping was not necessarily carried to regular boundaries nor constrained to one or a few scales. It was designed or expanded to cover the relevant area. This was intended to

maximize the coverage produced by the existing small staff and also reflected the problem-solving philosophy of the Branch.

Many of the projects and resulting bulletins expanded into a related sequential group as successful results were obtained. The prime example is the sequence of seven bulletins along the Kootenay Arc (four completed during the period). These started as an attempt to solve stratigraphic and structural problems in the Salmo area to provide a better framework for the mine staffs to explore and extend the reserves of their mines. The projects continued to define the arc itself, to outline novel concepts of the geological structure of southeastern British Columbia by demonstrating the existence of refolded nappes (Figure 12) and to outline the tectonics and metamorphic history of this critical region. During the course of these studies, models of three distinctly different types of lead-zinc deposit were developed that crystallized thinking in regard to their settings and origins. Consequently, the projects offered guidance for all lead-zinc exploration in the region and led directly to the extension of reserves in a number of areas, particularly south of the Salmo River at the Annex mine, at Duncan Lake and in the Jordan River area north of Revelstoke. The first four projects were by Jim Fyles and Cece Hewlett at Salmo, by Fyles and Peter Eastwood in the Ferguson area of the Lardeau district, by Fyles in the Duncan Lake area and by Fyles in the Ainsworth-Kaslo district.

Other bulletins were the product of a single project; some formed the basis of doctoral theses. Together they display great diversity but most had a prominent underlying commodity or economic basis. The majority of projects involved mapping and mineral deposit studies in an area critical to a particular mineral resource. Commonly these studies, because of their detailed scale yet extensive coverage, made significant contributions to the understanding of regional geological problems. Typical examples are the Zebellos area for lode gold, the Sandon area for vein silver and lead-zinc, the Shulaps Range for the chromium and mercury resources, the Queen Charlotte Islands for skarn deposits of iron and copper, the Stanford Range for gypsum, the Crowsnest for coal or even the subsurface Devonian reef front in the

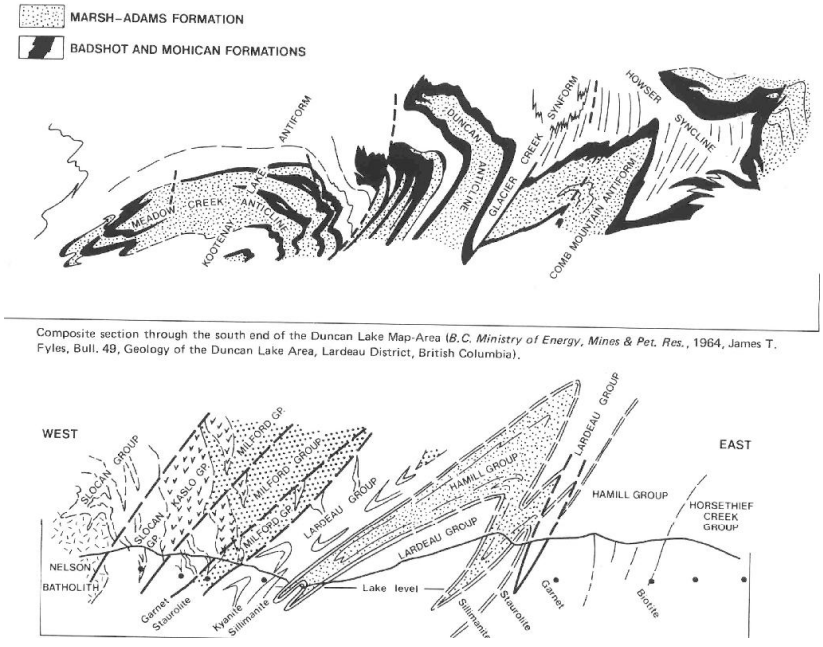


Figure 12. Extensive and detailed geological studies related to lead and zinc resources of the Kootenays revealed the complexity of the structure of this part of the Cordillera. J.T. Fyles showed the eastern flank of the Kootenay Arc was composed of complicated refolded nappes (large flat overturned folds) shown in simplified cross sections: a. Duncan Lake area, b: Kootenay Lake (Bull.59, 1964).

Peace River for petroleum. Other projects were related to commodities such as the calcareous deposits of the Strait of Georgia or the statistics on the production and fineness of placer gold; still others were related to physiography, glaciology or engineering studies for high dams.

Much of the research had a triple impact. It provided new detailed mapping that revealed the geological complexity of the Cordillera scarcely evident in the contemporary GSC maps, and in many cases pointed the way to new interpretations such as in the Kootenay Arc. It also provided a better framework for exploring a region with resulting discoveries such as Lornex in the Highland Valley or Burnaby Iron on the Queen Charlotte Islands. In addition it provided contemporary and generally original maps and interpretations of mines and prospects that led to extension of reserves in such mines as Tasu or the Annex at Salmo.

The Annual Report was very consistent throughout this period. As a result of protests it was restored to its pre-war appearance and content, representing all the activities of the Department and of industry. It was an eclectic volume including a full array of mineral and petroleum statistics when the latter industry developed, departmental activities, the Chief Inspector of Mines' report, industry activity and geological reports by the staff. In the latter sections many short summaries of mine development and exploration work on prospects were contributed by mines inspectors. It also included many geological reports on active properties, areas or minerals, which together comprised half the volume.

At first most articles resulted from a general attempt to cover the geology of exploration developments, particularly reports by Jim Black, Jim McCammon, Neil McKechnie and Bill White. This was a losing game after the great expansion in exploration late in the period. Many other articles in the Annual Report through the whole period represented interim coverage of important properties during bulletin projects. Some studies in the latter half of the period were bulletin-like in scope but of great immediacy so that they were published in the Annual Report. These included the reports on the Iron Mask batholith, the Craigmont area and the Endako area by Mike Carr and the Alice Arm molybdenum porphyries by Nick Carter. As the magnetite skarn exploration play developed emphasis was placed on these deposits first by Bill Bacon in 1952 and then by Peter Eastwood, Jeff Jeffery and Atholl Sutherland Brown. The focus switched to the porphyry deposits of central and coastal British Columbia as the 1960s began, led by Mike Carr and followed by Nick Carter, Rod Kirkham, and Sutherland Brown.

The Annual Report of this period had the virtue of currency but the disadvantage of dilution to any specialized reader. As mining and exploration increased late in the period the geological articles started to dominate a rapidly expanding volume but attempts to solve these problems were several years away.

First attempts were also made to recover industry exploration data and to expand the mineral deposit database. Starting in 1947 geological, geophysical and geochemical reports by industry were accepted in lieu of assessment for mineral claims (Assessment Reports) and these were listed in the Annual Report starting in 1958. In effect the government traded current exploration information for part of the fees to hold claims. Reports received varied from comprehensive to thoroughly abridged and emasculated but soon an important body of data was available. In addition, an exploration form was designed by Hedley in 1964 to be completed yearly by exploration companies so as to obtain broader and more complete coverage of industry activity. The information on these forms was tabulated by Holland, starting in 1966, to gauge exploration effort and direction.

Output of the Mineralogical Branch nevertheless started further diversification toward the end of the period. Provincial aeromagnetic maps and field studies (1956-59) and then the Federal-Provincial aeromagnetic map series (flying starting in 1961) were published. In addition an unnumbered collection of preliminary maps were issued to increase the size of maps

for field use and the rapidity of output. Such maps included the Granduc area by Bacon in 1956, Alice Lake - Benson Lake in 1962 and Buttle Lake in 1964 both by Jeffery. In addition an unnumbered collection of miscellaneous reports was issued, some culled from the Annual Reports. Stuart Holland's report on jade deposits in 1961 was followed almost immediately by positive prospecting results. Others reports such the one on Quaternary stratigraphy and geomorphology of the Fort St. John area by Bill Mathews in 1963 appeared nowhere else.

The geologists made increasing use of outside scientific and technical publications to float new concepts as the period progressed. For example Mike Carr's ideas on the explosive subvolcanic origin of brecciated porphyries and copper mineralization in the Highland Valley was published in the Western Miner in 1960. In particular many articles were contributed to the Canadian Institute of Mining and Metallurgy symposium published in 1966 on mineral deposits of the Western Cordillera which represented the level of understanding of the region and its mineral deposits at the time. The concept that the Cordillera was separated into five distinctive and largely fault-bounded tectonic belts arose (Figure 13) from this symposium although it was not fully codified at the time. Even today this concept, modified by recent elaborations from theories of plate tectonics and accreted terranes, dominates thinking about the framework of the Canadian Cordillera.

Other staff activities during the post-war period included teaching potential prospectors and the public about geology and mineral resources, curating a mineral museum and provision of sets of rocks and minerals. At the beginning of the period the Branch was again involved in exploration drilling to try to revive the failing Merritt coalfield. It was also involved, especially in the 1950s, in many engineering studies for other government departments and agencies. These involved dam-site studies, bridge foundation, groundwater resources and soil studies. Those involved included Hedley, Holland, McCammon, Nasmith and Jones. As it became apparent that the Branch was not capable of conducting these investigation and carrying out its primary mandate they began to be avoided early in the 1960s. As a result geologists were hired as specialists in many other government departments although tight rein was kept on staffing of Mineralogical Branch establishments.

Another activity that was periodically thrust on the Branch was the examination of properties advertising seemingly fraudulent resources. This role became progressively less important for a number of reasons. Firstly, it was dear to the pure hearts of Walker and Sargent and they were both gone by 1966. More importantly, Holland and Hedley argued that in the new era of gathering industry data, sources would dry up if the Branch was seen as a police force. They advocated such a role should reside with the Superintendent of Brokers.

The era of the Mineralogical Branch was coming to an end and another period of rapid change was being ushered in as Hartley Sargent retired in 1966. In retrospect the Branch fulfilled its limited mandate very well and was staffed with capable people but it was slow to realize and promote the potential of a holistic geological survey. After the reorganization and revitalization at the beginning of the period, it atrophied to some degree. The funds and imagination to break out of its mold were lacking.

Prospects, Mines and Smelters

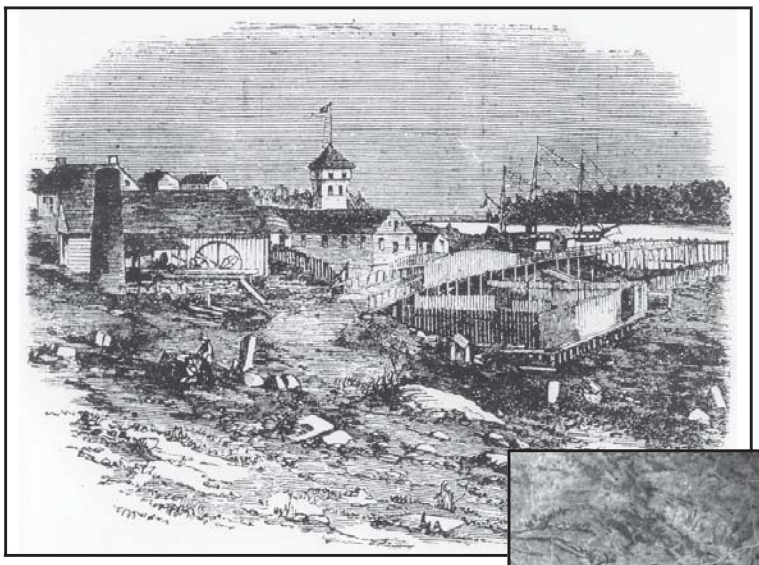


Photo D1. An etching of Nanaimo in 1859 that shows the first coal mine in the Crown Colony, which was owned by the Hudson's Bay Company, and also the bastion and a square rigger loading coal for Victoria. The drawing by Edward Panter-Downs appeared in the London Illustrated News on 1859-10-01. (BCARS 11054)

Photo D2. A prospector panning gravel for gold in British Columbia, a painting in 1864 by W.G.R. Hind, a well known Canadian painter who was a prospector in the Cariboo, hence its realism - no donkeys and no guns. Panning is a very ancient method but is still fundamental in the search for gold or other heavy minerals. (BCARS)

Photo D3. A placer mine on Williams Creek in 1867 that, unlike most of that time, exposes the workings to view rather than being underground. Note the central flume and sluice box, miners shoveling in gravel at the upper end and cleaning up bedrock in the foreground, and the stacked boulders - an eternal problem. (Fredrick Dally, BCARS HP 94703)

Photo D4. The Harewood mine in the forest south of Nanaimo in 1870 photographed by James Richardson of the GSC during his study of the coal measures. It was owned by titled ex-navy officers and developed by Robert Dunsmuir but at the time it was too far from the sea to be viable. (BCARS 93355)

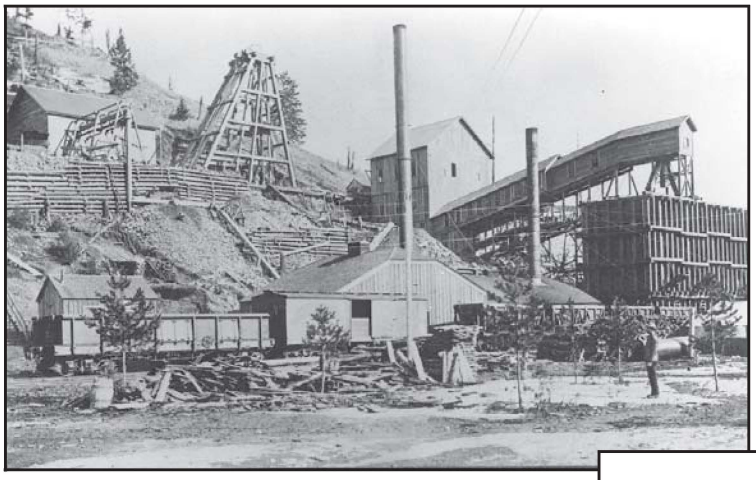


Photo D5. Motherlode mine at Greenwood in 1899. Note the well-engineered open shaft, ore bin and railway. (BCARS HP 99659)

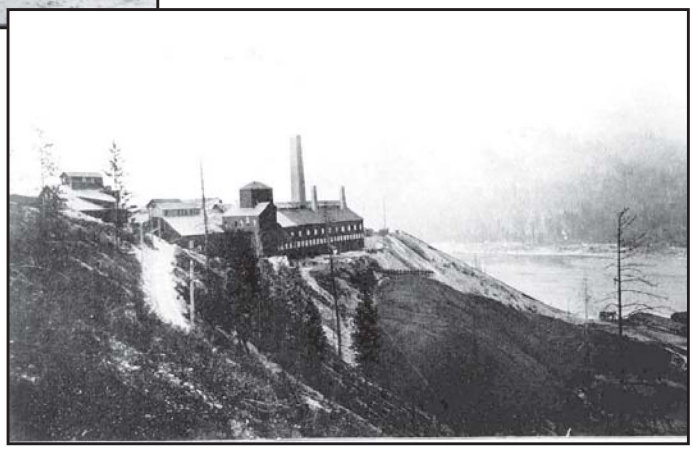


Photo D6. The Canadian Smelter Company works at Trail in 1899. It was a pawn in a complicated story of business competition among mines, smelters and railways. The plant was built four years earlier by F.A. Heinze (of Butte Montana fame) to smelt Rossland copper ores (the Le Roi mine) which were later contracted to a smelter in Northport, Washington. The Heinze smelter was then bought by the Canadian Pacific Railway to capture the Columbia and Western Railway grant. It thus became one of the early investments that formed Cominco, was later converted to smelting lead ores and eventually led to the purchase of the Sullivan mine to provide ore. (AR 1899)

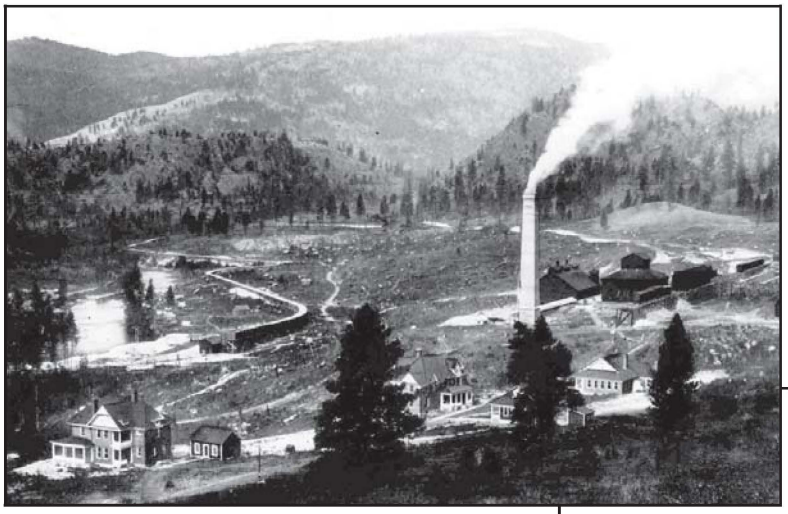


Photo D7. The Granby copper smelter at Grand Forks was "blown in" in 1900, the first in the Boundary District. It is typical of the small smelters of the day. Ore came directly from the mines at Phoenix by the upper railway visible. The management was substantially housed at the site. (AR 1900)

Photo D8. The provincial government's reduction works near Barkerville in 1902. This first primitive test mill and smelter was built in 1888 to stimulate exploration and mining of pyritic gold-quartz veins in the district as placer production decreased. The technology of the day was unable to adequately release the gold from the pyrite. (AR 1902)

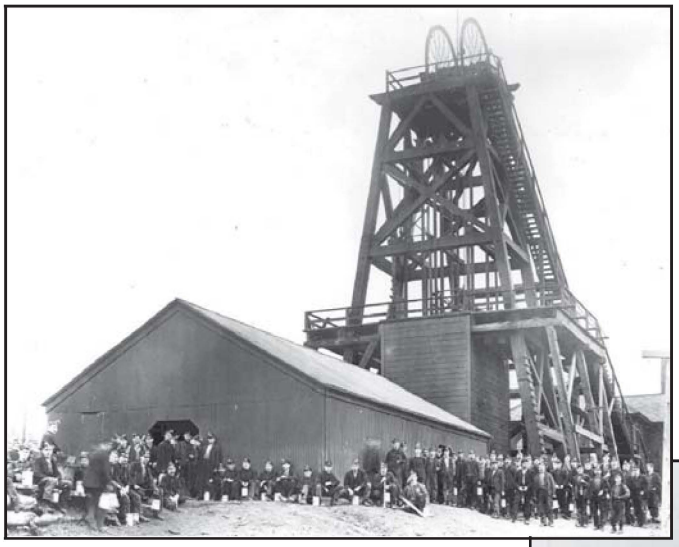


Photo D9. The head frame the Western Fuel Company's No.1 shaft pit head at Nanaimo with the miners clearly assembled for a photograph before shift about 1904. (BCARS 11278)

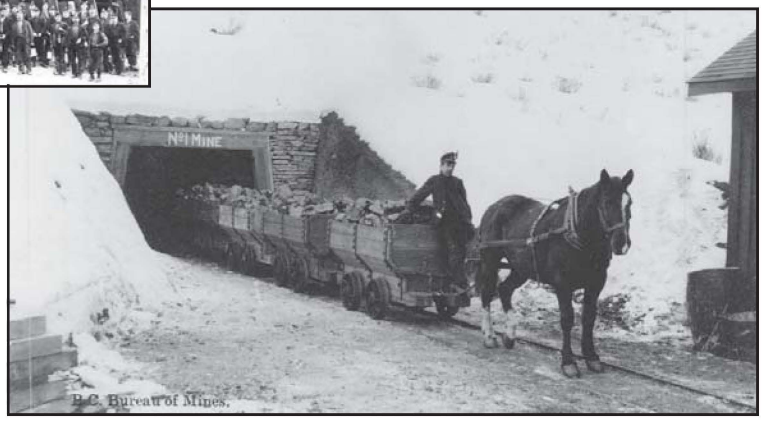


Photo D10. The new entrance adit to the No.1 mine of the Nicola Coal and Coke Company at Merritt in 1907 showing the horse drawn cars of the period. This is representative of the discovery and development of coal in the small Tertiary basins of the Interior. (AR 1907, BCARS HP 91677)

Photo D11. Fleet Robertson on the left talks to Warberton Pike, in front, and a miner during a visit to the Boulder Creek Mining Company property on Thibert Creek, north of Dease Lake. Hydraulic placer mining was still relatively new. Pike, besides being president of the mining company, was the unsuccessful promoter of the Cassiar Central Railway from Telegraph Creek to Dease Lake. (AR 1912, BCARS HP 99018)

Photo D12. The main portal (3900 level) of the world-famous Sullivan mine near Kimberley when the tunnel was newly driven in 1915. The site on Mark Creek is remarkably similar today except for a concrete frame of the portal and adjacent brick buildings. (AR 1915, BCARS HP 99020)

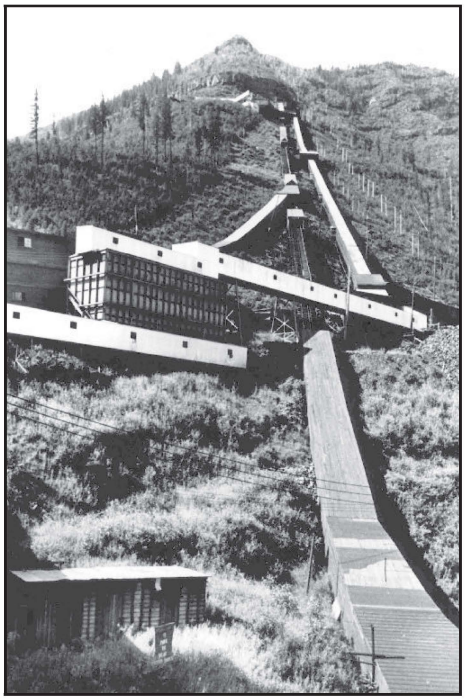


Photo D13. Covered skipways to the portals to some of the slopes of the Elk River colliery at Coal Creek mine near Fernie, the first area developed in the Fernie basin.

Photo D14. Diamond drill at Copper Mountain in 1913. Many of the characteristics of drilling were already established in these early days of the technology, including the driller's oily clothes. (BCARS HP 99661)

Photo D16. Early geophysical prospecting by Schlumberger electromagnetic methods at Stump Lake. (AR 1928, BC ARS HP 99664)

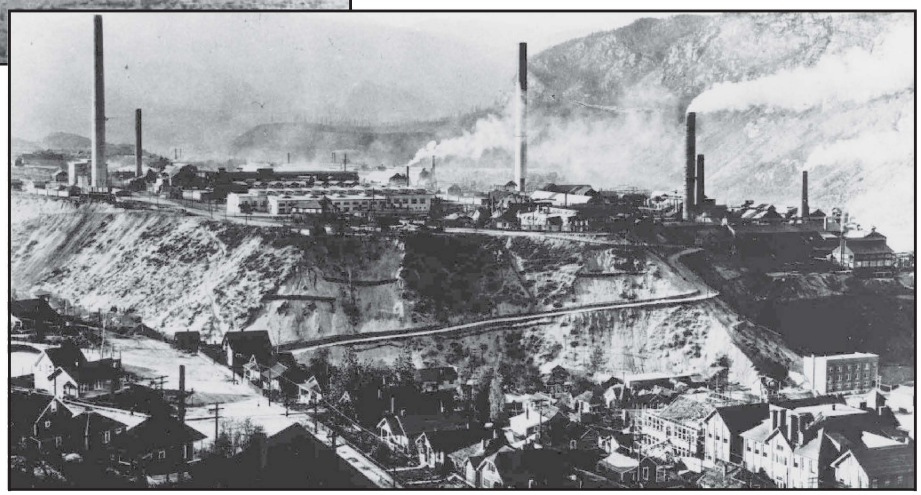
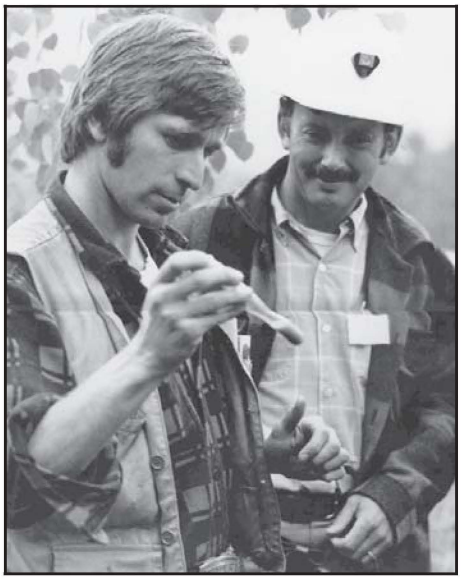


Photo D15. The Trail smelter in 1927 at the time when minor metals such as cadmium and bismuth were first extracted and before emissions of sulphur dioxide were tapped to curb pollution and to provide acid and fertilizers. (AR 1927)

Photo D17. A prospect developed by shaft rather than the characteristic Cordilleran method of entry by adit. The Canusa mine on Lowhee Creek near Barkerville in 1946. (Stuart Holland)

Photo D18. Portal of the HB lead-zinc mine developed mainly by adits. The photo shows one of the first diesel locomotives used underground emerging from the 2800 level. (Matt Hedley, AR 1956)



D19. Field methods of geochemistry taught at the first Mineral Exploration course for prospectors. Consultant Whelan Read shown with a student. (R.E. Player, AR 1977)

D20. A modern open pit coal mine, the Greenhills mine of Fording Coal Co., showing a Marion walking dragline used for casting off waste-rock overlying the coal. (R.E. Player, AR 1977)

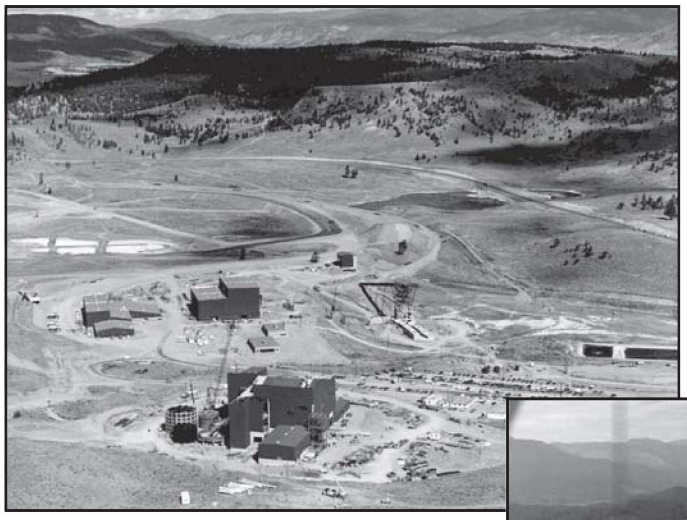


Photo D21. The Afton mine and its copper smelter near Kamloops is shown under construction. This, the only modern attempt at copper smelting in the province, was a technical but not an economic success. The site of the open-pit is outlined by a perimeter road and the Trans-Canada highway, which originally cut across it, has been re-routed. The old highway right-of-way remains visible in the middle-ground of the photo. (R.E. Player, AR 1977)

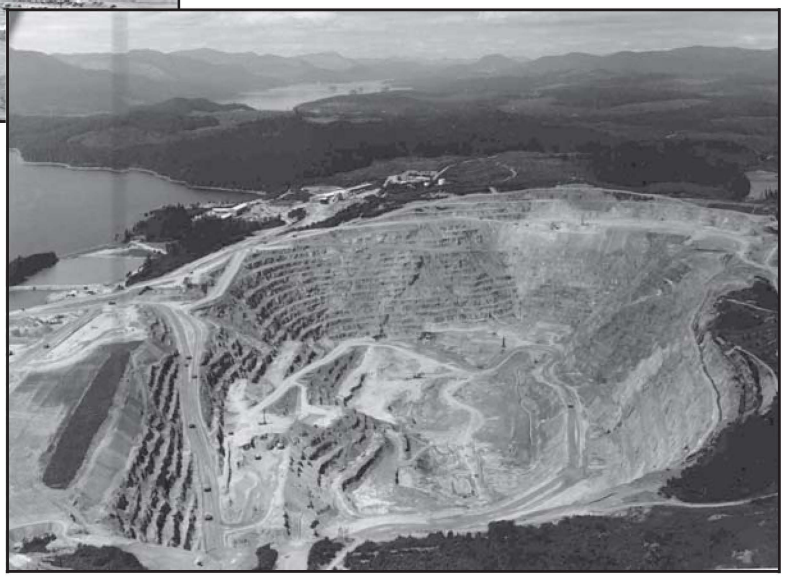


Photo D22. The Island Copper open pit mine and plant in mid-life, Holberg Inlet in the background. The pit bottom is well below sea level. Decommissioning proposals included opening the pit to the sea as a harbour or possibly to use it for waste disposal for cities in the Pacific Northwest. Subsequently the pit was opened to the sea and allowed to flood. (R.E. Player, AR 1984)

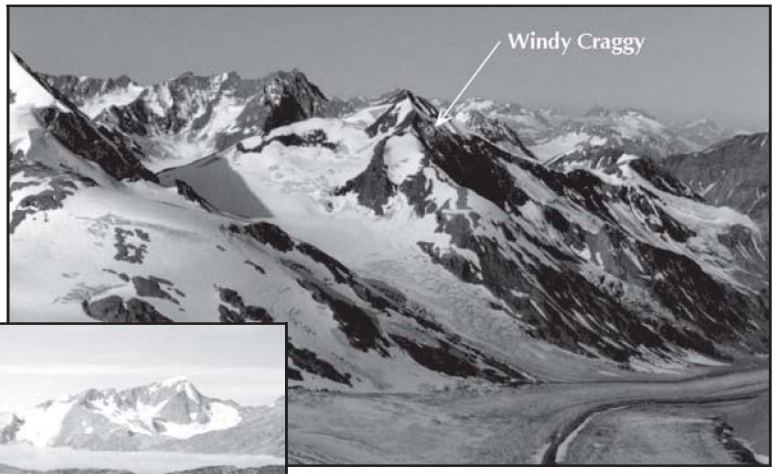


Photo D23. The Windy Craggy, a world class volcanogenic copper-zinc-cobalt massive sulphide deposit in St. Elias Mountains of Northwestern BC. It was discovered in 1958 By Jim McDougall of Falconbridge Limited by tracing sulphide boulders in moraines to their source on the steep glacially scoured rock face. In the 1990s the NDP government included the area in one of their new provincial parks and excluded any possibility of mining the deposit. (D. MacIntyre)

Photo D24. The Eskay Creek mine, which opened in 1995, is an unusual high grade, complex stratiform gold-silver mine with ore that is rich enough to ship without concentrating it. The photo shows the mine camp, and several mineralized zones and access adits. (T. Schroeter)

GEOLOGICAL DIVISION (1966-1984): Through Porphyry and Coal Booms to Recession and Restraint

8

The Geological Division was the name given to the organization in the middle of this period and will be used to characterize all of it. The unit retained the name Mineralogical Branch until 1973 and was eventually changed to Geological Branch in 1979 when the Ministry adapted to a uniform British Columbia civil service nomenclature.

The eighteen-year interval was one of continuous change and adaptation to shifting government priorities and industry needs. These were difficult times for management as the effects of politics and bureaucracy increased and budgets fluctuated. Staff too, often felt insecure because of the same reasons as well as the fact that their ivory tower was dismantled. However overall, it was a period of development and growth toward an agency that in most ways better served its clients. Hedley was the Chief at the beginning (1966-1970), followed by Holland (1970-1974) and then Sutherland Brown (1975-1984).

INDUSTRY

In this period industry experienced an irregular cycle of boom and bust. The years from 1966 to 1973 saw strong growth of solid mineral production in the province but this was followed by a plateau that continued to 1978. A short period of renewed growth was interrupted by the recession of 1981-1983. The initial surge in production to 1972 resulted from the coming on stream of the porphyry copper and molybdenum mines that had been discovered and explored in the 1960s. Much of the later growth was the result of the renewal of the coal industry in the Crowsnest after 1970 as a result of the development of international markets for metallurgical coal (Photo D20). The final surge resulted from the birth, with government stimulation, of a significant coal industry in the Peace River district in 1984. The total value of solid mineral production in 1966 was $284 million compared to $2 459 million in 1984, a five-fold increase in 1966 dollars. The quantity of copper produced in 1966 was about 48 million kilograms compared to 286 million kilos in 1984. Likewise about 0.77 million metric tons of coal were produced in 1966 compared to 20.7 million in 1984. Of the three explosive growth periods in the province's mining history, the gold rush of the 1860s, the lead-zinc boom in the 1920s and the porphyry copper and coal boom of the late 1960s, the last was the greatest.

Growth and success in exploration must precede any growth of production. The many ways of measuring metallic exploration effort all show a major build up through the 1960s to a peak about 1970. A simple measure is the number of exploration geologists located in Vancouver; they numbered 79 in 1961, 322 in 1967 and 468 in 1970, making this city one of the world's principal exploration centres (Mustard, 1976). Expanded coal exploration had an effect in sustaining these numbers through to the 1980s. A downturn in metals exploration was to be expected after a successful period like the late 1960s but it was exacerbated by unfavourable provincial legislation and world market oversupply in many minerals.

The exploration techniques developed late in the previous period basically did not change in this one although they were refined by the application of improved methods and equipment and more intensive field management through better two-way radio communications and helicopter use. Also results could be measured against better standards. Prior to the downturn in 1972, exploration was extended to the remotest parts of the province by massive application of the small piston-driven and newer turbo-jet helicopters.

Later in the period, new geological ideas such as the occurrence of massive sulphide deposition in the clastic sedimentary rocks of the Liard basin and of how volcanogenic massive sulphide orebodies form, drove exploration when only high-grade could be developed because of high interest rates and low commodity prices.

The involvement and the response of the Geological Division to these developments is the principal topic of this section. It was mixed; hobbled by low budgets, small staff and lack of anticipation, but also surprisingly innovative and effective at times. Unlike the Geological Survey of Canada, which was a pioneer in the use of helicopters in support of geological fieldwork, the Geological Division did not develop funding for helicopter support until the middle of the period. Even then it was minimal, barely enough for a few camp moves for each field party. The dispersed nature of the projects militated against anything but casual charters. This led to many wasted crew-hours sitting waiting as the prime contractors exercised their priority for the early morning flights. One aspect of field transportation where the Division did lead was in the use of trailbikes for traversing in the open hills of the dry interior (Photo B16).

EXTERNAL RELATIONS

POLITICAL IMPACTS

This period was one of major and diverse political impacts that even extended down to staff levels. However the end of the W.A.C. Bennett era was relatively serene with fairly regular political relationships at the upper management level and no attempts to rock the ship of state. There was little impact at the working level. This all changed when the Barrett government was elected (1972-1975). The mineral industry was looked on as a cash cow to be milked to provide for the extensive social program of the NDP government. A brief blip of high copper price while the government was writing new mining legislation led to the creation of 'super royalties' on metals *'to cream off windfall profits'*. Relationships between government and industry quickly reached a low ebb and exploration activity virtually ceased. Industry saw its very survival threatened and dialogue with government was conducted in an atmosphere of confrontation. Also industry and many geologists newly unemployed from the cessation of exploration, actively campaigned to defeat the government. The Geological Division, which had fostered good relations with industry, was caught in the crossfire. Curiously the government and the coal industry were not in such a severe confrontation so that exploration and development continued in this sector.

Internally it was a period of great change and uncertainty. The administration of the Ministry was abnormal. The Minister's assistant, Hart Horn, was soon seen to wield more power than the Minister, Leo Nimsick, or his deputy, John E. McMynn. Horn had been the Minister's campaign manager and was made his personal assistant on the Minister's appointment. Horn was eventually appointed Assistant Deputy Minister in January, 1975. It was he who rewrote the mining acts, proposed the super-royalty and, to a considerable extent, directed the Ministry. He was an intelligent, hard-working and quick-witted man who had a major impact on the Ministry and industry with which he had a minimal amount of background knowledge and little sympathy.

To the government, the management and staff of the Geological Division were identified with industry and, to a considerable extent, not trusted. Political staff did not believe some of the realities of mining portrayed by division management, for example, the inverse relationship between taxation and reserves of low-grade deposits. Conversion of the Division to an exploration arm of government with attendant elimination of geological mapping and research was closely considered to the point where the head of the Manitoba NDP government exploration agency was invited to come to Victoria to

talk to the Premier. Following rejection of these concepts the geological staff were still under pressure to carry out some vaguely political or social roles.

As a result much of industry distrusted the Division and in some cases ordered staff to restrict information exchange or even access to exploration properties. Innocent initiatives, such as the appointment of the district geologists, were commonly interpreted by industry in the worst light as the creation of industrial spies. What little co-operation remained rested solely on long standing personal friendships. However it was during this stressful interlude that colleagues from industry and the Division got together to initiate and carry through the production of the *Porphyry Volume* (see later) which did much to re-established trust and exchange.

In contrast to these events many others of this era were positive. The Division's role was expanded and its budget raised. The staff was increased by the establishment of positions for geologists and technicians for resource and inventory functions as well as the District Geologists (*see* Appendix Va). Furthermore salaries were raised to match the best industry standards. A new professionalism was added to the entire civil service after the parochialism of the former era. Most new senior civil servants were now well-qualified academically and intellectually in strong contrast to the clerk-like training and mentality of most of their predecessors. Geologists could elect to take benefits in the form of continuing education or international travel for study of mineral deposits, to the advantage of themselves, the Division and its clients.

The provincial electorate chose not to extend the NDP mandate to a second term. The treatment of resource industries was judged by some analysts to be one of the factors that militated against this. The incoming William Bennett regime followed a tortuous path; initially correcting the punitive taxation load on mining as well as removing threats to land tenure and other anomalies. It followed these measures by release of significant new funding for one year (1978), at short notice before the field season, to stimulate the economy (the Accelerated Mineral Development Program). Fortunately the Division was able to mount an effective program even at this short notice. The government then reacted erratically in regard to exploration and mining of uranium; at first seemingly unaware of the expanding exploration or the growing protests; then setting up a full Royal Commission of Inquiry, Health and Environmental Protection (Bates Commission); and finally terminating this inquiry before it could be completed by introducing a moratorium on uranium exploration and mining. The Division was a principal and early intervener in the inquiry because of its experience with uranium deposits and regional geochemistry. Senior management was privy to this information. The preemptive decisions to shut off the clamor of protesters and opposition were taken at the highest political level. Surprisingly the action was completely successful and uranium quickly became a non-issue although, of course, the high background radiation identified by geochemical surveys and exploration is still present in the soils and streams of the Okanagan.

Following the government's re-election during the recession in 1981-83, in which it campaigned on a platform of restraint, it reduced the civil service by 20 to 25 percent across the board without even quick studies to see whether this would have negative effects on certain sectors of the economy such as mining and exploration. The Division suffered not only the maximum reduction but was left without sufficient funds to mount a field program. At the same time the government poured funds directly toward stimulating the opening of mines in the Peace River coalfield. Certainly this was a period in which politics affected the Division from top to bottom.

INFLUENCES AND FEEDBACK

During the period the Division came under a greater degree of external influence than ever before and, as a direct result, became less parochial and

better adapted to its primary role. These influences resulted from the development of relatively cheap air travel, broadening recognition of the quality of the staff and usefulness of the Division, and its opening up to external advice and criticism from review committees.

Technology transfer is a two-way street but the Geological Division was a considerable gainer from outside influence. No longer was the only substantial contact with the industry and the GSC in Vancouver but managers and geoscientists were now in regular contact with colleagues all over North America and the world. The movement to freer travel was resisted by Treasury Board but when funds were not granted, travel costs were frequently paid for by host organizations or by the individual geologist.

A few notable examples will illustrate the opening of the Division to outside influences. The geological survey of the French Bureau de Recherches Geologiques et Minieres (BRGM), wished to study porphyry deposits, few of which were known in France or North Africa; the Division wanted to learn of BRGM's attempts to identify 'fertile' plutons by petrochemistry. Hence a co-operative program was arranged with exchange visits between 1975 and 1980 that resulted in an important publication by Bill McMillan and his French co-authors. Also many of the geologists held major offices in national and international professional geoscience and engineering organizations. Sutherland Brown was President of the Geological Association of Canada in 1980 and the Canadian Geoscience Council in 1982. Several geologists were selected to represent the province on trade or technical missions; Nick Carter was on the trade mission to Korea and Japan in 1980, Wes Johnson represented the Ministry as part of the Canadian Coal Liquefaction Coordinating Committee visit to facilities in Japan in 1981 and David Pearson was sent to study the Sasol coal-treatment plants in South Africa in 1980. Geologists were also chosen externally to represent Canada on international meetings, for example, Sutherland Brown at a UNESCO conference to initiate the International Geological Correlation Program in 1971 and the International Union of Geological Sciences in 1980, both in Paris. Other geologists were awarded lectureships such as Andre Panteleyev for the E.T. Emmons lectures at the Colorado School of Mines in Golden, Colorado in 1982.

The Division had long been in close contact with the GSC in Vancouver, Calgary and Ottawa but even that contact was broadened and the exchange became more equal. Sutherland Brown was appointed to the GSC advisory committee between 1976 and 1982.

During this era the Division also got in much closer contact with its sister agencies in the other provinces whose staff, organization and capabilities were virtually unknown to it before. The mechanism for this exchange was initially through the Provincial Mines Ministers' Conference, or more particularly, from the creation in 1976 of the Committee of Provincial Geologists which developed from the Conference. This committee had a major role in attempts toward standardization of regulations across the nation, technology transfer, comparison of facilities, organization and budgets, and general liaison. Meeting in the various provincial capitals facilitated these activities. The committee also helped to achieve a broader liaison with the whole Canadian exploration industry by holding meetings with industry organizations. It was from such meetings that the idea of Technical Liaison Committees arose. The Committee of Provincial Geologists also meets yearly in Toronto at the Prospectors and Developers Association conference, to jointly sponsor displays, exploration reviews and scientific papers. Starting in 1983 it published the annual Provincial Geologists Journal that features summary reports on the activities of the provincial surveys, their organization and budgets as well one or more feature articles such as comparison of land-use studies or tenure legislation in the individual provinces.

Another facet of external influences was subjection of the Division to a series of external reviews and mechanisms for advice. The first of these was a fairly brief review of the minerals side of the Ministry by the Mineral Resource Sector of Energy, Mines and Resources Canada in 1967. They advo-

cated greater attention to the resource aspects of the Division's work, a recommendation which was carried out. A second review was completed the following year Prof. Roger Blais and Dr. Charles Smith, authors of the EMR-sponsored report, *The Geosciences in Canada*, that covered the whole national scene. This report was fairly critical of provincial surveys in general but scant attention was paid to it in British Columbia by senior managers or the government. In 1971 the laboratory was reviewed, on Holland's request, by Dr. J.A. Maxwell, head of the GSC labs in Ottawa. This report pointed the way to an effective lab by recommending retraining and re-instrumentation, which was carried out slowly.

The first thorough review of the Division was performed in 1981 under the aegis of the Canadian Geoscience Council at the request of the Assistant Deputy Minister, Dr. A. Freyman, and Sutherland Brown. This advisory committee, chaired by Dr. H.C. Morris, had the mandate to review:

- the need for a geological survey and, if positive, the level of effort;
- the present and desired relations with the various components of the minerals industry, universities and other government agencies;
- the goals, organization, management and effectiveness of the Division.

The inquiry and its extensive list of recommendations has been a considerable guide to the Division management and later at the executive level. It was not received well at first by the mandarins and had little political impact, although many of the recommendations could only be addressed at those levels.

The next significant development was the institution of a permanent Technical Liaison Committee (TLC) in 1983-84. This was the outgrowth of discussions between industry exploration committees headed by Dr. Alan Coope of the Prospectors and Developers Association and the Committee of Provincial Geologists at the time that Sutherland Brown was chairman. The committees were calculated to provide a permanent mechanism for input by industry into program planning and to provide feedback on results. A tacit goal was that they would lobby governments to form stronger surveys. The format of committees was not well codified but British Columbia asked the various industry and professional organizations to each nominate a member. The Chief Geologist hoped that, because of the selection of members by permanent organizations, the new committees would have more impact on funding than the Advisory Committee had had. Dr. Owen Owens, representing the Mining Association of British Columbia, was chosen as chairman by the members and the committee immediately began to have an effect that became very evident in the next era.

The TLC represented a new and franker relationship with the contemporary industry. The Survey from its beginning devoted itself to helping industry in many ways, particularly by conducting perceptive geological mapping and research designed for the sharp end of the exploration industry. Nevertheless, the relationship with the mining industry has not been entirely reciprocal. During the Bureau of Mines era there was mutual respect and help, partly because there were so few players everyone knew each other. With the Mineral Survey the same relations continued substantially because their work was still largely person to person and so obviously of mutual benefit. During the Mineralogical Branch era things slowly began to change. Walker was on a crony basis with many but not all of the industry executive. He had detractors even in the board rooms as well as among the prospectors. In addition, after the War the separation between mining and exploration evolved rapidly with mining engineers and even lawyers and accountants providing the bulk of senior executives. They had dominant roles and in many cases no clear appreciation of their own exploration staff. Most did not know any geologists of the Survey or even know of their work and its improtance. The separation was nurtured by the fact that the BC and Yukon

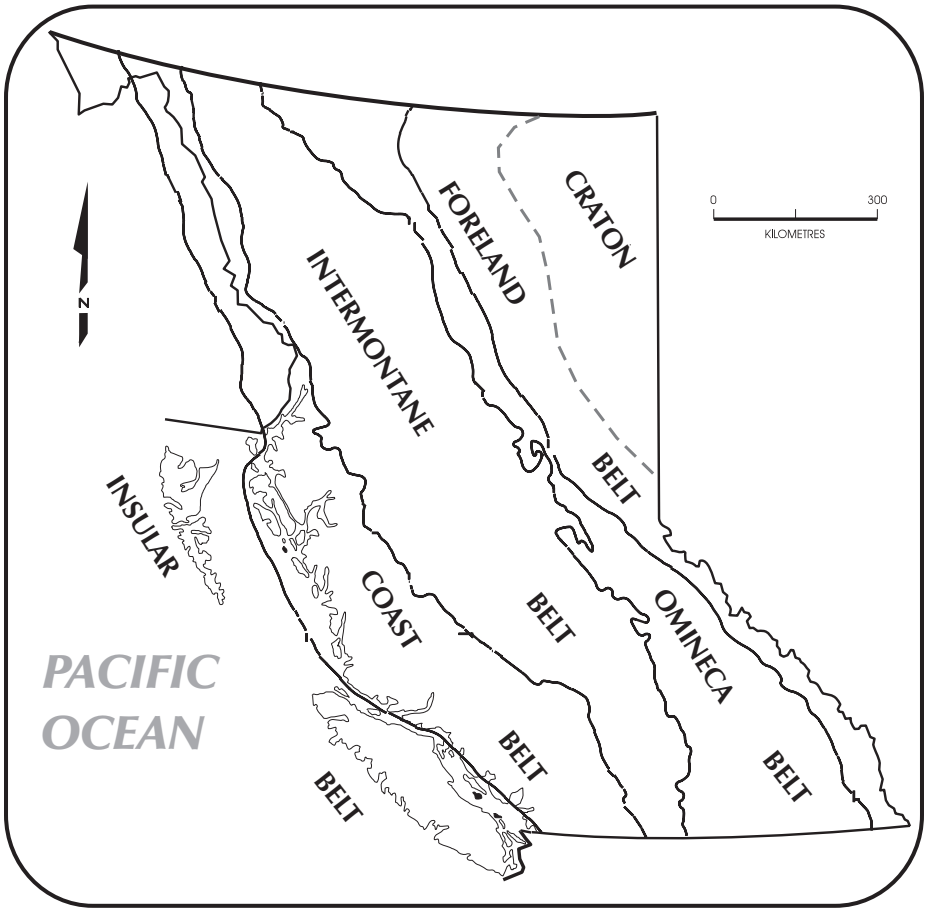


Figure 13. Simplified tectonic map of the Canadian Cordillera. Concepts of ***tectonic belts*** *in BC were applied slightly before those of* ***plate tectonics.*** *The belts have continued to be useful in understanding the tectonics, geology and distribution of mineral deposits of the Cordillera (after Sutherland Brown, 1971).*

Chamber of Mines represented the exploration industry and the Mining Association of BC the board rooms. Also, the geologists of industry and the Survey were a clubby bunch who had gone to school together, knew each other's work and co-operated to an extent some management deplored. Still, there was not much feedback, especially during the difficult days and there was not much advocacy of a stronger, better financed Survey. The Division probably did not help its cause because it thought it was obviously doing good and useful work which surely would be appreciated. They were surprised when even new ventures like Regional Geochemical Surveys were initially resented by some in the exploration industry. The Survey did not explain adequately, or to the right people, what it was doing and generally had not asked for input or advice in its programs. The TLC was created to rectify this and very soon did.

Other approaches to information exchange and feedback were related to Open Houses, polls and organizing and hosting scientific meetings large and small. The first Open House held by the Division was in Victoria in 1980 and had a good response from the exploration community in Vancouver. It was modeled on the successful events staged first by the Saskatchewan Geological Survey and followed eventually by all: an event to display the work of the surveys to their clients. An informal poll at the first Open House indicated that a two year cycle of meetings would be appropriate. The second Open House in 1982 ran a full poll on many questions including opinions about the talks and displays of the day. The most surprising result was that the respondents highest rating went to the availability of the geologists for consultation and opinion in the office and the field. In 1983 the Division approached the British Columbia and Yukon Chamber of Mines to explore the possibility of running the Open House back to back with their Annual Meeting in Vancouver in January, 1984. This proposal was received with enthusi-

asm and, before the initial meeting, developed into the now regular Cordilleran Roundup in which the GSC, Yukon section of Indian and Northern Development Canada and The University of British Columbia all participate.

Another poll was run by Carter and Sutherland Brown following release of the first geochemical survey results in the late spring of 1977. This was conducted by face to face interviews with company exploration managers in Vancouver, usually with many of the members of their staff present. Questions related not just to the geochemical surveys but the whole gamut of the Division's work and possible future activities. The visits were well received and lively and useful debates took place. Unfortunately the results were never collated and published but the utility of a regular mechanism of feedback was established.

The Division initiated or was host to a variety of scientific meetings, field excursions and workshops. Prominent among these were workshops held in Fernie, Fort St. John and Nanaimo dealing with resolution of stratigraphic problems, structure and origins of the various coalfields. The Division took a prominent role in leading field excursions in the province in connection with the International Geological Congress of 1972 held in Montreal. It continued this for the Geological Association of Canada for its Vancouver meeting with the Society of Economic Geologists in 1977 and, naturally, for the Geological Association's Victoria meeting in 1983. At the latter, one the largest of the association and the largest of any scientific meeting held in Victoria to that date, the Division staff, together with colleagues at the Pacific Geoscience Centre at Sidney, provided nearly all the organization and manpower. Many other meetings took place and the benefit to the Division equaled that to the delegates.

INTERNAL RELATIONS

ORGANIZATION AND PLANNING

Growth of organizations and growth of bureaucracy go hand in hand. Growth necessitates some elaboration but more is imposed on even a small branch of a big tree. This period of the Division's history demonstrates the acceleration of bureaucracy in the provincial civil service as mandarins and management practices migrated from Ottawa to Victoria.

As the Division developed its organization became more complex. In effect there was no formal subdivision of the survey in 1966. An organization chart published in the 1967 Annual Report showed a Deputy Chief reporting to the Chief with units, Geology, Industrial Minerals and Library, reporting to him. In practice there was no clear division, reporting structure or section leaders. In the next few years a more structured organization evolved so that by 1969 the Division was comprised of an Economic Geology Section under Atholl Sutherland Brown, a Mineral Resources Section under James T. Fyles and a Publication and Technical Services Section under Jim W. McCammon. The first major change in the organization was the incorporation of the analytical laboratory as a section of the Division in 1970 in response to dissatisfaction expressed by the geologists with the lab output and turn-around time.

The next elaboration was a response to a broader mandate that was both generated within and imposed from without. Under Holland, before and during the NDP era, the Division quickly evolved from a strictly field-oriented research and mapping organization to one where resource functions such as inventory, field aid, prospector training and land-use studies were important aspects of its work. Although field research remained the core program, some field geologists had to reorient their careers to fill some of these new roles even though several new positions were created.

In 1975 Sutherland Brown was appointed Chief Geologist and the Deputy Chief's position was eliminated. The organization then consisted of a chief with the following sections reporting directly to him:

- Project Geology involved in economic geology, mapping and research, and regional geochemistry;
- Applied Geology responsible for aid and monitoring of industry activity, prospectors' training and assistance, coal core curating and storage;
- Resource Data and Analysis providing mineral and coal inventories, review of assessment reports submitted by industry, land-use analysis, nonmetallic and metallogenic studies; and
- Analytical Laboratory supplying chemical analysis and assay services to research geologists, conducting research on analytical methods, certification industrial analyst's competence, and providing quality control for geochemical surveys.

This organization continued throughout the remainder of the period (Appendix Vb). It was functional rather than commodity based. There were good operational reasons for this at the time but an important subsidiary reason was that it discouraged easy capture of a section devoted to a specific commodity such as coal by aggressive and well-funded units such as the Energy Division. Such were the internal politics of the time.

Many of the Division's traditional service roles within the Ministry were stripped away during this period. These functions had accrued to the survey because it was the biggest user. They included supervision of vehicles, field and survey equipment, the library, publications production and sales. With the growth of the Ministry to include a Finance and Administration Division as well as Energy and Petroleum and Natural Gas Divisions, it was logical that most of these functions would be taken care of by Finance and Administration. Logical - but the Division was apprehensive that the results would be unresponsive service. The apprehension proved to be justified, not only for the Geological Division but also for all operational units. A new element of bureaucratic lack of understanding was overlaid on all these functions. The most melancholy example was the fate of Publications Subsection. It was transferred to Communications Branch where it reported to a succession of directors who had no knowledge of industry's needs and little interest in the publication process. In effect the subsection became the private preserve of the Deputy Minister and of Energy Division and was involved with the production of a welter of press releases and fancy brochures. The geological publications, including those that needed currency, were greatly delayed in spite of heroic unpaid overtime efforts by Rosalyn Moir and her staff, particularly Doreen Fehr. When Sutherland Brown retired a prominent member of the exploration community remarked, only partly in jest: "*You think you are going to be remembered for the geology you did, but you will be remembered mostly as the Chief who let publications get sadly behind".*

The Division was negatively affected by the growth of bureaucracy which distanced it from the Deputy Minister, as well as by rapid changes in ministers and mandarins. At the beginning of the period the Chief reported directly to the Deputy Minister (DM) and was his chief advisor on many technical matters. By 1979 two new layers of bureaucracy had been created between the Chief and the Deputy Minister: a Senior Assistant Deputy Minister (SADM) and an ADM (Mineral Resources). Furthermore the DM's attention was riveted on energy affairs because of the world oil crisis. The Chief Geologist was now out of effective contact with the DM.

There had been only two Ministers in the last six years of the W.A.C. Bennett era, Donald L. Brothers and Frank Richter, both of whom were from constituencies with important mining interests. There were seven Ministers

in the twelve succeeding years of which the two of longest tenure and greatest understanding were James R. Chabot and Robert H. McLelland.

The parade of DMs and ADMs was more convoluted. Patrick J. Mulcahy retired in 1966 and was replaced by another non-technical DM, Kenneth B. Blakey. The latter served until April 1972 when James T. Fyles from the Geological Division was appointed, the first professional since Walker had retired in 1958. Fyles was then relegated to a position called Associate Deputy Minister when John E. McMynn, a mining engineer, was appointed DM by the new NDP government in 1973. McMynn served until he resigned when the Minister, Leo T. Nimsick, was replaced just before the change of government in 1975. After a short interregnum with A.L. Peel, Fyles was re-appointed. Edwin R. Macgregor was appointed ADM (Mineral Resources) in March 1977 but moved to Energy in late 1980. He was replaced in March 1981 by Andrew J. Freyman who lasted a little over a year. Fyles was once again relegated to Senior Assistant Deputy when Roy Illing was appointed in December 1978 to manage the Ministry enlarged by the transfer of Energy to it. After Freyman's departure Sutherland Brown acted as ADM while still Chief Geologist until Lorne E. Sivertson was appointed in November 1982. Fyles retired in 1983 happy to be back doing geology.

These changes of pilot resulted from a mix of politics, growth and the clash of personalities but together they explain the Ministry's uncertain course. The result was the Geological Division alternately suffered from disregard and unrealistic direction to substantial approval. One example of unrealistic direction was evident in the budget exercise under Freyman, an intense, intelligent but erratic man who did not understand the civil service milieu and disregarded storm signals. At a time of imminent recession Freyman wished to generate significantly higher funding for Mineral Resources and his budget categorized many regular items such as regional geochemical surveys as 'add on' items while moving his desired new programs into the base budget. At the internal review of the budget presentation the DM commented that, in the light of the times it was a bold initiative, inferring it was not likely to work. Needless to say funding for regular programs, such as geochemical surveys, as well as his new ones was chopped. It took a year of intense effort by the Geological Division and its friends to justify the programs and restore them.

The growth and bureaucratization of the Ministry brought about an equivalent growth of formal committees for communication, planning and control. The Chief and senior geological staff became increasingly involved in management and other committees. One of the most effective of the special committees turned out to be the Land-use Committee, perhaps because it was backed by a secretariat of the geological land-use staff. In the Division, a management committee also developed in response to the modest growth but particularly because of the physical dispersal of the Division and its managers in the latter part of the period. The committee met irregularly under Holland and weekly under Sutherland Brown.

ACCOMMODATION

In 1966 the Ministry's share of the Douglas Building could no longer contain the whole staff and individuals and units were dispersed to a number of houses within the legislative precinct and rented space elsewhere. Starting in 1968 the project geologists were located in two houses behind the Douglas Building (*see* Photo E9) and the lab was still in its permanent 'temporary' site at 541 Superior Street. Additional houses were occupied as the Division grew and was evicted from the 'seat of power'. However by 1982 the Division became less dispersed as the main elements were brought together in fairly good quarters in a temporary building at 548 Michigan Street adjacent to the lab. The Chief and most of Resource Data Section were still located in the Douglas Building.

Between 1974 and 1978 district geologists were established in Fernie, Fort St. John, Kamloops, Nelson, Prince George and Smithers where they shared offices with the staff of Inspection and Engineering or with Petroleum Resources (Fort St. John). In general their accommodation was considerably better than that of the Victoria staff.

SENIOR STAFF

Hedley and Holland followed in rotation as chief geologists from their previous positions as deputy, but Sutherland Brown was the first to be selected by competition. The selection was not just a walk through as it was politicized to some degree. The new Deputy Minister and incoming Assistant Deputy held an image of Sutherland Brown that was not exactly their ideal: research oriented, sympathetic with industry and probably conservative by nature. In the first nationally advertised competition there were no other significant applicants internally or externally, perhaps because it was viewed as a 'staged' competition. A second competition was advertised and then re-advertised. It was now known internally that Sutherland Brown was not their choice. As a result there were a group of applicants both internally and externally with significant qualifications. Sutherland Brown flirted with accepting a position as chief geologist in Botswana but with timing complications he stayed to compete locally, believing it would be a fair competition. After acting as chief geologist for over eight months he was appointed chief in January 1975.

Under Sutherland Brown the management structure was developed to cope with the growth of programs and staff. To fit civil service nomenclature, the senior geologists became managers. To the civil service if they were involved in anything but 'management' they would not qualify for additional salary. Happily they continued whatever level of research and field involvement they could. Initially the managers were Nick Carter, Ted Grove, Jack Garnett and Wes Johnson. All had broad experience, had worked in industry and had degrees from diverse universities. They also had strong personalities but generally worked well together.

Nick Carter had degrees from the University of New Brunswick and Michigan Tech and got a Ph.D. from UBC while on the Division staff. He had worked for Inco in production and exploration geology. With the Division he had worked at Alice Arm, Babine Lake and the Skeena Arch, principally on porphyry deposits and regional mapping (Figure 15). He established a classification of the porphyries and showed that they were unrelated to the surrounding Hazelton volcanic rocks as was then widely believed. He was a great communicator with industry even at the cost of numerous headaches. He initially managed the Applied Geology but later was in charge of Project Geology. Ted Grove had experience with Cominco, and the Quebec Department of Mines and completed his Ph.D. from McGill University while on educational leave from the Division. Garnett was a practical and aggressive geologist with much exploration experience with Inco and the M.J. Boylen group of companies and had a managerial flair. He had a doctorate from UNB. Wes Johnson had been an assayer with Cominco when he decided to become a chemist. This led to degrees from UBC, Washington and McMaster Universities before he joined the Division as Deputy Chief Analyst. All but Johnson left to pursue other careers during a big turnover in staff during 1979-80. After a delay in each case of nearly a year Bill McMillan, Vic Preto, and Gib McArthur were appointed the new managers. These geologists likewise had experience in industry, with the GSC, and in the Division or other provincial surveys. The truly open competitions for these and other positions were effective in finding capable staff and resulted in a low level of inbreeding.

STAFF

The Division grew at a slow but steady pace until 1982. Initially the staff comprised twenty-four persons including the then independent lab. Early in the period a few new positions were created for what later became known as project geologists. There was strong growth from 1972 to 1974 and again in 1979 to 1981 by which time the staff had reached sixty-two, including contractors. The latter period was a boom time in exploration and many were tempted to leave for greater responsibility or higher pay. It was easy for the chief to tell who was seriously contemplating leaving by whether they were having their own and their families' teeth fixed while still on the employee dental plan. By the end of 1984 the staff was reduced to forty-nine by the government policy of restraint (*see* Appendix Vb). Overall, during the eighteen years considered, the staff was fairly stable although 33 left through retirement or resignation whilst 51 joined as geologists, chemists or leading technicians.

With such numbers only a few can be mentioned individually. In 1967 both Ken Northcote and Vic Preto joined the staff as they completed their doctorates at UBC and McGill respectively. Northcote had extensive exploration experience in B.C. and South America while Preto had research experience with the GSC. Bill McMillan was appointed in 1969 after exploration work with Cominco and earning a doctorate from Carleton University and started immediately on a major study of the Guichon Creek batholith and its porphyry deposits. Andre Panteleyev joined in 1972 after field experience of porphyry deposits with Kennco Explorations and a doctorate under way at UBC. Tom Schroeter was one of the first two district geologists appointed in 1973 after a Masters from Western Ontario and gaining exploration experience with Amoco. In the same year David Pearson signed on from the Saskatchewan survey and completion of a structural thesis in Norway. Although he started work for the Division on volcanic rocks, he became an innovative coal geologist when the opportunity arose. Trygve Höy joined in 1974 after earning a doctorate at Queen's University and experience in exploration. He continued the work of Fyles in the Kootenays. In 1977 Danny Hora took charge of nonmetallic mineral studies bringing with him experience with a consulting firm in Calgary, a Masters degree from Charles University and field work in Czechoslovakia, Cuba and Quebec. J. Gilbert (Gib) McArthur was appointed manager of Resource Data in 1980 after experience with the Newfoundland survey, exploration with Cerro Mining Co. of Canada and a Masters from Carleton University. Gerry Ray and Dani Alldrick both joined the Division in 1981. Gerry had worked previously for the Saskatchewan survey and in Africa; Dani in exploration with Cominco Ltd. in the Northwest Territories. Finally the present chief, W. Ronald Smyth, came to the Division in 1982 as the Senior Geologist of land-use analysis. He had degrees from Trinity College, Dublin, and Memorial University of Newfoundland in St. Johns and had become Manager of Regional Mapping with the Newfoundland survey.

The growth of the Division was a pale reflection of the five-fold increase in the real value of solid mineral production during the same period. The great expansion of exploration and mining compelled the Division to devote an increasing share of its energies to administrative tasks such as assessment report review and monitoring what was happening and taking inventory of the results. Then new demands arose in the 1970s from another direction that nearly overwhelmed Resource Data Section and the district geologists, the need to make large numbers of land-use evaluations. Hence the organization's growth resulted from the need to staff new or expanding functions such as district geology, inventory compilation, assessment report review, computer applications, land-use studies, coal geology and core storage. The regional geochemical surveys were mostly carried out by contractors with supervision and chemical control provided by Division staff. Field mapping and research (Project Geology) continued to be the heart of the organization but enjoyed no growth because any new funding was received only to operate these new and necessary services.

The complexion of the staff changed as a result of the new orientations. Originally it had been completely dominated by research-oriented, independently minded field geologists with doctorates and engineering degrees. By 1984 the Division was a much more diverse organization with many office and computer-oriented geologists most of whom also had higher degrees. The technical and clerical staff was also expanded. The lab too had been transformed from an organization of modest output, wedded to wet analysis and fire assays, to one of high output by instrumental chemistry with computer and automatic processing and used to much method development and inter-lab comparisons in which it faired very well.

Another aspect of the staff changed during this period. It had previously tended to be deadly serious, possibly reflecting the personality and direction of the chiefs. Under Holland it began to be leavened by an underlying sense of sociability and good humour. This helped in the carrying out of a demanding profession and tolerating the absurdities of civil service life. It also improved relations with the exploration industry. Some manifestations of this spirit were the annual exploration golf tournaments started in Smithers by Tom Schroeter and Victoria by Nick Carter and Jack Garnett which were more associated with camaraderie rather than low-handicap golf. Another was the mid-summer raft race and frolic on the Toodoggone River organized by Andre Panteleyev and Tom Schroeter. Staff morale remained generally high as a result except during the blood letting and fiscal restraint of 1983-84.

ACTIVITIES

PROGRAMS

The Division's core programs of field-mapping and research in the first half of the period (1966-74) commonly had a closer horizon than before, in an attempt to cover the expanding exploration scene and to be more immediately relevant while, at the same time, making the best use of lean resources. Most of the projects had porphyry copper or molybdenum as their *raison d'etre*. The Division moved quickly, after a tardy start, to become a significant contributor to the understanding of the nature and distribution of these deposits. Many of the projects and the principal investigators are mentioned in this history but many are not.

Geological Mapping and Mineral Deposit Studies

The most comprehensive group of linked projects were those on the Guichon Creek batholith, now the site of one of the world's largest open-pit copper mining complexes. Work began in the previous period with Carr's detailed mapping of the Highland Valley and the Bethlehem deposit, later to become Canada's first porphyry copper mine. Subsequently Northcote completed reconnaissance (1:126 720 scale) of the entire batholith, begun as a doctoral thesis supported by Kennco Explorations (Western) Limited, and completed and published by the Division in 1969. Ager, McMillan and Ulrych conducted innovative geophysical studies to interpret the three-dimensional shape and intrusive history of the pluton (Figure 14), Grove completed an exhaustive petrochemical sampling program followed up by detailed petrographic studies by McMillan in collaboration with Z. Johan of the geological survey of France (BRGM). McMillan also produced more detailed geological maps (1:25 000) published in the Preliminary Map Series. Interpretive modeling of the cluster of deposits in the core of the batholith, and comparison with Gibraltar, Brenda and Endako deposits elsewhere in the province, led to the recognition of a class of relatively deep, plutonic porphyry copper and molybdenum deposits (Figure 17). These new ideas made the Guichon Creek batholith and its prolific copper resources one of the best understood in the world and significantly contributed not only to

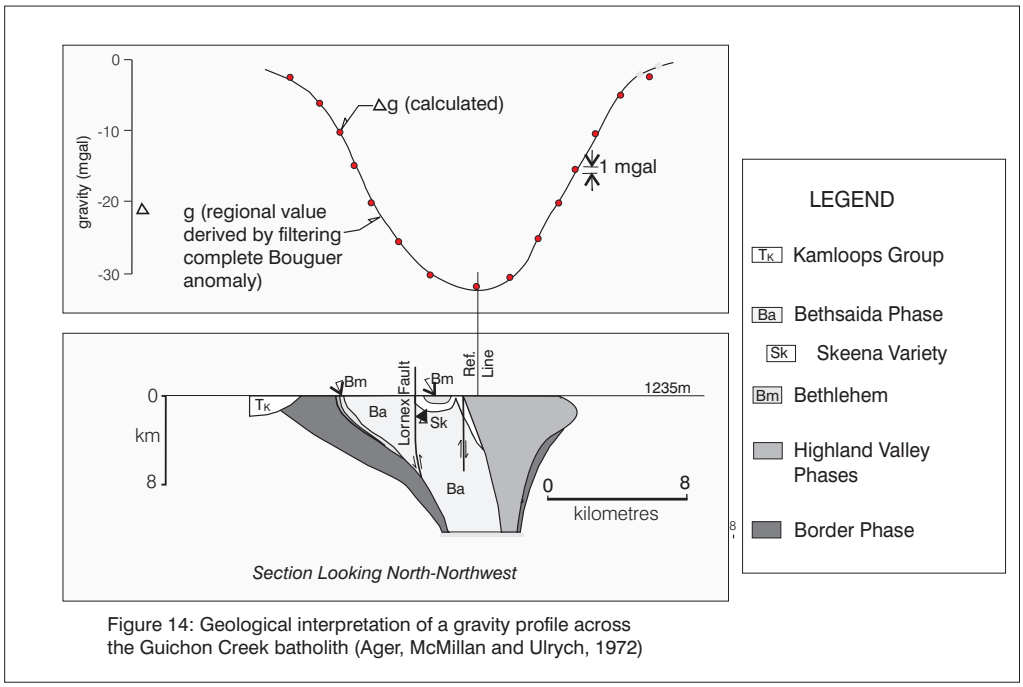


Figure 14: Geological interpretation of a gravity profile across the Guichon Creek batholith (Ager, McMillan and Ulrych, 1972)

file: EASTWB-W.CDR
B.C. Geol. Surv. Branch
1997

Figure 14. C.A. Agar, W.J. McMillan and T.J. Ulrych studied the petrology, the magnetics and conducted a gravity survey so as to understand the granitic intrusions of the Highland Valley and distribution and origin of their related copper and molybdenum porphyry deposits. They were able to visualize the shape of the intrusions at depth and show they tapered downwards and were tilted (after Bull.62, 1972).

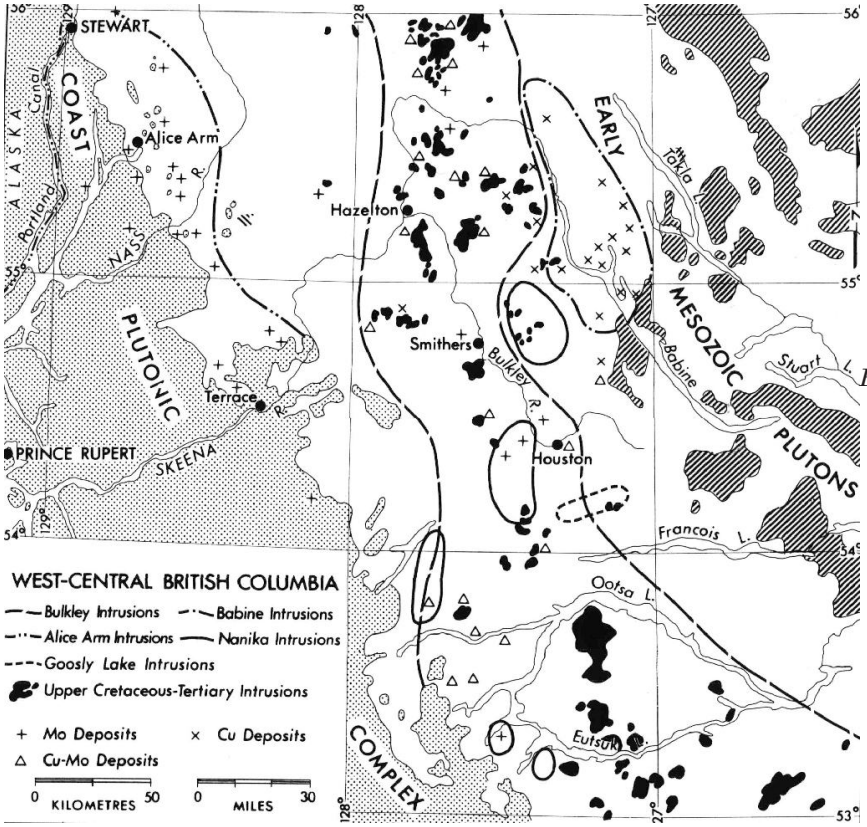


Figure 15. Regional studies of the nature and radiometric ages of intrusions in west-central BC were carried out by N.C. Carter to understand the relations to volcanic accumulations and predict the distribution of porphyry deposits. His summary diagram shows the classification and distribution of intrusive suites and associated mineral deposits and shows they are not related, as previously believed, to the Jurassic volcanics (Bull. 64, 1981).

the development of the resource, but also to the understanding of porphyry deposits everywhere.

Other porphyry-related projects were broadly distributed throughout the province, notably the work of Carter at Babine Lake and West Central British Columbia (Figure 15), Preto at Copper Mountain and the Afton deposit, Garnett in the Hogem batholith, and Panteleyev at Galore Creek and the Berg deposit (Figure 16). These studies led to four bulletins and numerous articles in GEM. The work of these and many other geologists from both industry and the survey, was drawn together in *Porphyry Deposits of the Canadian Cordillera,* edited by Sutherland Brown and published by the Canadian Institute of Mining and Metallurgy in 1976. The volume was dedicated to the memory of the late Charles S. Ney, one of the great economic geologists of his time and a native son of British Columbia born in the mining community of Britannia Beach in 1918.

At the same time the Division conducted many other field mapping projects related to precious and base metals, industrial minerals and eventually coal. The more important projects included Jim Fyles' and Trygve Höy's work in the lead-zinc-silver areas of the Kootenays; Vic Preto's research on the stratigraphy and copper resources of the Nicola Group south of Merritt; Ted Grove's mapping of the Anyox and Stewart to Iskut areas; and Jim McCammon's investigations of industrial mineral resources.

During the second half of the period (1975-84) the principal focus changed, first to the geology of uranium and coal deposits, in response to the first OPEC oil crisis, and then progressively to polymetallic and precious metal deposits as sharp increases in prices stimulated increased exploration for gold and silver. The geologists of the Division once again showed their versatility as they converted to these new targets and quickly started making major contributions to the knowledge of the geology and distribution of these resources.

Also about this time the survey was confronted with new obstacles hitherto unimagined. The wilderness was receding and the emerging environmental movement spawned many special-interest groups opposed to any form of mining development and actively seeking confrontation with both industry and government. Division geologists, caught in the crossfire, had to quickly learn the arts of diplomacy as they and their managers were involved in incidents and in public hearings such as the BC Railway Inquiry and the Bates Commission.

The flirtation with uranium exploration in British Columbia was both short and turbulent, beginning in 1975 and terminating with the moratorium in 1980. Industry was slow to recognize the extent of the public opposition to its activities and sometimes took actions unhelpful to its cause. Few in industry or government realized ahead of time the level of emotion stirred up by prospect of mining uranium which was closely linked in the active public's mind with 'the bomb'.

The principal uranium projects were in the Okanagan and Beaverdell areas, shown to have high concentrations of uranium by regional geochemical surveys. Here Peter Christopher studied the newly recognized 'basal' uranium deposits occurring in relatively young volcanic basins, a type of deposit previously known only in Japan. B.N. Church studied the stratigraphy of the Tertiary volcanic source rocks, applying the experience gained in his research on the White Lake basin near Penticton. A hint of things to come was provided when he asked the Chief Geologist whether right of access under the Mineral Act allowed him to traverse Indian Reserves. He was told to carry his surveys up to the boundaries and to talk to the elders about what he was trying to do while waiting for a ruling from the Ministry attorney. Six months after the field season ended an eight page study was received, laying out the precedents but containing no advice. The principal uranium-related study elsewhere in the province was by Preto who showed that the unique Rexspar deposit, near Clearwater, has characteristics of volcanogenic massive sulphide deposits normally associated with base metals. The company

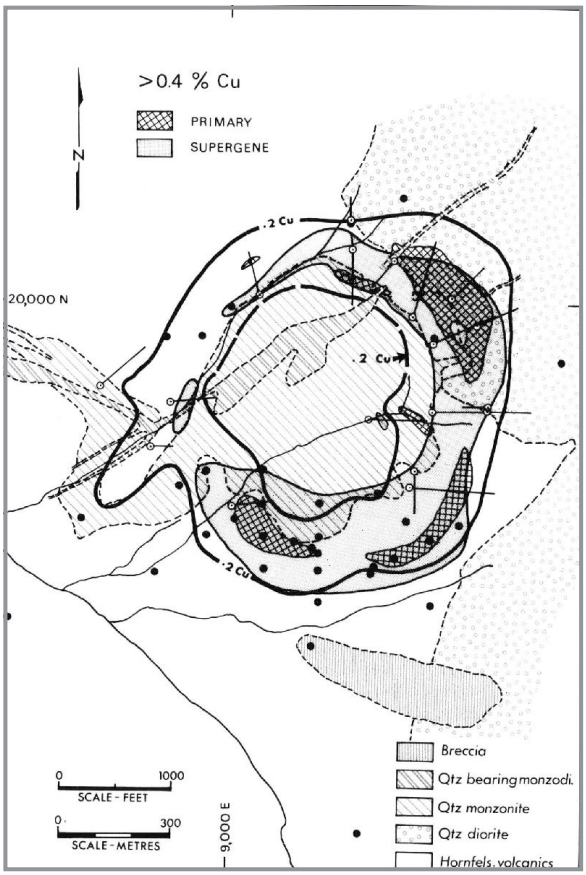


Figure 16. Detailed studies of major prospects are carried out in co-operation with industry to increase understanding of the ore forming processes and our knowledge of resources. For such a study A. Panteleyev shows the distribution of primary and supergene copper above 0.4% Cu in the Berg porphyry copper-molybdenum deposit (Bull.66, 1981).

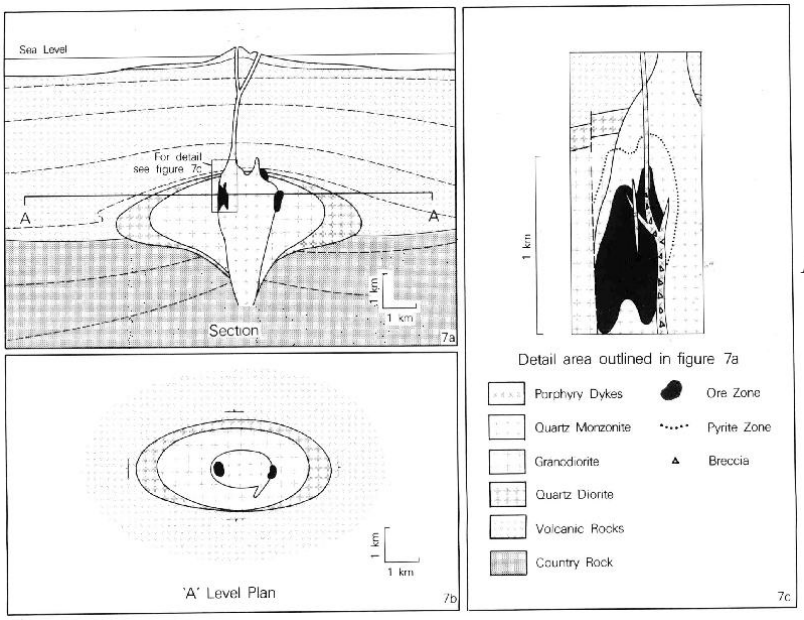


Figure 17. Ideas from the study of many porphyries were synthesized by A. Sutherland Brown and by W.J. McMillan and A. Panteleyev to form genetic models to help increase success in exploration. A model for relatively deeply formed deposits such as those of the Highland Valley is shown (Geoscience Canada, Vol.7, pages 59-63).

exploring the Rexspar deposit later attempted to obtain mine production permits without first completing a truly comprehensive environmental study or proposing adequate safeguards against radioactive contamination. It became subject to the first attacks of the growing anti-uranium lobby which became such a force at the Bates Commission hearings.

Projects aimed at encouraging exploration for volcanogenic and sedimentary massive sulphide deposits were highlighted by the work of Andre Panteleyev and Dave Pearson on the Kutcho Creek deposit in northern British Columbia where they unraveled the complex structure and stratigraphy; Trygve Höy's work in the Goldstream area near Revelstoke; and a major mapping project by Vic Preto, Paul Schiarizza and others on the Adams Plateau north of Kamloops. Höy's bulletin on the Goldstream area published in 1979 was quickly followed by another on the Bluebell lead-zinc mine, and then by a regional study of the Purcell Supergroup, host to the famous Sullivan lead-zinc silver orebody at Kimberley. In the same period Don MacIntyre mapped a large area of the northern Rocky Mountains (Akie River area) that was just becoming known as a host to sedimentary lead-zinc-barite deposits. Later he studied the Midway area north of Cassiar and the Alsek River area in the rugged St. Elias Mountains in the northwest corner of the province, site of the world class Windy-Craggy copper-gold-cobalt deposit (Photo D23).

Gold exploration, which was to dominate the late 1980s, was not long underway when Panteleyev and Schroeter, with graduate student Larry Diakow, completed extensive studies of the Toodoggone epithermal gold-silver district north of Smithers, Gerry Ray mapped the Coquihalla gold belt near Hope and Dani Alldrick renewed the work started by Grove in the Stewart area. Work on industrial minerals received minimal budget but the definitive study of the sand and gravel resources of the lower mainland by Danny Hora and Frank C. Basham presented challenging decisions for governments and industry.

Coal

Coal projects became an important element of the Division's work from 1975 onward, spearheaded by detailed systematic mapping and innovative coal-quality studies by Pearson and district geologist David Grieve in the Crowsnest coalfields and correlation studies of the Peace River coalfield by consultant Professor Donald Duff and Robert Gilchrist. The latter studies were based on company down-hole geophysical logs, mapping and examination of cores in the newly established division core library (Figure 18). Studies were also undertaken in Hat Creek, Tulameen, Princeton, Telkwa and Groundhog basins and the Quinsam Lake area of the Comox basin, some of which led to publications in the Paper Series.

The program of core recovery and storage, set in progress by the Division, was an important element in the success of evaluation of the provincial coal resources. In 1975 it became apparent that exploration drill-core in the Crowsnest coalfield was not being stored but, after logging, was commonly left in the field to deteriorate. Following critical comments by the Division, the operators started making provision for proper core storage. Major exploration in the Peace River coalfield was just beginning; subsequently more companies were active and there was much wider dispersal of activity. In 1976 the Division initiated a program of coal-core recovery, storage and curation. Initially core was recovered by the Division, but after 1977 it had to be delivered to Charlie Lake, west of Fort St. John, where the Petroleum and Natural Gas Division of the Ministry maintained a library of oil-well cores and cuttings. New warehousing was built (Photo A10) and offices and inspection facilities shared with Petroleum. A district geologist, a technician and two helpers were hired and, in the first two years of operation 90 000 metres of core were catalogued and stored. Later core for storage was selected on the basis of location and potential scientific importance. In addition selected core from other coalfields has been shipped to Charlie Lake for storage. As

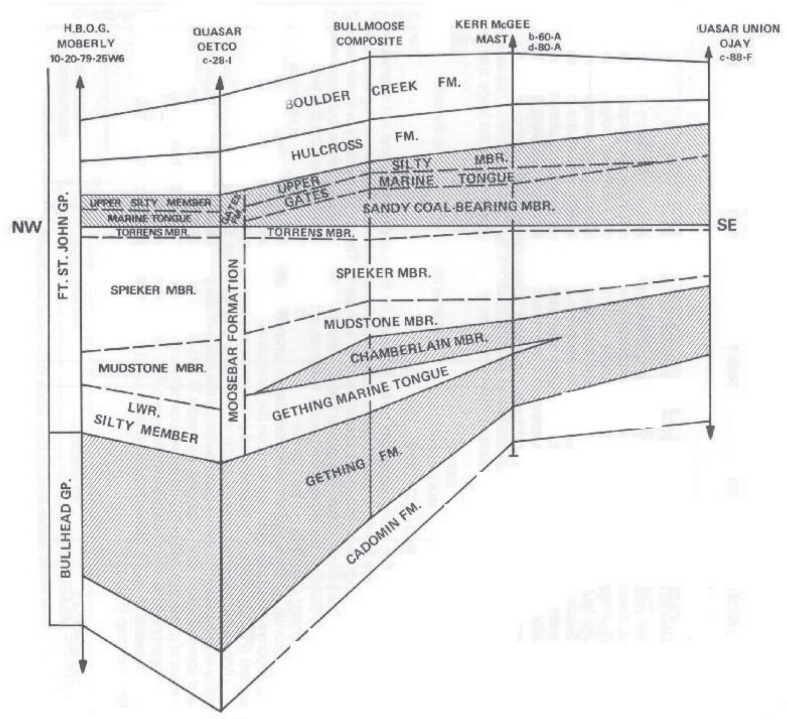


Figure 18. Study of drill core of similar-looking coal-bearing beds, sampling them for small fossils and analysis of company geophysical logs enabled P.McL.D. Duff and R.D. Gilchrist to make precise correlations of stratigraphic units, beds and coal seams in different areas. The figure is a simplified regional stratigraphic section (Paper 1981- 3).

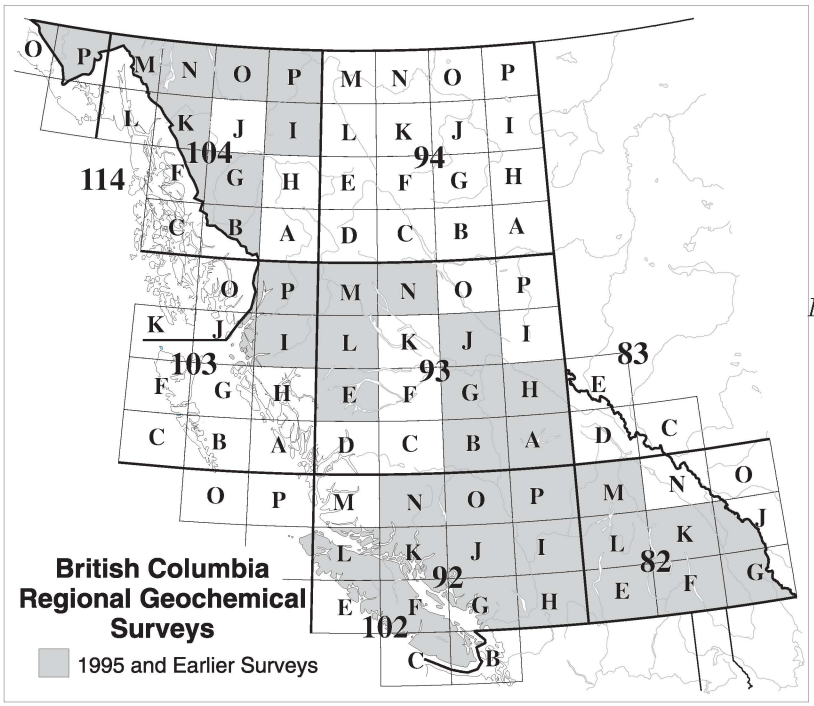


Figure 19. Reconnaissance geochemical silt surveys have been conducted by the Survey since 1976 to promote effective use of geochemistry by industry. The program has lead to many discoveries and re-evaluations. The figure shows the progress to 1995 (modified from Geological Fieldwork 1995, p185).

coal exploration wound down in later years the staff was reduced, but the facility remains the only core library in the province and the core has been repeatedly examined for many industry and academic studies.

Geophysics and Geochemistry

Geophysical programs have never been an important element of the Division's work. Aeromagnetic surveys of areas on the Coast favourable to magnetite deposits were flown under contract in the late 1950s, and then the more systematic 1:50 000 federal-provincial program was joined. This equally funded program, managed by the GSC, suffered to some degree from the conflicting objectives of the two agencies. The GSC wished to lead their 1:250 000 mapping while the province was more interested in covering mineralized districts. The program was funded by three year agreements and at the termination of the 1969-71 agreement, first one government, then the other, could not find the necessary funding. Although maps continued to be issued for a few years, the program sputtered to a halt and was not reactivated until the signing of the Mineral Development Agreement between the two governments in 1985.

In contrast the Regional Geochemical Survey program has grown and flourished. It had its origin in a GSC initiative, the Uranium Reconnaissance Program (URP), proposed at a Provincial Mines Ministers' Conference in a period when uranium demand was expected to outstrip supply because of a burst of commissioning of power reactors throughout the world. The program was to be Canada-wide, funded on a cost-shared basis with the 'richer' provinces, and to have airborne radiometric surveys as its main focus. At an organizational meeting in Ottawa in September, 1974, British Columbia argued for a multi-element stream-silt geochemical survey as proposed by some GSC staff. This was seen as providing more stimulus to exploration for many metals and more useful for resource and land-use studies. Federal officials countered with a proposal to solicit samples from a host of exploration companies working in the province, but British Columbia's representative won the day with the argument that an independently managed program of sample collection and analysis would be needed to achieve the rigour necessary to command industry's respect and approval.

The proposal was not well received by John McMynn, the incumbent Deputy Minister in British Columbia. He sarcastically asked how many uranium mines there were in the province, inferring that if there were none, clearly there were none to be found. In hindsight this may have been an astute political judgment, although the potential benefits to exploration for other commodities seemingly escaped him. Nevertheless, the Division was able to provide logistical support to the orientation surveys run by the GSC in 1975, and joined the program the following year when Fyles was reinstated as Deputy Minister. Three 1:250 000 map areas extending from Osoyoos to Clearwater were sampled that year. Management was by a joint committee, sample collection and analysis by separately bid contracts, and responsible for quality control and supervision split between the two agencies.

The results of the first surveys were clearly a success and the program was continued on a regular basis for a number of years. The Division proposed to change the name to Regional Geochemical Surveys as it became aware of the public's and the Cabinet's distaste for the word uranium and because of its multi-element approach. The GSC wished to maintain the name as a regular vehicle for funding. Curiously it was the federal cabinet that killed the GSC's participation in URP in 1979. The province had successfully completed an add-on survey, organized at very short notice the previous year, as part of the provincial Accelerated Mineral Development Program (Photo A12) and with this experience continued alone at a reduced scale. The GSC provided considerable on-going help in data processing and sample archiving. The surveys continued until canceled for one year in 1982, as previously described, but were then restored and have continued with

considerable vigour until the present day (Figure 19). By any standard the program has been a considerable success and its cumulative value impressive. It has generated intensive prospecting activity every year after the release of new data, and discoveries have followed. The accumulated data have also been helpful in guiding mineral potential and land-use studies.

Inventory Projects

The development of Inventory Projects, now a state-of-the-art computerized data base (MINFILE),had small beginnings. It started informally as an effort by a number of project geologists in the 1960s, encouraged by Holland, to develop suitable cards for a manual inventory system. The cards were originally designed to capture a wealth of data available on few properties and then split into three cards of increasing depth of information. At the same time a sorting system based on light projected through the holes drilled in the cards with 10 000 squares was experimented with as access to main-frame computers was blocked. These were volunteer efforts and languished until a geologist, E.V. Jackson, was hired in 1969 to work solely on inventory. He quickly developed a comprehensive manual card-based inventory of mineral properties. Also early in the 1970s Douglas McCartney and a group of coders were hired on a federal-provincial contract to produce geological resource assessments using an elaborate computer-based program at the GSC. However, the coded material and programming proved to be unmanageable and so were aborted - a common experience in early inventory projects. The final path to success was achieved in 1973-75 when the Division, together with some far-sighted mining companies, funded development of the MINDEP program by Hugh Wynne-Edwards, Alistair Sinclair and others at The University of British Columbia. The Division's manual inventory was donated to MINDEP as a source and when the program was completed it was acknowledged to be at the leading edge of the technology of computerized mineral inventories. Bulletin 68, *An Analysis of Distribution of Mineral Occurrences in British Columbia*, by Sinclair, Wynne-Edwards and Sutherland Brown, published in 1978, was based on the computerized maps and data the system could produce.

The Division took over MINDEP in 1976 and operated it as a service to industry and for internal uses. Unfortunately the program, renamed MINFILE, had to be converted to a different mainframe system, not once but twice, and in the process the capability to produce selective computer-drawn maps was lost. However the system gained a process of regular revision with the addition of new data from assessment reports and summary exploration reports filed by industry. Making MINFILE a truly effective tool had to wait for the arrival of skilled programmers and the development of personal computers during the late 1980s.

The coal inventory (COALFILE) was not initiated until 1978 and differed from MINFILE in being a deep, computer-based database from the outset. The *Coal Act of 1974* required companies exploring for coal to provide substantial information, as well as meeting their work commitments, when applying for leases. A federal-provincial agreement provided funding for the coding and development of computer programs to handle the mass of geographic and tenure information as well as the geological and coal-quality data from trenching, drilling and underground sampling programs. A series of contracts with Summus Consultants (Gordon Williams and David Proudfoot) produced software and coding to make the inventory operational in 1980, under the supervision of Candace Kenyon, but it was not developed to its ultimate potential of providing tenure data and control by relating work commitments to specific leases.

Land use Projects

The development of mineral and coal inventories had been spurred by the clear need for maps that would convey the concepts of relative mineral

potential to non-geologists responsible for the formulation of land-use policy. Holland and Sutherland Brown produced rudimentary mineral maps in the 1960s, showing a three-fold subdivision of terrain based on relative mineral potential, as a guide to prospecting and a basis for economic analysis. In 1971 Fyles developed the methodology to produce interpretive maps compatible with the Canada Land Inventory maps which used a five-fold subdivision with respect to renewable resources but made no attempt to assess mineral potential (*see* earlier). Fyles' ideas were implemented first by McCartney and Alex Matheson working on contract and later by Resource Data Section. By 1978 all but the northeast corner of the province, part of the Great Plains rather than the Cordillera, had been covered. These maps provided invaluable background for many studies, for example the map of the northern half of the province used in the Division's brief to the Royal Commission on the BC Railway in 1977. Problems related to land use had been of concern to the survey since inception but grew slowly to become a major factor in the early 1970s and to be almost overwhelming in the early 80s. Over time the Ministry's policy had sought to maintain as large a land base of high mineral potential as possible to facilitate the future discovery of mineral resources. To this end it had fought for the right to have lands that were proposed for single use evaluated for their mineral potential before changing their status. To many such a policy seemed only good sense, but the fight to recognize this principal was hard won and later lost.

In 1975 the program for assessment of mineral potential in proposed parks and ecological reserves was handled by one geologist with some small help from the District Geologists and others. By 1982 the program needed two geologists, a research officer, about half the time of the district geologists and the major attention of the manager of Resource Data Section. Still the Division was unable to keep up with the demands for appraisals made by the Ministry of Environment and others. In addition much effort was required in acting as secretariat for the ministry Land-use Committee.

During 1982 major reports were completed on the Kakwa, Akimina-Kishenina, Slocan valley, Cascade, Chilko and South Moresby proposals as well as evaluations of many ecological reserves. Most of these reports were the outcome both of field surveys and countless public and interagency meetings. Great cooperation was received from industry through the British Columbia and Yukon Chamber of Mines but the battles to maintain the land base for nondestructive prospecting were mostly lost. In the minds of opponents, exploration and mining were inseparably linked with the widespread destruction associated with the practice of clear-cut logging.

District Geologists and Prospector Training

The establishment of District Geologists in major centres throughout the province has already been touched upon. The need for closer and more continuous contact with industry and prospectors in the different regions had been felt ever since the withdrawal of the Resident Engineers. A system of resident geologists had been effective in Ontario for years. The NDP government was sympathetic with 'taking government to the people' and authorized ten District Geologists. The Division wished to hire two at a time to learn how the program could be made most effective. However, when it came to hiring the fifth and sixth geologists for the coal districts the government had changed and the doors were almost closed. It took until 1978 to place district geologists in Fernie and Fort St. John; the planned complement of ten was never achieved.

The role of the district geologists was complex and varied with time and place. It included provision of facilities and advice to prospectors and exploration personnel, mineral property examinations, monitoring of exploration activity and geological developments at operating mines, geological field mapping commonly in co-operation with project geologists, site-specific mineral land-use studies, prospector training, and representation of the

Ministry at regional meetings. It was a difficult role and generally done well. Perhaps the most difficult aspect was advancing the views of the Ministry at regional meetings: a relatively junior geologist might well be facing someone of Assistant Deputy Minister rank from a different ministry yet having to forcefully espouse widely different opinions. It could take courage to stand up to these heavy guns.

Prospector training was also a significant element in the district geologist's work. With the withdrawal of the geologists to Victoria before World War II, contact with prospectors, and hence prospector training, had fallen to the Mines Inspectors. With the creation of the district geologist program it was returned to the Division. The training program included formal prospecting courses under various auspices in regional communities, on-the-job training during field visits and the annual Mineral Exploration Course. This two week field-oriented course, conducted with the help of community colleges and volunteer lecturers from industry, was started at Castlegar and Nelson in 1977, moved to Terrace in 1981 and since then has been at Cowichan Lake. Geochemical (Photo D19) and geophysical exploration techniques are taught as well as basic applied geology and traditional prospecting methods. The course has been an acknowledged success; its alumni not only have many discoveries and optioned properties to their credit, but provide a cadre of well-trained prospectors for industry to hire.

Analytical Laboratory

The laboratory was in disarray at the beginning of the period, wedded to an old technology of wet analyses of low productivity. The staff had matured with it and was largely out of contact with new developments. The project geologists were very impatient with their lack of access to abundant chemical data to provide deeper insights into their work. Hedley responded by getting the lab to report directly to him and Holland by initiating the Maxwell Inquiry. Following this Sutherland Brown was charged by Holland in 1972 to find a suitable Deputy Chief Analyst and to advance a program of retraining and reorientation. Wes Johnson was hired and soon Stan Metcalfe opted to retire rather than change his methodology. Johnson became chief in 1973 and Paul F. Ralph his deputy. Forthwith the older analysts were retrained to instrumental chemistry and newer methods as the lab entered its third stage of development (Photo A19). The government did not see the necessity for a new lab although external studies concluded such was the case. However, new instrumentation was gradually acquired and the same temporary old lab building upgraded by a new design, cleaning and bright paintwork. Although productivity greatly increased this was not enough to please all. Objective studies and inter-lab comparisons showed that in fact it was in the forefront in accuracy and economy. Nevertheless the lab was subjected to repeated reviews and threats of privatization. Every study showed it filled a unique role between research labs of the universities and the commercial labs and that it was cost effective. Unfortunately the lab always seemed to have some personnel problems that sometimes made it less than a happy place to work. Nevertheless it was innovative in computerizing its data handling, designing automatic devices and for developing effective new and accurate methods of analysis of molybdenum and gold that were followed by industry labs. The laboratory has also been responsible for the certification of chemical analysts and assayers that has provided the province with strong and reliable laboratory industry that performs custom work that originates throughout the world.

PUBLICATIONS

The rationale for the survey's existence was then, and will likely remain, its ability to place the results of its research in the hands of those best able to use them productively. The primary vehicles for this transfer of information are its various publications, but also include papers published in various professional and scientific journals, presentations at professional

meetings and workshops and the personal contacts of individual scientists. Adapting the publication process to meet the burgeoning needs of an expanding exploration industry was an ongoing problem throughout much of this period of the survey's history. Resources allocated to the task were rarely adequate for the size of the job and only the Herculean efforts of a small but dedicated staff kept the publication process afloat. Lack of timeliness in reporting results was strongly criticized by industry but, although much progress has been made, even now some of the problems are yet to be fully resolved. The sometimes erratic evolution of the various publication series reflects the struggle to achieve an effective way of feeding an insatiable appetite for new scientific data.

At the beginning of the period the publication program was simple. *The Annual Report of the Minister of Mines*, first published almost a century earlier, contained mineral industry statistics, reports on geology, exploration and development activity on a property-by-property basis, and on the Ministry and its staff. It was virtually unchanged for seventy years except for growth in the proportion of geological reports. It had always provided invaluable information to prospectors and a complete set was a *sine qua non* in the personal reference library of any geologist seriously interested in the mineral potential of the province; bound copies of early editions are valued as collector's items. They were unique in North America.

The *Bulletin* series, first introduced in 1896 but revised to something close to its present format in 1940, remained the vehicle for the publication of more prestigious scientific reports, commonly the product of two or more years' fieldwork. However, for several reasons, including a perceived anti-research attitude in the NDP era, and a lack of access to publication facilities during the Illing regime, bulletins received less emphasis. Only twenty were published in the 18 years and a multiplicity of new publications were introduced.

As the Annual Report had spawned bulletins, so both now bore new generations of publications. The Annual Report was split into two entities, then four, then expired. Through the Sixties it had steadily increased in size, in parallel with the growth in exploration activity. By 1968 it had reached an unwieldy 513 pages and Holland decided to divide the next edition in two. The 1969 Annual Report contained only mining and petroleum industry statistics, a brief review of the mineral industry and a report on departmental work, including the report of the Chief Inspector of Mines. Geological articles, summaries of exploration activity and of development at producing mines, and a complete list of assessment reports filed during the year were included in a new publication, *Geology, Exploration and Mining in British Columbia*, soon to be known as GEM. Statistics on mineral production were included in both volumes.

GEM was well received by the exploration community and its publication eagerly awaited each year. From 1970 it was collated and set in-house by Rosalyn Moir at an IBM composing machine without a monitor, a remarkable feat, and was published expeditiously by the Queen's Printer. It too suffered from gargantuan growth related to the exploration boom. The 1970 edition topped the size of the Annual Report deemed to have grown too large in 1968 and, by 1972, GEM ran to almost 700 pages. This, and other unrelated factors, caused publication delays and in 1974 it was thought best to split it into its three component parts, each to be published when ready.

A new publication, *Geological Fieldwork*, was introduced in 1975, with the objective of placing preliminary results of the Division's work in the hands of the users well in advance of the following field season. The initial format was simple; the reports resembled extended abstracts and illustrations were hand-drafted by the authors. It too grew and elaborated, taking the place of *Geology in British Columbia* and geological articles formerly included in the Annual Reports. It has since become the principal showcase for the broad spectrum of the survey's work, given the highest priority in the publication process, and issued in early February following each field season

Annual publication of *Exploration in British Columbia* has continued to the present day. However, more stringent requirements for holders of mineral claims to submit detailed technical reports in support of applications for renewal of tenure have resulted in a much increased flow of information directly to the public domain and it has evolved away from the original format of providing capsule reports on every active mineral prospect throughout the province. Publication of *Mining in British Columbia* fell by the wayside but the Annual Report continued, with only a minor perturbation in 1974, until 1979. Thereafter the mineral section was continued as *Summary of Operations* until 1984. It is difficult to see how the publication program could have avoided gridlock had these changes not been made but, particularly from a historian's point of view, the lack of a unified and comprehensive Annual Report makes it difficult to track or evaluate the work of the survey or the ministry as a whole. The reader must judge whether or not this should be a matter of public concern

As already mentioned, only twenty bulletins were published in the entire period 1966-84, with none appearing in 1974-76 or 1982-83. The broadening scope of the Division's work required the creation of a publication format less costly and time-consuming to produce; so the *Paper* series was introduced in 1978. It incorporated Geological Fieldwork, designated as the first paper in the series in each publication year, but was initially used mainly to cover topics of general interest or of a technical rather than scientific nature, commonly the work of other divisions within the ministry. For example, these included the Mine Rescue Manual, the proceedings of annual symposia on mine reclamation, and the five volume Ministry brief to the Bates Commission. It was only in 1981 that it began to be used fairly extensively to release the results of geological research, generally shorter manuscripts that did not require coloured maps or were products of less exhaustive research than those published in the bulletin series

A number of other publication formats were introduced to meet specific needs. These included the *Preliminary Map* series, that began to be numbered in 1969 with some sixty issued by the end of the period. These were normally black-line prints, commonly with an appended short text, and were intended to be superseded by a final paper or bulletin; regrettably the final volume did not always come to press. The series was later replaced by the *Open File* series. *Aeromagnetic Maps* were almost entirely the product of a program equally funded by the federal and provincial governments, but mostly managed and entirely produced by the GSC. *The Mineral Inventory* and *Mineral Deposit - Land-use Map* Series, as their names imply, respectively portray the location of all known mineral, coal and placer deposits in the province and the probability of the presence of undiscovered resources of any given area. The *Regional Geochemical Survey* series has been published since 1976, with new map sheets released every year.

Some publications were not included in any series and are the despair of librarians. These were commonly the joint ministry efforts such as *Coal in British Columbia*, the product of the Coal Task Force, which was later revised and issued as a paper. Outputs from MINFILE and COALFILE, the survey's two computerized databases covering mineral and coal occurrences within the province, were initially made available to the public as paper print-outs, on an as-requested basis; with the increasing use of microcomputers it has now become feasible to make these data available on disks and tape. Similarly, assessment reports, once accessible completely only in Victoria, are now available on microfiche in major centres throughout the province.

9 THE GEOLOGICAL SURVEY BRANCH (1984-1995): Gold Again & Mineral Development Agreements

The history of the Survey in the last eleven years of its century of existence, and beyond, is as turbulent as any preceding period. Although the backdrop continuously changed under three different governments, the Survey nevertheless achieved its greatest successes as well as suffering some serious reverses at the end of the decade. Initially the unit obtained major funding advances, achieved important output gains and significant increases in recognition from industry just before the latter was crippled by the government's political decisions and hence turned its attention to exploring overseas.

Sutherland Brown retired in 1984 after 33 years of service. There was a six-month interregnum when the Senior Managers acted sequentially as Chief Geologist before Ron Smyth was appointed Chief. A relative newcomer to the Branch and not previously part of the Branch management, Smyth was not saddled with old loyalties or thinking. He was unknown to the Deputy Minister, Roy Illing, and before letting him loose on the Branch, he first took him into his office as his executive assistant for a month of grooming. This opportunity re-established communications between the Branch and the Deputy and set the groundwork for the unprecedented growth in budget programs and staffing in the 1985 - 1992 period. Building on the broadened base of programs established during the Sutherland Brown era, and guided by the Canadian Geoscience Council Reports, the Survey evolved under Smyth into a modern entity with programs in the most of the major earth sciences disciplines, except geophysics, which was left to the GSC, and oil and gas which continued in a much smaller sister branch in the Energy Division. In recognition of the broadened mandate, the Branch was appropriately renamed the Geological Survey Branch in 1986.

During those eleven years, British Columbia entered into two Mineral Development Agreements (MDA) with the federal government that saw expenditures on geological surveying boosted considerably. Despite British Columbia having the second largest minerals industry, the first MDA was one of the smallest in the country. Industry used this fact to advantage to persuade the government to significantly increase its investment in geological mapping by increasing the Survey's base budget in 1987. The new funds permitted doubling the activities in the 1986-1990 period by the hiring of a significant number of young male and female geologists (Photo E11 & E12). However, the trend for the Survey has been downward since 1992 as government priorities shifted and budgets yo-yoed.

In 1995 the Survey celebrated 100 years of service to the Province. The Minister, the Hon. Anne Edwards, commissioned a commemorative poster (see cover art) and publications produced in that year bore a 100th anniversary logo.

INDUSTRY

Throughout most of the decade the provincial mineral industry had a difficult time; initially because of the slow economic recovery in the mid 1980s, and then because of overt negative action of the Provincial and Federal Governments and neglect stemming from their fashionable belief that mining was a sunset industry. Another major factor was the increasing globalization of the mineral industry. With discouragement at home, major and minor BC and Canadian mining companies diverted their major exploration efforts overseas, particularly to Latin America where they were welcomed.

Rebound of the mineral industry in the late 1980s lagged well behind the slow general economic recovery because of continued world over-production with resultant low commodity prices. In 1985 coal continued as the premier mineral produced in British Columbia followed by copper with zinc a distant third. The value of solid mineral production was about $2.4 billion of which coal represented about $1 billion, copper $580 million and zinc about $110 million. Although the price of gold advanced in 1985 and 86, most metal prices did not advance sharply until 1987. Production increases soon followed price increases providing the first substantial rise in six years to a peak of $3.2 billion in 1988. Gold then became the third most valuable commodity produced in the Province. Coal prices remained soft although markets started to firm towards 1989 as sales broadened and prices edged upwards, especially for thermal coal.

In the period 1990-95 the mineral industry production decreased to a low in 1993 but then increased largely because metal prices increased. From 1990 to 1993 the value of solid mineral dropped back to hover about 2.5 billion dollars with coal and copper trading places from year to year as the most valuable commodity. Gold, however, consolidated it place as the third principal mineral. In 1994 the value of solid mineral production again rose above $3 billion to a peak in 1995 of about $3.25 billion, of which coal comprised $1.1 billion.

The eleven year period was very volatile in terms of mine openings and closings because of the factors to be described as well as a roller coaster regime of mineral commodity prices. In the late 1980s eight new mines, mostly small gold mines such as Blackdome, came on stream, as well a few medium sized mines such as the Nickel Plate gold skarn. Most of the new mines had limited reserves and so closed before the end of the period. In contrast, four new mines with significant reserves came into production: the HW volcanogenic polymetallic ore body of Westmin Resources Ltd. at Myra Falls on Buttle Lake in 1985; Prime Resources Group Inc.'s two properties in the Iskut area, the Snip vein gold mine in 1991, initially owned jointly with Cominco Ltd.; the complex stratiform Eskay Creek gold silver mine in 1995 (Photo D24); and lastly, the QR gold mine in the Cariboo in 1995. However, some major old mines closed, notably the Cassiar asbestos mine in 1993, which, for over thirty years had been a catalyst to the economy of the north, and Island Copper porphyry mine in 1995 which was its equivalent on northern Vancouver Island.

Exploration, the life blood of renewal, did not conform to the rise and fall in production because of four major negative political impacts in the 1990s. Exploration expenditures mirrored confidence, or lack of it, in the Provincial political environment more than it did market forces. Expenditures advanced slowly from a low in 1983 to extremely high values fueled by the Flow Through tax incentive scheme ($230 million in 1988 and $227 million in 1990) and then collapsed to values ranging from $72 million in 1992 to $85 million in 1994. The advance in expenditures in the beginning was stimulated by federal regulations permitting flow through shares, by the provincial Financial Assistance for Mineral Exploration (FAME) grants in 1986 to 1988 as well as advancing gold and other metal prices. Then four major negative political factors impacted the industry, three of them provincial. Doubts crystallized about the nature of native land claim settlements; lands were withdrawn from exploration to create new parks and, most seriously, the right to mine the fully explored, world class polymetallic deposit, Windy Craggy (Photo D23) of Royal Oak Mines Inc., was withdrawn. The property lay within the Tatshenshini area that the government was pressured by American and Canadian environmental activists (including whitewater rafting outfitters that appeared to have severe conflicts of interest) to create as a large park. The final nail was the Federal termination of flow through shares.

After the debacle of blocking development of the Windy Craggy mine, exploration imploded. This was made easy by the increasing globalization of mining. South America was the main beneficiary of major company expenditures, of junior companies raising funds on the Vancouver Stock Exchange

for offshore exploring, and of the enticement of British Columbia's talented but threatened cadre of geologists, including several from the BC Geological Survey Branch.

The principal targets of exploration in the province throughout the whole decade, paricularly during the bullish interval, were precious metals in epithermal, skarn, mesothermal veins. At the same time volcanogenic polymetallic and porphyry deposits, especially those rich in precious metals, were also eagerly sought. When exploration collapsed after 1990 it was even worse than it appeared because most exploration since then was aimed at extending reserves at established properties. Grass roots exploration was virtually dead.

EXTERNAL RELATIONS

POLITICAL IMPACTS

The election of the Vander Zalm Social Credit Government in 1986 began one of the most turbulent periods at the senior working level in the civil service, and ultimately for the electorate who rejected the government in the election of 1992 and, in the process, essentially destroyed the Social Credit party.

The Hon. Jack Davis was appointed Minister of Energy, Mines and Petroleum Resources in 1986. He was a quiet, thoughtful and learned man - a Rhodes scholar with a long background in federal and provincial politics. The provincial economy was moving slowly and mining was suffering from low metal prices. To assess the state of the industry and identify actions to ensure its survival and growth, Davis appointed a mineral industry task force composed of senior industry representatives. As part of their work, the task force presented an assessment of BC's exploration database and the budget for the survey to improve and maintain it. This work was assigned to the Technical Liaison Committee (TLC) which was now intimately familiar with the programs and budgets of the Branch.

The Task Force concluded that the level of activity of the Branch fell short of providing an important stimulus to new exploration and recommended an increase in the budget. The Task Force also recommended a number of tax changes for industry, a mining assistance program, and an exploration incentive program. The FAME financial incentive program was initiated within the Survey to counter a precipitous drop in the level of exploration due mainly to low metal prices but partly to offset Quebec's much touted incentive program. Another of the recommendations, cheapest and quickest to implement, was to boost the Survey budget, so that in 1987 it was increased from three million to five million dollars.

Although the Survey now had the money and the people it needed, it was not yet out of the seismic zone. Some erratic bureaucratic decisions and threats to its continuance took great effort and time to avoid or reverse. The first of these shocks was an incredible event to befall a research organization. In 1987, a short-lived Deputy Minister unilaterally decided to eliminate or dismember the Ministry's library to save a couple of staff positions and the funds for acquisitions. Efforts by industry and friends of the Survey thwarted the worst damage, but not before the library and its collections had suffered badly. This Deputy Minister was a direct, hard hitting businessman with no previous government experience. However, he later took a liking to the Survey, especially the prospector training program, and it survived essentially unscathed.

Another, more substantial shock came in early 1987 from the next Deputy Minister who also supervised privatization for the Government. He came up with a scheme to create a mining board, modeled on the Energy Resources Conservation Board in Alberta, that would be funded by levies on the

industry. The Mineral Policy Branch and the district geologists were to be retained by government; the rest of the Survey would go to the Board. Industry did not like the scheme believing that they were already paying for the operating costs of the Ministry through a superabundance of fees and taxes, and also that the present situation was working well. Things finally came to a head at a stormy dinner meeting at the Engineers Club in Vancouver between the Deputy Minister and the mining associations at which the Minister was present. Apparently, he had not heard the full arguments previously. The next day the Boards were dead. The Survey did not escape entirely as it lost its sales office and staff to Crown Publications Inc., a newly formed private company spun off from the Queen's Printer. This turned out to be a successful venture and Crown Publications remains the Ministry's sales agent today. Also, the "privateers" of the bureaucracy had another long look at the laboratory before deciding to leave it in place as it was not a viable business.

A period of reasoned calm returned with the appointment of Doug Horswell as Deputy in 1988. This young, open and dynamic man with an engineering background was highly regarded by the staff. He cared about their work environment and was instrumental in persuading Treasury Board to approve construction of a modern building to house all of the Ministry, which was scattered through some 20 buildings around the Legislature. The new office building, however, was not completed until after the fall of the Social Credit government. In what must have been a bitter pill, the new government permitted the chosen name, the Jack Davis Building, to be retained in honour of the Minister who died in office in 1991.

The budget increases for the Survey did not include an authorization to increase it's permanent staff. Horror stories were emanating from Quebec which contracted out much of their surveying under their MDA, so it was decided to 'contract-in' geologists to deliver the expanded program. At the beginning of the Vander Zalm era, his executive assistant, David Poole, decided that to help control spending; all government contracts over $50,000 had to be personally approved by him. The Geological Survey Branch hiring contracts were approved, but some time later when Poole found out about the 20 or so contract geologists working for the Branch, he accused the Ministry of trying to circumvent his directives. Fortunately, Norma Chan, the Chief's secretary, had kept copies of all the contract cover sheets with Poole's signature. Poole was universally disliked by the senior civil service which the government opposition picked up on. The power he wielded unwisely led to his ultimate downfall and firing.

A great watershed for the Survey resulted from another government initiative. The Branch's large contract staff were found by the Attorney General's department to be, in effect, 'employees' of the Ministry. This had potentially serious industrial relations consequences. The Ministry contracted Coopers and Lybrand to examine the problem and they presented two options:

1. contract out through an employee group or institute,

2. give key staff full civil service status by establishing new positions.

The government chose the second option and as a result the staff almost doubled to more than 90 in 1989.

The political process during these times was grinding for the Deputies and ADMs and in 1990, the Assistant Deputy Minister, Lorne Sivertson, took a leave to work in the private sector. He was replaced by another economist, Bruce McRae. It seems as if the days that geotechnical people headed the Mineral Division were well and truly past.

The fall of the Social Credit Government and the re-election of the New Democratic Government under Premier Mike Harcourt in 1992 ushered in another period of unease and distrust between industry and government. Industry was suffering from low metal prices, a sharp decline in exploration

spending following cancellation of the federal flow-through tax incentive scheme, and increasing pressure from environmental activists. The industry was even beginning to question its own future in the province. Many of the major mining companies already had a stake in mining in Mexico and South America and the Vancouver juniors were poised to follow.

John Allen, a career civil servant from the Energy Division was named Deputy just before the election and survived the transition. He was not much liked by the industry, but was astute and knew that something had to be done to improve mining's outlook in the province and the relationship between industry and government. It was decided to develop a white paper '*BC's Mineral Strategy*' which was referred to by staff as '*BC's Mineral Tragedy*'! Senior staff worked long and hard to detail a frank assessment of the situation and the challenges, but without a strong political commitment few solutions could be offered. A draft paper drifted about until March 1993 when a last minute decision was made to release the strategy then at the Mining Association of British Columbia's annual meeting.

Shortly afterwards, the government made its momentous decision to disallow mining of the giant Windy Craggy copper deposit in the remote Tatshenshini area of British Columbia and declared the whole region a park. This enraged the industry and mining officials were on hand to loudly protest the Premier's press announcement. Relations again sank to the levels of the 1970's. After that Mines Minister, Anne Edwards, lost credibility with the industry and was never again viewed as an effective minister.

During this time, the government appointed an academic and long-time NDP supporter as deputy minister of the Treasury Board. The Survey, along with other inventory branches in government were challenged to justify their work as this Deputy believed BC needed less inventory and more decisions; the survey was also challenged to prove it was not a subsidy for the mining industry and was told to examine and prioritize its program in preparation for a 50 percent cut in the 1993/94 budget. In a cloak of budget secrecy this was kept confidential from staff. The management team, working with a local consultant, Tony Seguss, prepared a defense document entitled *'The Essential Role of a Geological Survey*'. The work of the Survey was strongly supported by the ADM, Bruce McRae, and the Minister, Anne Edwards, and in the end escaped with a budget cut of 22% and cancellation of the provincial side of the MDA programs. As a result, many long-term senior assistants were advised they were on a layoff list and would be terminated later in 1993. Field programs were cut to the bone and the history of the early 1980s was again being repeated. A plea by the Professional Employees Association to the new Deputy Minister, Brenda Eaton, in the fall of 1993 was successful and the remaining geologists on lay-off status were given temporary appointments in other Branchs in the Ministry and returned to the Branch the following year when the MDA was re-instated. But morale in the Branch had again sunk to a low level as staff pondered if they and the mining industry were endangered species.

In 1994 the government instead of just paying lip service to 'we want mining' and to help offset the ongoing bad press around the Windy Craggy decision, announced a $100 million, five-year program to revitalize exploration. The program included tax breaks for coal producers, reinstatement of the provincial side of Mineral Development Agreement Programs, including the Survey's mapping projects, reactivation of the Prospector Assistance grants, and an exploration incentive program that was modeled on the FAME program of the mid 1980s, named EXPLORE B.C. Again, the Survey was given responsibility to manage these incentive programs.

Dani Alldrick, a senior mineral deposit geologist managed the 1994 Explore B.C. Program and Vic Preto again was responsible for the Prospectors Grants. In 1995/96 Vic Preto managed both programs.

EXTERNAL INFLUENCES

During this period, the Survey continued its liaison with industry through the Technical Liaison Committee formed in the previous period, through an annual Open House in Vancouver as part of the four day Cordilleran Roundup hosted by the BC and Yukon Chamber of Mines, and through a second review by a Canadian Geoscience Council Committee. The opening of a Branch office in Vancouver in 1986, headed by Tom Schroeter who previously was the district geologist in Smithers, did much to improve working relations and provide services to the Vancouver exploration community. Joint program planning with the GSC to maximize resources and to eliminate duplication of effort began in earnest in 1992, now on a far more equal basis.

Owen Owens took the Chair of the TLC for its first eight years. He had a strong personality and was both thorough and perceptive. With a razor sharp mind he kept Branch management on its toes during their biannual meetings with the Committee. He was an unwavering advocate for a program of systematic 1:50 000 scale mapping in British Columbia; the minimum scale industry now considered useful for targeting its exploration efforts. Owens enjoyed the respect of a succession of Mines Ministers and was an effective advocate for increased government support for the work of the Survey. In a meeting with one minister he traced the oak grain on a board room table to explain the need for 1:50 000 scale bedrock maps to outline the distribution of favourable rock formations. The TLC continues today to be an important adherent for the work of the Survey. The Chair in 1995 was Ian Thomson of Orvana Minerals, a Vancouver junior company that ironically is directing most of its efforts outside Canada.

The management structure of the Survey remained essentially unchanged through to 1989 despite the dramatic growth in programs and staff in 1988-89 period. It was again time for reflection and forward planning and in 1989 the ADM, Bruce McRae, invited the Canadian Geoscience Council to appoint a second review committee to:

- review the current mandate of the Branch in terms of the Province's needs through the year 2000;
- analyze its organizational structure; and
- report on the adequacy of staff and budget to meet the demands of the next decade.

The Review Committee was chaired by Chris Barnes, who had recently been appointed Director of the new Centre for Earth and Ocean Sciences at the University of Victoria, and had both a distinguished academic career and a short stint as a senior manager with the GSC in Ottawa.

The Committee filed a 108 page report with 63 recommendations. This time it was published expeditiously. They foresaw an impressive array of new challenges, including environmental geology, geological hazards, outreach and public information, and land-use issues, in addition to maintaining the traditional Survey role of support of the mineral industry. Significantly the Committee reported "*that the Government can be satisfied that its Geological Survey has translated the increased financial resources of the past five years efficiently and effectively into the generation of much needed geoscience data.*" One result of the review was a reorganization and a refocus of the Branch in 1991. Another, was an increased effort to work closely with other Ministries involved in resource inventory, especially those whose interests overlapped, such as Forestry through terrain mapping; Parks through sub-surface resource potential; and Lands through surface mineral resources such as sand and gravel. This loose network came together in 1992 as the Corporate Resource Inventory Initiative (CRII) and was successful in persuading the new NDP government to increase funding for resource inventories to assist it in its plan to increase the amount of the Province's protected lands to 12 percent. The Survey played a major role in promoting CRII and benefited in obtaining funding in 1992 for a detailed

mapping and geochemical surveying of the contentious Tatshenshini area. Ironically, these surveys showed there was potentially another similar major deposit close to the Windy Craggy at lower altitude but the studies were broken off and the areas potential wealth frozen. With the CRII funding the mineral potential maps of the Province that had become obsolescent were updated over a five year period by a new and more rigorous method.

By 1984 the federal government had signed MDA's with almost all of the provinces and was keen to have one with BC. However, relations between the previous Social Credit and Federal Liberal governments were sour and the province dragged its heels. This changed when the new federal Progressive Conservative government led by Brian Mulroney took office in 1984. An agreement in principal for a $37 million agreement was struck, but this was cut back to $10 million to allow for more forestry support, which eventually received $300 million. All that remained to be worked out was delivery mechanisms and program elements. British Columbia had been working on the premise that program delivery would be separate and parallel, *i.e.* federal or provincial surveys would spend their own money on their own programs, but was not too enamoured with this as Quebec was delivering 100 percent of their MDA program, including the 80 percent federal contribution.

Close to the end of the negotiations, and in a new spirit of co-operation, Pierre Peron, the ADM of EMR, phoned Lorne Sivertson of BC's ADMM and said it was BC's call on how much of the program British Columbia delivered including the federal contribution. Smyth and Sivertson decided the province was in the best position to deliver all of the geoscience program except for the aeromagnetic surveys and a small part of the coal inventory. This decision caught the GSC executive in Ottawa off guard. BC's decision to largely go it alone was partly because of the GSC's insistence that 1:50 000 mapping was too difficult and not a cost effective scale to work in the Cordillera in contrast to the opinion of the TLC.

Smyth played an effective role in the development and implementation of the program based on his previous experiences in Newfoundland. The agreement should have been signed early in 1985 but was delayed until August to permit a ceremony between the federal and provincial ministers in Prince George. As a result, new field projects could not be mounted until 1986. The MDA gave a significant boost to the morale of the staff after the dark days of restraint, loss of staff positions and truncated field programs.

Despite almost 100 percent provincial delivery of the MDA, relations with the GSC's Vancouver office continued on excellent terms and their senior staff generously shared their considerable experience and helped select the areas for 1:50 000 mapping.

For many years, the two Surveys met each spring to inform each other of their upcoming field program, but this was more out of courtesy than joint planning. By 1986 the GSC had largely completed the 1:250 000-scale mapping of the province and was embarking on the next phase of re-mapping in which areas mapped earlier were brought up to new standards by application of contemporary concepts and greater detail. The old division of powers worked out in Walker's day in the 1940s was now blurred.

Discussions took place with the GSC in 1990 to formalize joint program planning. A co-operation Agreement was signed by Smyth and Ken Babcock, the ADM of the GSC in 1991. In 1994 senior scientists from both organizations met for two days at Dunsmuir Lodge near Victoria to develop a five year geoscience plan for British Columbia. This marked a new stage in Federal/Provincial co-operation and became a model for the other provinces.

ORGANIZATION AND PLANNING

The organization remained unchanged until 1986 when a new Regional Mapping Unit was added to the Project Geology Section under Manager Bill McMillan and renamed Mineral Deposits and Regional Mapping. The Regional Mapping unit was headed by Senior Geologist Don MacIntyre, who recognized the power of personal computers and astutely instituted a digital map database for his mappers. Coal responsibilities had been scattered across three sections and these were combined into a single unit under Senior Geologist Ward Kilby in 1986. In the same year the Survey's Vancouver office was opened, headed by Tom Schroeter. A geological library, donated by Canadian Superior Oil Company in 1982, was housed in the new Vancouver office for use by industry.

In 1986 the Survey received approval from Treasury Board to purchase a new x-ray fluorescence (XRF) machine. A business case was developed that would recover the capital costs by charging back the MDA projects for analytical services. Although it was not recognized at the time, this was the beginning of the end of the Analytical Laboratory for it soon became clear from the charge back scheme that the laboratory could not compete in timeliness nor in costs with commercial laboratories.

The FAME (Financial Assistance for Mineral Exploration) program was instituted in 1986. John Gammon, who had managed Falconbridge Limited's western office, was contracted to run the program. He brought a wealth of experience plus considerable knowledge of personal computers and became a mentor to many staff during his two-year stint with the branch. He later became Assistant Deputy Minister with the Ontario Ministry of Mines and Northern Development. Vic Preto managed the Prospector's Assistance Program as part of FAME.

Because of the abundance of publications generated by the expanded geological program, the Survey received permission to appoint a scientific editor in 1988. Brian Grant, who originally joined the Branch with the MINFILE project, took over this position and became head of a publications unit that was named the Scientific Review Office to clearly distinguish its work from the Ministry's Communications Branch. The Survey thus finally regained control of its publications. To the pleasure of an eager staff Grant moved quickly to introduce desktop publishing and computerized drafting. Doreen Fehr and Janet Holland quickly adopted the new desktop publishing technology. Similarly, the drafting team of John Armitage, Pierino Chicorelli and Martin Taylor learned Autocad and moved to computer-based drafting. Such things as Information Circulars, and a new open file map and report series were started to disseminate results rapidly to an active exploration community.

By the mid 1980s the coal exploration boom was over and mines were struggling to survive in a tight world coal market. The district geologists' offices in Fernie and Charlie Lake were closed in 1988 after consultation with industry. David Grieve was transferred from Fernie to the Coal Unit in Victoria, and Andrew Legun was transferred from Fort St. John to the Nelson office vacant since George Addie had taken early retirement.

By 1990, land-use planning in the province had again reached the heights of the early 1980s. The Survey was in a difficult spot. It was the honest broker for unbiased inventory information and assessments of mineral potential, but because the land-use group was part of the Survey, it also played a policy role. The group was thus transferred to the Mineral Policy Branch in 1990. The Survey retained, and in fact expanded, its role of mineral resource assessments of planning areas and for conducting field evaluations of candidate parks. This reporting change was a sore point with some Survey staff but was endorsed by the 1990 CGC Review Committee.

As a result of the CGC Review the Branch underwent a major reorganization in 1991. A Manager of Finance and Administration was added to help handle the increasing burden of administration and to allow the program managers to focus more on scientific aspects. Shirley Marshall was the first appointee. The old Mapping and Mineral Deposits Section under Bill McMillan was split in two. McMillan retained the Mapping section and Dave Lefebure, an energetic district geologist based in Smithers, moved to Victoria to head the new Economic Geology Section, which included metallic, coal and industrial minerals.

The analytical laboratory ceased to be a section in its own right and became part of the new Environmental Geology Section under Paul Matysek. Wes Johnson, manager of the lab must have anticipated change and had resigned two years previously to join a commercial laboratory in Ottawa. Thus the oldest scientific position in the BC civil service dating from 1859, and a precursor of the Survey, was eliminated. The Environmental Geology Section was also made responsible for the regional geochemical surveys, geochemical research, surficial geology, placer, sand and gravel, and geological hazards.

The explosion in land planning on a regional basis throughout the province was the catalyst for a major reorganization in the Mineral Resources Division in 1993. A regional structure was created with four Regional Managers. It was logical that the District Geologists report to the new regional manager and after being part of the Survey for the first 19 years, the District Geologists were transferred to the new Land Management and Policy Branch. Rick Meyers, the District Geologist for the south central district, became one of the Regional Managers and was replaced by Mike Cathro. Today the Survey's only office outside of Victoria is in Vancouver.

The mineral inventory and related functions were grouped as Geoscience Information except that Mineral Potential (studies) became a separate unit. Also, Grant Programs became a separate unit, Prospector Grants under Vic Preto, and Explore BC under Dani Alldrick.

As part of the new regional structure, the Nelson office was transferred to Cranbrook, perhaps mirroring the demise of small vein mining in the west Kootenays. Cranbrook was the riding of the then Mines Minister Anne Edwards, but is centrally located to the industrial mineral mines in the Rocky Mountain Trench; the coal mines in Elk Valley and the Sullivan Mine.

The organization and nomenclature of units of the Survey have continued to evolve since 1995 under budget restraint and changing priorities although most functions have continued. The organization chart of 1995 (Appendix Vb) has changed considerably as a result of downsizing and merging. The main functions of quadrangle mapping, mineral deposit studies, surficial geology and geochemistry, inventory and mineral potential analysis, and a Vancouver Office have continued, although Scientific Review has disappeared.

ACCOMMODATION

Most of the Survey moved in 1985 to the upper two floors of the British Columbia (formerly the Hong Kong and Shanghai) Bank building at 756 Fort Street (Photo C4). A few parts remained in the Douglas Building and the laboratory remained at 541 Superior Street. Later the Survey moved to 529 Superior Street, next to Queen's Printer, and physically amalgamated the Coal Unit, Laboratory and Scientific Review Office with the rest of the Branch. About 1990 planning began for what was proposed as a new ministry building and a somewhat skeptical staff spent considerable effort over the next couple of years helping plan what could be the ideal office environment.

However, after many false starts the Survey, together with the rest of the Ministry, moved in July 1993 to its newly constructed headquarters, the Jack Davis Building, located at 1810 Blanshard Street (Photo C5). The Branch in 1995 occupied all of the fifth floor and the Scientific Review Office was housed on the fourth.

The Survey was a strong proponent that the new building be a showcase BC's dimension stone. Samples of British Columbia granite facing stone were shown to the architects and the ministry's executive coordinator for the building. The architect also had other samples from around the world. The coordinator preferred a deep red granite from Quebec and declared the British Columbia samples too "wishy washy." However, the Mineral Resources Division won the day and a contract was let to a BC company to supply granite facing stone from the Okanagan area. Unknown to the ministry, the company was in financial difficulties and after one delivery of stone it went into bankruptcy. The night before the receivers took over, the last shipment of stone was stolen and never recovered. The building was due for occupancy in only two months and there was no alternative but to purchase the remaining requirements from Quebec. So, the Jack Davis building could be considered a symbol of national interdependence: a showcase for Quebec's granite as well as British Columbia's!

The decision to close the analytical laboratory was made midway through construction of the Jack Davis Building. The lab was to have been accommodated on the basement and first floors. A stainless steel duct was to have run up the centre of the building to the roof. It is believed this ducting is still in place! Sample preparation and lapidary were retained for some time, and these were housed in the basement.

It was fitting celebration for the 100th anniversary that after a history of temporary accommodations the Survey was finally housed in a permanent building dedicated to the Ministry of Energy, Mines and Petroleum Resources. However, unlike the prediction of the Peter Principle the Survey did not fall into a semi-comatose state when finally properly housed.

STAFF

The explosive growth in the number of staff in this period changed the face of the Survey as many young male and female geologists were hired (Photos E11 & E12). Most had Cordilleran experience, some like Jim Logan and JoAnne Nelson while working with industry, others like Nick Massey and Graham Nixon with thesis projects, still others like Larry Diakow, Mitch Mihalynuk, Fil Ferri and Derek Brown both from industry and as field assistants with the Ministry. In addition, a number of easterners, including Chris Ash, Kim Bellefontaine and George Simandl, were also hired and brought with them experience in such areas as ophiolites, Cyprus-type deposits and Shield-type industrial minerals. Two young surficial geologists, Vic Levson and Peter Bobrowsky, graduates of the University of Alberta, were hired. Most of the professional geologists present at the end of the former era remained on staff. The fact that the new regional mapping unit was initially part of the 'project geology section' resulted in a good intermixing. The old guard mostly welcomed the new additions and the inexorable changes. The 1991 CGC Review stated, "*The Survey had evolved from a static, underfunded organization into a productive, innovative and respected institute of applied geoscience*."(*see* photos).

Survey staff were again in demand as experts around the world. Larry Jones, in charge of the MINFILE Project was invited to travel to Vienna to lecture at an International Atomic Energy Agency workshop on mineral inventory systems. Later he was a distinguished lecturer at a workshop on the same subject in Lusaka, Zambia. Senior Geologist, Andre Panteleyev was part of a lecture tour of South American Surveys in 1990. He later was a key participant in a contract let to the GSC to help the bordering countries of Chile, Peru, Argentina, Bolivia, develop a proposal for an Inter American

Branch sponsored Mineral Development Program. Of course the down-side of this international demand coupled with severe budget pressures, was that professional staff such as Andre Panteleyev, Vic Preto, Brian Grant, Paul Matysek, Gerry Ray, Eric Grunsky, and others, all left or retired from government service for prestigious positions in industry (*see* photos).

The importance of key professional, technical and clerical support staff to the effectiveness of the expanded survey cannot be overstated. The abundance of products from the program could not have been achieved without the devoted help of year-long Associate Geologists who were assigned to various projects. Ongoing program demands were met only due to the excellent administrative support which came from staff like Norma Chan and Claudia Logan who worked with the Chief Geologist, Debbie Bulincx in Mineral Deposits and Regional Mapping, Beverly Brown in Environmental Geology, and Geri Dickson in Applied Geology. Later, with further Branch reorganization to create the Economic Geology and Geological Information Services Sections, the administrative pool changed with shifts in responsibility and the addition of Bev Wendt, Kim Passmore, Donna Blackwell, Julie Hutchins and others. The technical capability and versatility of Mike Fournier led to him filling many essential roles from Field Assistant to production of computer graphics, to fluid inclusion analyses and more. Organization of the poster session at the Cordilleran Roundup, which became the Branch's main showcase for its work, was ably managed by Claudia Logan and Mike Fournier. The demise of the analytical laboratory was a sad necessity but the former head, Ray Lett, moved to managing contract analyses for the geologists and also enabled him to resume field studies. The laboratory staff were reassigned to other vacant positions in the Ministry and one, Verna Vilkos, became a valued member of the Mapping and Resource Evaluation Section.

ACTIVITIES

PROGRAMS

The new management team, in keeping with the business acumen of the day, produced annual business plans and published an annual directory of projects. The programs were largely similar to those at the end of the previous era except for the important additions of the Regional Mapping Program of 1:50 000 quadrangles, renewal of the Surficial Geology program, a rigorous system of re-estimation of the mineral potential of the Province at a 1:250 000 scale and initiation of an earthquake hazard mapping program in 1994.

The new detailed regional mapping program of three to five year projects began with four and currently involves ten projects that map three or more 1:50 000 National Topographic System (NTS) quadrangles. The regional mapping is designed to investigate poorly understood or under-explored parts of the Cordillera with mineral potential. Many of the projects incorporate specialist research by graduate students and professors on the study team. The product of every project has been excellent maps with an avalanche of new data and interpretations from fluid inclusions to mega-tectonics (Figure 20). This new work and the expertise developed in all of the terranes was essential in the success of 1:250 000 geological compilation of the Province carried out for the Mineral Potential Project. The critically acclaimed database was posted on the World-Wide Web in 1995 (Figure 21).

Mineral Deposit studies have continued with the former staff and produces exceptional products that have great relevance on exploration, such as Gerry Ray's modeling of gold-enriched skarns based on the Hedley camp, Dani Alldrick's identification of volcanic centres in the Stewart complex and the Eskay Creek sedex environment, and Panteleyev's work on modeling gold deposits. Their products also continue to have great importance in

building more accurate portrayals of the regional geology and tectonics of the Cordillera, for example Trygve Höy's, and more recently, Derek Brown's mapping and study of the Purcell Supergroup to facilitate the search for another Sullivan ore body.

Industrial Minerals Unit led by Danny Hora finally received the funding to start to attack the many aspects of this resource that will become increasingly important to the industrial economy of the province. The intention is to promote replacement of imported commodities, to develop exports and to add value by further processing. A wealth of commodity and field studies initially by MDA contractors and later with the addition of another Industrial Minerals staff geologist, George Simandl, have been published with evident stimulation to the resource.

Regional geochemical surveys were taken over completely by the province in 1988. A Survey research project in 1989 led by Paul Matysek tested and confirmed the value of using moss mats that grow on logs and rocks in B.C.'s high rainfall areas trap fine sediments and are natural collectors of gold and other heavy minerals. Due to this 'popularization' this sampling technique is now commonly used by industry as well as the Survey (Photo A16).

The Branch reinstated its Surficial Geology program in 1989 after a 20-year absence. The new program was initially applied to placer deposits and drift prospecting and later moved into aggregate inventory. A detailed study of the Cariboo placers by Vic Levson identified a number of environments for gold deposition. The models were successfully tested by GSC geologists using ground penetrating radar and later verified by follow-up drilling.

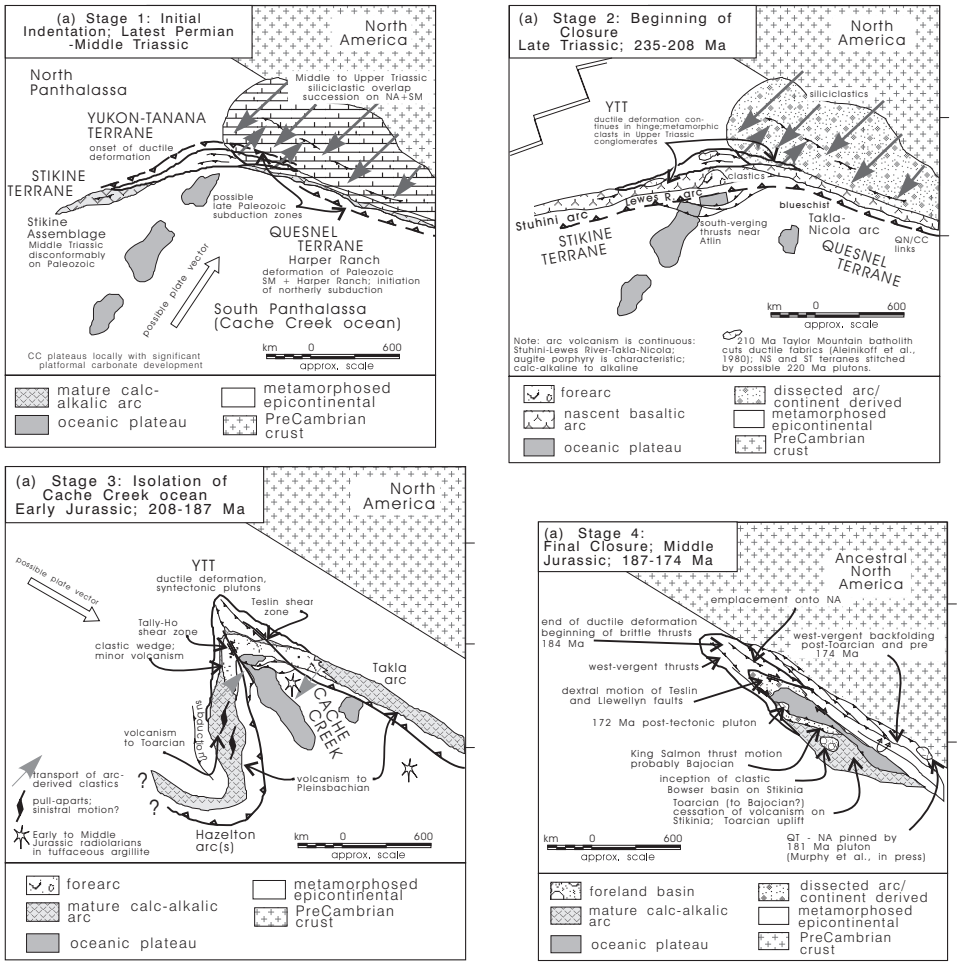


Figure 20. Recently, regional mapping staff of the Branch proposed a model to explain the enigmatic location of oceanic rocks with equatorial fossils (the Cache Creek terrane) between non-equatorial island arc rocks of the Quesnel and Stikine terranes (Mihalynuk, Nelson and Diakow, 1994).

In 1994 in response to greater awareness of the potential for a giant earthquake on the subducting Juan de Fuca plate, identified by GSC scientists working at the Pacific Geoscience Centre, the Survey received funding to prepare a pilot earthquake hazard map of the District of Chilliwack. Similar maps have been prepared in the USA for Los Angeles, Seattle and Portland areas and are proving valuable for municipal land-use planning and seismic upgrading of schools and hospitals. The Chilliwack map was completed in 1995 and the Survey is seeking approval and funding to initiate a systematic hazard mapping program in the populated lower Mainland and southeastern Vancouver Island areas.

The MINFILE database continued to evolve and become more complete. It was redesigned as a relational database in 1986 and in the early 1990s was moved from a VAX mainframe to the PC environment. At various

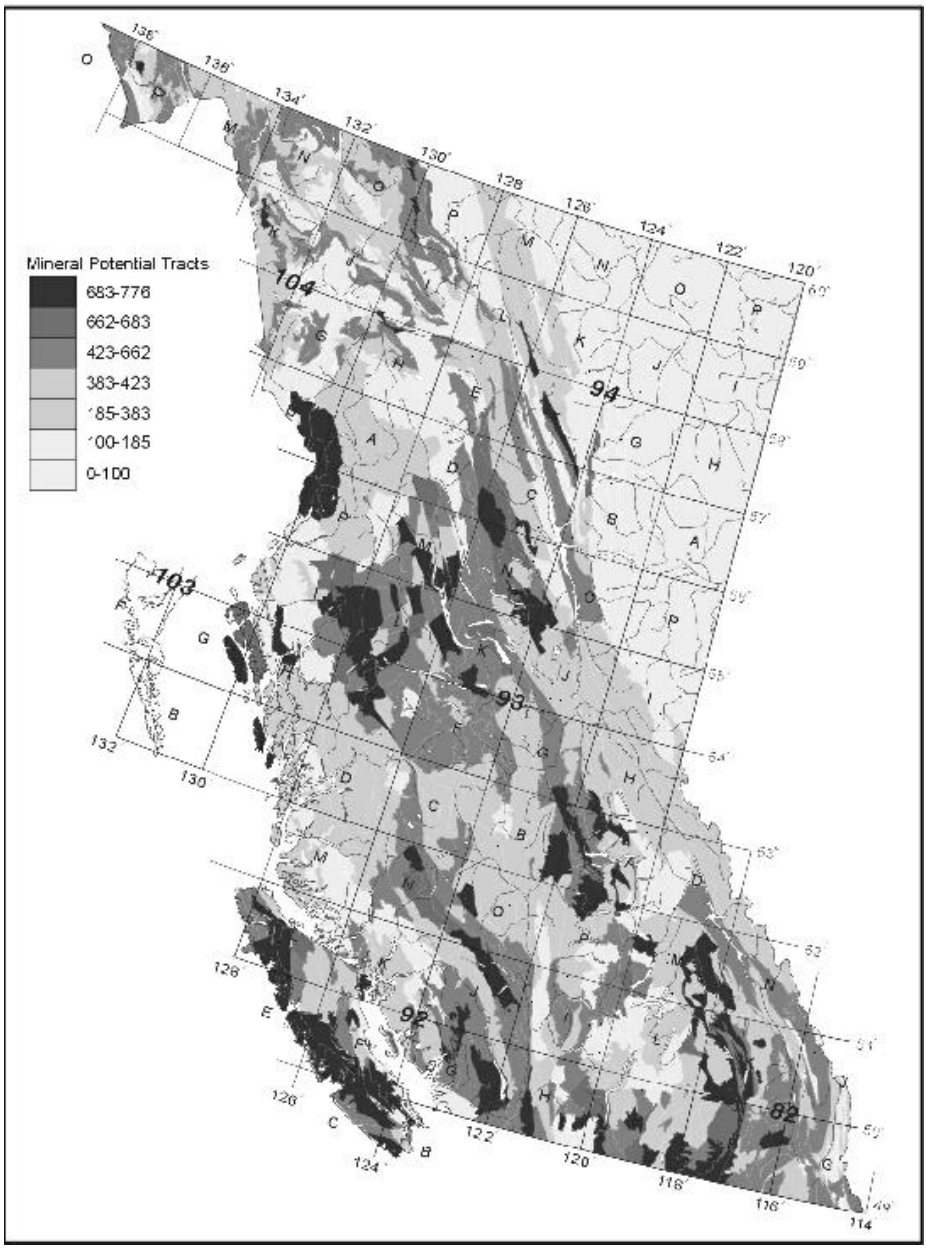


Figure 21. Branch staff, working with industry experts, recently produced computer-based mineral potential maps for the province. These aid the land-use decision-making process and provide regional exploration guidelines. This figure is generalized from the material available through the internet at the Geological Survey's "Map Place" web site.

points in the process most professionals in the Branch were involved with MINFILE either in system design or in doing inventory research. However, the pressures of the software redesign and constant database upgrades required a dedicated MINFILE team, which by the mid-90s consisted of Dorthe Jakobsen, George Owsiaki and Gary Payie and Alan Wilcox, with database management handled by Cindy McPeek and Laura de Groot, and overall management by Larry Jones. The Survey was the first agency in Canada to make its databank available to the public on diskettes in 1990 then later on the internet. The program was once again in the forefront of inventory developments.

The 1992 NDP government promised to double the amount of parkland and it was obvious that up-to-date mineral potential maps were required for the whole of the province. The first generation of mineral potential maps had not been updated since originally produced and the methodology, which was generated for quick response, was outdated. The Survey held a workshop on the subject in Victoria in April 1992, which attracted experts from the United States Geological Survey (USGS), GSC and industry. From this workshop a methodology was established based on the USGS Tongass scheme that uses the Geographic Information System (GIS). Ward Kilby was appointed manager of the Mineral Potential Project and using teams of in house geologists and industry experts, systematically evaluated the whole of the province. Significantly the data and maps were posted on the Internet. The first area completed was Vancouver Island in 1993, followed by the Kootenays and the Cariboo in 1994. At the request of the Committee of Provincial Geologists, Kilby and his team of Nick Massey, Eric Grunsky and Pat Desjardins ran a two-day training course in 1994 for the other Provincial Surveys. In 1995 the Survey's team was contracted by Yukon to advise on setting up a similar program.

PUBLICATIONS

The output of publications through the Scientific Review Office under Brian Grant during this period has been formidable. It is clear that the MDA, the recent growth of the Survey's base budget and CRII funding had a dramatic effect on the quantity of output and resulting publications. Throughout the quality has remained first class, in large part due to the use of new computer technology as well as to dedicated support staff. In addition, the publication backlog was largely eliminated by the end of 1988, as recommended by the Advisory Committee. Most of the new geological staff were computer oriented and produced much of their own graphic material and text directly.

All technical publications are now produced in a 8.5 x 11 inch format with a similar graphic card cover of a more resilient nature than those used formerly. *Geological Fieldwork* has continued to develop as the flagship annual publication. It reports each year on all the work of the Survey and is regularly released in January following the field season at the Cordilleran Roundup Conference in Vancouver .

The *Mineral Exploration Review* has also been issued at the same time since January, 1984. *The Review* is the principal reporting media for the district geologists. It is accompanied by a 1:2 000 000 scale computer generated map of the province showing the location of producers and potential producers of minerals and coal that is revised annually.

The publication *Exploration in British Columbia* had become dominantly composed of abstracts from Assessment Reports until 1990 when it was revamped. It now contains final copies of papers in the *Exploration Review* plus concise descriptions of mineral properties by staff. An *Open File* series has substantially replaced the previous *Preliminary Map* series which has been phased out. The format of the Open Files is similar to the other Branch publications, and from ten to thirty are published each year. These publications normally include maps at field scale and abundant preliminary

data, but receive less rigorous editing than the somewhat parallel articles in *Geological Fieldwork*. A new *Geoscience Map* series presenting final project data and interpretation in map form, replaced similar products formerly issued in the Preliminary Map series and these new products reflect the more diverse nature of the Surveys field programs.

MINFILE has been extensively redesigned for microcomputer use and is available digitally, and in map and hard copy. Coverage of over 96 percent of the province was available in this form in January 1995. In additional, the geochemical data packets are also available digitally.

In 1991 the Survey published a landmark volume initiated by Bill McMillan on *Ore Deposits, Tectonics and Metallogeny in the Canadian Cordillera* containing ten papers by Survey geologists. A reviewer in the prestigious journal *Economic Geology* stated: "*The volume is a testament to the 'bench strength' of the BC Survey, one that is likely the envy of many other jurisdictions of comparable size*." This popular volume was followed by a similar one entitled, "*Drift Exploration in the Canadian Cordillera*" organized by Peter Bobrowsky, which proved similarly popular in the exploration community and demonstrated the Survey's expanding expertise in surficial geology and applied geochemistry.

During this period the Survey also initiated a number of publications which were greeted with enthusiasm by the general public. An outstanding foray into the area of education and tourism was a colour brochure-map entitled *"Geology of Strathcona Park*" produced in 1995. This was a real team effort by GSB staff led by the Editor, Brian Grant. Much of the field research, photography and writing was carried out by the ex-Chief Geologist, Atholl Sutherland Brown, but significant contributions were made by staff and other professionals, including staff from Westmin Resources Ltd. and B.C. Parks. Equally popular were a thoroughly revised *Introduction to Prospecting*, a booklet and a colour poster on rockhounding, and a booklet entitled, *Dimension Stone in Victoria, B.C.* Also two educational brochures on *Earthquakes* and *Landslides,* issued in the early 1990s*,* have been among the most popular products ever produced by the Survey for public distribution. These types of products highlighted the growing awareness in the Survey that public geoscience education should be a high priority, particularly in light of political debate over environment, land use, geological hazards and resource management issues.

The distribution system for publications has been improved by privatization and other factors. Crown Publications Inc. took over distribution of publications. The British Columbia and Yukon Chamber of Mines office in Vancouver agreed to conduct over the counter sales of most publication in Vancouver and also assumed responsibility for distribution of assessment report products.

Staff

Photo E1. Robert Brown, leader of a government-sponsored mineral exploration expedition for the Crown Colony of Vancouver Island in 1864 which discovered placer gold on the Leech River and a thick coal seam on the Puntledge River. (BCARS HP 2396)

Photo E2. Field mining and geology conference (CIM) at the turn of the century, possibly at Rossland. W. Fleet Robertson second from the right, upper row.

Photo E3. Consultant, then Resident Engineer, W.M. Brewer on horseback about 1915. He had the perception to see the Highland Valley as a porphyry copper district at this time and promote a government drilling program to stimulate exploration. (BCARS HP 99658)

Photo E4. The Bureau of Mines staff in 1924, just before William Fleet Robertson's retirement, photographed at the Superior Street entrance to the Birdcage Building. The staff in the back row from left to right are D.E. Whittaker, Provincial Analyst; Fleet Robertson, the Provincial Mineralogist; and J.D. Galloway, his successor. The front row shows J.B. Adams, lab assistant; Major H.T. Nation, general assistant; and H. Pearson, clerk. (BCARS HP 99022)

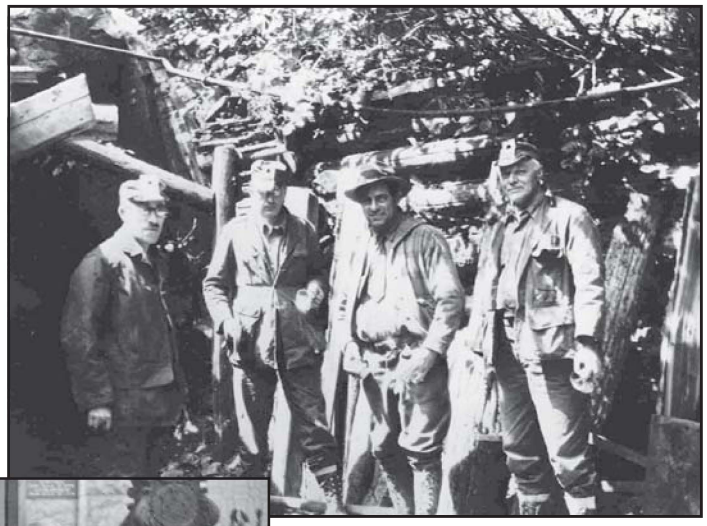


Photo E5. Resident Engineers B.T. O'Grady, second from left and A.G. Langley, right with consultant Col. H.H. Yuill, left and W.L. Scheder at the Hewitt mine, Slocan in 1928. Hartley Sargent and Stuart Holland both worked for Col. Yuill before joining the Department of Mines. Note the soft mining caps and carbide lamps. Also compare O'Grady and Langley in field clothes with their dress in Victoria, Photo B7. (BCARS HP 99666)

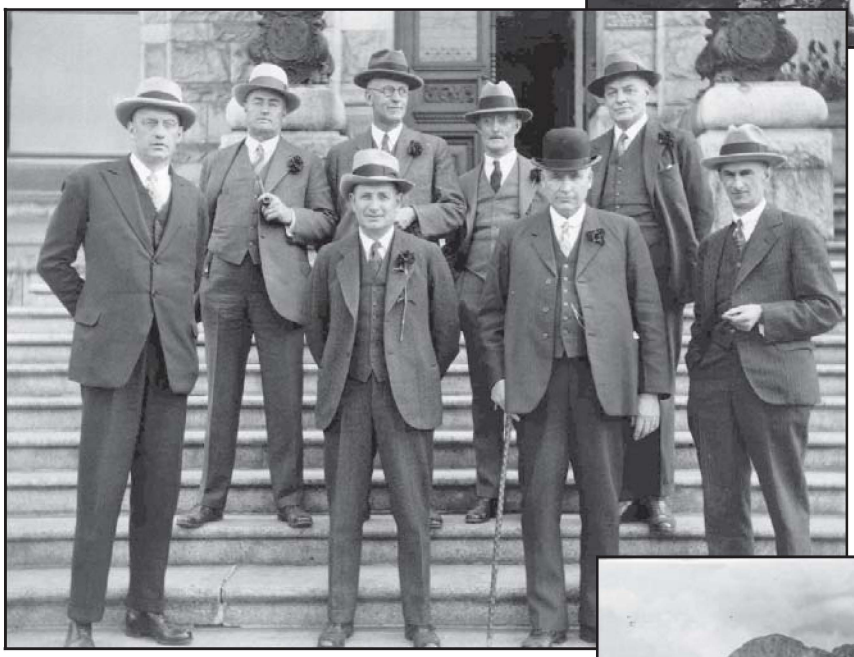


Photo E7. The Mineral Survey staff on 16 May 1929 on the front steps of the Legislature with the Minister and his Deputy. The back row shows from the left: George A. Clothier, Nanaimo; P.B. Freeland, Grand Forks; H.T. Nichols, Kamloops; and A.G. Langley, formerly at Nelson. Front row shows B.T. O'Grady, Nelson; Robert Dunn, Deputy Minister; Hon. W.A. MacKenzie, Minister; and J.D. Galloway, Provincial Mineralogist. J.T. Mandy, Prince Rupert and Douglas Lay, Hazelton, the northern Resident Engineers, were absent. Judged by the long-stemmed carnations those present appear to have returned from a good luncheon.

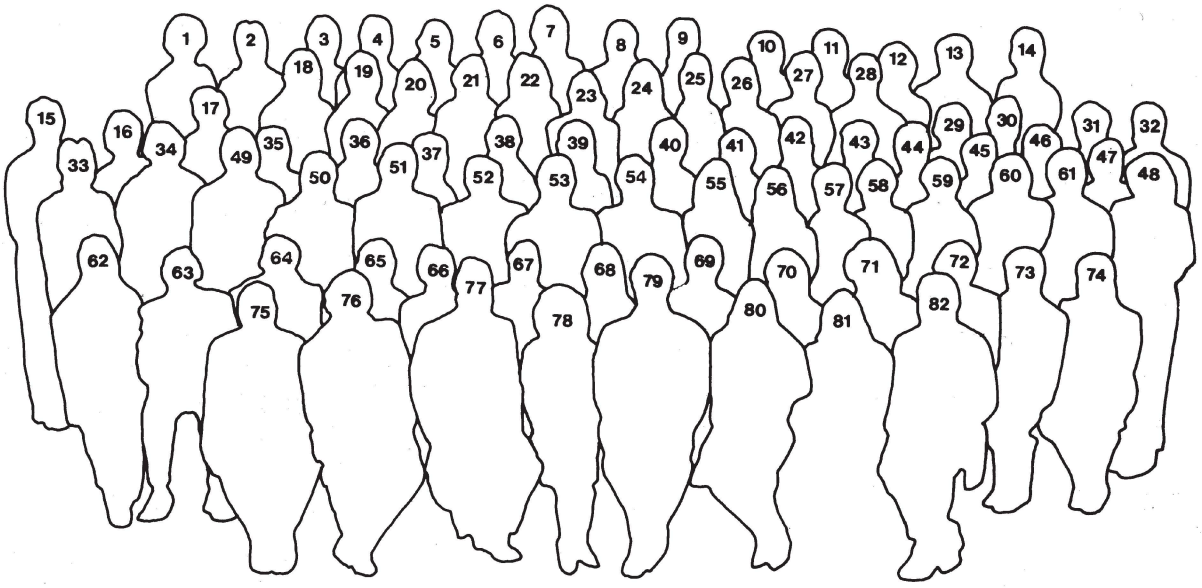
Photo E6. Resident Engineer A.G. Langley with the owner at the Alps Arcturus prospect in the Slocan in 1928. (BCARS HP 99665)

Photo E8. No general group photograph of the Mineralogical Branch during the Hartley Sargent era is known. This photograph shows half the field staff eating lunch during a fall excursion to Sooke in 1953. Their dress is characteristic of their office wear rather than their field clothes; the trip was organized at short notice to prepare for a visit by Washington State geologists. From the left are Stuart S. Holland, G.G.L. Henderson, W.R. Bacon, J.T. Fyles and J.W. McCammon. (A. Sutherland Brown)

Photo E9. The Victoria-based professional staff of the Geological Division photographed outside one of the "houses" occupied on Superior Street in March 1977. Front row from the left: Fraser Shepherd, Nick Carter, Danny Hora, Wes Johnson, Heidi Schwab, Ted Grove, Trygve Höy, Don MacIntyre, Assistant Deputy Minister Ed Mcgregor, John Kwong, Peter Christopher, Deputy Minister Jim Fyles, Bill McMillan, Neil Chruch and Peter Eastwood. Back row: Andre Panteleyev, Ken Northcote, Vic Preto, the frog totem, George James, Talis Kalnins, Alex Matheson and Atholl Sutherland Brown, Chief Geologist. (R.E. Player)

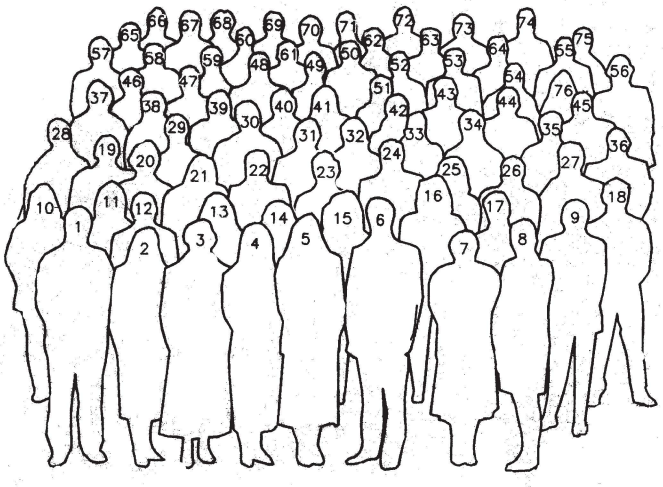
Photo E10. Applied Geology Section in 1977 on the rear steps of the Legislature. From the left: Dave Grieve, Fernie; Ted Grove, manager; George Addie, Nelson; Tom Schroeter, Smithers; Gerri Dickson, secretary; Randy Karst, Fort St. John; Jim Bristow, Ted Archibald, Joe Novaks, and Gary White, Victoria; Gerry Klein, Prince George; Fraser Shepherd, Victoria; and Gordon White, Kamloops. (R.E. Player)

Photo E11. The Geological Survey Branch, close to its zenith in personnel and programs, in the rotunda of the Legislature in December 1989. Ron Smyth, Chief Geologist, with the striped tie and the Assistant Deputy Minister, Bruce McRae, flank the chief's secretary, Norma Chan, in the front row. Also R.E. Player, lapidary and photographer of many of the recent photos, is fourth from the left in the third row. For identification of those present see the illustrated list below (note that there were some additonal staff not in the photo due to program duties, or possibly camera shyness):



1. George Owsiacki
2. Gary Payie
3. Peter Fischl
4. Jim Britton
5. Allan Wilcox
6. Kirk Hancock
7. Dave Grieve
8. Alex Matheson
9. Brad Van Den Bussche
10. John Armitage
11. James Pardy
12. Ian Webster
13. Andrew Legun
14. Jim Logan
15. Keith Mountjoy
16. Chris Ash
17. Dave Melville
18. Don MacIntyre
19. Ron Arksey
20. Bev Brown
21. Sandy Dumais
22. Susan Gillies
23. Becky Arnet
24. Laura de Groot
25. Cindy McPeek
26. Kathryn Andrew
27. John Gravel
28. Victor Levson
29. Graeme McLaren
30. Lee Ringham
31. Peter Bobrowsky
32. Filippo Ferri
33. Dorthe Jakobsen
34. Graham Nixon
35. Pierino Chicorelli
36. Trygve Höy
37. Nick Massey
38. Mike Fournier
39. Andre Panteleyev
40. Vic Preto
41. Barry Ryan
42. Greg Stewart
43. Paul Wilton
44. Greg McKillop
45. Ted Faulkner
46. Marlene Rumenovich
47. Talis Kalnins
48. Kim Passmore
49. Bob Paul
50. Dick Player
51. Pat Desjardins
52. Bish Bhagwanani
53. Victor Koyanagi
54. Brian Grant
55. Janet Holland
56. Joanne Nelson
57. Gerri Magee
58. Kim Bellefontaine
59. Doreen Fehr
60. Wayne Jackaman
61. Larry Jones
62. Shaun Pattenden
63. Gerry Ray
64. Gib McArthur
65. Tom Schroeter
66. Bev Wendt
67. Geri Dickson
68. Shielagh Pfuetzenreuter
69. Jim Hunter
70. Joanne Schwemler
71. Candace Kenyon
72. Derek Brown
73. Janet Fontaine
74. Mary Ann Bloodgood
75. Bill McMillan
76. Paul Matysek
77. Bruce McRae
78. Norma Chan
79. Ron Smyth
80. Claudia Logan
81. Mary McLean
82. Rick Meyers

Photo E12. Geological Survey Branch staff on the steps of the Provincial Legislature in 1992. This photo was taken just a short while prior to the move of the Branch, and consolidation of the Ministry, to the Jack Davis Building on Blanchard Street in 1993. For individual identification see following illustration key and list of names:



1. John Cunningham
2. Laura de Groot
3. Julie Hutchins
4. Janet Trenamen
5. Claudia Logan
6. Ron Smyth
7. Sheila Arnett
8. Shirley Marshall
9. Shielagh Banfield
10 Moira Smith
11. Anna Peakman
12. Bill McMillan
13. Cindy McPeek
14. Pauline Loos
15. Candace Kenyon
16. Linda Jensen
17. Mary-Lou Malott
18. Victor Koyanagi
19. Bev Brown
20. Donna Blackwell
21. Shannon Ferguson
22. Tom Schroeter
23. Brian Grant
24. Dani Alldrick
25. Joanne Schwemler
26. Maria Holuszko
27. Andre Panteleyev
28. Mitch Mihalynuk
29. Bob Lane
30. George Simandl
31. Jim Logan
32. Joni Borges
33. Jan Hammack
34. Don MacIntyre
35. Ian Webster
36. Ray Lett
37. Mike Fournier
38. Nick Massey
39. Dorthe Jakobsen
40. Larry Jones
41. Kathy Colbourne
42. Vic Levson
43. Wayne Jackaman
44. Derek Brown
45. Talis Kalnins
46. David Ballantyne
47. Gary Payie
48. Chris Ash
49. Eric Grunsky
50. Gib McArthur
51. Bish Bhagwanani
52. George Owsiacki
53. Dave Lefebure
54. Barry Ryan
55. Alex Matheson
56. Dave Grieve
57. Andre Legun
58. Danny Hora
59. Peter Bobrowsky
60. Gerry Ray
61. Trygve Höy
62. Bob Gaba
63. Paul Wilton
64. Rick Meyers
65. Alan Wilcox
66. Bruce Madu
67. Steve Cook
68. Rob MacDonald
69. Jim Britton
70. Vic Preto
71. Steve Sibbick
72. Larry Diakow
73. James Pardy
74. Kirk Hancock
75. Ron Arksey
76. Joanne Nelson

10 APPRAISAL AND POSTSCRIPT

The author is not an unbiased observer of the role and performance the BC Surveys of whatever name or stage but he feels an evaluation and codifying of their place in the history of British Columbia is necessary for the completion of this study. Others can in time provide their own appraisals. Any assessment of the role of the BC Geological Survey cannot be divorced from the related history of mining and exploration in the Province, nor from the concurrent political processes.

The mineral industry was, in fact, the real reason for the formation and development of British Columbia as a Colony and onward to Province. The placer gold rush in the Cariboo in 1858 was the initial spur but the sinews came from the development first of the coal industry and slightly later the base metal resources. A succession of Governors and Premiers knew this and kept it in the forefront of their thinking and actions. The latter included Governor Douglas' instructions to Chief Trader McKay in 1852 to secure the Nanaimo coalfield and to collect royalties; Governor Kennedy's creation of the Vancouver Island Exploring Expedition in 1864; the concern and actions of the government regarding the drop in production of placer gold in the late 1860s that, depending on viewpoint, threatened Union with Canada, or made it necessary. In the middle of World War I Premier H.C. Brewster felt it necessary to greatly expand the government's role in mineral exploration by creating the Mineral Survey. More recently Premier Pattullo, who had been Deputy Gold Commissioner in the Klondyke gold rush, advocated use of geological surveys in 1935 as a precursor to discovery of mineral deposits to lead to producing mines so as to aid in the recovery from the Great Depression. Also, most governments have repeatedly, if inconsistently, attempted to stimulate the mineral industry by such means as construction of major roads to resources like as the Cassiar highway and Omenica road, as well as by local road grants, by grubstaking and training of prospectors, by creation of flow through shares and, yes, even by forwarding the affairs of the Mineral (Geological) Surveys.

This all contrasted with the common political attitudes of treating the industry as a cash cow to be milked and taxed to the limit and even beyond as with the Super Royalties of the 1970s. It also contrasts with a widespread public apathy, or even active antipathy, to mines and mineral resources and some government economist's opinion that it is a sunset industry. However, the mineral industry has provided the Crown with more dues, royalties and taxes than the premier industry, forestry, throughout most of British Columbia's history. Also, even in the age of information, the public's appetite for metals does not decrease. Thus the Province in danger of becoming a net importer, and not a value added producer, of metals and minerals if additional fully explored world class deposits like Windy Craggy are blocked from development. Meanwhile our major producing mines age and become exhausted without replacement. The expansion of our cities will be impeded and made more costly if we freeze the non-metallic mineral resources such as sand and gravel near them. The work of the Survey might then be viewed as redundant should these things happen but surely the realization would strike us once again of the importance of mineral resources to our economy and future.

And that, of course, is characteristic of the history of the mineral industry and of the Geological Survey - a sine curve of care and neglect. For the Survey that has meant a recurrent relative waxing and waning of budgets and esteem by authority; together the Provincial government's repeated attempts to minimize responsibility for geological survey. Efforts have been made several times to cast it off to the federal government or to industry. In the former instance control from Ottawa was often remote and academic rather than focused and applied. With industry it would be inefficient and ineffective because mapping and surveys would have to be repeated end-

lessly and separately by the strong companies, and the information derived would not be available to the small companies or to individuals, who history has shown, have frequently been the discoverers. The understanding that geological surveys are, in the words of J.D. Weir, former Chief Geologist of Chevron Canada, *"part of the productive sector of the economy*" but are the responsibility of Provincial governments because of their ownership of the resource, is a lesson that has to be relearned by each new government. Nevertheless, it should be said the division of labour between the GSC and the BC survey has been relatively sharp since Walker's days, with just enough overlap to understand what the other is doing and why, and with increasing levels of joint planning.

In fact the Survey has three principal clients: industry, government and the general public. For industry the Survey forms the leading edge in the exploration process of renewal and an organized receptacle of industry data so that it is not lost. For government the Survey provides a data base and advice on resource adequacy, on land-use planning and routes for resource roads and railways, on geological hazards and on regional geochemical backgrounds of radioactive elements and metals in soils. The general public's interests are similar to, but separate from, the government's. In many ways the public's interest is more constant than that of the government as the consistent big sellers among the Survey's publications are the ones that answer their needs. The public's sharpest interest is in geological information useful for prospecting and in methods to carry it out as well as means of staking. The public also has a broad interest in fossils, rocks and minerals and their identification and in the general geology of the province, particularly of Parks. Finally the public shows a growing interest in geological hazards. This may all seem a paradox considering the perceived apathy stated before. The Survey earlier in its history also had a considerable role in protecting the public from fraud such as the Hedley Amalgamated scandal (cf. BreX) by vigilant appraisals, by forcing re-drilling and check assays and by certifying the capability of assayers and chemical analysts.

So how has the Survey done through the century of its being? In the last thirty years it has repeatedly been reviewed by critical appraisers, appointed at its own behest. The various committees have generally been approving of the Survey's efforts over the years but have greatly helped its focus and pointed out to its masters things well known internally that are weak or wrong. The records show that the work of the Survey beyond its general facilitation of the exploration process by geological mapping, has led industry in many instances to new concepts regarding mineral deposits or to discovery. Sometimes the efforts were not approved or were even ridiculed. Examples include the Survey's efforts in 1919 to prove the Highland Valley was a porphyry copper district. In the late thirties the Survey led by directing exploration to strategic metals, in evaluating them, and in helping to bring them into production for the war effort. In the 1960s it led in focusing on broader prospecting for jade in all the ultramafic areas of the Province. Since the 1970s it has led in formulating models of mineral deposits specifically for British Columbia as an aid to exploration. In the late 1970s it led, against some opposition, in initiating multi-element regional geochemical surveys of the province carried out to uniform rigorous standards. These surveys, now widely heralded, were nearly completed by 1995. The mineral inventory of the Survey is unequaled in all the world and is available at nominal price on diskettes for PC computers. In house polling has shown that one of the Survey's services most valued by mineral exploration geologists has been the open consulting and advice available in the field or office. In addition the BC Geological Survey's work has led companies and individuals again and again to mineral discoveries and extension of reserves (Linkages..., Sutherland Brown, 1986).

The Survey's advice to government has, in many cases, been confidential. Its suggestions have not always been taken and, furthermore in a few instances, were probably not correct as in the case of attempting to preserving the magnetite skarn deposits from exploitation. Different governments have sought advice with greater or lesser eagerness. Originally the Provincial Mineralogist advised the Minister or Premier directly as Walker's let-

ters show regarding GSC surveying or the Hedley Amalgamated scandal. In today's bureaucratic regime advice and information are filtered through about four additional levels of government - nothing may pass through the screen and feedback may be negligible. Nevertheless, the Survey under these conditions has provided very useful data such as the uranium content of soils and waters in the Okanagan, routes for northern resource roads and railways and the sharing of costs with the Federal Government by joint agreements for aeromagnetic surveys, geochemical silt surveys and Mineral Development Agreements.

The Survey has also had an important role in training geologists. Summer student assistants have had very personal instruction on survey methods, problem solving in the field and in 'reading the rocks'. This has been an asset to the exploration industry as well as a help in Survey recruiting. Also, throughout the history there has been a steady flow of geologists to the Survey where they developed rapidly in the fertile environment and then, quite commonly, move on to more lucrative or responsible jobs in industry, consulting or university positions. Unfortunately that flow recently has been accelerated by budget cuts and elimination of positions to the benefit of our South American competitors.

POSTSCRIPT

Ironically, as soon as the Survey had competed celebrating it's century of science and dedication it was bruised again in a downward trend of the sine curve. In 1996 the names Mines, Mineral, Energy and Resources all disappeared from the Ministry title as its functions were combined with others to become part of the *Ministry of Employment and Investment.* Along with this symbolic shock was a real, seismic one in which the Survey was subjected to major cuts in budget and staff. In 1998, some of the symbolic shock eased, to the relief of clients and staff, when the ministry reappeared as the new Ministry of Energy and Mines. The new century may not be much different from the old one!

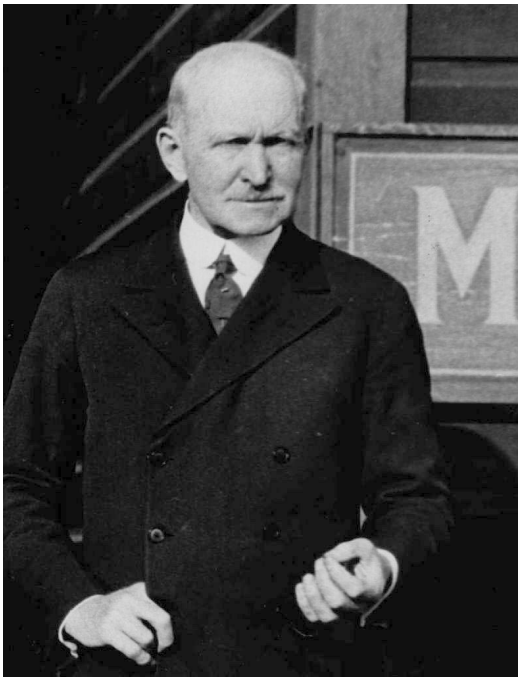
APPENDIX I
CHIEF GEOLOGISTS OF THE B.C. GEOLOGICAL SURVEYS

In the 100 years plus, since the birth of the British Columbia Geological Survey, or its variously named predecessors, there have been ten Chief Geologists, styled by various titles, the grandest of which was 'Provincial Mineralogist'. The following short biographies highlight aspects of the development of the survey through the lives and achievements of the Chiefs.

The biographies show a common thread. In spite of our colonial past all but one of the Chiefs were born or raised in Canada. All but the first two had higher degrees and such post-graduate work was rare in the profession then. Most had engineering or mining geology backgrounds. Most, including the first, worked with the Geological Survey of Canada as young geologists. Most had experience in industry. Most took leading roles in the geological, mining or engineering associations of Canada.

W.A. CARLYLE (1862-1947)
Provincial Mineralogist, 1895-1898

William Arthur Carlyle, the first Provincial Mineralogist, was born in Hamilton, Ontario on March 31, 1862, the grand-nephew of Thomas Carlyle, the Scottish historian. He graduated from McGill University in 1887 with the British Association Science Medal in engineering and natural sciences. He spent two seasons with the GSC in the Laurentian Mountains in Quebec and then worked as a mining engineer in Aspen, Colorado. At the time of his appointment as Provincial Mineralogist late in 1895 he was Professor and Lecturer in mining and metallurgy at McGill. Early in 1896 he and Herbert Carmichael, Assayer and Chemist, began to organize the Bureau of Mines in accordance with the "*Bureau of Mines Act,"* 1895. Carlyle set both the style of operation of the Bureau and the format of the Annual Reports of the Minister of Mines for the next twenty years. He did this by extensive field trips which were fully reported with an excellent photographic record, and by equally extensive statistics of the mining industry in the Annual Report. In 1896 and 1897 he visited and reported on the Alberni, Trail Creek, Slocan, Nelson and Ainsworth Districts. By the end of 1896 he had also laid the foundation of an excellent library and accumulated a large collection of ores, minerals and rocks for a museum. His statistics gave a comprehensive statement of the mineral production of the Province. Early in 1898 Carlyle resigned to become general mine manager of the British American Corporation at Rossland and a year later moved to Spain to become manager of the Rio Tinto mines. In 1907 he resigned to become a consulting mining engineer in London, England, but returned to Victoria to retire in 1924, the time of the photograph. He died in Victoria in December 1947.

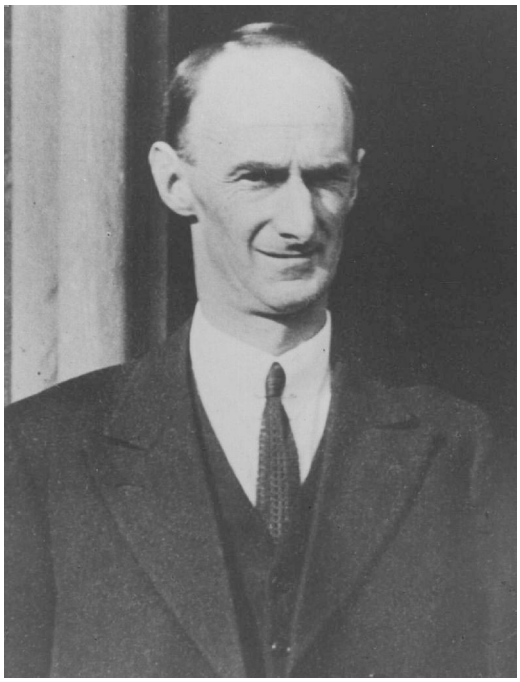


W. FLEET ROBERTSON (1859-1929)
Provincial Mineralogist, 1898-1925

William Fleet Robertson was born in Montreal on December 18, 1859 and educated at Montreal High School and Galt Collegiate Institute. He was awarded a B.A.Sc. with honours in natural sciences from McGill University in 1880. From 1880 to 1885 he worked for the Orford Copper Company and the Chemical Copper Corporation's copper operations in Quebec, Pennsylvania and New Jersey. In 1885 he returned to Canada to join the 6th Fusiliers as a Lieutenant on operations during the Riel Rebellion. In 1886 Fleet Robertson was appointed engineer of the coal mines and railway of the Cumberland Coal Company at Springhill, Nova Scotia. In 1887 and 1888 he was superintendent and consulting engineer to the Compania Soleil Coronada in Spain. Between 1888 and 1893 he was employed as superintendent, chief engineer and metallurgist at various copper smelters and refineries in Michigan, Montana, New Jersey and New York. In 1893 he opened offices as a consulting engineer in New York City. When Carlyle resigned in 1898 Fleet Robertson was recommended as his successor by G.M. Dawson and was appointed in June of the same year. He continued the style of operation of Carlyle with great vigour and over the next fifteen years systematically visited all regions of the province. In particular, he made arduous exploratory trips in 1905 from Ashcroft to Hazelton via the Chilcotin; in 1906 a west to east transit of the province from Port Essington on the Skeena River through the Peace River to Alberta; in 1908 from Hazelton through the Omineca to McConnell Creek and then via the Findlay and Parsnip rivers to Fort St. James and back to Hazelton; and, in 1912 from Wrangell in Alaska to Telegraph Creek, on to Dease Lake and the Cassiar and back through the Groundhog coalfield to Hazelton. On all these trips Fleet Robertson was accompanied by H.T. Nation as his assistant. In 1917 he presided over the expansion generated by the new Mineral Survey and Development Act and the creation of the Resident Engineers. He continued as Provincial Mineralogist until 1925, thus serving for twenty-seven years during the early growth of the lode mining industry in British Columbia. During all these years he produced the Annual Report of the Minister, normally with the help of Major Nation. Fleet Robertson was active in CIM affairs all his life. He retired in February, 1925 and continued to live in Victoria. He died on shipboard in Everett, Washington in 1929 at the start of a visit to England and was buried at Ross Bay Cemetery in Victoria.

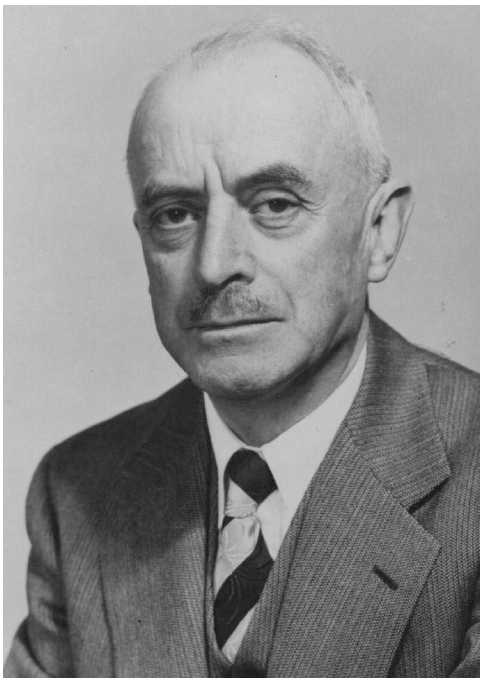
JOHN D. GALLOWAY (1889-1942)
Provincial Mineralogist, 1925-1934

John Davidson Galloway, third Provincial Mineralogist, was born at Napier, New Zealand on October 14, 1889. Early in his life his family settled in Greenwood British Columbia, where he received his primary education. He completed his high school in Vancouver and attended McGill University College there before going to McGill in Montreal. He graduated in 1911 with a B.Sc. and M.E. and first class honours in geology, metallurgy and mining, winning the British Association medal and the Sir William Dawson Fellowship in mining. He received an M.Sc. in 1912. During his university years he worked as a field assistant with the GSC. After obtaining his masters degree he became assayer and mill manager of the Coronation mine in the Bridge River district for a year. In 1913 Galloway was appointed Assistant Provincial Mineralogist of the British Columbia Department of Mines, however in the reorganization of 1917 he became Resident Engineer for the Northeastern Mineral District in Hazelton. In 1925 he succeeded Fleet Robertson as Provincial Mineralogist, continuing until he resigned in February, 1934 to become a consultant. During his tenure as Provincial Mineralogist Galloway made a clumsy administrative system work and produced informative Annual Reports until the arrival of the stringency forced by the Great Depression. When he left the department he managed the Surf Point mine on Porcher Island and later the Kicking Horse and Monarch mines at Field. He was consulting mining engineer for Alaska B.C. Gold Mines when he died. John Galloway was active in professional affairs with the Canadian Institute of Mining, a Fellow of the Royal Society of Canada and in 1933 was President of the Association of Professional Engineers of British Columbia. He died in Vancouver on February 21, 1942.



JOHN F. WALKER (1893-1977)
Provincial Mineralogist, 1934-1937

John Fortune Walker was born on 17 September, 1893 in Binsbrook, Ontario, the son of the Reverend W.P. and Mrs. A. Walker. He attended school in Westmount, Quebec until his final year when his family moved to Vancouver where he graduated from high school. He spent one year at McGill University College of British Columbia in Vancouver, two years with the engineering department of the Canadian Pacific Railway and one year at Vancouver Normal School. He enlisted in the infantry in 1916 and was badly wounded at Vimy Ridge. After his demobilization in 1918, Walker returned to what had by then become The University of British Columbia, graduating with a B.A.Sc. in geological engineering in 1922. Walker then attended Princeton University, receiving his Ph.D. in 1924. While at university he worked in the summers with the GSC and his Ph.D. thesis was the Geology of the Windermere Area of British Columbia which was published as a GSC Memoir. He continued with the Survey for ten years and was in charge of the Vancouver office in 1931. In 1934 he accepted the position of Provincial Mineralogist in Victoria, the last so titled. Walker had a good sense of organization and anticipation and thus had considerable impact on the development of industry and of resource administration. He became Deputy Minister of the Department of Mines in 1937 but continued an active role in regard to geology and exploration. In his early years with the Department of Mines he was instrumental in completely reorganizing the then Bureau of Mines to make it into something like a small GSC but with a mineral resource oriented mandate. This was accomplished by rescinding the Mineral Survey Act and the introduction of a new Department of Mines Act in 1938 which together resulted in a considerable restaffing of the newly created Mineralogical Branch and the establishment of its base in Victoria. Immediately before World War II he oriented the staff toward the study of strategic minerals and during the war made important contributions to the War Metals Advisory Committee. Before petroleum and coal were under his purview, he was advisor to the government on Acts concerning these resources and in 1960 all geological resources were united in one Department under his direction. Walker was a Fellow of the Royal Society of Canada, the Geological Society of America, the Society of Economic Geologists and was elected President of the Canadian Institute of Mining and Metallurgy for 1956-57. He was also active in university affairs, being on the Senate of The University of British Columbia and the Board of Governors of Victoria College. He retired in Victoria in 1958 and died after a short illness in 1977.



P.B. FREELAND (1878-1949)
Chief Mining Engineer (1937-1943)

Philip Broke Freeland was born in Charlottetown, Prince Edward Island in 1878 but moved to England with his parents at an early age and was educated there. He graduated from the Camborne School of Mines in 1901 and emigrated to Arizona where he worked as assayer and surveyor in the Sultan, Grey Eagle and Rapid Transit mines. He came to British Columbia in 1906 and worked for a year as a sampler in the Hall mines smelter at Nelson. He then worked as surveyor and engineer with the Canadian Pacific Railway and Sooke water supply from 1907 to 1911. Freeland then returned to work as a mining engineer, carrying out prospecting reconnaissance from Bella Coola to Fort George in 1912, followed by being engineer in charge of the Kallapa mine on Meares Island in 1912 and of construction of the Scott Goldie quarry on Burrard Inlet in 1913. From 1914 to 1917 he was employed as a mining engineer and surveyor with the Granby Company at Phoenix. Freeland joined the staff of the Department of Mines in May of 1917 as one of the original Resident Engineers and served the southern district until 1935, first at Grand Forks and then at Penticton. This district contained three of the biggest mines operating in the province at that time, Copper Mountain, Nickel Plate and Phoenix, but he also spent much effort surveying the many prospects, notably those of Beaverdell. In 1935 he moved to Victoria as consultant and was appointed Chief Mining Engineer in 1937, a position he occupied until his retirement in 1943. P.B. Freeland was active in professional affairs both with the Canadian Institute of Mining and the British Columbia Association of Professional Engineers of which he was a charter member and President in 1942. After retirement he continued to live in Victoria until his death in 1949.

HARTLEY SARGENT (1901-1986)
Chief, Mineralogical Branch, 1943-1966

Hartley Sargent was born in Manitoba in 1901 and moved with his parents to Victoria in 1908 where he attended school and Victoria College. He then attended Normal School and taught for two years in the Kootenays. Returning to studies at The University of British Columbia he acquired a B.A. and a B.A.Sc. in mining engineering. He attended the University of Toronto on a Nipissing Research Fellowship, obtaining a M.A.Sc. in mining engineering. During his summers he worked at the Britannia mine underground and surveying, as a draftsman and as an assistant with the GSC. After receiving his masters degree in 1932 Hartley Sargent worked as mine engineer and then manager at Island Lake gold mine in Manitoba and then as field engineer for Col. H.H. Yuill in the Bridge River, Slocan and Arizona. He joined the Department of Mines in July 1935 as Resident Engineer at Nelson and then in Vancouver. While acting in this capacity he received leave of absence in 1942 to obtain a Ph.D. at Massachusetts Institute of Technology in geology. During the years he was at MIT he mapped the Bedwell River area west of Buttle Lake with its numerous gold prospects, the subject of his thesis. In April 1943 Sargent succeeded P.B. Freeland as Chief of the Mineralogical Branch and hence presided over much of the change of direction integral to the creation of this branch. He served as Chief until retirement in 1966 during which the branch became an agency dedicated to detailed geological mapping and integrated deposit study of areas of high mineral potential. He was also responsible for the Department at first contracting a series of local aeromagnetic surveys and then joining in a federal-provincial systematic aeromagnetic program. During his career he took an active and executive role in the affairs of the Canadian Institute of Mining and Metallurgy and Association of Professional Engineers. He continued to work in community and church affairs in Victoria during retirement until his death in 1986.

M.S. HEDLEY (1905-1990)
Chief, Mineralogical Branch, 1966-1970

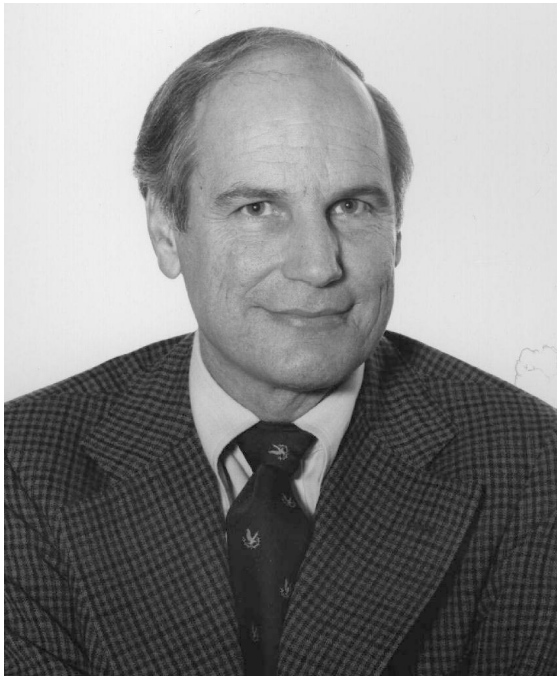
Matthew S. Hedley was born in Nelson, British Columbia on May 2, 1905 in the 'shadow of the Hall mines smelter', the son of the superintendent, Robert R. Hedley, a noted early mining man. His childhood and youth were thus spent in a mining atmosphere and he was acquainted with many of the lions of early lode mining in the province. His first job was as a mucker in the glory hole of the Bluebell mine at the age of 15. He went to high school in Vancouver and graduated from The University of British Columbia with a B.A.Sc. in geological engineering in 1930. He served as engineer at the Bell mine, Beaverdell, for a year and then attended the University of Wisconsin, from which he received a Ph.D. in 1934. The following year he was geologist at the Bralorne mine, and the year after led a GSC field party in the Tahtsa Lake area, spending the winter in Ottawa with the Survey. Hedley joined the British Columbia Department of Mines in May 1936 as the last Resident Engineer to be hired, serving at Penticton until moving to Victoria in 1940. He served the Mineralogical Branch as Geologist, Senior Geologist and Chief until he retired in 1970. As geologist he was involved in the reconnaissance of the northern Rocky Mountain Trench, in a study of chromite occurrences of the province, and was involved in the exploration and development that brought the Emerald Tungsten mine into production as a wartime measure. Hedley then concentrated on the silver-lead-zinc deposits of the Kootenays, particularly those of the Sandon area which he mapped in detail. In his senior positions he was responsible for the style, editing and production of the Annual Report and other publications of the ministry. As Chief he was responsible for the initial moves to broaden the scope of the Branch, and in particular for the introduction of an exploration data form that allowed successful monitoring of an expanding industry with static Branch resources. After retirement from the government, he consulted for the French company, Pechiney, for three years and edited some publications for the ministry before fully retiring in Victoria. He died in Victoria in September 1990.

STUART S. HOLLAND (1909-1989)
Chief Geologist, 1970-1974

Stuart Sowden Holland was born in Vancouver, British Columbia on December 4, 1909 son of Arthur H. Holland B.C.L.S. and his wife Charlotte. He grew up in the West End of Vancouver and attended UBC, graduating with a B.A.Sc. in geological engineering in 1930. He then attended Princeton University, receiving a PhD in 1933. Holland worked five summers with the GSC while an undergraduate and graduate. On returning from Princeton he was employed as a field geologist for Col. H.H. Yuill and after his death in 1935 for R.H. Stewart and Dr. Victor Dolmage chiefly on examination and exploration of lode and placer gold deposits. He joined the Mineralogical Branch in January 1939 where he spent 35 years as Geologist, Senior Geologist, Deputy Chief (1967-1970) and Chief (1970-1974). In this time Stuart Holland spent 27 summers doing field mapping and mineral deposit studies with an emphasis on lode and placer gold deposits. In 1940 he was involved with M.S. Hedley in a reconnaissance of the Northern Rocky Mountain Trench and the rest of World War II in a number of studies of strategic minerals: tungsten, mica and oil and gas. Thereafter he concentrated on Cariboo placer and lode deposits and the bedrock stratigraphy and structure. He also became involved in the study of lithophile elements and molybdenum and examined prospects from the Lardeau to the Alaska border. During the late 50s Holland was involved in many dam and bridge site studies for the provincial government. His interest in placers led him naturally to studies trying to relate the fineness of gold to sources and later to the study of jade. He advocated a wider search for jade in the ultramafic areas of the province than just the Bridge and Fraser rivers and was soon rewarded by widespread discoveries. His broad knowledge and extensive travels in B.C. led to a major study of the physiography of the province. The results of all this effort were published in six Bulletins and many reports. During his tenure as Chief he was responsible for initiating new thrusts in mineral inventory including the design and implementation of mineral deposit land use maps, the consolidation of all material related to mineral deposits into a mineral inventory file and the funding of MINDEP at The University of British Columbia. He also initiated new formats for publication and started the district geologists program. Stuart Holland retired and was active in horticultural affairs until his death in 1989 in Victoria.

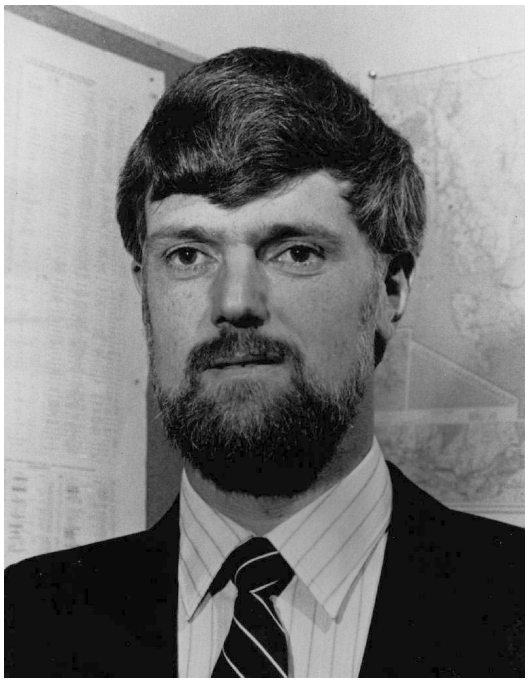
A. SUTHERLAND BROWN (1923-)
Chief Geologist, 1975-1984

Atholl Sutherland Brown was born in Ottawa on 20 June, 1923 the youngest son of then Col. James Sutherland Brown and his wife Clare T. Corsan. He grew up mainly in Victoria, attending Victoria College before joining the RCAF in 1941. As a pilot he served in the U.K. and Burma where he was awarded the D.F.C. After the War he attended The University of British Columbia and received a B.A.Sc. in geological engineering in 1950. As an undergraduate he was employed in the summers on exploration with Kennicott and Cominco. He attended Princeton University, was a University Fellow in 1951-1952 and received a Ph.D. in geology in 1954. He worked as a geologist with the Mineralogical Branch in the summer of 1951 and was appointed to the staff that fall. As a geologist he first continued the work of Stuart Holland in the Cariboo, producing two Bulletins. Sutherland Brown then produced a Bulletin on the Rocher Déboulé Range before mapping the Queen Charlotte Islands. The study of the copper-iron skarns of these islands was followed by similar studies on Texada and Vancouver Island that led to a general study of copper deposits in the province. This developed into a study of the porphyry copper and molybdenum deposits of British Columbia which culminated in editorship of the Canadian Institute of Mining and Metallurgy Special Volume No. 15, Porphyry Deposits of the Canadian Cordillera. His interest in the distribution of copper led him to a study of metallogeny and to authorship and co-authorship of a number of papers on these subjects including a Ministry Bulletin with A.J. Sinclair and H.R. Wynne-Edwards. He became Deputy Chief Geologist in 1971 and Chief in 1975. During this period he was responsible for the re-orientation and re-staffing of the laboratory and for the commitment to a regional silt geochemical program. He also reorganized the branch to create a Resource Data Section with an expanded capability in land-use analysis and an Applied Geology Section that included the district geologists. He was responsible for the growth of coal geology and core storage. Sutherland Brown was a charter member of the Committee of Provincial Geologists and instrumental in establishing closer relations with both the other Provincial Surveys and with the GSC on whose Advisory Committee he sat for six years. His experience here led him to advocate external reviews of the British Columbia survey and creation of the Technical Liaison Committee. He was also involved in professional affairs, being President of the Geological Association of Canada in 1980 and of the Canadian Geoscience Council in 1982. He retired in 1984 to become a consultant, continuing to live in Victoria. He was awarded the J. Willis Ambrose Medal of the Geological Association of Canada in 1986.



W.R. SMYTH (1946-)
Chief Geologist, 1984-

W. Ronald Smyth was born 27 April, 1946 in Cahir, Ireland and educated in Kilkenny and Dublin. He received a BA in geology from Trinity College, Dublin in 1968 and then undertook graduate studies at the Memorial University of Newfoundland. Smyth received an National Research Council Graduate Scholarship from 1971 to 1973 and was awarded a Ph.D. in the latter year for the field, petrographic and structural study of the Hare Bay allocthon. In 1973 he joined the Newfoundland Department of Mines and Energy and initiated mapping in the Central Mineral Belt of Labrador. Smyth was appointed Senior Regional Geologist, Labrador in 1975, followed by manager of the Newfoundland Section in 1978 with responsibility for the mapping and metallogenic studies of insular Newfoundland. In 1982 Smyth accepted an appointment as Senior Geologist with the British Columbia Geological Branch with responsibility for the mineral land use planning of the ministry. In addition to managing the section he carried out field work in the Chilcotin and Cape Scott areas. He was appointed Chief Geologist late in 1984 and was responsible for the effective implementation of two five year Federal-Provincial Mineral Development Agreements (1985-1990 and 1990-1995). Smyth was also responsible for introduction of the change of name to Geological Survey Branch and initiation of a regional program of systematic 1:50 000 scale geological mapping. He created a Vancouver office for the Survey and oversaw the growth of the Survey's annual open house into a major component of the successful Cordilleran Roundup in Vancouver. He created a geochemistry unit which took over the responsibility for the regional geochemical surveys from the GSC. He initiated a surficial geology program that included drift prospecting and earthquake hazard mapping. He embarked the Survey on an ambitious and successful resource assessment of the Province at 1:250 000 scale. Smyth has played a leadership role in the Committee of Provincial Geologists and was one of the architects in 1995 of the Intergovernmental Geoscience Accord that defines the roles and responsibilities of the federal and provincial surveys and ushered in a new era of joint planning. He was a member of the GSC's National Advisory Committee for three years.



Smyth has lectured internationally on survey management. He has been an author or co-author of more than twenty publications on the geology of Ireland, Newfoundland and British Columbia. Smyth has been prominent in the affairs of the Geological Association of Canada, as head of both Newfoundland and Pacific Sections and as a member of the national council.

APPENDIX II
MINISTRY NOMENCLATURE

YEAR	MINISTRY	SURVEY
1874 - 1960	**Department of Mines**	
1895 - 1896	"	Provincial Mineralogist
1896 - 1917	"	Bureau of Mines
1917 - 1934	"	Bureau of Mines and Mineral Survey
1934 - 1972	"	Mineralogical Branch
1960 - 1976	**Department of Mines and Petroleum Resources**	
1972 - 1982	"	Geological Division
1976 - 1978	**Ministry of Mines and Petroleum Resources**	
1978 - 1996	**Ministry of Energy, Mines and Petroleum Resources**	
1982 - 1986	"	Geological Branch
1986 - 1995	"	Geological Survey Branch
1996 - 1998	**Ministry of Employment and Investment**	
1998 -	**Ministry of Energy and Mines**	

APPENDIX III
Relevant Items from the *BNA Act,* 1867 and the *Terms Of Union,* 1871

British North America Act

109. All lands, mines, minerals, and royalties belonging to the several Provinces of Canada, Nova Scotia, and New Brunswick at the Union, and all sums then due or payable for such lands, mines, minerals, or royalties, shall belong to the several Provinces of Ontario, Quebec, Nova Scotia, and New Brunswick in which the same are situate or arise, subject to any trusts existing in respect thereof, and to any interest other than that of the Province in the same.

Order Admitting Colony to Canada,1871 at the Court at Windsor, the 16th Day of May, 1871.

Preamble

Whereas by the *British North America Act, 1867,* provision was made for the Union of the Provinces of Canada, Nova Scotia, and New Brunswick into the Dominion of Canada, and it was (among other things) enacted that it should be lawful for the Queen, by and with the advice of Her Majesty's Most Honourable Privy Council, on Addresses from the Houses of Parliament of Canada, and of the Legislature of the Colony of British Columbia to admit that Colony into the said Union on such terms and conditions as should be in the Addresses expressed, and as the Queen should think fit to approve, subject to the provisions of any Order in Council in that behalf should have effect as if they were enacted by the Parliament of the United Kingdom of Great Britain and Ireland:

And whereas By Addresses from the Houses of Parliament of Canada and from the Legislative Council of British Columbia respectively, of which Addresses copies are contained in the Schedule to this Order annexed, Her Majesty was prayed, by and with the advice of Her Most Privy Council, under Section 146 of the whereinbefore recited Act, to admit British Columbia into the Dominion of Canada, on the terms and conditions set forth in the said Addresses:

And whereas Her Majesty has thought fit to approve of the said terms and conditions,...the said Colony of British Columbia shall be admitted into and become part of the Dominion of Canada, upon the terms and conditions...

Terms of Union, 1871 - Schedule (Part)

Canada liable for existing debts

1. Canada...

Canada to assume following charges

5. Canada will assume and defray the charges for the following services:-

A. Salary of the Lieutenant Governor; ...
H. The Geological Survey;
I. The Penitentiary,
and such further charges ...

APPENDIX IV
Letters and Telegrams

a. Letter from Sir James Douglas to Joseph McKay, Factor of the Company, with instructions to secure the coalfields of Nanaimo.

Fort Victoria
24th August, 1852

Mr. Joseph McKay

Sir

1. You will proceed with all possible diligence to Wentuhuysen Inlet commonly known as Nanymo Bay and formally take possession of the coal beds lately discovered there for and on behalf of the Hudsons Bay Company.

2. You will give due notice of that proceeding to the Masters of all vessels arriving there and you will forbid all persons to work the Coal either directly by means of their own labour or indirectly through Indians or, other parties employed for that purpose, except under the authority of a licence from the Hudsons Bay Company.

3. You will require from such Persons as may be duly licenced to work the Coal by the Hudson Bay Company, security for the payment of a royalty of 2/6 a ton, which you will levy on the spot, upon all Coal whether procured by Mining or by purchase from the Natives, the same to be held by you and from time to time to be duly accounted for.

In the event of any breach or evasion of those regulations you will immediately take measures to communicate of the same to me.

I remain

Sir
Your ob! Serv!
James Douglas

b. Letter of recommendation by W. Fleet Robertson for the hiring of H.T. Nation, 1910

The Bureau of Mines
Victoria, B.C.
15th. February, 1910

The Honorable Minister of Mines
Victoria, B.C.

Dear Sir,

I beg to suggest for your consideration the placing of Harold Nation on the permanent staff of this Department, as a draughtsman and clerk, and would urge it on the following grounds.

I have to have and have had each winter a clerical assistant for four to six months, which covers nearly a whole year [as he was hired in the summer also] and has been charged to temporary assistance. So far as expense goes the placing of such an assistant on the permanent staff would be little expense.

As to Mr. Nation's qualifications - a New Zealander by birth - he has lived in British Columbia for twelve years, has an English Public School education [Bedford School] followed by an English technical course [three years at London University].

He is exceptionally careful and accurate at figures, is a typewriter, a good draughtsman, a surveyor and leveller and has run both transit and level parties in B.C.

Is an expert photographer and takes field notes and sketches all of which are of great assistance to me in the field.

Furthermore he can handle an axe and has been in a lumber camp, is mighty handy with a canoe and boat and with horses and can do camp with the best. He has done all these for me.

He is clean living and strong as an ox, so I should be loath to lose him and I'm afraid I may as I know several surveyors are after him, but he stays because he likes the work and wants to work up geology and mining.

I would like to extend the usefulness of this Branch by calculations, indexes and relief maps of certain districts. I can start if I can have an assistant whom I can train to carry on and I have had Mr. Nation for three years he knows the work thoroughly.

As to pay, he is better than many of the draughtsmen in the Lands Department, the Surveyor General will tell you so - who are getting $80 to $100 and I propose that Mr. Nation be put down to $75 a month.

I think you will find that the Deputy Minister of Mines will concur with this request.

I am Sir
Yours truly
sgd, W.F. Robertson,
Provincial Mineralogist

c. Telegram to W.F. Robertson at Telegraph Creek regarding hiring pack horses, 1912.

Hazelton, B.C. Aug 3

Wm. Fleet Robertson,
Telegraph Creek, B.C.

Not possible to obtain saddle or pack horses here. Am Arranging to secure animals for your requirements from pack trains now in Ground Hog or on way there. There will be no difficulty in getting animals from returning pack trains to bring you out the only question is as to whether I can get them to Beirnes Creek by fifteenth August. I am wiring to Fifth Cabin re pack train on way there and also in view another pack train now leaving Kispiox and will make best possible arrangement.

W. Allison.

d. Supplemental food order in Telegraph Creek.

29 July, 1912

Hyland & Befry
General Merchants, Packers and Forwarders

1 Can Mutton	*0.75*
1 Plug Tobacco	*0.50*
1/2 lb Candy	*0.25*
1/2 lb Candy	*0.25*
1 cake Tar Soap	*0.25*
3 lbs Biscuits	*1.—*
3 lbs Salt	*0.25*
3 Can Milk	*1.—*
Farm Lake [delivery?]	*3.—*
	7.25

Paid 29 July
C. Hornaby Smith

e. Letter of information and progress from J.D. Galloway in the field to W. Fleet Robertson, 1913.

The Riverside Hotel
Rock Creek
Oct. 23rd 1913

Wm. Fleet Robertson, Esq.
Victoria, B.C *[stamped, Rec'd 27 October 1913]*

Dear Sir:-

I arrived back in Greenwood yesterday afternoon from my trip up the West Fork to Beaverdell and Carmi. A wire was waiting for me from Mr. Tolmie [Premier] instructing me to go up the main Kettle River, which followed from the request by Mr. Duncan McIntosh to Mr. Tolmie. The only feasible way to make the trip was to take a team from Greenwood, drive as far as possible and then ride the horses to Copper Creek. I will be away from 5 to 7 days and should get back to Greenwood about the 30th. I did not receive any word from you at Greenwood and so last night I wired Mr. Tolmie that if the advance I had requested was not already mailed to forward it to Grand Forks. I should be there about the 31st and will go from there up the North Fork to Franklin Camp which should take 5 or 6 days.

I received a letter from Wm. E. Scott in regard to a series of pictures depicting the mining industry to be taken be Mr. Gintznich, and also a wire countermanding the instructions on account of unfavorable weather. I sent a wire to Mr. Scott last night telling him of my movements and prophesised good weather for two to three weeks now. The weather has been unusually severe the last 2 weeks but the chances are promising for a good spell now. If the pictures are not taken now there will not be much chance until next summer. Some good pictures could be taken at the Greenwood & Grand Forks smelters, the mines at Phoenix, and perhaps also at Rossland and Trail.

The coal mine at Midway is seriously handicapped by not having any coal, which one must admit is a serious difficulty. As far as I can figure out it is just a stock-jobbing fake. They have a fair amount of black shale which does look sufficiently well to deceive the unwary & sell stock.

I did not go into Camp McKinney as it was covered with snow two weeks ago & will remain covered all Winter. I met the only man who is living there and he assured me it would be a waste of time & money to go in as I could not find out anything.

Wallace Mountain at Beaverdell is reviving somewhat and many of the properties there have decided merit. The country is badly broken and in almost every case work has been stopped at some break in the vein. It appears to me the veins are secondarily enriched to a considerable extent between and along the fault planes, and it may be that when the veins are found in place they will be too low grade to be profitably worked. However some properties certainly warrant further exploration.

The Riverside between Rock Creek and Westbridge is a very doubtful proposition. It has been closed for the Winter. Will advise you again on my return to Greenwood.

Respectfully yours,
J.D. Galloway

f. Letter from Reno Sales regarding the possible discontinuance of the Annual Report and reply of the Minister, 1917.

Anaconda Copper Mining Company
Geological Department
Reno H. Sales, Butte Mont.,

Dec. 14, 1917

Minister of Mines
Victoria, B.C.

Dear Sir:-

It has been brought to my attention that the Director of Mines of British Columbia has under consideration the possibility of the discontinuance of the Annual Reports of the Provincial Mineralogist.

To those of us who have occasion to use and to know the value of these reports in connection with the mining in British Columbia, a discontinuance of this publication would be a very great loss. Personally I may say that I make constant use of these Annual Reports and am free to say that I know of no other publication which so completely covers the yearly activities of a large number of mining districts.

There is no other publication of the Canadian Government which so clearly puts forth the condition of the mining industry in Western Canada, and I sincerely hope a way will be found to continue the valuable Yearly Report.

Very truly yours,
Reno H. Sales

18th December, 1917

Reno H. Sales, Esq.,
Anaconda Copper Mining Co.,
Butte, Mont.

Dear Sir:

I have yours of the 14th instant in which you state that reports have reached you that the British Columbia Department of Mines has under consideration the discontinuance of the publication of its Annual Report. In reply I may say that there is no intention to adopt the policy indicated. It is proposed, however, to make an effort to have the Report for 1917 in the hands of the public at an earlier date than in the past. Wish to express my appreciation of the interest you evinced in the mining industry of this Province.

I am, yours faithfully
William Sloan
Minister of Mines

g. Letter from the Premier of British Columbia to the Prime Minister of Canada, 1935.

Right Hon. R.B. Bennett,
Prime Minister,
Ottawa, Canada.

Dear Mr. Bennett:

Re Geological Survey, 1935
British Columbia Programme.

Our Provincial Department of Mines has been discussing with Dr. Camsell, your Deputy Minister of Mines, questions relative to future work of the Survey in this Province.

It has been the desire here that this work should be so organized that it may be depended upon to go forward regularly, without interruption, towards a clearcut objective over a period, say, of five years. My information is that this collaboration between the two Departments has had good effect.

There has been mapped out a programme calling for the completion in orderly fashion of the topography and geology, and the issuance of maps recording this data, for the whole of the southerly part of the Province between Latitudes 49° and 50°. We also have been advised that it is proposed carrying on topography and geology in the Bridge River and Cariboo regions; that a study of the economic possibilities of known deposits along the Canadian National is to be undertaken; also that special study of the Nelson-Ymir District is to be carried out this year.

All this is as it should be, and is along the lines of our wishes. However, we have made a request which, for financial reasons, the Survey has been unable to consider. In this I am particularly interested. The suggestion was made by our Department that two parties be employed to undertake purely exploratory work in the territory north of the Canadian National Railway. It was pointed out that there is little knowledge of the mineral possibilities of this section, and that it seemed most important that some action be taken to correct this condition.

We urge that if this were done, the Geological Survey would be leading instead of following the prospector, and that anything it is possible to undertake that will give us a more intimate knowledge of the extent and character of our latent mineral resources must be a move in the right direction in these times. We are depending on mining, perhaps more than any other industry, to assist in economic recovery.

The response to this suggestion has been the explanation, in the first place that reconnaissance work we had in mind would not be satisfactory, that it was too general, and of no permanent value. Dr. Camsel expresses himself as convinced that if such work is undertaken, it should be done so that the results are of permanent value, and therefore that the mapping scale should not be more than four miles to the inch. There is no question that four miles to the inch would be of greater value than our Department had in mind, and as this is the Federal view, I should like to ask that special consideration be given British Columbia's request, and that provision be made for the initiation of work in the area under discussion on a scale satisfactory to the Ottawa Department. It is my understanding that the carrying out of methodical topographic and geological mapping north of the Canadian National would mean placing in the field three topographical parties and three geological parties, and that the cost of the first year would amount to about $15,000.00, and in subsequent years to between $25,000.00 and $30,000.00.

I wish to submit that a special appropriation to permit the work to begin this year would be the very best kind of investment. Approximately one-half of the Province lies north of the Canadian National Railway. We know in a general way that its rivers and creeks contain gold. The Atlin region is a placer gold camp well-known throughout the Dominion. There is every reason for optimism as to the possibility of finding important economic lode minerals in this central and northern territory. Already there are promising placer gold deposits under development in different sections, notably Manson Creek and Germanson Creek, as well as in districts closer to Prince Rupert.

If we are to plan the development of this area along such lines as would eliminate, as far as practical, wastage in construction of roads and trails, and other administration, we must know more about it. It is important, too, that we should give some kind of lead to prospectors. Furthermore, the investment represented in the construction and maintenance of the Pacific branch of the Canadian National Railway, with its terminal at Prince Rupert, it seems to me, is a most potent argument for the adoption of every reasonable measure directed to the obtaining of information from which economic exploitation of natural resources, first and chiefly mining, which is likely to be the most important basic industry of this area, and upon which agriculture and kindred industries must largely depend.

For these reasons, I would request that a special appropriation be made, in order that the Geological Survey may get a start on this very important work north of the Canadian National Railway, which must be undertaken sometime, and, in my view, and I hope in yours also, should not be further delayed.

Yours faithfully,
T.D. Pattullo
Premier

h. Letter from J.F. Walker to G.A. Young, Chief Geologist of the GSC, 1937.

October 18th,1937.

Dr. G.A. Young, Chief Geologist,
Geological Survey,
Department of Mines and Resources,
Ottawa, Canada

Dear Dr. Young:

I have your letter of the 7th October regarding suggestions for geological field work in British Columbia, and am glad to see that you are back at work again. I trust you are fully recovered from what I understand was a fairly lengthy illness, which I heard about at the Institute Meeting last month.

A year ago last spring the Hon. Mr. Pearson and I discussed with Dr. Camsell at the C.I.M.M. Meeting in Vancouver, geological survey work in British Columbia. We stressed at that time four-mile mapping, with the object of obtaining as rapidly as possible a picture of the geology of the Province. Dr. Camsell was quite agreeable, and we then discussed the amount of work that should be done annually under the terms of the B.N.A. Act which would be fair to both the Dominion and Province. Our suggestion to Dr. Camsell was that eight geological parties should be kept steadily at work on four-mile mapping, and two geological parties on one-mile or larger-scale mapping. Dr. Camsell of course, could not make any definite promise, but agreed our request was reasonable.

For next year, I would suggest that eight or nine parties be employed on four-mile mapping. Four parties on the tier of sheets between 49 degrees and 50 degrees latitude, and 115 degrees and 124 degrees longitude. I think the object in this work should be to complete those sheets on which most work has already been done, and this, I understand, has been your policy during the last two or three years.

Three or four parties could be employed on a tier of sheets between 54 and 55 degrees north latitude and 123 and 131 degrees longitude. In this connection the sheets between 129 and 131 may not be as important as the sheets in the next tier between 55 and 56 degrees of latitude and 127 and 129 degrees of longitude. We would like to see this work continued, not so much tier on tier of sheets, as by a north-westerly trending tier of sheets commencing with a sheet bounded by 55 and 56 degrees of latitude and 124 and 126 degrees of longitude, the succeeding tiers to the north-west overlapping the lower tier by one degree of longitude.

We would like to see one party continue four-mile mapping on the extension of the Barkerville area. Some time ago we suggested that this work be carried southeasterly to connect with the North Thompson, but from information obtained by one of our men in the Canim area, this year, I think that if the work is carried as far south as 52 degrees of latitude, it will be sufficient for the time being.

In the matter of one-mile mapping, the most important work in the Province for the coming season will be the Zeballos River area. There is a topographic map of part of this area, a copy of which I am sending, under separate cover. I am asking the Surveyor-General [of BC] to extend topographic mapping of that area north-westerly and southeasterly along the trend of the granite stock in and near which the mineralization is found. The Ymir-Nelson area is still attracting attention. I would like to see the geology completed on a one mile to the inch of the fifteen minute sheet immediately to the north of the Salmo sheet. A topographic base map, however, is required, and I would not recommend further geological work in that area until the topographic base is ready. I presume that you would like to carry on topographic work there, but realize that your Topographic Division will probably be taxed to keep up with the other programme. If you feel that your Topographic Division cannot undertake the mapping of the Ymir-Nelson sheet, I shall be glad to ask the Surveyor-General to undertake that work.

The policy of the Survey, adopted some two or three years ago, to carry out the mapping of the Province at four miles to the inch, commencing with the International Boundary tier and one along the Grand Trunk Branch of the Canadian National Railways, is sound, and cannot be improved upon. This is the work we would like to see go ahead with all possible speed. We appreciate the opportunity of discussing geological survey field work with you, and in the matter of obtaining topographic base maps, I shall be very glad to ask our Surveyor-General to carry out work that will facilitate geological mapping.

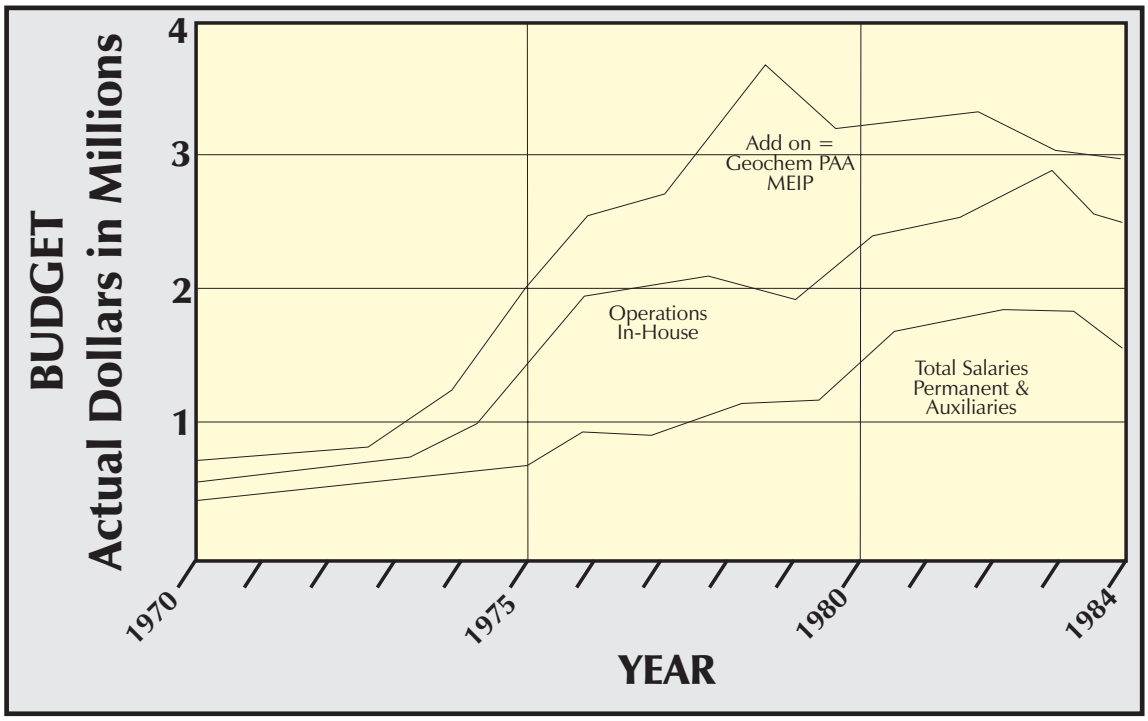
Kind regards.

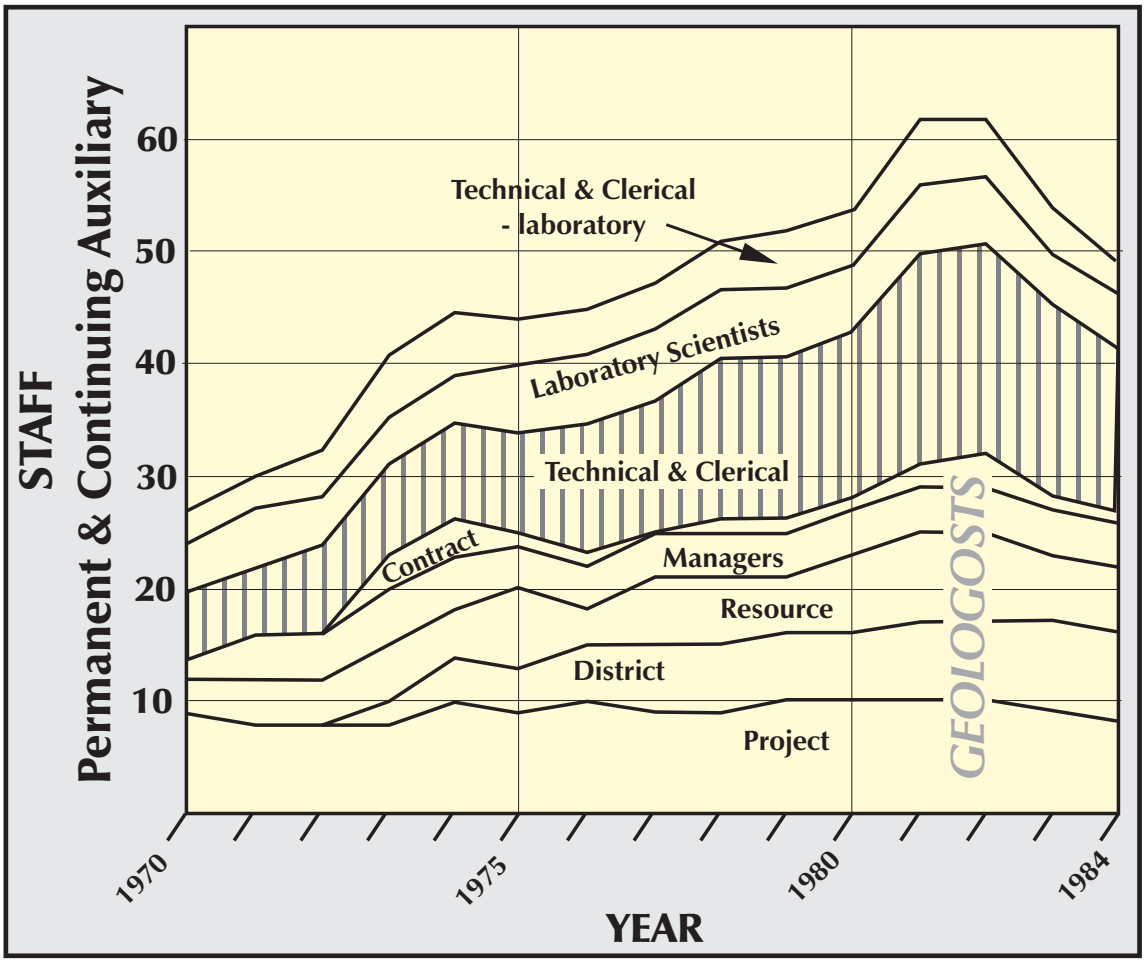
Yours very truly,
J.F. Walker
Deputy Minister of Mines

APPENDIX V
Organization, Staffing and Budget

a. Graphs of Staffing and Budget, 1970-1984.
b. Organization Chart and Staff, 1979.
c. Table of Budget, 1995-1996.
d. Organization Chart and Staff, 1995

Organization Chart and Staff, 1995





Organization Chart and Staff, 1979

ORGANIZATION CHART
GEOLOGICAL DIVISION - MINERAL RESOURCES BRANCH - 1979

RESOURCE DATA AND ANALYSIS

{vacant}	G.5
Special Projects	
K.E. Northcote	G.4
Z.D. Hora	G.4
Mineral Inventory	
{vacant}	G.3
G.L. James	S.A.4
J.E. Forester	R.O.2
A. Matheson	R.O.4
*C. Kenyon	
Clerks	
C. Ritchie	C. 3
E. Tait	A.O.1
{vacant}	A.O.1

**Temporary or Contract Employees*

APPLIED GEOLOGY

E.W. Grove	G.5
Prospectors Assistance	
A.F. Shepherd	G.4
G. Dickson	O.A.2
J. Novak	Lbr.1
*J. Bristow	
District Geologists	
Kamloops	
G.P.E. White	G.3
Smithers	
T.G. Schroeter	G.3
Nelson	
G.G. Addie	G.3
Prince George	
G.H. Klein	G.3
Charlie Lake	
R. Karst	G.2
G.V. White	Eng. Asst.
M. Parlee	O.A.2
Fernie	
D.A. Grieve	G.2

ANALYTICAL LABORATORY

W.M. Johnson	L.S.5
L. Parker	C.S.3
(Secretary)	
P.F. Ralph	L.S.4
(Deputy Chief)	
R.J. Hibberson	L.S.3
V. Vilkos	L.S.3
B. Bhagwanani	L.S.3
J. Kwong	L.S.2
M.A. Chaudhry	L.T.3
F.F. Karpick	L.T.4
L.E. Sheppard	L.T.1

PROJECT GEOLOGY

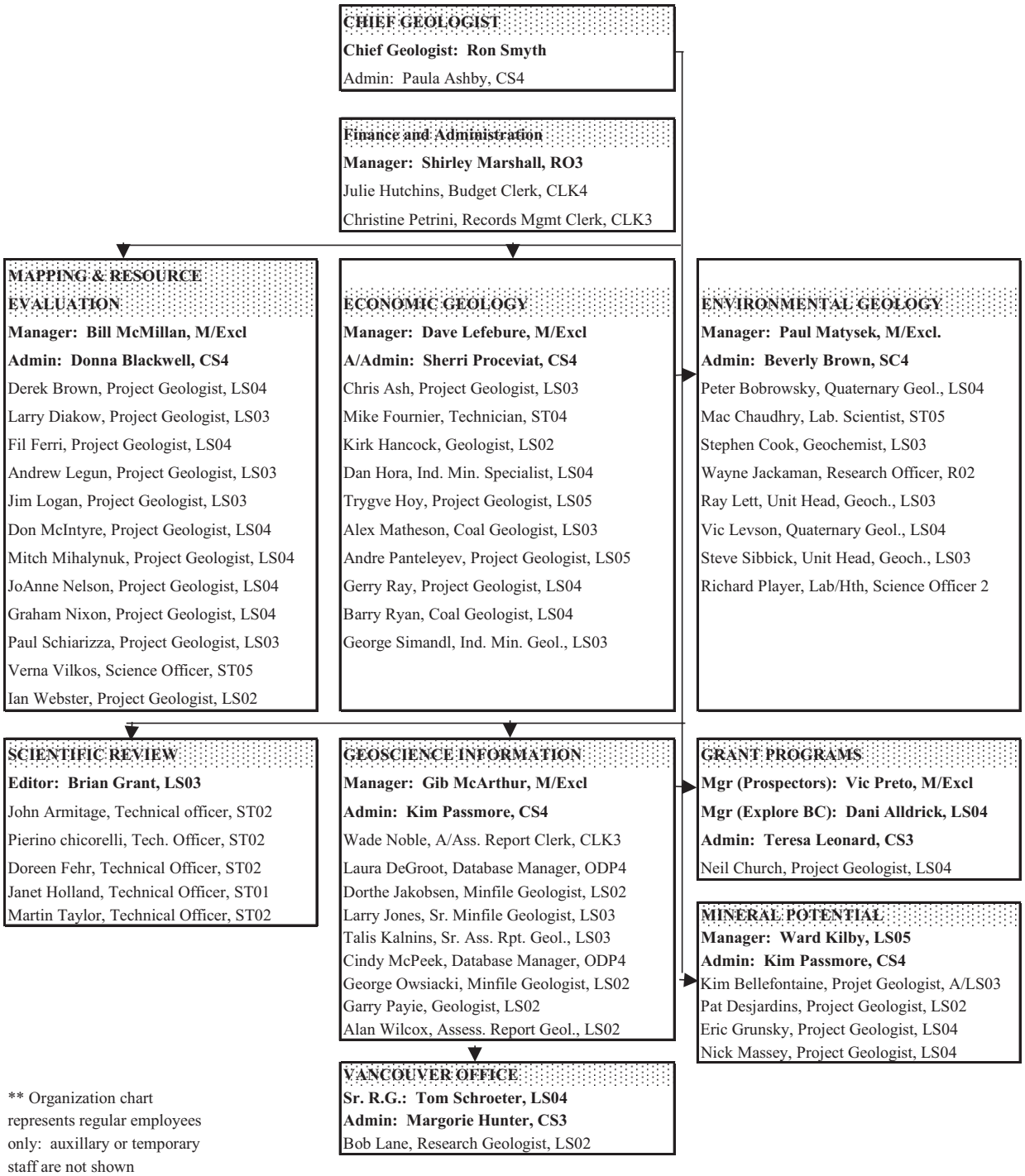
N.C. Carter	G.5
D. Bulinckx	O.A.2
(Receptionist)	
Geologists	
P.A. Christopher	G.3
B.N. Church	G.4
G.E.P. Eastwood	G.4
T. Hoy	G.3
W.J. McMillan	G.4
D.G. MacIntyre	G.2
A. Panteleyev	G.4
D.E. Pearson	G.4
V.A. Preto	G.4
R.D. Gilchrist	G.2
*T. Kalnins	
Draughting	
J. Armitage	T.A.4
R. Hoenson	T.A.3
P. Chircorelli	T.A.3
J. St. Gelais	T.A.3
Lapidary and Technical	
R.E. Player	Eng. Asst.
C.R. Cadwallader	Eng. Aide 2

Table of Budget, 1995 - 1996

Province: BRITISH COLUMBIA 1995-96
Geological Survey Branch

Category	No. of Projects	Permanent Positions	Casual Positions	A-Base Salaries	MDA Salaries	A-Base Operational $	MDA Operational $	Total $
Mineral Activities								
Bedrock Geology Surveys	8	16	3.75	$1,181,188	$149,486	$181,181	$176,621	$1,688,476
Geochemical Surveys	4	5.75	0	$345,001	$0	$270,766	$70,000	$685,767
Surficial Geology Surveys	4	2	1.95	$144,438	$97,506	$47,304	$85,494	$374,742
Mineral Deposit Studies	6	8.5	2.45	$725,213	$35,000	$211,048	$80,396	$1,051,657
Mineral Inventory Compilations	n/a	4.25	0	$254,307	$0	$36,529	$0	$290,836
Industrial Mineral Studies	4	4	0.3	$292,483	$0	$190,879	$0	$483,362
Mineral Resource Assessments	n/a	3	0	$189,367	$0	$164,603	$0	$353,970
District geologists/Vancouver Office	n/a	8	1	$488,345	$0	$388,270	$0	$876,615
Sub Total=	**26**	**51.5**	**9.45**	**$3,620,342**	**$281,992**	**$1,490,580**	**$412,511**	**$5,805,425**
Energy Activities								
Coal	2	1.5	0	$145,468	$0	$18,500	$0	$163,968
Oil & Gas	n/a	5	0	$438,000	$0	$74,000	$0	$512,000
Subsurface Analysis	n/a	4	0	$319,000	$0	$54,000	$0	$373,000
Sub Total=	**2**	**10.5**	**0**	**$902,468**	**$0**	**$146,500**	**$0**	**$1,048,968**
Other Activities								
Environment (hazards)	2	1.25	0.5	$133,462	$0	$54,178	$0	$187,640
Laboratories		1	0.3	$45,858	$0	$6,685	$0	$52,543
Chief Geologist's Office/Admin		5	0	$338,068	$0	$232,242	$0	$570,310
Sub Total=	**2**	**7.25**	**0.8**	**$517,388**	**$0**	**$293,105**	**$0**	**$810,493**
Misc Details								
Publications		6.64	0	$327,065	$0	$128,236	$0	$455,301
information/Assessment Files		4.25	0	$248,307	$0	$36,529	$0	$284,836
Research Grants		0	0	$0	$0	$94,000	$0	$94,000
Sub Total=		**10.89**	**0**	**$575,372**	**$0**	**$258,765**	**$0**	**$834,137**
Industry Grant Programs								
Prospectors Assistance		1	0	$62,962	$0	$422,141	$0	$485,103
Explora BC Grant Program		2.5	0	$172,726	$0	$1,682,312	$0	$1,855,038
Sub Total=		**3.5**	**0**	**$235,688**	**$0**	**$2,104,453**	**$0**	**$2,340,141**
			Total Mineral Survey Activities (GSB)				**Grand Total=**	**$6,942,477**

Organization Chart and Staff, 1995



** Organization chart represents regular employees only: auxillary or temporary staff are not shown

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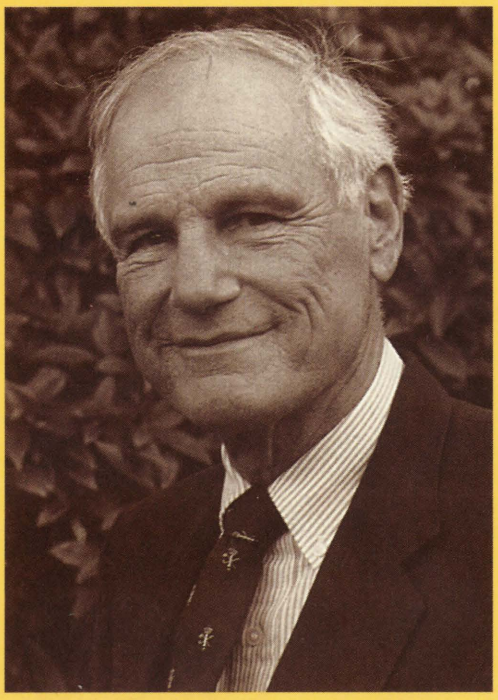
~ Brian Grant, P.Geo., Lima, 1998 ~

About the Author



Dr. Atholl Sutherland Brown

Dr. Atholl Sutherland Brown was born in Ottawa in 1923. He joined the then Mineralogical Branch in 1951, was deputy chief from 1971 to 1975, and then chief geologist of the Geological Survey from 1975 until 1984, when he retired early to become a consultant. Dr. Sutherland Brown has published widely, including a comprehensive geology of the Queen Charlotte Islands and a volume, published by the Canadian Institute of Mining and Metallurgy, on porphyry deposits in the Canadian Cordillera. In the 1980s he was President of both the Geological Association of Canada and the Canadian Geoscience Council. He also recently completed a book entitled "Silently into the Midst of Things" about his experiences as a pilot with the RAF in Burma during the Second World War.

This is the definitive history of an important branch of the provincial government and an introduction to the history of mining in British Columbia. It will serve as THE reference for years to come It will keenly interest historians, geologists, engineers, surveyors, members of the mining community and anyone curious about the historical development of British Columbia.

"This is a masterly account, written by a distinguished and respected insider, of a very technical institution with necessarily close links with government and business. The writing is uncommonly dense, concise, compact, and erudite."

— Dr. Richard Mackie
B.C. Historian

Geological Association of Canada - Pacific Section
Victoria, B.C.

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