



Mining in the Millenium

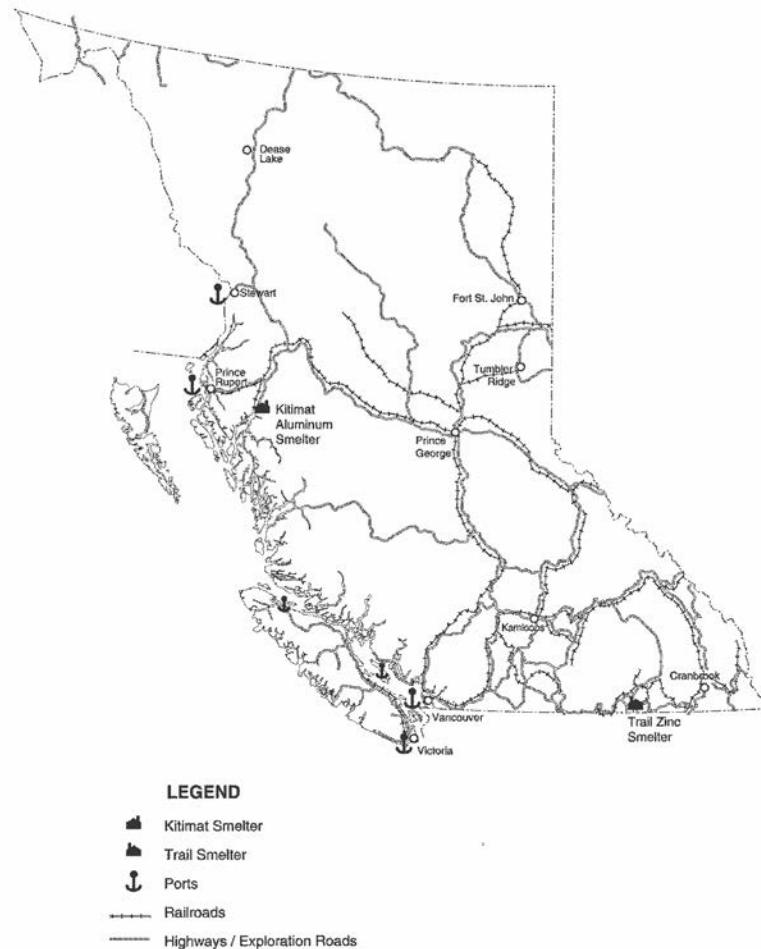
BCGS GeoFile 1998-01

By the British Columbia Geological Survey

British Columbia's Mineral Resources

Overview

Beginning in the mid-1800s, with the coal mines on Vancouver Island and the placer gold camps of the Cariboo, British Columbia (BC) has become one of the world's major mining regions. Today, BC is known for its high quality metallurgical coal, its giant open pit copper-molybdenum and copper-gold porphyry deposits, the world-class Sullivan lead-zinc mine, and the more recently discovered spectacular Eskay Creek silver-gold deposit.



British Columbia Infrastructure

British Columbia encompasses the largest part of the Canadian Cordillera, a mountain belt rich in minerals and coal. The province is an important producer and exporter of copper, gold, silver, lead, zinc, molybdenum, coal and industrial minerals.

British Columbia's mining industry is internationally recognized for its expertise in mineral exploration and mine development and today Vancouver is one of the great mining centres in the world.

With our abundant mineral resources, a skilled industry and a positive business climate, opportunities abound for growth in the mineral sector in the years ahead.

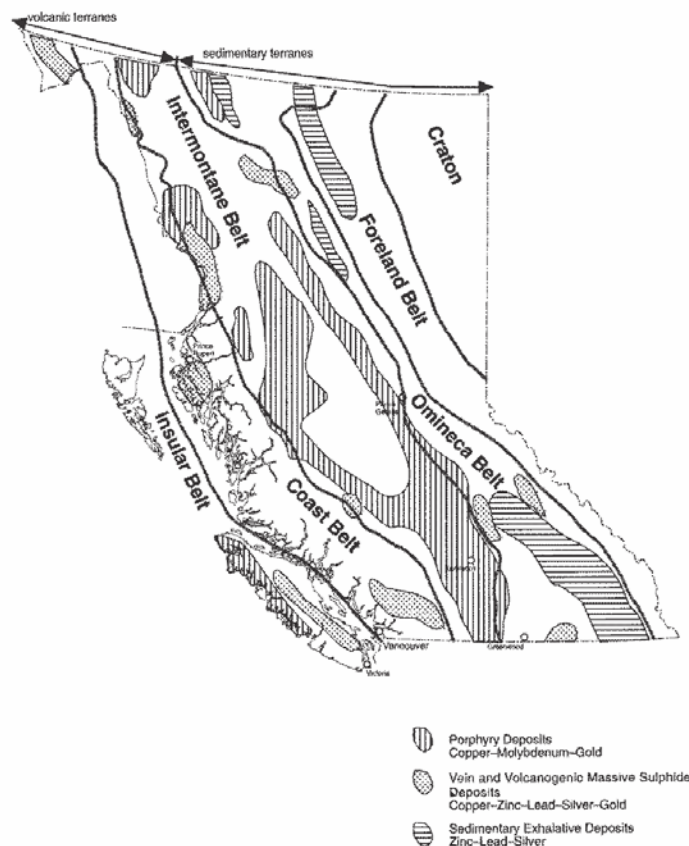
British Columbia is recognized as a centre of excellence in mining and related fields such as metallurgy, environmental engineering, geoscience research and assaying services. The foundation of this expertise is the domestic mining industry which produced an estimated 3.006 billion dollars' worth of coal and metallic mineral products in 1998. People employed in British Columbia's mineral industry -- mine and mill workers, engineers, geoscientists, managers and technical experts -- are highly skilled and productive. They, and BC mining companies, are in demand throughout the world. Vancouver is a major financial and technical centre for global mineral exploration and mining. British Columbia also produces a wide variety of structural materials and industrial minerals for local use and for export.

Eight coal mines operated in 1998; seven produce metallurgical coal and one produces thermal coal. There are eight base metal mines and six precious metal mines. The mining industry provides well-paid employment for approximately 14,000 individuals and an additional 15,000 to 20,000 indirect jobs in the supply, service and support fields.



Why BC is Rich in Minerals

The complex geological processes that formed the Canadian Cordillera are reflected in the abundance, variety and distribution of its mineral resources. Belts of distinctive rocks (called tectonic belts) each with a characteristic suite of mineral deposits, run northwest-southeast, approximately parallel to both the ancestral continental margin and the present coastline. As a result, the character of the province's mineral resources varies markedly from west to east. The dominantly volcanic terranes to the west contain deposits of copper, iron, gold, silver and molybdenum, while sedimentary rocks to the east are rich in lead, zinc and silver and a variety of industrial minerals. Most of the oil, natural gas and coal resources formed by various sedimentary processes, are located along the eastern margin of the Cordillera.



Tectonic Belts and Prospective Areas

The most important types of deposits include:

- metallurgical and thermal coal,
- porphyry copper-molybdenum, molybdenum and copper-gold deposits,
- sedimentary-exhalative lead-zinc-silver deposits,
- zinc and copper bearing massive sulphide deposits,
- mesothermal gold veins,
- epithermal gold-silver veins,
- base and precious metal skarns,
- a variety of industrial minerals including gypsum, limestone, magnesite and silica,
- structural materials including sand and gravel and aggregate.

Mineral Products

Commodity	Main Uses
Aggregate (At)	Construction and highway building, asphalt, concrete, graded fill, railroad ballast
Barite (Ba)	Filler for paint, paper and textiles; drilling mud
Building stone (Bs)	Rock suitable for use in construction based on its durability, attractiveness and economy
Chrysotile (Ch)	Brake linings, flooring products, pipe, insulation, cement, safety clothing, paper, yarn, filler
Coal (Cl)	Coke for steelmaking, fuel in powerplants to generate electricity
Copper (Cu)	Wire and electrical equipment, pipes and tubes, roofing, alloy for brass, bronze and coinage
Dolomite (Do)	Soil conditioner, ornamental aggregate, source of lime, flux, glassmaking, dimension stone
Fireclay (Fc)	Refractory ceramic products such as crucibles and firebrick
Flagstone (Fs)	Floors, retaining walls, pavement
Fuller's earth (Fr)	Domestic and industrial absorbents (Kitty litter), refining and decolourizing fats and oils; natural bleaching agent
Garnet (Gn)	Abrasives, semiprecious stone
Gold (Au)	Jewelry, international standard for world finance, electronic circuits, dentistry, coinage
Granite (Gr)	Decorative building stone, monuments and memorials; aggregate in concrete
Gypsum (Gy)	Wallboard and building materials, soil conditioner, portland cement, plaster of Paris, filler
Jade (Jd)	Jewelry, gemstone, carved articles, ornamental objects
Lead (Pb)	Automobile batteries, ammunition, glass, type metal, tubes or containers, gasoline additives
Limestone (Ls)	Cement, source of lime, construction aggregate, ornamental stone, soil conditioner, flux, fertilizer, paint, plastics, glass, sewage and water treatment
Magnesite (Mt)	Source of magnesia, refractory in steel furnaces and cement kilns, animal feeds, special cements, magnesium chemicals
Magnetite (Ma)	Heavy media separation for coal industry, source of iron
Marble (Mb)	Ornamental stone for buildings, memorials and statues; filler in paint and plastics
Molybdenum (Mo)	Hardening steel, alloy of iron and steel, jet engines, oil refining
Pumice (Pu)	Landscaping, lightweight aggregate, abrasives, baseball diamonds and sport tracks
Shale (Sh)	Making brick and tile, lightweight aggregate
Silica (Si)	Source of elemental silicon, steelmaking, flux, abrasives, memory chips in computers, glassmaking
Silver (Ag)	Photographic industry, electrical products, tableware, jewelry, mirrors, coinage, dentistry
Zeolite (Ze)	Agricultural applications, absorbents, molecular sieves used in numerous processes including oil refining
Zinc (Zn)	Plating or galvanizing for protection against corrosion, alloys, chemicals and medicines

Mineral Deposits of the Ancient Continental Margin

The Foreland and Omineca belts are underlain by cratonic rocks of the ancient Canadian Shield and overlain by material deposited as a result of three main episodes of rifting (fractures in the earth's crust). These episodes created basins into which thick wedges of sediment were deposited.

The initial event, some 1,200 million years ago (Middle Proterozoic time), produced sedimentary sequences many kilometres thick. Sediments from this time host the world class Sullivan lead-zinc-silver sedimentary exhalative (sedex) deposit in southeastern British Columbia.

Some 700 million years ago (Late Proterozoic time), a second rifting event occurred along the length of the Cordillera. Volcanic debris in the sediments provides evidence of associated explosive volcanic activity.

A major episode of metal enrichment accompanied the third (mid-Devonian to early Mississippian) rifting event about 380 to 350 million years ago. This led to the formation of barite-lead-zinc-silver deposits (sedex type) in the Selwyn Basin and the Kechika Trough. One such deposit, the Cirque (Stronsay) deposit in northern British Columbia, has been approved for mine development. Others are at an advanced stage of exploration and new discoveries have recently been made. In the Rocky Mountains, carbonate rocks of similar age host lead-zinc deposits (Mississippi Valley-type).

Mineral Deposits of the Cordillera

The younger, mainly volcanic rocks of the Intermontane and Insular belts were attached to the western edge of the continent 160 to 60 million years ago. The granitic rocks of the Coast belt were formed during these activities. The Intermontane, Insular and Coast belts host polymetallic massive sulphide, porphyry, skarn, and mesothermal vein type deposits.

Massive sulphide type deposits have been an important source of British Columbia's production of copper, zinc and silver. They remain favourite exploration targets because they are multi-element and can be very rich. The high grade Eskay Creek gold-silver deposit, for example, discovered in 1988 in the north-western part of the province has sparked exploration interest in finding other examples of this relatively unique type of deposit.

Very large, porphyry type, copper-molybdenum and copper-gold deposits produce most of the province's copper, all the molybdenum and significant amounts of gold and silver.

Significant copper, gold and iron production has been obtained from skarn type deposits.

Gold vein deposits have been mined along the length of the North American Cordillera from Cassiar in the north to Bralorne in south and to the Mother Lode district of northern California.

Coal Deposits

Coal occurs in younger sedimentary basins in all the tectonic belts. The most important in terms of production and size are the Rocky Mountain coalfields in the Foreland Belt.

Opportunities

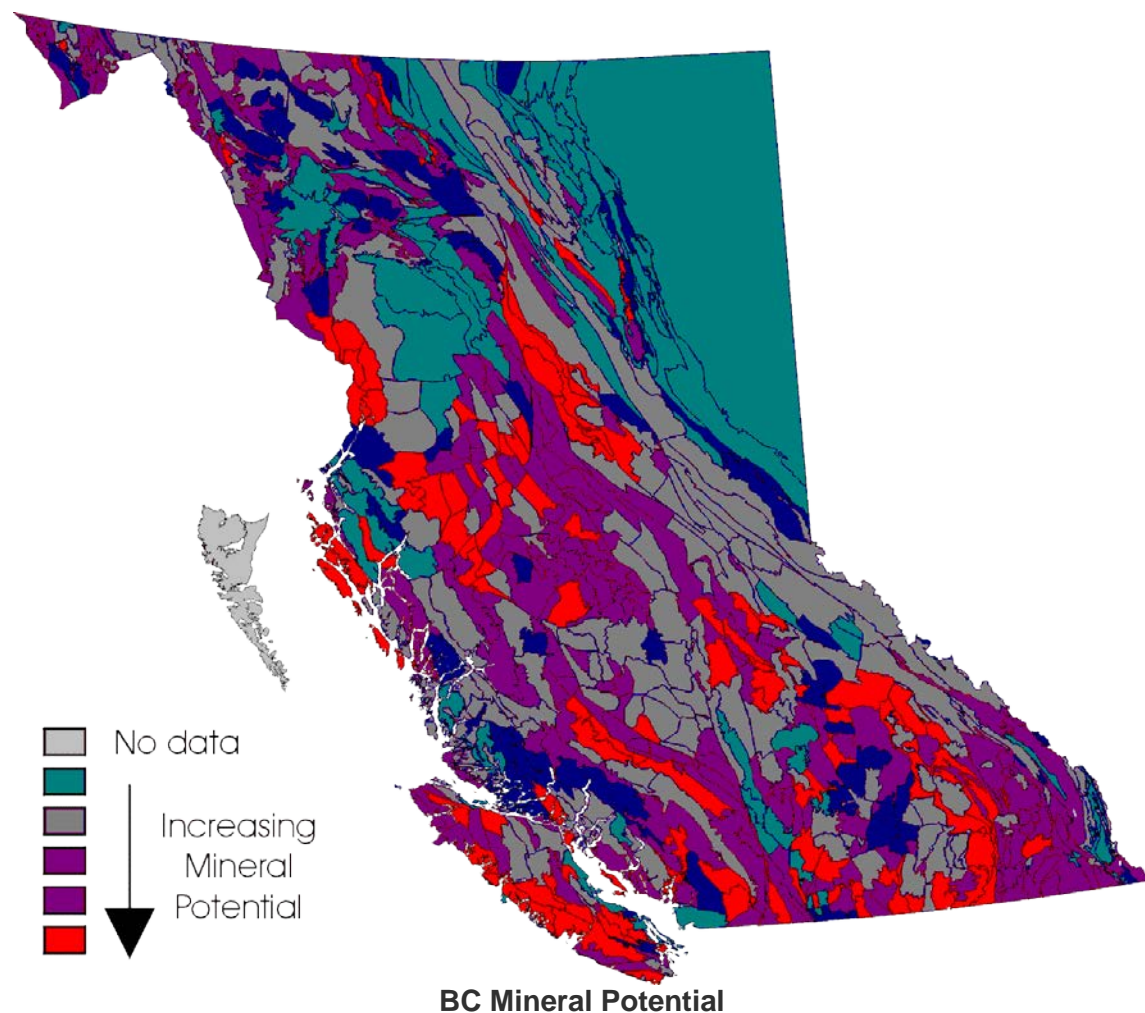
There are significant investment opportunities in British Columbia's mineral sector.

Our vast land base, favourable geology and abundant mineral resources hold promise for the discovery of new mines. New technology and an improved geological database are the keys to unlocking the mysteries of areas previously explored and modern approaches will lead to new and unexpected discoveries.

British Columbia's exceptional geoscience database is continually being updated and is readily available at low costs.

Recent new legislation and tax incentives highlight the government's commitment to the mineral sector. A large percentage of the land base has now been zoned for land use and most of it is open for mining and exploration.

Other opportunities include development of new markets and new products, particularly for structural materials and industrial and "high-technology" minerals.



Commodities

1998 FORECAST VALUE OF SOLID MINERAL PRODUCTION IN B.C .

Commodity	Quantity (millions)	C\$Value (millions)	Percentage Total Value
Gold	21.7g	303.9	10.1%
Silver	451g	118.8	4.0%
Copper	277.1kg	681.3	22.7%
Lead	31.3kg	24.4	0.8%
Zinc	153.6kg	231.4	7.7%
Molybdenum	7.6kg	82.4	2.7%
Other Metals		21.4	0.7%
Total Metals		1463.6	48.7%
<u>Coal</u>			
Metallurgical	23.7t	1042.5	34.7%
Thermal	1.6t	45.4	1.5%
Total Coal	25.3t	1087.9	36.2%
Industrial Minerals		49.9	1.7%
Structural Materials		404.3	13.4%
Total Solid Minerals		3005.6	100.0%

NOTE: Prices are F.O.B. for metals only. Source:
MEI Stats. & NRCan.(Feb.3, 1999)

Copper

History

Copper has long been a mainstay of the province's metal mining industry. Significant copper production dates from the turn of the century.

In 1963, the development of the [Bethlehem](#) porphyry copper mine in the Highland Valley southwest of Kamloops heralded a wave of exploration and mine development throughout the province. The Highland Valley has been the province's leading copper-producing district since the opening of the [Lornex](#) mine in 1972. As a result of exploration and development in the 1960s, 1970s, and 1990's, open-pit mining of porphyry deposits accounts for almost 90 per cent of British Columbia's copper production and all of the molybdenum production.

The other important source of copper is volcanogenic massive sulphide deposits which also contain gold, silver, lead and zinc.

In recent years copper has vied with coal as the most important mineral commodity mined in British Columbia.

Current Production

Copper production in 1998 is forecast to total 277.1 million kilograms.

The lion's share of the copper production comes from the [Highland Valley](#) copper mine which is one of the largest operations in the world.

Production at the [Kemess South](#) deposit began in May 1998 and estimated annual copper production is expected to be 27,220 kilograms.

A number of porphyry copper deposits are in the advanced exploration stage, including [Prosperity \(Fish Lake\)](#), [Mt. Milligan](#) and [Red Chris](#). The [Tulsequah Chief](#) copper-lead-zinc-silver-gold deposit in northwest British Columbia received Environmental Assessment approval in 1998 and is poised for development.

Potential

There are currently more than 100 known undeveloped deposits in the province that contain copper resources and exploration continues to locate new mines. The [Kemess](#) porphyry copper-gold deposit in northeastern BC, for example, was discovered in 1983 under 3 to 24 metres of till.

The use of solution extraction electrowinning (SX-EW) technology to recover copper from low-grade copper resources is a relatively new innovation for British Columbia and promises to become increasingly important. This process is currently utilized at the [Gibraltar](#) mine to produce 2,300 tonnes of cathode copper annually from low-grade stockpiles and waste dumps. A number of other lower grade deposits in the province could become economically attractive because of SX-EW technology.

The potential for other types of copper deposits exists throughout the province, including basaltic copper, sediment-hosted copper and copper-nickel deposits. To date, no large basaltic copper deposits have been mined in British Columbia. However, the [Sustut](#) deposit in the northern part of the province has geological reserves estimated at 50 million tonnes with a grade of 1.25 per cent copper. There are also a number of sediment-hosted copper-silver deposits, including the Troy mine in neighbouring Montana, which are hosted by rock units that extend into British Columbia.

Gold

History

Nearly eighty per cent of the gold production in BC has come from mesothermal veins, epithermal veins and skarns. Veins and skarns were the major source of gold until the development of porphyry deposits in the early 1970s. Annual gold output subsequently increased steadily until 1991 when it hit a 3-year decline. In 1995 the annual gold output increased due, in part, to the production of gold as a by-product from newly developed porphyry copper mines. The increase was also due to production from several epithermal and mesothermal veins and the very rich [Eskay Creek](#) massive sulphide deposit in northwestern British Columbia.

Current Production

Mesothermal veins continue to be an important source of gold. Recovery from volcanogenic massive sulphide deposits accounts for less than 10 per cent of historic gold production, but this proportion has recently increased due to the output from the [Eskay Creek](#) mine.

Production in 1998 totalled 21.7 million grams.

The [Quesnel River \(QR\)](#) mine closed in March 1998 due to high production costs and low gold prices. Production at the [Kemess South](#) porphyry deposit began in May 1998 with estimates indicating an annual gold production of 7,775 kilograms.

New gold production will come from mining the next generation of porphyry copper deposits. Many contain significant quantities of gold; for example, [Red Chris](#), [Prosperity \(Fish Lake\)](#) and [Mt. Milligan](#). Development of volcanogenic massive sulphide deposits, such as the [Tulsequah Chief](#) will also contribute to the province's gold output.

Potential

There are currently more than 100 known undeveloped deposits in the province that contain gold resources.

Mesothermal and epithermal veins continue to attract exploration and development interest, including [Specogna \(Cinola\)](#), [Blackdome](#), [Bralorne](#) and [Polaris-Taku](#).

At the Harmony Gold [[Specogna \(Cinola\)](#)] project on Graham Island, Queen Charlotte Islands, a geological re-interpretation of the host volcanic complexes has identified many new exploration targets.

The potential for low grade, large tonnage gold deposits, like Fort Knox, Alaska and Dublin Gulch in the Yukon, is attracting exploration interest in British Columbia. Recent developments in understanding the controls on gold mineralization along the Carlin Trend in Nevada suggests that the Canadian Cordillera could have deposits of this type.

Lead, Zinc, and Silver

History

The giant [Sullivan](#) mine in southeast British Columbia has dominated lead and zinc production in British Columbia for the past 50 years and, for many years, it was the largest lead-zinc producer in the world. The [Sullivan](#) mine has produced almost 93 per cent of the zinc, 82 per cent of the lead and 23 per cent of the silver mined in the province.

The [Eskay Creek](#) mine reported proven and probable reserves of 1,356,240 tonnes grading 58.05 grams per tonne gold and 2684.57 grams per tonne silver as of January 1, 1998.

Significant production of lead, zinc and silver has also come from volcanogenic massive sulphide deposits and from polymetallic veins. Epithermal and mesothermal gold veins and some porphyry deposits have also been important sources of silver.

Current Production

Canada is the world's largest producer and exporter of zinc and the third largest producer of lead, ranking behind the United States and Australia. Both metals are commonly produced

together, with considerable by-product silver. In 1998, BC produced 31.3 million kilograms of lead, 153.6 million kilograms of zinc and 451 million grams of silver.

Concentrates are smelted and refined at the Trail smelter, which was recently upgraded to increase both lead and zinc output.

Porphyry copper deposits produce significant by-product silver; for example, the [Highland Valley](#) copper mine produced 56,148 kilograms of silver in 1997.

Most of the balance of British Columbia's zinc and silver production comes from two volcanogenic massive sulphide deposits – the [Myra Falls](#) mine, and the [Eskay Creek](#) gold-silver mine. [Eskay Creek](#) is the fifth largest silver producer in the world and one of the highest grade precious metal deposits ever discovered in North America.

Potential

The [Sullivan](#) ore body belongs to the class of sediment-hosted exhalative (sedex) deposits that are prolific producers of lead and zinc. Other examples are found in the Kechika Trough in northern British Columbia. Sedex deposits are attractive exploration targets and British Columbia is fortunate to contain numerous belts of prospective Proterozoic and Paleozoic sedimentary rocks.

Metamorphosed (altered) sedimentary terranes, like the Shuswap Complex, have potential for Broken Hill-type high grade silver-lead-zinc deposits. In addition the province has a number of Mississippi Valley-type and polymetallic manto deposits with sizeable reserves of silver, lead and zinc. Advances in the understanding of such deposits in the last 15 years make them attractive exploration targets.

The recent discovery of the Kudzu, Ze Kayah and Wolverine massive sulphide deposits in the Yukon-Tanana terrane in the Yukon has awakened interest in correlative rocks in northern British Columbia.

The [Eskay Creek](#) discovery underlines the potential for finding gold and silver-rich deposits in correlative rocks throughout British Columbia, particularly in the north.

Molybdenum

History

Large-scale and continuous production of molybdenum began in British Columbia in the 1960s with development of the [Boss Mountain](#) and [Endako](#) porphyry mines. Prior to that, minor production came from the [Coxey](#) skarn in southern British Columbia. Molybdenum is also an important by-product in many copper porphyry deposits.

Current Production

Canada ranks fourth in the world for molybdenum production, after the United States, China and Chile, and virtually all of this comes from British Columbia.

Currently, the [Endako](#) porphyry molybdenum mine is the primary producer of molybdenum in the province, and accounts for more than 80 per cent of total production.

Three of the six operating open-pit porphyry mines, [Highland Valley](#), [Gibraltar](#) and [Huckleberry](#), produce about 1,700 tonnes annually of by-product molybdenum.

Potential

The potential for new mines that would produce molybdenum in British Columbia is excellent. Several porphyry molybdenum deposits are undeveloped and a number of undeveloped porphyry copper deposits contain significant amounts of molybdenum.

Coal

Coal is British Columbia's most economically important mineral product. Production in 1998 was valued at over \$1 billion.

Two modern ports, Robert's Bank near Vancouver and Ridley Island near Prince Rupert on the north coast, can handle 38 million tonnes of coal exports annually and have storage capacity for 4.4 million tonnes.

Coal resources in the province total 2.15 billion tonnes of metallurgical coal and 880 million tonnes of thermal coal. Most of the metallurgical coal resource is along the eastern edge of the province, mainly in the Peace River coalfield in the northeast and the Kootenay coalfield in the southeast. Most thermal coal resources are located in central British Columbia and on Vancouver Island.

Coalfields of Northeast and Southeast BC

The Kootenay coalfield in southeast British Columbia has produced more than 200 million tonnes of metallurgical coal and 10 million tonnes of thermal coal. Today coal is produced from five open-pit mines ([Fording River](#), [Greenhills](#), [Coal Mountain](#), [Line Creek](#), and [Elkview](#)) considered to be some of the most modern and productive in the world. The coal rank varies from high-volatile A bituminous to low-volatile bituminous. The coal is characterized by low sulphur content and makes excellent coke. The coal produces low coke-oven pressures, which makes it a prime component in the coking-coal blends of many steel mills.

In the Peace River coalfield in northeast British Columbia two mines, ([Bullmoose](#) and [Quintette](#)) produce close to 6 million tonnes of metallurgical coal a year. These mines began producing in the early 1980s and have shipped over 80 million tonnes. The coal, sold exclusively for coke making, has a rank of medium volatile bituminous. There are plans to open a new open-pit mine, [Willow Creek](#), which will produce about 900,000 tonnes of thermal and metallurgical coal annually over a proposed mine life of 15 years.

Vancouver Island Coalfields (Insular Coalfields)

A number of coalfields on Vancouver Island were extensively developed in the early 1900s and produced over 65 million tonnes of thermal coal prior to 1950. The underground [Quinsam](#) mine in the Comox coalfield near Campbell River is the only current producer. Quinsam Coal Corporation is also exploring the [Tsable River](#) deposit a few kilometres south of the present mine. There, the company plans to develop a second underground mine with up to one million tonnes per year production capacity. The coal rank is high-volatile A bituminous.

Central BC Coalfields (Intermontane Coalfields)

There are a number of coalfields in the interior of the province. The Telkwa coalfield is 400 kilometres from the Ridley Island coal terminal and close to the existing unit-train rail line that serves the Peace River coalfield. Exploration is in the advanced stage and Manalta Coal Limited plans to develop a 1.5 million tonne per year thermal coal mine ([Telkwa Coal](#)) with an expected mine life of 23 years. The coal rank is high-volatile A bituminous. Tests indicate that it will make

an excellent thermal coal product. Reserves are estimated at 50 million tonnes. This project is currently in the Environmental Assessment Process.

The Tulameen coalfield is the focus of recent exploration.

Other known resources include the [Hat Creek](#) deposit which contains up to five billion tonnes of lignite and sub-bituminous coal, and the Klappan coalfield, with nearly a billion tonnes of anthracite. Both deposits were extensively explored in the 1980s.

Industrial Minerals

Industrial minerals comprise a significant component of British Columbia's mineral production. Products such as limestone, silica and gypsum are processed locally and sold in local and regional markets. Other commodities, such as sulphur, magnesia and clay products, have international markets. There is significant growth potential in this sector with investment opportunities in many different fields such as dimension stone, refractory minerals, wollastonite, talc, high unit value products such as silicon, magnesium metal and others.

Limestone

For more than one hundred years, British Columbia has been the main source of limestone for the Pacific Northwest. Two production centres ([Gillies Bay](#), [Imperial](#), [Blubber Bay](#)) on Texada Island in the Strait of Georgia ship between four and five million tonnes of limestone annually to lime and cement plants along the Pacific Coast from northern California to Alaska. The value of cement, lime and limestone produced in British Columbia exceeds \$170 million annually. White limestone for extender and filler applications is produced from two deposits on the coast, and one in the interior. The present production rate of over 100,000 tonnes a year has significant potential for growth. About 200,000 tonnes of chemical lime is produced annually from the Marble Canyon limestone belt near Clinton.

Major limestone resources are located on the west coast of Vancouver Island in the Holbert Inlet and Quatsino Sound areas. Many potential limestone resources are also known in the interior.

Sulphur

About 1 million tonnes of sulphur are produced annually as a by-product primarily from processing natural gas. There is further potential for ultrasour natural gas pools and potential Frasch sulphur deposits.

Magnesite

The [Mount Brussilof](#) magnesite mine in the Rocky Mountains opened in 1979. It produces about 180,000 tonnes annually. Magnesite is processed into high-purity caustic and fused magnesia that have world-wide markets. Other undeveloped stratabound magnesite resources with good economic potential are known in the southeastern part of the province.

Silica

Approximately 150,000 tonnes of glass and metal-grade silica has been produced annually from two locations in southeastern British Columbia since 1980. The productive horizon is a massive quartzite unit that occurs over a length of 100 kilometres. A similar unit is known west of Prince George but has not been developed.

Clay Products

About 40,000 tonnes of refractory clay products valued at over \$10 million are manufactured annually near Vancouver at Abbotsford. This operation uses mostly local raw materials, and manufactures both high-alumina and light-weight insulation refractory bricks. The standard refractory bricks are sold throughout the Pacific Northwest area while the insulation production is marketed world-wide.

Diatomaceous clay-based industrial and domestic absorbents valued at \$400,000 annually are also produced in the province, at Kamloops, and exported to markets in western and central Canada and overseas.

Gypsum

The British Columbia gypsum industry, concentrated in the southeast part of the province, supplies cement and wallboard manufacturers in both Alberta and British Columbia. A number of undeveloped gypsum deposits should ensure that this \$7 million business will be able to maintain the current annual production of 500,000 tonnes well into the 21st Century.

Other Industrial Minerals

British Columbia produces jade and rhodonite as semiprecious stones from several locations in the central and northern parts of the province. Barite, for drilling mud and filler applications, is mined in the southeastern and northeastern parts of the province. There has been a recent revival of the dimension stone industry and today 15 varieties of granite and two of marble are quarried in the southeast part of the province and on Vancouver Island. There are three modern processing plants in Vancouver.

Industrial mineral development and exploration opportunities are too numerous to describe in detail. Garnet occurs in placer and hardrock deposits. Tertiary basins have development potential for zeolites, bentonite, residual kaolin and perlite. Extensive peat deposits occur in the northern coast and northeastern areas of the province. Major asbestos deposits are known in the northwest and there is current fibre recovery from tailings from the old Cassiar mine. Several wollastonite deposits are the target of exploration programs, including a major discovery at Zippa Mountain near the Iskut River in northwestern British Columbia. Reserves at Zippa Mountain are in excess of 1.8 million tonnes at a grade of 80 per cent. Talc and white limestone deposits offer development opportunities to supply Pacific Northwest pulp and paper producers.

Refractory minerals such as magnesite, olivine, kyanite group aluminosilicates, graphite and silica are known in many parts of the province. Processing these materials into specialized products that are able to withstand very high temperatures consumes large quantities of electricity, which British Columbia can supply at very competitive rates. Gem quality blue sapphires have been discovered near Nelson and precious opals have been discovered in Tertiary volcanic rocks near Vernon.

Phosphate horizons in southeastern British Columbia also have significant values of yttrium and other rare earth elements. There are significant deposits of niobium and rare earth elements in areas of the Rocky Mountains.

Mineral Processing Opportunities

Opportunities exist in British Columbia to locate energy intensive industrial mineral processing plants to produce value-added products for export and to replace imports. British Columbia's ample supply of low-cost electricity and natural gas provides a competitive edge. Examples of specific opportunities include refractory products, synthetic ceramics and silicon metal.

BC Advantages

British Columbia offers many advantages, including: good infrastructure, a skilled labour force, technical support and established capital markets. One of the most outstanding advantages is the exceptional geoscience database.

The Geoscience Database

The Ministry of Energy and Mines, through the BC Geological Survey and regional offices of the Mines Branch, collects and disseminates geoscience information to the mining industry, the government and the public.

A great deal of information documenting results of geological and geochemical surveys, coal and mineral deposit studies, research by ministry staff, and exploration activity is available in a number of Branch and external publications.

Through the BC Geological Survey's [MapPlace](#) website, multiple databases can be accessed and searched. The results can be viewed on a map of your choosing. Data and maps can also be downloaded.

MINFILE

MINFILE is a computerized mineral inventory system containing geological and economic information on 12 000 metallic mineral, industrial mineral and coal occurrences in British Columbia. The system is a "desktop prospecting" tool used for planning exploration programs, investment, resource management, policy planning, land use planning, teaching and research. MINFILE is recognized internationally as an exceptional geoscience information system.

Geochemistry database

The Regional Geochemical Survey database consists of high-quality, multi-element analytical data, field observations, lithological data and site locations for stream sediment and water samples. These samples have been collected from approximately 43,000 sites across British Columbia, at an average density of one site every 13 square kilometres. Many new mineral prospects have been discovered and a number of areas previously thought to have little mineral potential have been investigated as a result of these surveys.

This database is useful for exploration work, regional metallogenic studies, geological interpretations and projections, land use decisions and environmental studies.

Property File

Property File is a library of research material on many of the mineral occurrences documented in the MINFILE database. The material in Property File consists of news clippings, field notes, company documents, historical information, geology, geochemistry, geophysics, drilling data, claim maps, sketches of workings and photographs. Most of these are unique documents, and are extremely valuable to researchers. This library is available for public viewing and copying.

Mineral Assessment Reports

In British Columbia, Assessment Reports documenting mineral exploration programs are submitted by the mining industry to maintain mineral tenure. More than 25,000 reports, submitted since 1946, are available for viewing as originals or for purchase in microfiche format. These reports are also catalogued in ARIS, a computerized index.

[Coal Assessment Reports](#)

The BC Geological Survey maintains a large library of Coal Assessment Reports, that have been submitted by companies in compliance with the *Coal Act*.

Exploration data from the Assessment Reports have been summarized and stored in a computer information system called COALFILE, which provides a quick and efficient method for accessing the large volume of data.

[Data on the Internet](#)

Interpretative geology and mineral potential maps, at 1:250 000 scale, are available on the Internet at "[The MapPlace](#)". These maps were prepared so that the best possible assessment of the mineral resources of British Columbia is available for land use planning and exploration planning.

The MapPlace provides map-based Internet access to many of the Ministry's geological and tenure information data sets. This information may be searched and viewed interactively in map format and some of the data can be downloaded for use in desktop mapping or GIS programs.

The data sets available include mineral potential assessments, geology, MINFILE data, RGS data, indexes geological mapping and reports, mineral titles information and more.

[Mineral Tenure](#)

A Free Miners license is needed then title to minerals is acquired by locating and recording a claim. Claims can be changed to a lease for production purposes. Coal title is acquired by license, which can also be changed to a lease.

Tenure to minerals and coal is administered by the Mineral Titles Branch through two Ministry offices and a network of Government Agent offices throughout the province. There are 24 mining divisions arranged into 7 regions; each region has a Gold Commissioner who is statutorily responsible for the recording of titles and related documents for mineral tenures within that region.

The Mineral Titles database is available on the Internet at The MapPlace as a map theme.