

# Industrial Minerals in British Columbia

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## INDUSTRIAL MINERAL OPERATIONS

The total value of solid mineral production (including precious metals, base metals, coal, structural materials and industrial minerals) was estimated at \$2.84 billion dollars for the year 2000. Industrial minerals and structural materials represent 1.8% and 14.7% of the total, respectively (Schroeter *et al.*, 2001). These operations are located mainly in the southern half of the province, close to existing infrastructure and markets. The most economically significant industrial minerals produced are: sulphur, magnesite, white calcium carbonate, limestone, silica, dimension stone, gypsum, construction aggregate and crushed rock. Commodities produced in lesser quantities include jade (nephrite), magnetite, dolomite, barite, volcanic cinder, pumice, clay, fuller's earth and zeolites. There are more than 40 mines or industrial mineral quarries at present (Figure 1) and at least 20 major sites where upgrading of industrial minerals into value-added products takes place (Figure 2), not counting the aggregate operations listed by the British Columbia Aggregate Producers Association.

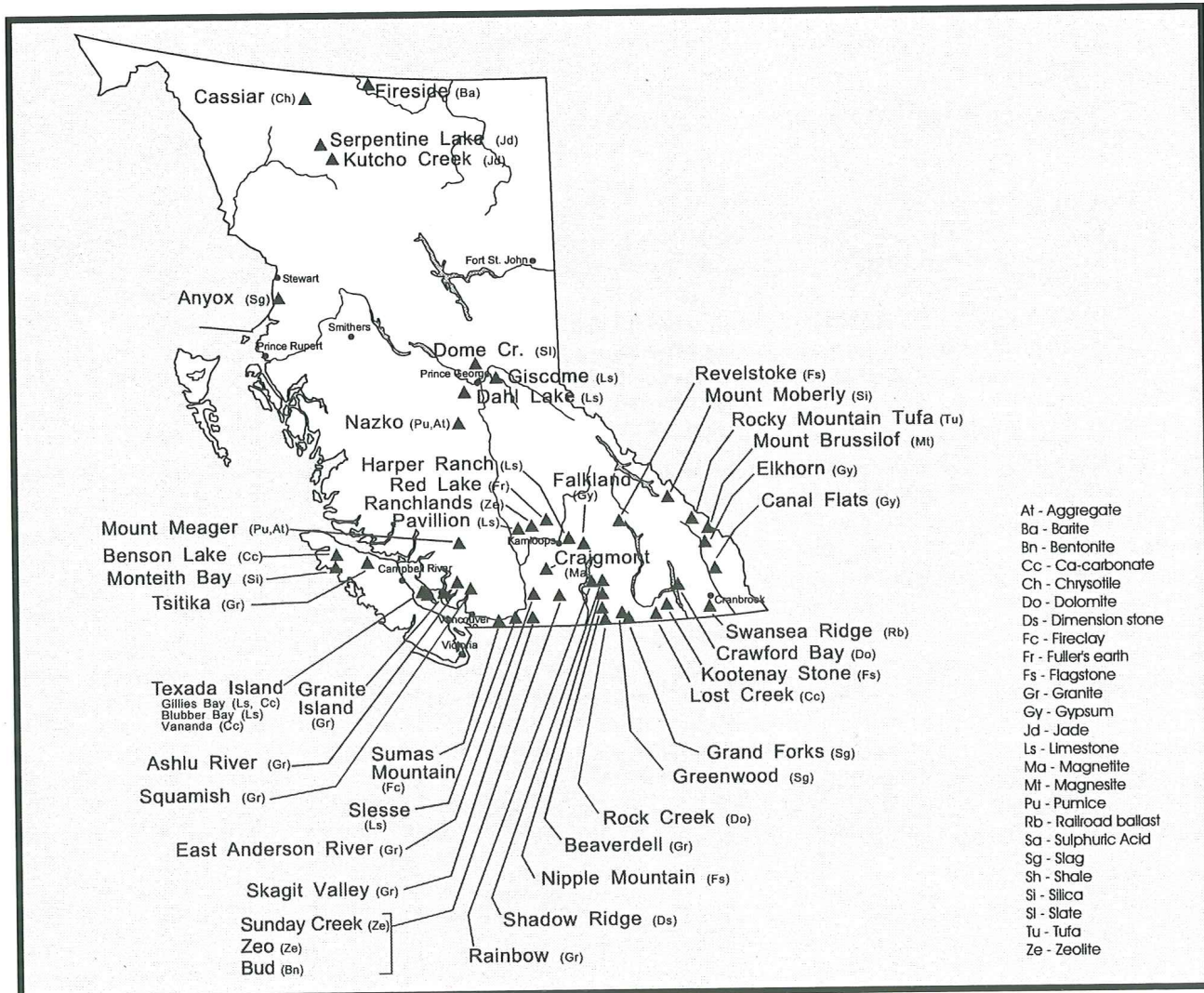


Figure 1. Operating Industrial Mineral Mines in British Columbia.



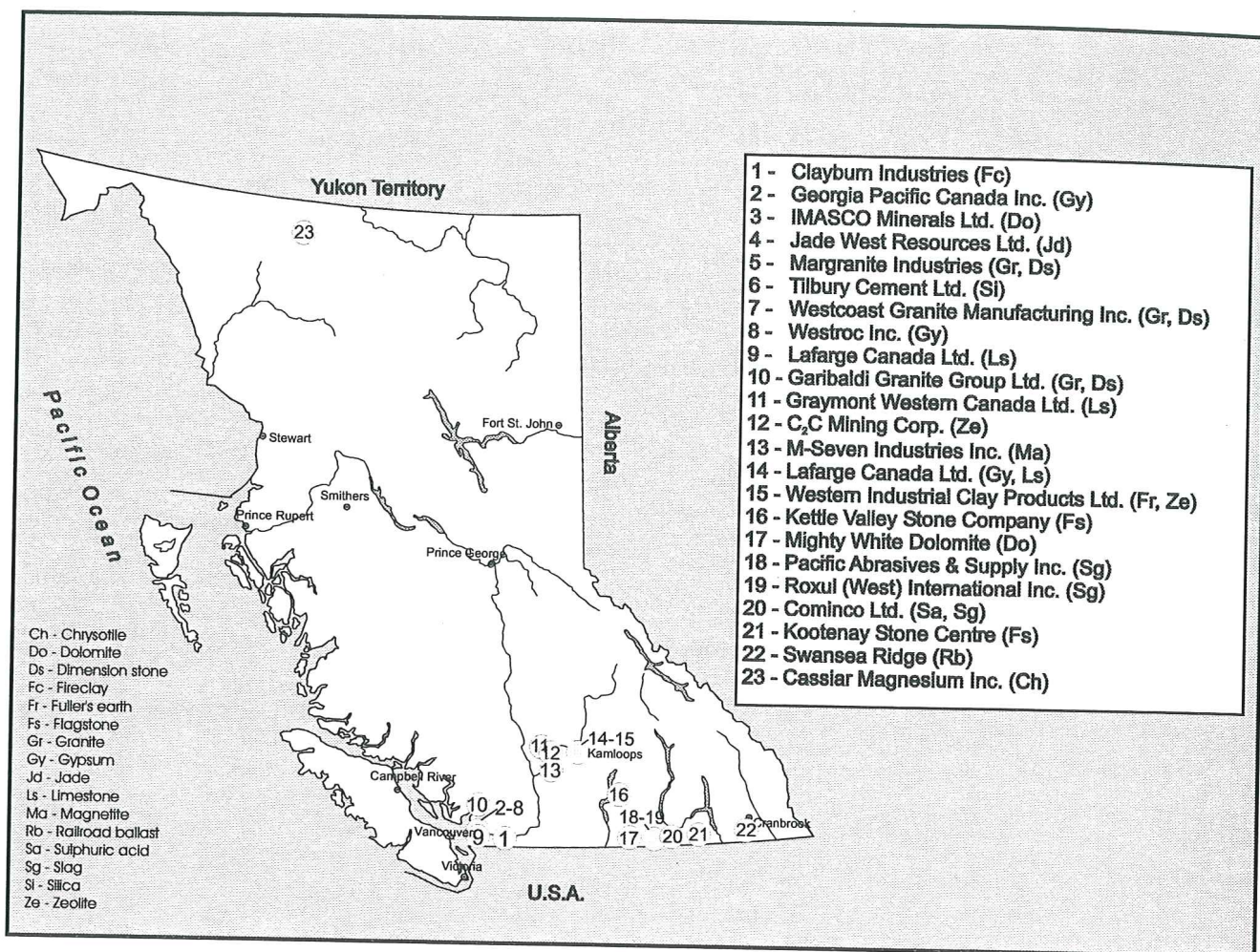


Figure 2. Industrial Minerals Processing Plants in British Columbia.

**Sulphur**, a by-product of natural gas, is produced at a number of processing plants in the northeast of the province by West Coast Energy Inc., Petro-Canada Inc., TransCanada Midstream, and Amoco Canada Petroleum Company Ltd. Liquefied SO<sub>2</sub> and sulphuric acid are also produced at Cominco's smelter in Trail.

In the Rocky Mountains, Westroc Inc. is producing approximately 500 000 tonnes of **gypsum** from its **Elkhorn I** and **II** quarries near Windermere. Reserves are expected to last approximately ten years. During 1999 and 2000, Westroc conducted a modest exploration program on its **Kootenay West (Koot)** gypsum property northeast of Canal Flats. It is not likely to shift its production to this deposit before 2005. Georgia Pacific Canada Inc. is mining gypsum from its **Four J** quarry southeast of Canal Flats. Both Westroc and Georgia Pacific also operate wallboard plants in the Vancouver area. The Georgia Pacific plant is dependent, to a large extent, on imported materials and supplements their raw gypsum needs with recycled gypsum. The Westroc plant is supplied by the Elkhorn quarries. Lafarge Canada Inc. also mines a small quantity of gypsum from its **Falkland** pit for its own cement plant near Kamloops.

Baymag Mines Company Ltd. continues to mine **magnesite** at **Mount Brussilof** at a rate of about 200 000 tonnes annually. Over the last ten years, improvements in grade control and systematic blending of magnesite from different parts of the mine has resulted in a very consistent feed for the sintering plant. The company has two plant sites; one produces sintered magnesia, the other consists of a 50 000 tonne capacity multiple hearth furnace vertical-kiln which is dedicated to specialty calcined MgO. An electrofusing installation which produces refractory grade fused magnesia at Exshaw, Alberta also exists. Most of the production reaches the market as calcined magnesia; however, a portion of the calcined magnesia production is further processed to produce high-quality fused magnesia, for use in refractories.

The Moberly and Horse Creek **silica** mines in the Golden area have traditionally accounted for most of the high-grade silica production in British Columbia. The Silica Division of Highwood Resources Ltd. produces approximately 120 000 tonnes at **Moberly** for shipment to Springfield, Oregon, Lavinton, B.C. and other destinations. The **Horse Creek** silica mine, which is owned by Silicon Metaltech of Seattle and was operated by Nugget Con-



tracting Ltd., closed in 1998. This resulted from the shutdown of the Wenatchee metallurgical grade silicon and ferrosilicon plant. In 2000, Monteith Bay Resources Ltd. supplied 37 000 tonnes of silica to the **Tilbury Cement Ltd.** plant in Delta, from its quarry at **Monteith Bay** on western Vancouver Island. Tilbury Cement Ltd. tested bulk samples of silica (chalky geyserite) from the Pem 100 deposit owned by Homegold Resources Ltd. and altered volcanic rock from Duval 1 quarry belonging to Jim Burgess.

The largest production center of **limestone** is **Texada Island**, where two quarries, the **Gillies Bay** (Texada Quarrying Ltd.) and **Blubber Bay** (Ashgrove Cement), ship some 5 million tonnes annually to customers in British Columbia, Washington, Oregon and California, mainly for cement, chemical and agricultural use. Over 1 million tonnes of aggregate-grade crushed rock are sold annually as construction aggregate. Limestone is processed by three cement plants and two lime plants in British Columbia. The majority of pulp and paper mills produce their own lime from nearby limestone quarries. Graymont Western Canada Inc. acquired all the properties of Continental Lime Ltd. including the **Pavillion Lake** limestone quarry and lime plant near Cache Creek which produces about 200 000 tonnes of lime per year. The **Kamloops** cement plant of Lafarge Canada Inc. is producing about 40 000 tonnes of cement annually from the **Harper Ranch** quarry. Lafarge modernized its plant in Richmond, increasing the capacity to 1.0 million tonnes of cement. It is expected to take some time before it will be able to increase sales in order to operate near the designed capacity of the plant. It is using limestone from Texada Island, coal from the Quinsam coal mine and silica mainly from Fraser River sands. Pacific Lime Products Ltd. at Giscome, near Prince George, sells small quantities of limestone to pulp mills in the region.

Northrock Industries Ltd. provided a limited amount of limestone from its **Dahl Lake** quarry for rip-rap and landscaping.

**White calcium carbonate** is produced from deposits on **Texada Island (Vananda and Gillies Bay)**, **Benson Lake** on Vancouver Island, and **Lost Creek** near Salmo. White calcium carbonate, depending on quality and degree of processing, has a variety of uses including paper paint and plastic filler, terrazzo chips etc.

**Dolomite** is quarried by IMASCO Minerals Ltd. at **Crawford Bay** on Kootenay Lake and by Mighty White Dolomite Ltd. near **Rock Creek**. Dolomite is used for soil conditioning, white ornamental aggregate, for stucco and roofing, as a fine aggregate, and for synthetic marble products.

In 1999, Highwood Resources Ltd. completed underground mining of the known reserves and closed the **Parson** mine, one of two British Columbia **barite** producers. There was no mining at the **Fireside Minerals Ltd.** barite quarry, east of Watson Lake, in 2000 as unsold product remained at the site from 1999 production. During 1999 the company processed approximately 18 300 tonnes of ore. The products were shipped mainly to Alberta, or used in British Columbia.

Clayburn Industries Ltd. of Abbotsford processes locally mined **fireclay** from **Sumas Mountain** into a variety of refractory bricks and castable refractory products. Its **pyrophyllite** property at **Princeton** is dormant, as the company shifted its diatomite-based insulating brick production to Alberta. Small quantities of **flueline pipe** and ornamental and **facing bricks** are also produced near Abbotsford by Sumas Clay Products Ltd.

Western Industrial Clay Products Ltd., in Kamloops, supplies approximately half of the **kitty litter** market (and other domestic and industrial absorbents) in Western Canada, principally from its **Red Lake diatomaceous earth** (fuller's earth) quarry near Kamloops. The company ships part of its production overseas. In addition, the company is looking into marketing "leonardite" or "humate" from a humic acid-bearing, carbonaceous layer which is sandwiched between two diatomaceous earth horizons at their mine site. This material may have use as a soil conditioner. Western Industrial Clay Products Ltd. has optioned the **Bud, Bee** and **Brom** zeolite properties at Princeton from Gordon Webster, and is mining small quantities of bentonite from the Bud property.

The Limeco Products Division of Highwood Resources Ltd. continues to develop a market for **zeolite** from the **Ranchlands Z-1** quarry near Cache Creek which has a variety of agricultural applications in Alberta. There was no mining in 1999 or 2000 as the company relied on stockpiled ore. In 1998, the **Z-2** deposit reverted back to C<sub>2</sub>C Mining Corporation which, by early 1999, began to sell zeolite from its Ashcroft processing and packaging plant. C<sub>2</sub>C Mining and Zeo Tech Enviro Corp. have created an alliance for processing, product and technology development, and marketing of their respective **zeolite** deposits in the Cache Creek and Princeton areas. Zeo-Tech Enviro Corp. conducted drilling and collected small bulk samples from the **Zeo** property at Princeton in 2000, and is preparing an application for a 75 000 tonne per year quarry. Canmark International Resources Inc. continues to develop a market in the lower mainland for zeolite from its **Sunday Creek** deposit near Princeton.

**Granite** and **marble** are produced by several companies. Stone-processing plants are operated by Westcoast Granite Manufacturing Inc. in Delta, Margranite Industries in Surrey, Matrix Marble Corporation in Duncan and Garibaldi Granite Group Inc. in Squamish. Margranite is processing a variety of imported granite and nine granite varieties from at least three quarry sites that are located in the East Anderson River, Beaverdell and Skagit Valley areas. In 1999 it doubled its plant capacity by adding a wire saw and hydraulic splitter. In 2000 the company further expanded its operation by installing two state-of-the-art gangsaws each with 150 blades and the ability to cut 3 international size blocks of granite simultaneously. A new, completely automated, slab polishing line was also in-



stalled. Garibaldi Granite owns a state-of-the art processing plant in Squamish and is processing three granite varieties from four quarry sites in the **Squamish** area. It also produces some specialty products from columnar basalt and rhyolite. The operation at Squamish is part of a joint venture with Pender Capital Corp.

In 1999, Westcoast Granite Manufacturing Inc. installed a second gang saw, a new wire saw and a new crane at their processing facility in Delta. Quadra Stone Ltd. started production of Cascade Coral Blocks from a new quarry near **Beaverdell**. Other active quarry sites include: Tsitika Stone Industries on northern Vancouver Island (gray granite), Yoho National Stone Inc. near Sayward, and Adrea Natural Stone Supplies Ltd. on Granite Island near Sechelt. **Matrix Marble Ltd.**, was developing a new site near the old **Tahsis Inlet** quarry and owns a marble quarry near Cowichan Lake; however, there was no mining activity in 2000. The **Kingfisher** quarry has been inactive since 1999, following a change in ownership; furthermore, the plant in Enderby was dismantled.

**Flagstone** has traditionally been quarried by Revelstoke Flagstone quarries and Begbie Flagstone Ltd., together producing approximately 200 tonnes of mica schist flagstone. Kootenay Stone Centre, and at least two other operators, are producing **quartzite flagstone** from a number of small quarries in the West Kootenays. One local company produces flaggy sandstone on a small scale near **Port Renfrew** on Vancouver Island. Near Kelowna, the Kettle Valley Stone Company produces flagstone, ashlar, thin veneer and landscape rock products from several quarries. The most popular rock is a buff-tan dacitic ash from Nipple Mountain ("Mountain Ash"), but the company also sells columnar basalt ("Shadow Ridge") and "Rainbow" gneiss. These products are mainly sold in northwestern USA but markets are being developed in the Lower Mainland, Whistler, and Alberta.

Canadian Pacific Railway continued to ship railroad ballast stockpiled at its Swansea Ridge gabbro quarry south of Cranbrook, but very limited additional mining or crushing was carried out in 2000. **Giscome** and **Ahbau** ballast quarries continued shipping, however all crushing was conducted in 1999.

**Dome Creek Structural Slate Company** quarried a limited tonnage of attractive green slate from its Dome Creek deposit on Highway 16, east of Prince George.

**Jade** (nephrite) production in 2000 was concentrated in the **Kutcho Creek** and **Serpentine Lake** areas in northwestern BC. Jade West Resources Ltd. and its affiliated company, Polar Gemstones Ltd., produced about 160 tonnes from that region. Jade West Resources Ltd. also operates a jade processing facility in south Surrey. The company is currently looking for partners to set up the facility to produce nephrite tiles. Nephrite is also recovered from the old Cassiar Asbestos mine waste dumps, sawn into blocks and sold on site by Jedway Enterprises. In 1999 Jedway produced about 40 tonnes of jade but in 2000 only a few blocks were recovered.

Canada Pumice Corporation produced red and black **tephra** from its **Nazko** quarry west of Quesnel. Current production is at a rate of about 15 000 m<sup>3</sup> annually. The deposit has a resource in excess of 44 million tonnes. The material from Nazko is used for landscaping, sporting facilities, growing and filtration media, and light weight aggregate applications. In 1999 the company bought a former Crownite site, adjacent to the railway in Quesnel and plans to modify it for processing and bulk handling of its products. On a smaller scale, Great Pacific Pumice Ltd. is shipping **pumice** from its **Pum** property on Mount Meager, north of Pemberton. Recently, the company conducted a ground radar survey to map the thickness of the pumice deposit.

M-Seven Industries Inc. produces typically between 60 000 and 70 000 tonnes per year of **magnetite** for industrial applications by processing the **Craigmont** tailings. The company is supplying most coal mines in western Canada with material for heavy media coal upgrading.

The insulation/mineral-wool manufacturing plant in Grand Forks, previously operated by Enertek, was acquired by Rockwool International A/S. It is now operated by a subsidiary company named Roxul (West) International Inc. The marketing expertise of the parent company in melting technology and insulation marketing is essential for long-term success of this operation. Bulk sample testing at a number of small quarry sites in the Boundary area took place in 2001 and exploration for new raw materials is still underway.

Production of chrysotile at the former Cassiar site resumed in early 2000. Cassiar Magnesium Inc., formerly Cassiar Mines & Metals Inc., dry milled surface stockpiles. It produced 11 749 tonnes of long and intermediate fiber which was sold to consumers in India, Dubai, Japan, Sri Lanka and Indonesia for use in the construction industry. The dry mill was destroyed by a fire on December 25, 2000. According to a company press release, the loss and damage from the fire has now been calculated and a formal Fire Proof of Loss Claim for \$27,772,438 was filed with the Insurers. No activity was reported at the tailings rehabilitation pilot plant that was completed in 1998.

**Pacific Abrasives & Supply Inc.** is producing and processing slag from **Grand Forks** dumps for a variety of applications, but mainly for sandblasting at major shipyards and for roofing granules. Some slag was also shipped from **Anyox** by Tru-Grit as abrasives for use in the cement industry, mainly in the Vancouver area, for roofing granules and some abrasive applications. Cominco Ltd. is also a major slag producer from operations at its **Trail** smelter. It markets its products mainly for cement production and abrasive applications. The company is converting one of the old furnaces into its second fuming furnace. The use of two furnaces doubles the fuming time and results in substantially lower base metal levels in the slag, enhancing its competitive edge. Slag is also recovered in the **Greenwood** area



and used as one of the raw materials in the production of mineral wool by Roxul (West) International Inc. in **Grand Forks**.

## INDUSTRIAL MINERALS EXPLORATION / DEVELOPMENT EFFORTS

In 2000, industrial minerals exploration expenditures are estimated at approximately \$2 million. Some noticeable trends are that grassroots exploration for traditional construction materials and lightweight aggregate are gradually expanding from the lower mainland along the British Columbia coast line. It is expected that over the next ten years, crushed stone from the coast will make even more significant inroads into the Vancouver area aggregate market. Also demand for aggregate in San Diego, San Francisco and Los Angeles areas is increasing, creating export opportunities for British Columbia. LaFarge Construction Materials is shipping crushed rock to the San Diego area from its quarry on Texada Island. Tilbury Cement Ltd. plans to ship aggregate from its facility at Sechelt, utilizing a new shiploader designed and built by Seabulk Systems Inc.

IG Machines and Fibers Ltd., a subsidiary of IKO Industries Ltd., continues development of its **Ashcroft** basalt quarry and roofing granule plant. The quarry will produce up to 250 000 tonnes per year of granules which will be crushed, sized and coloured on site, prior to shipping to IKO Industries shingle plants in Sumas, Washington, and Calgary.

In 1999, Cassiar Magnesium Inc., formerly Cassiar Mines & Metals Inc., announced that it signed a memorandum of understanding with Aluminum of Korea Ltd. to develop a magnesium project that will use the serpentine material from tailings. The short fiber tailing-processing plant remained inactive, while the company's newly rehabilitated long fiber plant burned down in December 2000.

**Wollastonite** claims north of **Rossland** originally staked by prospector Horst Klassen, are now being evaluated as a potential source of wollastonite to be used as a natural flux at the Cominco Smelter in Trail. In early 1998 Whitegold Resources Corporation completed a full feasibility study on its Bril deposit, part of the **Isk** wollastonite project. The resource estimate, conducted by Rescan Engineering Ltd., is 1.2 million tonnes of 58.14% wollastonite (using a 50% grade cut-off). The geological resource is estimated by the company at 20 million tonnes and the property contains five other surface deposits.

The company continues to conduct joint demonstration and research studies with various partners. These studies will document the benefits derived from the application of zeolite when blended with animal manure and other organic waste to reduce odours and to increase nutrient retention.

Zeo-Tech Enviro Corp. hopes to market rhyolitic **meta-tuff** from its **Dick/Slate** property in the Garrison Lake area as a **pozzalan** additive to concrete.

Crystal Graphite Corp., formerly I.M.P. Industrial Mineral Park Mining Corp., has announced plans to develop its **Black Crystal** graphite property on Hoder Creek, west of Slocan, at an initial mining rate of less than 75 000 tonnes per year starting in late 2001. If the mining goes ahead, the ore will be processed at a nearby company-owned mill to produce and market high purity flake graphite. Late in 2000, the company transported the remainder of a 10 000 tonne bulk sample to the mill site, and completed 1181 metres of exploration drilling to better define the size and average grade its resource.

Chapleau Resources Ltd. conducted detailed prospecting and surface sampling of the Hellroaring Creek pegmatite stock for **beryllium, rubidium, tantalum and rare earths**. Late in the season, the company, under a joint venture agreement with Naneco Minerals Ltd., drilled eight short holes to test newly discovered zones from the **Pakk** and **Peg** properties.

Anglo-Swiss Resources Inc. entered a joint venture arrangement with Hampton Court Resources to continue work at its **Blu Starr** gemstone property in the Slocan Valley, which is known to contain a number of occurrences of **star sapphire/corundum, iolite and gem-quality garnet**. In 2000, the joint venture completed a follow-up program of prospecting and mapping of the bedrock geology, as well as sampling and testing of alluvial gravels on its co-incident mineral and placer claims.

Okanagan Opal Inc. relocated its main office and continues to cut, test and market precious **opal** from the **Klinker** locality near Vernon. Follow-up prospecting took place in 1999 on the **Northern Lights** precious opal occurrence in the Whitesail Range, south of Houston. Precious opal bearing boulders, or subcrop, were discovered on the **Firestorm** property west of Burns Lake area by Mr. Schaefer of Burns Lake, in 1999. At least three in situ occurrences of precious opal were discovered in the Falkland area by Lloyd Nielsen.

Mining companies, as well as individual prospectors, are evaluating new **dimension stone** properties throughout the province.

In the Chilliwack valley, IG Machine and Fibers Ltd. is reviewing options for limestone products from its **Slesse** project.

**Graymont Western Canada Inc.** is examining the process for advancing its proposed 250 000 tonne per year chemical limestone, **Var** quarry, on Rupert Inlet near Port Hardy, into the Environmental Assessment Process.



Orinda Investments and North Pacific Stone plan to apply to the government for permits to operate a 250 000 tonnes per year **limestone** quarry at its **Laredo** property on Aristazabal Island. Late in 1999, North Pacific Stone carried out a small drilling program.

There is renewed interest by prospectors and some junior companies in **hydromagnesite**, *sabkha* type deposits that were known and exploited at the beginning of the 19<sup>th</sup> century. There is a very small, competitive but growing market for natural hydrated magnesia minerals in flame retardants. It remains to be established if British Columbia deposits are competitive in terms of specifications and economics.

Several of British Columbia's many **magnesite** deposits have changed hands and are being reexamined. Near Marysville, Stralak Resources Inc. and joint venture partner Magna Precious & Industrial Metals Inc. took control of the **Marysville** sparry magnesite deposit from Cominco and, according to a company press release, recently optioned the property to a Bahamas-based company. This deposit has an inferred resource of 12.7 million tonnes grading 88% MgCO<sub>3</sub>, most of which is available by underground mining. Oxydental Petroleum allowed the claims to lapse on its promising **Driftwood Creek** property and the property was restaked by a Cranbrook-based prospecting partnership.

In 1999, W.W.C. Consulting Ltd., under an option agreement with prospector Art Louie, conducted an underground exploration program on its barite project at **Jubilee Mountain**, west of Spillimacheen. Two adits were driven on the Heli and Grizzly veins, which are hosted by shear zones in dolomite. Also in 1999, the company transported a few thousand tonnes of barite ore to a mill at the Elkhorn barite property south of Windermere which is owned by its parent company, Hydrotech Dynamics Ltd. of Calgary. No further mining was done in 2000, but a program of surface drilling tested several other veins and breccia zones on the property. The company is currently constructing a jig concentrator at the mine site to enable it to pre-concentrate the barite prior to transporting it to the mill. Further underground development and bulk sampling are planned for 2001.

Other commodities currently enjoying a high profile in British Columbia are tantalum, and rare earth elements. Commerce Resources Corp. is actively exploring its **Verity** rare metals property near Blue River.

British Columbia is currently importing all of its **kaolinite** requirements. Locally produced material would have a cost advantage of over \$100 (the equivalent of current transportation costs), making kaolinite a hot industrial mineral exploration target (see Shearer, 2001, this volume).

Rocky Mountain Tufa Ltd. continues to extract **tufa** from its extensive surficial deposit at **Brisco** and to market it to alpine gardening and landscaping suppliers throughout North America. Several other occurrences of tufa and **travertine** scattered along the east flank of the Rocky Mountain Trench have been staked and are being tested by local prospectors. Mapping was completed at the Tufa Rock Garden project in Kelowna.

## ACKNOWLEDGMENTS

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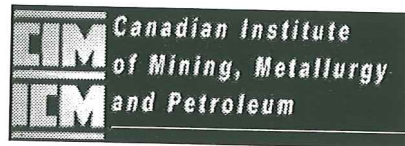


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**Program and Extended Abstracts for the  
37<sup>th</sup> Forum on the  
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**Compiled by**

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