

Photo: Teachers visit Gillies Bay Quarry, Texada Island

Industrial Mineral Operations in British Columbia: Teacher Information and Student Activities

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This classroom resource was developed to support the use of MineralsEd's **Mining in British Columbia** poster in BC classrooms. MineralsEd wishes to acknowledge BC Ministry of Energy and Mines' staff around the province, as well as individuals from the many industrial mineral operations and their corporate head offices for the generous support of their time and information on active industrial mineral operations, processes and products.

Industrial Minerals in British Columbia

What are Industrial Minerals?

Industrial minerals include any rock, mineral or other naturally occurring material that has economic value *except* metals ores, fossil fuels and gemstones. Industrial minerals are used for countless familiar things, from road and building construction to fertilizers and livestock feed, to sculptures and monuments. Many have very special properties and uses, such as flake graphite in hydrogen fuel cells and refractory clays in space shuttle tiles. Although their uses are commonly obscure and unappreciated, they are essential to countless industrial processes and fabricated materials which we use and take for granted every day.



Concrete = lime (limestone)
+ silica (quartz sandstone) +
aluminum (shale) +
aggregate (sand and gravel
or crushed rock) + water

British Columbia's Industrial Minerals

Industrial mineral resources currently extracted in the province include:

Aggregate*	Fuller's Earth	Magnesite	Sulphur
Andesite	Gabbro	Magnetite	Tufa
Barite	Gneiss	Marble	Zeolite
Basalt	Granite	Opal	
Bentonite	Graphite	Pumice	
Diorite	Gypsum	Silica	
Dolomite	Jade	Slag	
Flagstone	Limestone	Slate	

Included in this category is the element **sulphur**, which is not mined, but rather is extracted as a by-product of natural gas, crude oil and oil sands refining. Also included in the group is the silica-rich smelting by-product called **slag**, which is quarried from hardened piles at historical smelting operations, but which is also currently produced from molten waste rock at the zinc smelter in Trail.

Occurrences of BC's Industrial Mineral Resources

A quick glance at the Mining in British Columbia (2013) poster reveals that industrial mineral deposits, and other mineral resources, are found and extracted all over British Columbia. First and foremost, their occurrences depend on bedrock geology, which in our mountainous province is varied and quite complex. Importantly, BC's mountains expose or bring close to the surface mineral resource deposits which in other parts of the continent are present only at depth and are impractical or uneconomical to extract. While geology determines where a deposit occurs, the economic, logistical and environmental factors determine where an industrial mineral deposit can be mined. Proximity to transportation infrastructure and population centers correlate directly with greater density of operations in southern BC and in many cases, where they are located in the Interior.

* Aggregates include sand and gravel and crushed stone operations. They are not included on the MineralsEd poster and are not showcased in this teachers' resource. Aggregates are a large component of the industrial minerals sector in BC, vital to the cement, concrete and construction industries in rapidly growing urban areas. There are numerous aggregate operations around the province, many of which are very small and serve a very local need.

The **Mining in British Columbia** (2013) poster plots BC's industrial mineral operations in the context of the *five morphogeological belt framework* of the province (Figure 1), each one defined by their distinct geology and mountain-building processes that formed them. Correlations between the mineral resources and the general bedrock geology become apparent.

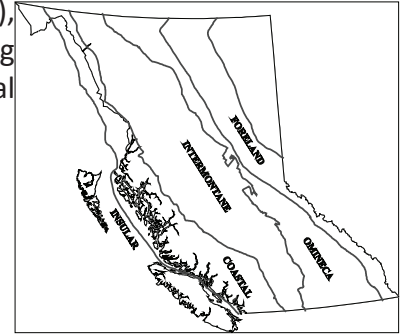


Figure 1 – Five morphogeological belt framework of BC

- Mineral resources of sedimentary origins are found where sedimentary sequences are uniquely exposed or dominant: ancient gypsum deposits are mined in uplifted sedimentary sequences in the Foreland; coal is mined from thick Mesozoic – age sequences in the Foreland and Insular belts.
- Mineral resources of metamorphic origin occur where the bedrock geology has a profound metamorphic overprint: slate and gneiss dimension stone come from quarries in the highly-deformed Omineca belt.
- Metallic mineral deposits related to igneous processes (granitic intrusions and hydrothermal fluids) are located where volcanic and plutonic rocks are major elements: copper-gold porphyry deposits are located in the Intermontane granitic bodies; base metals are mined underground from a volcanic sequence on in the Insular belt; granitic rocks in the Insular belt are quarried for dimension stone.

These first-order correlations surely guide exploration geologists in finding new resources. However, other geologic factors also help predict what mineral resources occur where. First there is a general metamorphic overprint on all but the youngest rocks across the province, reflecting the fact that the landscape records millions of years of deformation related to mountain-building. Second, in some regions there are relatively young volcanic events and sequences which mantle or overprint the bedrock, or there are younger basins into which sediments were deposited on top of the older, predominant bedrock. Finally, most of the province is veneered by soft sediments deposited by Ice Age glaciers or rivers or lakes related to them.

Industrial Minerals Operations

Industrial minerals in British Columbia are generally mined from pits or quarries, mostly away from urban areas. Most are small, but some limestone and gravel quarries are multi-hectare operations comparable in size to some metal mining operations (e.g. Figure 2). Of the 62 listed in **Industrial Mineral Mines and Quarries in British Columbia** (page 6), most are classified as small operations employing on average less than 6 people and generating less than \$1 million in sales annually. Many of these operate seasonally and some operate only when there is demand.



Figure 2 – Gillies Bay limestone quarry, Texada Island

The remaining 16 major operations employ on average 20-30 people and generate on average \$4-5 million in sales annually.

Industrial mineral extraction methods vary with the type of deposit. **Pumice**, for example, occurs as loose pieces that may simply be scooped up with a loader and hauled away by truck. Solid **limestone** quarried for cement, in contrast, must be drilled, blasted, crushed, moved by conveyor and sorted by size before it is trucked or shipped away (Figure 2). **Granite** mined for dimension stone, however, is quarried using drills and wedges or water jet saws and heavy equipment capable to moving multi-tonne slabs, which are then transported to a processing plant to be fabricated into tiles, countertops etc. Each operation is unique and some have washing, sorting or other processing on site. Importantly, industrial mineral operations commonly require little or no chemical processing, make comparatively little waste rock or waste material, are rather easily reclaimed and have very little long-term environmental impact.

Industrial minerals operations on private and Crown land in British Columbia are regulated under the **BC Mines Act and BC Waste Management Act** by the BC Ministry of Energy and Mines (BCMÉM). This ministry monitors all operations to ensure compliance with all regulations related to permits, worker health and safety, community consultations and reclamation (Figure 3). BCMÉM also evaluates and issues operating permits for new industrial mineral operations producing less than 250,000 tonnes/year. Approval for larger developments follows a more lengthy and extensive evaluation process through the BC Environmental Assessment Office (EAO). Industrial minerals operations must also comply with all BC Ministry of the Environment and the federal Department of Fisheries and Oceans regulations regarding air, water and wildlife protection.



Figure 3 – Reclamation work at a gravel quarry, Abbotsford, BC

Downstream Industrial Mineral Processing Plants

In addition to the mines and quarries there are 25 operations or plants throughout the province where upgrading of industrial minerals into value-added products takes place. They include the familiar production of lime (Figure 4), cement and concrete (limestone, silica, clay and aggregate), wallboard (gypsum), and stone tiles (marble, granite). They also include plants that produce kitty litter, roofing shingle granules, refractory bricks, rock wool insulation and other unique products. Many of these operations are situated in or near small communities, while several are located in industrial zones within major urban centers. On average, these downstream operations in BC employ over 30 people and generate more than \$12 million in sales annually (B. Northcote, BC MEMPR, July 2009, pers. comm.).



Figure 4 – Pavilion limestone quarry and lime plant northwest of Cache Creek, BC

Economic Value

Compared to precious metals, base metals and coal, industrial minerals as commodities are lower in value (Table 1). Therefore, on a site-by-site basis industrial mineral operations do not generate the revenue that precious or base metals or large coal operations do. Nevertheless, industrial minerals sector is a vital part of the provincial mining industry.

Table 1 – Select industrial mineral values compared to select metal values (July 2015)

Industrial Mineral	Value (US \$)	Metal	Value (US \$)
Barite: paint grade	\$140-150/ tonne	Copper	\$2.53/lb = (\$5576/tonne)
Bentonite: cat litter grade	\$45-55/ tonne	Zinc	\$ 0.91 /lb = (\$2009/tonne)
Sulphur: solid	\$195/ tonne	Lead	\$ 0.82 /lb = (\$1804/tonne)
Silica: foundry grade sand	\$400-700/ tonne	Gold	\$ 1160 /troy ounce = \$37,350,480/tonne)

In the *Provincial Overview of Mines and Mineral Exploration 2014*, the BCMEM estimated British Columbia’s 2014 industrial minerals production, including sulphur, at \$428 million (6% of the total BC minerals industry production in 2014, Figure 5), and \$373 million for aggregates (5% of the total mineral production). The industrial mineral sector is also estimated to directly employ 2,000 people (www. www.empr.gov.bc.ca (statistics)), approaching 9% of the total number of people in the entire mining industry, not including indirect jobs in the supply and service sector tied to industrial minerals operations. It is important to note that most of these operations are located near small communities and are important employers and contributors to the health of the local economy.

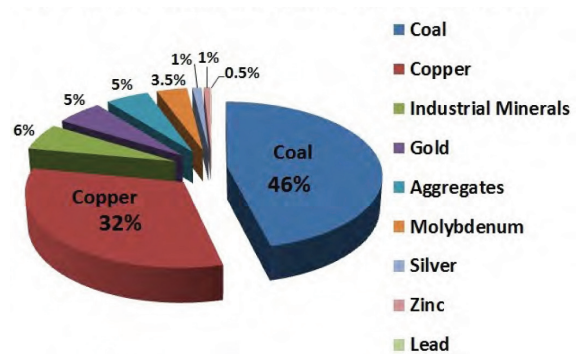


Figure 5 – BCMEM predicted mineral production by commodity, from *Provincial Overview of Mines and Mineral Exploration 2014*.

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Industrial Mineral Mines and Quarries in British Columbia¹

Operation Name <i>(Owner/Operator)</i>	Key Community ³	Size ²	Commodity	Plant Supplied/Market
Anyox (Tru-Grit)	Anyox	Small	Slag	Supplies crushed slag via barge to Vancouver and Washington state for cement manufacture; barges roofing granules to Washington state shingle plant
Apple Bay (PEM 100) (Electra Stone Ltd.)	Port Hardy	Small	Geyserite ⁴	Supplies crushed geyselite to Lafarge Canada's (Richmond) cement plant for use in all sorts of construction and road building in the Lower Mainland and US.
Ash (IG Machines and Fibers Ltd. (IKO Industries Ltd.))	Ashcroft	Small	Basalt	Supplies rock to IG Ashcroft (Ashcroft, BC) which produces roofing granules for home, business, institutional and industrial use for markets in Canada, Americas, Europe and Asia.
Benson Lake (IMASCO Minerals Inc.)	Port McNeill	Major	Limestone	Supplies crushed limestone to IMASCO Minerals (Surrey, BC) plant which produces various sizes of calcium carbonate for landscaping, stucco, paint, food and other industries in western Canada and northwest US.

¹ This Table includes all major and some larger minor operations excluding metals, fossil fuels and gemstones.

² Major operations have 20-30 employees and generate \$4-5 million annually in mineral sales; small operations have fewer than 6 employees and generate less than \$1 million annually in mineral sales. Many small operations are worked only seasonally or intermittently upon demand.

³ Benefiting through employment and/or supply and service contracts.

⁴ Geyselite is the rock quarried for silica at PEM 100.

Industrial Mineral Mines and Quarries in British Columbia¹

Operation Name <i>(Owner/Operator)</i>	Key Community³	Size²	Commodity	Plant Supplied/Market
Black Crystal (Eagle Graphite Corporation)	Slocan Valley	Small	Graphite	Supplies a plant in Pennsylvania, USA, where the graphite is used in the steel making process.
Blubber Bay (Ash Grove Cement Company)	Texada Island	Major	Limestone, Dolomite	Supplies crushed limestone for construction aggregates, cement, chemical lime and agricultural limestone to plants in Vancouver, BC and Portland, Oregon.
Brisco (Rocky Mountain Tufa) (Rocky Mountain Tufa Ltd.)	Brisco	Small	Tufa	Excavated tufa shipped by rail mostly to eastern Canada and eastern US markets for landscaping; onsite production of outdoor planters to Alberta market.
Bromely Creek (Canadian Mining Company)	Princeton	Small	Zeolite	Zeolite is shipped to Lethbridge, Alberta for use in making lightweight cement for oil and gas wells.
Burrell Creek⁵ (Roxul (West) Inc.)	Grand Forks	Small	Diorite ⁶	Supplies crushed diorite to Roxul's (Grand Forks) plant which produces mineral wool insulation for home, commercial and business markets.

⁵ Burrell Creek is not shown on Industrial Minerals, Metal and Coal Operations in British Columbia (2010) poster.

⁶ Diorite is a coarse-grained igneous rock, intermediate in composition between quartz-rich granite (light-coloured) and quartz-poor gabbro (dark-coloured).

Industrial Mineral Mines and Quarries in British Columbia¹

Operation Name <i>(Owner/Operator)</i>	Key Community³	Size²	Commodity	Plant Supplied/Market
Bud (Absorbent Products Ltd.)	Princeton	Small	Bentonite	Supplies bulk bentonite to Absorbent Products' plant (Kamloops) for the processing and manufacture of absorbent products for residential, commercial and agricultural use in North America.
Canyon (Kettle Valley Stone Company)	Kelowna	Small	Gneiss	Supplies rough stone to Kettle Valley Stone Company (Kelowna) where it is split and cut into thin veneer stone for building facades and landscaping, marketed for high-end commercial and residential developments in the Lower Mainland and Western US.
Cassiar (Cassiar Jade Contracting)	Cassiar	Small	Jade	Supplies rough jade for fashioning into ornaments and jewelry mainly for the Asia market.
Cox Station Quarry (Mainland Sand & Gravel)	Abbotsford	Small	Granite	Crushed granitic rock for road building, drainage, retaining walls.
Dahl Lake (Northrock Industries Ltd.)	Prince George	Small	Limestone	Supplies small quantities recovered from waste rock piles from pre-existing quarry for rip rap and the decorative landscaping market.

Industrial Mineral Mines and Quarries in British Columbia¹

Operation Name <i>(Owner/Operator)</i>	Key Community ³	Size ²	Commodity	Plant Supplied/Market
Decor (Pacific Bentonite Ltd.)	Cache Creek	Major	Bentonite, Shale	Supplies shale to Lafarge's Kamloops cement plant in addition to producing a small range of finished products onsite. Bentonite is processed onsite into special panels used in water proofing.
Elkhorn (CertainTeed Gypsum Canada, Inc.)	Windermere	Major	Gypsum	Supplies crushed gypsum to CertainTeed's wallboard plant (New Westminster). The wallboard is sold for of residential and commercial construction in BC and northwestern US.
Falkland (Lafarge Canada Inc.)	Kamloops	Small	Gypsum	Supplies crushed gypsum to Lafarge Canada's (Kamloops) cement plant used for all types of construction and road building.
Fireside (Fireside Minerals Ltd.)	Lower Post	Small	Barite	Supplies ground barite to the Alberta oil and gas drilling industry.
Four J (Canal Flats) (Georgia Pacific Canada Inc.)	Canal Flats	Major	Gypsum	Supplies crushed gypsum to Georgia Pacific Canada Inc. wallboard plants (Surrey and Edmonton, AB).

Industrial Mineral Mines and Quarries in British Columbia¹

Operation Name <i>(Owner/Operator)</i>	Key Community ³	Size ²	Commodity	Plant Supplied/Market
Garibaldi Pumice (Garibaldi Pumice Ltd.)	Pemberton	Small	Pumice	Excavated and sized for fill aggregate and drainage aggregate. Quarried from the Mount Meager deposit.
Gillies Bay (Texada Quarrying Ltd.)	Texada Island	Major ⁷	Limestone	Supplies crushed limestone to five different Lower Mainland cement plants as well as plants in Washington state and Hawaii, for a variety of construction projects.
Ginty ⁸ (Golden Rock Products)	Kimberly	Small	Slate, Flagstone, Tufa	Excavates and splits slate for interior and exterior floors, walkways, fireplaces and other construction; trucks larger pieces and sizes and palletizes smaller pieces for shipping by railcar to Canadian and US markets.
Giscome (Chemical Lime Company of Canada)	Prince George	Small	Limestone	Limestone is crushed and sized for local market: road base, driveways, park walkways, large boulders for landscaping. Also supplies limestone to local pulp mills for pH control.

⁷ Gillies Bay is recognized as Canada's largest quarry.

⁸ Golden Rock Products Headquarters and processing plant are located in Golden, BC while the Ginty quarry is located in Kimberly, BC (as it appears on the map).

Industrial Mineral Mines and Quarries in British Columbia¹

Operation Name <i>(Owner/Operator)</i>	Key Community³	Size²	Commodity	Plant Supplied/Market
Gordon River (Vancouver Island Marble)	Duncan	Small	Black marble	Supplies rough marble to Vancouver Island Marble plant (Duncan) for fabrication of countertops and building facades, and landscaping tiles.
Grand Forks (Pacific Abrasives & Supply Inc.)	Grand Forks	Small	Slag	Supplies crushed and ground slag for Kleen Blast (U.S.) for large-scale marine sandblasting projects for U.S. and other fleets. Also supplies slag to Roxul's Grand Forks mineral wool processing operation.
Haddington Island (Haddington Island Stoneworks Ltd.)	Pender Island	Small	Andesite ⁹	Supplies rough stone blocks to Bedrock Granite Sales (Coquitlam, BC) where they are tailor cut for restoration of historical buildings in the Lower Mainland and Victoria.
Hardy Island (Hardy Island Granite Quarries Ltd.)	Pender Island	Small	Granite	Supplies rough granite blocks to Bedrock Granite Sales (Coquitlam, BC) where they are cut and processed for exterior facing stone, retaining walls and fireplaces; also distributed to Washington state.

⁹ Andesite is a fine-grained volcanic rock intermediate in composition between basalt and rhyolite.

Industrial Mineral Mines and Quarries in British Columbia¹

Operation Name <i>(Owner/Operator)</i>	Key Community³	Size²	Commodity	Plant Supplied/Market
Harper Ranch (Lafarge Canada Inc.)	Kamloops	Small	Limestone	Supplies crushed limestone to Lafarge Canada's (Kamloops) cement plant for use in all types of construction and road building.
Hisnet (Matrix Marble Corporation)	Duncan	Small	Marble	Supplies rough marble to Matrix Marble and Stone plant (Duncan) for custom fabrication of countertops and bathrooms, and exterior flooring tiles
K2 Stone (K2 Stone Inc.)	Port Renfrew	Small	Slate	Supplies slate to K2's processing plant at Duke Point where it is turned into building and landscaping products.
Kettle Valley (Kettle Valley Stone Company)	Kelowna	Small	Basalt	Supplies Kettle Valley Stone's (Kelowna) plant for splitting/cutting and shaping for landscaping and facing stone.
King Mountain (Green Mountain Gemstones Inc.)	Dease Lake	Small	Jade	Ninety percent of the raw jade produced is exported directly to eastern Asia where it is fashioned into ornaments and jewelry mainly for the Asian market.

Industrial Mineral Mines and Quarries in British Columbia¹

Operation Name <i>(Owner/Operator)</i>	Key Community ³	Size ²	Commodity	Plant Supplied/Market
Klinker (Okanagan Opal Inc.)	Vernon	Small	Opal	Supplies rough opal to Okanagan Opal Inc. (Vernon), located 35 km south of the quarry, where it is cut, polished and set in jewelry products that are sold in BC and western Alberta.
Kootenay Stone (Kootenay Stone Centre)	Salmo	Small	Flagstone	Supplies to Kootenay Stone Centre (Salmo) where it is split and cut into decorative stone for interior and exterior walls and flooring for high-end developments in Western Canada.
Kutcho Creek (Green Mountain Gemstones Inc.)	Dease Lake	Small	Jade	Rough jade blocks are transported to Jade West Resources (Surrey) where they are cut and sold as is to buyers in Asia and all over the world.
Lady King Basalt (Opal Resources Canada Inc.)	Vernon	Small	Columnar Basalt	Rough basalt blocks are transported to the stockpile location (Vernon), which supplies the Okanagan Valley and Thompson-Nicola region with columnar basalt for landscaping

Industrial Mineral Mines and Quarries in British Columbia¹

Operation Name (Owner/Operator) <i>Website</i>	Key Community ³	Size ²	Commodity	Plant Supplied/Market
Moberly (Heemskirk Canada)	Golden	Major	Silica ¹⁰	Supplies quartzite to HCA Mountain Minerals Moberly plant (Golden) adjacent to the quarry where it is crushed, washed and dried and sold as silica sand for glass and fiberglass industries and golfing sand in BC, Alberta and local U.S. markets.
Mountain Ash (Kettle Valley Stone Company)	Kelowna	Small	Flagstone (dacite ¹¹)	Supplies rough stone to Kettle Valley Stone Company (Kelowna) where it is split and cut into thin veneer stone for building facades and for landscaping (retaining walls).
Mount Brussilof (Baymag Inc.)	Radium Hot Springs	Major	Magnesite	Supplies crushed magnesite (MgCO ₃) to Baymag's processing plant in Exshaw, Alberta where it is converted to magnesium oxide for many industrial and agricultural uses.
Mount Meager (Great Pacific Pumice Inc.)	Pemberton	Small	Pumice	Excavated and sized for fill aggregate and drainage aggregate.
Mount Polley (Craigmont Industries Ltd.)	Likely	Small	Magnetite	Craigmont Industries processing plant (Likely) re-processes the tailings from Mount Polley Cu-Au mine, to extract the magnetite. Supplies the coal mining industry in western North America.

¹⁰ Quartzite is the rock quarried for silica at Moberly mine.

¹¹ Dacite is a fine-grained volcanic rock intermediate in composition between rhyolite and andesite.

Industrial Mineral Mines and Quarries in British Columbia¹

Operation Name <i>(Owner/Operator Website)</i>	Key Community³	Size²	Commodity	Plant Supplied/Market
Nazko (Can Lava Mining Corp.)	Quesnel	Small	Pumice, vesicular basalt, lava rock	Dry-screened, crushed, classified and transported by truck or rail throughout Canada and the US. Used in the construction industry for lightweight geotechnical backfill, masonry blocks and concrete, a natural pozzolan used for cement replacements, water filtration medium, soil amendment, decorative landscape ground cover, winter road abrasive. LAVA Inc is fully permitted and holds a current Environmental Assessment Certificate.
Ogden Mountain (Green Mountain Gemstones Inc.)	Cariboo Region	Small	Jade	Ninety percent of the raw jade produced is exported directly to eastern Asia where it is fashioned into ornaments and jewelry mainly for the Asian market.
Orca Quarry (Polaris Minerals Corporation)	Port McNeil	Major	Sand and Gravel	Polaris Minerals Corporation owns 88% of the Orca Quarry with the remaining 12% participating interest held by the 'Namgis First Nation. A long-term supply agreement for a portion of production has been secured for delivery of construction aggregates to Shamrock Materials Inc., a major ready-mix concrete producer in the San Francisco Bay area.
Ord Road Quarry (Rockrite Resources)	Kamloops	Small	Basalt	Supplies Rockrite Resources' stockpile location (Kamloops) with rip rap used in driveway construction.

Industrial Mineral Mines and Quarries in British Columbia¹

Operation Name <i>(Owner/Operator)</i> <i>Website</i>	Key Community ³	Size ²	Commodity	Plant Supplied/Market
Phoenix Ridge (Phoenix Ridge Quarry Ltd.)	Kelowna	Small	Granite	Quarry large pieces of granite to be used as stacking stone for retaining walls, landscaping and stair building.
Pavilion (Graymont Western Canada Inc.)	Cache Creek	Small	Limestone	Supplies Graymont Western Canada 's plant adjacent to the quarry which produces lime (calcium oxide) for the mining, pulp and paper industries in BC and the US.
Red Lake (Absorbent Products Ltd.)	Kamloops	Small	Fuller's Earth and Diatomite	Supplies to Absorbent Products ' (Kamloops) plant which produces products that absorb odours and liquids for households (kitty litter), agriculture (barns) and industry.
Salmo (Crawford Bay) (IMASCO Minerals Ltd.)	Salmo	Small	Dolomite	Supplies dolomite to the IMASCO plant (Creston) where it is crushed and sized for landscaping, soil conditioning, and stucco; serving western Canada and northwest U.S. markets.
Sechelt (Construction Aggregates Ltd.)	Sechelt	Small	Aggregate	Quarries sand and gravel for aggregate. The main market for the product is the San Francisco Bay area and the construction industry in California.

Industrial Mineral Mines and Quarries in British Columbia¹

Operation Name <i>(Owner/Operator)</i> <i>Website</i>	Key Community³	Size²	Commodity	Plant Supplied/Market
Serpentine Lake (Polar Jade) (Green Mountain Gemstones Inc.)	Dease Lake	Small	Jade	Supplies rough jade to Jade West Resources (Surrey) for fashioning into ornaments and jewelry mainly for the Asian market.
Spumoni (Huckleberry Stone Supply Company)	Squamish	Small	Basalt	Supplies rough basalt blocks to Northwest Landscape and Stone Supply (Burnaby) for landscaping and decorative rock products.
Stoney Ridge (Stoney Ridge Aggregate)	Gabriola Isl.	Small	Sandstone	Supplies Stoney Ridge Aggregate (Gabriola Is.) with blocks of stone for landscaping on the Gulf Islands, Vancouver Isl., and in the Lower Mainland.
Superior Peat (S.L.8 Recreations)	Penticton	Small	Peat	Supplies peat and mulch to S.L.8 Recreations stockpile location (Penticton) for sale to the horticulture and viticulture industries in Central BC, the Lower Mainland, and Washington State.
Sumas Mountain (Sumas Shale Ltd.)	Abbotsford	Major	Clay	Supplies clay to Lafarge's cement plants in the Lower Mainland.

Industrial Mineral Mines and Quarries in British Columbia¹

Operation Name <i>(Owner/Operator Website)</i>	Key Community ³	Size ²	Commodity	Plant Supplied/Market
Swamp Point (Ascot Resources Ltd)	Stewart	Small	Aggregate	The primary market for the sand and gravel aggregate is Alaska and Northern BC via barge.
Swansea Ridge (CP Rail)	Cranbrook	Small	Gabbro	Crushed and sized for use by CPR as ballast for local railways.
Tahsis (Vancouver Island Marble)	Duncan	Small	White marble	Supplies rough marble to Vancouver Island Marble plant (Duncan) for fabrication of countertops and building facades, and landscaping tiles.
Trail (Teck)	Trail	Major	Slag	Produced from molten slag at the Trail smelter by quick water-cooling on-site and sold for use in cement manufacture.

Industrial Mineral Mines and Quarries in British Columbia¹

Operation Name <i>(Owner/Operator Website)</i>	Key Community ³	Size ²	Commodity	Plant Supplied/Market
Van Anda (Imperial) (Imperial Limestone Company Ltd.)	Texada Island	Major	Limestone	Supplies most of its crushed limestone via barge to J.A. Jack & Sons Inc. (Seattle, WA) plant for further grinding, supplying a nearby roofing shingle plant, a local glass manufacturer, the agriculture industry and other specialty markets; smaller quantities trucked to Powell River cement manufacturers.
Winner (Rockwool Group)	Grand Forks	Small	Diorite ¹⁸	Supplies crushed diorite to Roxul's (Grand Forks) plant which produces mineral wool insulation for home, commercial and business markets.
WRP (Western Rock Products)	Vernon	Small	Granite	Crushed granitic rock for road building, drainage, retaining walls.

¹² Diorite is a coarse-grained igneous rock, intermediate in composition between quartz-rich granite (light-coloured) and quartz-poor gabbro (dark-coloured).

Sulphur Refining Plants in British Columbia 2015¹

Operation Name <i>Company Name</i>	Key Community	Commodity	Market
Boundary Lake Petro Canada Inc.	Fort St. John	Sulphur as a by-product of natural gas refining	Information not available
Burnaby Chevron	Burnaby	Sulphur as by-product of oil refining in an on-site Sulphur Recovery Unit in which it is converted to a liquid form	Shipped to Washington state, then returned in pellet form to Pacific Coast Terminals (Port Moody) and shipped primarily to processors in China and India to be used in the production of fertilizer.
Cypress-Pink Mountain Anadarko	Pink Mountain	Sulphur by-product of natural gas refining	Information not available
Fort Nelson Westcoast Energy Inc.	Fort Nelson	Sulphur by-product of natural gas refining	Information not available
McMahon Westcoast Energy Inc.	Fort St. John	Sulphur by-product of natural gas refining	No information currently available
Pine River Westcoast Energy Inc.	Chetwynd	Sulphur by-product of natural gas refining	No information currently available
Trail Smelter Teck Ltd.	Trail	Slag and sulphur as by-products of zinc concentrate smelting (Trail)	Slag sold for cement production; sulphur sold for other industrial processes.

¹ The operations in the table are supplied with raw materials from nearby refineries, oil and gas wells.

Mining in British Columbia Poster Search

Look carefully at the poster **Mining in British Columbia (2013)** to find what industrial minerals are mined or quarried at the locations listed in the table below.

Operation Name	Industrial Mineral	Nearest Major Community
Anyox		
Apple Bay		
Ash		
Benson Lake		
Blubber Bay		
Brisco (Rocky Mountain Tufa)		
Bromley Creek		
Bud		
Canyon		
Cassiar		
Cox Station		
Dahl Lake		
Decor		
Elkhorn		
Falkland		
Fireside		
Four J (Canal Flats)		
Garibaldi Pumice		
Gillies Bay		

Name: _____

Industrial Mineral Operations Resource Package

Poster Search



Ginty		
Giscome		
Golden		
Gordon River		
Grand Forks		
Haddington Island		
Hardy Island		
Harper Ranch		
Hisnet		
Hunterstone		
K 2 Stone		
Klinker		
Kootenay Stone		
Kutcho Creek		
Moberly		
Mount Brussilof		
Mount Meager		
Nazko		
Orca Quarry		
Pavilion		
Red Lake		
Sechelt		
Serpentine Lake (Polar Jade)		

Spumoni		
Sumas Mountain		
Swamp Point		
Swansea Ridge		
Tahsis		
Trail		
Van Anda (Imperial)		
Winner		
WRP		

Mining in British Columbia Poster Search

This activity encourages students to look closely at the *Mining in British Columbia* poster, to become familiar with the names of the operations, what is mined or quarried and in what region of BC it is located. Most of the operations affect more nearby, smaller communities than those shown on the map, but it is still helpful to locate them relative to a major center. You might like to provide students with page size copies of the poster to look at (printable from the MineralsEd web site). Since there are many operations, it might also be speedier to divide the class into three groups and have each group collect the information for one page.

You might ask in conclusion: *Where are most operations located - in southern or northern BC?* Most are in the south in proximity to the most population, roads and rails, where the demand is greatest and transportation is easiest.




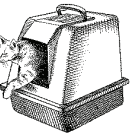




You might also ask: *Where are most of the mines and quarries located – in town or outside of town?* Most are located outside of town where there are no residential neighbourhoods or business areas. If the students are familiar with BC geography you might also ask them to list which ones appear to be within city limits. For those that are in rural areas now, they may like to consider what should or could happen when a community expands so that it encroaches on an existing mine or quarry.

Operation Name	Industrial Mineral	Nearest Major Community
Anyox	Slag	Terrace
Apple Bay	Silica	Port Hardy
Ash	Basalt	Kamloops
Benson Lake	Limestone	Port Hardy
Blubber Bay	Limestone and Dolomite	Campbell River
Brisco (Rocky Mountain Tufa)	Tufa	Brisco
Bromely Creek	Zeolite	Princeton
Bud	Bentonite	Kelowna
Canyon	Gneiss	Kelowna
Cassiar	Jade	Dease Lake
Cox Station	Granite	Abbotsford

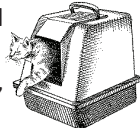


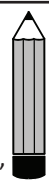

Dahl Lake	Limestone	Prince George
Décor	Bentonite and Shale	Cache Creek
Elkhorn	Gypsum	Invermere
Falkland	Gypsum	Invermere
Fireside	Barite	Dease Lake
Four J (Canal Flats)	Gypsum	Canal Flats
Garibaldi Pumice	Dacite Pumice	Pemberton
Gillies Bay	Limestone	Campbell River
Ginty	Slate, Flagstone, Tufa	Kimberley
Giscome	Limestone	Prince George
Gordon River	Marble	Nanaimo
Grand Forks	Slag	Grand Forks
Haddington Island	Andesite	Port Hardy
Hardy Island	Granite	Campbell River
Harper Ranch	Limestone	Kamloops
Hisnet	Marble	Campbell River
K 2 Stone	Slate	Port Renfrew
Klinker	Opal	Vernon
Kootenay Stone	Flagstone	Cranbrook
Kutcho Creek	Jade	Dease Lake
Moberly	Silica	Golden
Mount Brussilof	Magnesite	Invermere/Radium Hot Springs

Mount Meager	Pumice	Pemberton
Nazko	Pumice	Quesnel
Orca	Sand and Gravel	Port McNeill
Pavilion	Limestone	Kamloops
Red Lake	Fuller's Earth	Kamloops
Sechelt	Aggregate	Sechelt
Serpentine Lake (Polar Jade)	Jade	Dease Lake
Spumoni	Basalt	Squamish
Sumas Mountain	Clay	Abbotsford
Swamp Point	Aggregate	Stewart
Swansea Ridge	Gabbro	Cranbrook
Tahsis	Marble	Campbell River
Trail	Slag and Sulfur	Trail
Van Anda (Imperial)	Limestone	Texada Island
Winner	Diorite	Grand Forks or Greenwood
WRP	Granite	Vernon



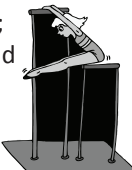
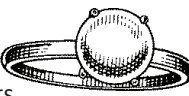
Uses of Industrial Minerals Mined in British Columbia

Commodity	What it is	Main Uses
Aggregate / lightweight aggregate	Loose rock that can be either river/beach sand or gravel, or crushed hard rock (e.g. granite, limestone) or loose volcanic rock fragments	Commonly used to build roads and make highways, to make asphalt and concrete, as railroad ballast and to improve icy and snowy road surfaces. 
Andesite	A fine-grained igneous volcanic rock , intermediate in composition (and colour) between basalt and rhyolite, commonly with crystals of plagioclase feldspar.	Used in BC as a building stone.
Barite	An ore mineral (Ba_5O_4) most commonly found in sedimentary rocks such as limestone or dolostone; locally occurs in veins.	Commonly used as a filler and white ner in paint, is used to increase the specific gravity (weight) of drilling mud, and is ingested to conduct x-ray diagnostic tests on the human digestive tract. 
Basalt	A dark-coloured, fine-grained igneous volcanic rock; may have vesicles (trapped gas bubbles) like pumice, but is very dense and heavy.	May be crushed into granules that are used to make asphalt roofing shingles. Larger basalt pieces are also used in landscaping. 
Bentonite	A soft, light-coloured clay that forms by the weathering of a volcanic ash layer, mostly made of an expandable clay mineral named montmorillonite ($(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \cdot nH_2O$).	Commonly used in drilling mud and as a sealing agent. It is also used to make kitty litter and other absorbents used in industry and agriculture. 
Clay¹ (Medical)	A soft, very fine-grained sedimentary deposit, not completely compacted or cemented enough to be called a rock, which may be bentonite clays, Fuller's Earth or other absorbing clays.	Used for facial masks. 
Dimension stone	Refers to any number of sedimentary, metamorphic, and igneous rocks, especially sandstone, granite, and marble that can be cut in different sizes and used in construction in various ways	Used as decorative rock, ashla (rectangular block of chiseled stone used in buildings), and facing rock. Cut pieces of solid rock are used to face buildings, make monuments, and to make floor tiles and countertops. 
Dolomite	A mineral ($Ca,Mg(CO_3)_2$) that makes up the sedimentary rock dolostone.	A source of lime (calcium oxide) and magnesium, used to neutralize acidic soils, as a flux in steelmaking, as an ingredient in glassmaking, in cement production, fertilizer, and paint. 
Fireclay	A type of shale (sedimentary rock) that is made up of aluminum-rich clay minerals such as kaolinite and montmorillinite (see above), and the very fine mica-like mineral illite.	Used to make refractory ceramic products such as crucibles and firebrick. Refractory minerals are resistant to extreme heat and exposure to corrosives. The clays provide excellent thermal insulation; fireclay bricks are used to line kilns, smelting vessels and containers used in pulp and paper, chemical, mining, water treatment and food making processes. 

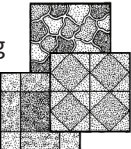


¹ Clay (Medical) is currently (2010) not mined in BC.

Commodity	What it is	Main Uses
Flagstone	Refers to rock that can easily be split into flat pieces, commonly, but not always referring to a metamorphosed sedimentary rock – slate, phyllite or schist.	Used to make floors, and to build retaining walls (layers placed horizontally one on top of another), to build fireplaces or make sidewalks and pavements.
Fuller's Earth	An earthy material containing clay minerals, mostly montmorillonite and commonly some bentonite.	Used to make household and industrial absorbents (e.g. kitty litter); used for refining and decolourizing fats and oils, absorbing skin oils in clay facial masks and as a natural bleach. Also used as a carrier for pesticides, and an anti-caking additive to animal feed. 
Gabbro	A dark-coloured, coarse-grained igneous plutonic rock made mostly of calcium-rich plagioclase feldspars and iron-magnesium rich silicate minerals.	May be quarried in large pieces that can be cut and polished for interior floor tiles and counter tops or cut for facing stones on buildings or tombstones and monuments. Crushed and used in BC for railway ballast.
Gneiss	A coarsely-crystalline metamorphic rock with distinctive dark- and light-coloured mineral bands, commonly derived from granitic or coarse-sedimentary parent rock.	May be quarried in large pieces that can be cut and polished for interior floor tiles and counter tops or cut for facing stones on buildings or tombstones and monuments.
Granite	A light-coloured, coarse-grained, igneous plutonic rock that is made up mostly of potassium feldspar and quartz, plus mica and hornblende.	May be quarried in large pieces that can be cut and polished for interior floor tiles and counter tops or cut for facing stones on buildings or tombstones and monuments. Crushed at some BC quarries to make aggregate for road base and to make concrete. 
Granodiorite ²	A coarse-grained igneous plutonic rock similar to but generally darker in colour and poorer in quartz than granite, and which also contains mostly feldspar minerals plus mica, and hornblende.	May be quarried in large pieces and used in ways similar to granite. In south central BC and elsewhere it may be melted and spun to form mineral wool insulation. 
Graphite	A mineral composed of carbon (C) which most commonly occurs in metamorphic rocks. It can be found as large crystalline plates or small flakes.	Used in pencil lead, in automobile gaskets and brake linings, in high technology electrical circuitry, in fuel cells, in sports equipment, as a flame retardant in paint and carpet, as a high-temperature lubricant, in refractory bricks, and many other specialty applications. 
Gypsum	A soft, white evaporite mineral ($\text{CaSO}_4 \cdot 2(\text{H}_2\text{O})$), which makes up a layered sedimentary rock also called gypsum.	A main ingredient in wallboard and building materials, plaster of Paris, and Portland Cement. Also ground and used as a soil conditioner to allow water and air to penetrate the soil, and to prevent it from compacting and losing its leaching ability. Gypsum is also used as a filler in paint. 




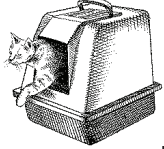




² Granodiorite is currently (2015) not mined in BC.

Commodity	What it is	Main Uses
Jade	The common name for the minerals jadeite ($(\text{Na}, \text{Al}, \text{Fe})\text{Si}_2\text{O}_6$) (a type of amphibole) and nephrite ($\text{Ca}_2(\text{Mg}, \text{Fe})_5\text{Si}_8\text{O}_{22}(\text{OH})_2$) (a type of actinolite) which form by metamorphic alteration of other sodium- and calcium-rich minerals.	This hard, green mineral is commonly used to make jewelry, gemstones, carved objects, and ornamental objects. 
Limestone	A common sedimentary rock composed mostly of the mineral calcite (CaCO_3).	Used as an ingredient in cement; roasted in a kiln to produce lime; used in construction aggregate, flux in steel manufacturing, in fertilizer, in poultry feed, a filler and whitener in paint and plastics, glass, soil conditioner; also used for sewage and water treatment. 
Magnesite	A magnesium-rich carbonate mineral (MgCO_3) commonly occurring in the sedimentary rock dolostone.	Source of magnesia (magnesium oxide); used as a refractory in steel furnaces and cement kilns because it is very resistant to heat; used in animal feeds, stucco, Epsom Salt, special cements and magnesium chemicals. Small chunks are used for landscaping. In its powdered form, it is used by gymnasts and weightlifters for grip. 
Magnetite	An iron-bearing mineral (Fe_3O_4) occurring in small amounts in all types of rocks. (In BC, it is recovered from the tailings deposit at Mt. Polley Mine)	Mixed with water to form a dense liquid that is used in the coal mining industry to separate coal from rock. Mined elsewhere as a main source of iron used in the manufacture of steel.
Marble	A metamorphic rock that originated as the sedimentary rock limestone.	Used as ornamental stone for buildings, memorials, and statues; used as a filler in paint and plastics.
Monzonite³	A light-coloured, coarse-grained, igneous plutonic rock that is rich in sodium-rich feldspar minerals, lesser amounts of potassium-rich feldspar, and poor in quartz.	Quarried in south central BC for processing into mineral wool.
Opal	A type of very finely crystalline quartz, a mineral ($\text{SiO}_2 - n\text{H}_2\text{O}$), which occurs in veins associated with some volcanic rocks.	Cut and polished into cabochons and used to make jewelry such as rings, earrings, necklaces, pendants, and mounted on gold or silver settings. 
Pumice	A light-coloured, light-weight igneous volcanic rock that is full of vesicles (trapped gas bubbles).	Pumice naturally occurs in pebble to boulder size pieces that are used in landscaping, lightweight aggregate, abrasives (stonewashing), baseball diamonds, and sport tracks. It is also used as a cosmetic abrasive (removing calluses), and to make stonewashed jeans.

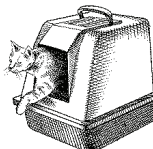

³ Monzonite is currently (2015) not mined in BC.

Commodity	What it is	Main Uses
Shale	A fine-grained sedimentary rock made mostly of clay minerals and silt.	Crushed and processed for brick-making and ceramic tiles; ground and used in cement-production. 
Silica	Generally refers to the silicon-rich mineral quartz (SiO ₂). It is common in many kinds of rocks, but is a dominant mineral in many ancient sandstones.	Source of elemental silicon; used to make glass, as a flux in steel making, to cast metal, a main ingredient in cement, and used to make memory chips in computers.
Slag	A glassy-looking by-product of the smelting process.	Produced by water-cooling molten slag into a granular form or crushed to sand-size grains that may be used in road bases, asphaltic aggregates, abrasives, fills, mineral wool, cement, and concrete applications.
Slate	A fine-grained metamorphic rock that originated as shale, and has strong cleavage planes along which the rock readily breaks apart.	Used as decorative building stone, ornamental stone, roofing tiles, and in flooring; the original blackboard.
Sulphur	A bright-yellow element (S) derived as a by-product of crude oil, natural gas, and tar sands refining.	Used to make sulphuric acid which is used in many industrial processes, one important use of which is the production of fertilizer; ingredient in match sticks.
Tufa	A type of limestone formed by the precipitation of the mineral calcite from hot springs in volcanic areas.	This unusual deposit displays internal layers and smooth, irregular surfaces so it is decorative and commonly used in gardening, landscaping, water fountains, ponds, and sculptures. 
Zeolite	One of several sieve-like minerals that form by weathering of feldspars in volcanic rocks or weathering of volcanic glass.	Uniquely capable of absorbing gases and liquids, and capturing metals. Used to produce absorbent pellets for animal litter, for example in kitty boxes and livestock pens (e.g. used in stables along with horse bedding to prevent ammonia fumes from damaging the horse's lungs and coat); used as molecular sieves in oil refining and other industrial processes; component of some fertilizers. 



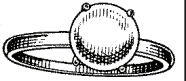
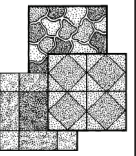
Uses of Industrial Minerals Mined in British Columbia

Commodity	What it is	Main Uses
Aggregate / lightweight aggregate	Loose sand or gravel, or crushed hard rock or loose volcanic rock fragments	<ul style="list-style-type: none"> • Road and highway building • Ingredient in asphalt and concrete • Railroad ballast • Improving icy and snowy roads 
Andesite	A medium-coloured volcanic rock	<ul style="list-style-type: none"> • Used in BC as a building stone for historical and modern building
Barite	An ore mineral that most commonly occurs in veins	<ul style="list-style-type: none"> • Paint filler and whitener • Drilling mud • X-ray medical tests 
Basalt	A dark-coloured volcanic rock	<ul style="list-style-type: none"> • Crushed into granules for asphalt shingles • Larger blocks for landscaping 
Bentonite	A soft, light-coloured clay (very fine sediment)	<ul style="list-style-type: none"> • Ingredient in drilling mud • Sealing material • Ingredient in kitty litter and other industrial and agricultural absorbent • Binding agent in iron ore pellets 
Clay¹ (Medical)	A type of soft, very fine-grained sedimentary deposit	<ul style="list-style-type: none"> • Facial masks 
Dimension stone	Any kind of rock that can be quarried and cut in different sizes for many different uses	<ul style="list-style-type: none"> • Decorative rock • Ashlar (rectangular block of chiseled stone used in buildings) • Facing stone on buildings • Monuments • Floor tiles and countertops 
Dolomite	A mineral that makes up the sedimentary rock dolostone	<ul style="list-style-type: none"> • Source of lime • Acid neutralizing material • Flux in steelmaking • Ingredient in glassmaking, cement, fertilizer, and paint 
Fireclay	A type of shale (sedimentary rock) that is made up of aluminum-rich clay minerals such as kaolinite and montmorillinite (see above), and the very fine mica-like mineral illite.	<p>Materials that must withstand high temperatures and corrosive mixtures such as:</p> <ul style="list-style-type: none"> • Crucibles • Firebrick to line kilns, smelting vessels, and containers used in pulp and paper-making, chemical processing, mining, water treatment and food making processes • Space shuttle tile ingredient 



¹ Clay (Medical) is currently (2015) not mined in BC.

Commodity	What it is	Main Uses
Flagstone	A rock that can easily be split into flat pieces, commonly a metamorphic rock	<ul style="list-style-type: none"> • Floors, sidewalks, pavements • Retaining walls • Fireplaces
Fuller's Earth	A fine-grained earthy material (mostly fine clays) that absorbs water, oil and colour	<ul style="list-style-type: none"> • Ingredient in kitty litter • Refining and decolourizing fats and oils • Facial masks • Natural bleach • Carrier for pesticides • Anti-caking additive to animal feed 
Gabbro	A dark-coloured igneous plutonic rock	<ul style="list-style-type: none"> • Dimension stone: tombstones, countertops, floor tiles, facing stone • Railway ballast and road beds
Gneiss	A coarse metamorphic rock with wavy, dark- and light-coloured mineral bands	<ul style="list-style-type: none"> • Dimension stone: tombstones, countertops, floor tiles, facing stone • Crushed for aggregate
Granite	A light-coloured igneous plutonic rock	<ul style="list-style-type: none"> • Dimension stone: tombstones, countertops, floor tiles, facing stone • Crushed for aggregate for road base or to make concrete
Granodiorite²	An intermediate-coloured igneous plutonic rock	<ul style="list-style-type: none"> • Dimension stone: tombstones, countertops, floor tiles, facing stone • Melted and spun into mineral wool insulation
Graphite	A soft grey mineral that occurs in metamorphic rocks	<ul style="list-style-type: none"> • Pencil lead • Automobile gaskets and brake linings • High technology electrical circuitry • Hydrogen fuel cells • Bikes, tennis rackets and fishing rods • Flame retardant ingredient in paint and carpet • High-temperature lubricant • Ingredient in refractory bricks 
Gypsum	A soft, white mineral that makes up a layered sedimentary rock also called gypsum	<ul style="list-style-type: none"> • Ingredient in wallboard, plaster of Paris and Portland Cement • Soil conditioner • Paint filler
Jade	Hard, green semi-precious mineral	<ul style="list-style-type: none"> • Jewelry • Gemstones • Carved objects • Ornamental objects

² Granodiorite is currently (2015) not mined in BC.

Commodity	What it is	Main Uses
Limestone	A sedimentary rock composed mostly of the mineral calcite	<ul style="list-style-type: none"> •Source of lime •Ingredient in cement •Construction aggregate •Flux in steel-making •Ingredient in fertilizer, poultry feed, glass, •Filler and whitener in paint and plastics •Acid neutralizer for soil, sewage and water treatment 
Magnesite	A mineral most commonly occurring along with the mineral dolomite in the sedimentary rock dolostone	<ul style="list-style-type: none"> •Milk of magnesia (laxative) •Animal feed •Epsom Salt •Special cements •Gripping powder 
Magnetite	An iron-bearing mineral that is naturally magnetic	<ul style="list-style-type: none"> •Coal washing additive •Main ingredient in steel
Marble	A metamorphic rock that originated as the sedimentary rock limestone	<ul style="list-style-type: none"> •Ornamental stone for buildings, memorials, and statues •Flooring, facing stone and countertops •Filler in paint and plastics
Monzonite³	A light-coloured igneous plutonic rock	<ul style="list-style-type: none"> •Mineral wool insulation
Opal	A type of quartz, a mineral, which occurs in veins in some volcanic rocks	<ul style="list-style-type: none"> •Jewelry: rings, earrings, necklaces, pendants 
Pumice	A light-coloured igneous volcanic rock with holes	<ul style="list-style-type: none"> •Landscaping •Lightweight aggregate in concrete •Abrasives (stonewashing fabric) •Baseball diamonds and sport tracks •Cosmetic abrasive (removing calluses)
Shale	A fine-grained sedimentary rock made mostly of clay minerals and silt	Ingredient in: <ul style="list-style-type: none"> •Bricks •Ceramic tiles •Cement-production 
Silica	Refers to the mineral quartz which is the main mineral in many sandstones and some other rocks	<ul style="list-style-type: none"> •Silicon source •Ingredient in: glass, cement and computer microchips •Flux in steel making •Molding sand for casting metal
Slag	A man-made, silica-rich, glassy-looking by-product of smelting	Processed to sand-size grains used in: <ul style="list-style-type: none"> •Asphalt, cement and concrete, and mineral wool •Sandblasting

³ Monzonite is currently (2015) not mined in BC.

Commodity	What it is	Main Uses
Slate	A fine-grained metamorphic rock that breaks into flat layers	<ul style="list-style-type: none"> •Decorative building stone •Roofing tiles •Floors and walkways
Sulphur	A bright-yellow element produced as a by-product of crude oil, natural gas, and tar sands refining	<ul style="list-style-type: none"> •Sulphuric acid used to make fertilizer, match sticks, gun powder, batteries •Antibiotic drugs and other medicine •Rubber tires and many other things
Tufa	A type of limestone precipitated from mineral hot springs	<ul style="list-style-type: none"> •Decorative landscaping 
Zeolite	A group of minerals with special sieve-like properties	<ul style="list-style-type: none"> •Animal litter •Oil refining •Water filtering processes •Livestock feed additive •Water softening 

Match the Industrial Mineral with its Use

Match the industrial minerals on the left with one of its most common uses from the column on the right.

Industrial Mineral

1. Aggregate _____

2. Limestone _____

3. Slag _____

4. Gypsum _____

5. Clay _____

6. Granite _____

7. Slate _____

8. Jade _____

9. Zeolite _____

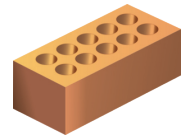
10. Pumice _____

Uses

a) Kitty litter



b) Bricks



c) Callous remover



d) Roads

e) Countertops

f) Roofing granules

g) Cement and concrete



h) Jewelry, carvings



i) Wallboard

k) Roofing tile



Match the Industrial Mineral with its Use

Match the industrial minerals on the left with one of its most common uses from the column on the right.

Industrial Mineral

1. Aggregate __d__

2. Limestone __g__

3. Slag __f__

4. Gypsum __i__

5. Clay __b__

6. Granite __e__

7. Slate __k__

8. Jade __h__

9. Zeolite __a__

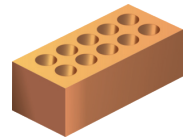
10. Pumice __c__

Uses

a) Kitty litter



b) Bricks



c) Callous remover

d) Roads



e) Countertops

f) Roofing granules

g) Cement and concrete



h) Jewelry, carvings

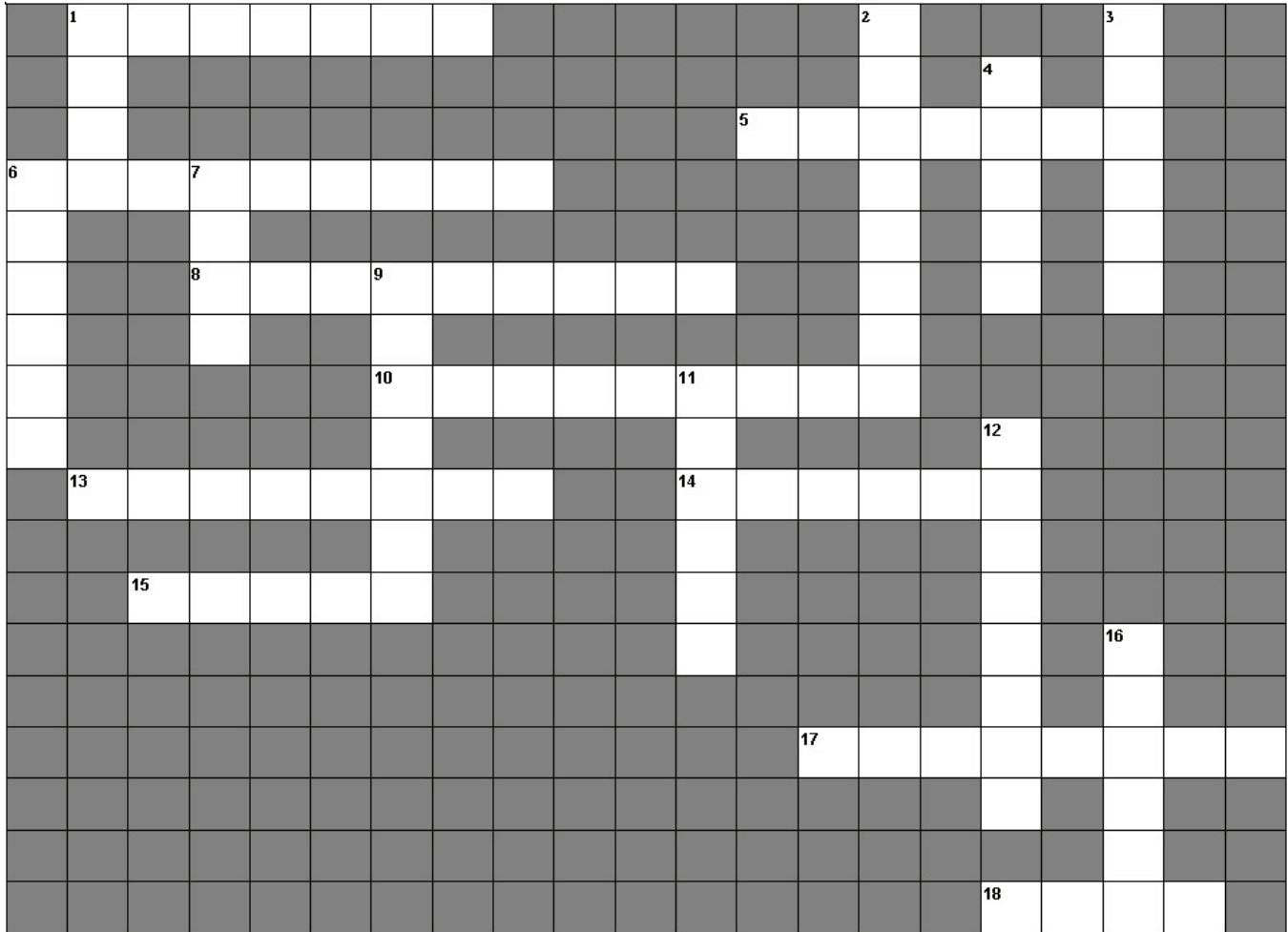


i) Wallboard

k) Roofing tile



Industrial Mineral Uses Crossword


Across

1. Use of opal
5. Smelly, yellow element produced from natural gas refining which is used to make matchsticks
6. Absorbent clay used to a make kitty litter
8. Common name for building stone that breaks into flat pieces used for walkways, etc.
10. Loose or crushed rock used in making concrete
13. Soft grey metamorphic mineral used in pencils
14. Light weight volcanic rock used in landscaping
15. Metamorphic rock used as roofing tile
17. Industrial mineral used to make insulating bricks
18. Glassy by-product of smelting used in making cement and for sandblasting

Down

1. Hard green mineral used in jewelry and carvings
2. Industrial mineral used in cement, fertilizer, paint, and glassmaking
3. Metamorphic rock used by great European sculptors
4. Fine-grained sedimentary rock used to make bricks and ceramic tiles
6. Heavy mineral used in drilling mud and for some medical tests
7. Ornamental limestone used for landscaping
9. Igneous rock commonly used for monuments
11. White industrial mineral used to make wallboard and Plaster of Paris
12. Minerals that readily absorb gases (odours) and liquids and metals
16. Hard clear mineral used in making glass

Industrial Mineral Uses Crossword

	J	E	W	E	L	R	Y							D				M			
	A													O		S		A			
	D												S	U	L	P	H	U	R		
B	E	N	T	O	N	I	T	E						O		A		B			
A			U											M		L		L			
R			F	L	A	G	S	T	O	N	E			I		E		E			
I			A			R								T							
T						A	G	G	R	E	G	A	T	E							
E						N						Y					Z				
	G	R	A	P	H	I	T	E				P	U	M	I	C	E				
						T						S					O				
		S	L	A	T	E						U					L				
												M					I		S		
																	T		I		
														F	I	R	E	C	L	A	Y
																	S		I		
																			C		
																	S	L	A	G	

Across

1. Use of opal
5. Smelly, yellow element produced from natural gas refining which is used to make matchsticks
6. Absorbent clay used to a make kitty litter
8. Common name for building stone that breaks into flat pieces used for walkways, etc.
10. Loose or crushed rock used in making concrete
13. Soft grey metamorphic mineral used in pencils
14. Light weight volcanic rock used in landscaping
15. Metamorphic rock used as roofing tile
17. Industrial mineral used to make insulating bricks
18. Glassy by-product of smelting used in making cement and for sandblasting

Down

1. Hard green mineral used in jewelry and carvings
2. Industrial mineral used in cement, fertilizer, paint, and glassmaking
3. Metamorphic rock used by great European sculptors
4. Fine-grained sedimentary rock used to make bricks and ceramic tiles
6. Heavy mineral used in drilling mud and for some medical tests
7. Ornamental limestone used for landscaping
9. Igneous rock commonly used for monuments
11. White industrial mineral used to make wallboard and Plaster of Paris
12. Minerals that readily absorb gases (odours) and liquids and metals
16. Hard clear mineral used in making glass

Name: _____

Industrial Mineral Operations Resource Package

Mineral Resources in BC Word Search



Mineral Resources in British Columbia Word Search

V L G C S D E J E M M F G L M
D V I H O T L T D A E U A L U
I I A M I P I O G G A L B M S
E L O R E N P N G N Y L B U P
E T A R O S E E O E A E R N Y
E B I T I S T Y R T L R O E G
Z T N S I T G O S I C S L D Q
R E I T E R E E N T E B E B R
B D E L A D J A D E R L A Y E
E T I N O Z N O M A I A R L V
C N I Z N E M A M N F O T O L
H T F L A G S T O N E C H M I
E T A L S G R A P H I T E B S
B A S A L T G R U H P L U S H
P U M I C E X K S S I E N G W

Circle the mineral resources listed below where they occur in the puzzle above. Word spellings may be forward, backward or diagonal.

ANDESITE
BARITE
BASALT
BENTONITE
COAL
COPPER
DIORITE
FIRECLAY
FLAGSTONE

GABBRO
GNEISS
GOLD
GRANITE
GRAPHITE
GYPSUM
JADE
LIMESTONE
MAGNESITE
MAGNETITE

MARBLE
MOLYBDENUM
MONZONITE
PUMICE
SHALE
SILVER
SLATE
SULPHUR
ZINC

Mineral Resources in British Columbia Word Search

V	L	G	C	S	D	E	J	E	M	M	F	G	L	M
D	V	I	H	O	T	L	T	D	A	E	U	A	L	U
I	I	A	M	I	P	I	O	G	G	A	L	B	M	S
E	L	O	R	E	N	P	N	G	N	Y	L	B	U	P
E	T	A	R	O	S	E	E	O	E	A	E	R	N	Y
E	B	I	T	I	S	T	Y	R	T	L	R	O	E	G
Z	T	N	S	I	T	G	O	S	I	C	S	L	D	Q
R	E	I	T	E	R	E	E	N	T	E	B	E	B	R
B	D	E	L	A	D	J	A	D	E	R	L	A	Y	E
E	T	I	N	O	Z	N	O	M	A	I	A	R	L	V
C	N	I	Z	N	E	M	A	M	N	F	O	T	O	L
H	T	F	L	A	G	S	T	O	N	E	C	H	M	I
E	T	A	L	S	G	R	A	P	H	I	T	E	B	S
B	A	S	A	L	T	G	R	U	H	P	L	U	S	H
P	U	M	I	C	E	X	K	S	S	I	E	N	G	W

Circle the mineral resources listed below where they occur in the puzzle above. Word spellings may be forward, backward or diagonal.

- | | | |
|-----------|-----------|------------|
| ANDESITE | GABBRO | MARBLE |
| BARITE | GNEISS | MOLYBDENUM |
| BASALT | GOLD | MONZONITE |
| BENTONITE | GRANITE | PUMICE |
| COAL | GRAPHITE | SHALE |
| COPPER | GYPSUM | SILVER |
| DIORITE | JADE | SLATE |
| FIRECLAY | LIMESTONE | SULPHUR |
| FLAGSTONE | MAGNESITE | ZINC |
| | MAGNETITE | |

Name: _____

Industrial Mineral Operations Resource Package

Industrial Mineral Uses: True or False?



Industrial Mineral Uses: True or False?

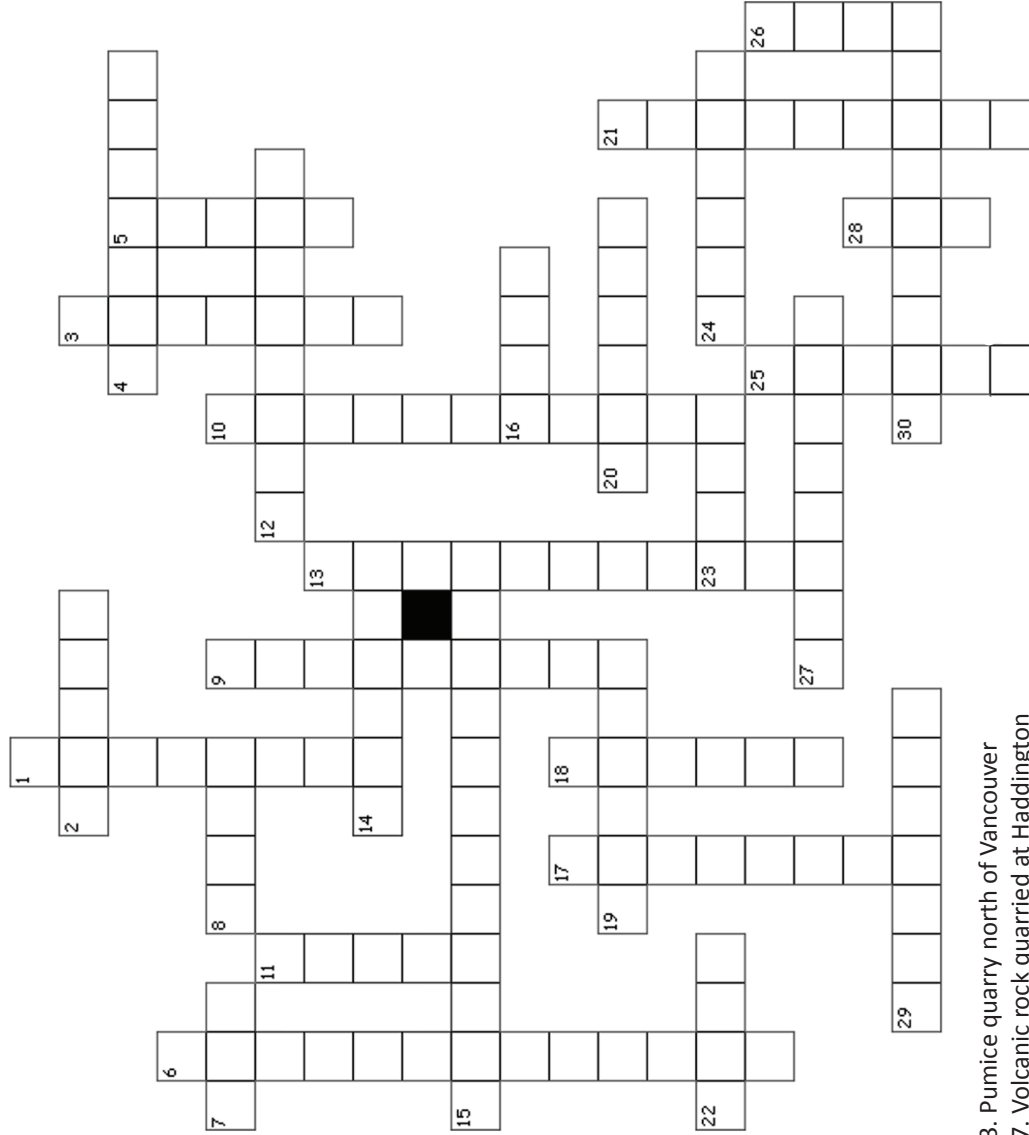
Place a **T** (true) or **F** (false) in the blank at the end of each sentence.

1. Pencil leads are made of the soft mineral graphite . ____
2. Roofing tiles in BC are commonly made of gypsum . ____
3. Granite is quarried for ornamental facing stone on buildings. ____
4. Cement and concrete are the same thing. ____
5. Limestone is the source of lime that is used to make glass. ____
6. One ingredient in kitty litter is bentonite . ____
7. Insulating bricks are made from magnetite . ____
8. Flagstone makes good stepping stones for walkways. ____
9. A gymnast's grip powder is made of magnesite . ____
10. Slag and basalt are used for roofing granules. ____

Industrial Mineral Uses: True or False?

Place a **T** (true) or **F** (false) in the blank at the end of each sentence.

1. Pencil leads are made of the soft mineral graphite . <u> T </u>
2. Roofing tiles in BC are commonly made of gypsum . <u> F </u>
3. Granite is quarried for ornamental facing stone on buildings. <u> T </u>
4. Cement and concrete are the same thing. <u> F </u>
5. Limestone is the source of lime that is used to make glass. <u> T </u>
6. One ingredient in kitty litter is bentonite . <u> T </u>
7. Insulating bricks are made from magnetite . <u> F </u>
8. Flagstone makes good stepping stones for walkways. <u> T </u>
9. A gymnast's grip powder is made of magnesite . <u> T </u>
10. Slag and basalt are used for roofing granules. <u> T </u>



BC's Mineral Resources, Operations and Communities Crossword

Across

- 2. Pumice deposit in north central BC
- 4. Important BC gold rush community, now home to some of Mount Polley, Gibraltar and QR workers
- 7. Bentonite quarry in southern BC
- 8. Gemstone that refracts the colours of the rainbow
- 12. Soft grey mineral used in pencils
- 14. Molybdenum mine in north central BC
- 15. Coal mine in southeast BC
- 16. Glassy by-product of metal smelting
- 19. Kelowna's metamorphic bedrock
- 20. Black volcanic rock used for landscaping
- 22. The great protector
- 23. Wedding ring metal
- 24. Diorite quarry supplying Grand Forks' rock wool plant
- 27. Historical brick-making deposit on Sumas Mountain
- 29. Silica quarry near Golden
- 30. Common sedimentary rock ingredient in cement

Down

- 1. Limestone quarry (and lime plant) west of Kamloops
- 3. Natural gas refining by-product
- 5. Natural roofing tile material
- 6. Location where three industrial minerals are quarried
- 9. Underground zinc/copper mine on Vancouver Island
- 10. Granite quarry on the coast across from Texada Island
- 11. South central BC smelter producing slag and sulphur
- 13. Pumice quarry north of Vancouver
- 17. Volcanic rock quarried at Haddington Island
- 18. Cement ingredient mined near Port Hardy
- 21. Historic mining town near the U.S. border with a recently closed slag quarry
- 25. Ingested for certain x-ray tests
- 26. Semi-precious green mineral used in carvings
- 28. Basalt quarry west of Kamloops

