



The open-pit, lead-zinc mine of Anvil Mining Corp., Ltd. is at Faro, Yukon Territory.

Conquest of the Northwest Frontier

A. Blake Caldwell

Editor

Northwest frontier is here defined as Alaska, the Yukon, the Northwest Territories and northern British Columbia.

The mineral potential of this area is great and will unfold in the decade ahead but now the largest single producer is the Pine Point lead-zinc mine in the NWT about 1200 km north of Edmonton, Alta., close to the south shore of Great Slave Lake. The mill, initially designed for 4540 mtpd, was expanded to 7250 mtpd in 1969. This operation is described in detail in *Mining and Concentrating of Lead and Zinc*, Vol. 1, Chapt. 17, SME/AIME in the article by W. H. R. Gibney.

Alaska

Value of mineral production in Alaska totalled \$299.4 million in 1970, compared to \$257.6 million in 1969. Of this amount crude oil and natural gas accounted for 86% of the total, a drop of 2% under the previous comparison. Although, fuels account for the lion's share of the minerals currently produced in Alaska, metal exploration expenditures indicate that minerals are attracting an ever increasing audience and this coupled with exploration work funded by the State should boost metals production later in the 1970's.

Alaska, under a policy of opening certain reservations for mining

authorized its Fairbanks office of the Bureau of Indian Affairs to issue a Notice of Availability of Nonexclusive Prospecting Permits on the Venetie-Chandalar Indian Reservation. The area between the Chandalar and Christian Rivers north of the Yukon River and of the Arctic Circle, covered lands as far north as Arctic Village above the 68th Parallel. Mineral prospecting permits, excluding oil and gas, sand and gravel, were available without lease option. Other areas which the State was reportedly considering included Akutan, Annette Is., Diomedes Is., Karluk, Klukwan, Unalakleet and Wales.

COAL—In 1969 coal production dropped 11% compared to the ex-

perience of 1968. Usibelli Coal Mines, Inc., completed its purchase of Vitro Minerals Corp., Nenana (Healy River) field. This leaves Vitro without an operating mine. Cortella Coal Corp. of Cordova continued its examination of coal deposits in the Bering River field, north of Controller Bay on the Gulf of Alaska. Japanese business men show an interest in the Kukpowruk River coalfields in remote northwestern Alaska. Immense coal resources are indicated in the area between Point Hope and Barrow north of the Bering Strait on the Chukchi Sea. Work conducted by the Bureau of Mines indicates that the Kukpowruk coals are capable of producing metallurgical quality coke by blending as little as 15% of strongly coking coals. Morgan Coal Co. of West Virginia and Kaiser Steel Corp. are reported to be interested in the coal resources of this area. American Carbon Co. reported plans for a \$35 million installation to mine and upgrade 7-million tpd of coal from its Bering River deposit.

Senator Ted Stevens of Alaska has requested a \$422,000 feasibility study for delineating the Beluga coal field west of Anchorage. It is hoped that a reserve of about 1 billion tons of bituminous coal will be developed. This field is located across Cook Inlet from Anchorage and about 25 miles to the west.

COPPER—Under the stimulus of expropriation by developing nations in other parts of the world, the copper potential of Alaska has been the subject of much interest by many major mining companies. In 1969, it was estimated that \$4 million was spent on copper exploration in southeastern Alaska. During that period 1041 new claims were staked. Nuclear Minerals Corp. was active in the McCarthy district and in Kushokwin. El Paso Natural Gas Co. moved to the Alaska scene and put field crews to work on the Prince of Wales Is. and the mainland. Humble Oil and Refining Co., American Smelting and Refining Co. (Asarco), Newmont Mining Corp., Paramount Mining Co., Dynasty Exploration, Inc., Phelps Dodge Corp., Utah Construction and Mining Co., Falconbridge Nickel Mines, Copper Range Co. and Mobil Oil Co. were also reported to be interested in southeastern Alaska.

GOLD—Gold output continues without any dramatic growth developments. In 1968, 21,227 oz was produced, 99% of which comes from placer deposits. Starting in 1969 strong interest developed in offshore placers. Shell Oil Co. and Asarco returned to the Nome area during the year for additional exploratory work. In addition to the two companies listed above, Amerada Hess Corp., Auric Mining Co., Inlet Oil Co., Ocean Science and Engineering,

Inc. and Occidental Mineral Corp. are prospecting for offshore placer deposits.

IRON ORE—U.S. Steel Corp. leased a 589-acre tract from the Klukwan Indian Council for an alluvial fan iron ore deposit along the Chilkat River near Haines. It is reported that the company has other holdings at Klukwan on lode and placer deposits, both of which are gigantic. The ores are said to be amenable to relatively simple upgrading.

OTHER METALS—Nurana Mining Co. of Japan reopened the Red Devil mercury mine in the Kuskokwinn River basin in 1970 and as a result Alaska mercury production was the best since 1962. Chandalar Gold Mining Co. operating its Chandalar lodes north of the Arctic Circle reported milling some 3000 tons of 0.5 oz gold ore in 1970. This production resulted in boosting Alaskan gold output over the 1969 amount significantly and in addition showed the first increase in gold output for the state since 1962.

Newmont Exploration Ltd. serving under a joint agreement between its parent company Newmont Mining Corp. and Kendrick Bay Mining Co., discovered a moderate tonnage of uranium-thorium ore on Kendrick's property on Prince of Wales Island, Alaska, in 1970. Tonnage at that time would not justify a treatment plant but preparations were made to develop the mine for production and shipment of the ore to Newmont's subsidiary Dawn Mining Co.'s uranium mill for treatment in Ford, Wash.

It has been reported by E. R. Chipp, mining geologist for the Alaska Geological Survey, that hard mineral exploration and development in Alaska continues steadily upward. Total exploration expenditures in 1970 were estimated at \$7 million which was considered a slight increase over 1969 allocations. Prospect development, offshore gold and platinum exploration and grass-root reconnaissance are included in this total. So far the chief interest seems to be for copper, copper-moly, uranium, fluorite-tin-beryllium-tungsten, nickel-copper, iron, coal, gold, barite and mercury.

Chipp reports **Newmont Exploration Ltd.**'s Ross-Adams high-grade uranium deposit in southeastern Alaska should begin production soon. **Chandalar Gold Mining and Milling Co.** is producing high-grade gold from its Mikado Lode in the Brooks Range in a 100 tpd mill. **Bear Creek Mining** continues to develop its Bernite Copper deposit; **Cities Service** has performed underground development work on its Denali stratiform copper deposit in the Alaska Range; **Serem Alaska, Inc.**, a French joint venture continues development work on its copper-moly prospect near Chignik on

the Alaska Peninsula; **PCE** is trying to reopen its Lost River Mine as detailed elsewhere in this article and **American Exploration Co.** is drilling its Orange Hill copper-moly deposit in the Copper River area.

The leached porphyry copper-moly deposit at Casino (100 mi from the Alaskan border in the Yukon) has promoted interest in the Forty-mile district of Alaska.

A. H. Daily, mining engineer, Oakland, Calif., estimated the Nome area has produced some 5 million ounces of gold from 1897 through 1964 and that the greater part of the production came from placers on the coastal plain. Beach ridges detected offshore are important as possible sites of placer gold deposits similar to beaches on shore which were mined during the Nome gold rush. The most promising areas for offshore placer gold deposits are where beaches are carved in or rest on drift and nearby areas to the east of Nome because of eastward longshore drift.

Similar deductions related to fans or deltas offshore indicate that because fans are sites of aggradation, there is little opportunity for the repeated winnowing and reworking that is generally involved in the development of rich placer deposits.

In contrast to the findings for fans or deltas, surface channels or depressions in the sea floor are considered significant in placer exploration because they mark sites of fluvial deposits that may contain concentrations of placer gold. The most significant of all of these are those surface channels that are most extensive and which cut either into bedrock or through auriferous Illinoian drift.

As with surface channels, buried channels are also important for concentration of heavy minerals. In the past, dredges have worked buried channels onshore at Nome and recovered significant amounts of gold. There is no reason to believe that offshore buried channels should not contain quantities of detrital mineral deposits in the nearshore areas.

In addition, acoustical sinks should be significant features by which detrital deposits of heavy minerals, especially gold may be located.

The importance of morainal deposits placed by glaciers and faults within the area are not as clear as the foregoing features but as detrital heavy minerals often concentrate on bedrock surfaces, particularly in small pockets or depressions, bedrock depth and surface configuration should be significant in offshore placer gold mining.

Lockwood, Kessler & Bartlett, Inc. of Pasadena, Calif. announced in April, 1971, that the firm was awarded a large contract by Alaska for aerial magnetic surveying of the East Alaska Range, Goodnews area and near Nome. Officials of this consulting firm believe that the results



The new 7500-tpd copper concentrator of Granduc Operating Co. receives ore through a 10.3-mile tunnel connecting the mine with the mill at Tide lake, 32 miles by road from Stewart, B.C.

should provide a real impetus to Alaska minerals exploration.

BC-Yukon-NWT

J. S. McIntosh, Kaiser Engineers, Vancouver, B.C., delivered a paper, "The Growth of Mining in British Columbia", at the February 1970 AIME Annual Meeting. In this presentation he informed the audience that British Columbia is 1.4 times the size of Texas and largely composed of rugged, mountainous country and timberland. The Province has within its borders a part of the great Cordillera which stretches from Central America to Alaska and because of this structure it is a favorable geological environment for mineral occurrence. With 60% of the Province's population living in only 1% of the region (in the extreme southwest corner) mineral exploitation has been welcomed as a means

of opening-up British Columbia to industrial and economic development.

Based on McIntosh's paper, British Columbia mine output rose sharply from 96,000 tons in 1968 to 136,000 tons in 1969, a 42% increase in a single year.

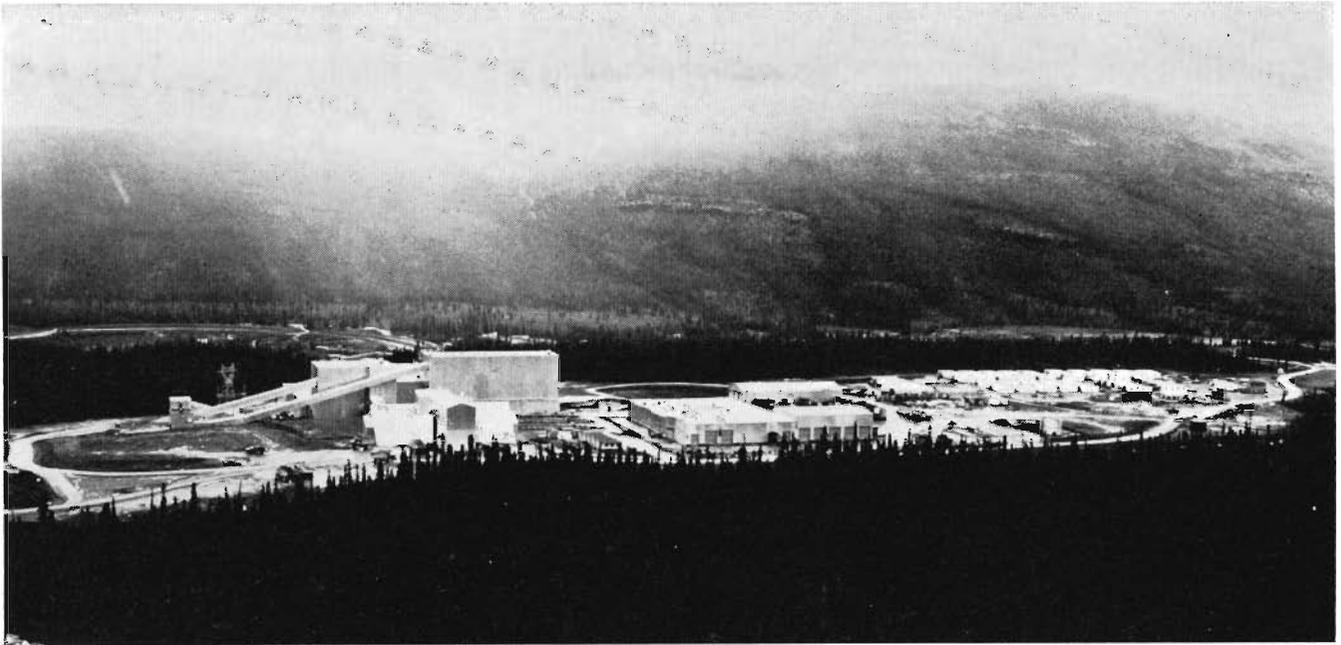
Contributing to this rise in output are the following developments:

Brenda Mines Ltd. 24,000 tpd open-pit copper-moly operation. Investment \$64 million . . . **Kaiser Resources, Ltd.** 6.7 million tpd strip-mine coal operation. Investment \$140 million . . . **Granduc Mines, Granduc, B.C.**, 7500 tpd underground copper operation. Investment \$100 million . . . At the time the paper was delivered new project developments announced but not constructed included the following: (The latest production data is given in the last sentence of each based on "Mining Development Review 1971" published by British Columbia & Yukon Chamber of Mines.)

Lornex Copper Corp., Highland Valley B.C. 38,000 tpd open-pit copper-moly operation. Investment \$133 million. Startup 1972 . . . **Utah Construction & Mining Co.**, Port Hardy, B.C. 33,000 tpd open-pit copper-moly operation. Investment \$70 million. In production 1971 . . . **Fording Coal Co.**, Elk Valley, B.C. 3 million tpd strip-mine coal operation. Investment \$80-million. In production 1972 . . . **Churchill Copper Corp.** 750-tpd underground high-grade copper operation. Investment \$6 million . . .

McIntosh also said that British Columbia officials could look forward to the development in the immediate future (years after 1969) of the following properties: (The latest data is given on each project also.)

Valley Copper Mines Ltd., Highland Valley. 40,000 tpd open-pit copper property. (Cominco 80% and Bethlehem Copper 20%) Investment \$150 million . . . **Bethlehem Copper**



Anvil's concentrator has a capacity of 6600 tpd. The company is owned jointly by Cyprus Mines Corp. and Dynasty Explorations.

Corp., Highland Valley expansion to 11,000 tpd. Investment \$27 million . . . **Newmont Mining Corp. of Canada Ltd.**'s Similkameen Mining Co., Princeton, B.C. 15,000 tpd copper property. Investment \$72 million. In production 1971 . . . **Noranda Mines Ltd.**'s Babine Lake, B.C., 10,000 tpd Bell copper division property. Investment \$40 million. In production 1972 . . . **Kennco Explorations (Western) Ltd.**'s Stikine Copper property . . . **Highmont Mining Corp.**'s Highland Valley, B.C., 25,000-tpd open-pit copper property. Investment \$66 million. Startup 1972 . . . **Alwin Mining Co.**'s Highland Valley, B.C. 500 tpd underground copper property. Investment \$3.4 million. Looking for backers . . . **Placer Development Ltd.**, McLeese Lake, B.C., 30,000 tpd copper-moly property. Investment \$74 million. Startup 1971 . . . **Gilbralter Mines Ltd.**, McLeese Lake, B.C., 30,000 tpd. Investment \$74 million. In production 1971 . . . **Granisle Copper Ltd.**, Babine Lake, B.C., expansion to 14,000 tpd operations. Investment \$9 million. Startup in 1972 . . . **Hudson-Yukon Mining Co. Ltd.**, Quill Creek, Yukon, 600 tpd nickel-copper operation. Investment \$10 million. In production 1971 . . . **Dison Development Ltd.**, Jordan River, B.C., 1500 tpd copper operation. Investment \$1.8 million. In production 1971 . . . **Placid Oil Co.**, Cranbrook, B.C., 750 tpd open-pit copper operations. Investment \$7.5 million. In production 1971 . . . **Emkay Canada Natural Resources Ltd.**, Elk Valley, B.C., 3-4 million tpd coal operations. Investment \$100 million. Startup 1974-1975 . . .

Quoting McIntosh again, he estimated total British Columbia capital investments in the mineral industry at \$162 million in 1969, a record level. In addition, he projected announced investments during the three-year period 1970-1972 in excess of \$300 million. Actually investments in 1971 totalled over \$500 million alone and there is another \$350 million in investments awaiting final authorization. Of this latter total, \$100 million is to be spent by 1972 and the balance of \$200 million by 1975.

A quick run-down of properties being considered for development would include the following: **Amax Exploration, Inc.** is drilling the Axe (Summers Creek) property of Adonis Mines Ltd. The object of this work is to extend the mineralized zone . . . **Amoco Canada Petroleum Co. Ltd.** is to drill its Kinasken Lake prospect in northern B.C. in the summer of 1971 . . . **Anaconda American Brass Ltd.** withdrew from exploring the Yukon . . . **Atlas Explorations Ltd.** will continue its drill program on the Scot zinc property in the Hess area of the Yukon . . . **Bathurst Norsemines Ltd.** received \$416,375 from Cominco Ltd. under an option agreement in 1970 for 858 claims on its property on Bathurst Inlet, N.W.T. Two principal discoveries are the "A" zone and the Cleaver Lake zone. Limited drilling has cut two massive sulfide lenses in the "A" zone containing complex silver-zinc-lead-copper-gold minerals. In the Cleaver Lake area 3 miles west of "A" zone, two similar-grade massive sulfide lenses are indicated. Cominco plans to spend \$420,000 on further exploration . . . **Brameda Resources Ltd.** plans to

sink 25,000 ft of holes in its Sukunka River coal project 38 miles south of Chetwynd, B.C. . . . **Yukon Exploration Co. Ltd.** will conduct a preliminary exploration program to evaluate a geochemical anomaly and exposed molybdenite mineralization on its Lime Creek property in the Carcross area of the Yukon . . . **Bullion Mountain Mining Ltd.** has an 86-claim, silver-lead-zinc property south of Clark Lakes, Davidson Range, Yukon. Trenching yielded a grade of 9 oz Ag per ton and 8% Pb and 4% Zn . . . **The Cariboo Gold Quartz Mining Co. Ltd.** in drilling its 130-claim White Rocks Mountain property, sank its first hole to a depth of 530 ft and cut 160 ft of high-grade magnetite . . . **Consolidated Rexspar Minerals & Chemicals Ltd.** is assessing its Birch Island, B.C., fluorspar property and looking for possible participating companies . . . **Copper Keays Mines Ltd.** is surveying, drilling and trenching its 104-claim property which is located 105 miles west of Ft. Nelson and 25 miles south of Mile 440 on the Alaska Highway. The continuation of the Neil vein in this area is the target of this \$123,000 program . . . **Crows Nest Industries Ltd.** has proved large reserves of metallurgical-grade coking coal on both its Line Creek Ridge and Erwin Pass properties. Reserves will support a 3-million tpy operation. Additional thermal coal has been proven also . . . **Croydon Mines Ltd.** plans to drill its Vent claims property 35 miles from Port Alberni on the Ucluelet highway. A 1500 x 600-ft anomalous area was revealed by geophysical and geochemical prospecting . . . **Donna Mines Ltd.** discovered two silver sulfide zones

trying to develop a market for its Tulameen coal . . . **KRC Operations Ltd.** is operating its Mt. Copeland mine near Revelstoke, B.C., at its rated capacity of 200 tpd of 1.00% MoS₂ . . . **Kaiser Resources Ltd.** will confine its exploration to the Michel mining area. Extensive coal reserves exist in this area . . . **Libell Mines Ltd.** is arranging financing for an exploration program on the Spook property at Owen Lake, B.C. . . **Luscar Ltd.** is reopening its Luscar coal mine in the Coal Branch area of Alberta so it may ship 1.1 million tpy of metallurgical coal to Japan. In addition, Luscar Explorations is proving up coal reserves in other areas of Alberta . . . **McIntyre Porcupine Mines Ltd.** is exploring its coal properties in the Smoky River area of Alberta and on its Copton Excol property . . . **Matt Berry Mines Ltd.** is planning a \$200,000 exploration program on its Francis Lake, Yukon, properties. The company has staked over 400 claims in the area . . . **Nadina Explorations Ltd. and Bralorne Can-Fer Resources Ltd.** will put Nadina's gold-silver-lead-zinc property at Owen Lake, B.C., into production. Plans call for a 500 tpd mill and startup in 1973 . . . **New Imperial Mines Ltd.** is examining a feasibility report on mining the Cowley Pass orebody which lies 3 miles from Keewenaw . . . **Anglo American Corp. of Canada Ltd. and Hudson Bay Mining and Smelting Co. Ltd.** have agreed in principle on how an underground mine on the Little Chief and Middle Chief orebodies will be financed. The combine is sinking a 14-ft-diam shaft now and is hopeful of startup of mining in 1973 . . . **Nickel Mountain Mine Ltd.** plans to complete its exploration program on its Nickel Mountain property this year . . . **Nittetsu Mining Co. Ltd.** plans a detailed IP survey on four groups of claims totalling 327 units near Babine Lake, B.C. . . . **Penarroya Canada Ltd.** (Western Division) continues its underground development program on Cadillac Explorations Ltd.'s zinc-lead-silver-copper property on the South Nahanni River, N.W.T. . . . **Prado Explorations Ltd., Indian Mountain Metal Mines Ltd., Gui-Por Uranium Mines and Metals Ltd., and Lion Nickel Mines of Canada Ltd.** own equal shares in a 400 claim porphyry copper prospect in the Hayes Creek area, Dawson Range, Yukon. Diamond drilling this prospect is proposed to establish the potential worth of the property . . . **Pyramid Mining Co. Ltd.** is exploring two adjoining groups of claims called the Tan and U.E. claims in the Clinton mining division of B.C. These claims are located 18 miles northwest of Cache Creek, north of Bethlehem Copper's Maggie discovery. Work is also planned on 8 Burg claims in the Gibraltar area . . . **Spartan Explorations Ltd.** is exploring a selected area in the Yukon

and is financed by Preussag A.G. Metall of Germany. \$90,000 will be spent to locate lead-zinc deposits. Spartan will also evaluate two porphyry copper prospects in north central B.C. . . **Starmex Minerals Ltd.** has completed a feasibility study on its Revelstoke property and says its reserves will support a 400-tpd lead-zinc-tungsten operation . . . **Excalibur Explorations Ltd.** will surface explore its Nahami area claims in the N.W.T. . . **Torwest Resources (1962) Ltd.** continues exploration of its Highland Valley, Aberdeen and Crown copper prospects. Work is also planned for the Marb copper claims in the Merritt area adjoining the Craigmont mine. Other work is planned near Noranda's Bell copper project and Endako's operation . . . **Towinigan Mining Explorations Ltd.** is concentrating its exploration effort in the Dease Lake-Cassiar area. Its Halfmoon asbestos property near Dease Lake has been optioned to Asarco. This property is four miles from Cassiar Asbestos' Kutcho Creek deposit. Further exploration is planned for Tournigan's Snow Peak molybdenum property in the Dease Lake area and at its Altan Lake property near Cassiar. It is reported that an option on its Snow Peak property may be forthcoming . . . **Tyee Lake Resources Ltd.** found significant copper-moly mineralization on its Rondah group of the Duckling Creek properties. Cominco Ltd., Maribeni-lida (Canada) Ltd. and Tyee entered a joint venture agreement to delineate the Duckling Creek properties. Tyee intends to explore its Osilinka moly property; and Telkwa River copper property; the Houston-Tommy copper property; and the Bridge River Copper property. The last three prospects are large tonnage low-grade prospects . . . **Union Minière Explorations and Mining Corp. Ltd. and Wenner Gren (B.C.) Development Co. Ltd.** are jointly exploring in the Dease Lake and Gernanssen Landing areas of northern B.C. . . . **U.S. Smelting, Refining and Mining Co.** is active in general exploration in B.C. and Yukon . . . **Western Mines Ltd.** is exploring its Myra Falls operations, its Price, and Cream Silver Mines Ltd. properties. Diamond drilling of the latter two depend on preliminary exploration.

Canadian Taxes

Strong national interests, expropriation and higher taxes in some developing countries are forcing mining companies to look closer to home for their minerals. Canada and Alaska, as a result, are attracting many companies and as the mineral deposits nearer to the population centers of this country and state are gobbled up, mineral exploration and development are forced farther

north. Because of this trend northward into Alaska, Yukon, Northwest Territories and the northern portions of the other Canadian Provinces, exploration activity has spiralled upward.

Yet Canada has strong national interests itself and tax reform legislation has been introduced by Finance Minister Edgar Benson. In his budget in the House of Commons in June, Benson said that the present 3-yr tax moratorium applying to new mines will end Jan. 1, 1974. Benson also informed the House that after 1976 the present depletion allowances will end and thereafter, the mines will have to earn depletion at the rate of \$1 for each \$3 of eligible expenditures. The sale of mining properties will be taxable after this date, thus putting a cramp in the style of grubstakers and prospectors. Fast write-off of assets of new mines will be allowed when the 3-yr tax moratorium is dropped and this will soften somewhat other increases in the tax load. Corporation taxes will also decline uniformly 1% annually from 50% in 1972 to 46% in 1976. Other changes are proposed in the tax structure but the above changes should suffice in giving the reader a basic understanding of the issues.

The *Northern Miner* reports that the Mining Association of Canada announced that "It is clear that the government intends to withdraw the key provisions which have undoubtedly contributed strongly to the high level of exploration of mineral resources in Canada during the past few decades."

As John L. Bonus, managing director, The Mining Association of Canada sees it Canada's mineral surplus (difference between imports and exports) was C\$3.15 billion in 1970, including petroleum and gas. This mineral surplus was larger than Canada's unprecedented total trading surplus of C\$2.9 billion in 1969. This surplus allows Canada to secure capital needed for industrial development. In addition, minerals make possible shelter, places to work, transportation and communication and even clothes for Canadians. It is hard to conceive how Canadians or any other people could exist without minerals.

Even British Columbia is getting into the act. Since Bill No. 40, the "Mineral Processing Act", was introduced in this province the British Columbian Yukon Chamber of Mines (BC & YC of Mines) reviewed expressions of concern from responsible mine developers in B.C. and representatives of foreign companies presently involved in financing B.C. mining ventures as well as purchasing copper concentrates from local mines. Essentially, the Act requires a guaranteed market for concentrate output before Canadian banks would finance local mining ventures. NE