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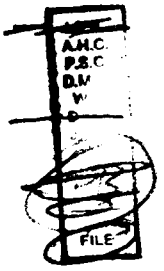
Carolin Mines Ltd
Hope B.C. Property

Jan 3 1975



Carolin finds financing with State Farm

Carolin Mines Ltd. of Vancouver says it has entered an agreement with State Farm Mutual Automobile Insurance Co. of Bloomington, Ill., whereby State Farm is to advance Carolin $6-million (U.S.) by way of subordinated notes.

An initial advance of $3-million was completed June 28, which was secured by a 12 per cent subordinated promissory note, which matures Oct. 1, it said. It is contemplated that this note will be rolled over into the $6-million subordinated note, Carolin said.

Carolin said terms of the proposed subordinated note are that it be for 10 years, maturing June 1, 1992, that it bear interest at 12 per cent a year, payable semi-annually beginning July 1, 1983, and that the note be convertible into common shares of Carolin.

The conversion price is subject to the approval of the Toronto Stock Exchange and the Vancouver Stock Exchange, and that price has not yet been agreed upon between the parties, Carolin said.

If the note is converted, it would result in State Farm acquiring a sufficient equity position in Carolin that the proposed transaction would be subject to provisions of the Foreign Investment Review Act. An application is therefore being made to FIRA for approval.

Carolin said it has suggested to regulatory authorities and to State Farm that an appropriate conversion price would be $5.50 (U.S.). If that price is accepted by all parties and the entire amount subsequently converted, it would result in State Farm acquiring an additional 18 per cent of the common shares outstanding of Carolin, it said.

Proceeds from the note will be used by Carolin to pay its proportionate share of capital costs to bring into production its Ladner Creek, B.C., gold property, to carry out exploration and development work on the adjoining Ladner Creek North gold property and to provide working capital.

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THE GLOBE AND MAIL

JULY 24, 1982

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Mill throughput at Carolin Mines' new gold operation has already exceeded the design capacity of 1,500 tons per day. Ore is mined using long hole open stoping; all crushing is done underground

Smooth startup at western Canada's largest gold mine

By **Kelson G. Collins,** general manager, **Rod Samuels,** mill superintendent, and **John R. Bogert,** director, Carolin Mines Ltd.

After ten years and an expenditure of C$37,000,000 ($30,000,000), the first doré bullion bar was poured at the Carolin mine of Carolin Mines Ltd. on February 3, 1982. The mine is now operating smoothly and efficiently. The current production rate of 1,500 tons per day will soon be increased to reach 2,400 tons per day. Daily production of 175 to 200 ounces of gold should then increase to 300 ounces.

Drill indicated reserves in the Idaho ore zone of the Carolin mine now exceed 2,000,000 tons grading 0.12 ounce per ton, on a cutoff grade of 0.05 ounce per ton. The ore is open down plunge.

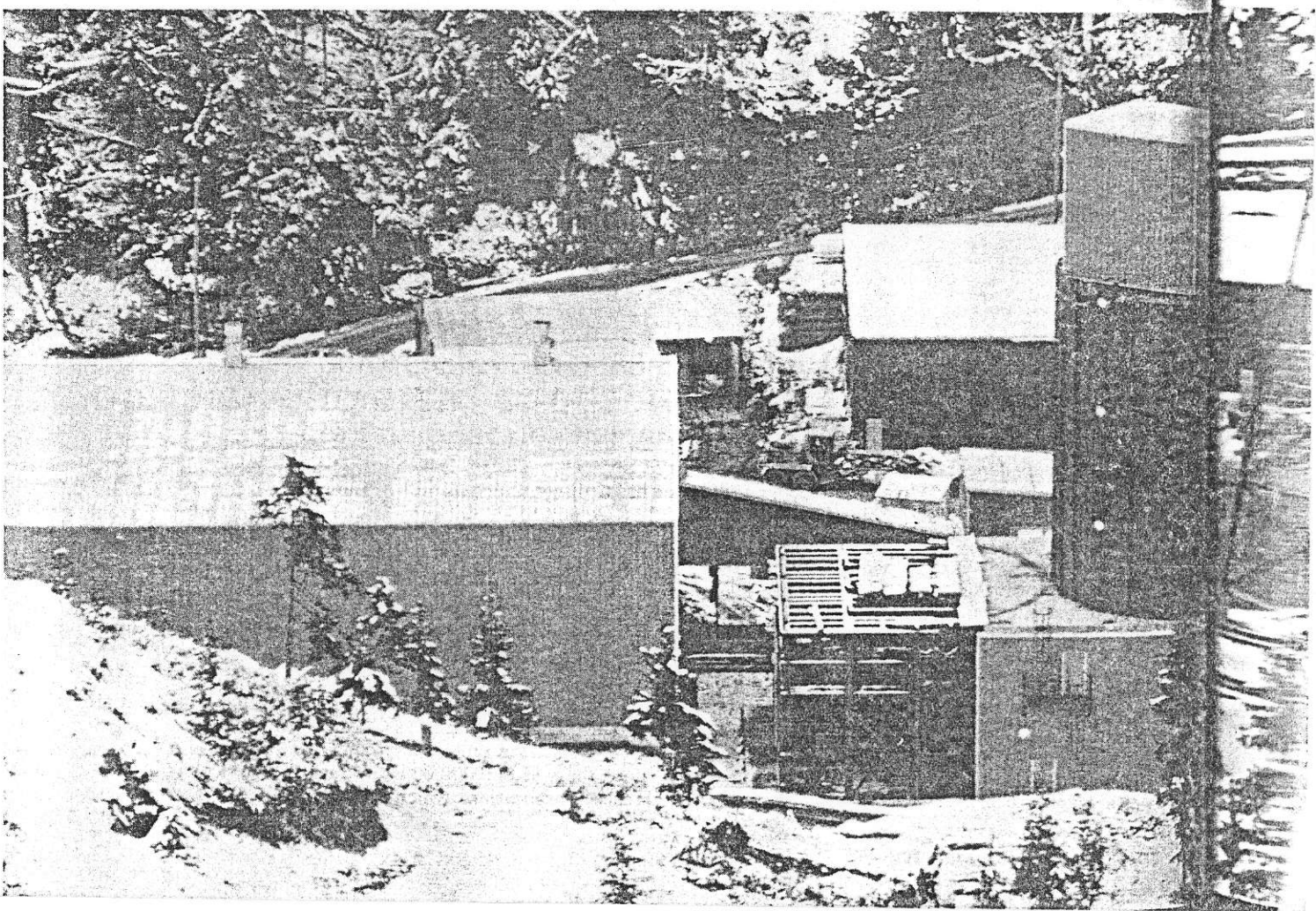
Area History Traced 100 Years

The Carolin mine is in the Cascade Mountains of southern British Columbia, 20 kilometers (12 miles) northeast of Hope and 150 kilometers (90 miles) east of Vancouver. The mine is at an elevation of 850 meters (2,500 feet) in heavily forested, mountain terrain typical of western Canada. The concentrator is in a narrow valley of the southwest fork of Ladner Creek, which flows some 5 kilometers (3 miles) southeast to the Coquihalla River, which in turn feeds the Fraser River.

In the immediate area of the Carolin mine there are a number of lode gold deposits that comprise the Coquihalla Gold Belt. Discovery of gold in this area was made during the 1858 Fraser River gold rush. Placer miners working the tributaries of the Fraser found gold in the Coquihalla River, and follow-up prospecting soon revealed the lode deposits.

The first recorded workings in the Coquihalla Gold Belt were on the Ward claim on Siwash Creek, and from 1913 to 1942, there was intermittent production from the Emancipation, Aurum, Georgia No. 2, Pipestem, and Idaho mines. The total recorded production was 3,913 ounces of gold from an unknown tonnage, although the Arum has a recorded production of 500 ounces from 500 tons.

Production in the area ended during World War II, and the area remained relatively dormant until Carolin Mines Ltd. acquired eight crown-granted min-



eral claims, which included the Aurum and Idaho zones, from Summit Mining Ltd. in 1972. Over the years, additional claims were added to this key group, and today there are just over 80 contiguous claims collectively known as the Ladner Creek Group.

During 1973 and 1974, extensive surface exploration work was conducted on the property, including line cutting, geochemical and magnetometer surveys, and diamond drilling. The work focused on the Idaho gold-bearing zone, and by November 1978, some 44 surface holes totalling 6,908 meters (22,800 feet) had been drilled. Earlier in 1975, the property had been optioned to Numac Oil & Gas Ltd. and Precambrian Shield Resources Ltd., which carried out surface work, including the drilling of seven of the 44 holes. In mid-1976, Carolin reacquired control of the property by purchasing Numac's earned interest.

Carolin was able to arrange further financing, and during 1977 and 1978 carried out an extensive underground exploration program. This included sinking 744 meters (2,500 feet) of decline, now known as the Idaho decline, and crosscut development from which 120 diamond drill holes were drilled. This drilling totalled 6,792 meters (22,500 feet).

During 1978, Carolin arranged financing with the Aquarius group of companies, which includes Ocelot Industries Ltd., Great Basins Petroleum Ltd., Windjammer Power and Gas Ltd., and Aquarius Resources Ltd. The group agreed to finance the final underground exploration phase and a subsequent feasibility study. Only the south half of the Ladner Creek group is included in the agreement; the northern half remains wholly-owned by Carolin.

The feasibility report, which was completed in May 1979, was prepared by Kilborn Engineering B. C. Ltd. with input from Ker, Priestman & Associates Ltd., Golder Associates, and Britton Research Ltd. Based on the study, the Aquarius group then agreed to finance development of the Idaho zone for a 50 percent joint venture interest. Carolin Mines manages the joint venture, while Kilborn Engineering was retained as construction manager.

Ore Reserves Open

The Cascade Mountains in the deposit area are composed of a mixture of sedimentary and volcanic rocks strongly folded by heat and pressure. The principal geological feature is the Hozameen fault, which is composed of talc and carbonate, varying from 10 centimeters to 2 meters (3.9 inches to 6.5 feet) in width, separating the main geological formations. West of the fault is the Coquihalla serpentine belt, consisting of serpentine, metagreenstone, talc, schist, and miscellaneous basic intrusives. Further west lies the Hozameen group, consisting of chert, argillaceous schists, metagreenstone, and minor limestone. The eastern contact of the Hozameen group is the western limit of all significant gold mineralization found to date.

East of the Hozameen fault is a discontinuous unit of extrusive greenstone followed by the Ladner group of sediments, consisting of greywackes, argillite, and graphitic argillites or slate. The Ladner group comprises host rocks for the main gold occurrences in the Coquihalla Gold Belt, including the Idaho Deposit.

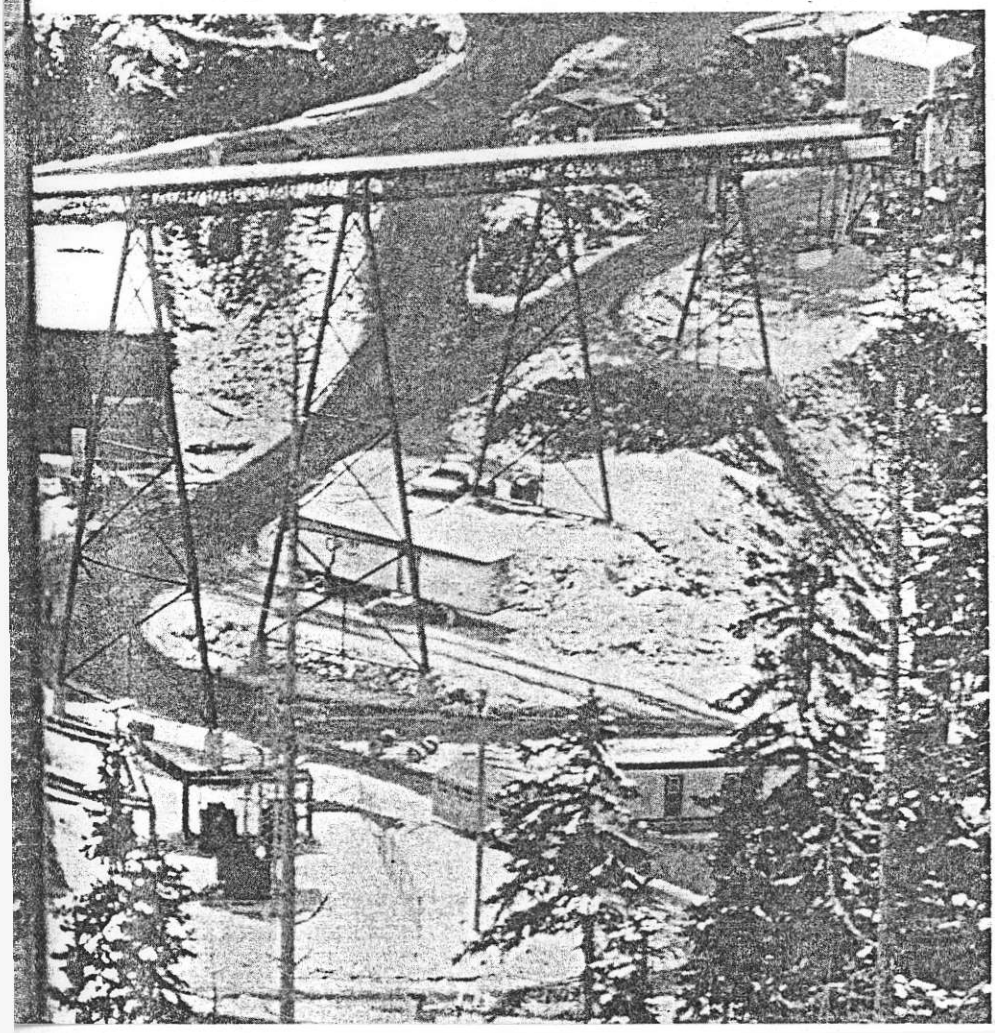
There are two main controls to mineralization in the Idaho zone:

- quartz veins associated with steeply dipping faults sub-parallel to the Hozameen fault, and
- gently dipping zones of replacement and mineralization within certain greywacke beds of the Ladner group.

The ore itself is not visually striking; the sulphides average less than 3.0 percent by volume. The principal sulphides, in decreasing order of ore abundance, are pyrrhotite, pyrite, and arsenopyrite. Also present are traces of chalcopyrite, magnetite, and sphalerite. No specific sulphide is the major host of the gold, which is very fine-grained and is disseminated in association with the sulphides. However, the values are economic where all the sulphides occur together. Possibly the presence of chalcopyrite is essential to the presence of economic amounts of gold. There are minor occurrences of visible native gold.

Scattered gold values occur throughout the Idaho zone, but the more intensely mineralized areas form lenses whose attitudes roughly parallel those of the zone proper. Except where cut off by faulting, there are no sharp boundaries, but rather the intensity of mineralization tends to diminish toward the edges of the lenses. Thus, mining will be carried to an assay wall.

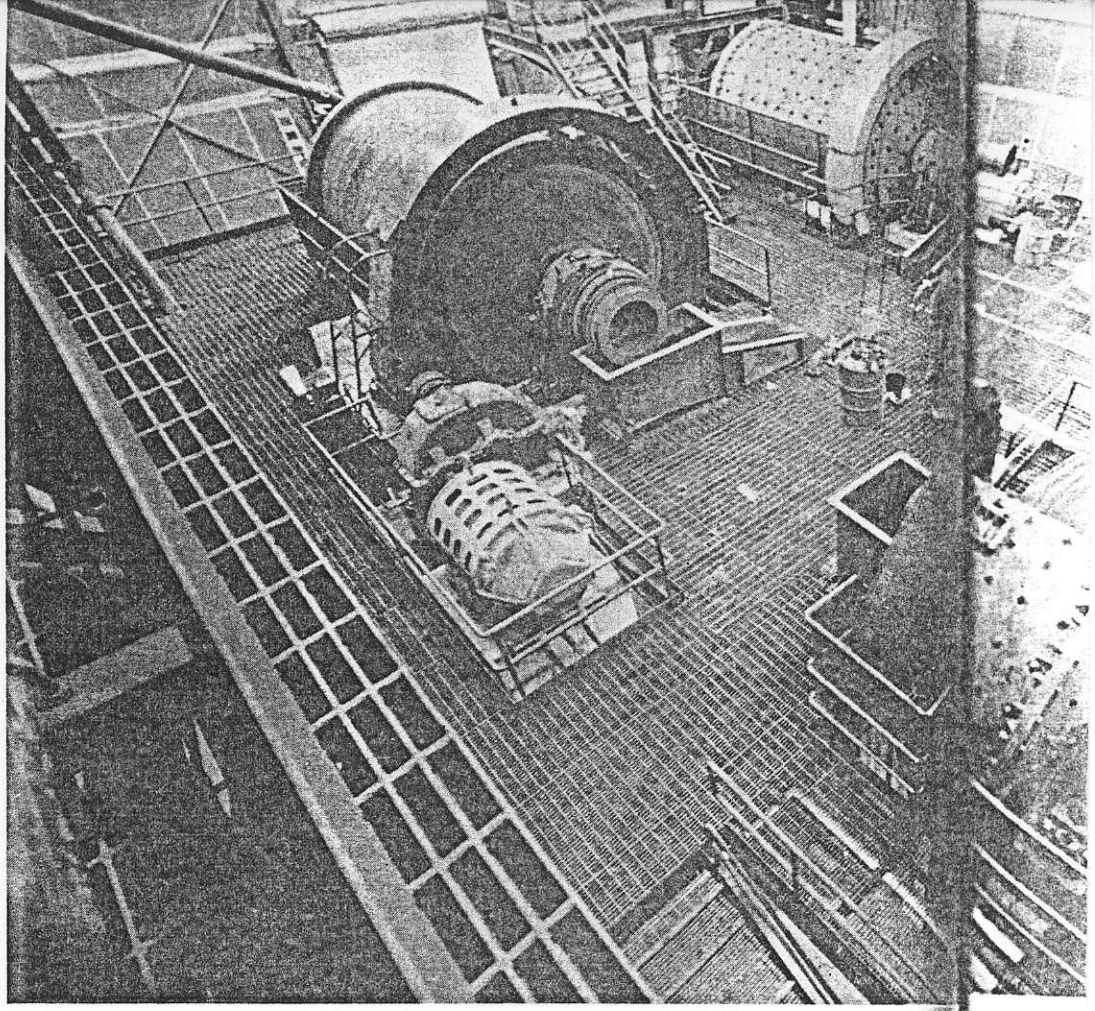
As presently known, the Idaho deposit consists of a series of lenses, irregular in both the horizontal and vertical planes, but with generally steep dips and a low plunge of about 20° northerly. The lenses vary in length from a minimum of 50 meters (165 feet) to a maximum of



CAROLIN MINE is in heavily forested, mountain terrain typical of western Canada.

200 meters (660 feet), and in vertical height from less than 10 to 100 meters (33 to 330 feet).

In the feasibility study, drill indicated ore reserves, based on a cut-off grade of 0.08 ounce per ton gold, were estimated at approximately 1,650,000 tons grading 0.14 ounce per ton. Silver content is 0.03 ounce per ton. Subsequent calculations using the 0.05 ounce cutoff grade increased marginal reserves to approximately 2,000,000 tons grading 0.12 ounce per ton gold. This should provide more than four years of mill feed. Based on geology and structural trends, it is highly probable that ore reserves will be increased by future exploration drilling. The Idaho zone is open and untested north of the reserve area, where it continues to plunge to the north.



Mining by Sub-level Stoping

Development mining began in December 1979 with portals collared at the 900 and 820 meter (2,970 and 2,700 foot) levels. The 900 level access has dimensions of 3.5 meters (11.5 feet) wide by 4 meters (13.2 feet) high to allow entry of 5-cubic-yard (3.5-cubic-meter) load-haul-dump equipment. It was driven horizontally for a distance of 915 meters (3,000 feet) from which point ramps turn upward and downward to establish drawpoints and drilling sub-levels at the stopes. Maximum ramp inclination is 15 percent. The northern extremity of this drift intercepts the Idaho exploration decline. The Idaho decline, because of its location, is not suitable for mining development but is being utilized for ventilation and as an escapeway.

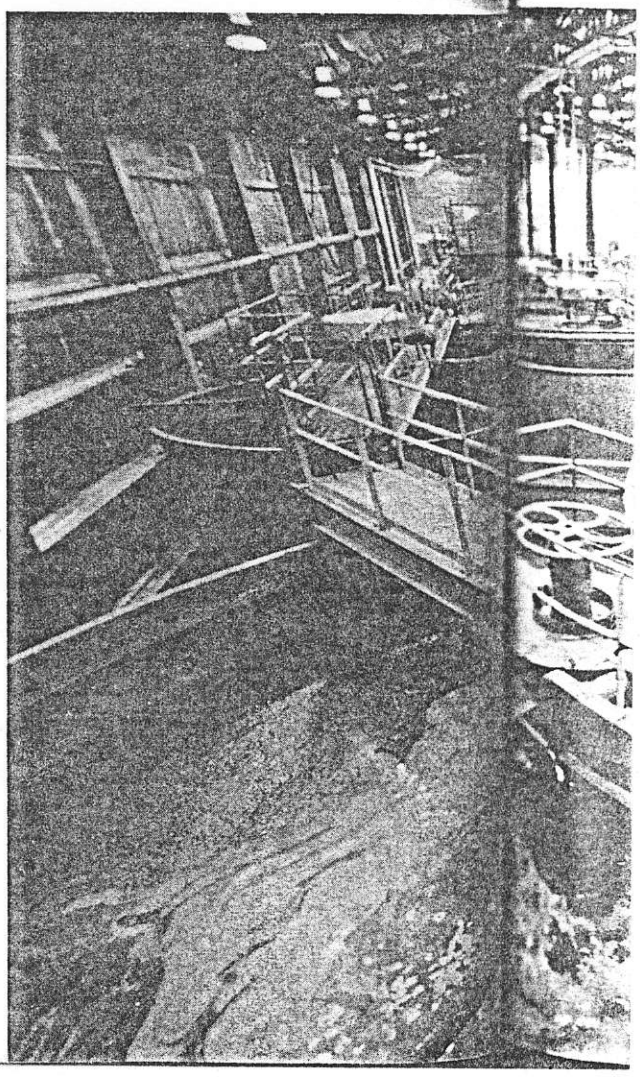
The crusher portal is collared at elevation 795 meters (2,625 feet), and this 4 by 3.4-meter (13.2 by 11.2-foot) decline slopes at 18 percent to elevation 780 meters (2,575 feet), where it is enlarged to house the primary and secondary crusher rooms. The primary jaw crusher room is joined to the 820 meter (2,700 foot) haulage level by a 1,200-ton coarse ore storage pocket and a raise required for ventilation and secondary access.

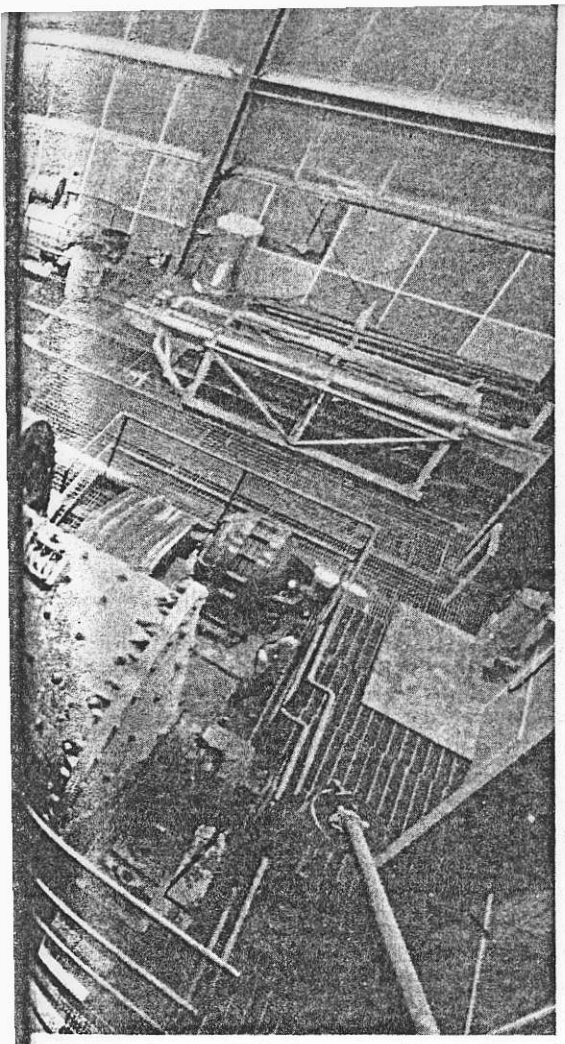
Long hole open stoping has been chosen as the mining method. Mining has started near the northerly end of the present known ore zone, and is proceeding sequentially upward toward the surface. This approach offers the probability of the quickest return of capital, because of marginally higher ore grades, maximum size of stopes, and minimum amount of stope development. When the stopes are mined out they will be backfilled with a mixture of deslimed tailings and cement in a 30 to 1 ratio. Later, it will be possible to mine out the pillars with an overall recovery of nearly 100 percent of the ore.

Due to the differences in size of the various ore lenses and their irregular wall outlines, it is not possible to introduce a standard stoping pattern. Each stope must be individually engineered.

Production drilling of the 2-inch (50-millimeter) diameter longholes is done with a Simba H-221 electric-over-hydraulic drill at a current rate of 150 meters (495 feet) per drill shift. Ring burden is 1.5 meters (5.0 feet) and toe spacing is 3.5 meters (11.5 feet). This will break 2.35 tons (2,130 kilograms) per foot drilled with an initial powder factor of 0.6 pound (0.3 kilogram) of explosive per ton broken. Changes in both burden and spacing of drill holes can be expected after initial blasting results have been evaluated.

Ore recovery from the stope drawpoints is done with four Jarco JS-500 5-cubic-yard (3.5-cubic-meter) LHD's, and distances to the ore passes will range from 120 to 240 meters (400 to 800 feet). Ore is then drawn on the 820 meter (2,700 foot) level from the ore pass chutes and transported to the coarse ore pocket above the primary crusher. The haulage equipment includes a 10-ton





GRINDING SECTION, here under construction, houses both a rod mill and a ball mill.

(9,070-kilogram) electric trolley, or battery-operated locomotive and a fleet of 165-cubic-foot (4.7-cubic-meter) capacity side-dumping ore cars. Waste dumps will be located outside the mine portals. These dumps will be constructed to provide a stable base for ultimate revegetation. Drainage control should ensure that erosion of fines is prevented.

The mine will operate two shifts a day, five days a week, to produce enough ore to sustain a continuous seven day per week milling operation at over 1,500 tons per day.

Western Canada's Largest Au Mill

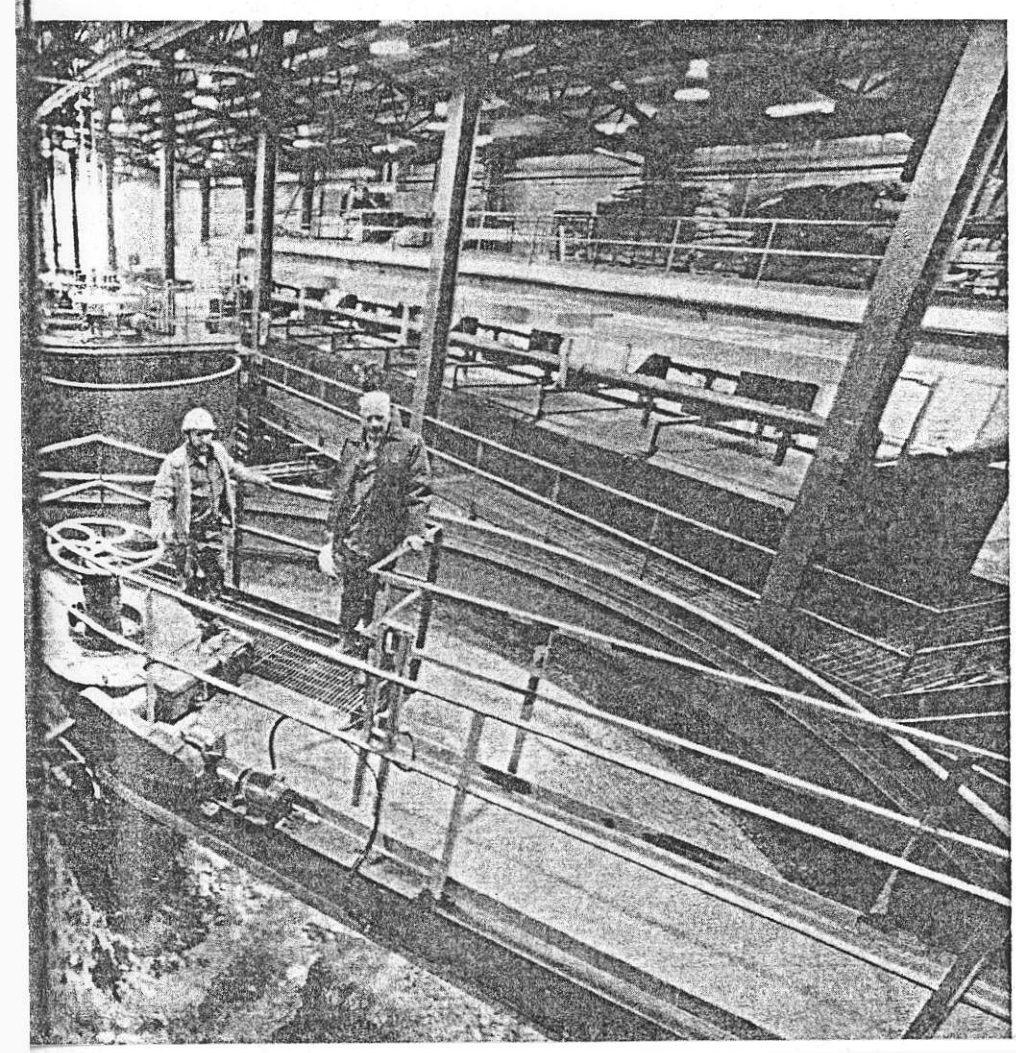
Based on design throughput, the Carolin mill is the largest gold mill in western Canada, and ranks fifth among the largest gold concentrators in Canada. Carolin's modern facility is unique in construction and design. However, like most of Canada's larger gold mills, which have been in production for many years, the metallurgical flowsheet has remained conventional, particularly in the area of cyanidation and gold precipitation—the Merrill-Crowe process.

Location of the crusher is not typical. The steep valley and lack of working area prompted a decision to construct the total crushing operation underground. The high cost of excavating rock limited the facility to two-stage open circuit crushing. The flow of minus-24-inch (minus-60-centimeter) material from the coarse ore pocket is controlled by pneumatic fingers and chains. The controlled tonnage is fed to a 36 by 48-inch (0.9 by 1.2-meter) Birdsboro Buchanan jaw crusher. Minus-4-inch (minus-100-millimeter) crusher discharge is conveyed to, and sized by, a 5 by 8-foot (1.5 by 2.4-meter) rod deck vibrating screen with ⅝-inch (16-millimeter) openings. The screen oversize is then reduced by a 5½-foot (1.7-meter) Symons shorthead cone crusher with a closed side setting of ½ inch (13 millimeters). A combined product of screen undersize (minus-⅝-inch or minus-16-millimeter) and cone crusher discharge (minus-1-inch or minus-25-millimeter) is moved by conveyor belt up the decline and over the valley to a 2,200 tons live capacity, fine ore storage ore bin. The design calls for two 2,200-ton fine ore bins, but construction of one was delayed until this summer.

Ore is recovered from the fine ore bin with three slot feeders discharging to three parallel belts, one of which is variable speed for fine control of the rod mill feed. The feeder belts discharge to a fixed speed belt, which in turn feeds minus-⅝-inch (minus-16-millimeter) ore into the rod mill. A weightometer monitors tonnage on the rod mill feed belt for metallurgical accounting purposes.

Primary grinding is done with a 9½ by 12-foot (2.9 by 3.7-meter) Dominion rod mill with an inventory of 3½-inch (90-millimeter) rods. The rod mill discharge, along with the discharge from a secondary 10½ by 12-foot (3.2 by 3.7-meter) Dominion ball mill is pumped to a 24-inch (0.6-meter) cyclone in open circuit with the rod mill and closed circuit with the ball mill. The ore, with a Bond Work Index of 12.0 kilowatts per ton, is ground to 66 percent minus-200-mesh. A jig and table will be installed in the grinding circuit because gold particles have been found in the rod mill discharge and these particles would not be recovered by flotation.

After conditioning at pH 8.7 with 0.33 pound (150 grams) per ton of copper sulphate, 0.33 pound (150 grams) per ton potassium amyl xanthate, 0.01 pound (4.5 grams) per ton Aerofloat 31 and 0.08 pound (36 grams) per ton pine



FLOTATION CELLS recover bulk concentrate grading some 1.8 ounces gold per ton.

oil, a bulk rougher concentrate totalling 6 percent by weight of the feed is recovered in four 300-cubic-foot (8.5-cubic-meter) flotation cells. The metallurgical testwork showed only 91 percent of the gold was recovered by flotation, and therefore, 50 percent more retention time than was actually used in the laboratory tests was designed into the circuit. The slurry is scavenged in four 300-cubic-foot (8.5-cubic-meter) cells, and the scavenger concentrate is discharged back to the conditioner tank. Scavenger tailings are pumped to the tailings pond.

At this point all that remains is 100 tons per day of bulk concentrate assaying 1.8 ounces gold per ton. The flowsheet now becomes typical of most small gold mill operations. Rougher concentrate reports to a 10-inch (250-millimeter) cyclone and the underflow goes to a 7 by 6-foot (2.1 by 1.8-meter) regrind mill for reduction to 98 percent minus-325-mesh. Regrinding is done with high lime addition to neutralize the acid products formed by pyrrhotite, which would otherwise consume excessive cyanide. Fuel oil is also added in the regrind mill to deactivate any carbonaceous material in the concentrate. The ore body does contain minor amounts of graphite.

The reground and thickened pulp is agitated in leach tanks with cyanide reagent and dispersed air for 72 hours. Anticipated reagent consumptions are 1.28 pounds (0.58 kilogram) per ton sodium cyanide and 2.6 pounds (1.2 kilograms) per ton lime. Gold dissolution in the testwork was 91 percent for an overall recovery of 83 percent. Experience has shown that better recoveries can be achieved in a plant environment versus bench testing, and we believe that the 83 percent overall recovery predicted in the feasibility study is a conservative figure.

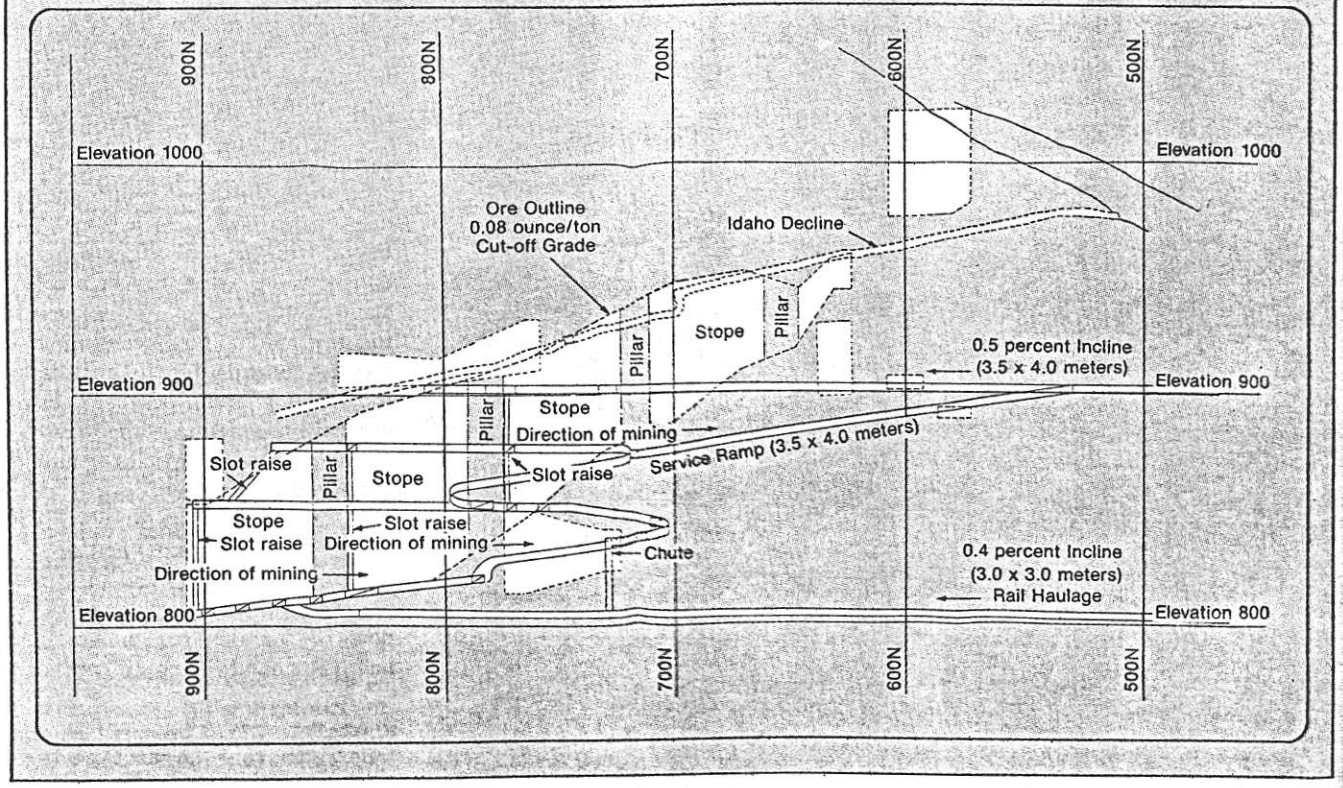
After it decants from the last leach tank, the pregnant solution is recovered in a 40-foot (12.2-meter) thickener as overflow. The thickener underflow is pumped to a primary 10 by 10-foot (3 by 3-meter) drum filter, where additional pregnant solution is recovered. The filter cake is repulped in barren solution and subsequently filtered in a secondary 10 by 10-foot (3 by 3-meter) drum filter. The filter cake is repulped and charged to tailings. All filtrates return to the pregnant solution thickener, where they are recovered as pregnant solution overflow. The overflow is pumped to a leaf clarifier to ensure the removal of finely divided, suspended solids, and passed through a deaeration tower. Zinc dust and lead nitrate are added to the deaerated solution and the gold-zinc precipitate is removed from the now barren solution by one of two 36-inch (0.9-meter) Perrin filter presses. The air dried gold-zinc precipitate is then fluxed and smelted to bullion in a single chamber, oil fired, smelting furnace.

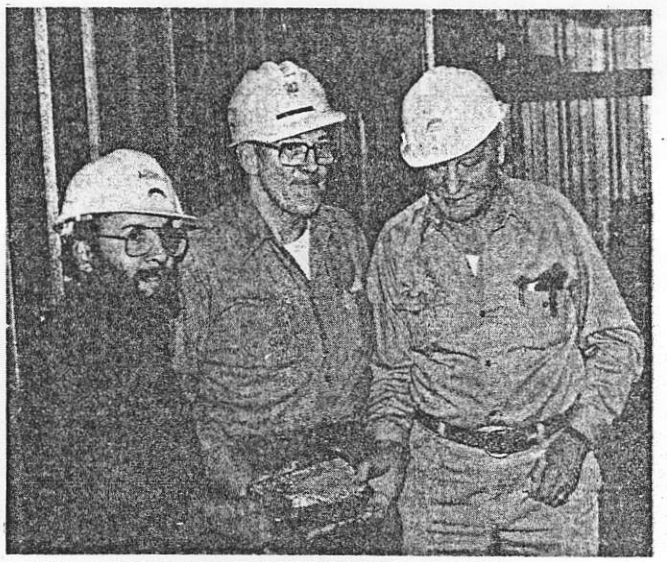
To avoid leach circuit contamination, a bleed from the barren stream must be continually removed. Cyanide must be destroyed prior to disposal of the solution to tailings. Carolin has elected to install an alkali chlorination system to oxidize and destroy cyanide. Chlorine gas is bubbled through the solution at a maintained alkaline pH. After retention in two 6 by 6-foot (1.8 by 1.8-meter) fiberglass tanks, the treated barren solution is passed through a carbon column for extraction of residual chlorine and other undesirable ions. In addition to its environmental advantage, it is felt that the carbon system will prove to be a profitable back-up for collecting gold not precipitated by zinc.

Solid tailings disposal is a significant operating cost. There are no downstream impoundment sites where effluent can be discharged by gravity from the mill.

The flotation tailings will not require any chemical treatment prior to disposal. However, it is proposed that the sand portion will be used as mine backfill, the need for which will not arise until early 1983. At that time, a backfill preparation plant will be required. This plant will consist of two stages of pumping and hydrocyclone classification. The coarse sands will be pumped to the mine and the overflow, comprising a product that is primarily fines, at approximately 17 per-

Section view of Ladner Creek





FIRST DORÉ BULLION BAR, left, was poured at the Carolin Mine on February 3, 1982, after ten years and $C37,000,000. **GOLD BRICK,** right, is held by Rod Samuels, mill superintendent, Kelson Collins, general manager, and Ted Worthington, consulting metallurgist. Mill output has already exceeded design capacity. Plans for the near future call for an output of some 300 ounces of gold per day.

cent by weight, will be delivered to the tailings pond.

Flotation and leach tailings are currently collected and pumped through a series of five 6 by 4-inch (150 by 100-millimeter) Warman pumps. A final discharge pressure of approximately 400 pounds per square inch (28 bar) boosts the tailings up a 6-inch (150-millimeter) pipeline through approximately 600 feet (183 meters) of head to the tailings impoundment area.

Tailings Containment

The tailings dam is an earthfill structure, constructed mainly of compacted boulder clay from a borrow pit local to the site. First stage construction includes a downstream zone of free draining shot rock, which will become a central chimney drain in the final design. The two zones are separated by filter cloth. In the summer and fall of 1981 approximately 350,000 cubic yards (270,000 cubic meters) of earthfill were placed on the dam to net one year of storage capacity. In the future, the dam will be raised annually to meet the production requirements.

Final dam crest will be 148 feet above the valley floor. It will require 1,140,000 cubic yards (872,000 cubic meters) of earthworks, which should provide 6⅔ years of tailings storage. This capacity will be substantially increased by implementing underground back filling. Seepage is controlled by a small downstream sump and pumping system. Pumps on a floating barge reclaim clarified water and pump it up to a head tank. From here the water flows by gravity back to the mill to meet much of the process water demand.

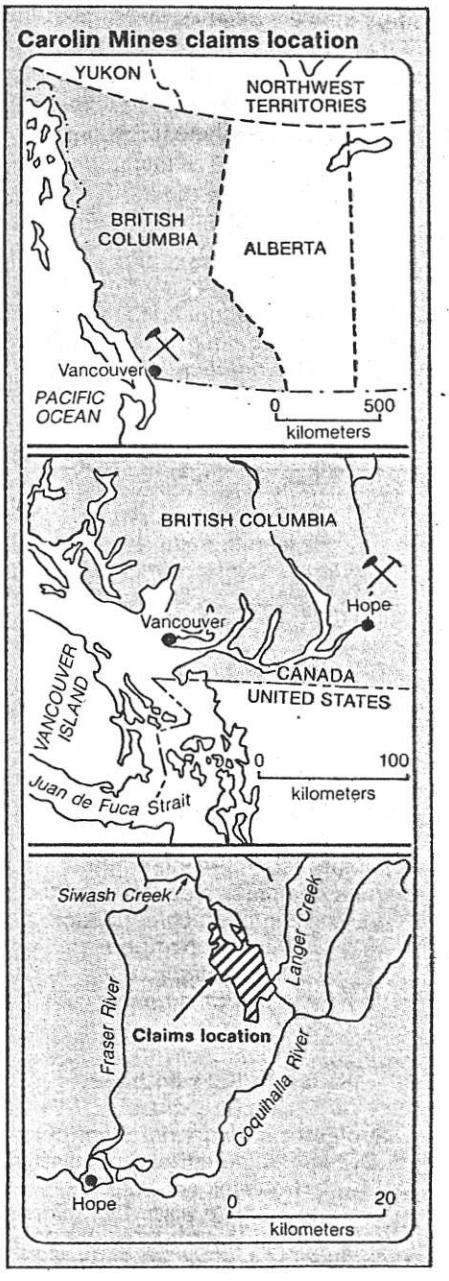
Make-up water for the process and for fire storage is pumped from Ladner Creek. The potable water system is charged by a separate upstream infiltration gallery.

Inflation Causes Cost Overrun

The 1979 feasibility study estimated that the Idaho zone ore body could be brought into production at an estimated cost of C$19,300,000 ($15,600,000). The actual production cost was about C$37,000,000 ($30,000,000). It can be appreciated that there is a significant difference between those second quarter 1979 dollars and the dollar's current purchasing power.

Although a good portion of the overrun can be attributed to inflation, there have been other contributing factors. Most notable of these was a C$1,242,000 ($1,006,000) extra cost to place a 10-foot (3-meter) diameter, precast concrete culvert to divert Ladner Creek past the mill site. After backfilling with mine waste, the culvert placement provided much needed office and shop space as well as reducing the environmental impact of the possible silting of Ladner Creek. In addition, the change to underground crushing from surface crushing increased the final cost. The requirement to shotcrete both crusher rooms was another major expense not covered by this study.

The Carolin operation is now making a significant contribution to the economy of the Hope area and adds another 63,000 annual ounces to Canadian gold production. With favorable geology, encouraging exploration results, a strong management team, and no debt, Carolin Mines Ltd. looks to the future with enthusiasm. ■



Report from Vancouver

From Page 1

holdings near the Carolin mine in the Coquihalla gold belt.

Although approached by The [illegible] molybdenite, Mount Pleasant is expected to yield about 1,800 tonnes tungsten and 600 tonnes molybdenum disulphide every year, both in concentrates. While prices of both products have been just as depressed as everything else lately, tungsten demand is inherently strong, with consumption hitting an all-time high in 1981.

Tungsten prices are of more than

For additional expenditures of $US450,000 Ayerok's interest would rise to 50%.

* * *

Brunswick Tin, since that company won't be receiving its share of any profits from the mine until its portion of the capital (put up by Billiton) is paid back. Billiton, an arm of the Royal Dutch-Shell group, forwarded Brunswick's share of the money in the form of a loan bearing interest of 1% above prime. Brunswick, however, will receive royalties of $2 per ton, up to $1 million per year. At

In surprise move

Canusa to acquire Bonanza Oil

CALGARY — Canusa Energy (TSE) threw the investment community a curve ball last week with its offer to acquire up to 87.5% of Bonanza Oil & Gas (TSE).

Bonanza currently holds 22% of Canusa and there had been indications it would move to increase its position in the company (**N.M.**, May 27).

"It was just easier to do it this way for securities reasons," explained Wesley Ismond, Bonanza vice-president.

Canusa is offering 1.75 common shares for each Bonanza share held in Canada. There are currently 10.2 million Bonanza shares outstanding. In addition, Canusa holds Bonanza warrants exercisable until 1983 at $4.75 per share.

The combined company would have assets of about $115 million, and working capital of some $13 million, said Mr. Ismond.

Canusa is debt-free but Bonanza will bring to the new company a $3 million bank loan and a long-term 8% convertible debenture of $13 million.

Revenue for 1982 is projected at $9 million, increasing to $11 million next year on the basis of existing reserves.

The amalgamated company will have net proven plus probable reserves of 2.1 million bbl. of oil and some 70 billion cu. ft. of natural gas, and holds interests in about 600,000 gross acres in Canada and the U.S.

According to Bonanza officials, the two companies compliment each other, with Canusa providing strong financial support and Bonanza contributing the bulk of the reserves.

Scotia Shelf gas find

HALIFAX — Petro-Canada's Banquereau C-21 well, located on a wildcat structure 60 miles east of Sable Island, tested 23.3 million cu. ft. of gas per day and 100 bbls. of condensate between 11,762-11,798 ft. Premier John Buchanan announced in the legislature here.

A previous test of a lower interval recovered only a small amount of fluid. The company says it will run additional tests uphole, prior to drilling below the casing, which was set at 16,238 ft.

The first Canadian-owned semi-submersible drilling rig to operate in Canada, Bow Drill I, was utilized for this test.

Partners in the well are: **Petro-Canada** (40%), **Husky Oil** (32%), **L.K. Oil and Gas, Lochiel Exploration, Petroventures Resources, Polaris Petroleums, Ranger Oil, Roxy Petroleum** and **Universal Explorations**, each with 4%.

Report from Vancouver

Carolin resumes Ladner production

By David Duval

After a 2-month shutdown Carolin Mines has resumed production at its Ladner Creek gold mine near Hope, B.C. Clearance was given by government regulatory bodies June 17 after the company was charged with dumping hazardous wastes into the Coquihalla River in April.

According to Kelly Francis, Ministry of Environment, following an initial court appearance May 18, Carolin's trial date has now been extended to December 14. Ms. Francis says the milling operation will now be operating on a "recycling basis" thereby eliminating any effluent entering the water system.

Earlier fears of excessive spring run-off causing uncontrolled discharge from the tailings dam, seem to have been alleviated, she reports, as the pond was rising about one inch per day prior to startup.

Dr. K. Warren Geiger, president and managing director of **Aquarius Resources**, part of the Aquarius Group joint venturing the property with Carolin, told The Northern Miner that "everything was under control" and the reservoir was pumped down to a level where it didn't pose any danger.

Carolin has been plagued by startup problems and delivery of ore to the mill only commenced Nov. 23, 1981. However, expansion of the mill rate was hampered by the fact the underground crusher hadn't been completed and the company was forced to rely on a portable surface crusher with limited capacity.

Most of the problems in the mill involved the cyanide leach circuit which later got the company into trouble with the Ministry of Environment. The first gold bar was poured February 11.

Aquarius, which has a 5% interest in the operation, also has extensive

See Page 2

Mt.

From Page 1

complex could be recovered i years. Since the orebody has a jected life of about 13 years, it looked as though Brunswick [illegible] the last developing offsho Scotia-Sable Island oil-g Indeed this company hol key blocks totalling 2,332,0 making it the second large dian landholder in that fiel planned expenditures are approaching the half billio mark.

"Onaping and its partne Energy Resources Ltd., ha tiated an agreement with tw Canadian oil companies, an an important announceme made within the next 30 da V. N. Harbinson, Onaping man, adding that "becaus significance of this annou it would be inappropriate any further comments at thi

Under the terms of its exp agreements with the gove Onaping was required to deposit of $800,000 and co minimum of 800 km of new shootings on its ground in year. This work has been co to the satisfaction of the pr mines minister and its $

As dollar advances

Gold plunges

By S. Paul Rana

Deflationary forces cont play havoc in the metal m And, none of it is more fo evident than in the two mos sentative markets, gold and

Resuming its long-term trend, which had been bri terrupted by hostilities in th land Islands and Lebanon, g smashed through a critical logical support level of SUS oz.

The next support level, ac to some pundits, is around $ However, at mid-week, the was trading around $US306

Dropping some $US32 week, gold established a $US293 in Zurich. The yello sold in London at $US296 lowest level since August 19

This injected fresh nervou other precious metal marke silver falling below $US5 first time in four years.

Copper, the most importa metal, lost fresh ground in th sionary onslaught. All free m recorded new 4-year lows North American produc sponded by cutting their twice to as low as 63.5¢ in t and 82¢ a lb. in Canada.

The dismal mood of th market was fully reflected i ings on the stock exchange TSE gold index last week di a new 1982 low of 1,340.10 the year's high of 2,907.51 re months ago.

The gold market remain by the problem of high intere in the U.S. Much investment is flowing out of gold and oth

ning Brae field production is
nanding considerable investor
tion, Mr. Seaman and new
lent, Gerald J. Maier (formerly
nan of Hudson's Bay Oil and
expressed strong confidence
the prospects for Bow Valley's
varied activities:

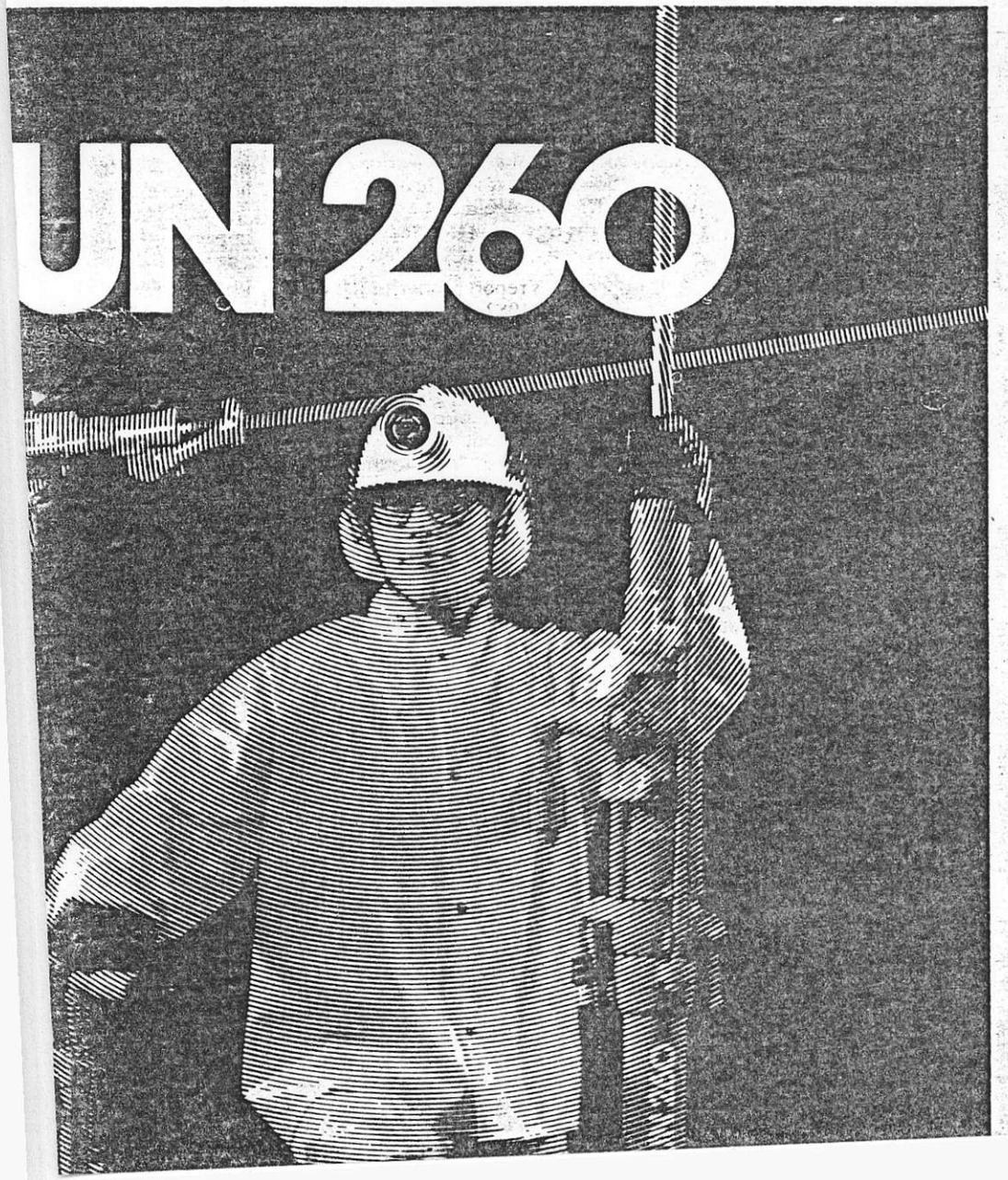
ment program in South Sumatra, Indonesia, is expected to lead to a production boost (net to Bow Valley) to 1,000 bbl. per day by the end of 1982 from a recent 450 bbl. per day.

— In the U.S., where production to the company's interests averaged 2,557 bbl. per day last year, Bow Valley expects that its share of output from the new Altramont-Bluebell field in Utah will be about 2,500 bbl. per day by the end of this year.

— In Canada, Bow Valley is securing a significant presence in frontier exploration through recent participations in Beaufort Sea and offshore East Coast prospects. Additionally, the company expects its 1982 income to benefit in the amount of $4.7 million as a result of new Alberta government incentives.

— Successful development drilling in the North Brae field suggests that production from this field (one of four in the Brae area of the North Sea) could start in 1986.

— In the Norwegian sector of the North Sea, the Heimdal gas-condensate field (Bow Valley, 8%) is scheduled to start producing in 1986.



...and 1.20 oz. gold per ton. Grade may increase with depth which is where most of the potential lies, in his view.

Drill targets are also being sought on the Oakland claims where veins on surface have alteration zones even larger than the Verdstone. The company expects mineralization there should be encountered within 150 ft. of surface.

Located about 153 km west southwest of Phoenix, the property is accessible by two-wheel drive but is isolated enough that it wouldn't cause any major environmental conflict should the existing program be expanded. A major power grid exists just 15 km north of the property and a rail line about 60 km north.

* * *

The feasibility study on **Ruth Vermont Mine's** silver property near Golden, B.C., concludes that if silver "exceeds $US8 per oz. the property has excellent potential to become a profitable long-term producer."

According to the report, reserves in all categories comprise 302,000 tons averaging 6.8 oz. silver, 4.8% lead and 5.4% zinc, and the mine could be operational one month after start-up preparations begin, ment and spare parts on time, and poor cost control because no accountant was located at the mine-site.

M. M. Pardek, president, states that "pretty well all of the loan" made by the Royal Bank ($4 million) has been used up and the company is now looking for a 50/50 joint venture partner to bring the mine into production. About $450,000 is needed to meet existing creditors, $150,000 for moving in expenses and another $1.2 million in operating capital, he noted.

Adjoining ground on strike with the main property, and in which Ruth Vermont has a 25% interest with joint venture partners **Bluesky Oil & Gas** and **Cochrane Oil & Gas**, also has potential, and Mr. Pardek concludes the chances for an ore reserve extension to this ground appear excellent. Some diamond drilling, mapping and geochem has been done there with positive results.

* * *

Carolin Mines says that of the 21 charges it faces for dumping hazardous chemicals into the Coquihalla River near Hope, B.C., 15 are identical and refer "to each day water was released to alleviate the level of water in the tailings pond."

Unusually heavy run off from heavy snow has been putting considerable pressure on the tailings pond making it impossible to dump tailings from their process plant, a fact which is causing serious financial problems for the company, industry sources conclude. Cost overruns bringing the mine into production are also hurting as well.

Carolin rejects speculation that as many as 20,000 fish may have been killed, noting only about 100 have been found dead and none of these could be attributed to the Carolin operation.

The company would not comment on other charges relating to the late filing of certain reports and having possible non-functioning drainage ditches as a result of the snowpack.

A detailed program is under way by consulting engineers to rectify the problem which would enable the mine to dispose of excess water into the tailings pond in a controlled manner when it starts up again, says Carolin.

MAY 20, 82

Conwest

From Page A1

will be approximately $76,000,000, made up of $16,000,000 in preference shares, and $60,000,000 in 7,275,000 common shares.

The proposed amalgamation, which is subject to approval of regulatory authority and approval of shareholders of each of the companies, will not result in any change in control of the companies, Conwest says.

The amalgamation proposal provides the following exchange ratios:

• One Class A share of the amalgamated company for each Conwest

Report from Vancouver

Carolin in court on cyanide charges

By David Duval

Carolin Mines faces 14 charges under the Federal Fisheries Act and seven under the Pollution Control Act of B.C. for discharging untreated cyanide effluent into the Coquihalla River near its Hope, B.C. gold mine.

Industry sources believe the company may have a major problem on its hands because of high snow levels and a massive runoff into the tailings area which now holds about 45 million gallons of treated effluent.

Just recently the environment ministry granted Carolin a permit to discharge 300 gallons per minute of treated effluent from the dam. The move was designed to take pressure off the structure which at one point was believed in danger of collapsing.

Spokesperson, Kelly Francis, from the BC environment ministry, told the Northern Miner the approval enables Carolin to increase the discharge to 400 gallons per minute.

She noted the discharge was not toxic since it would be treated and neutralized. As a precautionary measure, however, the river has been closed for drinking. The permit, which is good for 30 days, could be extended if the situation warrants, reports Ms. Francis. At presstime no tailings from the mill were going into the dam and the mill was shut down. And sources conclude the situation will probably remain this way until the effluent level in the tailings dam has dropped and the danger of collapse is eliminated.

Unusually high snow levels have played havoc with the operation this year and the ministry reports there is still about 10 ft. of snow behind the tailings dam. This has been aggravated further by rainfall and both the company and the ministry are hoping for a more gradual runoff in the next few weeks.

The first court appearance for Carolin is May 18, 1982 and officials of the company have been reluctant to talk to the media including The Northern Miner since the problem cropped up.

* * *

Eaglet Mines reports that exploration drilling last year over a considerable area on its Quesnel Lake fluorspar prospect showed an enriched zone adjacent to the footwall or lower contact of the mineralized granite gneiss, the predominant structure on the property.

Out of seven holes completed late in the season, six intersected this enriched zone and the average true width over 78,740 sq. ft. was 60.7 ft. indicating a content of 1.3 million metric tons with an average fluorspar content of 12%.

Eaglet President Andrew Robertson contends the material is definitely economic at current world prices being paid for fluorspar."

Additional exploration holes will be drilled to test the large area of "potential mineralized formation within our claim boundaries," says Mr. Robertson.

The company is well financed for the 1982 exploration program with a working capital of over $1.2 million.

Fluorspar, a mineral, has applications in the chemical and aluminum industries.

* * *

Granduc Mines, reports net earnings of $338,985 (7¢ per share) for the year ended Dec. 31, 1981. The net earnings figure in the previous year was $165,426 (2¢ per share).

While royalty income was identical with 1980, higher interest income and a gain on the sale of securities contributed to the improved earnings.

* * *

Brican Resources says that **Ventures West Minerals** has defaulted on payments regarding its option on Brican's 18% interest in the Santa Fe joint venture. Should Ventures not exercise the option the interest would revert back to Brican.

* * *

Regional Resources has approved a take-over offer for all the outstanding shares of **Logtung Resources** on the basis of one Regional Class A common share for one Logtung.

* * *

Summit '81 drilling doubles proven gas

CALGARY — by participating in low- to medium-risk plays, **Summit Resources** (ASE) doubled its proven gas reserves during 1981 and greatly expanded its asset and cash flow base, says the company's annual report.

At year end, Dec. 31, Summit had natural gas reserves of 12 billion cu. ft. and established oil reserves of 450,000 bbl.

The increase was accomplished through the company's participation in 26 wells, resulting in 20 gas finds and three oil wells. In addition, the Czar/Summit joint venture drilled a further six wells which produced five natural gas discoveries. Summit's interest in the joint venture is 35%.

Maintaining that concentrated acreage positions stand a better chance of obtaining gas markets, the company increased its interests in the Craigmyle area of east-central Alberta to 17,500 acres. With a gross reserve exposure of 30 billion cu. ft., Summit intends to actively seek a market for gas from this reservoir in 1983.

Last year marked the company's entrance into the U.S. oil and gas market with participation in six gas wells in Texas and Pennsylvania.

Summit reports net profit for 1981 of $84,554 or 8¢ per share on revenues of $894,433, compared with net of $102,210 or 10¢ per share on revenues of $557,490 the previous year.

Cominco loss

VANCOUVER — Co
Limited, probably the bellw
Canada's mineral industry, re
its first loss since the early
the depression, Norman An
chairman and chief executi
cer, told the annual meetin

In the first quarter of 1
company ended up some $
lion in the red or 92¢ per c
share, for the same reason
other mining company is fee
pinch these days — weak
prices and higher operating

Diversified Cominco also s
from weak fertilizer mark
though prices were higher,
ing profit was $16.3 million le
the comparable period last ye
Mr. Anderson cautioned the
turnaround many are pre
"keeps fading into the future
he predicted "we'll likely
any significant change soon
ably not until year end."

Earlier this year Comin
nounced a shut down at Tr
Kimberley for "at least five
and after the meeting he conf
The Northern Miner the co
might be forced to consider
ing the shutdown if the ec
situation deteriorates furthe

This summer approxi
10,000 employees in the indus
be out of work at some point
that period although Cominc
sure isn't as severe as som
open pit copper producer
ting down for a year.

According to Mr. An
nearly all of Cominco's met
at 35-yr. lows and demand i
15-20% from two years ago
magnifies the situation furth

Governments aren't h
either, especially the provinc
ernment which has been har
declining revenues as well. R
it announced plans to raise
rental rates" (a fee charged C
for water going through its
electric generating plants) a
will see the 1980 rate of $1

Hollinger Argu in Iron Ore ea

While Hollinger Argus ha
earnings in 1981, it was
because of higher interes
rather than reduced revenue

As previously reported
Mar. 25/82), consolidat
income last year, exclud
extraordinary loss of $12,709
disposition of Argus Corp
$21,404,000, equal to $3.
share. Earnings after the ex
nary item were equal to $1
share, compared with 19
income of $30,411,000 or $5
share.

…eng, came on stream
…n January indicating
…n cutbacks elsewhere
…y the new mine's out-

…nd company which,
…own production, con-
…eting of about 80% of
…ms. has signalled one
… dividend cut. It is
…do whatever is neces-
…ain its control of the
…et. The 1981 total div-
…A50¢ from SA75¢ in
…d De Beers R90 mil-
…es nowhere near pro-
…h cash to fund this
… diamond stockpile
…it does tell the group's
…o will have to provide
… the stockpile — that
… single-minded in its
…l determination.

…rden increased

…eers' results were not
… the stock market on
… was the national bud-
…4 which increased the
…n gold and diamond
…y reeling from lower
…nand. The gold mines'
…es have not been
… the tax surcharge lev-
… normal tax has been
…% to 15%. Taking the
…whole, it should mean
…f about 8% in after-tax
…er things being equal.
…ings are not, of course,
… price drop is the major
…o the nation's growing
…ce and budget deficit.
… been exacerbated by
…rt prices for a wide
…r materials. An end
…e coming to the profit
…forded by a decline of
…inst the currencies of
…h Africa's major trad-
… while the gold mines
…demonstrate that cost
…an be brought down
….9% average of 1981.
…er of finance attempted to help those mines in temporary difficulties because of short-term price setbacks. About 10 mines are now operating below break-even and coping with the strain in all sorts of ways.

Capital program scrapped.

Veteran producer East Rand Proprietary Mines (ERPM) has almost completely scrapped its ambitious R300-million capital program aimed at increasing production, extending life well into the next century and improving the quality of its plant, equipment and facilities. The project was based originally in August, 1980, on the assumption that the gold price would start from a $600-an-oz. base and rise in line with working cost advances. It didn't.

Then there is another old mine, South Roodepoort, which had been counting on raising funds in London to allow it to continue operating. The underwriters of that venture appear to be back-pedalling on their earlier implied commitment, while the cost of producing each ounce of gold at the mine is currently about twice the price of gold. No one in Johannesburg is really prepared to bet that the mine will survive until the gold price recovers and there is talk that break-up specialists are bidding for the property.

A faint silver lining

In this picture of almost unrelieved gloom there has been one faint silver lining — the maintained SA12.5¢ interim dividend from the world's largest platinum producer, Rustenburg. Its first-half profit crashed from SA49.7¢ to SA22.4¢. Last year Rustenburg and the other major producer, Impala, reduced platinum production by about 15% to prevent excessive stock buildups and as a means of protecting the $475-an-oz. platinum producer quote. (Free-market platinum is about $175 an oz. less than the producer figure.) But the cutbacks, apparently, have been insufficient

mill near Matheson, Ont., The Northern Miner learned at press-time.

The mill, currently being built by **J.M. Ore Dressing** on an open pit gold property (see separate story, page B21), will cost a total of about $3 million to construct. However, Gowganda's 50% interest will only cost about $1 million if the deal goes through, since it is conditional upon acceptance of J.M. Ore Dressing's application for a grant under the provincial government's Gomill scheme. The mill could be operating by late summer.

Gowganda plans to finance its participation through a convertible debenture negotiated through a bank against a 10,000-ton high grade ore stockpile on Gowganda's gold

says he estimates the stockpile is worth at least $2 million, and contains ore grading as high as 0.7 oz. per ton.

The debenture would be made to **Tri-Con Custom Mining and Milling**, a private company which owns the mill venture. Gowganda would have the right to convert the debenture into a 50% ownership of Tri-Con.

Gowganda is currently assessing the results of the winter program at its property, which included dewatering the shaft and 4,000 ft. of diamond drilling along with 10,000 ft. of blast hole percussion drilling. Unable to release detailed results at this time, Mr. Stirling says the diamond drilling program encountered some "very high grade" intersections.

APRIL 15, 1982

Pollution fears temporarily close Carolin mill

VANCOUVER — Investigators from both the federal and provincial governments here are trying to determine if the Carolin gold mine near Hope, B.C., has caused any environmental damage to two Fraser River Tributaries.

Sources indicate that Carolin Mines allowed waste water from its mill, containing cyanide, to drain into Ladner Creek instead of directing the effluent to its tailings site. The move was originally thought to be a precautionary measure in case there was a massive runoff into the tailings area from unusually high snow levels in the surrounding mountains.

The mill has been shut down but Carolin expects the closure to be of short duration, The Northern Miner was told at presstime.

From 20-200 gallons per minute of reclaimed water containing cyanide were believed discharged into Ladner Creek over a one-week period at levels approaching a high of eight parts per million, well above the maximum allowable level of 2/10ths of a part per million, the fisheries department points out.

Carolin wasn't aware the levels were so high, noting the recycling system was still being tested. It appears they hadn't acquired enough operating expertise on the system, sources conclude.

The mine is located in an environmentally sensitive area where all water drainage systems empty into the Coquihalla River and the ministry of environment has been restocking this river in order to increase the fish (steelhead) population. Speculation has risen these fish may have been adversely effected by the cyanide.

Drinking and fishing from the two tributaries has been banned as a precautionary measure. There are no reports of anybody becoming ill from the contamination.

Bethlehem Copper Corp. started mining copper ore from the first large low grade open pit mine in British Columbia in 1962.

30¢	Dec. 30	Quarterly	30¢	$1.20
10¢	Jan. 1	Semi-ann'l	10¢	16¢
80¢	Dec. 18	Quarterly	80¢	$4.10
12.5¢	Jan. 1	Semi-ann'l	12.5¢	20¢
20¢	Jan. 25	Quarterly	20¢	$1.40
50¢	Mar. 12	Quarterly	50¢	$2.00
1¢	Dec. 31	Annual	.....	1¢
4¢	Feb. 22	Quarterly	4¢	23¢
10¢	Sept. 30	Quarterly	.....	40¢
50¢	Sept. 30	Quarterly	.....	$1.50
25¢	Mar. 31	Quarterly	.....	25¢
55¢	Feb. 26	Quarterly	55¢ y	$2.20
15¢	Mar. 11	Quarterly	10¢	$1.05
5¢	Mar. 12	Quarterly †	5¢	59¢
40¢	Dec. 14	Semi-ann'l	.....	80¢
25¢	Jan. 1	Semi-ann'l	25¢	40¢
19.6¢	Feb. 22	Quarterly	16¢	74.6¢
20¢	Dec. 16	Quarterly	15¢	60¢
15¢	Dec. 23	Initial	.....	15¢
65¢	Feb. 19	Quarterly	65¢	$2.60
10¢	June 1	Initial	.....	10¢
$1.00	Nov. 30	Semi-ann'l	.....	$2.00
15¢	June 1	Semi-ann'l	.....	15¢
$1.00	Dec. 14	Initial	.....	$1.00
35¢	Dec. 15	Quarterly	25¢	$1.40
$1.00	Feb. 11	Initial	.....	$1.00
5¢	June 10	Quarterly	.....	15¢
3.40	Jan. 5	Interim †	$3.40	55.50
$2.00	Dec. 18	Semi-ann'l	.....	$4.50
7.5¢	Dec. 21	Quarterly	5¢	45¢
75¢	Nov. 30	Semi-ann'l	.....	$1.50
25¢	July 15	Interim	.....	25¢
25¢	July 17	Semi-ann'l	.....	25¢
13¢	Feb. 22	Quarterly	13¢	61¢
$1.00	Mar. 27	Initial	.....	$1.00
7.5¢	Dec. 31	Semi-ann'l	.....	15¢
Stk	Jan. 16	Annual	.....	Stk
50¢	June 26	Interim	.....	95¢
50¢	Mar. 31	Quarterly	.....	50¢
$2.50	Nov. 27	Semi-ann'l	.....	$5.00
10¢	Dec. 18	Semi-ann'l	.....	17.5¢
10¢	Dec. 10	Annual	.....	10¢
25¢	Nov. 20	Semi-ann'l	.....	50¢
4¢	Dec. 15	Semi-ann'l	.....	8¢

ny dividends

he Northern Miner

Previous Payment		Remarks	Total* 1982	Total 1981
20¢	June 10	Annual	.....	20¢
20¢	Nov. 1	Semi-ann'l	.....	40¢
55¢	Dec. 15	Quarterly †	60¢	$2.20
7.5¢	Dec. 31	Semi-ann'l	.....	15¢
30¢	Jan. 15	Quarterly	60¢	$1.20
7.5¢	Jan. 4	Semi-ann'l	7.5¢	12.5¢
9¢	Jan. 1	Quarterly	18¢	34.5¢
40¢	Dec. 7	Quarterly †	.....	$1.60
5¢	Sept. 30	Semi-ann'l	5¢	10¢
60¢	Dec. 15	Quarterly †	60¢	$2.30
11¢	Jan. 1	Quarterly	11¢	44¢
70¢	Mar. 10	Quarterly †	70¢	$2.65
8¢	Jan. 12	Quarterly	8¢	38.3¢
7.5¢	Nov. 27	Semi-ann'l	.....	15¢
35¢	Dec. 29	Quarterly	35¢	$1.40
6¢	Oct. 15	Semi-ann'l †	7¢	12¢
Stk	Jan. 23	Initial	.....	Stk
25¢	Dec. 15	Annual	.....	25¢
Stk	Feb. 11	Initial	Stk	.....
50¢	Mar. 10	Quarterly †	50¢	$2.00
25¢	Mar. 1	Quarterly	25¢	$1.00
10¢	Sept. 30	Semi-ann'l	10¢	20¢
Stk	June 1	Initial	.....	Stk
62.5¢	Jan. 15	Quarterly †	$1.25	$2.35
50¢	Nov. 16	Annual	.....	50¢
90¢	Dec. 31	Quarterly	90¢	$3.60
$1.20	Sept. 30	Semi-ann'l	.....	$2.40
55¢	Mar. 1	Quarterly †	55¢	$2.20
45¢	Dec. 15	Semi-ann'l	.....	90¢
45¢	Dec. 21	Quarterly †	45¢	$1.80
$1.50	Dec. 23	Quarterly	20¢	$1.50
25¢	Feb. 26	Quarterly	25¢	82¢
12¢	Dec. 21	Quarterly	12¢	48¢
1¢	Nov. 30	Semi-ann'l	.....	2¢
1.2¢	Nov. 30	Semi-ann'l	.....	2.4¢
20¢	Feb. 1	Quarterly	20¢	76.5¢
3.5¢	Jan. 15	Quarterly †	3.5¢	14¢
Stk	Feb. 26	Semi-ann'l †	Stk	Stk

ng days prior to record date. Shares traded on or dend. * Includes current 1982 payments. † U.S. is of present shares. y Plus stock dividend.

l policy

of the policy, saying that it provided a basic framework but few specifics. In agreement with Mr. Thomas, he voiced his concern that the policy might result in more government control in the industry.

While the PDA appreciated the recognition of the junior mining

from the modest $750,000 project undertaken by **Northumberland Mines** in Nova Scotia to the $128-million **Echo Bay Mines** venture in the Northwest Territories, the survey is intended to present the data on the various mines in one article rather than reach a definite conclusion on the viability of each.

A number of factors have been looked at to help in determining which mines will best weather the current economic storm. In addition to the cost per ounce, this article takes into account debt positions, the annual gold production and total reserves. It should be noted that all figures are projections, since it will take some time before exact figures become available.

The first of the gold mines in the survey to see production was the Renabie mine, operated through a wholly-owned subsidiary of **Sungate Resources.** Located 85 miles north of Wawa, Ont., the 550-ton-per-day operation was brought on stream last October for about $9.5 million. The money was raised through loans. Mining a grade of 0.221 oz. gold per ton, the company is projecting costs of $C384 per ounce. However, Renabie hopes to decrease this to $253 by the last quarter of the year. Reserves are 1,125,913 tons and recovery is expected to be about 93%, indicating a total yearly production of 26,500 oz.

Highest grade

Another mine that began its tuneup in October was **Cullaton Lake Gold Mines.** With the highest grade of any mine in the survey, Cullaton is able to produce an ounce of gold for about $180 not including debt servicing. The company reports that interest costs on the $20-million long term debt run to about $40 per ounce at a capacity of 330 tons per day mining the reserve grade of 0.74 oz. per ton. Cullaton expects to be producing 81,000 oz. with a 90% recovery each year when full production is reached (see separate story).

The mine with the largest reserve picture of the new crop is **Kiena Gold Mines,** with 5,929,000 tons grading 0.178 oz. per ton. This Val d'Or area mine, a 68.3% subsidiary of **Falconbridge Nickel Mines,** reached full production of 800 tons per day in November. The $20 million Kiena spent on development does not include a mill, since ore is being shipped to the nearby Lamaque facility. The cost was financed primarily through bank loans. The company isn't saying what it is projecting the cost per ounce to be.

The company faced with the tightest budget of any new mine was the 100-ton-per-day mill put into production last December by **Northumberland Mines** near Cochrane hill, N.S. The $750,000 financing for the project was raised through an underwriting, and so profit from the 10 oz. per day the mill is expecting to produce will not be offset by loan repayment. The

[illegible] tons per day. The $17-million startup costs were financed by loan and at a cost of $200 per oz. the company hopes to reach payback in little more than a year. Production began last month.

Another mill brought on stream was the **Consolidated Louanna Gold Mines** operation near Nakina, Ont. With a reserve grade of 0.30 oz. per ton the company expects to produce about 15,000 oz. gold annually putting through 140 tons per day. Reserves are calculated at only 113,000 tons, but the company reports the initial mill feed was taken from ore not even included in original reserve estimates (**N.M.,** Mar. 4/82). The company will receive 25% of the profit and partner **Cumo Resources** will receive the remaining 75% until payback, at which time the situation will be reversed. Costs were about $4.4 million to production.

The big **Carolin Mines** project near Ladner Creek, B.C., has been experiencing considerable delays in the tuneup of its 1,500-ton-per-day mill. Originally slated for production last August, the company is not sure when full production will be attained although it conducted some test pours last month. Problems with power mean the operation will be operated on a 5-day week instead of the planned seven, which will lower the previously announced 200-oz. per-day production. Carolin has reserves of 1,530,000 tons grading 0.14 oz. per ton. It was originally to be one of the lowest cost producers in the country at $120 per oz. although it remains to be seen if the operation can produce gold at this price. The $36 million Carolin has spent so far came from the Aquarius group (**Ocelot Industries, Windjammer Power and Gas,** and **Aquarius Resources**) and is mostly represented by loans.

Next on stream

The next mine expected to reach production is the **Bachelor Lake** gold mine, 80 miles southwest of Chibougamau, Que. This 500-ton-per-day facility was financed entirely through a $10.5-million underwriting and so the company is in the enviable position of not having to worry about loan servicing affecting production costs. Reserves are reported at 967,046 tons grading 0.195 oz. per ton, and Bachelor expects to produce about 32,000 oz. annually at a cost of $250 per oz. Some minor tuneup problems have delayed the production start, originally scheduled for last November. The company has indicated that the first gold should be poured within a month.

Goldlund Mines is expecting to commence production next month on its Echo Twp. gold property near Sioux Lookout, Ont. The company has been making slow progress on its 200-ton-per-day mill but has been able to keep expenses near the $1 million originally budgeted. Reserves are estimated at 900,000 tons

seriously affect operations. **Wil nour Resources** recently announce that it was cutting back staff on i Red Lake area project which wa designed to mill gold at its revampe mill from numerous properties.

If all projects in the survey com off as planned, Canada will exper ence a 28% increase in annual gol production by 1983, not includin expansion of existing mines or th big Detour Lake project schedule to start production in a little mor than a year. And if the past is an indication, this production shoul be sustained for some time, sinc the average gold mine in Canad traditionally produces three time the amount of gold indicated in pre production reserves.

Gulf to scale down mineral exploration

Close on the heels of Shell Canada Resources' decision to get out of mineral exploration (**N.M.,** Feb. 18/82), **Gulf Minerals Canada** has opted to scale down the extent of its exploration exposure.

Essentially, Gulf will continue "as is" in uranium ventures in Saskatchewan, but will cut back exploration activities in other parts of Canada, President J. Keily tells The Northern Miner. This means the phasing out of a number of projects across the country, including the search for uranium in Nova Scotia. But Mr. Keily points out that operations outside of Saskatchewan represent the "smaller part" of Gulf's exploration effort.

MARCH 11, '82

Chieftain, Texaco start gas operation in Northwest Alta.

CALGARY — A 40 million cu. ft. per day capacity gas plant in northwestern Alberta is now in commercial operation say joint owners, **Chieftain Development Co.** (TSE) and **Texaco Canada** (TSE).

The first section of the Hythe-Brainard plant cost $5.5 million to build and will handle gas from 13 wells, connected to the facility by a $4.8 million, 25-mile gathering system. Completion of the plant is scheduled for 1983.

Also with Chieftain, the company reports a 28% increase in the value of its proved and probable oil and gas reserves during 1981, the result of new production late in the year. Independent consultants estimate cash flow from reserves was an undiscounted $2.3 billion at Dec. 31, 1981, compared with $1.8 billion a year earlier.

Shares of Calgary-based oil and gas exploration and development company, **Pillar Petroleums,** have been posted for trading on the Montreal Exchange. The firm, which last month changed its name from **Petromont Oil & Gas,** was also listed on the Alberta Stock Exchange earlier this year.

peaked at $US32.50 a lb. on the dealer's market in 1979, but is now holding at about $US7 a pound for molybdic oxide. "Adverse world economic conditions have reduced molybdenum consumption . . . at a time when several new mines have been coming into production or have been committed to construction," Mr. Bennett said.

Further aggravating the situation is talk of a production decision by U.S. Borax at its Quartz Hill, Alaska, prospect, considered the world's largest and richest molybdenum deposit that could become the lowest cost producer. The decision isn't expected until around 1987, but Lawrence Adie, Placer's vice-president of exploration conceded at the meeting that "If Alaska comes on stream, large tonnage, low grade deposits (like Adanac's) will have to take a back seat."

If there should be delays at Quartz Hill (which is adjacent to a National Park), possibly over tailings disposal, Adanac's timing could move up, Mr. Adie said.

In the meantime, approval by the B.C. government on the Stage Two environmental and social impact study is expected soon, Mr. Bennett said, with a "generally positive response from the Metals Mines Steering Committee."

He said the sewage and radiation issues (because of uranium in the tailings) have been resolved, with the Atlin community "won over" by Placer's study under the guidance of Terry Allen. He said Environment Canada has also commended the venture for defining the radiology issue.

Placer has spent approximately $3.7 million on the property through to Sept. 30, 1981. Technical work on the project is now complete. Minable reserves total 201 million tonnes grading 0.098% MoS_2 at a waste-to-ore ratio of 1.56 to 1. Higher grade core is available from within this volume for mining in the early years, Mr. Bennett said.

Adanac has now reached agreement with **Johns-Manville Canada** to extend the lease option for a similar period on whose land a minor portion of the deposits occurs. Placer has paid Adanac $295,000 and will pay an additional $889,000 before Dec. 31, 1985, to maintain the option on the property.

* * *

MARCH 4, '82

As reported last week, **Carolin Mines** after much delay, has now poured the first two gold bars at its joint venture Ladner Creek mine near Hope, B.C. The major components of the underground crushers are now complete, and the 1,500-tons-per-day mill is operating over capacity. That capacity will be increased to a maximum of 3,000 tons as more mine and milling expe-

lion tons at 0.052 gold equ... have been tabulated using a cut-off of 0.03 oz. for a total reserve in both categories of 8.07 million tons grading 0.088 gold equivalent.

Westley's vice president of exploration, Dr. C. L. Smith, reports they are contained between the 6,000 and 5,100-ft. elevations within a disseminated gold-silver, pyritic jasperiodal silica body some 300-400 ft.in diameter which plunges to the northeast at approximately 60 degrees.

Several holes drilled in the central part of the Santa Fe have bottomed in mineralization of the same grade as the definite reserves. This means it's open at depth, he notes. The northern and eastern limits remain to be located.

He adds that various mining con-

to purchase Ballingarry Colli... (Production) Ltd.'s interest in a States Mining Lease covering 14 square miles in county Tipperary, Republic of Ireland.

The Ballingarry coal deposit has been worked since the early 19th century; and is now being mined at a rate of 300 long tons per week. A preliminary inspection of the underground workings and surface facilities indicate the mine can be modernized and facilities upgraded to maintain a production rate of 1,500-2,500 long tons. Flair says a conservative estimate of the reserves is three million long tons.

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Table Mountain Mines reports that 2,184 ft. of diamond drilling in

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Report from Vancouver

Adanac sits out molybdenum glut

By David Duval and Margaret Nutt

Nobody is saying when **Adanac Mining & Exploration's** Ruby Creek molybdenum property near Atlin, B.C., will be put into production. But it's conceivable it may be later than Dec. 31, 1986, by which date **Placer Development** must make a production decision to earn a 70% interest, with Adanac retaining the balance. That date is already a 3-year extension granted recently because of the current soft market and molybdenum glut that has forced established producers, including Placer, at Endako Mines, to cut back production.

Adanac president Winslow Bennett talked of "an overhang of unsold inventory in producers' hands for several years to come" at the company's annual meeting. But he said Adanac "isn't considering moving its eggs into a different basket though we've been tempted." He also said Adanac and Placer are "good friends," indicating the joint venture will likely continue even if a production decision isn't reached by December, 1986. "It's all a matter of timing," he told The Northern Miner.

At the moment, the timing is wrong. When Placer optioned the property in December, 1978, the price of molybdenum was rising. It peaked at $US32.50 a lb. on the dealer's market in 1979, but is now holding at about $US7 a pound for molybdic oxide. "Adverse world economic conditions have reduced molybdenum consumption . . . at a time when several new mines have been coming into production or have been committed to construction," Mr. Bennett said.

Further aggravating the situation is talk of a production decision by U.S. Borax at its Quartz Hill, Alaska, prospect, considered the world's largest and richest molybdenum deposit that could become the lowest cost producer. The decision isn't expected until around 1987, but Lawrence Adie, Placer's vice-president of exploration conceded at the meeting that "If Alaska comes on stream, large tonnage, low grade deposits (like Adanac's) will have to take a back seat."

If there should be delays at Quartz Hill (which is adjacent to a National Park), possibly over tailings disposal, Adanac's timing could move up, Mr. Adie said.

In the meantime, approval by the B.C. government on the Stage Two environmental and social impact study is expected soon, Mr. Bennett said, with a "generally positive response from the Metals Mines Steering Committee."

rience is gained by the staff, the company says.

On the company's wholly-owned Ladner Creek North property, adjacent to the joint venture holdings, a limited program of diamond drilling last fall and winter confirmed gold geochemical anomalies and rock formations similar to those at the Carolin Mine. Assays from 21 surface diamond drill holes have been received. One zone in hole 81-5 assayed 0.206 oz. gold/ton across 0.5 m and one zone in hole 81-20 assayed 0.11 oz. gold/ton across 3 m.

A joint venture of Carolin Mines and **Aquarius Resources** has staked an extensive area near Likely, B.C., for a future gold exploration project.

* * *

Westley Mines has established a new reserve figure for its Sante Fe gold-silver deposit in Nevada. The calculation is based on approximately 42,000 ft. of vertical rotary percussion drilling and 4,700 ft. of diamond drilling with 5-ft. assay intervals.

Classified as definite are: 4.87 million tons averaging 0.112 oz. gold equivalent based on a cut-off grade of 0.06 gold equivalent.

In the marginal category, 3.2 million tons at 0.052 gold equivalent have been tabulated using a cut-off of 0.03 oz. for a total reserve in both categories of 8.07 million tons grading 0.088 gold equivalent.

Westley's vice president of exploration, Dr. C. L. Smith, reports they are contained between the 6,000 and 5,100-ft. elevations within a disseminated gold-silver, pyritic jasperiodal silica body some 300-400 ft.in diameter which plunges to the northeast at approximately 60 degrees.

Several holes drilled in the central part of the Santa Fe have bottomed in mineralization of the same grade as the definite reserves. This means it's open at depth, he notes. The northern and eastern limits remain to be located.

He adds that various mining concepts are under consideration, including both open pit and underground methods.

Metallurgical studies thus far have given favorable results for the oxidized upper horizons and progress has been made on the underlying unoxidized material. Kilborn Engineering of Vancouver is supervising the test work.

* * *

Work carried out on **Inca Resources'** Kem property near Chappelle Creek, B.C. by **Kidd Creek Mines**, and centred on a newly discovered quartz-specularite vein system, indicates the mineralized zone is some 15 m long and 1-1.5 m wide with an unknown depth. Grab sampling gave assays as high as 28.46 g gold per tonne (0.83 oz.) and 846.9 g (24.7 oz.) silver. A program of diamond drilling and trenching is planned for 1982.

Inco also reports that diamond drilling is continuing on its Rich Gulch property in Plumas County, California, under option to **Campbell Resources**. Eighteen more holes have been completed since the company said DDH-53 returned a 40-ft. intersection assaying 0.402 oz. of gold per ton. The most recent holes are in for assay.

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Flair Resources has made a 10% down payment on the $734,000 cost to purchase Ballingarry Collieries (Production) Ltd.'s interest in a States Mining Lease covering 14 square miles in county Tipperary, Republic of Ireland.

The Ballingarry coal deposit has been worked since the early 19th century; and is now being mined at a rate of 300 long tons per week. A preliminary inspection of the underground workings and surface facilities indicate the mine can be modernized and facilities upgraded to maintain a production rate of 1,500-2,500 long tons. Flair says a conservative estimate of the reserves is three million long tons.

* * *

Table Mountain Mines reports that 2,184 ft. of diamond drilling in eight holes was completed on the company's Cassiar area gold property during 1981. The drilling tested the A, G and H zones for a possible down-dip extension on a northwesterly rake. One 4-ft. intersection in the A Zone, which is now known to continue to the west, returned 0.39 oz. gold and 0.315 oz. silver per ton.

Discussions have been held with other companies nearby to mine and custom mill Table Mountain ore but no agreement has been reached. Working capital at the end of the fiscal year was $57,150.

* * *

Phoenix International Energy has entered into an agreement in principal with **World Wide Minerals**, a private B.C. company, to commence test production of Phoenix's Kewebb gold property in Yavapai County, Arizona. If results are satisfactory, World Wide will provide the financing necessary to put the property into full commercial production.

While test production facilities are being completed, Phoenix will continue to carry out detailed mapping and sampling to establish the full extent of mineralization on the property.

newest treatment plant, at Tweepad on the Namaqualand coast, just a year after it was brought on stream. It had produced almost 150,000 carats last year, from 1,300,000 tons of diamondiferous ore. This year it was scheduled to reach its full capacity of 270,000 tons of ore per month. In South West Africa, one treatment plant, a sampling plant, and two small screening facilities have been shut down.

CANADA

BRITISH COLUMBIA

FURTHER EXPLORATION AT LADNER CREEK IS PLANNED

Carolin Mines Limited has begun drilling on a new mineral exploration program at its wholly-owned Ladner Creek North property, located near Hope, about 100 miles east of Vancouver. The program will include large-core diamond drilling, stripping, and mineral sampling, and will cost approximately $800,000. Carolin has been developing its Idaho Mine, at which it now plans to begin mining in early November, on one of 78 claims in the Ladner Creek area—the existence of adjacent mineralized zones had been suggested for some time (see WORLD MINING, December 1980, pages 70-71).

In addition, Carolin will begin driving a 3,000-foot extension of the main haulage tunnel at the Idaho mine, to develop new ore reserves in the McMaster Zone, at an approximate cost of $1,600,000.

Initial production at the Idaho mine is expected to yield 200 ounces of gold per day. Reserves at this deposit are 1,530,000 tons averaging 0.141 ounce gold per ton. The expected yield is thus roughly in line with earlier plans to mill about 1,500 tons per day here. The company says that the Idaho mine, when in full production, will be western Canada's largest gold mine, and one of the lowest cost producers in North America.

YUKON TERRITORY

Homestead Minerals Corporation (HMC), a United States-based company, has formed a wholly-owned subsidiary, **Canadian Star Placer Gold, Limited**, to develop its properties in the Dawson Mining District. HMC has signed leases for 149 claims along the California and Fish creeks, and estimates that the material contains an average of 0.07 ounce of gold per cubic yard, with enough material to sustain operations of 10,000 to 15,000 cubic yards per day for 50 to 60 years.

The claims are about 14 miles long and 2,000 feet wide. Full operations are currently scheduled to begin by the second quarter of 1982. HMC has also retained the rights to all other precious metals present in this material.

BRITISH COLUMBIA

A substantial increase in ore reserves estimates has been made by **Silver Standard Mines Limited** for the Schaft Creek deposit of its subsidiary, **Liard Copper Mines**. The new figures show 1,000,000,000 tons of ore averaging 0.30 percent copper, 0.034 percent MoS_2, 0.004 ounce per ton gold and 0.035 ounce per ton silver. Total copper equivalent is 0.61 percent copper, and the reserves are figured with a cut-off grade of 0.30 percent Cu equivalent. The new figure more than double the previous estimate of 400,000,000 tons, which also used the above Cu equivalent cut-off.

The increase is a result of a large drilling program recently completed by **Teck Corporation**, which has a development contract entitling it to earn 70 percent of this deposit by placing it into production. Liard would hold the remaining 30 percent as a carried interest, and through its 66.5 percent interest in Liard, Silver Standard would hold an interest of about 20 percent.

The summer program here entailed some 25,000 feet of diamond drilling, to provide sufficient data to design an initial open pit. Results to date have indicated a waste to ore ratio of 1.2 to 1.0 if a pit is developed.

This property is located in the Stikine River area in northwestern British Columbia, 40 miles south of Telegraph Creek and 40 miles west of the Stewart-Cassair Highway.

LATIN AMERICA

CHILE

ENAMI SEEKS NEW PARTNER FOR ANDACOLLO Cu PROJECT

The state-controlled mining company, **Empresa Nacional de Minería de Chile** (Enami), will retender the Andacollo copper project, which was abandoned by **Noranda Mines Limited** of Canada when the company was unable to negotiate a satisfactory financing agreement for the $452,000,000 project.

The Andacollo copper deposit, in northern Chile, contains more than 200,000,000 tons of reserves with an average grade of 0.56 percent copper, 0.007 ounce gold per ton, and about 0.007 percent molybdenum. Enami and Noranda were evaluating an operation involving about 44,000 tons per day of ore feed to a concentrator and Enami

changed for pipe materials. Another way that profits could be improved would be through the production of cobalt concentrates from a copper recovery section the company operates at San Nicolás. A pilot plant to study this possibility would cost some $6,000,000 and require joint venture financing. Cobalt production would be unlikely to begin before 1985, according to company sources.

BRAZIL

Companhia Vale do Rio Doce S. A. (CVRD) should find it easier to find final financing for the Carajás iron ore project it is developing in the Amazon (see WORLD MINING, June 1981, page 172) with the recent announcement by Japan's seven major steel manufacturers of plans to purchase 150,000,000 tons of iron ore. The Japanese mills now purchase 26,490,000 tons of iron ore from the company's Minera Gerais mine, although this volume will be reduced when Carajás begins production. Development costs of the project, estimated earlier at $2,800,000,000, now appear to be closer to $4,000,000,000.

MEXICO

Armco Inc. and **Minera Frisco S. A. de C. V.** have formed a joint venture to explore for silver ore in northwestern Mexico, with Frisco holding a 51 percent interest and Armco the remaining 49 percent. The joint venture company is named **Minera Cerro de Plata S. A. de C. V.** Frisco currently operates a silver mine in the state of Sonora, the primary exploration target. Frisco's mine, Lampazos, was reported on in the October 1980 issue of WORLD MINING, pages 50 to 53. Under terms of the agreement, Armco would license silver processing and refining technology to the joint venture company in the event that a silver deposit would be found.

CANADA

MANITOBA

ALCAN PLANS LARGE Al SMELTER FEASIBILITY STUDY

A full feasibility study for a 200,000 metric-ton-per year aluminum smelter to be located within 50 miles of Winnipeg will be conducted by **Alcan Aluminium Limited**. Cost of the smelter project would be about $1,000,000,000. The full feasibility study will take from one to two years and will cost approximately $5,000,000.

This province has a surplus of hydroelectric power from the Nelso River and the lowest industrial power rates in Canada. The alumina feed for the smelter would come from Alcan's worldwide operations. Marketing of the aluminum ingot would be primarily to industry in the midwestern part of the United States.

The feasibility study will concentrate on all economic and technical aspects of the project, including power source. There is some possibility that Alcan would enter into a joint venture for new hydroelectric facilities to power the proposed smelter.

BRITISH COLUMBIA

RECENT RESULTS MAY LEAD TO IDAHO GOLD EXPANSION

Final work on the mill and tailings dam at **Carolin Mines Limited**'s Idaho gold mine near Hope is proceeding smoothly and on schedule. As a result of recent underground development work and fill-in diamond drilling in the mine, the company is comtemplating a major expansion of its development program. The expanded program would include a further 3,000 feet of tunneling along the mineralized zones, extending from the northern end of the developed portion of the Idaho zone further north to the McMaster zone, where several diamond drill holes and surface trenching have indicated that there is another mineralized zone similar to the Idaho.

The ambitious exploration program on Carolin's Ladner Creek North property has yielded particularly encouraging results. Several major gold-in-soil anomolies have been outlined by geochemical sampling during the course of this work. The largest of the anomolies appears to have considerably larger dimensions than the approximate 2,000 foot length and 500 foot width previously determined. Geological reconnaissance work in parts of this anomoly shows the area to be underlain by diorite and slate which often contain irregular microquartz veinlets and often considerable disseminated pyrite. This anomoly has gold-in-soil values as high as 0.15 ounce gold per ton.

ONTARIO

An international group of nickel producers has formed an organization to develop and publish scientific information concerning occupational health and safety and environmental matters related to the production of nickel. Some projects will be conducted by the members of the group, but most of the research will be conducted by experts from the academic community. The group is looking for a multi-disciplinary organization capable of providing the administrative and technical support needed to develop and supervise a comprehensive program of scientific research. The current headquarters for the group is in Toronto. Companies in the organization are: **Amax Inc., Falconbridge Nickel Mines Limited, PT Aneka Tambang, Impala Platinum Limited, Hanna Mining Company, Inco Limited, Nippon Mining Company Limited, LARCO, Outokumpu Oy, Sumitomo Metal Mining Company Limited, Sheritt Gordon Mines Limited, Western Mining Corporation Limited,** and **Société Metallurgique Le Nickel.**

Large zinc and lead producer to be way up north

A small Arctic island in Canada's Northwestern Territories is the planned site of what will be the world's most northerly mine, the Polaris mine of Cominco Limited (see artist's conception of completed project above). The zinc-lead deposit on Cornwallis Island, which is located 60 miles northwest of Resolute and within 70 miles of the magnetic North Pole, contains an estimated 23,000,000 metric tons of ore averaging 14.1 percent zinc and 4.3 percent lead. Bechtel Canada Limited was chosen to provide engineering and construction services; Pamo Inc. of Quebec is general contractor, and Armco is supplying pre-engineered steel building systems. The mine will employ about 250 miners when in full operation. Development costs are estimated at $150,000,000.

Campbell mill, of which Campbell can acquire a 100 percent interest subject to royalty payments. A total of 21 widely-spaced drill holes here have shown reserves of 746,700 tons, assaying 6.9 percent zinc, 0.55 percent copper, and 0.38 ounce silver per ton

• The Norbeau Mine, a former gold producer, which is being brought back into production by the **Norbeau Joint Venture**, owned by **Consolidated Copper Lode Developments Inc.**, and **Zinc Metal Corporation**. Campbell will purchase Zinc Metal's 50 percent interest in the joint venture. Recent surface trenching and sampling has indicated the presence of a new vein system, currently being outlined by diamond drilling.

MANITOBA

HUDSON BAY UPGRADING FLIN FLON ZINC OPERATIONS

The Canadian Metals Division of **Hudson Bay Mining and Smelting Company** is undertaking three projects costing a total of $20,200,000 at its zinc refinery at Flin Flon, as part of an ongoing program to upgrade and modernize its metallurgical operations there.

A $10,400,000 zinc casting plant is now being built, and is scheduled to be completed in July 1982. It will include new casting and slab handling equipment, and an electric induction furnace that will replace two existing reverbatory-type melting furnaces.

Work has also begun on two new zinc roaster precipitators, which will cost $5,300,000. Completion is scheduled for December of this year. The new units will be designed to have a collection efficiency of 99.5 percent.

The third of these projects is implementation of a hot purification process into the electrolytic tankhouse. This project will start this June, and will cost $4,500,000.

BRITISH COLUMBIA

CAROLIN'S IDAHO MINE TO START PRODUCTION

Carolin Mines Limited has planned to start production at its Idaho gold mine, located on the company's Ladner Creek property near Hope, by the end of the second quarter of this year. Final installation of the mill equipment, installation of the underground crushers, and final work on the tailings dam are on schedule. The mill is designed with a capacity of 1,500 tons per day.

The Idaho mine is but one of 78 claims on the Ladner Creek property, which contains an estimated 1,530,000 tons of ore averaging 0.141 ounce gold per ton (see WORLD MINING, December 1979, page 95 and December 1980, pages 70-71). Carolin has reported several major geochemical anomalies on the North Property of Ladner Creek, one of which is more than 2,000 feet long and 500 feet wide, with samples as high as 0.15 ounce gold per ton. In addition, exploration at four other underground levels has shown gold values ranging all the way up to 1.45 ounces gold per ton, and the dump at the old Pipestem Mine has shown samples grading better than 0.2 ounce gold per ton.

ONTARIO

Exploration by **Craigmont Mines Limited** on its Red Bird molybdenum property 100 miles south of Smithers in this province, with 125 diamond drill holes complete, indicates one zone containing an estimated 20,000,000 tons grading 0.21 percent MoS_2 plus an estimated 23,000,000 tons grading 0.13 percent MoS_2.

A second zone is estimated to contain 10,000,000 tons grading 0.20 percent

uct have been accumulated in outdoor stockpiles at one time to accommodate shipping schedules. Normal plant operations, at 1,000 tons per day, include open stockpiling at the plant via belt conveyor. The briquettes are reclaimed from the stockpile by front-end loader and transported by dump truck about 10 miles to the ocean shipping terminal at Puerto Ordaz on the Orinoco River.

CANADA

BRITISH COLUMBIA

Carolin Mines Limited reports continuing good progress in the development of its Ladner Creek gold mine near Hope. Ladner Creek has been diverted slightly and covered over near the mill, thus increasing the site area for the mill and related facilities. Concrete foundations have been poured for the 1,500-ton-per-day mill and the structure is now closed in. Road widening and shortening is continuing and underground development is on schedule. Sampling and testing at the Pipe Stem and McMaster ore zones continues and diamond drilling should begin before year end under the direction of Cochran Consultants Limited of Vancouver. Startup of operations is expected in the second quarter of 1981.

ONTARIO

Northgate Exploration Limited has entered into an agreement to acquire an undivided 100 percent interest in a gold prospect and adjacent areas totaling 196 claims in Scadding Township. Under the terms of the agreement covering this acquisition, Northgate is committed to spend at least $856,000 in exploration and development work within a period of 18 months in the initial stage of the program, the purpose of which is to delineate an economically minable body and complete a positive feasibility study. The second stage provides for development with an elective right to proceed to production on a tonnage scale to be determined based on the results of the first stage of the project. The property has been partially tested by surface drilling, totaling some 23,800 feet, including 10,058 feet in 35 holes in the 1979 program, indicating at least three zones of gold mineralization, to a tested depth of 400 feet with the general grade of intersection assaying about 0.25 ounce gold per ton. An immediate start of the first stage of exploration and development is contemplated including extensive diamond drilling. The company hopes to test zones for continuity to depth below the 400-foot level.

MANITOBA

Four holes of a proposed 10-hole drilling program on **Maverick Mountain Resources Limited's** Puffy Lake precious metals prospect have been completed. The results are considered encouraging. The gold silver mineralization is found in biotite granitic gneiss on the Bed claims, near Puffy Lake, some 65 kilometers (40 miles) north of Flin Flon. Maverick Mountain Resources can earn a minimum of 60 percent interest in the property from **Gränges Exploration Aktiebolag** by spending $350,000 on the claim block. The highest grade intersection was 5 feet between 33 and 38 feet with a grade of 0.543 ounce gold per ton.

YUKON TERRITORY

The Clear Creek gold placer operation of **Crescent Mines Limited** is now producing at a rate of some 3,000 cubic yards per day. The operation is working on a 15-hour day basis.

AFRICA

SOUTH AFRICA

PALABORA GOING AHEAD WITH TROLLEY ASSISTED TRUCKING

Following trials carried out since July (WORLD MINING, July 1980, page 54), **Palabora Mining Company Limited,** has announced its decision to go ahead with the installation of a trolley assist system for its fleet of 75, 150-ton Diesel-electric dump trucks. The company hopes to save up to 20,000,000 liters (5,284,000 United States gallons) of Diesel fuel per year, from the present total consumption of 60,000,000 liters (15,852,000 gallons) per year using trolley assistance.

The tests carried out at Palabora have shown that consumption can be reduced from 24 liters per kilometer (10.2 gallons per mile), in the Diesel-electric mode, to 3 liters per kilometer (1.3 gallons per mile) using trolley assistance. These figures are comparable with those achieved by the **South African Iron and Steel Industrial Corporation Limited (Iscor)** in more extensive trials at the Sishen iron ore mine. (See page 35 this issue.) At Sishen, Diesel fuel consumption was reduced from 26.7 liters per kilometer (11.4 gallons per mile) to about 4 liters per kilometer (1.7 gallons per mile) using trolley assistance. Sishen is also going ahead with a fully operational system. Experience at both mines has also shown that trolley assistance increases truck speeds and reduces engine maintenance costs.

The first phase of the project at Palabora will be the installation of 2.7 kilometers (1.7 miles) of overhead trolley lines on the main haulage ramp leaving the pit. This together with the necessary truck conversions will cost $16,000,000. It is expected to be completed by late 1981. The system has been designed so that the trolley line can be extended as the pit deepens.

Another project that will reduce costs is the decommissioning of five 4.6-cubic meter (6-cubic yard) face shovels and 17, 100-ton trucks. These units will be replaced by one 19-cubic meter (25-cubic yard) shovel and nine 150-ton trucks, at a cost of $15,200,000.

Replacement of the small shovels with one large one will achieve a significant reduction in loading costs. The new trucks will reduce congestion on haul roads, cut truck costs, and facilitate the introduction of the trolley system.

ZAMBIA

Mining the lower ore body on the southern side of **Nchanga Consolidated Copper Mines Limited's** open pit located in Chingola began earlier this year. This ore body is expected to yield approximately 615,000 metric tons of copper over the next 13 years; the final depth of the pit will be 473 meters. During overburden stripping, an intermediate ore body containing refractory cobalt was uncovered. This cobalt ore is not treatable at present so it is being stockpiled.

NIGERIA

Associated Ores Mining Company Limited (AOMC), in association with the consultancy company **Sofremines,** is confident of meeting the target date of late 1983 for the first production of iron ore from the Itakpe mine in Kwana state. Work on the Osara River dam and township development is being expedited. A call for tenders for the major items of industrial plant has been put out.

In 1975, reserves of the Itakpe deposit were estimated at 200,000,000 tons with an iron content of between 60 and 65 percent. The mine is being developed as an open pit with a concentrator designed to produce 4,000,000 tons of ferrous products annually.

ASIA

MALAYSIA

The Malaysian Mining Corporation (MMC) Berhad has recently signed an agreement with the Kelantan state government to undertake operations and development of this state's mineral re-

day by 1982. Mount Tolman and a new rougher regrind plant to improve recovery at the Climax mine should both come on-stream in 1984.

UTAH

Sunshine Mining Company is exercising its option to lease the underground mining rights to 1,387 acres from **Chief Consolidated Mining Company,** including the Burgin Mine, located in the East Tintic Mining District. The term of the lease is 50 years with a right to renew for an additional 25-year term. Recent drilling by Sunshine on the leased properties confirms substantial mineralization containing quantities of lead, zinc, and silver to the west, and at greater depths than in areas previously mined. **Kennecott Corporation,** a former lessee, mined about 1,800,000 tons of ore from the Burgin Mine during the 12 years from 1966 to 1978 containing mineral values of approximately 8.6 percent lead, 8.7 percent zinc, and 8.5 ounces per ton of silver.

CANADA

SASKATCHEWAN

2,000-FOOT DRILL PROGRAM PLANNED FOR STAR LAKE GOLD

Phoenix Canada Oil Company Limited and **MSZ Resources Limited** have entered into an exploration agreement on the Phoenix Canada gold prospect at Star Lake. The pact calls for an early start by MSZ on a $150,000 exploration program which will be completed by March 1981. At least 2,000 feet of diamond drilling, an electromagnetic survey, and geological mapping are part of the plan.

Surface exploration during the summer tested a promising high-grade gold-bearing quartz vein in a strong shear zone exposed over a strike length of at least 160 feet and an average width of about 4 feet. Additional, as yet untested, gold-bearing quartz veins were located in several outlying shear zones. Other shear zones may be present under the extensive overburden cover.

Trenching across the primary zone returned assay values averaging 1.0 ounce gold per ton. Several channel samples assayed several ounces of gold per ton, the best being 5.96 ounces per ton across a 20-inch vein width.

The property is located approximately 80 miles north of LaRonge and 4 miles from the all-weather road to **Gulf Mineral Corporation's** Rabbit Lake uranium prospect.

BRITISH COLUMBIA

CAROLIN MINES GOLD PROJECT CLOSER TO PRODUCTION

Carolin Mines Limited continues to make good progress toward bringing its Idaho Zone gold property on Ladner Creek near Hope into production. The underground development work is on schedule and mineralization encountered in the workings outside the known Idaho ore zone suggests that additional ore-bearing zones may occur northerly and also to depth. This gives promise of potentially significant additions to ore reserves in the future.

Surface work, including road development, culvert construction, bringing in hydroelectric power lines, construction of a tailings dam, site preparation, construction of the 1,500-ton-per-day mill and ancillary buildings, and installation of the mill equipment is progressing well and is generally on schedule.

Barring unforeseen developments, start-up of the facilities is expected during the second quarter of 1981.

Initial production from the Idaho joint venture mine is expected to be from 175 to 200 ounces of gold per day with operating costs estimated at under $100.00 Canadian ($86.00) per ounce. This will make the mine one of the lowest cost producers in Canada.

Exploration work, including diamond drilling, north of the Idaho has indicated a gold deposit similar in nature to the Idaho. Considerable potential is expected in this area, known as the McMaster Zone, since it lies along the same structure and there are remarkable geological and mineralogical similarities with the Idaho zone. Management is equally encouraged about the potential of the Ladner Creek North property, where there is good reason to believe that an additional gold-bearing zone may occur northerly from the McMaster Zone, lying along the same geological structure which hosts the Idaho and McMaster zones.

Management believes the expenditure of nearly $500,000 in the exploration program now underway on the wholly-owned North property is justified and that sufficient ore reserves could be proven to warrant a feasibility study for the establishment of a mine on the North property.

AUSTRALIA

WESTERN AUSTRALIA

3,000-TON-PER-DAY TIN-TANTALITE PROJECT PLANNED

New reserves of tin and tantalite have been outlined by **Greenbushes Tin N. L.** at the company's operations in this state. Exploration results have been sufficiently encouraging that the company is evaluating plans to place a 3,000-ton-per-day operation into production. Cost of such an operation has been estimated to be $70,000,000.

The area so far covered by Greenbushes' latest drilling contains multiple zones of tin and tantalite mineralization from surface to a depth of 340 meters (1,100 feet). Taking a 0.6 percent tin equivalent cutoff grade, probable reserves of 9,700,000 tons containing 0.15 percent tin, 0.06 percent tantalite, and 0.042 percent columbium have been outlined by the company. This gives a 0.867 percent tin equivalent for an average grade across a true width intersection of 9.6 meters (31 feet).

Raising the cutoff grade to 0.8 percent reduces the tonnage to 3,000,000 tons grading 0.22 percent tin, 0.07 percent tantalite, and 0.031 percent columbium with a resulting average tin equivalent grade of 1.06 percent over a width of 8.2 meters (27 feet).

If the cutoff grade is lowered to 0.3 percent, then the tonnage increased to approximately 21,800,000 tons grading 0.11 percent tin, 0.044 percent tantalite, and 0.031 percent columbium, giving an average equivalent grade of 0.64 percent tin over a true width of 14.7 meters (48 feet). Stripping ratio for the operation would be about 4.5 to 1.0.

Further exploration could increase the reserves by three times, according to the company.

QUEENSLAND

Peko Wallsend Limited plans to recover approximately 460,000 ounces of gold over a 20-year period from the treatment of tailings at its Mount Morgan mine. Studies have shown that there are some 40,000,000 metric tons of tailings assaying about 0.03 ounce gold per ton, which can be economically processed. Estimated cost of the project is $15,000,000 and tailings will be treated at a rate of about 9,500 tons per day. The Mount Morgan mine was at one time the largest open pit copper mine in Australia. In recent years, gold has been the mainstay of the mine. Production of gold from the mine was 7,014 ounces in 1979. About one third of the gold in tailings is expected to be recovered after the company has reached a decision on whether to go ahead in June 1981. The company would begin treating tailings in March 1982. With Mount Morgan's ore milling operation already extended by 2 to 3 years because of the treatment of ore from the small nearby Mount Chalmers mine, the life of the Mount Morgan mining district could be prolonged until the mid-1990's.

OCEANIA

INDONESIA

ERTSBERG EAST ON SCHEDULE AND UNDER BUDGET TO DATE

In the company's third quarter report, **Freeport Indonesia Incorporated** reports that development of the new Ertsberg East underground copper, gold, and silver ore body and related facilities is continuing ahead of schedule and well under budget of $101,500,000. Initial block caving and ore production are expected by the end of this year, and 1981 operating plans are now being formulated with the objective of increasing metal output of concentrates some 20 percent over 1980 planned levels.

The deposit contains approximately 45,000,000 tons of ore with an average copper grade of 2.75 percent along with gold and silver values. Plans call for a gradual buildup of underground ore mining to some 4,500 tons per day during the course of the first half of 1981 to supplement open pit ore tonnage.

Revenue from copper and precious metals sales during the quarter amounted to the equivalent of about $1.35 per pound of copper compared with $1.06 per pound in the third quarter of 1979.

PAPUA NEW GUINEA

Unforseen drops in production at **Bougainville Copper Company**'s mine will force back the growth plans of this country. The government will absorb roughly 70 percent of the drop in revenue through decreased taxes and dividends. Copper production will drop from an expected 162,000 tons to 150,000 tons, while gold production will be approximately 450,000 ounces instead of the expected 562,500 ounces. The government had hoped to increase the country's annual growth rate from 3 to 5 percent per year based on increased revenues resulting from the high price for gold, but much lower ore grades than expected from Bougainville have forced the government to abandon this plan.

PHILIPPINES

Acoje Mining Company Incorporated is expanding and modernizing its operations in Santa Cruz, Zambales, in order to maintain its lead in metallurgical chrome concentrate production and to insure that its buyers have an adequate and reliable supply.

INDONESIA

Because of the acidic nature of its higher grade nickel ore, **Inco Limited** has dropped production expectations by 8,000,000 pounds of nickel from its operations here during 1980. The company now projects a production for the year of some 47,000,000 pounds. Inco had planned to process principally its higher grade ore at its operations here during the early part of the mine's life, but the high acid nature of this ore has forced the company to blend the higher grade material with lower grade, less acidic material and to spend $2,500,000 last year and this year to modify two electric furnaces to prevent corrosion of their refractory linings. The company does not anticipate reaching a break-even point on the project until late 1981, when it expects to be producing between 60,000,000 and 65,000,000

southeast, on the apparent extension of a common structure containing the two deposits. Diamond drilling to the northwest of the Manifold Zone in 1973 led to the discovery of the Warman Zone. In 1974, a successful underground development program was carried out on the Warman and Manifold zones.

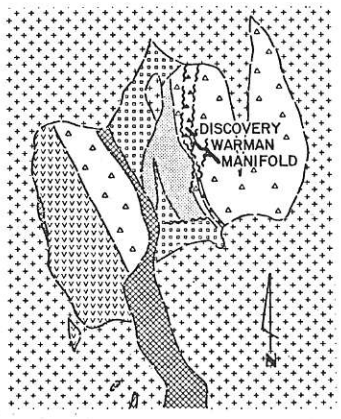
Production commenced in May 1976 with a partly used cyanide plant having a capacity of 340 tons per day. The operation, with original capital costs of $5.5 million, was debt-free by January 1979. Ore produced to date has had a recovered grade of 0.34 ounce gold per ton, 2.5 ounces silver per ton, 2.4 per cent zinc and 2.0 per cent lead.

Diluted reserves(1), as of February 28, 1977, consisted of 211,122 tons in the Warman and Manifold zones grading 0.567 ounce silver per ton, 1.44 per cent lead and 2.41 per cent zinc, and 119,515 tons in the Discovery Zone grading 0.93 ounce gold and 1.77 ounces silver per ton, 4.99 per cent lead and 6.99 per cent zinc.

The Brandywine property lies within a roof pendant of Early Cretaceous (or older) coarse agglomerates to fine tuffs of andesitic to rhyodacitic composition. The Coast Plutonic Complex is locally of dioritic composition (Fig. 17). The roof pendant is 2 by 4 miles in size, and is oriented northeasterly, but the volcanic rocks strike north to northwest and dip vertically. Where present, schistosity and faults commonly are sub-parallel to bedding in volcanic rocks. A whole-rock K-Ar date of 74 m.y. on foliated greenstones adjacent to sulphide bodies indicates that greenschist metamorphism of pendant rocks, intrusion of plutons and/or vein emplacement might have occurred at this time (Ditson, 1978).

The three ore zones strike about N 40°W, are essentially tabular in form and have nearly vertical dips. They appear to be offset by northerly trending, nearly vertical faults. The zones vary from 3 to 40 feet in width, occupy a strike length of 4000 feet and are known to be mineralized through a vertical range of at least 400 feet. Average thicknesses are 6 feet in the Discovery Zone, 8 feet in the Warman Zone and 17 feet in the Manifold Zone. The grade, mineralogy and structure of the zones vary, as shown in Table 3, prepared from data by Ditson (1978), Miller and Sinclair (1978), and the *Canadian Mines Handbook* (1978/79).

(1) Financial Post Survey of Mines, 1978.



TERTIARY
VOLCANICS – BASALT
CRETACEOUS (OR EARLIER)
COAST PLUTONIC COMPLEX
VOLCANIC BRECCIA
ACID VOLCANIC ROCKS
CRYSTAL TUFF
AGGLOMERATE
GREENSTONE
MINERALIZATION

GEOLOGY
BRANDYWINE MINE

0 3000
METRES

AFTER MILLER & SINCLAIR, 1978

FIGURE 17. Geology of the Brandywine Mine.

The mineral deposits are veins or massive and disseminated sulphide bodies of tabular form. Veins contain abundant quartz and calcite gangue and undeformed sulphides. Massive and disseminated mineralized zones occur in lenticular, partly layered masses that show superimposed deformational features, the most obvious of which is gneissosity. Some disseminated ore in the Manifold Zone occurs in a metamorphosed, bedded, siliceous limestone (Miller and Sinclair, 1978).

Vein minerals include pyrite, sphalerite and galena, and minor amounts of chalcopyrite, native gold, electrum, pyrrhotite and various silver minerals, among which argentite, tetrahedrite and stromeyerite have been identified. No hydrothermal alteration related to the deposits has been recognized (Ditson, 1978).

The origin of the Brandywine deposits has been the subject of controversy, with two extreme points of view being:
(1) an epigenetic origin, based on inferred cross-cutting relationship of the veins to bedding in the volcanics; and
(2) a volcanic exhalative origin followed by partial remobilization accompanying plutonism, as advocated by Miller and Sinclair (1978).

Carolin Mines

The gold deposit of Carolin Mines Ltd. lies at an elevation of about 3000 feet on the east side of Fraser River, 15 miles northeast of Hope and about 100 miles east of Vancouver (Fig. 1).

The economic potential of the area was realized in the years subsequent to the intense placer mining activities initiated along the Fraser River in 1858. The Carolin Mines property covers the former Aurum Mine, where spectacular surface showings of free gold were discovered in 1927. Gold at the Aurum Mine occurred chiefly in talcose quartz veins and stringers filling fractures in the Ladner Slate Formation of Lower to Middle Jurassic age and localized along the east contact of a belt of serpentine marking the Hozameen Fault (Fig. 18). Gold occurred mostly in free form and in association with pyrrhotite, pyrite and chalcopyrite, in decreasing order of abundance (Cairnes, 1937). In the years between 1930 and 1932, the Aurum Mine shipped 95 tons containing 432 ounces of gold and 92 ounces of silver. In 1966, Summit Mining Company tested the Idaho-Aurum zones by 8,000 lineal feet of trenches. Sampling in the Idaho zone indicated an average content of 0.176 ounce gold per ton.

Diamond drilling and underground exploration by Carolin Mines since August, 1973 has led to the delineation of the Upper and Lower Idaho zones, lying about 2000 feet north of the Aurum Mine in a similar geologic setting.

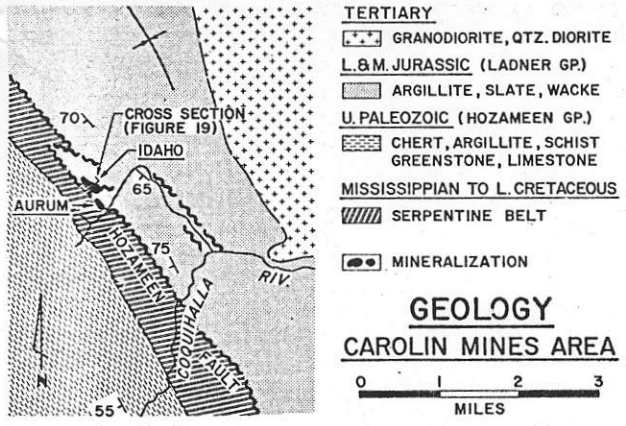
The Upper Idaho Zone is described (Kayira, 1975) as a carbonaceous, weakly foliated quartz-albite-chlorite schist, overlain by moderately to strongly foliated biotite-chlorite schist and underlain by carbonaceous argillite and slate, as depicted in the accompanying schematic cross section looking northwest (Fig. 19). The rocks are part of the Ladner Slate assemblage.

The Upper Idaho Zone, about 50 feet thick, is relatively flat

TABLE 3. Characteristics of the Northair sulphide bodies

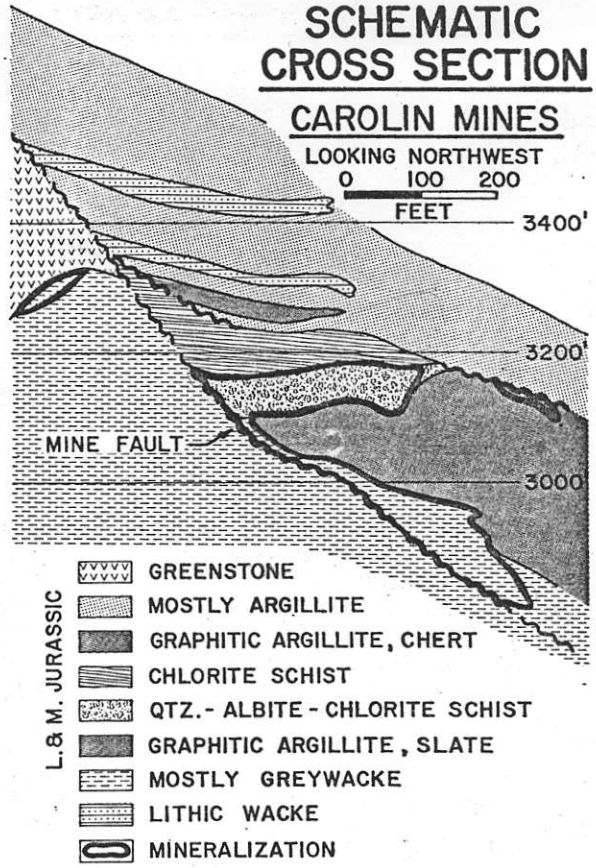
Zone	Cu (%)	Pb (%)	Zn (%)	Au oz/t	Ag oz/t	Remarks
Discovery	0.55	4.99(1)	6.99(1)	0.93(1)	1.77(1)	Layered, locally massive
Warman	0.24	1.45	2.39	0.68	0.85	Massive, disseminated
Manifold	0.07	0.28	0.57	0.28	14.48	Thickly layered or disseminated in siliceous carbonate gangue

(1) Canadian Mines Handbook, 1978/79.



AFTER G.S.C. MAP 12-1969 & D. GRIFFITH, PERS. COMM.

FIGURE 18. Geology of the Carolin Mines area.



AFTER KAYIRA, 1975 & D. GRIFFITH, PERS. COMM.

FIGURE 19. Schematic cross section, Carolin Mines.

lying and concordant with the enclosing rocks, although it may be partly controlled by shearing (D. Griffith, pers. comm.). The host rock belongs to the greenschist facies and was probably originally a mudstone, metamorphosed to argillaceous slate and later subjected to regional metamorphism and metasomatism (Kayira, 1975).

The Lower Idaho Zone, which is of lower grade than the Upper Idaho Zone, lies in a fault which cuts off the Upper Idaho Zone to the west and, like the shear zone in the Upper Idaho, is considered to represent a splay of the Hozameen Fault (D. Griffith, pers. comm.).

The mineralogy is similar to that in the nearby Aurum Mine. Sulphide minerals associated with gold comprise about 15 per cent of the ore by volume, and include pyrrhotite, arsenopyrite and pyrite, with minor chalcopyrite and rare sphalerite and bornite. Studies by Kayira (1975) show that the gold content varies more or less directly with content of arsenopyrite and with total amount of sulphide minerals present.

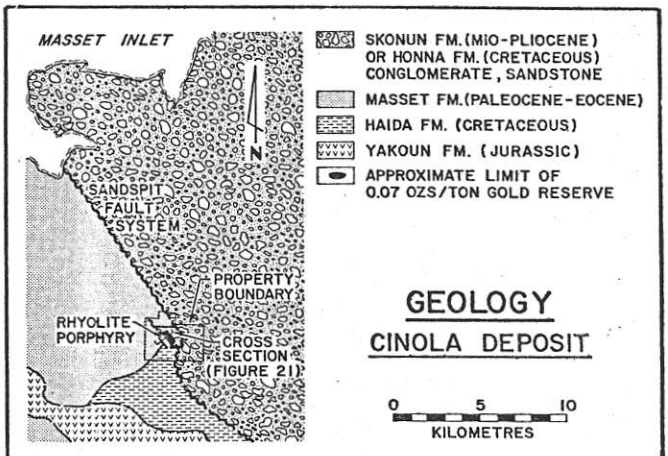
The mineralization in the Upper Idaho Zone is considered to be of syngenetic origin by Kayira (1975) and other geologists. The nearby high-grade gold mineralization in veins and shear zones is believed to have been derived by remobilization of lower-grade mineralization in the Ladner Slate argillaceous sediments during emplacement of serpentine along the Hozameen Fault in the early part of the Late Cretaceous.

The deposit is currently in the feasibility stage and latest reserves (*Vancouver Express,* May 30, 1979) are 1,530,000 metric tons grading 0.141 ounce gold per ton at a cut-off grade of 0.08 ounce gold per ton.

Cinola (Babe, Specogna)

The Cinola gold deposit, owned by Consolidated Cinola Mines Ltd. (Cinola) and Energy Reserves Canada Ltd., lies 10 miles south of Masset Inlet on Graham Island, Queen Charlotte Islands. The deposit was discovered by Efrem Specogna and John Trico while prospecting in 1970. It was subsequently explored by five companies who completed geochemical sampling, trenching and diamond drilling programs. In 1977, the property was purchased by Cinola, who completed a considerable amount of additional diamond drilling and metallurgical tests. A feasibility study was in progress in late 1979 with the expectation that an underground exploration program would be initiated in 1980.

The area is underlain by relatively young, gently dipping rock assemblages truncated by the Sandspit Fault, a major fault system, which trends northwest through the property (Sutherland Brown and Schroeter, 1975). Sandstone and overlying shale members of the Haida Formation of Cretaceous age, which are overlain by rocks of early Tertiary age, lie to the west of the fault. Poorly lithified sands, shale



AFTER CHAMPIGNY & SINCLAIR, 1979

FIGURE 20. Geology of the Cinola deposit.

and conglomerate of the Skonun Formation of Mio-Pliocene age occur on the east side of the fault (Champigny and Sinclair, 1979). The relationships of geologic units are shown in plan and section on Figures 20 and 21.

The major structural feature on the property is the 'footwall fault', which strikes northwest and dips 40-60 degrees to the east, and which is probably part of the Sandspit fault system (Champigny and Sinclair, 1979). Rhyolite porphyry, which is commonly brecciated, crosscuts sedimentary units on both sides of the 'footwall fault' and is believed by Sutherland Brown and Schroeter (1975) to represent part of the Masset Formation that formed a flow dome at the base of the unit.

Developing Carolin Mines — an uphill battle

By D.H. COCHRANE, consulting geological engineer

Carolin Mines is a Vancouver based public company listed on both the Toronto and Vancouver Stock Exchanges. The company holds title to a large block of mineral claims situated just over 100 mi east of downtown Vancouver, near the town of Hope in southern British Columbia. The claims are collectively known as the Ladner Creek group and are set in the Cascade Mountains, a very scenic portion of the Pacific Northwest.

Over the past eight years, Carolin has conducted extensive exploration on the property including approximately eight miles of diamond drilling and one-third of a mile of underground ramps and lateral work. This work has been carried out mostly on a single claim, the Idaho claim group, originally staked in 1915.

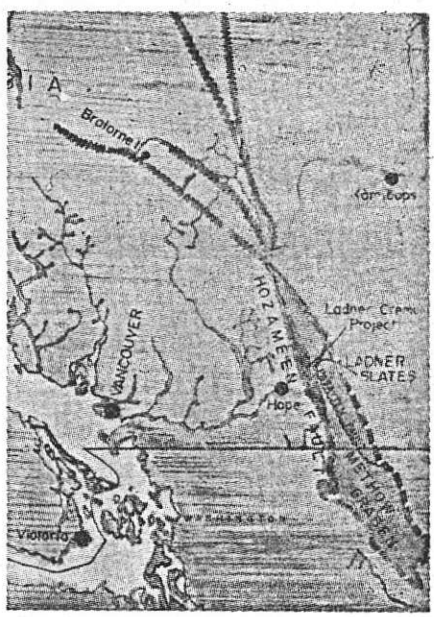
Present ore reserves are estimated at 1.4 million tons grading 0.15 troy ounces of gold per ton in a replacement type deposit. The deposit is still open in places. There is a second zone, similar in nature to the Idaho zone, located some 4000 ft to the north. Indications are that these gold bearing zones are repetitive in a Jurassic greywacke-slate formation.

At the present time, two levels are being driven to prepare for stope development and construction will soon commence on a conventional 1500 ton per day plant. The town of Hope will serve as the townsite — a new four-lane highway is under construction and will pass within five miles of the mine site.

Carolin Mines was formed as a private company in 1964 by an enterprising ex-diamond driller named Orville Gillespie. The company came into the world the same way the rest of us do, that is with very little. Initial financing was made privately, by friends, business associates and relations. Carolin acquired, looked at and worked on dozens of mineral properties in the early years, and as the need for funds grew, other sources of capital were necessary. Consequently Carolin turned public in 1966.

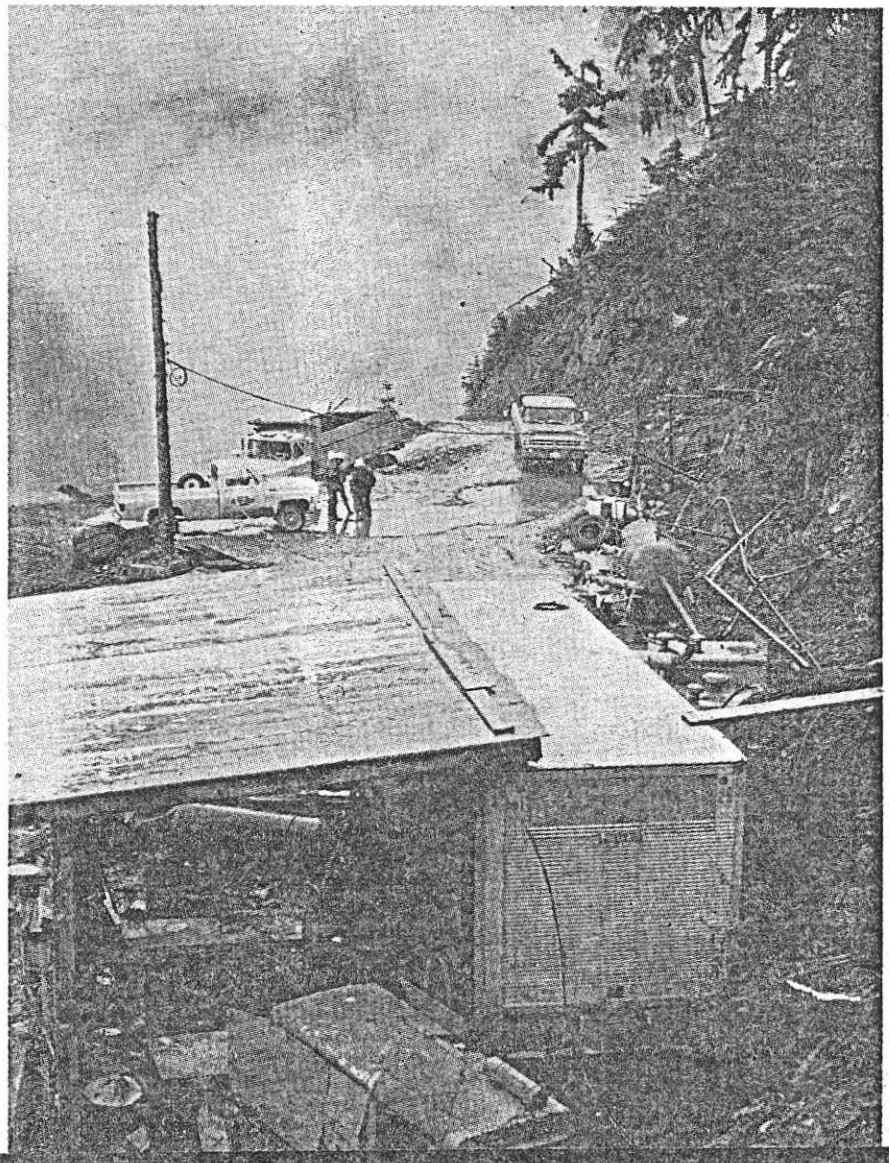
We are fortunate to have in Canada at this time a capital market which give the investing public an opportunity to participate at early stages in junior mining companies. Junior companies can, through the facilities of our original stock exchanges, offer shares to the public very early in their existence. Such initial share offerings are usually priced low, and despite high risk, afford the investor an opportunity to realize a return many times the original investment — if the company is reasonably successful in its efforts.

Few countries in the world offer such opportunities and I hope for all of us that the situation won't seriously change in the future.



Site of Carolin Mines' Ladner Creek properties, east of Hope, BC

Carolin's mine camp perched on the hillside at the Idaho zone



Taking advantage of events

Several events occurred in the early 1970s that had effects on us all and particularly Carolin Mines. Late in 1971. President Nixon announced a devaluation in the US dollar and consequently the price of gold rose from its fixed price of $US35. That's the good news.

The other news is that on Aug 30, 1972 the BC electorate decided on a change and the New Democratic Party formed the provincial government. As we all know it is difficult enough to play the game, but almost impossible if the rules keep changing.

By the spring of 1973, arrangements were made by Dr Gillespie, the president of Carolin, on a block of claims near Hope and after my first visit in June, I prepared a report recommending $220,000 worth of exploration work. The money was raised and by October 1973 the first surface drill hole was into the Idaho zone. It averaged 0.136 oz of gold across 102 ft. By December 1974, 33 holes were down, with the last hole averaging 0.22 oz across 75 ft. However, the intersection was 1000 ft deep in the hole.

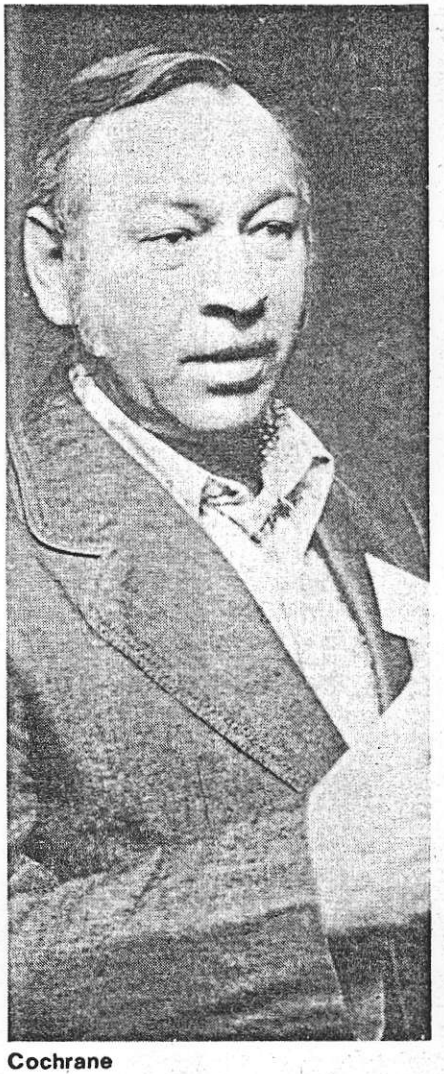
Also in 1974 a number of major companies were approached with a view to participating financially in the project. Responses ranged from "Thanks but no thanks" to "Due to the present situation in British Columbia as a result of government legislation, we are sorry to inform you we cannot participate."

Early in 1975 a deal was finally made and financing became available. The agreement was with Precambrian Shield and Numac Oil & Gas by which the two companies would provide necessary funds and management to carry out additional work. Work was continued by Precambrian and Numac until June 1976 at which point Carolin re-purchased the property through shares.

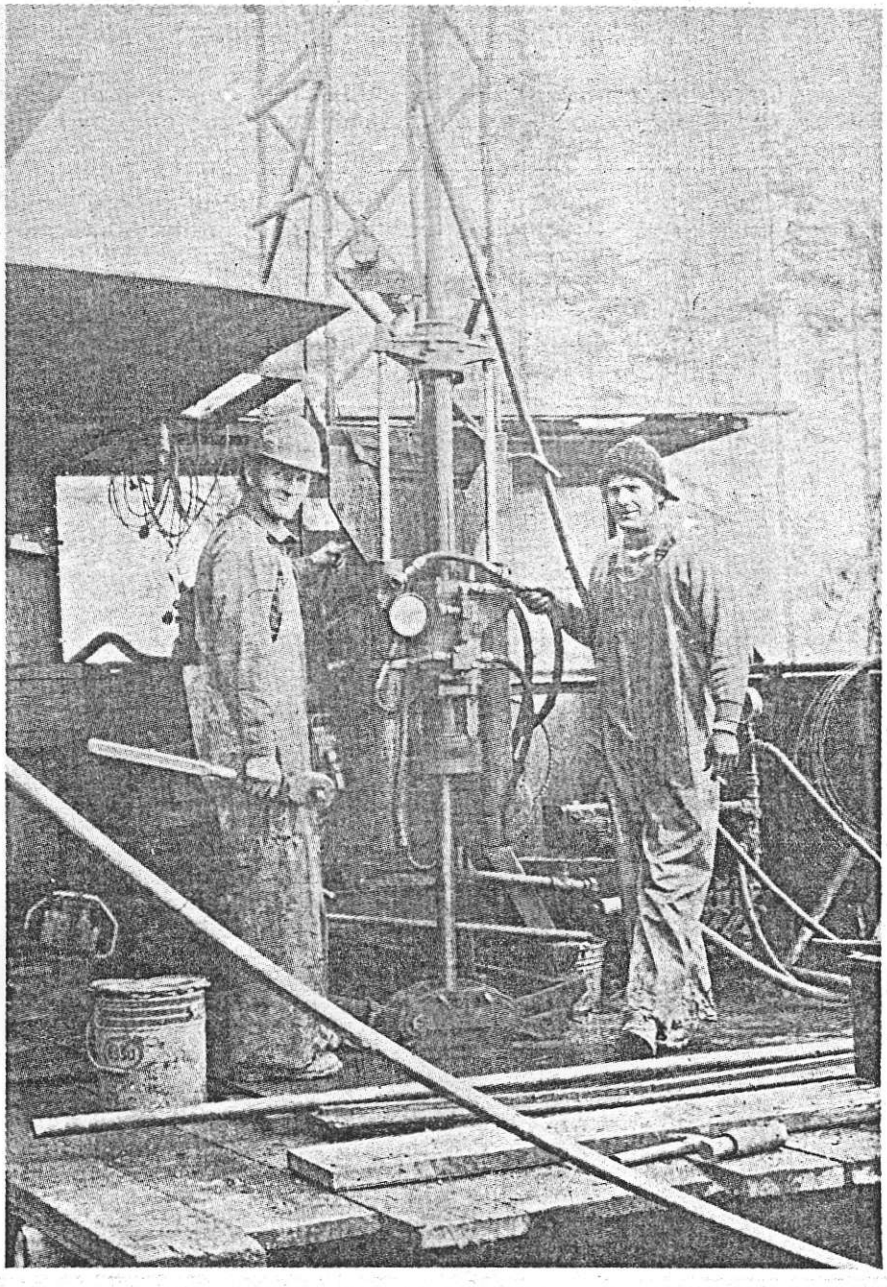
1976 was basically devoted to averaging additional drill results. The geometry was such that it was necessary to decline on the zone. The Idaho zone plunges northerly and the hill gains elevation to the north. The underground work is expensive and this area is a critical one for any company who has an attractive prospect. But information for a thorough feasibility study was insufficient.

The attraction of fairly large amount of risk capital at this stage is dependent on a host of variables which even date back to the original deal, in Carolin's case a simple cash payment to cover 100 per cent. In addition to the property, it also depends on the directors' credibility, the lawyer, accountant, geologist and so on.

If a company decides to "go it



Cochrane

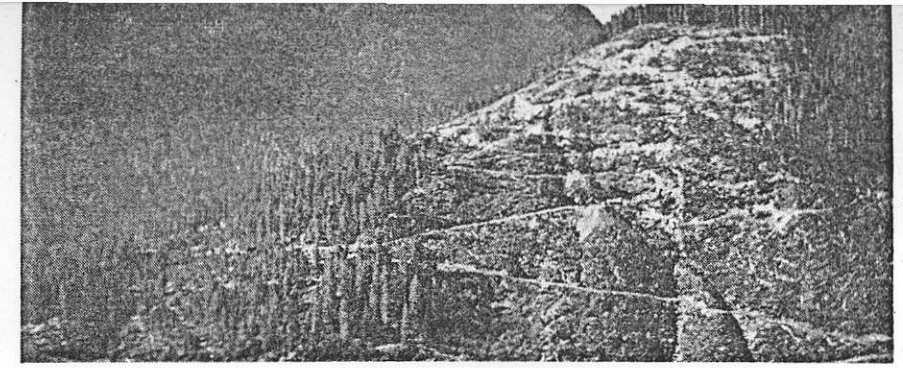


Diamond drill rig readied for one of the first holes to be drilled on the Idaho zone

alone," it is important that banks, financial institutions and stockholders be completely aware of the situation. A company may have to face significant dilution whether by the sale of equity interests in the stock or by sharing ownership and profits from the property with another party, often a major mining company. Conventional bank-type financing is generally not available at this particular time. Carolin "went it alone" by the sale of blocks of shares.

In 1977 the decline was collared and diamond drill holes cut at 33 metre intervals down the decline. The area was ring drilled, extensively mapped and sampled. Mysteriously enough, diamond drill hole 33 was intersected at the end of the snakey decline some 1000 ft below surface. It soon became evident that additional funds would be required to expand underground exploration laterally. Consequently, discussions were made with the Aquarius Group, a consortium of Calgary-based oil and gas companies, whereby at the end of this phase, and after a positive independent feasibility study, the Aquarius Group would place the property into production for 50 per cent of the block of pay claims including the Idaho.

The feasibility study was complete early in 1979, and as mentioned at the onset, work is currently in progress. At the present rate of development,



Carolin Mines near Hope, B.C. — production by the end of 1980

Carolin Mines should be in production in the second quarter of 1981.

The mine is planned to employ approximately 100 people and will give a significant boost to the economy of the Hope area.

The greatest risk period for the junior mining company in terms of the greatest dollar risk is the period from feasibility stage through production and recovery of capital investment. Too many mines have gone into production only to fail to recover the capital costs for the investors and to be shut down forever.

The reality facing growing junior mining companies is that of the constant need for ever more capital, the inevitability of dilution and the need to make wise decisions in reference to the best way to finance the company at various decision points and stages in its development, lest dilution and loss of control be excessive.

The current period of generally high metals prices has created an unusually favorable opportunity for junior mining companies at all stages of growth to finance themselves with minimal dilution. It is easier for new issues to be bought. Brokerage houses normally find it more attractive to sell to the public something that is constantly in the news in a favorable way.

Also, current high metals prices may favor some innovative methods of financing junior mining companies — through the advance sales of concentrates to customers, against advance payments by customers, or against firm "take or pay contracts" which are bankable. The further from production a company is however, the less likely that such arrangements are possible. Also, there is always the risk that the company may not be able to deliver.

It seems certain that the strong world demand for minerals and metals and the natural resources wealth of Canada, together with this nation's potential for self-sufficiency in energy, and the healthy aggressive nature of our junior mining industry, all suggest that the opportunities for financing them appear to be excellent.

For myself, as an independent consultant, the Idaho zone portion of the Carolin Mines story is almost over, but for Carolin Mines, its directors, shareholders and partners, it is just beginning.

Canada

BRITISH COLUMBIA

LADNER CREEK PROPERTY WILL PRODUCE BY LATE 1980

Contracts for more than $2,000,000 have been awarded by **Carolin Mines Limited** for underground development and other initial work on its Idaho zone gold mine on the company's Ladner Creek property near Hope. The site has been selected for the concentrator and production from the mine is expected to begin about the end of 1980. Some $23,700,000 worth of financing has been approved for the project on behalf of Carolin's joint venture partner, the **Aquarius Group.**

Based on the feasibility report for the project, indicated ore reserves from the Idaho zone gold mine, which represents only one of 78 claims on the Ladner Creek property, are estimated at 1,530,000 tons, grading 0.141 ounce gold per ton. The mine will start up at a milling rate of about 1,500 tons per day and operating costs are estimated to be $14.53 per ton, thus making the mine one of the major gold producers in North America.

YUKON TERRITORY

Campbell Chibougamau Mines Limited has received encouraging drilling results from initial holes completed in the Cortin Joint Venture in the Mayo area of the territory. Four shallow holes were drilled to test a geochemical target containing enhanced values in tin and silver. Three of the holes are on a north-south section line 25 meters (82 feet) apart and underneath a northsouth 47-meter (154-foot) long trench to bedrock. The fourth hole is 25 meters (82 feet) to the east. Tin was encountered in every hole, varying in value up to in excess of 10 percent tin in core lengths in excess of 4 meters (13 feet). Silver analyses were not complete at press time. As a result of the preliminary results, a stepped up diamond drilling program will be conducted in 1980.

BRITISH COLUMBIA

Northern Lights Resources Ltd. has agreed to acquire a 70 percent interest in eight mineral claims known as the Yalakom group, located 27 kilometers northeast of Gold Bridge in the Bridge River area. In 1949 and 1950, 807 feet of drifting was carried out on the No. 9 vein on the property. A 165-foot length of this drift is reported to have averaged 0.94 ounce gold per ton across a width of 1.23 feet. This section averages 0.38 ounce gold per ton across a 3-foot mining width. Work will be concentrated on the No. 9 vein area.

ONTARIO

Oriana Developments Limited has recommended a two-phase program for the Sioux Lookout gold property including remapping, sampling on surface, and 12 short diamond drill holes to establish near surface grade and vein dips. The second phase would be detailed drilling of the higher grade areas located in phase one. Gold was discovered on the property in 1929 and in the next 10 years a series of companies drilled a number of holes, carried out surface trenching, sunk a 350-foot shaft, established two levels, and drove 941 feet of crosscuts and drifts.

appropriating $25,000 to study the possibility of California's claiming federally managed public lands.

Nor are prospects bright for legislation introduced in Congress by Sen. Orrin Hatch (R-Utah) to establish procedures for states to obtain title to public lands within their borders. Hatch, however, told the conference: "The passage of my bill is possible. All that is necessary is that the elected representatives of the western states unite totally and completely in their commitment to its enactment."

But ranking Democrats such as Warren Magnuson and Henry Jackson of Washington, Frank Church of Idaho, and Alan Cranston of California report that they will not support the Hatch bill.

Secretary of the Interior Cecil D. Andrus has labeled the Sagebrush Rebellion "an attempt to hornswoggle all Americans out of a unique land heritage which has been a bulwark of our society and the source of special freedom that has made the West such a great place to live." According to Andrus, few states would find it feasible to manage these large areas soundly.

New fuel was added to the fire in late October when John Connally of Texas, on his first campaign visit through the West, told Colorado audiences that there is "unrelenting injustice and hostility shown toward the West today by officials in Washington." Connally favors legislation that would limit federal control to 20% of the land in any state, including national parks, forests, and monuments. He noted that more than two-thirds of western land is controlled by federal agencies. They manage 96% of the land in Alaska, 87% in Nevada, 66% in Utah, 43% in Arizona, and 32% in Colorado, Connally pointed out. ■

Carolin Mines will start production in 1980 from new B.C. gold mine

Carolin Mines Ltd. announced in late September that contracts worth more than $2 million have been let for underground development and other initial work on the Idaho zone gold mine on the company's Ladner Creek gold property near Hope, B.C., about 70 mi east of Vancouver. When the project comes on stream at the end of 1980, it will be the first new gold mine in Canada since gold prices began spiraling upward.

According to Carolin Mines president, Orval E. Gillespie, a site on the property has been selected for a mill. The plant will use conventional flotation and cyanide recovery. Surveying, testing of the mill site, road grading, and construction of a road to the tailings pond have been completed, Gillespie said.

A C$20.4 million financing commitment received by the company from Ocelot Industries Ltd. on behalf of Carolin's joint venture partner, the Aquarius Group, will provide the entire projected capital cost, including working capital, to bring the Ladner Creek gold property into production. Carolin will be the manager and operator of the mine, with a 50% net carried interest in its production after payback.

Based on a feasibility report by Kilborn Engineering Ltd., indicated ore reserves of the Idaho zone are 1,530,000 mt grading 0.141 tr oz gold per mt, with a drill-indicated potential of additional tonnage. The Kilborn report recommended startup at a milling rate of 1,500 stpd and estimated operating costs at C$12.53 per st of ore milled.

Carolin Mines purchased the property in 1973 for $465,000. Exploratory drilling conducted over the next few years indicated that the mineralized zone sloped downward inside the hill. The company conducted underground drifting and cutting and drilling to fill in details of the zone.

An underground drill contract was then let to Kema Drilling, which began work in October 1977 and completed 1,500 m by March 1978. In April, Kema was awarded an additional contract for a minimum of 1,500 m, which was completed in May 1978.

In all, a total of 538 m of underground work was completed, including 470 m of a 2.5 x 2.5-m decline driven mine-northerly at −20% and a 67-m crosscut driven at +17% and −8%. A total of 3,051 lineal meters of wireline diamond drilling was completed by Kema on Carolin's behalf. Drillholes totaled 68, mainly in a "ring" pattern and along east-west sections spaced 33 m apart. Drilling proceeded northerly, and a "mine north" length of 266 lineal meters has been drilled from underground. Maximum east-west drilling coverage is close to 100 m.

Carolin has completed an access road to the tailings pond and is preparing to start the main haulage tunnel. During 1978, a sample plant was completed, and extensive testing of ore samples was done to confirm the feasibility of the project.

The Ladner Creek property is approximately 4 mi long and 2 mi wide. In addition to the Idaho zone, it includes three former gold-producing mines and a number of other good prospects, where Carolin has done only limited exploratory work so far. ■

Zimbabwe Rhodesia's mineral exports await end of trade sanctions

The possibility of normalizing trade between Free World nations and Zimbabwe Rhodesia holds important implications for US natural resource companies. Lifting of trade sanctions in effect since 1966 (with temporary exclusions for chromium and nickel during the Nixon and Ford administrations) would restore free availability of a variety of important raw materials. Besides chromium and nickel, Zimbabwe Rhodesia has large reserves of coal, lead, zinc, copper, asbestos, and cement. And current high prices for precious metals have made once-uneconomic deposits commercially viable.

Both the Prime Minister of Zimbabwe Rhodesia, Bishop Abel T. Muzorewa, and Minister-Chief Duwene of the Ministry of Mines and Mining have strong hopes for a return to "rational export" of their country's mineral commodities. Exports would be controlled by federal licensing and registration, rather than being traded via third parties such as South Africa and the USSR, which did not acknowledge the international trade sanctions.

The US law imposing trade sanctions against Zimbabwe Rhodesia expires on Nov. 15. Within 30 days, President Carter may order an extension of the sanctions if he believes they are in the best interests of the US. However, such an extension can be overridden by a simple majority of both houses of Congress. In a test, the Senate voted 72 to 19 in favor of lifting sanctions; the House has not yet taken a stand. ■

Copper complex to be designed for Pakistani government

A preliminary engineering and feasibility study for an integrated 12,500-mtpd copper project at Saindak, Pakistan, will be performed by Mountain States Mineral Enterprises Inc. for Resource Development Corp. of Karachi. The Saindak plant will be designed to process more than 5 million mtpy of ore. Cost of the project is estimated at over $250 million.

The Saindak complex will be based on large open-pit mines to extract copper ores that also contain iron, molybdenum, magnetite, and pyrite. Ore will be moved to processing plants by conveyor systems or by 100-mt trucks.

Concentrates will be railed to shipping points and manufacturing facilities in Pakistan. Processing will include crush-

(Continued on p 247)

The mineralized intrusive is a stock of light-colored alaskite. Because of microscopic work conducted on mineralization, the term "alaskite" was preferred to "quartz monzonite porphyry." Alaskite is a granite or quartz monzonite lacking in dark minerals. The significance of the alaskite is that virtually all moly found and sampled to date occurs in this rock, and derives from the igneous system which emplaced it.

The alaskite crops out in nine distinct exposures in the steep headwall and sidewalls of an active cirque. Total distance spanned by these discontinuous exposures is about 1,800 meters (5,900 feet) in the north-south direction and 1,500 meters (4,900 feet) in an east-west direction. The exposures are the upper parts of a stock, intruded into the overlying tactites; and they are visible only because the glacial ice has carved the wide, deep cut through the upper surface of the stock. The cut is still occupied by glacial ice, and the exposures are overlain and concealed by ice on their downhill sides.

Molybdenite is present in the alaskite in several forms, in order of importance, they are: coarse platy crystals present in widely-spaced veins of sub-horizontal to moderate dips; in networks of thin veinlets of any attitude, which have light-colored alteration envelopes; moly paint on fractures; rosettes of coarse or medium grains often associated with quartz and vuggy open spaces; and as fine interstitial grains. Some of the sub-horizontal veins are spectacular accumulations, up to 10 centimeters (4 inches) in thickness and traceable for 30 meters (100 feet) across an exposure; and may occur in a system with spacing of several meters between individual veins.

Moly mineralization is generally confined to the alaskite with the exceptions of a few dikes or fractures passing into overlying tactites.

Canada

BRITISH COLUMBIA

HOPE GOLD PROPERTY TO MILL 1,500 TONS PER DAY

After six years and more than $4,000,000 of extensive exploration and development work, plans are now underway by **Carolin Mines Ltd.** to put its gold property near Hope into production. A feasibility study, conducted by Kilborn Engineering, recommends start up of the Ladner Creek gold deposit at a milling rate of 1,500 tons per day. Operating costs are estimated to be $12.53 per ton of ore milled. Development of the property will be by Carolin and its joint venture partner, the Aquarius Group, comprising three oil companies, **Great Basin Petroleum Ltd., Ocelot Industries Ltd., Canadian Obas Oil Ltd.**, and a mining company, **Aquarius Resources Ltd.**

The study recommends that a conventional highly mechanized low-cost sublevel open stoping method of mining be used. Processing is to be by conventional flotation-concentrate cyanidation. Capital and development costs are estimated to be some $20,000,000, all of which is to be provided by the Aquarius Group if it wishes to keep its current 50 percent interest in the property.

The Idaho zone of the deposit, which will be mined, lies in the southern quadrant of the property, on the south flank of a fairly steep ridge. The location of

the ore body facilitates development of the mine from the side and below as opposed to the usual situation in underground mining of having to raise the ore long distances.

The zone is a sulphide arsenide replacement deposit and is adjacent to the former producing **Aurum Gold Ltd.** mine. Present drill-indicated ore reserves, based on a cutoff grade of 0.08 ounce gold per ton and applying anticipated mining dilution, are estimated at 1,530,000 tons grading 0.141 ounce gold per ton.

BRITISH COLUMBIA

HOUSTON Ag-Cu-Au MINE TO START PRODUCTION IN 1980

Equity Silver Mines Ltd., 70 percent controlled by **Placer Development Ltd.**, announced its decision to place the silver-copper-gold property near Houston into production at an estimated cost of $73,000,000. Placer has overall responsibility for the mine's development and Commonwealth Construction will be the primary contractor at the site.

Ore reserves are estimated at 28,000,000 tons with an average grade of 3.7 ounces silver per ton, 0.03 ounce gold per ton, and 0.384 percent copper. Construction of the plant facilities is now underway; foundation excavations are largely complete and steel erection has begun on the primary crusher, concentrator, and various plant facilities. Overburden is being stripped from the ore zone and Equity estimates that mining of the first ore will commence by April, 1980.

Construction is scheduled to be completed by July, 1980, and the mine should reach design throughput of 4,500 tons of ore per day by October of the same year. The projected annual production over the first five years is: 5,757,000 ounces of silver; 11,000 ounces of gold; 6,400 tons of copper; and 1,700 tons of antimony.

QUEBEC

Lake Asbestos of Quebec Ltd., a subsidiary of **Asarco Inc.**, has changed its name to **Lac d'Amiante de Quebec, Ltee.**, the French translation of the company's former name. The new name carries forward the acronym long used by the company—LAQ.

NORTHWEST TERRITORY

Net income of **Canada Tungsten Mining Corporation Ltd.**, which operates at Flat River, rose to a record $23,400,000 in 1978 from $18,700,000 in 1977. The company, owned 65 percent by **Amax Inc.** and 20 percent by **Dome Mines Ltd.**, increased its production to a record 3,170 tons of tungstite, up from 2,390 in 1977. The two year program to expand capacity of the mill to 1,000 tons per day is reported on schedule (see WORLD MINING, April 1979, pages 50-54).

ONTARIO

Production at the Kidd Creek base metals operation in this province is rising. This year 4,000,000 tons of ore will be milled compared to 3,300,000 in 1977. By the end of 1981, the concentrator will be able to operate at its capacity of 5,000,000 tons per year. Kidd Creek operating costs are low in any case, but **Texasgulf Inc.** is pushing ahead with metallurgical projects to reduce costs further. The recovery of tin and the recovery of additional value from pyrite are considered as challenges.

KERR ADDISON MINES LIMITED

(FOR INTER-OFFICE USE ONLY)

MAR 1 1 1975

To Glen M. Hogg *From* W. M. Sirola

Subject CAROLIN MINES LTD. *Date* 3rd March 1975

I.D.B.
T.W.B.
J.K.C.
D.M.H.
G.M.H.
E.C.J.
W.J.
P.M.N.
S.P.
G.R.
M.D.
J.
C.K.

Herewith John Lund's summary of the Carolin Mines Ltd. low grade gold property near Hope, British Columbia.

Carolin has recently made a deal with Numac Oil & Gas and Precambrian Explorations wherein the latter two companies may earn a 60% position by spending something in excess of $800,000. If, after spending this money, they decide to pull out, they will retain 25% equity in the Carolin property.

We do not consider that this deposit is economic at $150.00 gold because it is basically an underground operation, despite anything you may read in the George Cross Newsletter. The combination of very low grades (0.09 Au), underground mining costs and B.C. royalties plus super royalties, puts a rather effective clamp on the profitability of this situation.

W. M. Sirola

WMS:lmp

enc:

CAROLIN MINES LTD.

HOPE, B.C.

INTRODUCTION

Carolin Mines property is located about 10 air miles North North East of Hope, B.C. and 110 miles East of Vancouver. It is well situated with respect to transportation, power source and service centres.

The company holds 8 Crown granted and 70 located claims that cover two former producing gold mines. The two former producers are Aurum (545 tons production) and the Pipestem (1650 tons production). Grade of material extracted was 0.978oz/ton Au, and 0.177oz/ton Ag from the Aurum; 0.165oz/ton Au and 0.022oz/ton Ag from the Pipestem. Work by Carolin has concentrated on the Idaho zone which appears to be either part of the Aurum or an adjacent property.

Topography is rugged. The Idaho zone is centred at the 3500' elevation on the South West slope which rises to ridge at just over 5000'. The rugged topography makes any hope of open pit mining doubtful.

THE DEPOSIT

Paleozoic Hozameen group metasediments underly the Western part of the claim group and Jurassic Ladner group slates, argillites and greywackes underly the Eastern part. The two units are in part separated by a narrow steeply dipping band of Serpentine. The Serpentine is bounded to the East by a fault. The Idaho zone lies east of the Serpentine within the Ladner group rocks.

Mineralization occurs primarily in two zones, the lower and upper Idaho. Mineralization consists of pyrrhotite, pyrite, arsenopyrite and chalcopyrite with associated gold in an albite-carbonate-silica host rock. The two zones vary from a few feet to over 100' thick and are separated by 50' to 130' of relatively barren slate.

The zones dip at a moderate angle to the North. Neither zone has been completely delineated.

Reported reserves and grade in the Idaho zone are as follows:

1. Upper Idaho - 550,000 tons averaging 0.092oz Au
2. Lower Idaho - 150,000 tons averaging 0.085oz Au

These reserves are drill indicated and fill-in drilling is necessary to bring these into a more positive category.

Other areas remain untested by diamond drill and are targets for additional work. It is conceivable that the reserve figures will be increased with additional exploration in these zones, however, the probability of increasing the grade significantly is unlikely.

ECONOMIC CONSIDERATIONS

Assumptions:

1. D. Cochrane's figures for grade and tonnage are correct.
2. A recovery of 88% over the total ore reserve could be maintained.
3. In the areas explored, mining would have to be done using underground methods.
4. A mining rate of 500 tons per day would be maintained for a mine life of 4.5 - 5 years.
5. Mining milling and administration costs:
   (a) Open Pit $ 6.50
   (b) Underground (using long hole method) $11.50
6. Capital Costs:
   $15,000 per ton capacity, or $7,500,000 for a 500 ton per day operation.
7. A gold price of $150.00. Base price in B.C. is now $92.00, consequently, the net price to the operator after royalties would be $122.50.

Using a net price of $122.50 for gold and a recoverable grade of 0.08loz/ton, the value per ton, after royalties, would be $8.97/ton for the 560,530 ton reserve. Since the underground mining and milling costs are estimated at $11.50, any operation would suffer a net operating loss of $2.53/ton. To break even or zero operating profit using above figures, a net smelter price of $200/oz would be required for gold.

CONCLUSIONS

1. There are 560,530 tons of reserves in the Upper Idaho zone. Of these, only 75,000 tons could be mined using open pit methods.
2. The Lower Idaho zone has reserves of approximately 150,000 tons.
3. The average grade in the above zones of 0.092oz Au and 0.085 oz Au in the Upper and Lower zones respectively, will not support a profitable mining operation capable of returning the capital investment.
4. Probability of increasing the reserves is good, but grade is unlikely to vary significantly from the present reported average.

John C. Lund

JCL:lmp

21 Feb. 75