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Apr. '86

881032

BLACKDOME PROJECT

Stage I Submission

Environmental Impact Assessment

January 1983

1.0 EXECUTIVE SUMMARY

Blackdome Exploration Ltd. is planning to construct and operate a gold/silver mining and milling operation on Black Dome Mountain 230 km north of Vancouver and 70 km northwest of Clinton.

The mining/milling capacity of the proposed project is 200 tons/day or 73,000 tons per year. This rate of milling combined with the drill indicated reserves of 313,000 tons gives an initial mine life of 4.3 years. Addition exploration will be carried out in 1982 and 1983 with a production decision being made before June 1984. The contruction period would be approximately 1 year.

The mine will be an underground operation with the stopes being serviced from above and below either through drifts or from the surface. Because of the nature of the host rock it is probable that backfilling will be required. The portals to the mines will be located above the mill/tailing pond complex in the Lou Branch draw of Fairless Creek. The mine waste rock dump will be located to the north of the portals in the Lou Branch draw upstream of the tailings pond. Acid producing tests performed on samples of this waste rock have shown it to be an net acid consumer.

The mill/concentrator facility will be located on the south side of the Lou Branch upstream of the tailing pond. The ore will be ground to 85% minus 200 mesh, concentrated by conventional flotation techniques and the concentrate marketed to a smelter. Cyanide will not be used in this process.

The tails will be disposed of in a tailings pond contructed in the Lou Branch draw of Upper Fairless Creek. The pond will be of an overflow design with the use of flocculants possibly being required to obtain an acceptable discharge. Toxicity testing of the tailings waters indicated that there is 100% survival of juvenile fish in 100% tailings water concentrations.

The operation of the mine and mill would require a labor force of 87 people with annual wages of 2.5 million dollars and create a total of 184 - 244 jobs.

Blackdome Exploration Ltd. commissioned environmental studies of water, air, wildlife, vegetation, and fishery resources in the area in order to assess the potential impacts that this development would have. In general, because of size and nature of the project and the consideration of the environmental factors in the layout and design of the facilities, the impacts on the physical and biological resources will be minimal. Because of the minimal impacts expected and considering the following points:

1. small production rate (200 tpd);
2. the mine is an underground operation;
3. no cyanide will be used;
4. the ore is a net consumer of acid; and
5. effluent toxicity tests indicated no toxicity.

it is felt that the Blackdome development should qualify as a small project under procedure B or C as outlined in the "Procedures For Obtaining Approval of Metal Mine Development".

3.0 INTRODUCTION

3.1 Location

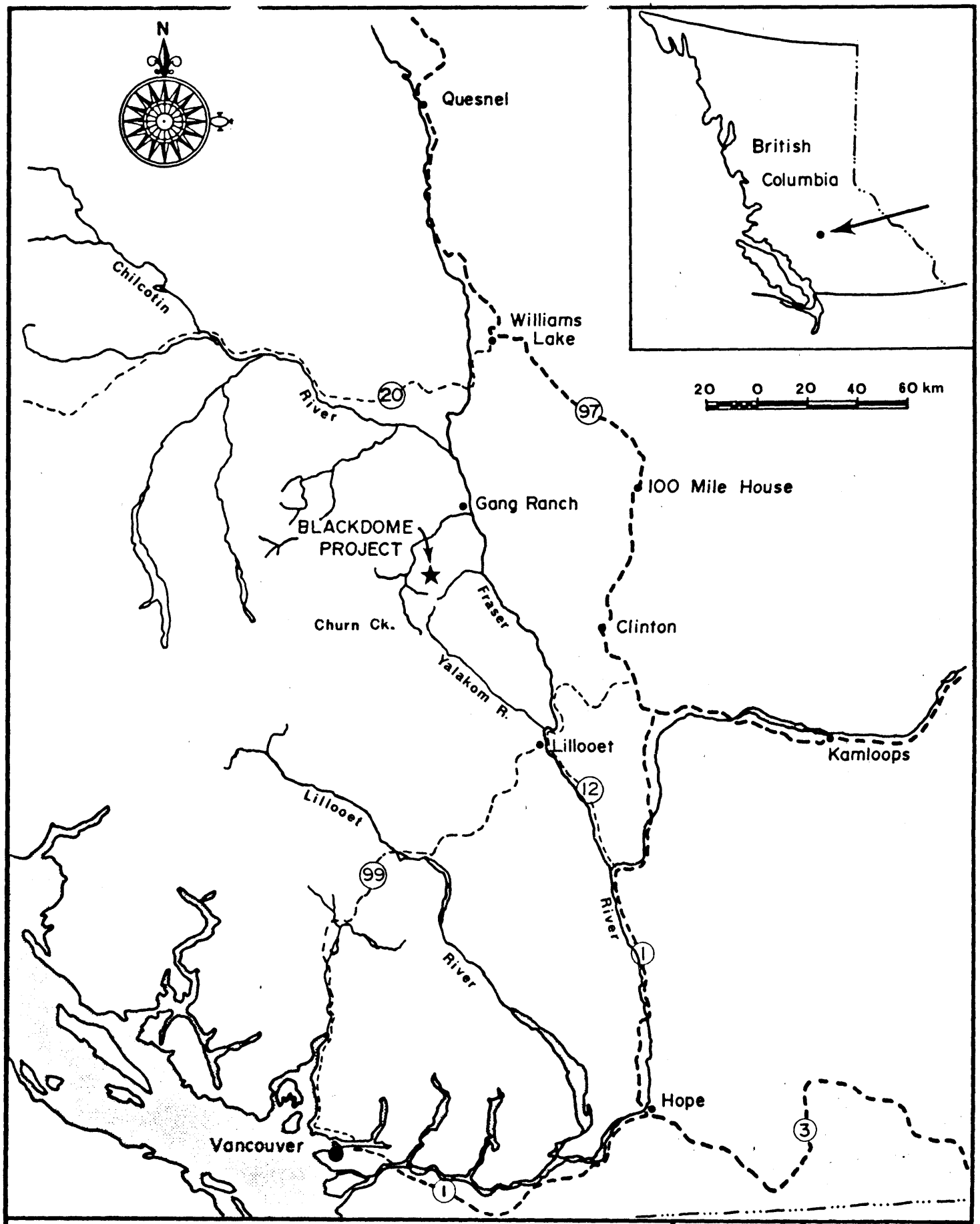
The Blackdome project is located at Black Dome Mountain in the Camelsfoot Range of the Clinton Mining District in southwestern British Columbia. The mine is located about 2 km (1.25 miles) from the mountain peak, on a ridge which extends south-southwest from the Mountain (see Figures 3.1-1 and 4.1-1).

3.2 History

Gold was first discovered on Black Dome Mountain by Lawrence Frenier in 1947. He staked his claims and prospected for several years. In 1952 Empire Valley Gold Mines bought his claims and constructed a new access road and began bulldozer stripping in the area. In 1953 Silver Standard Mines optioned the adjoining property to the south and east of Frenier's original claims. Extensive trenching and sampling was subsequently undertaken. Empire Valley Gold Mines continued exploration adits on veins in the area. At this time a 520 m (1700 ft.) air strip was constructed. By 1958 Silver Standard had optioned the Empire Valley ground and did extensive trenching on all the known vein occurrences on Black Dome Mountain. Not much exploration work was conducted during the 1960's but in the early 1970's exploration was continued on areas west and south of the original crown grants.

In 1977, Barrier Reef Resources Ltd. did sufficient prospecting and geochemistry in the area to demonstrate that the area was of importance and consolidated the underground mineral rights in 1977 under the name of Blackdome Explorations, Ltd.

In 1978, a program of exploration was carried out mainly on the southern extension of the No. 1 vein, the so-called "Ridge Zone". This work consisted of geological mapping, a ground magnetic survey and geochemical soil sampling. Two kilometers of new road were constructed and 1600 m (5250 ft.) of trenches were dug. Diamond drilling was conducted on the ridge zone in 1979-1980 and potentially economic portions of the vein were indicated.



GENERAL LOCATION OF THE BLACKDOME PROJECT

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bgs	3/82
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MCB	

FIGURE: 3.1-1

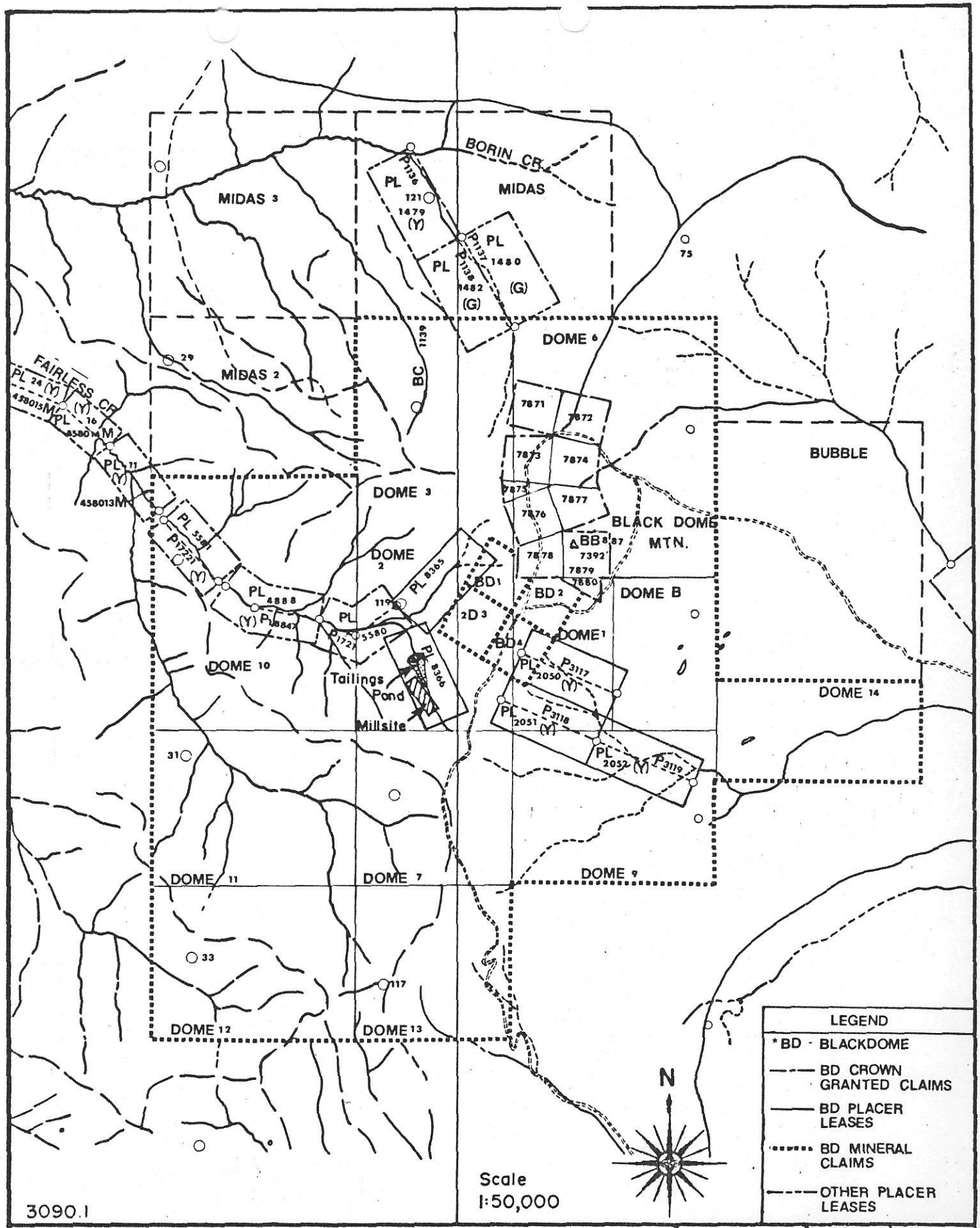
In 1981 an underground exploration program to establish the mineable reserves in the central part of the ridge zone was begun. The environmental studies were also begun at this time.

During the underground exploration a total of 915 m (3000 ft.) of underground development was completed on the 1960 m (6430 ft.) level of the No. 1 vein. This includes 152 m (500 ft.) of crosscutting to the No. 1 Vein from the portal and 53 m (175 ft.) of drifting, plus, 110 m (360 ft.) of raising within the reserves indicated by diamond drilling in 1979 and 1980. Fifty thousand tons (45,360 tonnes) of mill feed grading 0.62 troy oz. gold per ton (21.26 g/t) and 5.6 troy oz. silver per ton (192 g/t) have been indicated by the development of 366 m (1200 ft.) of strike length within the No. 1 vein which has a known length of more than 1525 m (5000 ft.). In 1981, 3800 tons (3450 tonnes) of reserves from this development were stockpiled on the pad near the 1960 m (6430 ft.) portal.

3.3 Project Schedule

Surface geological work by Blackdome began on the property in 1978. Exploration diamond drilling was carried out in 1979 and 1980 followed by underground exploration in 1981. It is anticipated that drilling and underground exploration will be continued in 1982 and 1983 and that a production decision will be made before the end of June 1984. The construction period will be approximately 1 year from the production decision date. Projected on the basis of present reserve estimates and an assumed production rate of 200 tonnes per day, the mine life will be 4.3 years from completion of the construction phase.


26
27
28
29
30
31
32
33
34
14
7
24
6
10
11
Barin Creek
2 m silty gravel
subbase
Fairless Creek
23
8
silty gravel
4
5
C.
BLACK-DOME MOUNTAIN
7392
7871
7872
7874
7875
7876
7877
7878
7879
7880
9
15
17
B.
16
A.
18
19
20
2
3
PROPOSED TAILINGS POND AND MILL SITES.
D.
E.
CAMELSFOOT
RANGE
5846 Flapjack Peak
5100
5400
5900
6000
6200
5700
5500
5300
6900
7050
7030
6877
6431
6468
6100
1-24
A to E



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MINERAL CLAIMS IN THE BLACKDOME AREA

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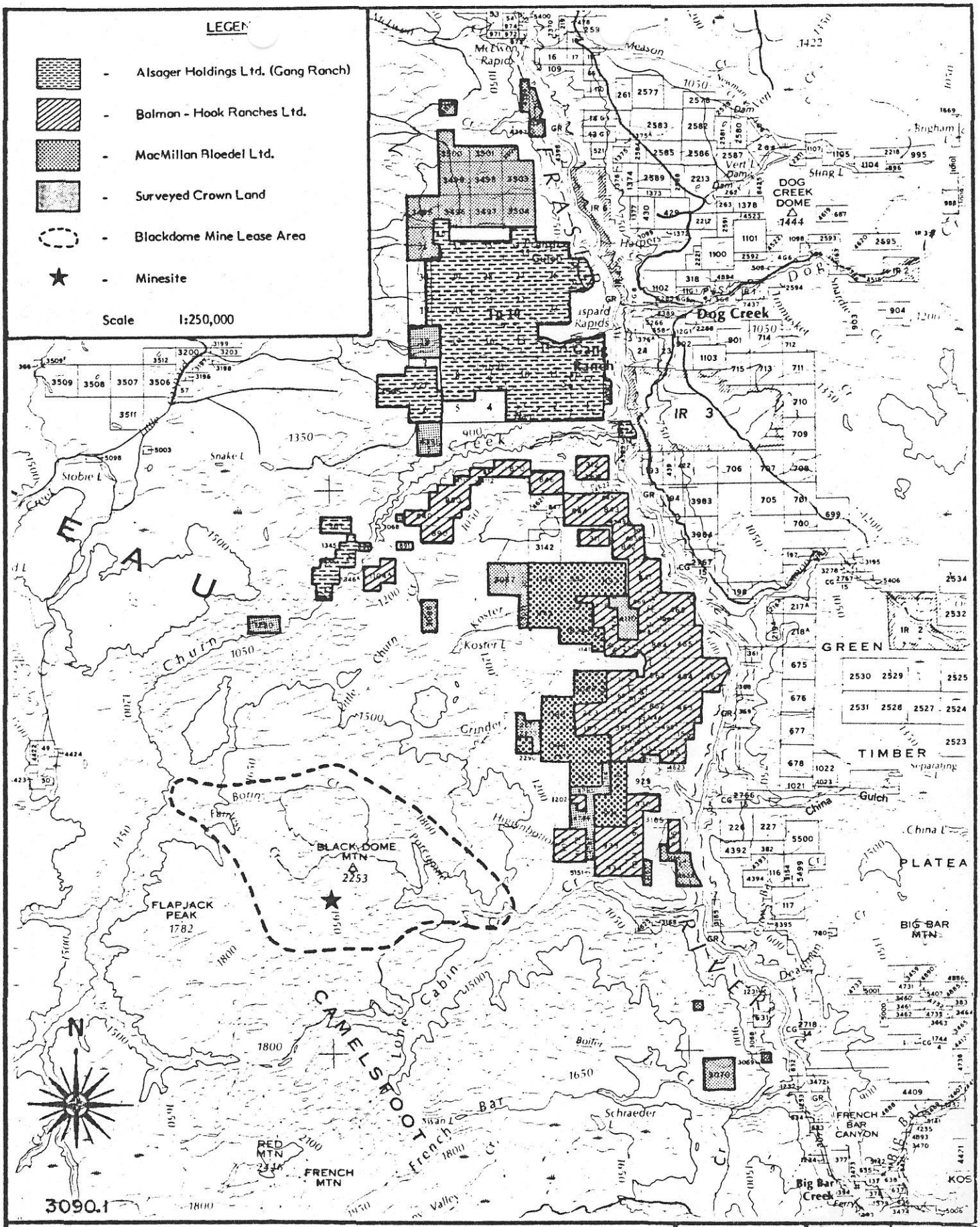
FIGURE: 4.4-2



LAND TENURE IN THE BLACKDOME AREA

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bgs	3/82
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FIGURE: 4.4-3

5.0 PROJECT DESCRIPTION

Adapted from a Report by L. J. Manning, P. Eng., Blackdome Explorations Ltd.

5.1 Description of Deposits

5.1.1 Location

Blackdome Exploration Limited owns or controls 16 contiguous claim blocks aggregating 142 units plus ten Crown Grants and Placer Leases (Figure 4.4-2, Land Tenure Section). These claims occupy an area of about 126 units or 3150 ha and are underlain by several vein systems located at approximately 51°20"N Latitude, 122°29"W Longitude and 1975 m (6480 ft.) ASL. These vein systems are on Black Dome Mountain, 71 km (44 miles) west-north-west of Clinton, B.C.

5.1.2 Reserves

Mineralization occurs as gold-silver enriched shoots within generally steep-dipping quartz vein systems. Ore reserves are presently outlined by surface trenching and diamond drilling with sufficient density to define a drill indicated reserve of 313,000 tons (284 000 tonnes) containing 0.35 oz./T (12 g/t) of gold and 3.21 oz./T (110 g/t) silver from a mining width of about 6.2 feet. All foregoing reserves are outlined in the No. 1 vein system which strikes at 40° azimuth and dips about 70° west (Figure 5.1-1). Approximately 210,000 tons (190 500 tonnes) are in a 730 m (2400 ft.) strike length at the south end of the presently tested vein length with an additional 70,000 tons (63 500 tonnes) in a 122 m (400 ft.) northern section separated by 853 m (2800 ft.) of lower density drilling indicating the rest of the reserves.

Good opportunity exists to develop reserves both in the immediate vicinity of the drill indicated reserves in the No. 1 vein and in undeveloped areas of the other known vein systems.

5.1.3 Production Development

Present plans call for the processing of only the ore grading over 0.26 oz/T (8.91 g/t) of gold equivalent at the rate of about 200 short tons per day, or 73,000 tons (66,200 tonnes) per year. The initial life of the project is estimated to be 4.3 years and assumes increasing the present drill-indicated reserves of 120,000 tons of this better material which grades 0.6 oz/T (20.6 g/t) gold and 5.5 oz/T (190 g/t) silver or 0.725 gold equivalent.

5.1.4 Disposition of Known Deposits

The known 'south' or 'ridge' zone is drill indicated over distances of about 91 m (300 ft.) vertically by 731 m (2400 ft.) horizontally. The ridge zone dips at about 63° west and averages 2.53 m (8.3 ft.) in horizontal width or 2.22 m (7.3 ft.) in true width. This zone appears to be continuing at depth toward the south where continuity through a suspected fault has yet to be established by diamond drilling. Sparsely drilled reserves are scattered along an additional contiguous 853 m (2800 ft.) to the north, then 70,000 tons (63 500 tonnes) of material is indicated over the next 122 m (400 ft.) to the north. This north zone dips at about 75° west and averages 2.15 m (7.05 ft.) in horizontal width or 2.07 m (6.8 ft.) in true width.

5.2 Mine Development

5.2.1 Mining Methods

Experience to date indicates that cut and fill methods will be required in the upper "weathered" zone for purposes of providing both support to the walls and draw facilities for ore from flat plunging portions of the ore shoots. Preliminary mill testing indicates that grind will be of the order 85% - 200 mesh. Tests by Lakefield indicate that perculation rates required for normal stope hydraulic fill are obtainable from only a small portion of the tailings so that additional sources of fill must be provided. Mine design is therefore based on using fill from surface. Hard andesite scree derived from rocks near the vein outcrop will be crushed in the summer and stockpiled on the ridge above the present proposal raise breakthroughs.

maintenance. These will be on surface at first and, as development advances, be established on the levels underground. Levels will be provided with either approved safety bays or approved cross section to obviate the necessity of such safety bays.

Main haulage will be by battery powered locomotives hauling Granby cars on rail. This will permit good long distance low cost haulage of the small tonnages needed. Again clearances and/or safety bays will meet approval requirements.

Ventilation will be forced into the main haulage portal and exhausted through the stopes to exit through the surface breakthroughs. When necessary heat will be added by a propane fired mine ventilation furnace. A stench warning system will be established in conjunction with the furnace and main ventilation fan, and as well, will be added to the compressed air system. Ventilation doors and bulkheads will maintain supplies of fresh air as close to the working faces as possible, and auxillary fan powered ventilation will duct fresh air to any working areas not swept by the main fan. Flow quantities will provide 100 cfm/H.P. of diesel engine or 50 cfm/ft^2 of working face, which ever is the greater. In general, flow quantities and qualities will be maintained to approved standards.

Electrical power will be distributed to consumption points so that fans, pumps, battery charging stations, rescue stations, fueling stations, and shops may be supplied with approved cable and switch gear.

Telephones will connect all refuge stations with the main telephone system thus interconnecting with all the plant offices including the mine rescue control room.

5.2.2 1981 - 1982 Development Program

Nine hundred and forty five metres (3100 ft.) of underground development and 152 m (500 ft.) of surface stripping were completed in 1981. This program indicated the presence of possible Mill Feed Reserves of 53,171 tons (48 236 tonnes) grading in troy ounces per ton 0.65 gold and 5.8 silver (22.3 g/t gold and 200 g/t silver) or 0.78 gold equivalent, (Au Eq. = gold + silver/45). This reserve has a minimum mining width of 2.63 m (8.64 ft.) and occurs in three blocks each of which averages about 46 m (150 ft.) long.

Metallurgical testing of a sample from these reserves indicates that 95% gold and 87% silver, or 93% of the gold equvalent, may be recovered by conventional flotation of the ore.

From this work 19,442 tons (17 638 tonnes) were produced from which 3800 tons (3450 tonnes) were segregated and stockpiled at the portal grading 0.80 oz/T gold (27.4 g/t) and 4.4 oz/T silver (151 g/t) or 0.89 gold equivalent. A further 3200 tons (2900 tonnes) were stockpiled which graded 0.049 oz/T gold (1.68 g/t) and 0.354 oz/T silver (12 g/t) or 0.057 gold equivalent. The remaining 12,400 tons (11 250 tonnes) were piled as waste as an extension to the portal pad.

The mine will continue to be developed by establishing portals of the 1880 and 1920 levels on the west side of the ridge. Crosscuts from these portals may be of the order of 305 and 244 m (1000 and 800 ft.) long respectively. The 1880 m level will be developed as a track haulage level with ore passes raised to the sublevels. These will usually be driven in the vein to permit serving as stope raises when convenient. After connecting through to the 1960 m level south, ore from the surface pad may be either hauled back underground and fed through ore passes to the 1880 m haulage level, or loaded and hauled by surface truck to the coarse ore bin.

Heated air will be introduced at the 1880 m level portal and will upcast through the slopes to be discharged at the surface.

5.2.3 Mining Waste Disposal Plan

5.2.3.1 Mine Waters

Taken from a report by Cecil Urlich, Reimchen Urlich Geological Engineering.

Mine water will be discharged at the 1880 m level portal into the tailings pond before being discharged to the receiving environment. Auxillary portals will have their water collected in sumps and returned to the 1880 level or, if necessary, treated before discharging to the receiving environment.

This outline of proposed ore treatment at the Blackdome project is based upon the results of metallurgical testing by Lakefield Research of Canada Ltd. on ore samples submitted by Blackdome Exploration Ltd.

Test work to date has shown this gold-silver ore is amenable to treatment by either flotation or cyanidation. With the former, flotation concentrate may be marketed through a custom smelter, while with the latter, dore bullion may be sold to the Canadian Mint or to any one of several bullion refiners.

After considering the alternatives, Blackdome has decided to treat the ore by flotation, followed by marketing of the concentrate at a smelter. The possibility of producing a flotation concentrate, followed by cyanidation of the concentrate has been considered, but to date there is no experimental evidence to confirm the economics of this mode of treatment.

5.3.1 Ore Characteristics

Technical aspects of the ore are as follows:

- The ore is comprised mainly of silica, silicates (orthoclase) and minor amounts of carbonates with oxides of iron and manganese. The economic constituents of the ore are gold and silver as the base metal concentrations are too low to be significant. The base metals occur as sulfides of iron (pyrite), copper (chalcopyrite), lead (galena) and zinc (spalerite) and total one percent or less of the ore. Gold is present in a finely divided state in quartz. Silver may occur as finely divided native silver or may be present as sulpho-salts such as tetrahedrite or related minerals. Spectrographic examination of three ore samples showed no antimony, bismuth, cobalt, nickel, cadmium and a maximum of 0.027% arsenic (Table 5.3-1).

- Ore specific gravity is approximately 2.63.

TABLE 5.3-1
SUMMARY OF VARIOUS ORE/ROCK SAMPLES AT THE BLACKDOME SITE

	Surface Trenches[1]	Diamond Drill Core[1]	Drift Rounds[2]
Gold (Au)	3.28 g/t	16.67 g/t	13.07 g/t
Silver (Ag)	87.36 g/t	88.30 g/t	178.5 g/t
Copper (Cu)	0.0059%	0.006%	0.013 %
Zinc (Zn)	0.004%	0.004%	0.012 %
Lead (Pb)	0.01%	0.012%	0.017 %
Iron (Pyrite)	0.058%	0.08%	0.14 %
Titanium (Pyrrhotite)	0.087%	0.19%	0.46 %
Chromium (Cr)	0.024%	0.009%	0.025 %
Manganese (Mn)	0.018%	0.005%	0.056 %
Tellurium (Te)	L0.0003%	L0.001%	L0.0002 %
Sulphur (S)	0.047%	0.20%	0.088 %
Silica (SO_2)	80.5%	82.0%	78.0 %
Arsenic (As)	0.007%	0.027%	0.009 %
Bismuth (Bi)	ND	ND	ND
Cobalt (Co)	ND	ND	ND
Nickel (Ni)	ND	ND	ND
Uranium (U)	ND	ND	ND
Thorium (Th)	ND	ND	ND
Columbium	ND	ND	ND
Molybdenum (Mo)	ND	ND	ND
Cadmium (Cd)	ND	ND	ND
Tin (Sn)	ND	ND	ND
Antimony (Sb)	ND	ND	ND
Iron Pyrrhotite	NT	NT	0.031
Iron	NT	NT	2.26

NT = not tested
ND = not detected

Source: Lakefield Research of Canada Ltd., An Investigation of the Recovery of Gold and Silver from Blackdome Mountain Project Ore Samples submitted by Barrier Reef Resources

Reports: 23 January 1981; Report L.R. #2382
26 March 1981; Report #2 of L.R. #2382
15 January 1982; Report #1 of L.R. #2523

[1] XRF and chemical analysis on detectable elements

[2] XRF semi-quantitative analysis only

- The average calculated head assays from the testwork were 14 g/t (0.41 oz/ton) gold and 167 g/t (4.9 oz/ton) silver.

5.3.2 Mill Process

Characteristics of the mill process are summarized below:

- The ore is ground in water to 85% minus 200 mesh. Finer grinding does not appear to be advantageous.

- The end product of the grinding circuit, a slurry of 25% solids, is conditioned with 0.03 kg/tonne of Potassium Amyl Xanthate and 0.02 kg/tonne M.I.B.C. Frother. The conditioning time is two minutes. No reagents are required to alter the natural pH of the slurry (pH 6.5 - 7.5) and is run as a near-neutral system.

- Rougher flotation requires 10 minutes contact, producing a concentrate amounting to approximately 10% of the ore feed, and containing 95% of the gold and 88% of the silver. In addition to the reagents noted above, one test used a dithiophosphate, frequently employed to promote recovery of gold and silver, but in this instance it had little or no beneficial effect. Use of copper sulphate is shown to be detrimental to both recovery and concentrate grade.

- Cleaning of rougher concentrate takes place in two stages without additional reagents, giving a final concentrate amounting to 2.62% of the ore feed, with an overall recovery of 92% of the gold and 84% of the silver. As the rougher concentrate has a high silica content, it is reasonable to make provision for feeding a little sodium silicate to the cleaner circuit - a maximum of 20 gms. per tonne of rougher concentrate.

- Dewatering of the cleaned concentrate follows conventional lines with thickener and filter. As the cleaned concentrate is high grade, thickener overflow and filtrate are both returned to the mill circuit. Partial drying of the filter cake is not required at this time. Shipping of the concentrate to a custom smelter is to be in steel drums - or in a fully enclosed truck body.

- With the high ratio of concentration it was necessary to use all of the cleaned concentrate from each test to do the fire assaying for gold and silver, so it was not possible to perform detailed chemical analysis of the final concentrate, but as a close approximation, the intial rougher concentrate (the high grade fraction) was submitted for chemical analysis with the following results:

Gold	257.73 g/t	(7.52 oz/ton)	
Silver	3,228.0 g/t	(94.15 oz/ton)	
Iron	4.7%	Antimony	0.011
Copper	0.055%	Sulphur	1.29%
Nickel	0.0044%	Silica	69.5%
Lead	0.048%	Alumina	12.4%
Zinc	0.037%	Lime (CaO)	0.48%
Bismuth	0.006%	Magnesia (MgO)	0.45%
Cadmium	0.0007%	Sodium (Na_2O)	0.70%
Chromium	0.008%	Potash (K_2O)	6.18%
Cobalt	0.0052%	Manganese	0.07%
Mercury	0.0013%		

By comparing the gold and silver content of this initial rougher concentrate with comparable figures in the cleaned or final concentrate, it is probable that all elements present as sulphides will appear at least double the percentage figure shown in the above analysis. Note that the above sample did not contain arsenic. There was no determination of CO_2 - or oxygen equivalent for those elements present as oxides, except where noted.

TABLE 6.10-1

Operating Workforce Requirements

	Job Description	Number of Employees	
Hourly			
Mine:	Stope & Development Drill & Blast	25	
	Tram	6	
	Fill Haul	2	
	Fill Preparation	1	
	Timber	4	
	Bit, Steel & Machine Dr.	1	
	Lamps, Dry, Tool Crib	1	
	Sub Total Mine		40
Mill:	Crush	2	
	Grind	4	
	Filter & Box	1	
	Repair & Maintain	1	
	Labour	1	
	Sub Total Mill		9
Plant:	Mechanic & Welder	6	
	Electrician	1	
	Carpenter	1	
	Heavy Equipment Operator	1	
	Greaser	1	
	Truck Driver	1	
	Power House Operator - Mechanic	4	
	Sub Total Plant		15
	TOTAL HOURLY		64
Staff			
Mine		6	
Mill		2	
Office (includes Manager)		3	
Manager		5	
	Total Staff		16
Kitchen Crew			7
	TOTAL SITE PERSONNEL		87