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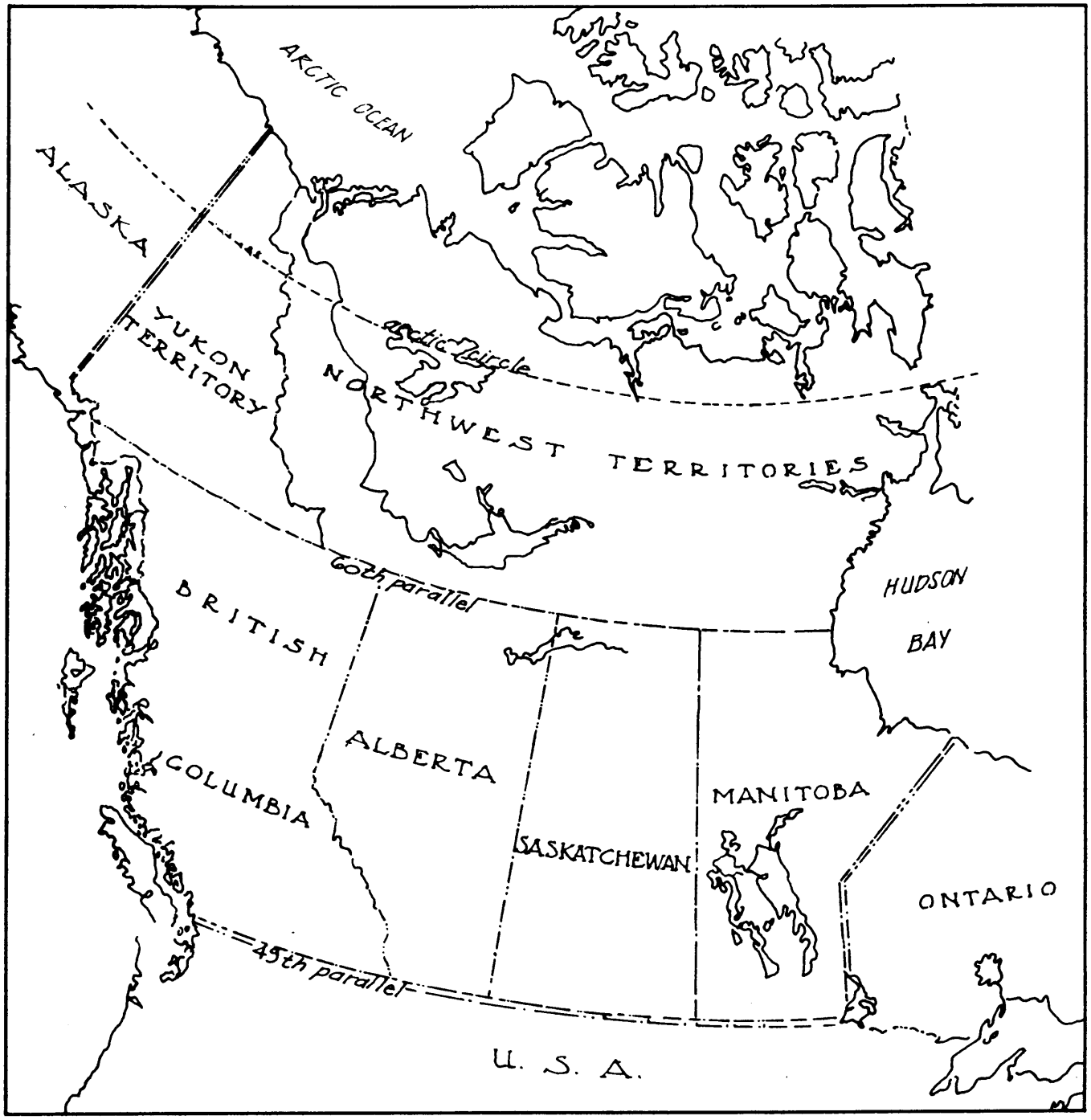
MINERAL INDUSTRIES IN WESTERN CANADA

THE TENTH COMMONWEALTH MINING AND METALLURGICAL CONGRESS – SEPTEMBER 2-28, 1974



PROPERTY FILE 93K049 (90) -04

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THE PINCHI LAKE MINE

(Latitude 54° 38' N, Longitude 124° 27' W, Elevation 2,315')

LOCATION, ACCESS AND CLIMATE

The Pinchi Lake Mine is located on the North Shore of Pinchi Lake, fifteen miles northwesterly from Fort St. James, B.C.

Access to the property is by way of a twenty-eight mile all weather road from Fort St. James, B.C.

The ambient air temperature ranges from a mid-winter minimum of -40 celsius degrees to a summer maximum of +32 celsius degrees. Freezing conditions commence in late October and persist for the ensuing five months. Snowfalls account for approximately one third of the eighteen inches of annual precipitation, with the fallen snow reaching a maximum thickness of three feet during late February.

HISTORY AND OWNERSHIP

The mercury occurrences at Pinchi Lake were first noted by J.G. Gray of the Geological Survey of Canada in a reconnaissance of the area in 1937 and were mentioned in his preliminary report 38-14 (East half, Fort Fraser Map Area), which was published with an accompanying map in March, 1938. As a result the showings were staked by A. J. Ostrem on May 30, 1938. The property was optioned by Cominco Ltd. on November 4, 1938.

Development was started in the winter of 1938-39 by drifting and crosscutting under the original surface showing on the Main Zone, a limestone ore horizon up to 700 feet long and 120 feet wide. During the summer of 1939 a second orebody was uncovered by stripping in the west zone. A diamond drilling program was started in October 1939 with results sufficiently encouraging to warrant the establishment of a fifty ton roasting unit. This plant was increased in size several times and by the end of 1942 had a rated capacity of 1,000 tons per day.

Maximum production was maintained during 1943, but early in 1944 the price of mercury gradually declined and it was decided to shut the mine down completely on July 7, 1944.

The mine resumed production with a completely new plant on August 11, 1968 and in 1973 produced 12,500 flasks of mercury.

The mine is wholly owned by Cominco Ltd.

GEOLOGY

On a regional basis the Pinchi Lake Mine is located in Cache Creek rocks of late Palaeozoic age. The orebodies lie immediately south of the Pinchi Fault, a major crustal break traced from east of Williams Lake to the Stikine River area and possibly to the Yukon.

North of the Pinchi Fault, Takla rocks of Upper Triassic age occur.

The Cache Creek rocks consist of limestone, ribbon cherts, hornblende schists, quartz sericite schists and interbedded andesite.

The Takla rocks include andesites, tuffs and agglomerates, with interbedded shales and conglomerates.

Intrusives include ultrabasics which have been intruded along the Pinchi Fault Zone, granites of Permian and later age, and Omineca intrusions, granodiorities, quartz diorites and diorites of Upper Jurassic to Cretaceous age.

In the vicinity of the Pinchi Fault the Cache Creek rocks have been intensely folded and faulted and exhibit marked metamorphism. They consist of quartz sericite schists, greenstone schists, quartz graphite schists, glaucophane schists and limestones which are often dolomitized and silicified.

Production is obtained from two orebodies which lie about 1,000 feet southwest of the Pinchi Fault. The Main Zone orebody occurs in grey stylolitic limestone which is often dolomitized. It is oval shaped, about 800 feet long, up to 120 feet wide and dips north at 65 degrees. The West Zone orebody is about one third the size of the Main Zone and has a similar attitude.

Mineralization consists of cinnabar and minor stibnite in erratic stringers and blebs in fractures and cavities in the limestone and dolomite.

Both hanging wall and footwall rocks are fairly competent quartz sericite schists.

Ultrabasic intrusives outcrop on Pinchi Mountain, about two miles to the northwest of the mine and on a low hill about one half mile southeast of the mine.

PROPERTY OPERATION

The surface layout of the Pinchi Lake Mine is shown on Figure 1, "Surface Details, Pinchi Lake Mine".

The operation currently produces 650 tons per operating day, working one shift mining and two shifts milling per day. The work force totals fifty-one, with a general roll of fourteen underground and seventeen on surface and a staff of six underground and fourteen on surface.

MINING OPERATION

Stoping

Mining operations include cut and fill stopes underground and an open pit on the main zone orebody. A second open pit on the west zone orebody was mined to completion in 1972. The pit, as a general rule is only worked during good summer weather.

The underground mine is serviced by a 1300 foot -9% decline, fourteen feet high by fifteen feet wide, which reaches from the surface to the base of present mining activity. A 15% inclined ramp nine feet high by fifteen feet wide angles off the bottom of the decline at 90 degrees and is developed as a switchback in the footwall. It reaches to the top of the mining blocks and provides full access to all sections of the mining operation.

The main zone is mined by trackless cut and fill methods. Stopes are taken twenty feet wide on forty foot centers, leaving twenty foot pillars. Stopes are normal to the strike of the ore and are reached by short access drifts taken at ten foot vertical intervals off the ramp. Two stoping levels are currently being worked, with a timber mat installed at the base of the upper level.

Trackless equipment used includes Gardner-Denver jumbos and Wagner ST5A Scooptrams. Mining proceeds from the access drifts across the orebody to the hanging wall and along it. Stopes are then mined back to within twenty feet of the ore footwall, where a pillar is left for access in subsequent pillar mining. A typical breast is ten feet high, ten feet deep and twenty feet wide, with three foot burden, three foot spacing and eighteen inches on trim holes. Explosives used are "Cilgel" 70%, NCN (Cominco AN/FO) and "Xactex" for back control. About 160 tons are produced per round using 1.02 pounds of explosive per ton of production.

Load-haul-dump units are equipped with five cubic yard buckets. They haul a maximum 900 feet to dump into a raise that is accessible at one point in each of the switchbacks of the ramp. The raise feeds to a loadout station at the bottom of the access decline, where ore is loaded into twelve and half ton capacity Euclid R-13 rear dump trucks to be hauled to the mill. Stopes are backfilled with a twenty to one sand cement mix that is piped into the mine from the mill. Backfills are made in ten foot lifts.

Pillar Recovery

The primary ramp access at fifteen percent is used for both initial stoping and pillar recovery. A footwall drift in ore is driven east and west to the extremities of the orebody from an existing stope access and pillars are extracted systematically toward the central access on ten foot lifts. An eight foot by ten foot jackleg drift is driven on centerline to the nose of the pillar and mucked with a Scooptram ST2B or Cavo 310. Slashing and posting with twelve inch stulls proceeds from the nose of the pillar toward the Footwall.

Hydraulic fill is introduced as soon as possible after mining, with tight fill facilitated by a -4% slope in the back.

Conversion to post pillars is being introduced in the lower mining horizon at the present time. Post pillar mining allows safer and more efficient ore removal with one pass mining compared with conventional stope and pillar mining. This stoping method involves using then vertical rock pillars for supporting the back; these pillars will not be recovered. Where post pillars have been started on top of conventional pillars, spans are twenty-five feet and thirty feet between fifteen by fifteen foot pillars.

Ore will be removed in ten foot lifts, blasting into a vertical air space of five feet for ventilation and rock swell.

The upper mining horizon was not converted to post pillar mining in consideration of the proximity of open stopes from previous operations.

Figure 2, "Plan and Long Section", illustrates the orebodies and underground mining layout.

Figures 3 and 4, "Cutaway of Underground Operations" and "How we Produce Mercury" further illustrate the operation.

MINERAL PROCESSING

The Pinchi Lake Mill has a capacity of 1100 short tons per day. Due to reduced demand and sales of mercury, the mill was operated only 40% of the total available time in 1973.

The crushing and screening plant has a capacity of 150 short tons per hour and is shown in Figure 5, "Crushing and Screening Flow Sheet". The grinding, flotation, and filtering operation is shown in Figure 6, "Concentrator Flow Sheet". The roasting operation is given in Figure 7, "Roaster Flowsheet".

1. Crushed minus five eights inch ore is fed from the fine ore bin by two slot feeders to the 250 H.P. seven foot diameter by eleven foot rod mill. Rod mill discharge is pumped to a head tank distributor for three D158 Krebs Cyclones (one is used as a spare). Cyclone underflow is fed to the 600 H.P. ten foot diameter by eleven foot ball mill.

2. The cyclone overflow is pumped to nineteen No. 48 Agitair Flotation Cells, the first six being roughers and the balance Scavengers.

3. The ball mill discharge (65% -200 Mesh) is fed to six No. 48 Agitair Flotation Cells which are used to scalp this flow. Scalp concentrate plus rougher concentrate is pumped to eight No. 36 Agitair Cells for cleaning. Scalp tails are returned to the cyclone circuit.

4. Scavenger concentrates are returned to the cyclone circuit with the cleaner tails.

5. Final scavenger tails are double cycloned to give approximately 50% as a coarse sand produce which is mixed with cement (20:1 ratio) and pumped underground as backfill. The balance is pumped to the tailings disposal area. At times when backfill is not required all of the tailings are pumped to the disposal area. Process water is returned from the tailings pond by gravity to the mill and is pumped to the precess water head tank. The tailings dyke was constructed entirely from borrow material. The pond covers an area of sixty acres. Experimental plots of various types of grasses, legumes and shrubs are grown on the section of the disposal area which is already filled. The response to various types and levels of fertilizer applications is being evaluated.

6. Cleaner concentrates are thickened, filtered (17.5% moisture) and fed to a propane fired hearth roaster (six hearths-ten feet in diameter). The hearth roaster is automatically operated under draft to prevent the escape of mercury vapor. The maximum temperature in the hearth roaster is 1350 degrees F. The mercury vapor and combustion products are drawn from the hearth roaster through two parallel air cooled condensing trains. Condensed mercury drops from the tubes into water filled launders. A mixture of mercury, fine solids and water is drained from the launders into the separator where quick lime is added and the mixture is agitated. Mercury is separated from the mixture and drains from the bottom of the separator to a storage tank. The dry mixture of fine solids, lime and some mercury referred to as soot is returned to the hearth roaster by screw conveyors for reprocessing. The calcine from the hearth roaster is combined with the tailings and sent to the disposal area. The condenser discharge air is scrubbed and cooled to remove mercury prior to being vented to the atmosphere.

7. Mercury from the storage tank is bottled in 76 pound flasks and loaded in boxes (25 flasks per box) for shipping by truck.

8. Because of the hazards of mercury vapor, considerable emphasis has been placed on personal and plant hygiene. Regular urine analyses are conducted on operating and maintenance personnel to prevent overexposure to mercury vapor. Atmospheric mercury vapor levels in the roaster are monitored. Respirators and protective clothing are provided and must be worn at all times in the roaster.

TABULATION OF MINERAL PROCESSING OPERATING STATISTICS

The milling statistics for the twelve month period ending December 31, 1973 are as follows:

Total Mill Feed	163,031 Tons of ore
Concentrate Produced	1,674.8 Tons grading
Overall Mill Recovery	95.3%
Roaster Production	12,521 flasks of Hg (951,596 lbs.)
Roaster Recovery	99.5%
Power Consumption	25 KW Hr/Ton of mill feed
Grinding Media	2.54 pounds of steel/Ton

Reagent Usage: Mill

Collector	(Sodium Amylxanthate)	0.22 lbs/Ton milled
Frother	(Dowfroth 250)	0.085 lbs/Ton milled
Activator	(Copper Sulphate)	0.62 lbs/Ton milled

Reagent Usage: Roaster

Lime 21 lbs/flask of Hg

Mineral Processing Operating crew Strength = 17

	Hourly Rated	Staff
Operators	5	4
Maintenance	3	1
Assaying	1/2	
Bottler	1/2	
Foreman		1
Superintendent		1
	9	8

ENVIRONMENTAL CONTROL

The effects of mercury pollution are common knowledge and control of effluents from mercury production is a prime responsibility. Cominco recognized this problem and has adopted very stringent control measures to ensure protection of both the general environment and the health of Pinchi Lake employees. Some 15% of the capital cost of refitting the mine were related to environmental protection. These measures include special ventilation, systems for trapping particulate matter and vapours at source and control of processing plant effluents.

Very close monitoring is applied to ensure that working conditions and effluents meet strict standards. Special mercury detectors are used throughout the operation. Frequent regular checks are made on the health of each employee. The overall program is considered to be highly successful at Pinchi Lake.

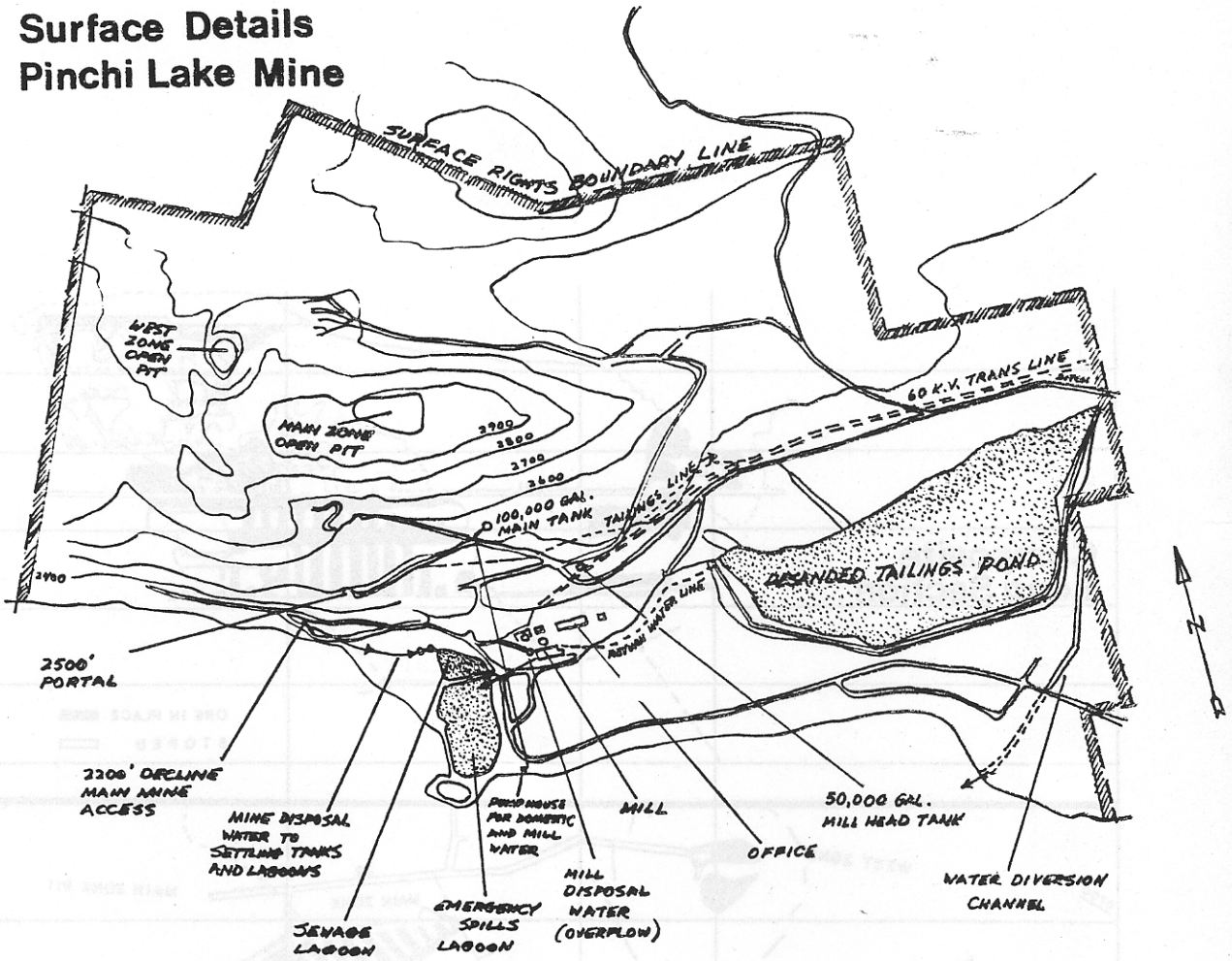


Figure I

Surface Details - Pinchi Lake Mine

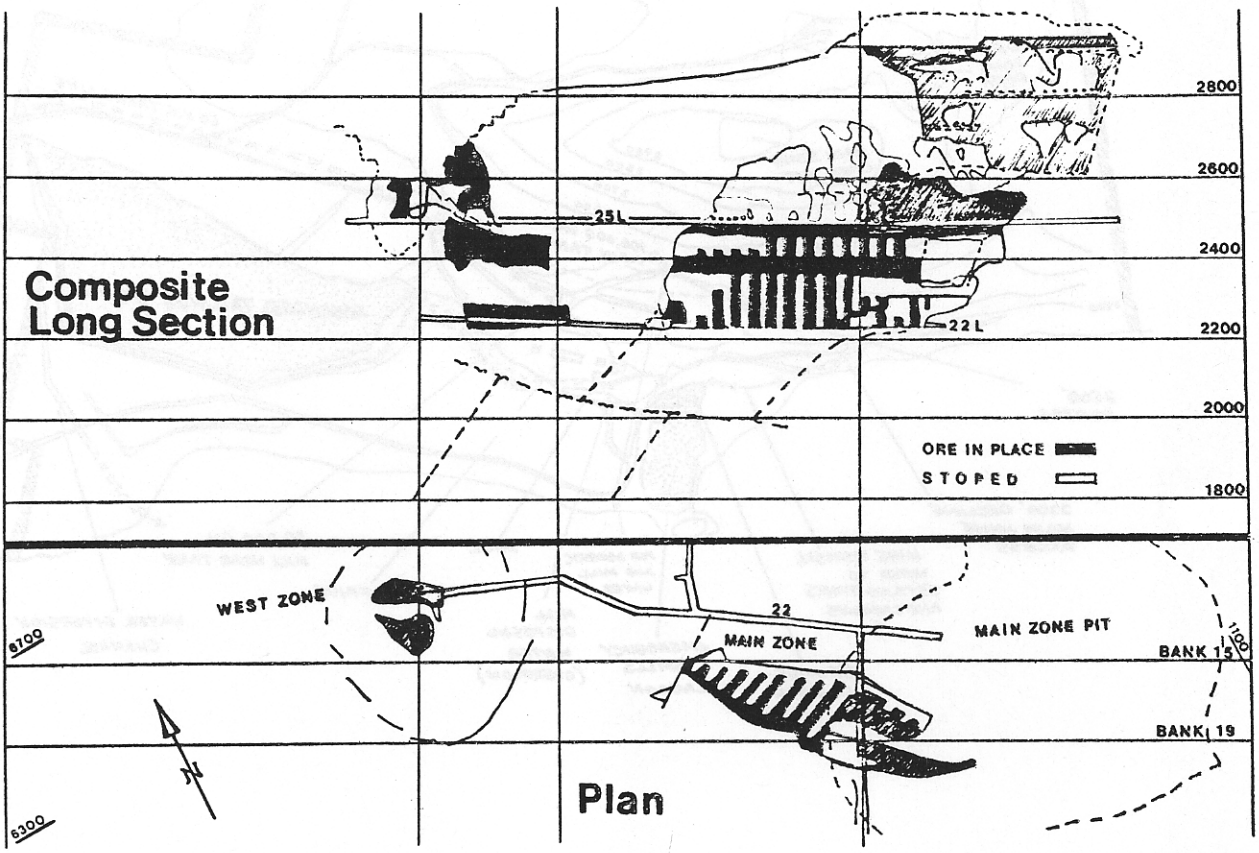
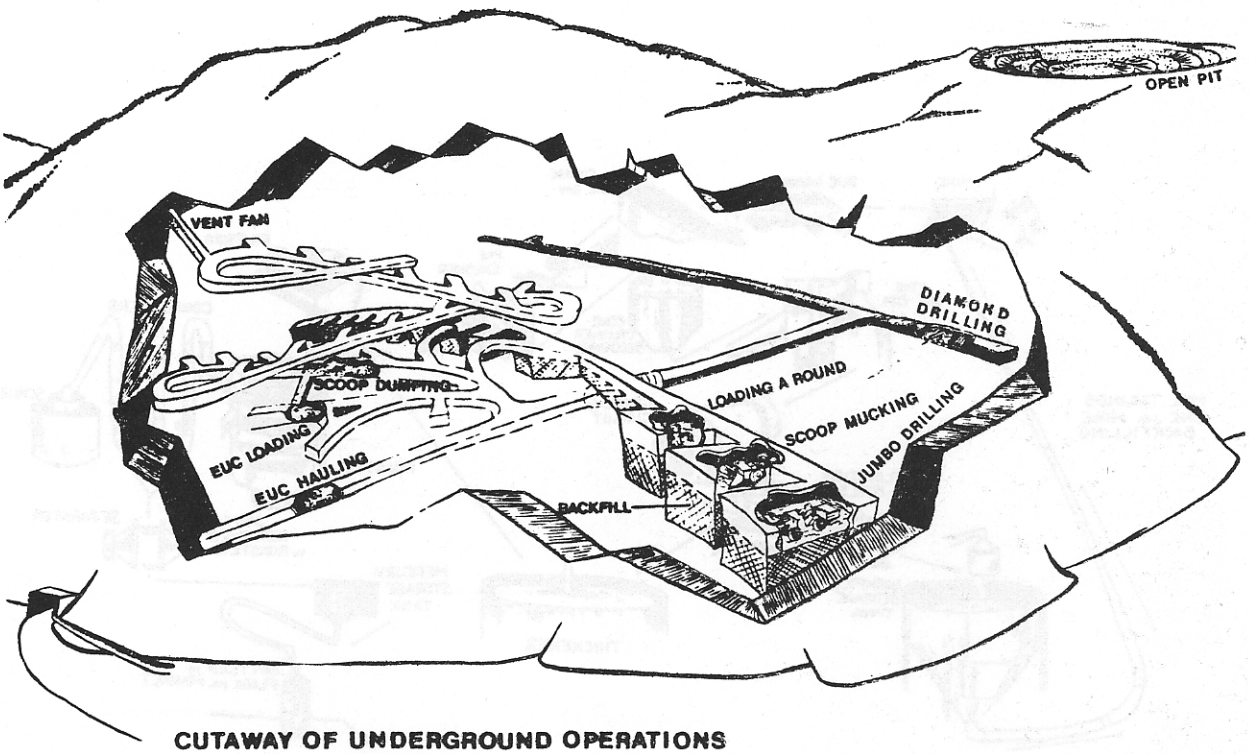


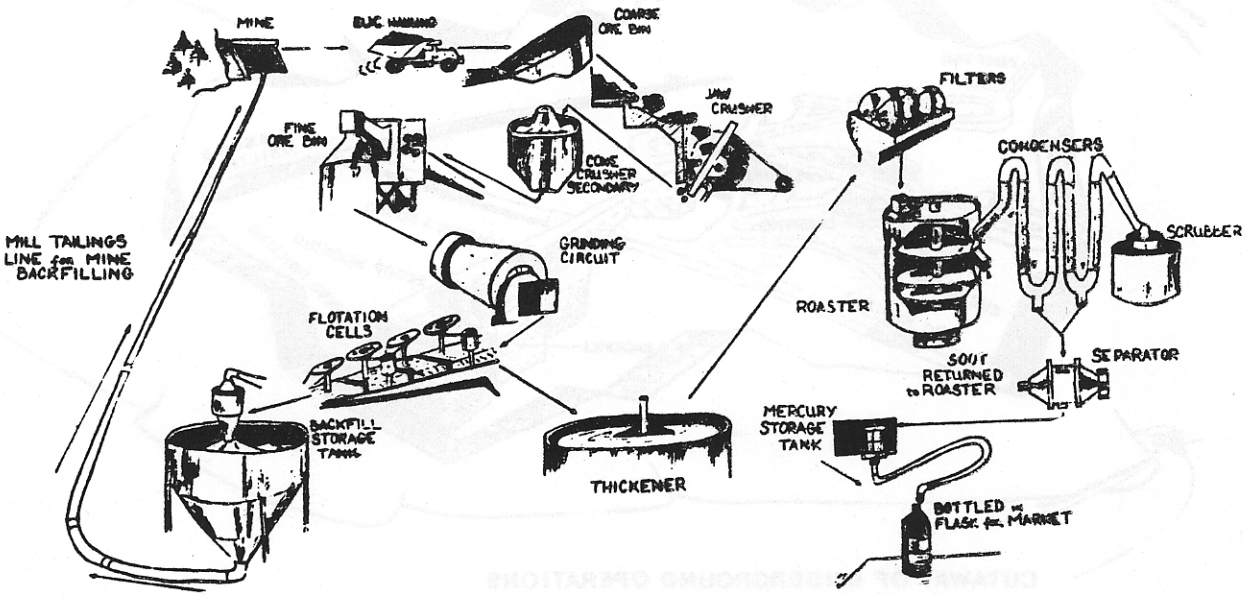
Figure II

Plan and Longitudinal Section



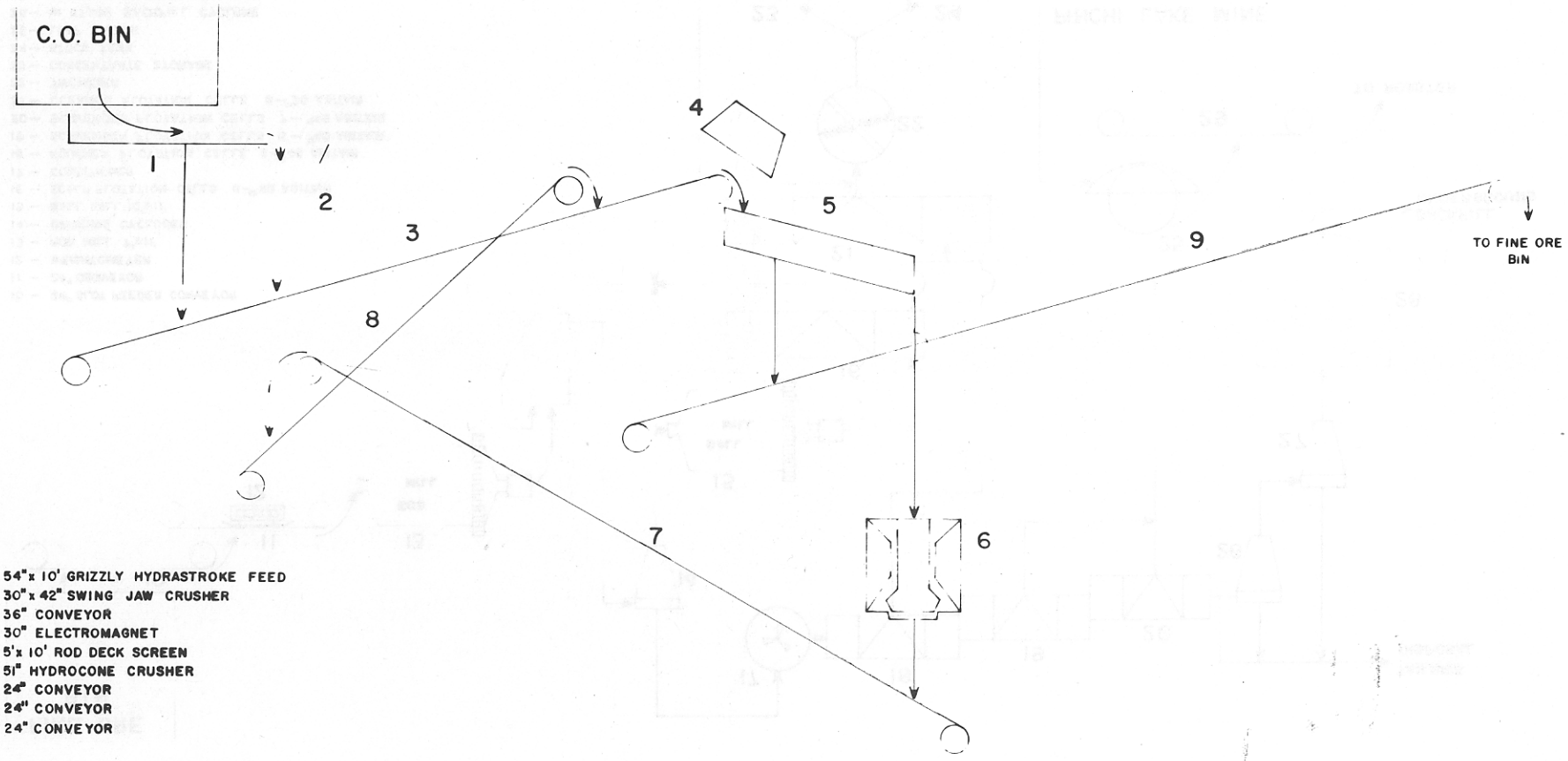
CUTAWAY OF UNDERGROUND OPERATIONS

Figure III



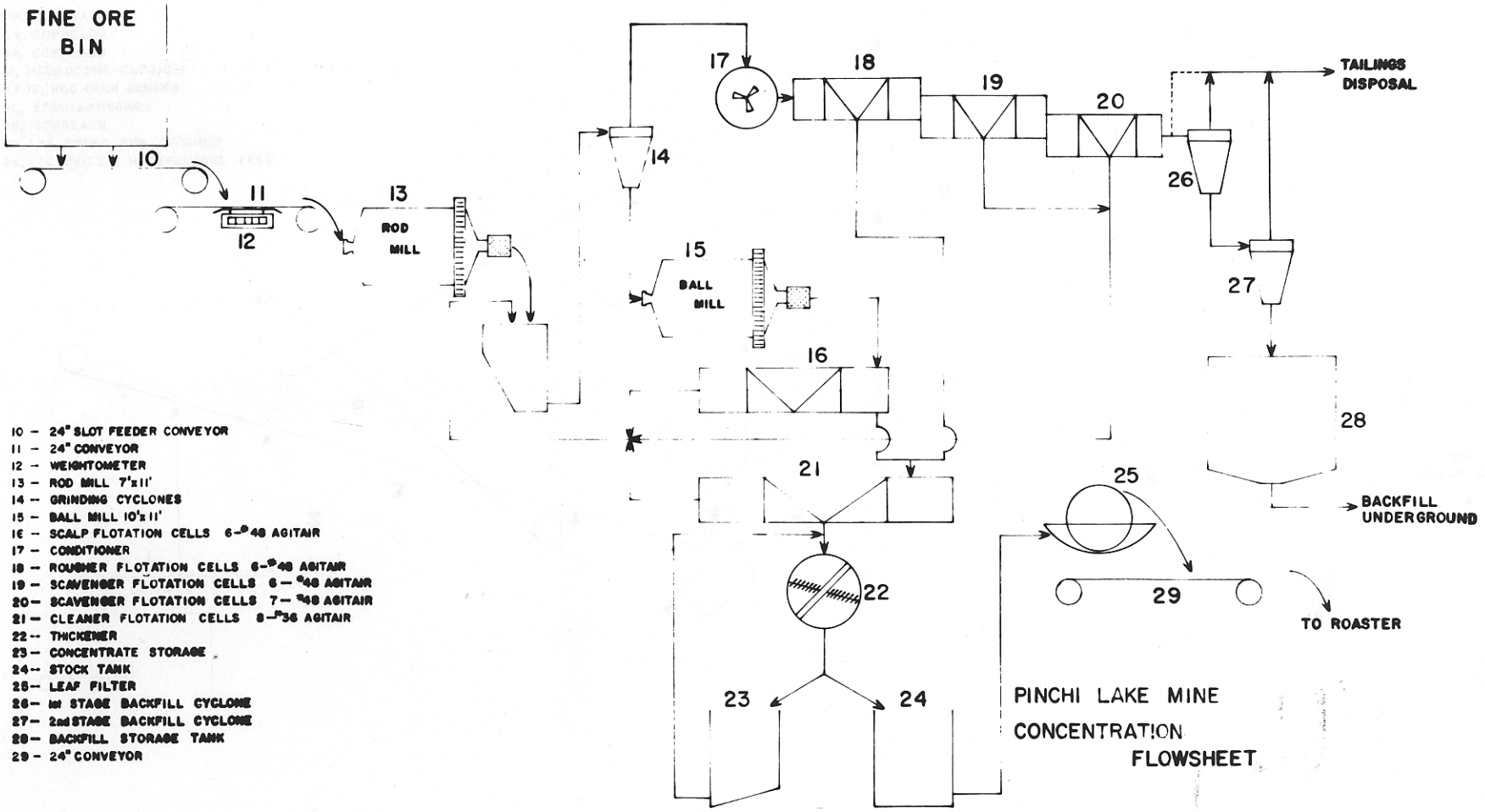
How we produce Mercury

Figure IV

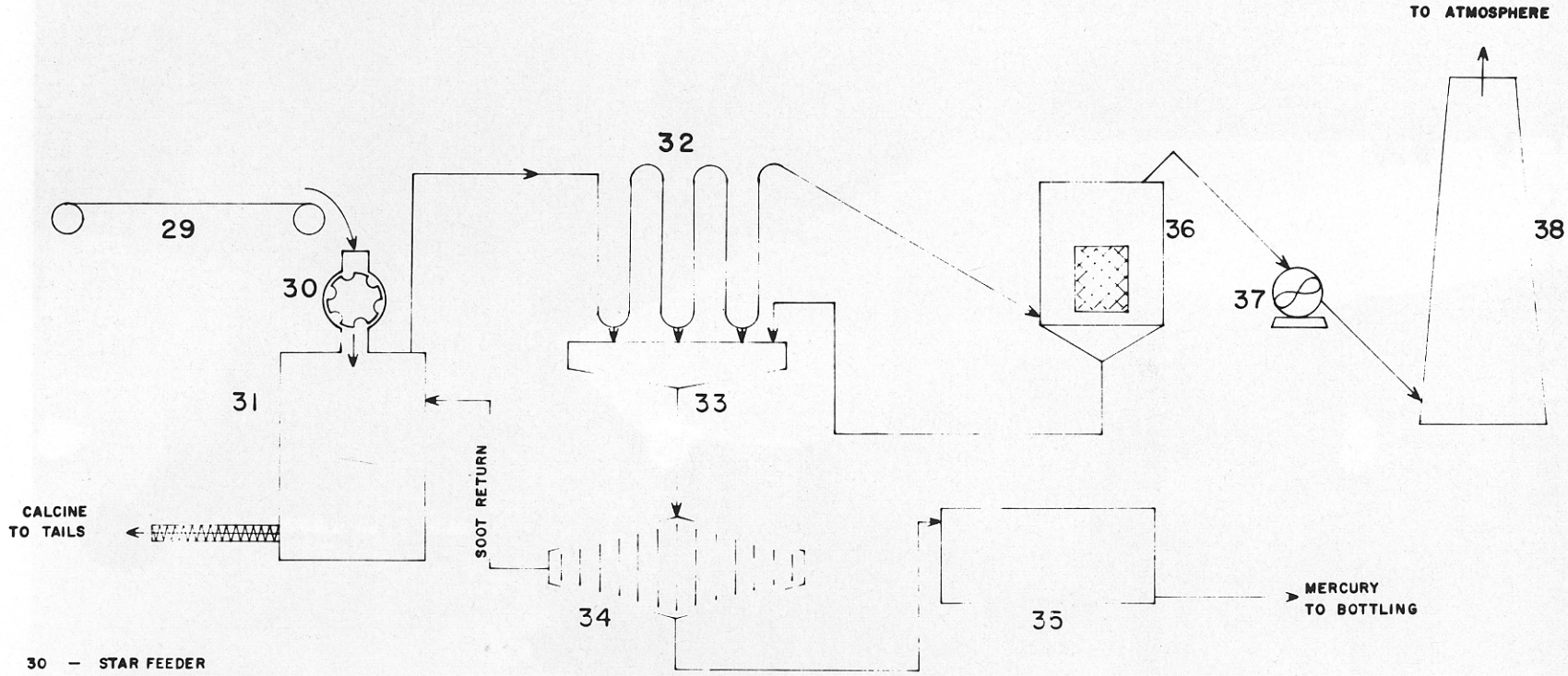


1 – 54"x 10' GRIZZLY HYDRASTROKE FEED
2 – 30"x 42" SWING JAW CRUSHER
3 – 36" CONVEYOR
4 – 30" ELECTROMAGNET
5 – 5'x 10' ROD DECK SCREEN
6 – 51" HYDROCONE CRUSHER
7 – 24" CONVEYOR
8 – 24" CONVEYOR
9 – 24" CONVEYOR

PINCHI LAKE MINE
CRUSHING FLOWSHEET



10 – 24" SLOT FEEDER CONVEYOR
11 – 24" CONVEYOR
12 – WEIGHTOMETER
13 – ROD MILL 7'x11'
14 – GRINDING CYCLONES
15 – BALL MILL 10'x11'
16 – SCALP FLOTATION CELLS 6–[illegible]48 AGITAIR
17 – CONDITIONER
18 – ROUGHER FLOTATION CELLS 6–[illegible]48 AGITAIR
19 – SCAVENGER FLOTATION CELLS 6 – [illegible]48 AGITAIR
20 – SCAVENGER FLOTATION CELLS 7 – [illegible]48 AGITAIR
21 – CLEANER FLOTATION CELLS 8–[illegible]36 AGITAIR
22 – THICKENER
23 – CONCENTRATE STORAGE
24 – STOCK TANK
25 – LEAF FILTER
26 – 1st STAGE BACKFILL CYCLONE
27 – 2nd STAGE BACKFILL CYCLONE
28 – BACKFILL STORAGE TANK
29 – 24" CONVEYOR



30 – STAR FEEDER
31 – 6 HEARTH ROASTER
32 – CONDENSER TRAINS (2)
33 – SOOT LAUNDER
34 – SEPARATOR
35 – MERCURY STORAGE TANK
36 – WATER SPRAY SCRUBBER/COOLER
37 – DRAFT FAN
38 – STACK

PINCHI LAKE MINE
ROASTING FLOWSHEET

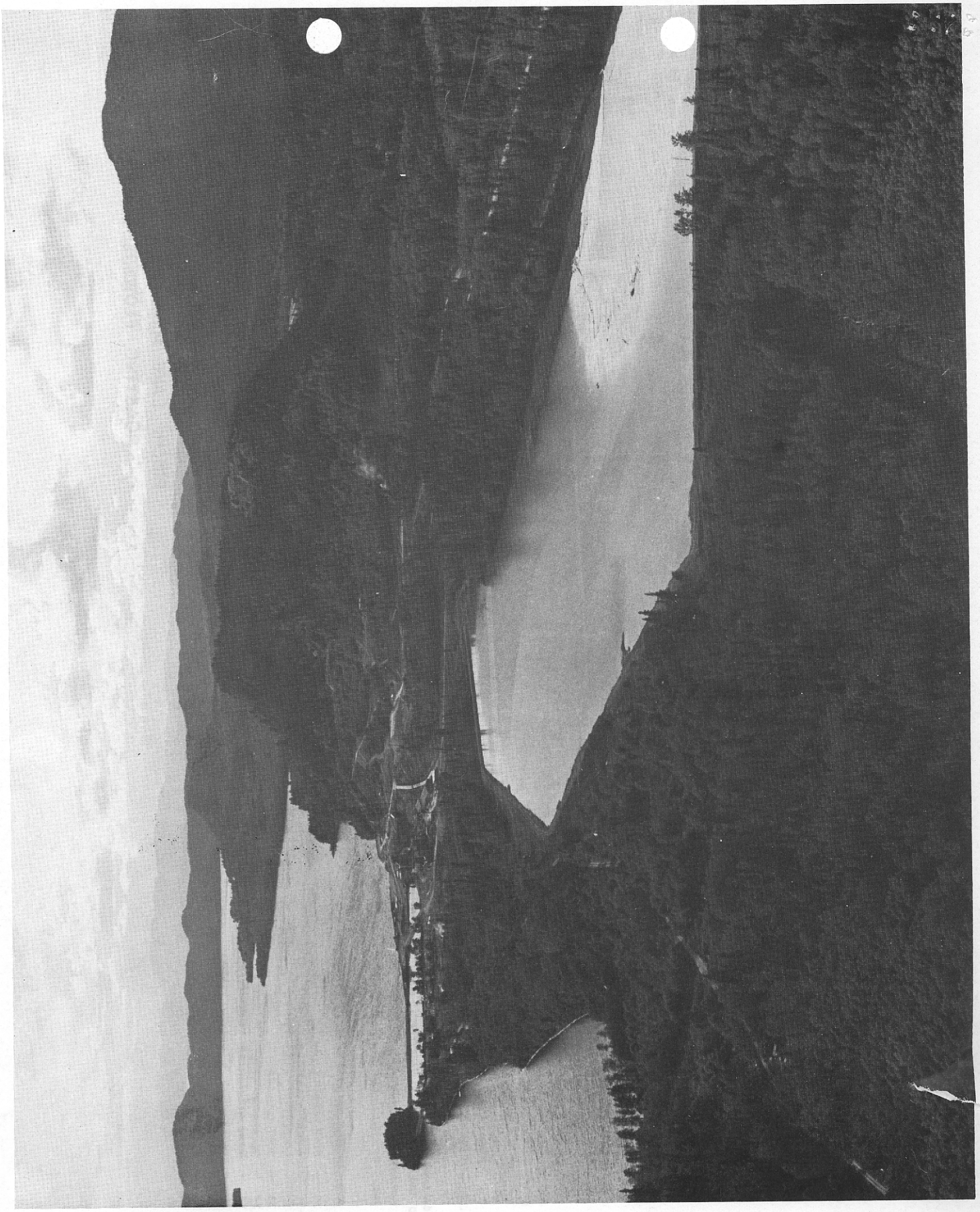


Photo courtesy of Cominco Ltd.

The minesite at Pinchi Lake.