NAME .....

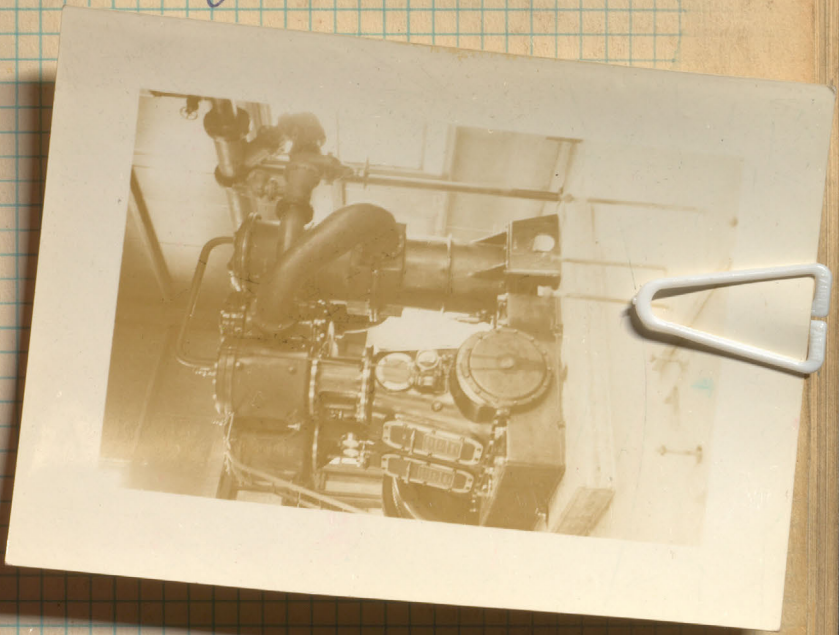
FIELD NOTE-BOOK

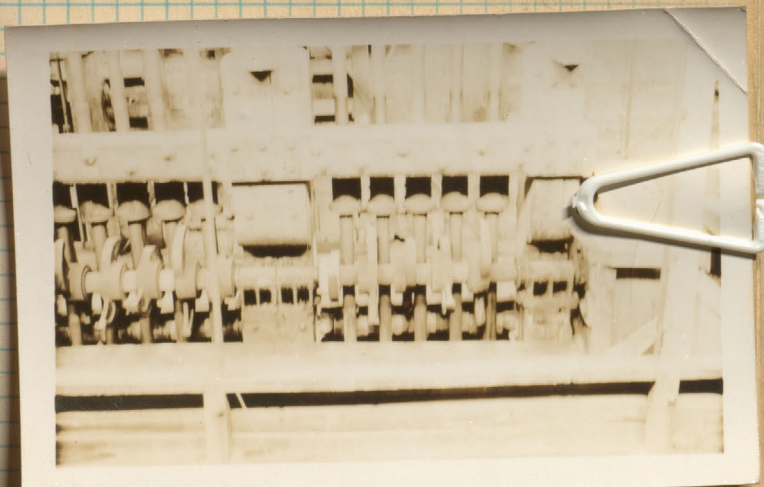
DEPARTMENT OF MINING ENGINEERING
McGill University
MONTREAL

Plan Mc 1768

McGill Mining School Survey.

May 1936.





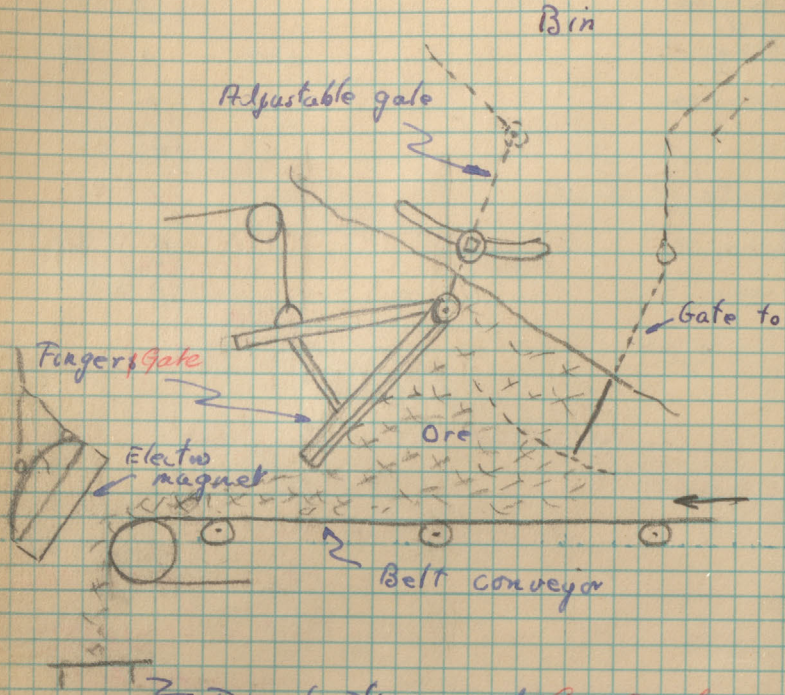
Index.

Use undefinite words as "this" and "it" sparingly and only when reference is clear.

You have some excellent photographs.

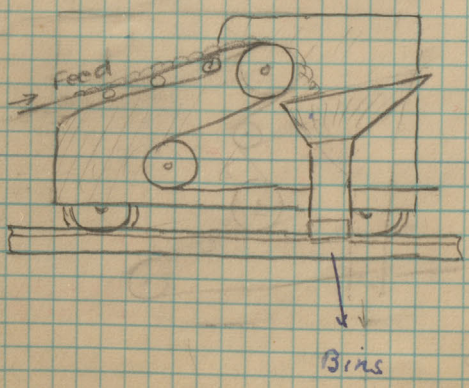
Watch your capital letters, and be careful in their use. Also watch your punctuation. Very poor.

You are in places to brief. Sufficient detail should be recorded to make notes easily understood when referred to years later. Much data is now probably stored in your mind. We are apt to forget many small details, unless they are properly & carefully recorded.



Top of Hf symonds Cone Crusher

Elevation- Showing Feeders *2.



Belt Link automatic Tripper (Distributor)

(Local name used)

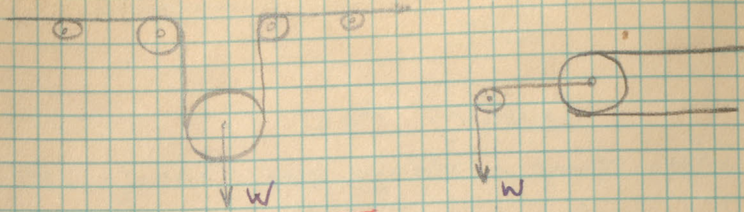
27. April 1936

McIntyre Flotation & Cyanidation Plant

Crushing Plant

1. Skips dump in storage bins Capacity 750 tons
2. Two feeders into one belt conveyor.
3. Conveyor speed 4-20 ft/min. Cap. at 15 ft/min = 100 tons/hr
4. Electro magnet No 1.
5. Symonds cone crusher 7ft diam. — 7/16 in set.
   Motor 200 H.P. 500 rpm 2,200 volt.
   enclosed, and drive by rubber V bands.
   Oil pump on shaft, separate filter.
   Crushes 150 tons/hr to 1 in. Liners last 10 months and are set in Babbit.
6. Electro magnet # 2.
7. Conveyor Merrick Weightometer Model E
   error less than 1%
8. Wood hand picked
9. Dust aspirator and return from rolls.
10. Swith-belt automatic distributor which feeds the surge bin chute. Note plough which lifts canvas top from surge bins. (see page 6)
11. Surge bins 190 tons capacity
12. 6 - 4' x 6ft Hummer Screens V 794.
    Screen cloth openings $\frac{3}{16}$ x $\frac{5}{8}$ in last 70 days
    Vibrators 16 ~ 10 H.P. 550 volt.
    Belts have drive at top and motors are equipped with Falk reducers. The conveyors are tightened (both vertically & horizontally)
    Dust collector is a canvas screen beaten every hour. 5 tons of dust / 16 hrs

(Refer to sketch overleaf)



Conveyor Belt Tighteners

Flow Sheet of Mill

Crushing Section

Underground Blake crusher ↓ to -7 in

\# 11 Shaft (—— skips?)

* 1. Bin 750 ton capacity
4. Magnet
5. Symmonds (Cone Crusher) 7' to -1"
6. Magnet
7. Weightometer
10. Automatic (Distributor) Tripper on Belt Conveyor
11. Surge bins Cap. 190 Tons
12. Hummer Screens -6 to -3/16"
13. Taylor (Jersey) Rolls

Undersize

To (Flotation Section)
(Mill Bins)

13. Traylor Rolls 78 in diam 18 in width chokefed set $\frac{1}{8}$ in Reduce the $\frac{3}{16}$ in screen oversize 125 rpm driven by ~~125~~ 150 HP motor forced lubrication Chrome shells which are worn down to $2\frac{1}{2}$ in before discarding. Heated by electricity before being shrunk on. 2 - 9 ± 4 ± 2 in Carborundum bricks (cakes) keep the rolls faced (or remove ridges on face) keep the wear even

14. Belt conveyors & distributor & storage bins capacity 4,200 tons

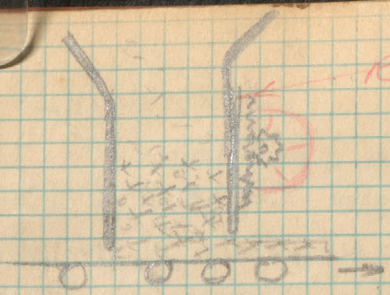
Screen Analysis of Crusher House Products

Symons Cone Crusher. Feed.		Discharge	
+6 in	16%	+1.5 in	none
+2 in	17.5%	+.525 Tyler Screen	17.2 %
-200 mesh	4 %	+.371 "	16.3 %
		-200 "	61 %

Rolls Feed	Feed	Screen Sizes	Discharge
	+4 Tyler 31 %	3-4-6	60 %
Mill Bin	6-8-10 50 %		
	-200 10 %		

Crushing Costs

Total cost - - - $ 0.1070



Hand controlled gate operated ← feed → to ball mills

Flow Sheet of Mill Crushing & Flotation Sections

#(14) Millore bin cap 4000 tons
(15) Tube mills 5.
(16) Denver Unit cell 5.
(17) Dorr Classifier 6.
sand ← Overflow →
(Overflow ?) concentrate ?
Wilfley Sand Pump
(20) Concentrating Surge tank
Bottom ← Top →
Dorr conc. classifier
overflow ← Sand ←
(21) American dewatering filters
Pulp → Repulpers
Filtrate → 6" Morrison sand pump
(18) Denver Classifiers
Sand → Concentrate
(19) Wilfley table
Dump
To Cyanide Plant

(Not clear - last deleted)

Flotation

14. From storage bin feed to tube mill is very even, controlled by hand worked gates shown in opposite sketch

15. Tube mills Allis-Chalmers 5 x 16 ft grinding the 3/16 in to 65 mesh

Motor 550 v 150 h.p. 375 rpm. helical drive
speed of rolls 22.5 rpm. Scoop feed (spiral)
Discharge 27% moisture
Ball Load = 40,000 16 - 2 in Forged steel balls 650 lbs daily
Wave white iron liners are good life 9 months

16 Denver Sub A flotation cell. Pulp discharge into it through a basket screen. Rubber propeller in bottom.
Padlocked plug valve at the bottom for catching heavy sulphides. Emptied once a day by shift boss. $3,000 recovered daily.

17. Dorr duplex classifier 6 x 30 ft.

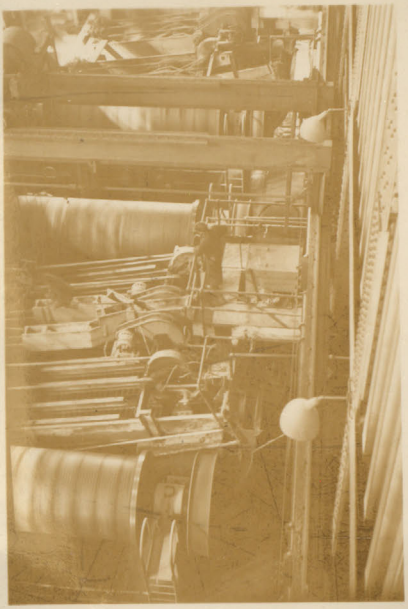
Motor 5 HP 550 rpm
speed of classifier varied from 18½ to 22½ strokes pm
Slope 2 11/16 in. liquid solid ratio 2:1
New classifier not so efficient as old ones due to an imperfection in the design

Dorr & Denver in closed circuit with the ball mills.

18. Denver Sub A cells. 6 in a unit

Motor for each cell 5 h.p. belt drive 265 rpm
The tailing from the classifiers go to secondary cells and then to a

19. Wilfley table 15 ft to check on Denver cells



McIntyre Rolls + Derr Classifiers

Tube Mills

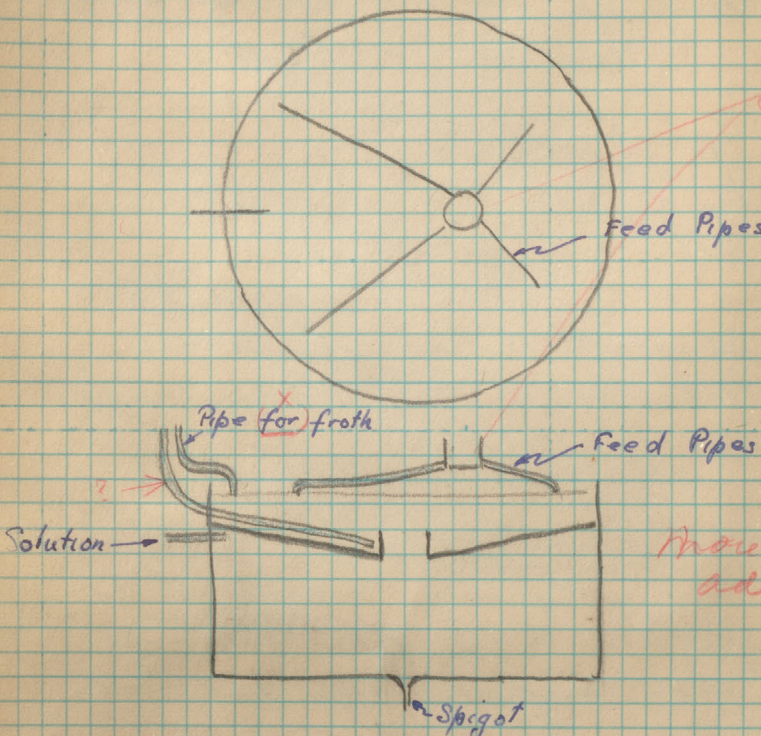
20. Surge tank 12' x 10' ft Dorr.
Pulp thickened to 1·7:1 dilution.

21. American dewatering filters
Dimensions 8ft 6in drain 8 disks. Feed in distributed through ripples to prevent concentrates building up.
Motor 5 H.P. V belt drive
Vacuum 24 ins. Cake washed with to remove soluble flotation reagents.
Feed is actually 2.5:1 ratio and hence the filters are not efficient.
Cake contains 20% moisture repulped to 50% moisture with barren cyanide soln
Filtrate goes to 16' x 24' deep storage tank capacity 36000 gals.

Flotation Reagents

American Cyanide Company promotor reagent 0·1 lb /ton fed into tube-mill
No 25 Aerofloat fed into Denver cells 0·08 lb per ton.
Drip pails used when necessary (? hydrolean)

Assays - Tailings (gold per ton) $ 0·241
Total cost ——— ? $ 0·3633



Tray Thickner

Should be central. Rakes not shown.

More rotation advisable.

to rake settled material to central discharge in bottom of bowl.

Cyanidation (Last Section)

Tube Mill 5 × 16 ft. 29 r.p.m.
Motor 150 hp 550 volt

Ball loaded with 30 550 lbs. forged steel 2 in balls
Rubber lines, life 2 years, 1 in thick
Solid-liquid ratio 2:3.

Dorr Classifier $2\frac{11}{16}$ in slope. 20 strokes/min
7:1 dilution. Overflow 92% -200 mesh
and 80% -325

Dorr agitators. Dilution 3:1 Size 24 ft diam
20 ft deep. Discharge cone 36 in. Connected
by 6 in pipes.

Dorr bowl classifier 20 ft diameter
This is not large enough for the rakes to
handle the return product, so it is used
as a settling cone, the sand return going
for regrind to tube mill. The rakes are
only used for agitation.

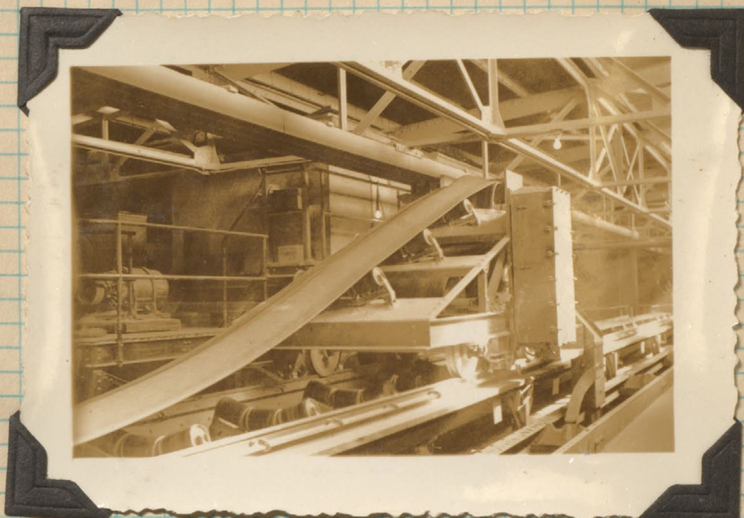
Dorr tray thickner 50 ft diam. 14 ft deep
See sketch. This method of feed eliminate
froth. Pumps are all diaphragm pumps

American Filters. The same as in the
flotation circuit, the pulp is sprayed with
barren soln. Each bag is treated with acid
every 8 days.

Clear soln measured by a Venturi Tube
Crowe tanks. Zinc dust and Cyanide and
lead acetate added. 50 lbs/day

Merrill triangular presses 52 in 22 frames
capacity 1600 tons/day for 8 of them.
Canvas with inside layer of sheeting used.
Cleaned every 10 days

Merrill Crowe vacuum system



Link belt (Tripper Distributor).

Merrill Triangular precipit~~ation~~ l Press.

Note paper over canvas

→ See bottom previous page.

Vacuum pumps for filtration are 3 - 23 x 12 in Ingersol Rand; capacity 2,188 cu ft per min each. Motor, 150 h-p at 190 rpm belt drive.

Compressor pump for agitation, and (air lifts) Sentinel Alley and McClellan

Tailings disposal. Gravity discharge through ? to pond 1000 ft distant.

Total Milling Operating Costs per Ton 1933.

Crushing and conveying	$ 0.107
Flotation	0.363
Cyanidation	0.273
Refining	0.022
Assaying	0.015
Mill alterations	0.009
	$ 0.785

8ft 6in x 8ft dish American Fellap

Refinery

Precipitate removed from filters and discharged into lead-lined acid tank 10 ft diameter 6 ft deep. Fumes discharged by fan through roof.

Zinc treatment.

Pulp 3:1 dilution + 3 carboys of Sulphuric agitated with steam for 3 hrs, allowed to settle and decanted. Foul soln. run through presses. Three more carboys added and agitation continued for 5-6 hr.

Copper treatment.

Copper dissolved by chemicals and manganese dioxide until no more copper goes into soln.

(Pulp) forced through presses, press 20° per again. 21 frames, 30 in, Perrin, make, paper medium.

Soln again ppt and filtrate dumped into lake.

Precipitate fluxed with soda, Silica, Borax, Fluorspar.

Rockwell Furnace N°2, oil-fired, "Carbofrax" lining (Silica carbide) charge 300 lb.

Furnace lining crushed, put over Wilfley table and remelted.

Matte kept and shipped to smelter once a year

Complete treatment takes 48 hr

Miscellaneous Data.

Mill Building.

Structural steel, frame, five inch, double walls, and asbestos insulated roof.

Fireproof and could thus be set near the shaft. This fact offset the added expenditure when compared to a wooden building

Building 214 x 176 ft.

Traveling cranes, Northern Crane manufacture

Conveyors, Timken bearings

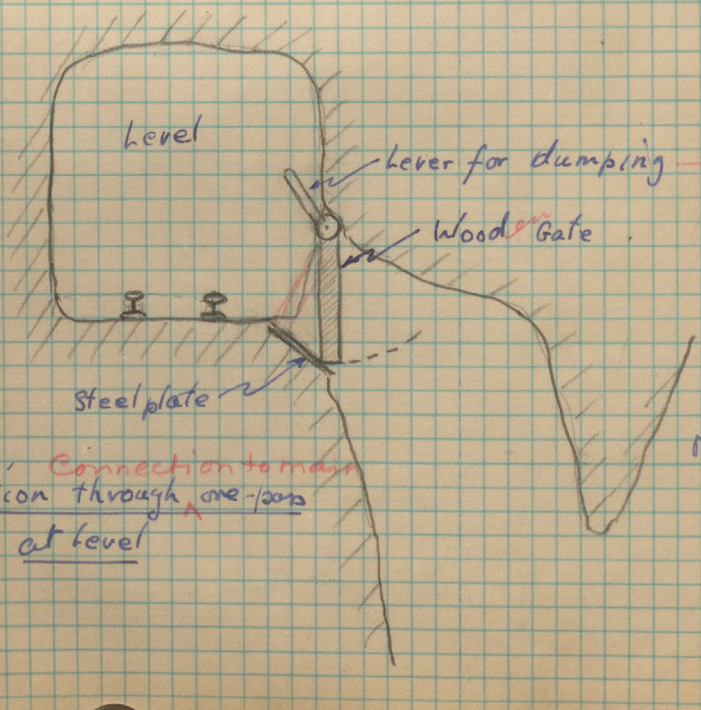
Duplicate pumps installed where shut outs are likely to occur, thus assuring continuous operation.

Flotation cells have vulcanized impellers (these show very good wear.)

Total power 2,653 H.P.

Reference E & M.J. Nov 1933.

Withdrawn upon request by Standard?



Connection to main

Section through ore-pass at level

Underground

Stations

Same width as the respective shafts.
White washed to reflect light.
Standard 10 × 10 in timbering
(Steel piled upright on side)
Telephone to surface and cage-tender.

Levels

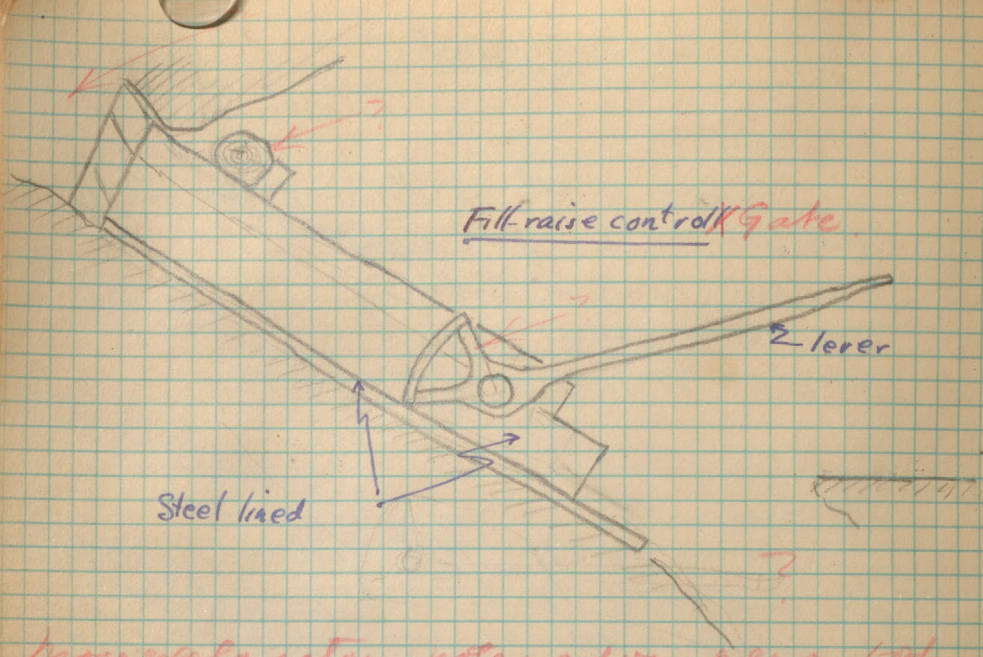
Driven 7 × 9 ft. Not timbered. Sand floor and ditch. Dam 100 ft from shaft to prevent water flowing down it. Door to control ventilation. Pipes suspended from roof, (air and water lines.)

No safety stations.
Subdrift for latrine cars.
Walls covered with "gunite" 1:1 (cement & sand.)
Distance apart 75 ft.

Ore-passes

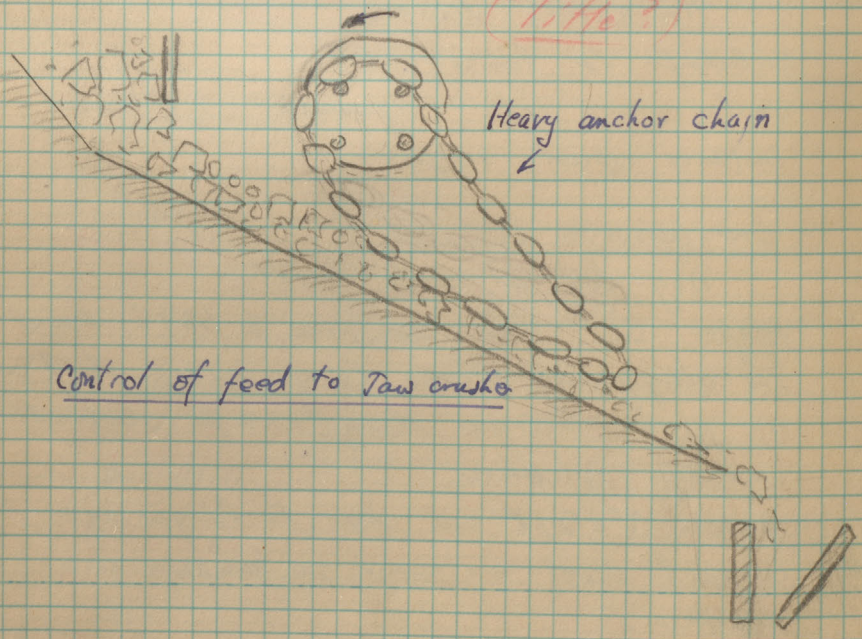
Dog-leg at each level.
Slope 55°. Main ore-pass to 3875 level
The staggering saves large amount of crushing
No pieces larger than 2 × 2 ft observed entering crusher.
Driven 7 × 9 ft but wear to larger sizes.
At each level (entrance) as shown in diagram.

Suggest these are not safe as no plank or rail is kept in front of them when not being used. Horses have fallen down them.



more explanatory notes advisable on final sketches

(Title ?)



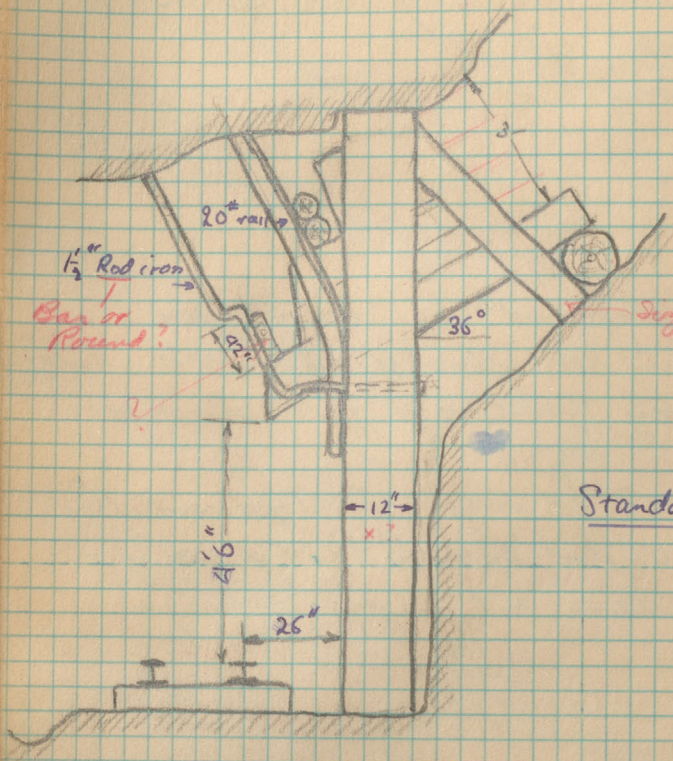
Timber dogs should be driven in to the bottom, for men to catch hold of should they slip and fall when cleaning cars, etc.
Width of dump 10 ft.
(Controlled every level)

Fill raise

7 × 7 ft (staggered). (Sub-raise) from every level, (pulled) through standard chute. Controlled at every level by gate shown in diagram opp page. Fill from a (fill stope) × development. This is nearly (exhausted) so now sand is being brought from sand pit, as the Hollinger mine

Haulage

Track - 20 lb 1 ft 6 in guage through the mine.
Cars - Hudson. 2 × 4-ton cars. Some with no safety locking device. Hand-dumped. Chain coupling.
Haulage trolley for tramming between (hoists), battery motor, horse for short haulage and hand tramming.
Horses brought to surface every shift.
On some levels plates are used at the shaft entrance (instead of rails and switches).



Standard McIntyre Chute

Need a good beam & location

Pipe lines

Air and water take off main lines in shaft at every level.
Pipes connected by Victaulic" couplings.
Air-pressure 90 lb/sq in on surface
Suspended from roof.

Chutes

Standard type as shown in diagram
Bars for pulling chutes are 1½ in rod iron.
A piece of air hose 4 ft long is slipped over the end to give a better grip.
Possibly an unnecessary elaboration.
This system of chute may be hard to control, should have a steel bar on the end.
See I.V.Co. chutes.
Spaced 50 ft.

Raising

Bonus based on £ 8.50 per ft.

Drifts

Timber B.C. 12 x 12 in Zinc treated.
The wall is test holed before drilling
The drift under the stope 7 ft x 9 ft.
The caps of the drift are treated hardwood.
All timbering done on contract
Survey stations are marked with metal disk and number. Waste is marked "W" in paint.

3825 Level pumping station.

Matlex Platt multistage centrifugal pump 300 gals/min, 1100 ft head, 1455 revs, 6 in. discharge 6 in. suction pipe, head pressure 450 lbs

Motor 150 HP, 2200 V, 35 ∝, 25 ~, 3 phase.

Evans horizontal triplex ?

250 gals/min, 1100 ft, 6 in. discharge pipe.

12 in strohe 7 in. diam cylinde

Motor 85 H.P. Belt drive to ?

Total Sump capacity 20,000 gals, in conjunction with settling tank/sump.

37-50 Hoist room.

The walls & and roof are reinforced with discarded hoisting cables interwoven with wire mesh, and sprayed with gunite. Layers of gunite are applied until the coats are as much as 6 in. thick.

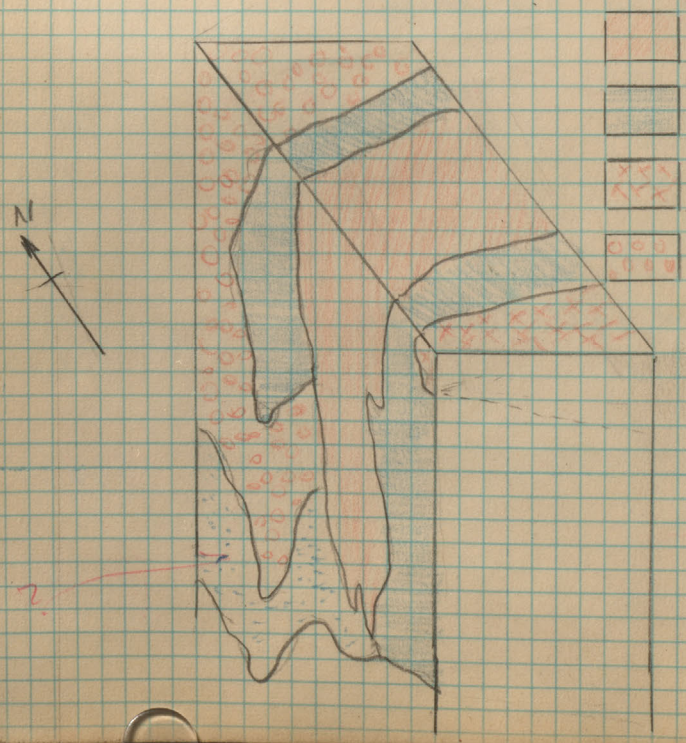
Method of Stoping.

(Stoping Costs)	% Tonnage Stoped	Cost ratio
Shrinkage	25	0.55
Cut + fill	41	1.00
Cut + fill (with waste ? cut)	11	1.41
Square-set + fill	23	1.32
Total	100	1.00

(8-d ← ?)

Geology

All the ore bodies lie within 1000 ft. of a large porphyry mass which intruded into the Temiskaming rocks. The strike is N 60°-80° W & it plunges from 1200 ft on the west of the property to 9000 ft on the east. The large veins (ore bodies) are associated with the flow contacts. Stoping length is up to 200 ft in porphyry and 350 ft in the pyroxene basalt. The shape of the porphyry does not vary much with increasing depth and projections can be made from the lower levels. Faulting and a great deal of metamorphism above the 30 level. No faulting below 30 level.



Surface

Steel Shop.

Tempering point 775°C ascertained by a counterbalanced apparatus which depends on the iron loosing its magnetism with heat. Cost 5½£ per point handled.

N° 11 shaft hoists

Peak loads taken by a regenerative flywheel set on cage hoist

Motor 2,250 h.p d.c. 0.C.

Koch hoist, Ilgner set 1700 a.c., 2,200 v, 580 r.p.m, 50-ton flywheel; 550 v, 2000 kw generator 35 kw exciter. The flywheel has enough momentum for two full winds on power failure with loaded skips.

Dry House

Precautions are taken against high grading by having two separate changing rooms, the men passing through a Burdich solarium

No figures available about reduction of lost time due to preventions of cold.

Treated Timbers. Treatment Plant.

The timbers underground is treated with a mixture of zinc chloride and a little creosote. Procedure:- The wood is inserted into a pressure tank then steamed, evacuated, cooled, Zn soln. forced in under pressure, & finally evacuate again

Time of treatment 4 hrs, 10 mins.

Diamond Drill.

Borts are used, Cost is $6 a carat instead of black diamonds at $95 a carat.
Carbon loss 20c a foot
Each bit good for 50' No setting material needed. One to one, nitric acid and water used for removing the borts from the bit.

Assay Office

The left to right system in running assay is no. 250 samples are run per day. Crushed by a Blake crusher (1/2 inch), pulverized to -200 mesh by a Braun pulverizer and reduced to 60zo by a Jones riffler.

Of fusion 1/2 A.T. used

Flux PbO 25 lb Soda 12 lb Borax 3 lb Silica 1½ lb
Crucible used 6-8 time Furnace for pot fusion 1800°F
Cupels 30% bone ash, 30% cement, 20 water at 1400°F
Parting acid is kept just below boiling.
(Balance made by) Hennes, Salt Lake city ($785)
Sensitivity 1/500 milligrams but used to 1/100
This is an accuracy of 20 cents.

Electric Boiler

The cost of power is based on peak loads, so when the cage is not running the surplus power is used for heating. Equipped with automatic cut-out when power approaches its peak

Miscelaneous

Ore reserves for 5 years
Total (operating cost) wages 34% Dividends 20%
Supplies 12%, Surplus 15% Plant and equipment 9% Power 15%.
Total product $75 000 000 gross (when?)

earnings to date distributed as follows -

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Coniaurum. Head Frame.

Coniacum Flow Sheet

Run of Mine
↓
10in Underground grizzly → crusher
↓
allis chalmers finishing gyratory 10 → 1½ in
↓
Magnet 39in
↓
Circular tank 700 tons (capacity)
↓
60" × 20in Taylor primary rolls 1½ in → ½ in 50 HP.
↓
Leahy vibratory screens
↓
Oversize → 60×20in. Taylor secondary rolls → 6 mesh
Undersize
↓
Weightometer
↓
Mill storage tank 1000 tons (capacity)
↓
Cyanide and lime added
↓
1- Tube mill 5×16 ft allis chalmers
↓
Dorr Duplex classifier 6×30 ft
Sand → 4- Dorr Agitators 24×20 ft (in series)
Underseze
↓
Bowl Classifier 17ft bowl
Spigot
overflow
↓
Tray thickner 40×14 ft.
Spigot
overflow
↓
American filters 8ft 6in by 8 disks (Primary)
Repulper
18×20 ft Dorr agitator
Secondary
Final American filters
Filter cake repulpes
Tailings
Dam.
Storage Tank

overflow
↓
Hardinge conical Clarifier 32×16 ft
↓
Gold sola tank 2 - 10×15 ft
↓
Merrill Crowe vacuum Sytin receiver 6×12 ft
↓
Merrill Zn dust feeder
↓
Precipitation acid tank 2×6 ft
↓
Pering filte press
↓
Refinery

Pit

CONIARUM MILL

No crusher underground since all the ore has to pass through 10 in. grizzly.
Cone roll feeders before gyratory. (see p. 18)
Leahy vibrating screens (cam and tappet)
The screens are a perforated sheet 5/16" opening
Operator states that they are not efficient and are costly.
Rolls have pocket liners 800 lb ball added/day

By feeding the tube mill directly the tonnage is increased.

A thick pulp is maintained in the Agitators pulp rated 1:1. this gives 10-15% -65 mesh overflow.

The grinding is controlled by the Bowl classifier. It is regulated so that the overflow is 65% -200 mesh. The heavy sulphides returned to the tube mills for further regrind.

Hardinge sand classifier was equipped with rakes which could be lowered to take a slice off the top of the sands every two weeks and thereby keep the fillter free of slimes. The sand has to be renewed every 18 months + cost: $225 once a year. The filtered solution is clear and sparkling.

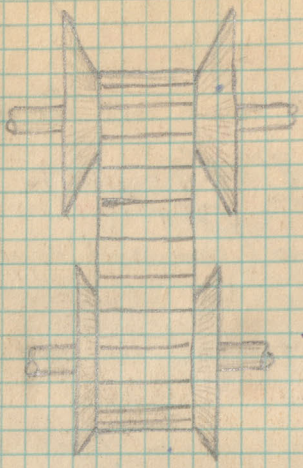
475 tons treated per day.

The use of caustic soda starch increased the tonnage by 50 tons a day.

96% extraction.

Milling cost $0.80 per ton

Mill cost $480,000

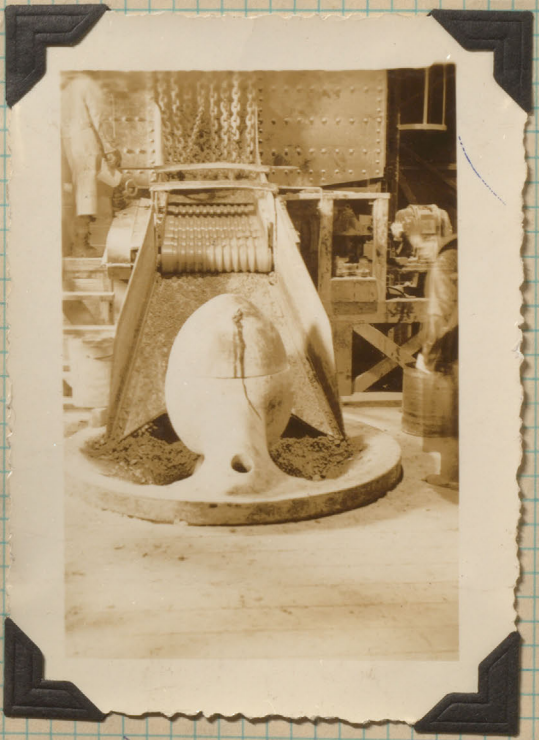


To motor

Some explanatory notes advisable

To belt conveyor

Variable Speed Transmission (where used?)



Very good

Line Roll Feeders

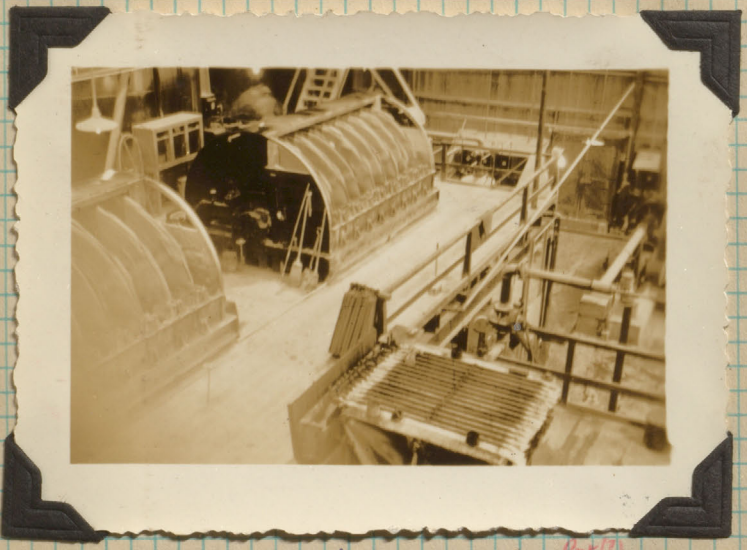
Note chain (control) gate

Hoist

Ingersol Rand Size 120"×72" PE-1.
Rope speed 1800 ft/min (No. of drums)
Motor - English Electric DC. 1040 HP. 600 volts 540 rpm
Ward Leonard control. Parallel four brakes - wood lined.

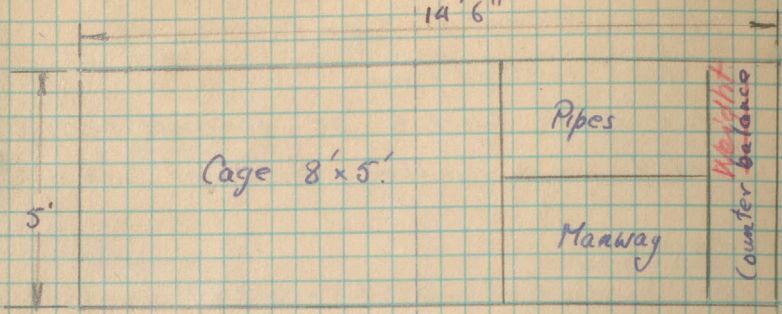
Compressors

3- Ingesol Rand. 26"×16½"×18" ppE-2.
Speed 214 rpm Air pressure = 100 lbs/sqin
Each motor 400 H.P. 550 v 337 a

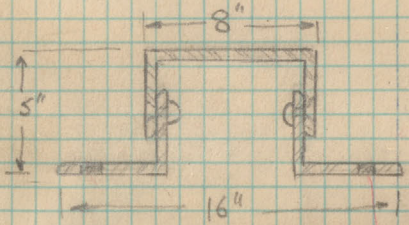


American Filter & Merrill Press (Portec)

Reference Milling A.I.M.E. 1939. p 618.



Sketch of N°11 Shaft



Steel Skip Guide
For Skips

How decorated + when?

Steel ~~Fireproof~~ doors at the entrance of every bal 100 ft from Loader. Near each is a box of clamp clay to seal off the doors off if necessary. all the dry wood has a sprinkler system over it.

THE HOLLINGER MINE

Underground

Shafts

4- shafts from surface and one from 38 level. Plan of No 11 shaft opposite page. All the ore and rock is hoisted through by the central and No 19 shaft from [illegible] to [illegible].

Steel skip guides used in central shaft as shown. Very satisfactory. Have been used for seven years

No 11 shaft cage equiped with chairs, safety-dogs and holds 16 men. Rope - 2 1/8 in. Hoist Signals are not repeated.

Ore and Waste passes.

One main ore pass - 2 main waste passes all staggered from level to level.

Levels, Drifts, and Cross-cuts.

The track is offset and there is a safety station every 50 ft.

The pipes for air and water are layed on the bottom of the drift. No "Victaulic" couplings are used. The trolley wire is enclosed by wood.

A drilling crew consisting of a machineman, helper and two muckers are given two faces. The drillers set up and drill a round then at the end of the shift they blast the cut-holes and the square-up holes of the next face. This saves the drillers returning through the smoke and dust to the face.

The muckers are allowed to come up to surface when they have cleaned up the drift.
all the timber is zinc treated.
all levels are 7 ft. & 8 ft.

Haulage

The majority of the haulage is done by trolley locomotives (2-6 ton, 40 HP) pulling 3-ton Granby cars. Track from surface to 18 level 18 in gauge, below that 30#, 36 in gauge. Hudsons — ? are used on the upper levels, No end-dumped cars.

Train Motor crew consists of a switchman and motorman, no chute blaster. Switchman allowed to ride on cars. This practice has caused accidents. Switchman signals by ~~means of~~ tapping car with a hammer. Red light displayed on end car

at the entrance to every crosscut chains are fixed to the ground and can be laid across the track to prevent runaway cars from running into the main line.

Many of the switches have vertical levers but so far no accidents have been caused by this.

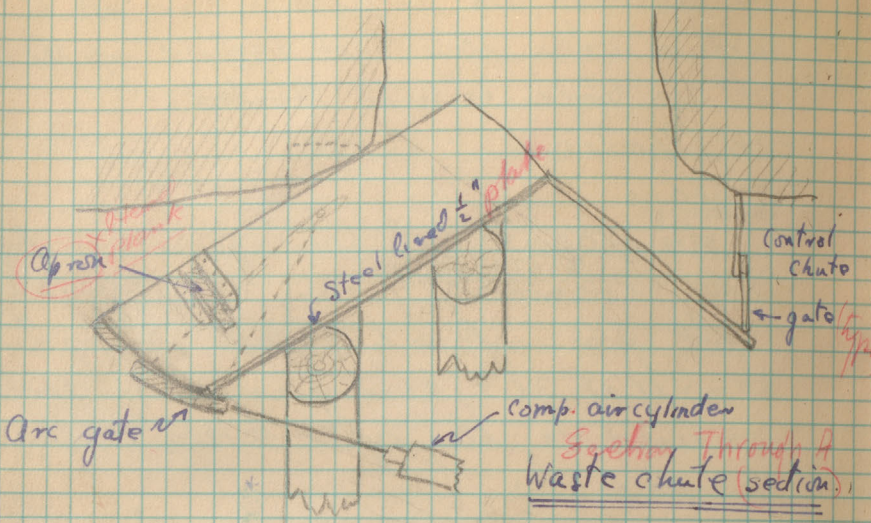
Switchmen and motormen do not wear the cord of their lamps inside their shirt.

Tipples on every level, some take as many as five cars at a time.

dump

Ventilation

Natural.



Section Through A
Waste chute (section).

(form?)

Chutes

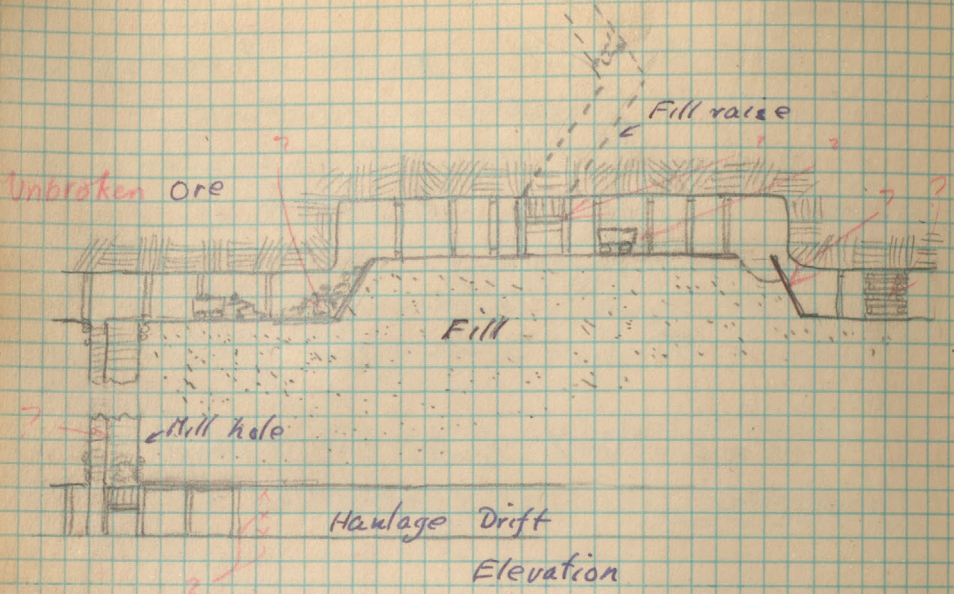
Both the chutes from the shrinkage and cut and fill stope are standard. 12" x 14" in and 12" x 12" in B.C. fir is used in the shrinkage stope chutes, while 12" x 12" in B.C. fir is only used for the cap in the fill stope chutes, the remainder is round timber. The chute bottoms are of flattened lagging.

The main fill chutes are worked by compressed air. Cost as much as $ 300-400

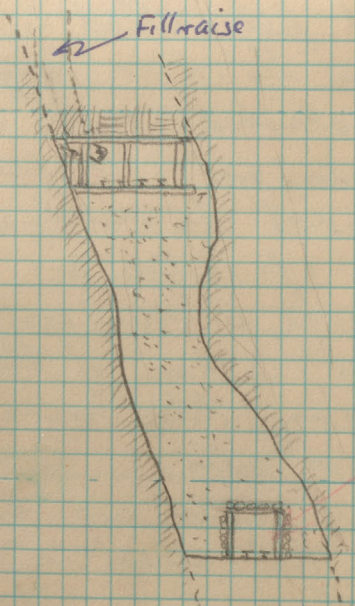
Stoping

The cut and fill method is used. A drift is driven the whole length of the ore body, and stoped out the whole width of the vein, and 17 ft from the raise. The muck is removed by muckers, and timber sets, on 7 ft centers, are installed. Timber is zinc treated, Round posts, 12" in minimum, Caps 12" x 16" in. If the floor of the drift is going to be mined, the posts are set on sills.

Mill holes with chutes are built 200 ft apart and a fill raise is driven to the level above, from approximately the middle of the stope. Manways are in every other mill hole. The stope is then started as a shrinkage for the first 30 ft and the muck drawn off. The stope is filled to within 10 ft of the



Elevation



Section

Cut-and-Fill Stope.

back. The mill holes are kept level with the fill. The cars in the stope are end dumped, one and a half tons, track 18 in, 20 lb rail. A ten-foot breast is then advanced from the fill raise towards each end of the stope, as shown in the diagram. 5-foot rounds are taken. The back is posted or cribbed, if necessary, and cribbing is always erected within 15 ft. of the fill or chute. The crib timber is 12×12 in. The muck is blasted down onto a plank muching floor. Test holes are drilled along the walls.

When the stope is driven to the next level an 18-ft sill is left, the fill raise sloped out so that two square sets on top of each other can be inserted to catch the sills of the level above and the sill of one is then removed catching the remaining sills with further square sets.

If the stope is wide the sides of the drift are lagged and fill is dumped in between the drift and the two walls. Initially the whole width of the stope was lagged, but this required too much timber as well as being unsatisfactory.

The advantages of this method of stoping is that horses can be left anywhere in the stope. It does not matter if the vein suddenly narrows and then widens, and its great flexibility and the protection it gives in bad ground.

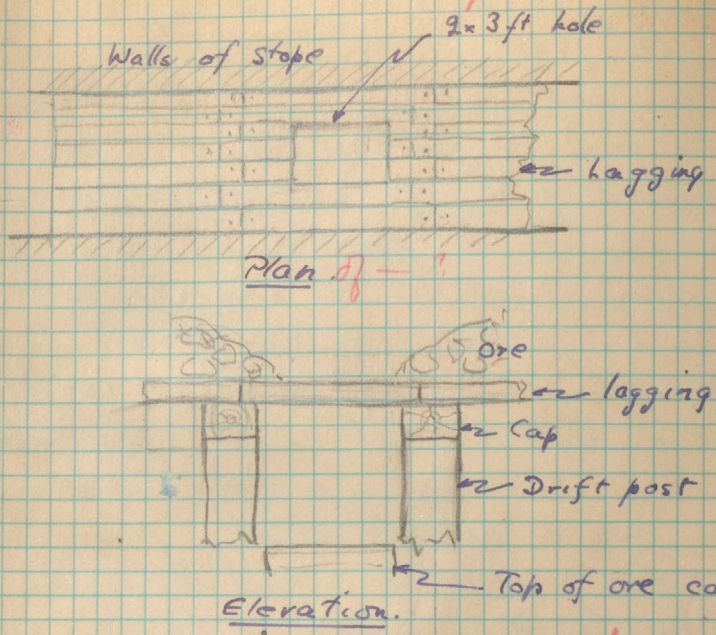
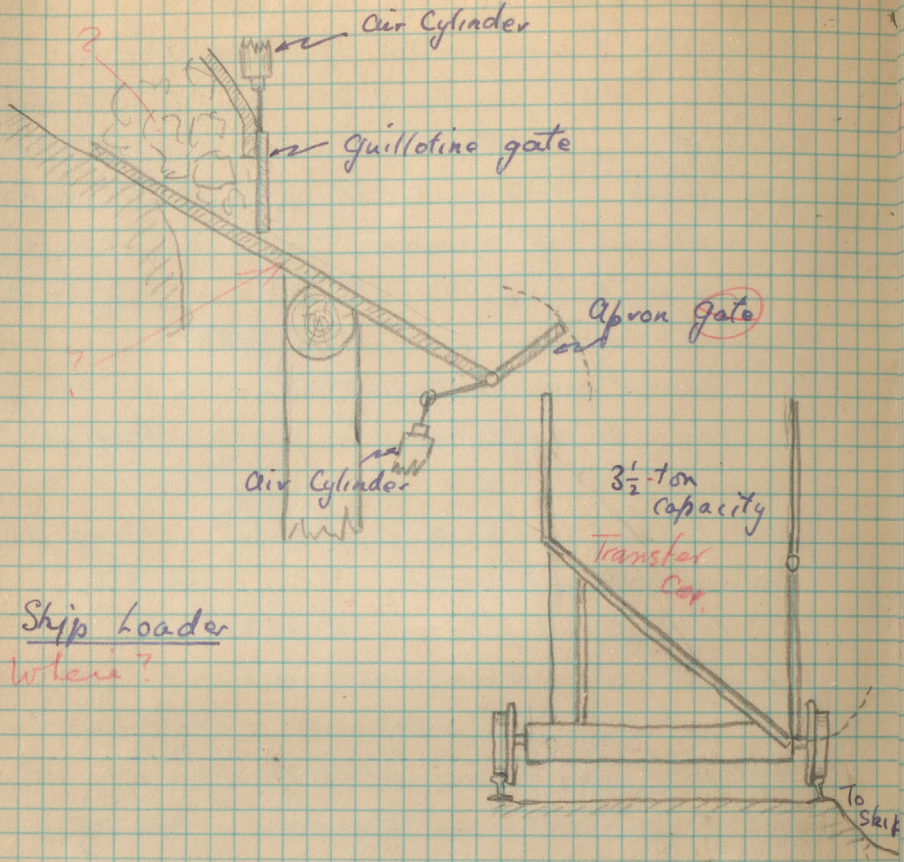


Diagram showing the method of drawing the ore from the stopes when they are started. Chute holes are left between every other set and are boarded up before fill is dumped into the stope.

There is ~~also~~ neither dilution nor waste. Contract is based on the following rates:- Mucking 45c per ton, Breaking 45c - Fill 10c - Chute $30.- Timber is put in during the men's own time. All contract is calculated on a period of 4 weeks of 6 days each. The shift bosses do not receive any bonus from the stope under them. No stope bosses. The development and production is being limited to a few levels since there is a tendency to have too many shift bosses due to the distance apart of working places. Cost of shrinking - 40c per ton.
" " cut-and-fill - $1.00
The men work 8 hrs from collar to collar and not from face to face.
Scaling bars have a rubber band round them to protect the workman's hands.

Hoist at 2400 level

The hoist is a double-drum Nordberg 7' x 4' drums. Rope speed 1260 ft per min. Motor 500 HP 2200 volts
The hoist room is reinforced with steel H beams and very closely lagged with steel rails. Everything is coated with aluminium paint.
The cage is made of aluminium alloy and is divided into two compartments, separated by a hinged floor. On the back of the cage is a small tugger hoist which can be connected to the air supply at every level. The cage also has four guides and is equipped with safety dogs.
The shaft is ~~equipped~~ timbered to keep it out as protection



Ship Loader

Where?

A smaller plan would be advisable to show transfer arrangement.

Ship Loader Arrangement at —

The ~~first~~ loader shown opposite is on rail so that it can be dumped into either ships and be loaded from a rock or ore pass It is moved by means of a tugger hoist ~~attached~~ and to a cable, and the doors are worked ~~by~~ air-operated.

Crusher-Underground

Blake 48" × 60" in ½-6 in. set choke fed. Motor 200 H.P. 2200 V. capacity 500 tons/hr. It has not much crushing to do since most of the rock is broken small in the ore passes.

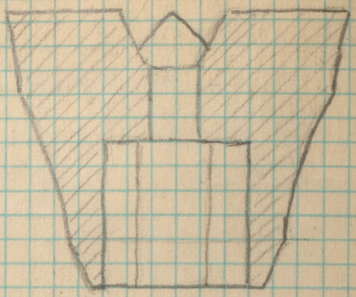
Pumps. (Fairbanks).

Fairbanks Morse capacity 250 gals/min 4 cylinder. 75 H.P. Head 1200 ft. = 500 lbs pressure 6 in spigot discharge. Slush lubrication.

Mining costs

Exploration & development.	$0.796
Stope Stoping	1.442
Haulage	0.225
Hoisting	0.167
Pumping	0.025
general	0.309
Total	2.973 (1934)

Reference C & M.J. Sept 1935.



Cross Section Through Bit

(Shank)

Detatchable Bit ~~(Drill Steel)~~

Forged End Of Steel On Which Bit Is Fixed.

Shank of drill steel

Bit holder for Carrying transportation them Underground

Suface

Steel Shop.

Furnaces are oil, and the bits are tempered by eye at a temperature of 1425°F. 0·9% carbon in the drill steel. Quarter octagon. Cost of sharpening 6 cents.

Experimenting with replacable bits. They are only used where steel cannot be got in easily. Doubtful if very satisfactory since the bit is liable to work loose from the shank and thereby diminish the drills cutting power. The drop is 1/16 in for every 18 in

Compressors

9 (Ingersol Rand) compressors. Total capacity 3200 cu ft/min Running at 95% P.F. 11,520 K.W. for 24 hrs.

Stench, Fire warning in air line.

Powder Magazine (see p. 29)

Capacity 1500 cases. Powder used 40% Forcite 40% Kinite & Stopeite 55%.

Magazine is protected by a bank of sand, It is kept warm by an thermostatically controlled electric boiler, and ventilated by air ducts which have intakes at the lower half of the outside walls, and outlets in the ceiling of the magazine. The track is of wood and all matches have to be deposited outside. The powder is unpacked in an underground room and the sticks are taken in enclosed powder cars. No wooden boxes or paper

Tailing Dam

Slope 1 in 1½

Method of Spraying Slimes

Note :- pipe elevated in background to give the req'd head.

go underground.

Tailing Dump. Dam (or Pond)

Pump at Tailing Dump is a centrifuge 8" in discharge (pipe). (How many pumps)

Motor 150 HP 550 v.

Steel propeller lasted 60-80 days; casing 90-120 da. Rubber was installed 2 years ago for propeller and liners) and is still going strong.

5000 tons dry slimes + 5500 tons of water are pumped a day. Sp Gr. 1.56.

Two pipe lines, used one spare

Pipe 12 in. diam. wood, pitch lined outside

The dam is raised 4 ft per year (by means of a 20 ton 3/4 yard bucket (electric shovel)

Shovel capacity 1½ yards / min.

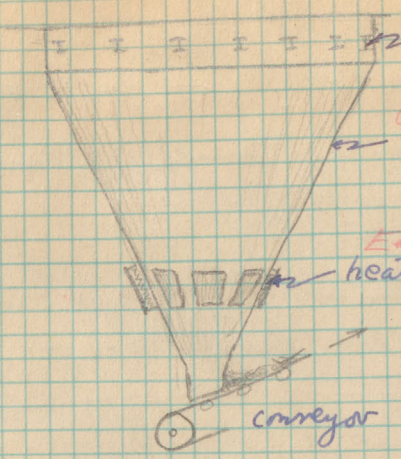
The required head is kept in the pipe by turning up the end. (How well explained!)

Spigots discharge 7/8 in. winter, 5/8 in summer

The water is removed from the center of the dam by a pipe, and goes to a settling pond at the side. The sludge can flow to an emergency pond by gravity should the power fail.

(The angles in the pipe are cast) (How clear)

(No a shovel - a drag-line excavator)



Heated Bin
at ———

(Tailing Dam. 12 in. Diam. pipe.
Wood Stave Pipe & Coupling – Used ——

Sand Pit

The sand is loaded into cars by means of an Byes electric shovel on a caterpillar tread, 1½-Cu yds capacity, driven by 2 motors 100 H.P. for the hoist. 60 H.P. for moving. This shovel loads 4 cars, self-dumping, with steam coil heated bottoms, pulled by a small steam engine.

Dumped into a conical bin, through a 10 in grizzly. The bin is heated electrically at the bottom. (Why?)

Cable 1 5/16-in. diam. 38500 ft long. It is held taught by a 13-ton weight geared to the take-up device which gives 14 ft of play. Capacity 3000 ton per day 24 hr. Motor 100 H.P. Running at 2000 tons/ cost 12c per ton.

The quality of the sand is determined by filling a 10 ft pipe, 1 ft diam, with it, placing the pipe over a ¼-in perforated screen and pouring water through the pipe. The amount the sand settles during a given time determines whether the fill is too fine or not for fill.

The sheaves are copper lined. Buckets self-dumping. Equally spaced at 60 ft. This is important otherwise the rope will jump the guide wheels.

(The grooves of the terminal sheaves of cableway are copper lined.)

← Suspended weight.

McIntyre Conveyor. ~~Take off~~ Rope Tightener.

McIntyre ~~take off~~ Conveyor

Note: Full bucket is not attached to wire but simply rests on it.

Safety

One first-aid station on surface, and three first-aid men in attendance. No doctor on premises. All injuries, no matter how slight, must be reported to the shift boss and first-aid. A check is kept of all the injuries of each man and they are divided into three classes Major, semi-major and near accident. A graph is made showing all the occupations and the accidents in that branch so that steps can be taken to decrease the number. A set of safety rules has been drawn up and the miners are required to know them. All men are required to pass the St Johns ambulance examinations and classes are held in the company's own time. Safety posters and signs are placed at every level on which are such as stretchers and first aid kits.

The names of the captains, with the number of shifts since the last lost-time accident after them are posted in a conspicuous place, and a prize is given to all the members of a shift if they go a certain number of shifts without any accident.

The principle is to get the miner safety conscious by competitive means without differentiating between bosses and men. e.g. no safety bonus is given to shift bosses. From the diminishing number of accidents it would seem that this

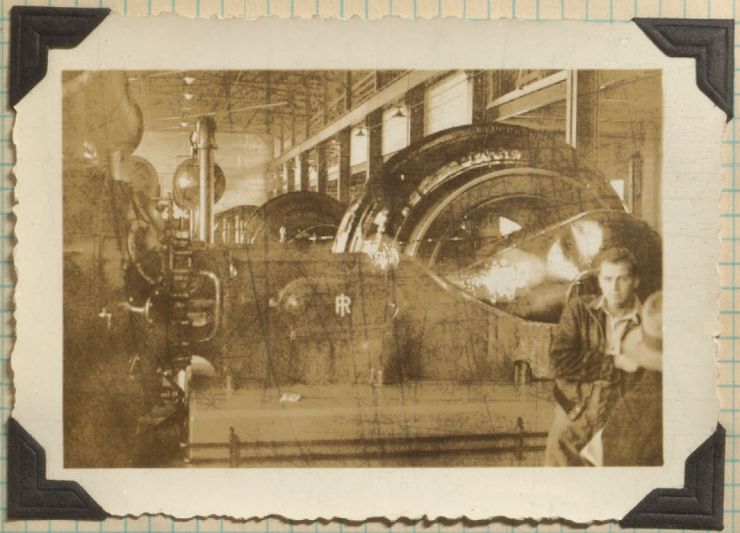
Sand pit Steam Engine

Powder Magazine

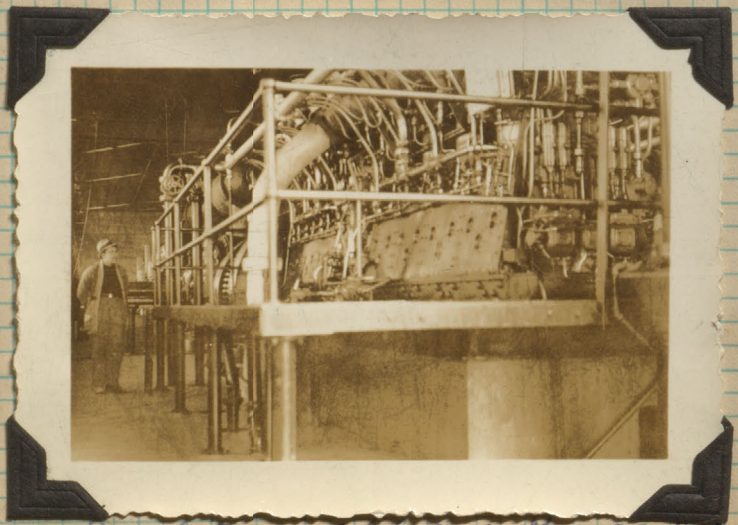
Note : Air vents

(method) is very effective. Giving shift bosses a safety bonus was found to be (vicious.) (!)
Compare with Frood I.N.Co. where the safety practices (are enforced by intimidation)

(Avoid statements such as this, even though you may think so.)



Compressor Plant



Diesel Engineer (from a Russian submarine) in compressor plant should be here-for.

7 ton skip from Crusher to Mill Bins Operating Between

Note:- rubble coolers on rope guides.

self dumping wheel

Do not understand. Mill Cleats

Hollinger Mill

Note The numbers opposite the paragraphs refer to the numbers on the flow sheet.

Crusher

14 The rolls are kept even by turning them with tool steel every day. Are almost choke fed. 75 H.P.

Size from crusher - $\frac{7}{8}$ in.

Taken to mill in two 7 ton skips. This gauges the amount of tons per day. Nordberg hoist 350 H.P.

Grinding and concentration

5B. Primary grinding done in tube mills. Two rods of 350 lbs added per day. Rod mills discharge to tube mills and tube mill discharge is 70% - 200 mesh.

Experiments are being run which use Marcy Rod mill as a ball mill in closed circuit with a Dorr classifier (capacity 10 000 - 12 000 tons / day). It is hoped to get finer grinding and possibly eliminate to a certain extent the tube mills.

6. Pebbles from Denmark are used in the tube mills.

10. 112 Concentration tables. Deister tables 275 vibrations / min. $\frac{3}{8}$ in stroke, slope 1 in 12 by 1 in 2. Double-decked, driven from overhead countershaft.

Three stage single tray counter-current decantation.

15. Regrinding tube mills use steel balls, pocket lines (lasting) 300 days. 99% - 200 mesh.

21. Pachucas, are in series agitation takes 16 hrs. 30 lbs/sq in air pressure; (all?). Discharge:- 34% goes to primary fillers 36% to three-stage decantation plant.

24. Counter-current decantation.

The pulp is added at one end of three single tray thickners in series, drawn off through the spigot of the first and discharged into the top of the second, by means of a diaphragm pump, and so on through all the trays. The barren soln. is added at the other end and flows in the opposite direction to the pulp.

40 Oliver filters. Canvas lasts 300 days washed with dilute sulphuric to get rid of the lime.

Miscellaneous

All figures are based on $20.67 per ounce

Tailings 9c { 1.7 cents solid
1.6 cents soln.

Recovery 96.1 %.

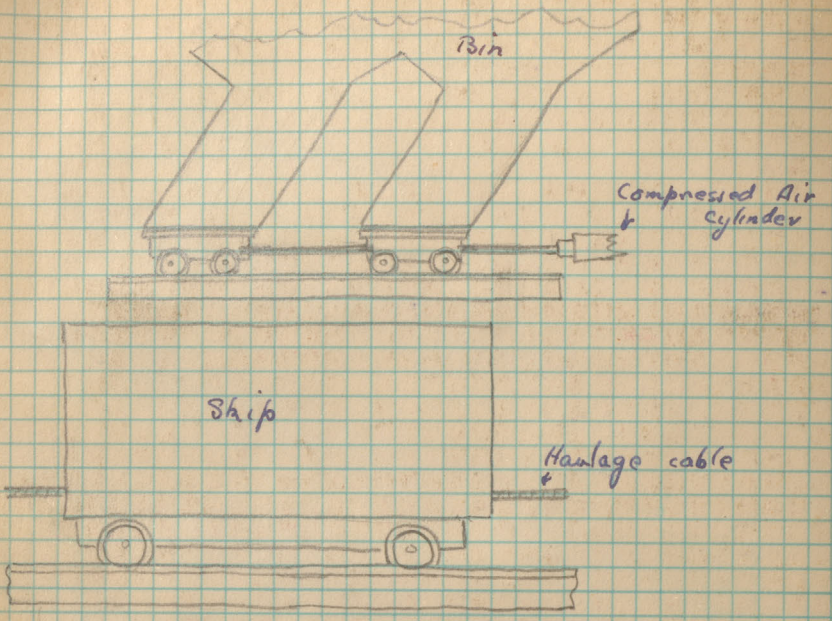
Milling cost 64.74c per ton of ore milled

Lead acetate per ton solution	= 0.0085 lbs.
Zinc dust " " "	= 0.0957 lbs.
~~Free~~ Cyanide (Kind) " ore milled	= 0.479 lbs.
Lime " "	= 2.10 lbs.
Rods ~~in mill~~ " " "	= 0.638 lbs.
Pebbles " " "	= 1.74 lbs.
Balls " " "	= 0.582 lbs.

Amount of sulphides 2 %.

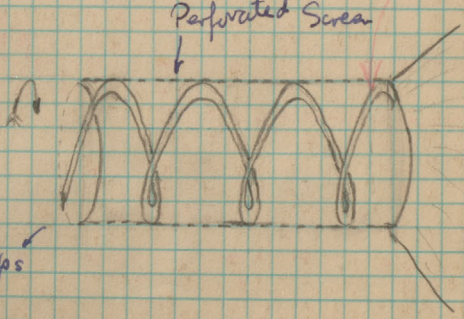
Total mining cost	$ 3.25 per ton
" milling "	= $ 0.647 " "
Total cost	= $ 3.897 per ton.

mining & milling (1935 figures)



Skip Loaders ~~from~~ at 500 ton bin (Shaft)

(Enlarged Plate)



Screen on Ball Mill Discharge

THE DOME MINE

Note :- The numbers opposite the paragraphs refer to the numbers on the flow sheet.

Crusher

The 2 skips, capacity 4 tons, dump into a 500 ton ore bin. The ore is transported from the bin to the crusher house by a 20-ton car. (Same principle as the Holbinger.)

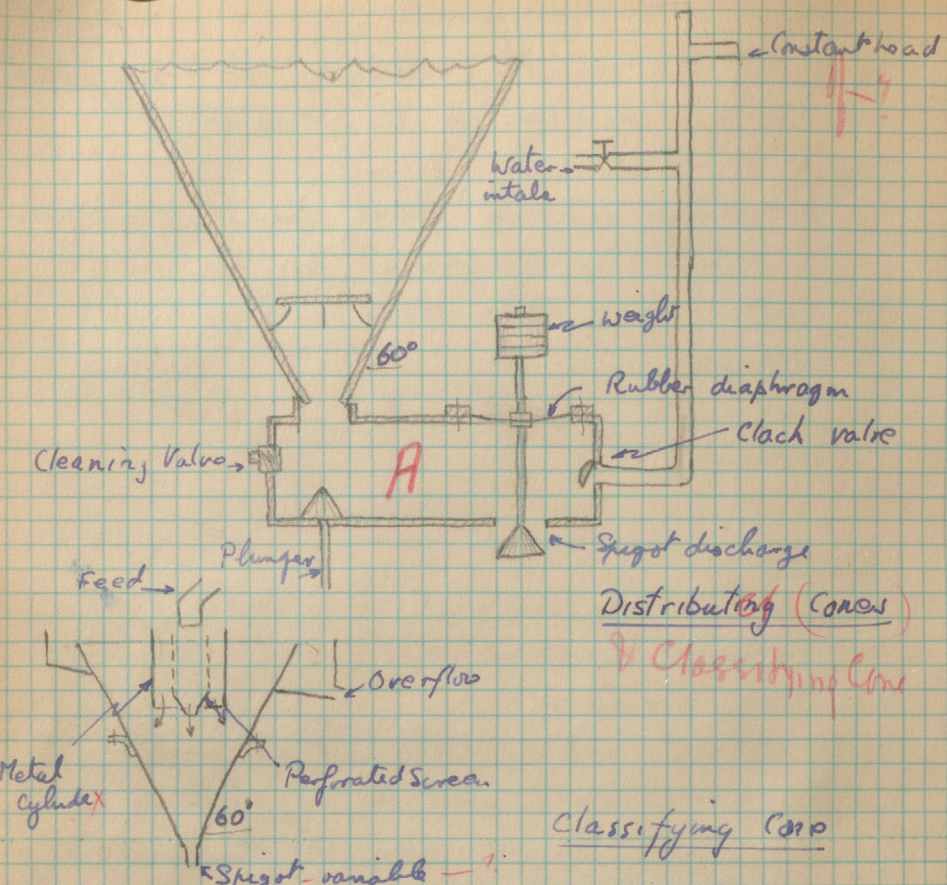
7. Lubrication for jaw-crusher was water, oil, and soft soap.

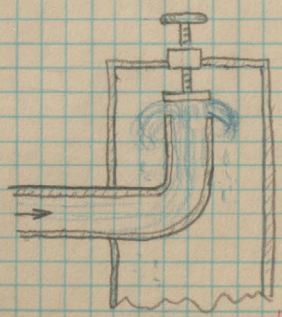
Grinding

27. Belt feeding ball mills is moved in jerks, (same principle as stamp mill.) Feed to mill is 530 tons. Discharge $\frac{1}{4}$ in. Motor 150 H.P 140 ∝. Each unit is equipped with its own ammeter and the way the mill is grinding can be denied from the fluctuations of the ammeter needle.

31. The mills use $\frac{1}{2}$ in. balls. 150 H.P motor. Wave liners. Helical drive. The circuit runs twice in gold values as mill heads. It takes down fine heads of concentrate.

29. Two classifiers to ore ball mill. Specific gravity of pulp is lowered by heavy spray of water in the rakes. (Sand overflow 120 mesh)





Control valve for Tray Thickner

38 The distributing and classifying cones are
39. used instead of a bowl classifier

Overflow 852 ± 200 mesh

The centre cone distributes to 8 smaller cones
The automatic discharge of the outer cone is
shown opposite page. The spigot box fills up with
sand and water, and the head pressure due
to the head in the cone forces the rubber diaphragm
up and closes the spigot. At the same time
the clack valve is closed. The water in the
sand then seeps out through the spigot
and a cone of sand builds up in the large cone
which takes the pressure. The weight then force
the spigot valve open, and with the pressure
released the clack valve opens whereupon
the water flushes out the sand in the spigot
box. Sand is discharged through the cone
and the operation repeated. The opening of
the clack valve at the right time is
regulated by the constant head.
The box can be cleaned by raising the
plunger and opening the cleaning valve.

The cone is very cheap and efficient, but
hard to regulate and must be carefully watched.

The classifying cone (intake) is as shown.
This layout is important otherwise bubbles of air
will get into the pulp, and cling to the solids
and give bad classification. The size of
spigot can be varied by inserting a different
size of pipe.

Dome Flow Sheet.

Crusher.

Underground Buchanan Crusher – 8" set

Skip

500-ton ore bin

Transfer

20-ton car

Jaw crusher – 4 in set

Hammer Screen 1" × 3/4" mesh

Oversize — Undersize

Symonds cone 1/4" set.

3 Hummer screens 3/4 – 3/8" mesh

oversize — undersize

Buchanan rolls 1/4" set

1800-ton bin

Grinding

3 Hardinge ball mills

5 Duplex "D" Dorr classifiers

Sand. — overflow

5 Tube mills

A regular cycle of 4 stages

28 Blaisdell tables

slimes — concentrate

Amalgam barrel

Refinery

Cone classifier

Spigot — overflow → Lime added.

C Dorr classifier

?What do you mean?

4 Balanced tray thickeners

Sand — overflow

4 Pachuca agitators (pre aeration)

2 Tube mills

Cyanide added.

8 Pachuca agitators

Surge tank (lime added)

Slime

5 Merrill Filters (desliming)

Unclarified solution — Tailing

Dorr thickener

2 Merrill clarifiers — Tails

Tailing Dam

Clarified solution

?— Crowe tank

Merrill precipitation Filters Presses → Refinery

The tonnage of the mill is measured by discharging the pulp into tank of known dimensions, and the time noted that it takes to fill it up. The Sp. Gravity is taken and the tonnage calculated. This is done every two hours.

36 Pachucas. The slimes are preaerated this was found to be necessary, for otherwise the pyro sulphide would precipitate the gold from the cyanide solution. Air 35 lbs/sq in

44. Lime is added through a small ball mill must be kept at 0.07 lbs/ton in pachucas The amount is determined by titration. Date is added and lumps of lime add to balls.

47. The overflow, or clear solution from the trays thickners is controlled by means of a valve shown opposite page 35.

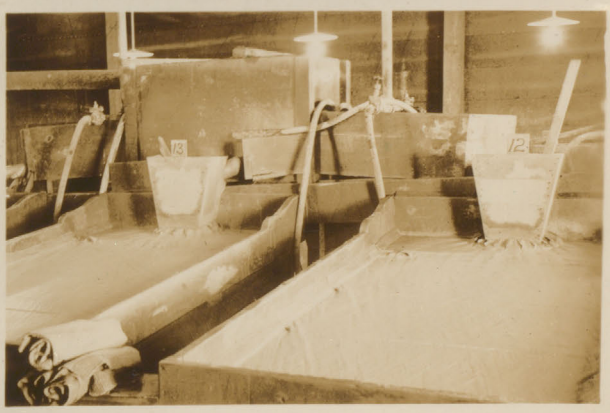
62. The Merrill slime filters are washed out every half hour by a barren and water wash

33. Blanket tables 1 3/8 in to ft slope. 8 blankets, used changed 5 times every shift washed in water. after 90 days blankets are removed and leached in cyanide solution. 70% of gold is extracted here. 2000-4000 dwts of gold to 1 ton concentrate. (seep. 37)

Amalgamation.

Concentrate is put with balls mills and ground with lime for 16 to 18 hrs. Mercury added and re-ground for 2 hrs. goes to clean up tank, wood and slimes float on top, and are returned to blankets, steel & amalgam goes through finger. Steel is removed from amalgam by hand. Excess Mercury is removed from the amalgam by a press goes to refinery where mercury is distilled off. (Amalgam 192 Hg) Hot water is used for the amalgamation. Mercury loss is less than 0.04 %

Cone Classifier



Blanket table

Note:- only top blanket is held

Rubber distributors

Return launder

Tank for washing blankets at back

The iron from the amalgam (solution) is placed in the ore (i.e. exposed to the elements) and crushed (passed over through) a ball and tube mill. Then over an amalgam table
Tailings run at 16 cents/—
Mill heads — $ 12.50 cents/—

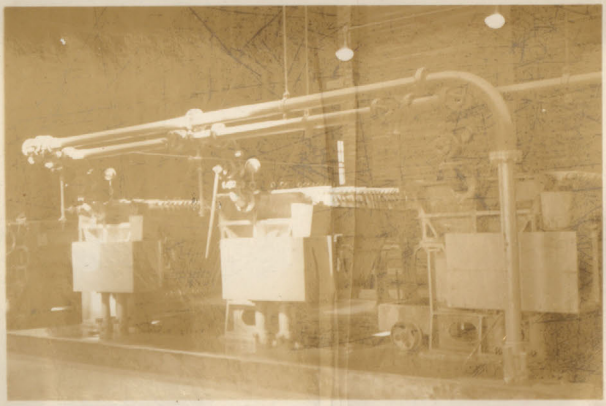
Refinery

Pot. Presses in mill cleaned every 10 or 11 days
Sulphuric (?) strength 12 - 16% is added in lead lined tank and agitated for 4 hrs by means of wooden vanes. Water is heated by steam.
Glue added to make solution settle.
Top part of solution is pressed ; Spigot discharge washed
Montejus used.
Precipitate roasted (with coal)
Fluxed with 20% Borax 14% Silica 1/4 % MnO_2
Fluxes are mixed in a hermetically sealed mixer then put into graphite pots inside Battersea pots and placed inside a reverberating Temperature 2400°F.

(Above is not a clear logical description of method)

Reference

Killing methods 1939 AIME p 624
Give complete details of Blanket amalgam



Heidl clamping presses
ore bin in background

Surface.

Assay office.

Very many precautions are taken against men getting ulcers, and lead poisoning. Mixing of fluxes is done either by in airtight boxes or in a 'fume cupboard' with aspiration electric fan. Men eat together in separate thermostatically controlled room. All flue bores are designed to eliminate eddy currents. Ventilation ducts

Crusher house divided into parts to eliminate dust giving wrong results in samples. Samples are graded by eye (if they contain free gold.) Sample baked & dried, crushed (8-10 mesh) twice through rolls (-200 mesh). Large draught in crushe room to remove dust. Men equipped with masks. Samples are put through Jones riffler. Rejects kept 3 days. Diamond drill cores are kept 9 months.

Samples are kept trace of by metal & paper tags

Electric Muffle. No bottom tray of metal. Bone ash on top of fire brick. Osbins muffle with elements on the side and top. 4 elements last 23000 assays. The muffles are mounted under a travelling crane, and once a week each one in turn is taken down and repaired if necessary.

Pot fusions:- 15 fusions per pot.

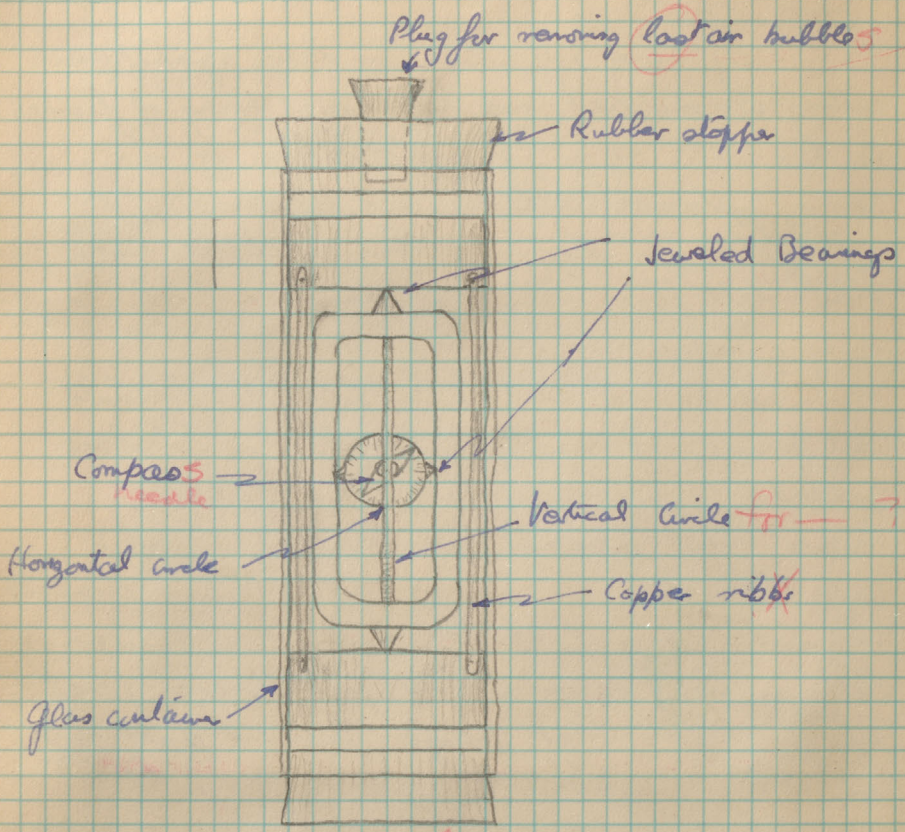
Charge of Flux 50lb PbO, 35 soda, 15 silica, 12 borax, ½ lb flour. Flux ratio 8:1. Flux to ore 8:1

Diamond drills run in triplicate, Rendues 6.

Fusion (1800 - 2000 °F. 20gm pots left in for 25 minutes

23000 assays per month.

Silver added as $AgNO_3$. No salt.

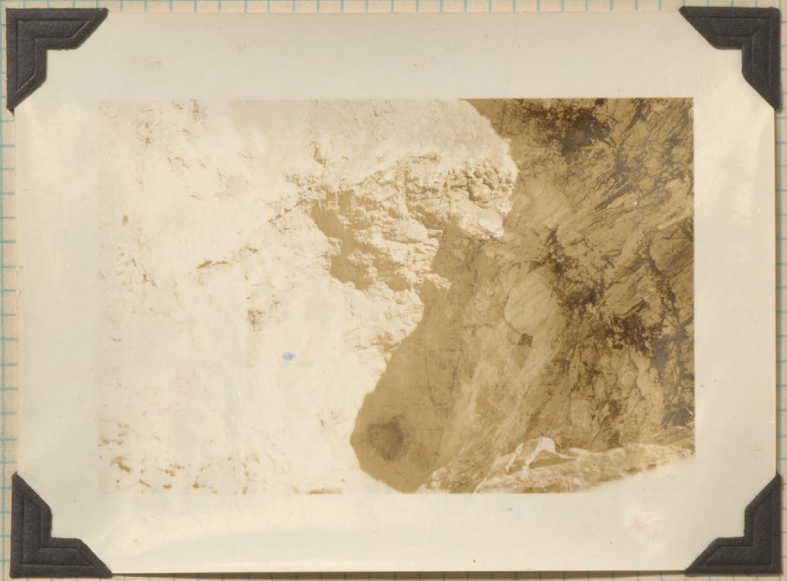


The Carlson Compass.

Cupelling :— Cupel ^ 2 parts cement : 1 bone ash
Dry 2 weeks. ^ Button ^ 20 - 30 gms.
Parting ^ = 1 HNO_3 : 5 H_2O
The Chiddy method is used for solutions
Small annealing furnace.
Balances :— One (spring) balance used ^ $ 293 as well as two ordinary Emkling an (English) balance very satisfactory. Spring balance sensitively 1/500.
All the balances are on a lead sheet which is (connected to earth) to eliminate static. Balance table on mounted on H-beams. ^ Lights ^ 3 ft above balances to prevent air currents.

Carlson Compass

The compass is inserted in a glass tube which is in turn put into a brass container. The container is separated from the rods by 20 ft of brass tubing. Gelatin is the glass tube containing the compass is filled with gelatin (which sets in 1½ hrs) and lowered into the hole. The tube compass is then drawn out and the compass can be read without taking the tube out of the glass.
Recomended by all the mines in this camp.
Price $ 75



Glory Hole

Hoist

Cage Hoist:- Nordberg angle drum double wound i.e. rope came off both sides. Rope speed 2500 ft/min 350 HP. Lilly safety control; parallel, hardwood bales. The cage has a counter balance, this is why it is possible to have one drum since the rope length stays constant.

Skip hoist:- Nordberg double drum electric. Drum 7 ft diam. Rope speed 1650 ft/min single reduction. Positive tooth clutch. Motor - Westinghouse 396a 600 H.P. 735 rpm.

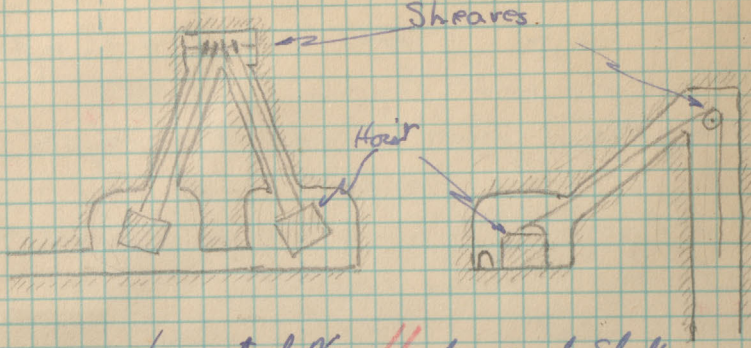
Steel Shop

Drill ~~rods~~ rods quenched except shafts which is oil-quenched. Magnetic annealing control. O'Donavan heating furnace. In this furnace the steel does not come into contact with the flames. Steel hardness tested by means of a Firth hardness tester.

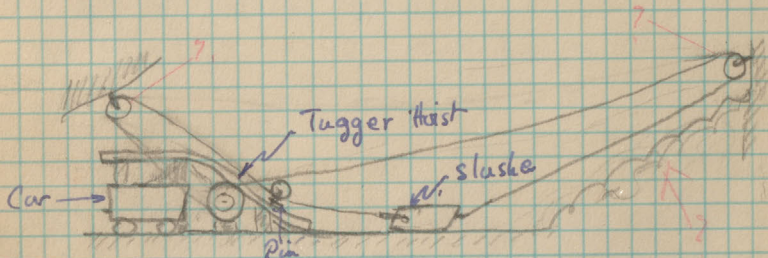
Air Compressors

3- Bellis and Morcom. Capacity each 2500 ft³/m. 33-19-13 in stroke.

Motor 15 highest of 240 rpm 3 phase. Power measured on the 15 highest 3 minute peaks.



Layout of New Underground Shaft.



Layout for Slusher Scrapers

Underground.

Shafts

One main shaft to surface, five compartment. Two 4 ton skip, cage, counter-balance, pipes and manway.

New shaft being put in at 2100 ft. Much being removed from future hoist room by scrapers

Haulage

50 in gauge, 35 lb rail. Battery locomotives and trolley, 4 ton Granbys. Self-dumping. Men are taken from far distant working places on cars. Switches have red and green lights. Vertical switches now horizontal.

(You can express this much better)

Drifts and Crosscuts

All drifts are 10 x 10 ft. The manway in the main haulage drift is separated from the trolley track by pipes. Latrines near station.

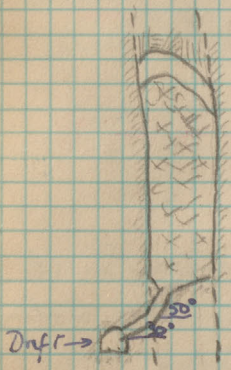
Sketch?

Ventilation

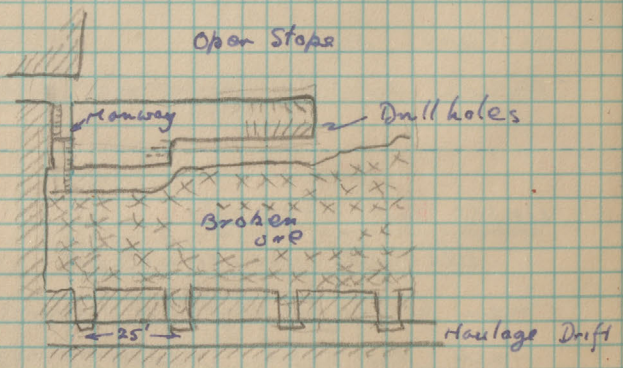
Natural. It is aided by having an intake through the glory hole. The drifts leading to the hole are always frozen so temperature is cool. In stopes air circulates up through broken ore, and manway. (Air hose also left open).

Poor

not much if any - when much ore broken



Vert. Section
Aft. Angle to walls



Elevation

Shrinkage stope

Pumps

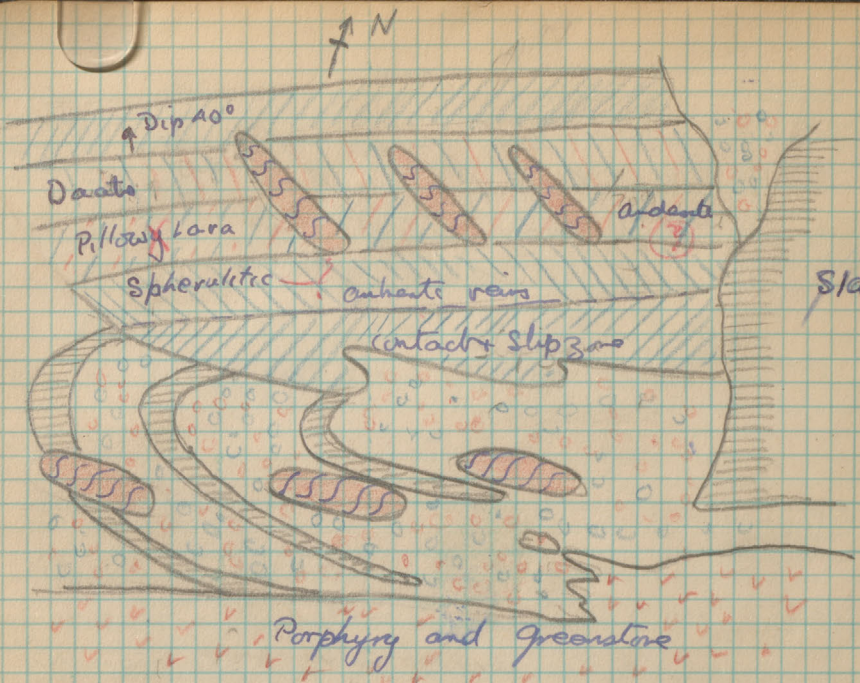
Station	To	Make or Type	Size	Cap. gals/min	Head	RPM	HP
23 level	16 level	Smart Turner	3×6 in	150	1000	—	10
16	14	Joseph Evans	6×4	300	300	52	25
14	11	Gold's Vert. Triplex	6½×8	115	450	33	25
11	8	" " "	6½×8	115	450	33	20
8	Surf	Aldrich Vert. Triple	6×12	250	900	—	75

Stoping

Shrinkage method. Boxholes at 25 ft centres, 6'×7 ft wide. Sometimes it is necessary to cut two drifts so that the ore may be pulled. Shrink is kept pulled to within 6 ft of roof. Roof is arched from the hanging wall to the footwall as shown. This is to prevent spalling off of the footwall. One helper to two machines. No fill has been necessary in the upper levels and very large stopes have been left unfilled some 1500 ft long, 1000 ft deep and 25–60 ft wide.

Drifts 5×5 ft are taken out by raising the stope beneath to within 25 ft of the drift and then drilling from underneath and from the top in a fan shape, spacing the holes 3 ft apart. Electric detonators are not used. If possible, fuses being used up to 4000 to 5000 holes.

Black and white coloured fuses are used (1 ft in 20 and 39 secs respectively). Caps crimped on underground. Powder houses not kept locked.



Legend

- One body with S shaped quartz veins
- Slate
- Lavas
- Conglomerate
- Porphyry

Your geological work-up is badly mixed-up. You probably have the correct ideas but they are poorly expressed.

geology

The country rocks are all pre-Cambrian composed of

1. A series of lavas of the Keewatin Andesite pillow lava, Dacite Spherulitic
2. Sediments Temiskaming
   Slates sometimes folded into waves and Conglomerate which contains fragments of lava (and some porphyry?)
3. Porphyry, and Diabase dike from the Keewatin.

The oldest rocks of all are the lavas and they have been laid down (with the latest layer on the north side.) This can be determined from the size of the crystals in the flows. Since they lie on top of the conglomerates they must have reached their present position by a thrust fault. The porphyry was probably a later intrusion and the diabase dikes cut all the rocks. They have no connection with the ore bodies, show quick cooling, and calcite veins.

All the lavas and conglomerates lie on on the south side of a synclie raking east. The conglomerates form a synclie the axis of which dips N.E. And the ore bodies rake up east.

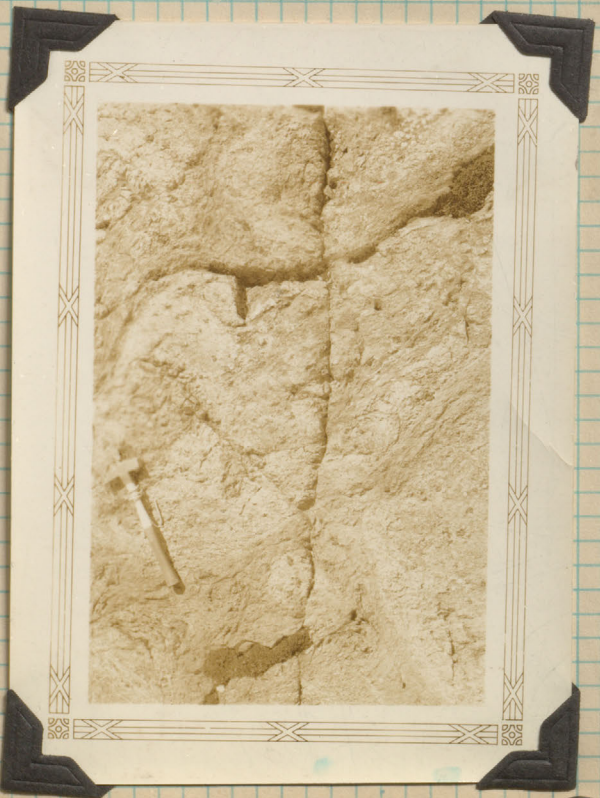
When the rocks were folded cracks were produced in the lavas and sediments and minerals intruded. The minerals were quartz, free gold, and pyrite.

Spherulitic Lava

No ore bodies are found in the lavas below the level of the conglomerate. The rocks surrounding the ore bodies are slightly mineralized. Intrusions also occured along the contacts of the lavas, forming anhérite and quartz veins about 6 ft wide. These are being mined at the present time.

The shaft is in an anhérite vein but a pillar of 150-ft radius is being left around it.

The ore bodies themselves are lenticular in shape the long axis being east and west and vertical. They are composed of quartz stringers formed in an S shape.



Pillowy Lava.

Flow Sheet — (Which Mill?)

100 Ton Bin

Jaw crusher 15 × 34 in

Double decked screens

$-\frac{5}{8}$" | $-1\frac{1}{2}+\frac{5}{8}$" | $+1$"

200 ton bin | 42" rolls | 4' Symons Cone Crusher.

Niagra Screen

$-\frac{1}{2}$ | $+\frac{1}{2}$"

400 ton Bin

Cyanide solution added

Lime

Hardinge Ball Mill 7' × 36"

Hardinge Counter-current classifier → Sands

Bowl classifier

Sand | overflow

Tube mill 5' × 16'

Dorr classifier

Thickener

Slime

overflow

Kind? Purpose

overflow

Sand

Merrill Press

gold tank?

Zinc feeder

?

4 Pachucas

American Filter

Filtrate

Slimes

3 Dorr agitators

Counter-current decantation

Fish Filter

Solution storage

Tailing Pond

Buffalo Ankerite

Mill — how — ?

Grinding is controlled by the bowl classifier. It is 95% ↑ 200 mesh — ?

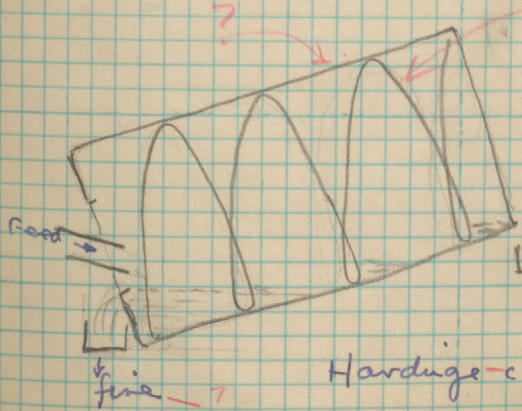
Cyanide is added at the Hardinge ball mill, bowl classifier and Pachucas (Solution is 0.005% — ?) what do you mean?

Ball mill liners are Mn-Mn steel-wave type. The classifier overflow is 2:1 ? Motor 125 H.P. Tube mill motor - 150 H.P. 375 r.p.m. (for?)

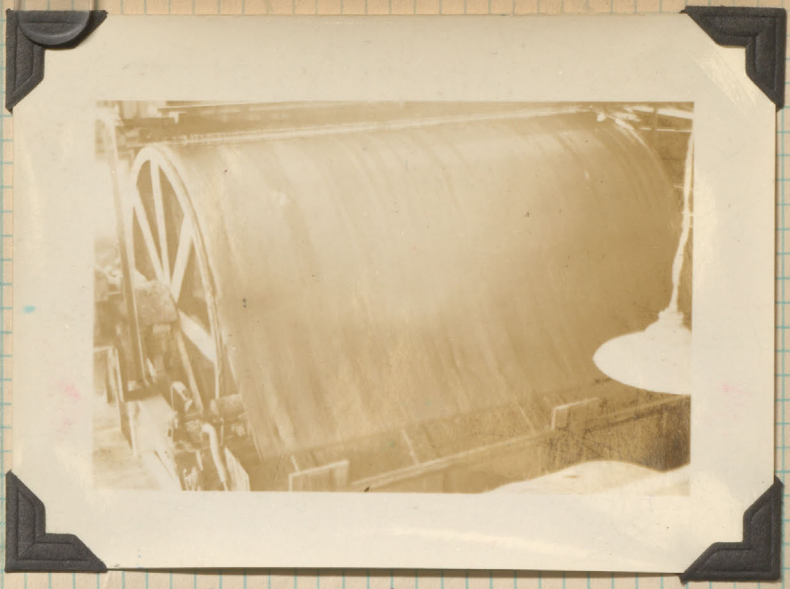
The tonnage of the mill is computed by taking a cut 1ft long of the load on the main feed belt, weighing it and knowing the speed of the belt, the tonnage can be calculated.

The Wemco screens are vibrated by means of a (two stroke motor out of balance) — (!) (?)

The cake in the sink filter is lifted off the cloth by means of strings. No compressed air is necessary. Cake about 1 in thick (See p — ?



Hardinge-counter-current-classifier



Tank string Filler

Note agitators at (side) end?

Classifier + tube mill

Hoist

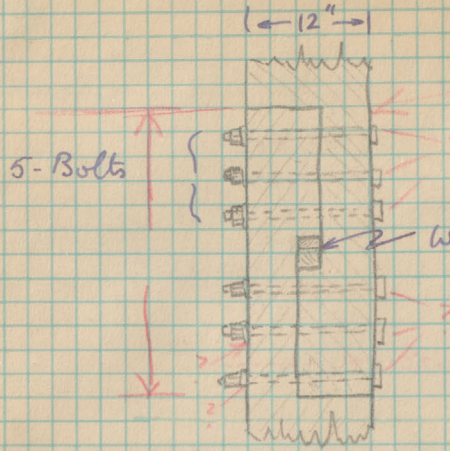
Ingersoll Rand, double-drum, electric.
Motor 150 H.P. Speed 750 rpm.
The drive (to the Lilly governors) is by means of chains). This has to be changed.
Hoistman answers signals received from cage tender

Poorly expressed. Why?

Compressors

1- Ingersoll Rand, capacity 2600 cu.ft/min.
Size 29½ × 18 × 16 in; pressure 100 lbs; speed 250 rpm.
Motor 500 H.P.

1- Chicago Pneumatic, capacity 1400 cu ft/min
Motor 280 HP. 550 v 179 a Belt drive.
Size 20 × 12 × 14 in.



Method of Splicing Back & end of Head Frame.

(No chain on cage.)

(The ~~shaft~~ chains for the cage are) chains are fastened to the ~~side~~ timber of the shaft at every level. (They) are simply hooked onto the cage, and automatically come off as the cage is hoisted.

(How?)

Underground.

Shaft. — (which?)

4-compartment, ship, cage, manway & pipes, and a sinking compartment.

A winze has been sunk from to 875 level and was intended for the 1000 ft level but below 800 ft it was driven through serpentine, which has since moved and twisted the shaft, and —— ?

Levels and Crosscuts. of —— ?

Dimensions 10 × 8 ft. Ditch on one side to remove water seepage (keep level dry). Not timbered except in serpentine zones.

Ore passes.

All the ore is either (pulled) on 600 ft level or else it is hoisted to the level by means of the winze. No fill is ~~run~~ into the mine. Most of the walls stand well.

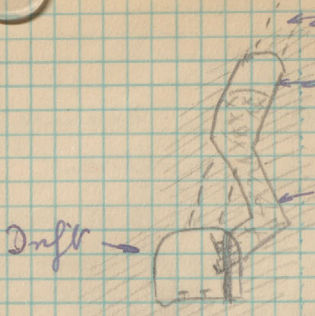
(a winze cannot "hoist"!)

Haulage

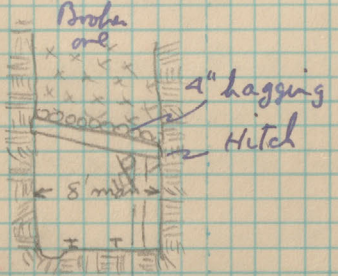
Track is 18 in gauge 30 lb rails. One Battery locomotive on the 600 level. Hand tramming from chutes. gradient 0.45 % where? Hudson cars, 1½ tons. all chutes are pulled (from the drift) — what do you mean?

Ventilation

Natural.



(~~Box hole~~) shrinkage Stope
(or Shrinkage Method of Mining)
Using Boxholes (or Solid Back)



Narrow Stope

Wide stope

~~Stull~~ Shrinkage Stope
(With Timbered Back)

The

("The first lift is taken down with light blasts of charges of powder)

Pumping

All water is raised to 600 level and from there to surface.

600 level pumps is Mathews and Platt ——— ?
Capacity 250 gals/min — 700 ft head, 1450 RPM
Motor 550 volts 50 HP 72.5 A
Sump divided into two compartments to allow settling ——— ?

Stoping.

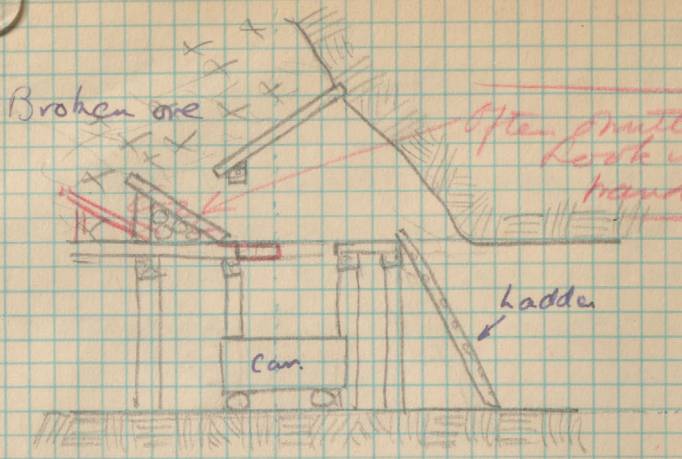
Shrinkage. Both the boxhole and the cribbing method is used, but the boxhole is being superseded because it does not give complete recovery of all the ore — ? and also because it is more expensive

a drift is driven along the vein following all its turns (too expensive otherwise) and for boxhole shrinking a chute boxhole and chute are put up as shown ——— ?

When stulls are used a slash 15 ft high is taken along the vein. The timber is then put up as shown, after the muck has been removed.

The first cut is blasted down very lightly The muck is kept pulled to within 6 ft of the roof. At the same time a raise is put through to the level above to bring down air and water. By this means the pipes are shortened as the stope goes up.

The walls hold well and there is not much dilution at ——— ? by ——— ?



Type of Chinaman's Chute.

What do you mean?

(may be satisfactory)

A type of chute shown opposite was being lined out. It might work if it was well designed. The difficulty is to lies in the size of opening in the above the car. If it is too big there is a lot of spill. If it is any smaller the much cannot get through

(not well expressed)

Contract prices

Stope $ 1 0 per ton hard rock 5 ft narrow Breast. Men buy their own powder Per ——?

Drifting Hard rock $ 8.50
Ordinary rock $ 8.00
Slabbing $ 1.00

(Cross section?)

Timbering Stull - $ 7.50 ——?
Cap and post $ 6.00
chute $ 10.00 ——?

Extra post 60c.

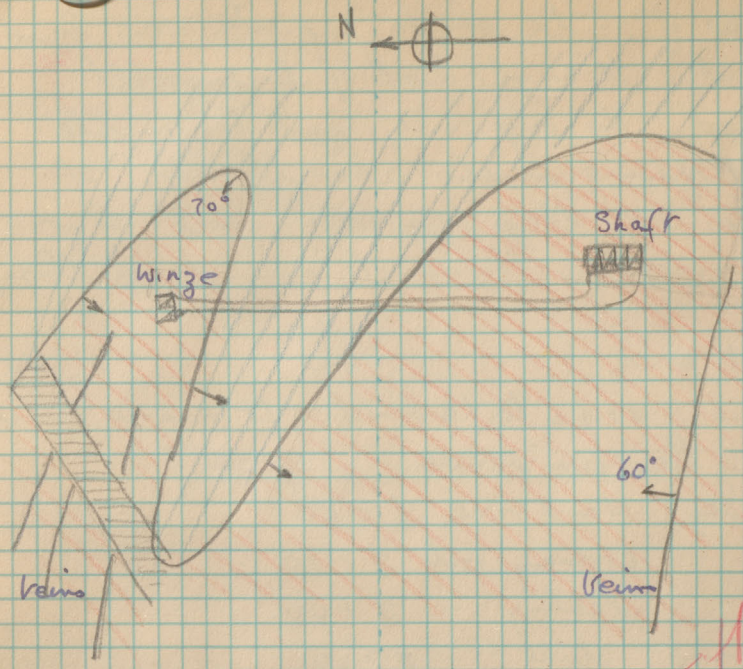
(The day (pay) and the materials is subtracted from the above prices) which are known

The tonnage in a stope is determined by the volume of ore broken (from plans, both plan and elevations kept) and

11.2 cu ft of ore in 1 ton of ——?
17.6 " " broken ore.

(The plans are all drawn 11.2 ft to the in so that the tonnage can be read directly)

(No!) You evidently did not get the idea.



Title ?

Legend

Serpentine + peridotite.

Recrystallized lavas.

Waste zone.

Geology

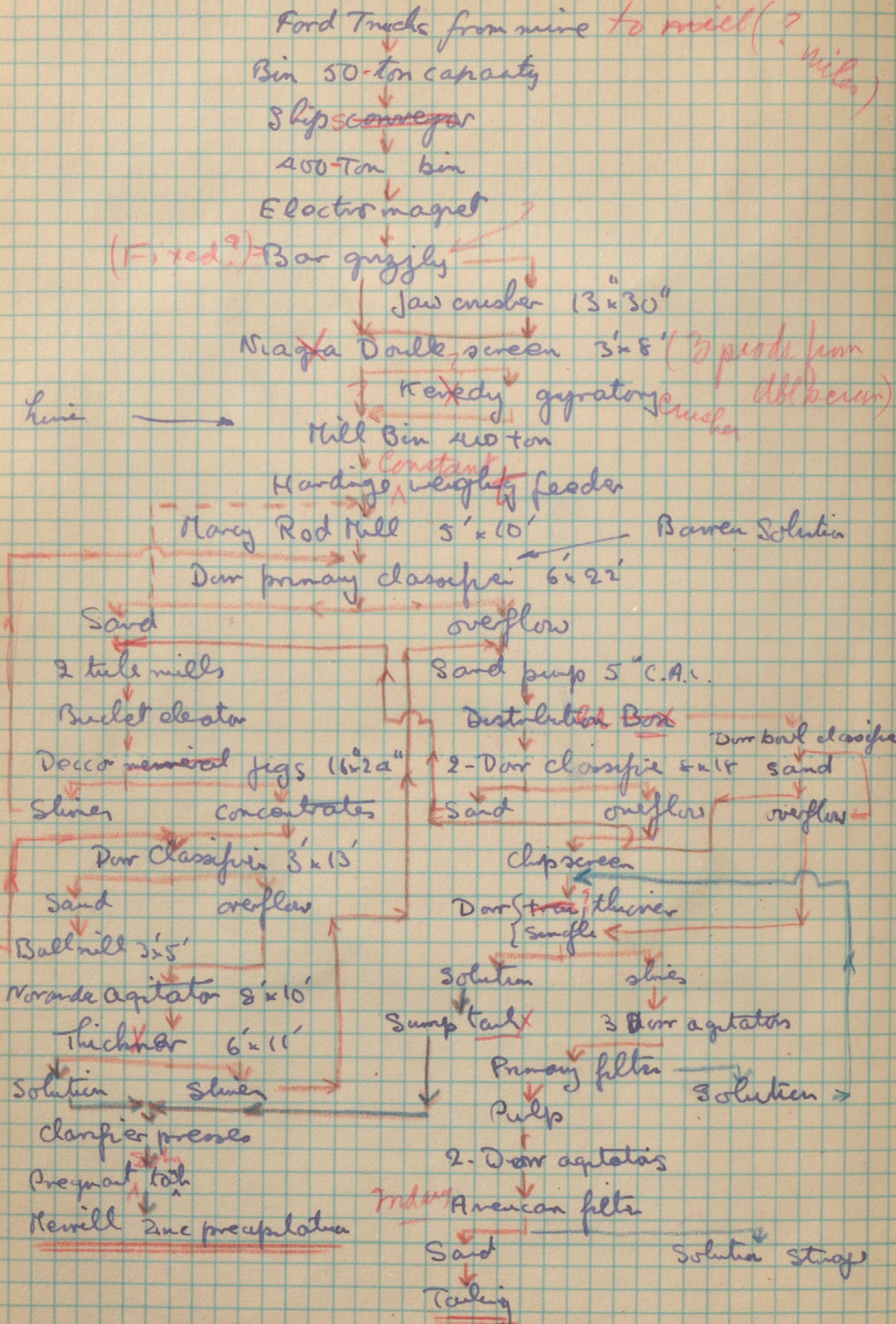
The north orebody is cut by a (barren zone which is wedge-shaped (waste zone) the vein (getting nearer together) as the depth increases.

The (area?) is an overturned syncline plunging north west and all the orebodies rake north west. The serpentine crumbles easily and at 500-level can almost be dug out with the hand.

A fair amount of sulphides (pyrite) in the ore, not much free gold.

A. Paymaster Shaft

Flow sheet



Ford Trucks from mine to mill (? miles)
Bin 50-ton capacity
Skip ~~conveyor~~
400-Ton bin
Electro magnet
(Fixed?) Bar grizzly
Jaw crusher 13"x30"
Niagara Double screen 3'x8' (3 prods from dbl screen)
Kennedy gyratory crusher
Lime
Mill Bin 400 ton
Hardinge constant weight feeder
Marcy Rod Mill 5'x10'
Barren Solution
Dorr primary classifier 6'x22'
Sand
overflow
2 tube mills
Bucket elevator
Decco ~~mineral~~ jigs 16"x24"
Slimes
concentrates
Dorr Classifier 3'x13'
Sand
overflow
Ball mill 3'x5'
Noranda agitator 8'x10'
Thickener 6'x11'
Solution
Slimes
Clarifier presses
Pregnant tank
Merrill Zinc precipitation
Sand pump 5" C.A.C.
Distribution Box
Dorr bowl classifier
2-Dorr classifier 8x18
sand
Sand
overflow
overflow
Chip screen
Dorr tray thickener single
Solution
slimes
Sump tank
3 Dorr agitators
Primary filter
Solution
Pulp
2-Dorr agitators
American filter
Sand
Solution storage
Tailing

Paymaster Mine

Grizzly feeding jaw crusher as shown on next page. Quite successful.

The mill was badly designed in layout, so many of the belts have to be at a steep angle, also elevators are necessary.

Harding weightometer as shown (p 59)

The agitator in the concentrate circuit is a Noranda agitator (see Bannow mill)

Jig. The jigs are Decca mineral jigs (see p 58) with false bed.

The false bottom of the jigs is made of a layer of iron scrap ½" and a layer of Noranda pyrite 1½ in.

33% of the gold is recovered in the jig circuit and 68% is extracted. The gold concentrate is treated in a separate circuit

The tonnage per day fluctuates from 2-10 tons depending on the sulphide contents of ——?

Dorr thickener. Sprays of water are turned into the intake to keep down the foam.

Filters: ¾-in. cake on filters. An Oliver filter is going to be installed

22 lb of Zn added/day

Barren solution ——? ½ lbs of cyanide /ton

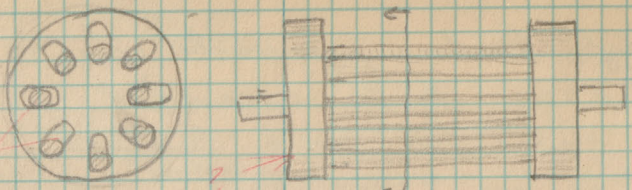
Tailing assays: solid 0.001 to 0.002 oz/ton
liquid 0.015 to 0.018 oz/ton.

Head $ 7.14

Capacity of mill 425 tons/——?

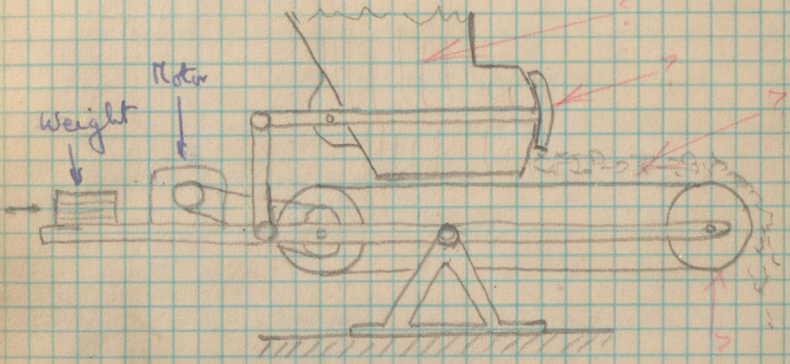
(Running at ——?) 395 tons ——?

Milling now



End Section View Side Elevation

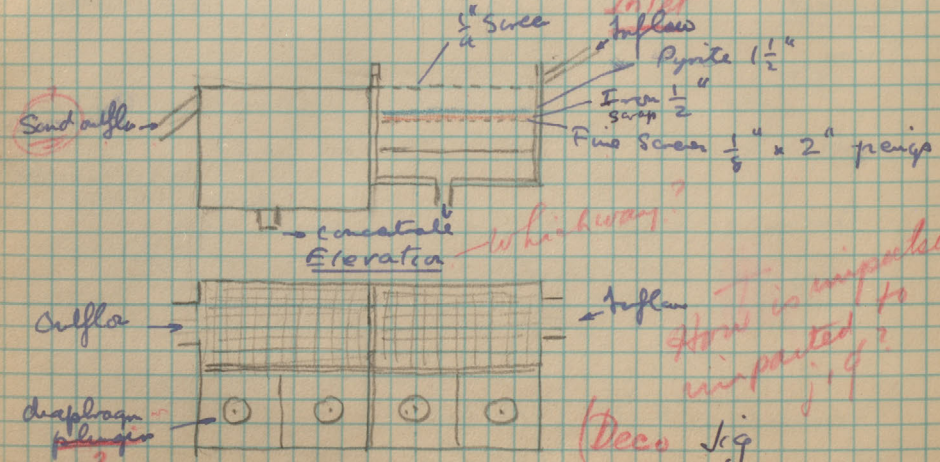
Rotary Grizzly (Loose Bar)



Constant Weight

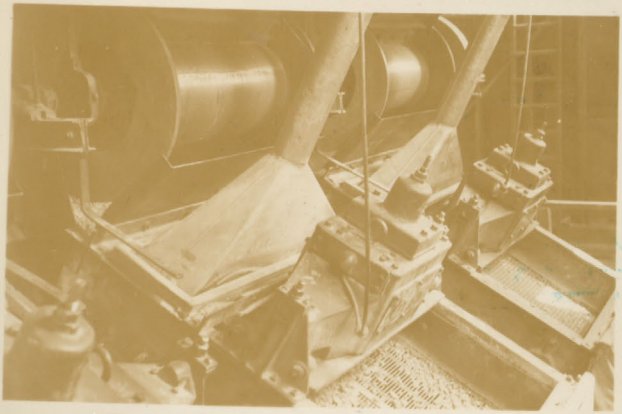
Hardinge weighing feeder.

Increase in feed lowers the right hand end and closes the gate. This keeps the feed perfectly uniform

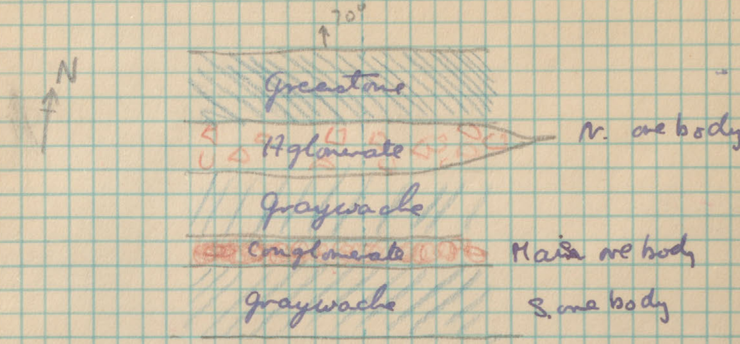


How to impulse impacted ?

(Deco Jig



Hummer Screens (Dome)
Note roll feeders
dust aspirations.



220 level

Title?

[illegible]

Pamour.

Underground

Geology

The ore body is a mineralized agglomerate and conglomerate in a greywacke. Strike N72E Dip 70° The present known length extends for some thousands of feet, but and the end has not yet been reached.

The paying ore can be detected by eyes from the nature of the rock. This is a contact quartz stringers and amygdules, fine pyrite crystals, and anhanite. Free gold is also found. When the pyrite crystals increase in size the gold content is lowed (below the cost of mining). a few vein lie in the greenstone but the main orebody is in the conglomerate and agglomerate and greywacke

The North ore body 12 ft wide (in the Agl)

Main orebody - 30 ft - (in the con)

Small " " 15 ft - (in the greywacke)

120 ft between ore bodies

Ore runs $10 at $35 per oz

Shaft

The main shaft is (11 x 12 ft) 6 compartments. As extensive development is being done ~~The shaft is~~ still used as a man hoist. (!) (!)

Drifts and levels

Driven by two machinemen and 2 or 3 muckers. 10 x 10 ft. Pipes, electric couplings. Contract is based on $7 for greywacke $8 for conglomerate. ~~Pipes~~ (Mud hole at steel plates)

Ore pass

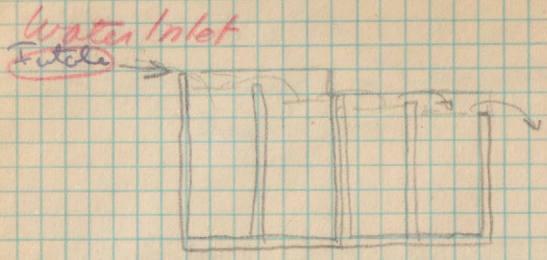
Main ore pass ~~going to~~ under construction will connect all ~~the~~ levels

Haulage

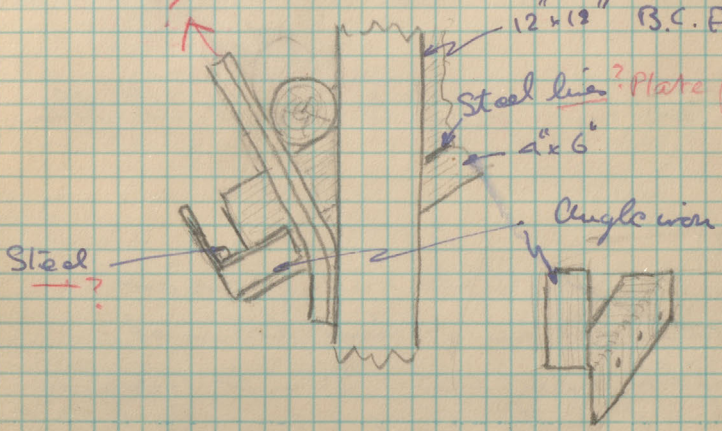
Track: 30 in gauge 30 lb rail. Cars are at the present all hand ~~dum~~ trammed. End-dumped ~~1 ton~~ car. 30 cu ft capacity. 30 cu ft for Miranda? Trackmen lay the track it is not left to the muckers. Machinemen are responsible for the grade but it is checked by the Engineers. The water from the drifts is removed at present by light pumps. No timbering necessary

Tipple

The tipple installed will be able to rotate in both directions and dump the cars without uncoupling them. One side ore the other side waste. (By which arrangement?)



Sump intake Settling Boxes At Sump.



Sketch of Clu Kend

Poorly Stacked.

Pump at 900 level

3-stage ~~centrifuge~~ 75 HP (~~Spigot~~ + in

300 gallons / min McCullough pump.

The Sump (intake?) was made of 3 removable wooden boxes with baffles as shown (Reason for?)

Chutes

Massive. ~~Iron~~ line. Lined with steel plate. See diagram.

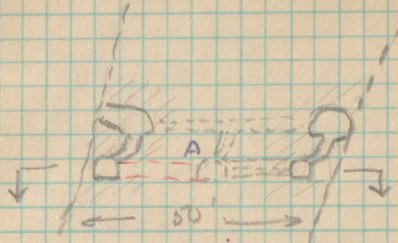
B.C. Fir timber used throughout, ~~planks~~ dressed, no ~~Stoping~~ rounded timber. They are (put up) when the faced boxhole is 10 ft above the drift.

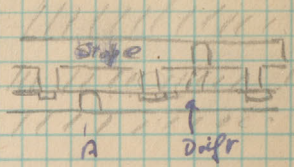
Stoping

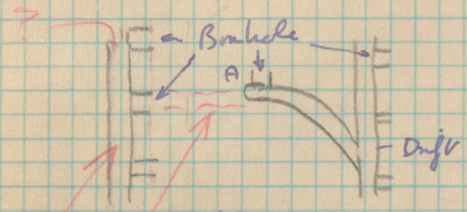
Shrinkage method is used.

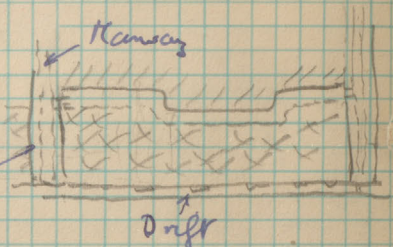
In the wide orebody the following method is used.

A ~~Drifts are~~ is driven along the footwall of the ore body, parallel to the wall and in the ore. Boxholes are ~~then put up~~ established on the footwall side ~~every~~ on 25 ft. centres. Chutes are ~~then~~ built in ~~built~~ at the ends of the boxholes. The box holes are then joined together 25 ft above the drift by a sub-level for the whole length of the stope i.e. 200 ft. A pillar of 30 ft is left where? and (the next lot of) boxholes in the ~~following~~ adjacent stope joined up. A crosscut is then driven along the pillar line at right angles to the ~~hanging and~~ footwall ~~until it reaches~~ to the hangingwall.









Shrinkage Stope

Ind drift may not be driven along hanging wall. Footwall crosscut (A) may be driven from foot to hanging wall and box holes driven along crosscut.

Surface

All the buildings on surface have walls made of galvanized iron (on the outside of) wood and then copper sheeting on the inside. The total thickness 1 in. The copper is to prevent the (moisture condensate from corroding into contact with the wood. Roof made of "halite" concrete with tar matting of felt on the outside). It is all supported by structural steel.

Compressor

Belliss & Morcome (England). (Very small)

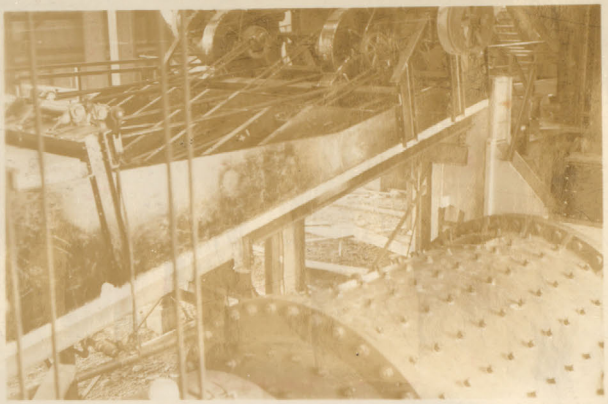
Capacity (250 ft/m) 500 H.P. 100# ref comp. Motor 250 rpm to 2950 r Synchronous with an excite and (flywheel attachment).

Tailing

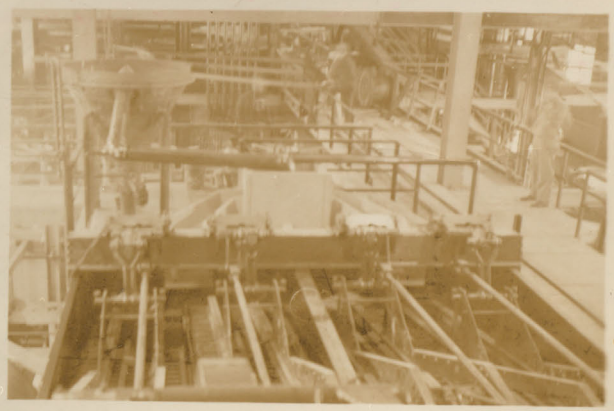
The tails are (removed by) an 12" in wood pipe, 50c per foot.

All the buildings are connected to the power plant by tunnels. There are no overhead wires.

(How for purpose?)



Ball mill & Classifier



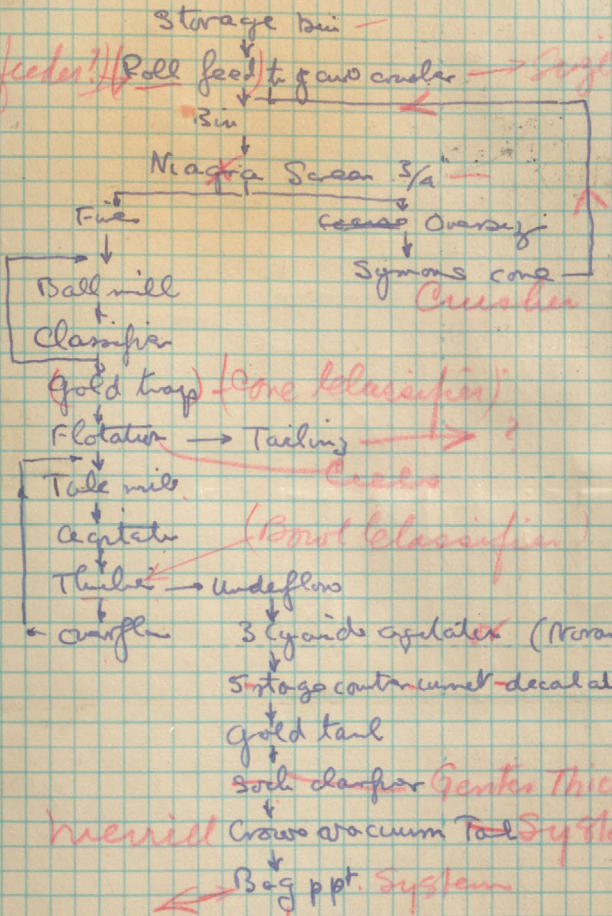
Gold trap Classifier

(Cone Classifier)

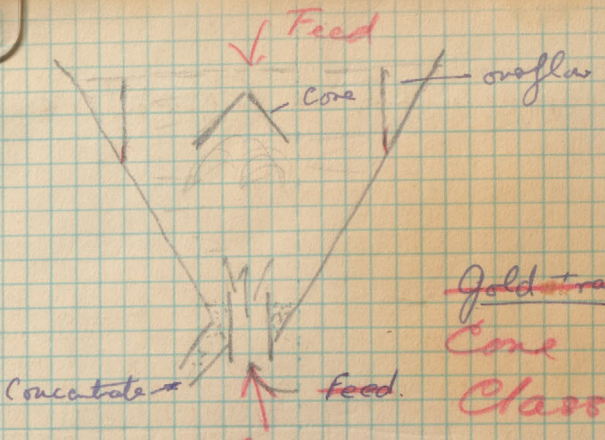
Note has rubber rakes.

Mill.

Flow sheet.



P.T.O.



~~Gold trap~~
Cone
Classifier.

Rising
Water Current

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