115.0 004685

R. GRANGER & G. LEE SUBMISSION

DAGO HILL, HUNKER CREEK, Y.T.

JANUARY 1982

KERR ADDISON MINES LIMITED

(FOR INTER-OFFICE USE ONLY)

To W. M. Sirola **From** D. A. Lowrie

Subject Report on the Dago Hill, Underground Placer (Gold) Mine, by G. C. Lee **Date** January 11, 1982

We are forwarding this to you for your interest. I do not believe that this to be of economic interest to Kerr Addison at this time.

D. A. Lowrie

DAL/sm

Encl.

~~DKW~~

Dave

10 [illegible] of material

to us?

Scheduled by

Gary Lee & Ron [illegible]

Dave

~~CKW~~

FILE

REPORT ON THE DAGO HILL

UNDERGROUND PLACER (GOLD) MINE

LOCATED ON

DAGO HILL, HUNKER CREEK, YUKON TERRITORY

BY

G. C. LEE, P.ENG.

Development Work Between May and September 1981

TABLE OF CONTENTS

REPORT ON THE
DAGO HILL UNDERGROUND PLACER MINE
Dawson Mining District - Yukon Territory

INTRODUCTION

As most people are aware, just before the turn of the century the Klondike region of the Yukon Territory was the location of the largest and richest gold rush in North America. In this area, many are not aware that there was a considerable number of rich deposits discovered at the bottom of permanently frozen White Channel gravels as high as 300' in elevation above the present valley floors. This report attempts to demonstrate the feasibility of employing a modern mechanized underground mining method for these ancient stream-deposited gold-bearing bench gravels.

It should be noted that, unlike all the present placer operations in the area which must shut down for over six months per year, underground mining can operate throughout all twelve months of the year. Once the underground exploration and/or development adits, X-drifts, etc. are complete, a massive retreat type of mining could build a large stockpile for sluicing in the spring.

Specifically, this report deals with an underground gold mine developed this year (May to September 1981) in permafrost White Channel gravels located on Dago Hill - the purpose being to underground mine the deeper portion of the Dago Hill coarse gold pay channel while leaving the shallower parts of the hill to more conventional surface mining methods. As can be seen by inspecting the photographs (see Appendix), a considerable amount of development work is now complete. This report examines the general feasibility of continuing this project with special regard to experiences gained this past summer.

The main purpose of writing this report is to attract a new operator to replace the present one of WHITE CHANNEL UNDERGROUND MINING LTD. The company is presently wholly owned by the writer and Mr. Jim Simcox.

With the foregoing in mind, it would probably have been preferable to have had this report prepared by an independent consultant; however, the writer has attempted to be as objective as possible under the circumstances.

LOCATION

Dago Hill is located approximately eight to ten miles from Dawson City, Yukon. It is located on Hunker Creek, roughly two miles up the Hunker Creek Road which begins at the Klondike Highway. The hill is on the left limit (looking downstream) of the creek and is situated on a relatively level bedrock bench high above the present creek elevation. The mine is only a couple of thousand feet from the Hunker Creek Road and is connected by an access road. (See photos in Appendix, pages 25 and 26.)

TRANSPORTATION

Dawson City and Whitehorse (Yukon's capital) are connected by the Klondike Highway which is an all-weather road kept open year-round. Dawson has an airport and bus service to and from Whitehorse. As a result of the increased placer mining activity on both Bonanza and Hunker Creeks, the roads are now maintained by the government (Yukon Territory) for their entire creek lengths during the summer and, since the government snow removal crews are based close-by in Dawson, they would probably plow the roads for a winter mining operation either free of charge or for a nominal fee. As can be seen from the "Climate" section, Dawson's mean annual snowfall is only about 4½".

GENERAL SUPPLIES, ETC.

Since Dawson is the only community of any size on the Klondike Highway, it is an adequate source for food, fuel and lumber. Also, because of the considerable amount of heavy equipment in the area, Finning Tractor and Equipment Co. Ltd. have an office, parts depot and mechanics available within a few miles of Dawson City. They are also the dealership for Gardiner Denver rock drills, with reasonably good service through their air freight division.

CLIMATE

Although it is significant to note the climatic conditions in summer, the most important aspect is the extreme cold in winter. From 1940 to 1970, the average of the mean minimum temperatures for December, January and February has been approximately -30°C. The average snowfall for this same period for the winter was 136 cm, or approximately 4½". The same equivalent for mean monthly maximum temperatures for June, July and August was 21°C, with an annual mean rainfall of 196 mm.

The main consideration is the setting up of properly heated surface facilities for a winter operation; snow removal is only considered as a minor problem.

Of course, it goes without saying that,when underground mining in permanently frozen gravels, the underground workings must be kept from thawing out during the hot summer months.

GEOLOGY

General

During the period of primary gold deposition, which was coincident with the White Channel period, the conditions were far more stable, marked by slow, meandering streams with gentle slopes. This is the reason why the old valley represented by upper level gravels is much wider than the present valley. It was during this time that the substantial volume of upper level gravels were deposited with their rich accumulations of gold. Then a period of uplift occurred, causing these streams to increase their gradient and not only cut down through the upper level gravels but also to cut a trough-like depression up to 300' into bedrock. This formed the existing valley bottom.

It was the cutting-through of these high level White Channel gravels with the subsequent rewashing of the gold that resulted in the secondary distribution of gold on the creek bottoms - although a minor contribution could be due to the breaking down of existing gold-bearing quartz veins in bedrock at lower levels. This is the reason for the creek claims on Eldorado being so rich - almost all the upper level gravels here were destroyed when rewashed, thus concentrating the gold in the bottom of a relatively narrow "V" shaped valley; whereas, on the wider valleys, part of the upper level gravels were preserved and the amount that was rewashed was distributed or diluted over a wider area. Although there are exceptions to this - such as Lowe's famous 75' pie-shaped fraction on Bonanza Creek - it has been speculated that part of the hill slid into the present creek in relatively recent times, concentrating the gold from the White Channels in a small area. The ancient valley has a grade of roughly 33'/mile whereas the new valley is closer to 50'/mile on both Hunker and Bonanza Creeks. This, plus the fact that Hunker valley is the widest, is the possible reason that the coarse pay channel had lower values and was considered inferior to Bonanza in the old days; hence, it only saw a limited amount of underground drifting on some of the hills from the turn of the century to present times. Also, there is a possibility of encountering a greater area of side or fringe pay which was uneconomical in the past on the wider sections of the ancient valleys.

A copy of the aerial photo in the Appendix (page 25) shows the relationship of Dago Hill (the old valley) with the present valley.

The bedrock underlying all the Bonanza valley and the benches of Hunker Creek consists entirely of the Klondike Schist series. These are the main gold-bearing rocks of the area and consist mainly of light-coloured sericite schists associated with a subordinate quantity of greenish chloritic schists. These are cut repeatedly in places by small faults. Many quartz veins - some gold-bearing - have been observed in this formation. It is the cutting of the schist by these quartz veins that has been concluded by many as being the original source of the Klondike gold. Free gold, along with pyrites, has been noted in quartz veins, occasionally in considerable quantities - such as at the head of Victoria Gulch. Small veins carrying grains of gold have been discovered on nearly all the producing creeks. The Lone Star group, Violet group and Mitchell group were all quartz properties which saw a limited amount of work in the past.

The Klondike Schists being very old and unglaciated during the last major period of glaciation on the North American continent, are deeply weathered and altered. Indeed, based on this past summer's experience underground, the top two feet of bedrock could be picked and shoveled out if allowed to thaw. As McConnell points out, unlike the present creek bed, the bedrock underlying the benches is "tighter" and, with only the occasional exception, the gold rarely penetrates more than a foot into the weathered bedrock. A more solid or fresher-looking bedrock is usually encountered within 10 to 12 feet.

Upper Level Gravel Deposits

R. G. McConnell's report (G.S.C. 1906,7) notes the classification of gravels. In the section designated "High Level Bench Gravels" there are two sub-groups: Klondike and White Channel gravels. The Klondike gravels are in the area of the Klondike River and, since this is not the main area of interest of this report, they will not be dealt with; but the White Channel gravels are of specific relevance and this group is further subdivided into white and yellow gravels. The yellow gravels generally overlie the white gravels and are a rusty colour, more distinctly stratified than the white gravels, and consist mainly of flat schist pebbles lying loosely in a coarse, sandy matrix. Quartz pebbles and boulders are also present but are much less abundant than in the white gravels. Since the yellow gravels have never proved economic, the discussion will be confined to the white gravels.

In one of McConnell's previous reports, he gives the following description of the white gravels - or what are more commonly referred to as the "White Channel gravels":

> *"The general character of the White Channel gravels is remarkably similar in various Klondike creeks but differs considerably from the ordinary type of stream deposits in other regions. They consist of a compact matrix of small, clear, little-worn and often sharply angular grains of quartz and scales of sericite, thickly packed with rounded quartz pebbles and rounded and sub-angular and*

wedge-shaped quartz boulders, often two to three feet in diameter. Flat and sub-angular pebbles of sericite schist, the principal rock of the district, are also present but in much smaller numbers than the quartz constituents. The schist pebbles are usually decomposed and crumble rapidly when thawed out. The deposit is always stratified but, except in rare instances, there has been no sorting of the various constituents into separate beds and the composition is very uniform throughout. The colour is characteristically white or light grey due to the preponderance of the quartz constituents and the leaching-out of the greater part of the iron. The colour is darker and sands are noticeably coarser towards the limit of the deposit on the upper part of the creeks. The White Channel gravels vary in thickness from a few feet to 150' and in width from 100' to half a mile or more. The deposit increases in volume descending the streams, and attains its greatest development near their mouths. They differ from ordinary stream deposits in their compactness, white colouration, and imperfect bedding and differentiation of material."

MINING ACTIVITY

Past Mining

Shortly after the discovery of the White Channel deposits, mining was confined almost entirely to underground hand mining only. The following is an excerpt from McConnell's 1903 report:

"A shaft is sunk to bedrock, and the pay gravels around the foot of the shaft are thawed out and hoisted to the surface. If the work is done in the winter, the material is piled up in great dumps and sluiced in the early spring; if in the summer time, the two operations are carried on simultaneously. In the better-worked claims, a system of drifts is extended from the shaft or shafts to the edge of the claim, or of the pay, as the case may be. The drifts are connected by cross-cuts, and the farther blocks are worked first.

"The gravels are everywhere frozen and require to be thawed before they can be extracted. This was done in early days by wood fires or by heating the water at the foot of the shafts with hot stones; but now, except in remote districts, it is done altogether with steam thawers or pumps.

"Thawing by steam is a simple operation. The steam is usually obtained from the boiler that furnishes power for hoisting and other mining operations. It is passed through rubber hose, to the ends of which pointed steel tubes four or five feet in length are attached. The latter are driven into the frozen gravel and steam is forced through them for a period of from six to twelve hours. They are then withdrawn and the thawed material is removed. The points require steam equal to about one horse-power each, and thaw

from one to three cubic yards of gravel at a shift. Any number can be used.

"In thawing with water, a small Worthington pump with a 3" discharge and 3/4" or 1" nozzle is usually employed. Only a small amount of water is required, as the stream played against the gravel face is collected in a sump and used again repeatedly. The relative merit of steam and water thawing is still an open question among the miners. The size of the excavation can be more easily regulated with water as the steam, especially in the summer time, heats the air in the chamber and portions of the waste in the roofs thaw out and fall. Steam is used on the majority of the claims.

"Timbering is seldom required, as the bed of frozen muck which overlies the gravels forms an extremely tenacious roof and chambers of astonishing size can be excavated beneath it, in the winter time, without danger. In one case, on Dominion Creek, a muck roof, unsupported by pillars, covered a vault said to measure 140' x 230' and remained unbroken until midsummer. Examples of muck roofs spanning vaults over 100' in width are common.

"In working claims by the second method, that of open cuts, the first objective is to get rid of the muck covering. This is easily done in early spring by taking advantage of the spring floods and leading the water by several channels across the claim. The muck thaws easily and the streams soon cut down to the gravel and then gradually widen their channels until they meet. In some cases, the process is hastened by blasting out the walls of the muck channel with slow explosives. When the muck covering is removed, the gravels usually thaw to bedrock in a single season. The upper portion, if barren, is removed and piled up where most convenient, and the underlying pay gravels are shovelled up or hoisted in buckets and sluiced in the ordinary way. The open-cut method of mining leads to a more complete recovery of the gold but is too expensive to be used where the barren overburden of muck and gravel exceeds 10-15' in thickness.

"While the general system of mining creek claims has changed very little since the early days of the camp, there has been a great improvement in the plant employed. Wood fires, for thawing, as stated before, are now altogether superseded by steam thawers and pumps. The hand windlass has been replaced by steam hoists working with self-dumping buckets, and steam scrapers are used instead of the shovel and wheelbarrow of early days to remove the waste in open cuts. On many of the claims, the water for sluicing purposes, instead of being flumed from a point up the creek distant enough to give the required grade, is now pumped up and the sluice boxes are placed high enough to carry the tailings where required. The employment of steam power and machinery in place of hand labour has reduced the ordinary expenses of mining by nearly one-half and has given value to long stretches of gravel on the various creeks formerly too low-grade to work.

"The equipment required to work a creek placer claim at the present time by the drifting method where the water for sluicing is pumped up consists of a 35-50 h.p. boiler for furnishing power, a hoist and self-dumping bucket worked by an 8-10 h.p. engine, a centrifugal pump with a 6" discharge for elevating water for sluicing (driven by a 15 h.p. engine), and a small Worthington pump with 3" discharge, a 1" nozzle for thawing or a set of points when the thawing is done by steam. The installation of the plant on one of the distant creeks usually costs from $5,000 to $7,000. The operating expenses on an ordinary claim, with one shift and night thawing, amount to about $100 per day, and from 50 to 60 cubic yards of material are mined and sluiced daily.

"The paystreak in the elevated White Channel gravel is worked from drifts along bedrock, starting at the rim or, when the deposit is wide, from the foot of the shafts, often over 100' in depth, sunk to bedrock. A small amount of open-cut work is usually done along the rim."

And, in regard to McConnell's rather lengthy description on surface mining:

".... A Riedler pumping engine, with a nominal capacity of 1,500 gallons per minute, was also installed during the past season by Alex McDonald, at the mouth of Dago Gulch on Hunker Creek for use on Dago Gulch."

Present Mining

One only has to drive up any of the historic placer creeks to see that the new price of gold has resulted in the gold rush of the 1980's. Rather than being labour-intensive, it is a time of heavy equipment, as borne out by the fact that Finning Tractor is reputed to have shipped a considerable amount of equipment into the Yukon recently. There are numerous operations employing medium-sized equipment and it is not uncommon in the larger operations to see D-9 cats, 992 loaders, five-yard backhoes, buggies, conveyor systems and processing plants (e.g. Cogasa and Canada Tungsten mines), 5,000 gallons/minute or more pumping stations (e.g. Jackson Hill-Union Oil, Dago Hill on Hunker Creek), and even the refloating of a retired bucket-line dredge in the Mayo district (Queenstake). In many cases, this equipment is moving tremendous volumes of overburden in order to simply expose the paying ground immediately above bedrock. Miben's trommel (see photo on page 32) operation on the southeast part of Dago Hill is successfully mining an area with moderate overburden depths in comparison to that part of the hill slated for underground mining. Underground operations in the Klondike area, especially any attempt at a modern mechanized operation, seem to be almost extinct. There were only two attempted this year in the Yukon - the one subject of this report, and one on Miller Creek. The Miller Creek operation was still going at the time of writing this report; however, it is not known whether they are in full production yet.

GOLD VALUES

In Underground Mining Zone

For a discussion on gold in the White Channel gravels, it is important to separate the pay zones into three categories: coarse pay, side pay and fringe pay. The coarse paystreak is the richest of the three, with a width up to 200' on Bonanza and wider on Hunker. Followed by this is the side pay which can have a width up to 200' adjacent to the coarse pay. The coarse pay saw intensive drifting before being hydraulicked off on Bonanza Creek, while the side pay received a limited amount of drifting before part or all of it was hydraulicked. With little being known about the fringe pay, it may or may not exist on the hills since it has never been considered economic, attributable to a combination of factors such as the price of gold, mining methods, overburden depths, tailings room and water requirements. Unlike Bonanza, Hunker still has coarse pay streaks which have only seen a certain amount of hand mining because of its generally inferior gold concentrations.

Provided on the next few pages are Yukon Consolidated Gold Co. (Y.C.G.C.) drill results in the form of sections (page 9), a copy of R. G. McConnell's values obtained on the Last Chance Creek slope of Dago Hill (page 11) and a plan of this summer's underground work in which 60 ounces were recovered (page 10). The important thing to note about R. G. McConnell's column is that it confirms that most (approximately 80%) of the total value of gold in the hill occurs very close (within 6') to bedrock. Y.C.G.C.'s drilling (6" churn drill) gives values per cubic yard at $20.67/oz and their corresponding depths of pay gravels immediately on bedrock are shown in the drill sections. The discussion will be limited to a comparison of the drill results with values obtained from the actual mining.

Referring to the drill sections (page 9), the area made available for underground mining is bordered by drill line D-13 to drill line D-7 and left (northeast) of the baseline. Any part to the right of the baseline is not included. On inspection, one can see there is at least a 200' (perhaps more) mining width. The present location of the portal (see page 10) is just at or inside D-13, indicating a mining length of 1400' to 1500'. Hence, the minimum size of pay channel is indicated as being 200' x 1400'. The overall average height of pay channel is slightly over 7¼'.

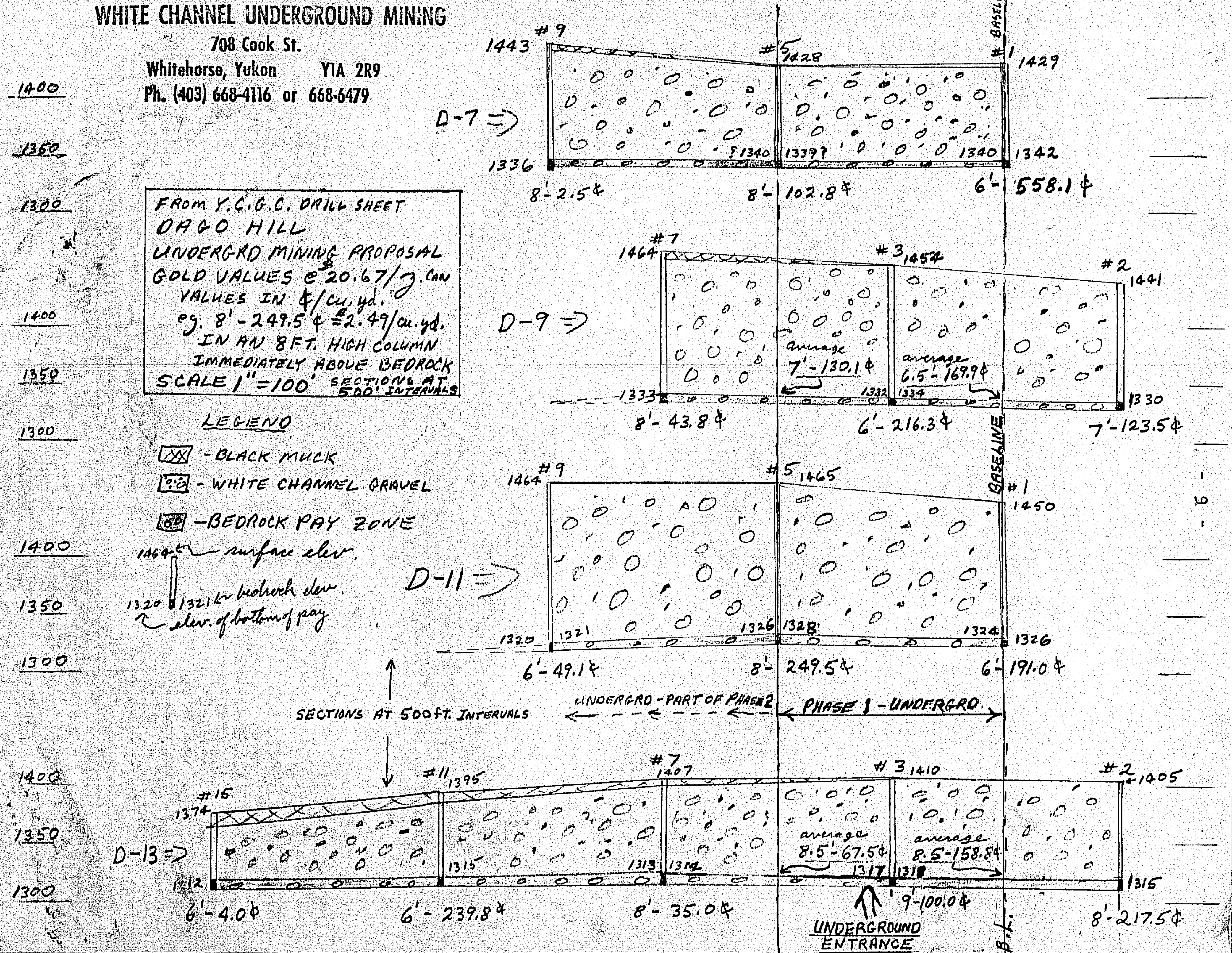
Due to the present condition of the hydraulic face, the best place to collar the portal was on a 120' offset from the Y.C.G.C. drill sheet baseline. On inspecting the sections (page 9), one can see that the drilling indicates rather poor values where the portal was collared, as opposed to the next drill section 500' away (1½% incline). Since the ends of the tunnels are roughly a third (140') of the distance to the next drill section, the main pay channel should be intersected within the next 200'. In any event, 706 cubic yards of underground pay were mined this past summer, yielding 60 oz of raw gold (800 fine). This

WHITE CHANNEL UNDERGROUND MINING

708 Cook St.
Whitehorse, Yukon YIA 2R9
Ph. (403) 668-4116 or 668-6479

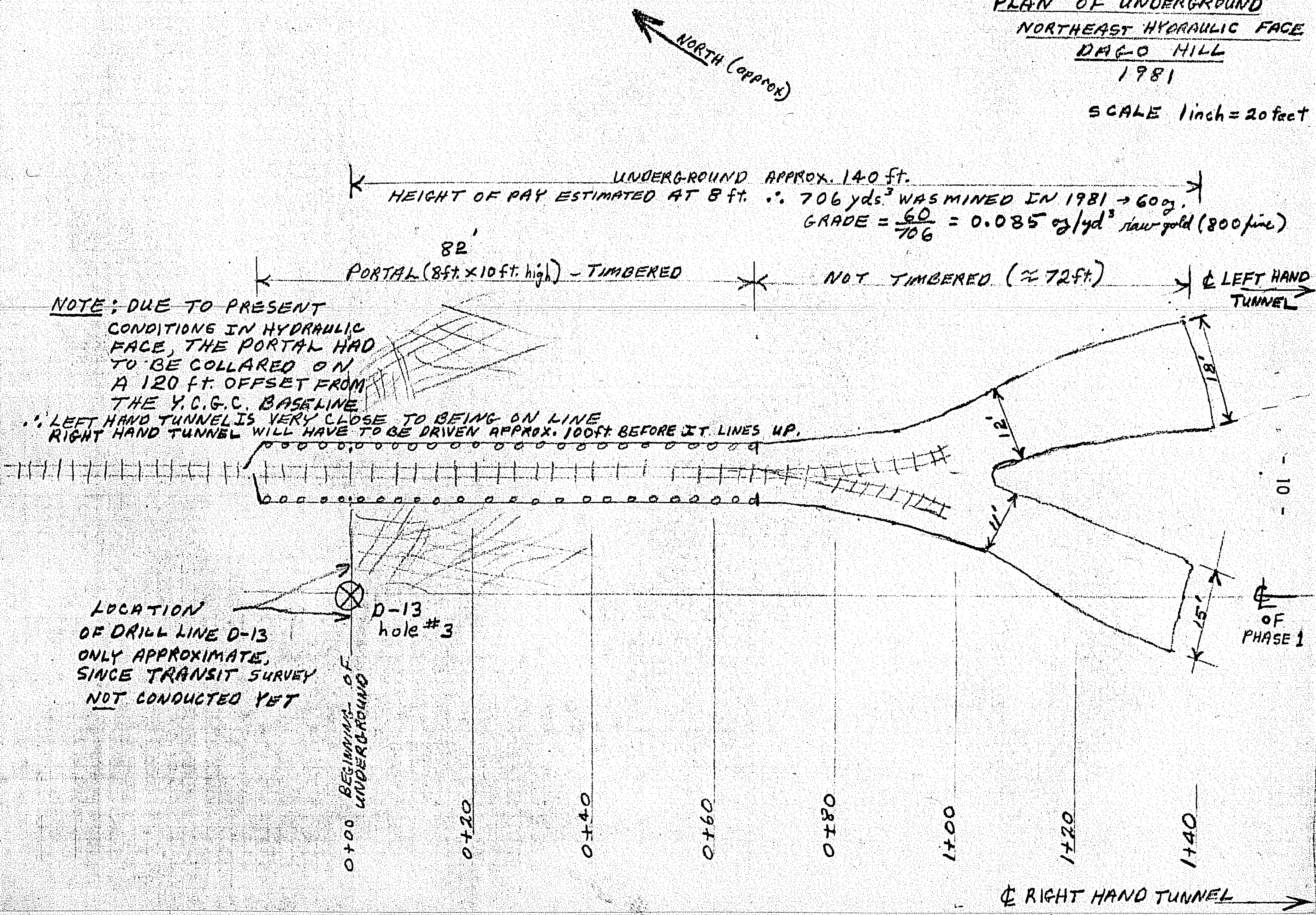
FROM Y.C.G.C. DRILL SHEET
DAGO HILL
UNDERGRD MINING PROPOSAL
GOLD VALUES @ $20.67/oz. CAN
VALUES IN ¢/cu.yd.
eg. 8'-249.5¢ = $2.49/cu.yd.
IN AN 8 FT. HIGH COLUMN
IMMEDIATELY ABOVE BEDROCK
SCALE 1" = 100' SECTIONS AT 500' INTERVALS

LEGEND
- BLACK MUCK
- WHITE CHANNEL GRAVEL
- BEDROCK PAY ZONE



PLAN OF UNDERGROUND
NORTHEAST HYDRAULIC FACE
DAGO HILL
1981

SCALE 1 inch = 20 feet



Taken from report by R.G. McConnell 1906, 07
 Geological Survey of Canada

the bottom to the top of the section proved to be constant, except at one point forty-five feet above bedrock where a slight enrichment takes place.

The following table shows the values obtained in a square yard column of the White Channel gravels in the Last Chance creek slope of Dago hill:

					Total value	
84–90 feet.	Average value per cubic yard			.007....	.014	
78-84	"	"	"	.009....	.018	
72–78	"	"	"	.012....	.024	
66–72	"	"	"	.014....	.028	
60-66	"	"	"	.020....	.040	
54–60	"	"	"	.0675...	.135	
48–54	"	"	"	.0275...	.055	
42–48	"	"	"	.030....	.060	
36–42	"	"	"	.041....	.082	$20/oz. Can.
30–36	"	"	"	.040....	.080	
24–30	"	"	"	.0425...	.085	
18–24	"	"	"	.050....	.100	
12–18	"	"	"	.060....	.120	
6–12	"	"	"	.114....	.228	
on bedrock → 1–6	"	"	"	$2.200....	$4.400	← ON BEDROCK
Total values in square yard column thirty yds. high.					$5.469	

In this column a considerable enrichment takes place at a point sixty feet above bedrock. The enriched gravels have a thickness of a few inches only and rest on a compact clayey stratum not easily penetrable which acts as a bedrock. The gold is moderately coarse, much coarser than that in the gravels immediately above and below, but finer than that on bedrock.

A marked exception to the general rule in the district, that the gold decreases in quantity and coarseness from bedrock upwards, occurs on Paradise hill on Hunker creek. The main gold zone here in many places is found not in bedrock but at elevations of from three to twelve feet or more above it. A section of the gravels twenty-four feet thick a short distance below Hester creek gave the following values:

18–24 feet.	Average per cubic yard			$ 0.025........	$0.050
12–18	"	"	"	0.266:	.532
6–12	"	"	"	0.776........	1.552
1–6	"	"	"	0.576........	1.152
Total values in square yard column eight yds. high...					$3.286
Average values per cubic yard......................					42.1 cents.

The lower gravels in this section and in other places on the hill are very siliceous, consisting almost entirely of vein quartz pebbles and boulders. The siliceous layer varies in thickness from a few inches up to eight or ten feet, and is overlaid by gravels containing a greater proportion of schist pebbles. The best drifting ground worked so far occurs above the siliceous layer, in the lower part of the upper gravels.

The gravels on Paradise hill although rich in places have seldom paid to drift on account of this irregular distribution of the gold. The pay zone, in place of lying in a plane, undulates along the surface of the uneven siliceous gravels and is very difficult to follow.

The concentration of all the coarse, and the greater part of the fine, works out to 60 ÷ 706 = 0.085 oz/cubic yard which is higher than the drilling in this area indicates; Miben Mining have also found this to be the rule rather than the exception on Dago Hill with respect to their past surface operations.

It will not be attempted here to work out grade and reserves with respect to a feasibility study; however, anyone wishing to do so has all the necessary data provided in this report as regards both the underground mining results and drill data.

MINING METHOD

General (See Appendix pages 25 - 34 for photos of mine)

The basic underground mine plan on Dago Hill is to collar a portal, timber until solid permafrost is encountered, and then Y off into two parallelling tunnels (incline @ 1.5%), thereby creating two headings as quickly as possible, allowing for both mucking and drilling to occur simultaneously in a drill-blast-rail type of operation. This mine plan is also designed to be mining in pay gravels all the time, including taking one foot of bedrock.

The overall mine plan in a drill-blast-track type of operation is to drive two parallelling tunnels (each 20' wide) at 100' centres, thus creating an 80' wide pillar. These tunnels would be driven up the centre of the pay channel a distance of between 1400' and 1500', parallelling the Y.C.G.C. baseline and within a 200' mining width which is known to have good gold values. The reason for the 100' centres on the parallelling tunnels is that it has been found that the maximum efficient distance the Eimco 630 mucker should have to muck is 50'; therefore, the full 200' width of pay channel can be mined efficiently whether a massive retreat or room and pillar type of mining method is employed. Of course, most of the time the mucking distance can be kept very short by keeping the track close to the face and near the wall on a 20' wide drift, thereby allowing the car or cars to be end- and side-loaded to their maximum capacity before tramming. Various examples of drifts being driven from 50' to 100' apart for retreat and/or room and pillar type mining can be found in the Appendix (pages 20 - 24) (from Peele's "Mining Engineering Handbook", 3rd edition, 1941.) Peele gives examples of various mining methods used in underground placer mines.

The massive retreat method obviously results in mining out all the pay; however, it should be studied carefully as to ground support before attempting it underground on Dago Hill. The more conservative approach of room and pillar results in less extraction but is more predictable with regard to ground stability. Artificial pillars can also be employed to get the maximum amount of pay out.

The type of mining equipment used in the Dago Hill operation consists of an Eimco 630 mucking machine (1/3 yard on crawler tracks and forming the upper part of the arch began to thaw out and deform plastically away from the shear (see photo, page 32 of Appendix); eventually, these chunks would fall. It was this development which reaffirmed that underground temperature control is critical. This is not to say that the mine has to be operated all the time at below-freezing temperatures - only that it be brought well down below freezing for a while during a 24-hour period. The overall average temperature should be below 0°C (32°F). If a thin skin of material begins to thaw, then it should be frozen back (within, say, 24 or 36 hours) before it loses its moisture content.

Quite an extensive technical report was prepared on the "Stability of an Underground Room in Frozen Gold-Bearing Strata, Fairbanks, Alaska" by the U.S. Bureau of Mines, 1969 (Pettibone and Waddel, 1969). Here, a tunnel 30' wide x 70' long x 10' high was excavated in frozen strata and a considerable amount of technical tests (modulus of deformation, etc.) were conducted. The following is part of the abstract:

> *"... in-place dry density of 129 pcf and a moisture content of 10%, the in-situ modulus of deformation of frozen gravel was found to be 20,000 psi at 23°F. For five months of the year, November through March, an operating mine in frozen gravel would remain open without artificial support. For year-round mining, i.e. during the remaining seven months, the mine must be protected from the heat or else partially supported with yielding-type supports. If the mine is sealed during these seven months, the mine back will creep and a few roof falls will occur, but the opening will remain open without artificial support."*

Blasting

A considerable amount of experimenting had to be conducted in order to perfect a reliable blasting method. Unlike proven methods which had worked so well in the colder permafrost of the Sixtymile River area the previous year, the White Channel gravels required a completely different blasting technique. The main problem was that the ground was "springy" or "plastic", so to speak, resulting in the initial charges, when fired, cutting off the next set of delayed holes, causing the round to freeze. The method which resulted in consistent, near-perfect rounds required only the bottom half of each hole to be loaded with 1" x 8" Forsite 40% or Cigel 70. There also had to be lots of ground (3' to 4') on each delay and the cutshad to be spaced one foot apart. The cheaper Amex method turned out to be totally unreliable.

Blasting can also be improved by adding a few more back holes and loading all the back holes with a shearing powder. This should result in a smoother arch.

Drilling

Holes were drilled with water, much the same as in a hard rock mine. The holes were then blown out with a blow-pipe (compressed air) before loading. However, some important advances were made when 1-3/16" auger steel (with normal 1½" knock-on carbon tungsten bit) was tried: the auger steel kept the hole much cleaner during drilling and made loading much easier. Unfortunately, the only auger steel available was accidently broken and a subsequent shipment lost en route from North Bay, Ontario did not arrive until after operations ceased at the mine.

However, dry drilling was experimented with, using ordinary steel, and was found to have good possibilities. Some holes had trouble past 4' in depth, probably due to inability to clear and blow out the cuttings from behind the bit. Nevertheless, it is felt that by modifying the drills (perhaps just adding larger diameter water needles) and using auger steel, dry drilling has an excellent chance for success. It should be noted that there was no increase in dust during the dry drilling as the frozen particles simply fell to the floor; therefore, danger of silicosis seems low. It should be noted that, in R. A. Dick's experiments for the U.S. Bureau of Mines in Alaska in regard to "Evaluated Blasting Techniques in Frozen Gravel", he drilled his rounds dry with a modified rock drill to produce more air. The main problem he encountered was extracting the steel, which probably would be eliminated if he used a jumbo rather than a jack leg. Anyway, the advantage of perfecting dry drilling is that large quantities of water would not have to be hauled in winter.

The time required to drill a 25 to 30 hole round (6') and load it amounted to between four and five hours. If dry drilling was perfected, this time could probably be reduced since blow-piping the holes could probably be eliminated. As various techniques in drilling were perfected, one could try 8' or 10' rounds.

Tramming

The blasted muck was conveyed to the dump station (see photos in Appendix) in a 5-yard Granby car pulled by an Eimco air locomotive. This might well be suitable for short, straight-line hauls in exploration work; however, it was found to be far too slow for our purpose. Also, it would be totally unsuitable in winter. Therefore, an electric battery type of locomotive is recommended in order to make the tramming efficient.

Boring Machine

A Dosco boring machine (see photo, page 30) was tested on a freshly exposed frozen face (S.E. part of Dago) during early September 1981. It bored a 15' wide x 9' high x 3' opening in one hour using six bits costing \$20.00 each. The bit costs work out at \$120 ÷ 5 x 3 x 1 = \$8/cubic yard. It is powered by a 250 KW power plant which was just barely above an idle for the test, indicating fuel consumption to be low.

This machine was brought over from the Sixtymile River area because the boulders and permafrost were too hard or abrasive there to make it economical.

This preliminary test is encouraging, probably made possible by the brittleness of the quartz boulders in the White Channels which make them very sensitive to impact. Further tests were not conducted since the capital cost of the boring machine, power plant and conveyor system (to load mine cars) is in the order of $200,000.

Surveying

VERTICAL CONTROL:

By noting the bedrock elevations in the drill sections (page 9), one can see the proposed underground tunnels are on a predictable, even incline, grading at approximately 1½%. There are no abrupt changes - which is important in a track or rail type of underground placer mine where one to two feet of bedrock must be carried. Hence, strict vertical control is not essential except as an occasional check.

HORIZONTAL CONTROL:

The present location of the underground tunnels relative to the baseline is only by rough chainage. The location of the drill line to the portal is only an estimated location since most of D-13 has been hydraulicked away. Accordingly, it is important to conduct a transit survey from D-11 on top of the hill, including offsetting the baseline accurately. The tunnels as they exist should be tied in accurately so that they can eventually be positioned on their respective centre lines.

CONCLUSIONS

With regard to the experiences and development work completed to date, putting this mine into production should be seriously considered. However, if production is to proceed during summer, a refrigeration unit must be installed. Experiments on dry drilling appear very encouraging and should be continued. Blasting techniques are working well; however, a shearing powder as detailed in the report should be tried, the purpose being to create a smoother arch. The compressed air locomotive is unsuitable for efficient tramming and should be abandoned.

The preliminary test on the boring machine appears encouraging, especially as regards its potential for speeding up production with minimum labour requirements. However, the test only lasted one hour and should, by no means, be considered conclusive. Both the capital cost and mechanical availability should be taken into account.

Of further interest - some old underground tunnels were discovered at the bottom of Miben's cut (SE part of hill) and were found to be in excellent condition, running 100' or more in spite of being abandoned for decades. There are few signs of old underground workings on the deeper part of the hill (the area of this report), probably because of the excessive depths in which the "old-timers" would have had to sink a shaft.

The 200' mining width is by no means to be considered final; hence, the area from 200' to 300' from the Y.C.G.C. baseline could have portions of economic pay channel contained in it and, therefore, this section of ground could be blocked off (as part of a phase 2) by the addition of a third tunnel branching or 'Y'-ing off from the presently proposed left-hand tunnel.

RECOMMENDATIONS

1) Make calculations of estimated and proven grades and reserves.

2) In conjunction with the above, decide on a type of mining - whether the same as or different from the one described in this report - and make a preliminary mine plan.

3) Work out a feasibility study as to production estimates, costs, income, etc. based on a one, two and three shift basis.

4) If the foregoing are found to be satisfactory, proceed with mining on a one shift basis with the purpose being to refine a mining method and any technological advances (e.g. experiments with dry drilling) which may be close at hand. This is recommended during the cooler months, unless a decision is made to install a better refrigeration unit. The only significant purchase which is definitely recommended at this time is a battery locomotive.

5) If the above proves successful, advance to a full production status based on a two or three shift basis. At this point, the acquisition of a second mine car would possibly be warranted in order to double the yardage mucked between trams.

Respectfully submitted:

Gary Lee

Gary C. Lee, P.Eng.

A P P E N D I X

WHITE CHANNEL UNDERGROUND MINING LTD.

Whitehorse, Yukon

I N T R O D U C T O R Y   L E T T E R

OPTION
of
MIBEN MINING
and
WHITE CHANNEL UNDERGROUND MINING LTD.
Joint Venture

Development Work Between
May and September 1981

Phone:
(403) 668-4116
(403) 668-6479
(403) 668-4698

WHITE CHANNEL UNDERGROUND MINING LTD.,
708 Cook Street,
Whitehorse,
Yukon.
Y1A 2R9

November 1981

Dear Sirs,

During the winter of 1980-81, White Channel Underground Mining Ltd. was incorporated under the laws of the Yukon Territory for the specific purpose of underground mining the deeply buried gold-bearing pay channels located in the Klondike gold fields. During the spring of 1981, this company entered into a Joint Venture with Miben Mining, who own and operate a surface mining operation on a White Channel hill (Dago Hill) located approximately 8 - 10 miles from Dawson City, Yukon.

Between May and September 1981, the initial development work on the underground project was completed as outlined in the enclosed report. It is now felt by the Joint Venture partners that, in order to bring this operation into relatively large-scale production, a new party needs to be brought in with the ability to manage, operate and finance the project. Any new operators will have to assure the present owners of their ability to manage a producing underground mine, since the present operators feel that a diversified expertise in this field is needed to mine this hill in the most economical and efficient method possible. Further to this, new outside financing of the project is required.

The expenditures made to bring this operation to its present status have amounted to $275,000.00. The terms of an option are as follows: firstly, no "up front" money in the form of cash payments is required. Since the owners (Miben Mining) have been the financial backers to date, they would have first call on 100% of the returns (sluicing and clean-ups) from the underground production agreement until the $275,000.00 is recovered. At that time, the new underground operator would receive full ownership of all the buildings, machinery, equipment and tools listed in the attached Inventory. From these inventory sheets, it will be seen that a rough value of $151,900 has been estimated; this value is certainly lower than what it would cost under normal circumstances to purchase, transport to the Yukon and install or construct an installation with the type of accompanying mining equipment as listed. However, from the perspective of, say, salvage value, this figure would probably be a little high.

Once the $275,000.00 is recovered from production, the option would fall under the terms of an underground production agreement; this agreement would consist of the following: the new operator would be responsible (including finance) for the underground mining, transporting, dumping and stockpiling of the underground muck; at this point, the owners (Miben) would take the responsibility (including finance) for sluicing and clean-ups. They also would provide a cat (without operator), free of charge, for

/2 .....

stockpiling, including miscellaneous surface work such as snow removal in winter time. It should be noted that 'clean-ups' can only be accomplished during the summer and early fall.

In return for the foregoing, the owners (Miben) would receive a 20% royalty (gross) of all gold recovered throughout the lifetime of the mine. This is felt to be a good option since Miben has all the facilities in place for processing the underground material (muck) and possess all the important government licences such as water - resulting in the underground option commitments and responsibilities ending at the stockpiling stage. Of course, the remaining 80% of all gold recovered would go to the underground operator.

Secondly, this brings us to the present operators. We are currently the legal and sole owners of White Channel Underground Mining Ltd. who, along with three employees (one being Tom Gilchrist who has verbally agreed to become a future third partner in the firm), did all the work (with the exception of a few specialized trades or jobs) on the property, thus keeping labour costs to a minimum. Realizing that this project requires further investment to bring it into a viable producing mine, we require no considerations at this time; however, at such time as the new operator meets his financial commitments and shows a profit, the present operators will retain 15% of the net or profit. This profit, or net, shall be calculated on the basis of gross revenue minus reasonable or direct operating costs. However, if a new operator wishes to phase us out completely within the first six months of an agreement being reached, then a sum of $60,000.00 will eliminate us from retaining any interest whatsoever.

All the foregoing terms and conditions would be given top priority. This should be taken into consideration by anyone wishing to submit a proposal differing from the above. It should be noted that the figure of $275,000.00 advertised as the minimum investment required before return is only an arbitrary one, since that is just a "ballpark" figure of what it will take to upgrade and sustain production long enough to pay back the investment to date. It is estimated that the upgrading would cost between $20,000 and $50,000, with the remainder going into production costs. The mine, as it exists now, could be brought into production with the following minimum upgrading: the compressed air locomotive was used initially for the development phase only and is inadequate for fast tramming needed in production; we have located, within the Yukon at the time of writing this letter, two battery-type electric locomotives which are for sale at $5,500.00 each and which may be of sufficient capacity to do the job; secondly, the rock drills should be sent out for a rebuild (total cost: $1,000 to $2,000); and thirdly, if mining is to proceed in the hot summer months, a better refrigeration unit should be installed. Estimates (via a refrigeration consultant) of these costs, including the power source, range between $18,000 and $24,000.

Arrangements to inspect the property can be made by meeting us in Whitehorse (CP Air has regular 737 service to Whitehorse) and thence either renting a truck and driving to the property or chartering a small two-engine plane and flying to Dawson. If you wish to make an inspection and return to Whitehorse all in one day, the charter method is the better since

Dawson City's airport is only two miles from the property and a helicopter based in Dawson can be arranged for a quick drop-off and pick-up after the inspection is complete.

We trust the enclosed information is adequate for you to give our rather unique project serious consideration.

Yours very truly,
WHITE CHANNEL UNDERGROUND MINING LTD.

Gary Lee, President.

Jim Simcox, Secretary/Treasurer.

Tom Gilchrist.

MIBEN/WHITE CHANNEL JOINT VENTURE

INVENTORY AND PRESENT VALUE OF ASSETS
September 25, 1981
(Value estimates range between salvage and actual cost)

Quan-tity	Item	Estimated Present Value	Total
	Major Equipment and Buildings		
1	Ingersol Rand 900 c.f.m. compressor, rebuilt (new: $82,000)	$ 35,000.00	
1	Eimco 630 ¾ cu.yd. mucking machine, in good running order (with some new spare parts - cables, springs, etc.) (new: $80,000)?	22,000.00	
1	Side dump (Granby) 127 cu.ft. mine car	4,000.00	
1	Air cylinder dump mechanism for mine car (installed)	2,500.00	
1	Long Tom mini drill jumbo (2 boom) (self-propelled-air)	15,000.00	
3	Gardener Denver rock drills with $1,500 new spare parts	3,000.00	
1	Lister 12.5 KW power plant (1500 hrs)	5,000.00	
1	Eimco 401 air locomotive	4,000.00	
1	New 3000 gal. fuel tank	2,600.00	
1	Tandem utility trailer (5 ton) with 500 gal. water tank	1,500.00	
1	12 x 50 ft. 1970 Parkwood mobile home c/w new 3-room insulated addition, porch, new propane stove, 1 hot water heater, 2 new propane heaters, new pressure pump, 2 x 250 gal. indoor water tanks, new fridge, washer; furnished	20,000.00	
1	1000 gal. propane tank - 70% full (700 gal.)	1,000.00	
1	48 x 16 ft. fully insulated compressor building ($20/sq.ft.)	15,000.00	$130,600.00
	Equipment Underground - Installed, Ready to Use		
1	12" turbine air fan - 50 hrs ($2300 new)	$ 1,400.00	
1	California switch (new: $700)	300.00	
1	70 ft. vent ~~fan~~ tubing	30.00	
260'	30 lb rail (130 running ft.), 13 x $40/20' lengths (used: $400/ton)	520.00	
4	4" T's, 4" x 4" x 2" @ $12 each (new: $25.24 ea.)	48.00	
4	20' lengths thin wall (4") air line @ $1.20/ft. (new: $2.37/ft.)	96.00	
4	2" valves @ $15 ea. (new: $30 ea.)	60.00	
2	Waterproof electrical switches and outlets (110, 220)	50.00	
4	4" Couplex couplings @ $5 ea. (used)	20.00	2,524.00
	c/f		$133,124.00

Quantity	Item	Estimated Present Value	Total
	b/f		$133,124.00
	<u>Surface Equipment and Gear - Installed, Ready to Use</u>		
960'	30 lb rail (outside tram, 480 running ft.) bought new; used: 40 x $40/20' length	$ 1,920.00	
440'	2" thin wall airline with victollic couplings, bought new; used: $.70/ft., plus couplings	360.00	
3	2" victollic tees and 1" valves	25.00	
1	60' long permanent planked (2x6) trestle (6x6 construction) (new: $3000) - salvage etc?	1,000.00	
2	40-50' I-beams	(?)	
60'	4" thin wall airline with victollic fittings (underground to compressor building)	100.00	
10'	3" heavy duty flexible air hose (airline to compressor)	50.00	
-	Assorted (1", 2") headers (valves) on compressor	50.00	
1	4" valve on main 4" thin wall airline (new: $95 ea.)	40.00	
≈ 500'	Triple wire power line (3 hydro poles)	2,000.00	
-	Installed electrical equipment - gauges, breakers, boxes, cable, outlets, lights, 1 x 1500 watt flood light, 3 x 500 watt flood lights (new: $2500)	1,200.00	
120'	3/4" water pipeline (new: $0.55/ft.) - used: 25¢/ft.	30.00	6,775.00
	<u>Equipment and Gear Stored in Compressor Building or on Surface</u>		
1	≈100 gal receiver tank	$ 500.00	
25	20' lengths 30 lb rail, new (500 ft @ $75/length)	1,875.00	
1½	Kegs of new track spikes ($135/100 lb)	500.00	
-	Fish plates, bolts and nuts (total new:$1000)	500.00	
1	Track spike puller	50.00	
1	Track bender (Sim Crow)	100.00	
18	20' lengths 4" thin wall airline with victollic couplings, new (@$2.37/ft. and $10 ea. resp.)	1,033.00	
12	20' lengths, new (@$1.04/ft.) 2" thin wall airline with victollic couplings ($10 ea.)	280.00	
5	20' lengths, used, 4" thin wall airline with victollic couplings	100.00	
15	20' lengths, new, 3/4" water line	165.00	
	c/f	$ 5,103.00	$139,899.00

Quantity	Item	Estimated Present Value	Total
	b/f	$ 5,103.00	$139,899.00
1	New 4" air valve (victollic)	95.00	
2	New 50' lengths 2" bull hose ($280 x 2, Nelson Machinery)	560.00	
5	Used 50' lengths 2" bull hose @ $140 ea. (purchased new) (1 length is burstproof)	700.00	
400'	1" air hose (used, bought new) - ½ price used = $100/100'	400.00	
50'	1" air hose (new) - Nelson Machinery, Vancouver: new = $208.11/100'	104.00	
100'	¼" air hose (used, purchased new), high pressure	50.00	
1	Model 120 Amex blasthole charger	800.00	
-	New 12" fan tubing with connectors (400 ft. new = $73/100')	300.00	
1	Mechanical (electrically operated) door with hardware (new)	705.00	
3	Pails lubricants etc: 1-80W90, 1 Harmony 4-5, 1 Tanner gas	100.00	
2	Pails rock drill oil	100.00	
6	Mining lamps with chargers (purchased new),used	400.00	
6 each	Hard hats, slickers, etc., belts, ear protectors - used	75.00	
1	Push-down blaster with 500' firing line	200.00	
1 Case	Lister oil filters	80.00	
1 Case	Diesel starter fluid	33.00	
10 Qts	SAE20 motor oil (for air motors)	15.00	
1	6 amp battery charger	50.00	
5	New, 6', 7/8" hex (knock-on) drill steel (Boart, Vancouver - new: $34.40 ea.)	172.00	
4	New, 10', 7/8" hex (knock-on) drill steel (Boart, Vancouver - new: $47.30 ea.)	189.00	
3	Used, 8', 7/8" hex chisel steel - almost new	100.00	
2	Used, 10', 7/8" hex (knock-on bits) drill steel	50.00	
2	Used, 8', 7/8" hex (knock-on bits) drill steel	40.00	
2	Used, 6', 7/8" hex (knock-on bits) drill steel	35.00	
1	Electric water or fuel pump - bought new: $350	175.00	
1	Electric drill, used	50.00	
1	Electric skill saw, used	75.00	
1 Set	Open-end wrenches, 3/8" to 1-1/8"	100.00	
2	12" pipe wrenches	25.00	
2	12" crescent wrenches	25.00	
1	15" crescent wrench	30.00	
1	15" pipe wrench	30.00	
1	Metal day box	100.00	
22	4" x 6" ties (rail)	50.00	
	c/f	$ 11,116.00	$139,899.00

Quantity	Item	Estimated Present Value	Total
	b/f	$ 11,116.00	$139,899.00
2	12' 6x6's	24.00	
1	16' 6x6	16.00	
½ Case	100 watt light bulbs	20.00	
4	10' nylon loading sticks	20.00	
2	6' scaling bars ($30 new, each)	30.00	
1 Case	Spikes (½ case 6", ½ case 8")	70.00	
1 Set	(3) new fan belts for compressor	47.00	
-	Miscellaneous tools and supplies	100.00	
-	4" elbows, 4" T's (4x2), 2" valves, etc. - new	500.00	$ 11,943.00
			$151,842.00

MINING ENGINEERS' HANDBOOK

WRITTEN BY A STAFF OF FORTY-SIX SPECIALISTS
UNDER THE EDITORSHIP OF

ROBERT PEELE
PROFESSOR EMERITUS OF MINING ENGINEERING IN
THE SCHOOL OF MINES, COLUMBIA UNIVERSITY

WITH THE COLLABORATION OF

JOHN A. CHURCH
MINING AND METALLURGICAL ENGINEER

THIRD EDITION

IN TWO VOLUMES
VOL. I

(SELECTED PLACER DATA)

NEW YORK
JOHN WILEY & SONS, INC.
LONDON: CHAPMAN & HALL, LIMITED
1941

has been opened, bank and giant water aid in thawing gravel faces and new surfaces are constantly exposed to solar heat. In drift mining (Art 130) no stripping is necessary, but the paystreak must be thawed. In dredging (Art 128) the muck must be thawed and stripped and the entire gravel bank thawed. Adequate (not necessarily perfect) thawing is essential for successful dredging (435) to save excessive wear on machinery, permit effic digging, and to avoid loss of gold encased in frozen lumps rejected by the screen. While most gravel can be sufficiently thawed in a short time to permit dredging, it is best to allow thawed ground to stand several months, during which small isolated frozen patches may continue to thaw.

Thawing methods were developed in drift mining. Early shaft sinking and drifting in Alaska and elsewhere were done with wood fires and hot stones; these are still used by prospectors, but boilers light enough to be carried by 1 or 2 men are now obtainable, and permit steam thawing for prospecting and exploration in remote districts (380, 390, 408, 455). Steam-thawing, introduced about 1898, developed rapidly; steam is carried into gravel through pipes terminating in a bit or "point" (Fig 870); the method was soon applied to thawing frozen ground ahead of dredges. Numerous experiments have been made with hot water instead of steam, but with indifferent success; C. Janin in 1922 traced the development of thawing methods, and summarized available data in Bib (629). Since 1917 cold water has largely replaced steam for thawing dredging ground.

Physical properties of frozen gravel (Table 147). Extensive tests in 1912 by H. M. Payne, on permanently frozen gravel in the Klondike, gave following results; temp (F) of bedrock, 2°–14°; of gravel, 17°–22°; of black muck, 17°–24°; of sandy muck, 19°–24°. Mean temp of frozen ground depends solely on the kind of material and not on its depth, depth of frost line or water level, nor on presence or absence of muck overburden. A. Gibson states that the temp of perpetually frozen ground on Seward Peninsula is about 28° F, except when near thawed ground; he estimates the sp heat of gravel at 0.2. Nearly all the heat required to thaw frozen ground is that needed for converting ice into water; hence percentage of ice in gravel should be determined in estimating probable fuel or water requirements (454, 451, 629).

Table 147. Physical Properties of Frozen Material (393)

Aver of tests on 46 samples	Black, sandy muck	Gravel and sand	Bed-rock
Sp gravity, frozen	1.401	2.189	2.590
Sp gravity, thawed and dry	2.411	2.691	2.655
Sp heat, frozen	0.196	0.172	0.183
% ice, frozen ground, by vol	68.2	29.1	9.6
% ice, frozen ground, by wt	44.7	16.0	4.26
% solids, frozen ground, by vol	31.8	70.9	90.4
% solids, frozen ground, by wt	55.3	84.0	95.74
% voids, frozen	0.0	1.28	0.0
% voids, thawed	6.1	3.97	1.65
Lb ice per cu ft frozen ground	39.11	22.00	6.96
Lb solids " " " "	48.39	115.50	154.94

87.50

Comparison of thawing media. Experiments by J. H. Miles, of Alaska Mines Corp'n, in 1917–1918 at Nome, in thawing deep dredging ground with steam, hot water and cold water, are described by W. S. Weeks (644) as follows:

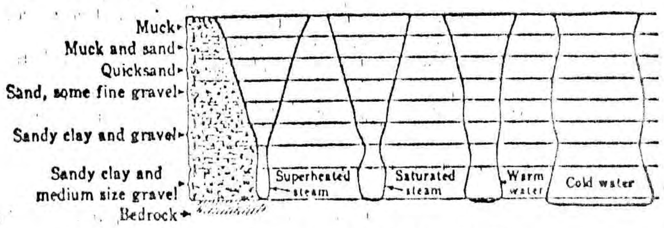


Fig 869. Comparison of Thawing Media

Depth of ground, approx 42 ft; character is shown in Fig 869. Thaws were made with superheated steam, saturated steam, hot water and cold water; in each case the thawing agent was introduced at bottom of a churn-drill hole. In following winter, when surface water was frozen, shafts were sunk on these holes and the thawed volumes computed. Fig 869 shows cross-sec of a thaw of each type. Results (Table 148) show relatively high utilization of heat available for thawing with cold water and very low utilization for steam and warm water. Tests with superheated steam indicated that most of its heat was expended in heating a relatively quiet pool of water around the

(19)

YOUNG'S REFRIGERATION & EQUIPMENT LTD.
129 COPPER ROAD
BOX 4156, WHITEHORSE
PH. 667-2604 - 667-2853

Oct 10/81

Gary Lee
Box 5348
Whitehorse Y1A-4Z2

Dear Gary -

Re your request for Info + price on freezing + maintaining frozen the mine Tunnel the dimensions as given + according to the photographs, I find some options that should be decided.

Considering some future expansion + air change, machinery etc I would estimate 10 tons to be ample for start.

I have checked with Mr Dixon Palmer, Refrigeration Engineering in Vancouver and he has indicated 5 to 7½ Tons for the present Tunnel as is with some extra for air change etc.

The options to consider is the type of systems + machinery as expanding of some type are considerably more expensive than others and the load difference between operating hours and none operation would be in many times more than double.

In Total Dollars Spent 2 simple hot gas defrost Systems may be adequate but are not too variable to control.

The next system would be to use a deisel powered direct-drive compressor of ample capacity and control its speed to gain the capacity necessary.

Broad estimates on Costs are

2 - 7½ Hp R502 all Electric (approx 4½ Ton Each) Installed $20000.00 / 24000.00

1 - 10 Hp R502 " " " 6-7 Tons Installed $18000.00 / 22000.00

Various used equipment is also available at considerably less cost that could well serve your needs, and ample time to assemble such would well reduce the costs. Trust this assists you.

Respectfully Vince Young

of ³/₈-in, and 2 ft of 0.5-in holes. Wash water, 3 200 gal per min. Stacker, 50 ft long, with 26-in belt. Total (Hungarian) riffled area of 16 cross-sluices and 2 lateral sluices, 1 500 sq ft. Clean-ups, every 10 days; mercury supplied during interval, 225 lb; loss of mercury, 6–7 lb at each clean-up.

Fresh water for pond is pumped 2 miles through 8-in pipe against 420-ft head. Washer equipment driven by individual elec motors: 30-hp for trommel, 40-hp for wash-water pump, 7.5 hp for stacker. Crew for 3-shift work: 3 operators, 3 washer attendants, 3 laborers; 2 blacksmiths on day shift to maintain bucket teeth, wear on which is very severe. Of 2 close neighbors of the Lilly mine, one suspended operations owing to expense of saving rusty gold, the other because the gravel proved too hard for a 100-hp gasolene dragline with 1.25-yd bucket.

Boise Basin, Idaho. Data from O. H. Metzger (428) on 2 dragline dredges operating in 1937. (*A*) On Grimes Cr, above Pioneerville. Stream gravels 75–100 ft wide, 6–8 ft deep; little overburden (gravel previously worked by hand) but heavy brush, which was cleared by caterpillar tractor. Excavation by Diesel-driven 1-yd dragline. Washing plant, on steel pontoons, had 4-ft trommel in 4 sections with ³/₈-in holes; tables covered with carpet and expanded metal. In 3 mo, plant advanced 1 mile upstream, treating 75 000–85 000 cu yd of gravel. (*B*) On a tributary of Fall Cr, west of Granite. Bench gravel about 15 ft deep, more firmly consolidated than stream gravel, with 5 ft of topsoil which was stripped and piled at sides. Excavation by Diesel 3-yd dragline with 65-ft boom, delivering 75 yd (aver) per hr. Washer was on six 8 by 36-ft steel pontoons assembled from ³/₁₆-in plates at the property; it had a 5-ft trommel in 10 3-ft sections (³/₈-in holes differently spaced), delivering to 10 tables on each side, covered with Brussels carpet and expanded metal (which proved better than Hungarian riffles). Individual motors for trommel, 2 centrif pumps (10- and 5-in), stacker, etc, were supplied by 100-kw Diesel-driven generator on boat. Labor, 3-shift: 3 operators, 3 oilers, 2 shoremen, 1 dredgemaster.

Mill Gulch, Tenabo, Nev. Data from W. O. Vanderburg (443) in 1939. Ravine deposit of sand and medium-size boulders; 200–300 ft wide, is 10–45 ft (aver 30 ft) deep; gold, both fine and coarse, is mostly close to bedrock. Link-Belt dragline has 60-ft boom and 1.75-yd, heavy-duty bucket. A caterpillar tractor-bulldozer is used for grading. Washer is on wooden scow, 30 by 40 ft, with 3 additional steel pontoons; draft, 40 in. Estimated (3-shift) capac, 1 500 cu yd per day. Trommel, 24 ft by 54 in, is in 2 equal sections; upper, unpunched, has spiral disintegrating flights; lower, ³/₈-in holes. Six cross-sluices on each side are 30 in wide by 12 ft long; total (Hungarian) riffled area, 400 sq ft. A 6-in centrif pump circulates wash water, pumped to the pond from a well through 15 000 ft of 8-in pipe against 500-ft head. Stacker is 70 ft long, with 24-in belt. A 160-hp, 8-cyl Diesel supplies all power. Crew, 16 men, 3-shift. Clean-ups daily.

130. DRIFT MINING

Drift mining is the exploitation of placers by underground methods. It was one of the early types of mining in Calif, reaching its peak between 1870 and 1880; thereafter it declined and almost ceased (57). Since 1933, due to higher price of gold, a revival of drift mining has occurred.

Field of use is in mining rich paystreaks of moderate thickness, where open-cut methods are impossible or would yield a smaller net return. Large boulders must usually be blasted; if numerous, they may increase cost to a point which is prohibitive. Drift mining has been practiced chiefly in the ancient buried channels in Calif, the buried bench placers at Nome, Alaska, and the deep leads of Australia (Art 117). Alaska-creek gravels, where frozen, are often drifted, especially by small operators. In early Calif and Alaska mining, many placers were drifted for rich streaks by miners with small capital; later the same deposits were profitably hydraulicked or dredged (385). Drift mining costs more than open-cut work, hence requires richer gravels to yield a profit. Ordinary thickness of gravel mined is 5 to 8 ft; up to 10 or 15 ft in rare cases, and down to 3 or 4 ft, which is about minimum for economic work in flat openings.

General plan. The methods of OPENING are the same as for other underground mining (Art 14–16), with emphasis on a mode of entry that will drain the workings and eliminate equipment and costs for hoisting and pumping. But tunnel or drift entries are limited to bench gravels or other elevated deposits like the old Calif channels. Details of LATERAL DEVELOPMENT (Fig 857–859) vary widely with local conditions. In general, a central haulageway is driven from the point of entry close to the long axis of the paystreak, and on or partly in bedrock; in Calif and Victoria, this opening is sometimes entirely in bedrock and connected by chute-raises with the workings in the gravel above. Crosscuts are driven from the central drift to the RIM of the channel, or limits of the paystreak; auxiliary drifts also are driven in wide deposits. These openings have both a mining and an exploratory function; latter often predominating in fixing the dimensions of the blocks of ground. MINING is done by a form of longwall-retreating (Art 108), called

"breasting"; advancing longwall has been used in a few cases. Ground is broken with picks where possible; by hand drilling and blasting where necessary. Frozen gravel is usually thawed before it is excavated; for exceptional case, see Idaho Mining Co, below. The roof of working places is temporarily supported by timber; posts and head boards serve in firm, cemented, or frozen ground; spiling or forepoling may be necessary in loose gravel. Barrows are best for transport in small mines or under low roof; otherwise tracks are laid along the working faces and the gravel shoveled into cars. Tracks are shifted bodily after the face has advanced 6–8 ft. Equipment for haulage, hoisting, and pumping is the same as in metal mines of similar area and output.

Fig 857 typifies early work in Calif in WIDE deposits (456, 457). Main haulageways *H* are 6 ft by 6 or 7 ft in the clear, often requiring heavy drift-sets and close lagging. Some

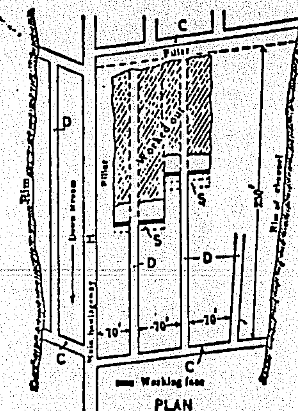


Fig 857. Layout of Wide Drift Mine, Calif

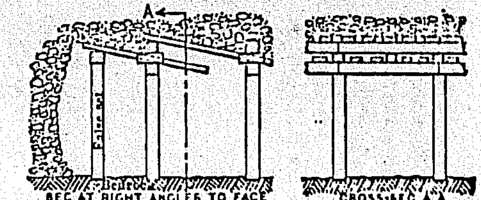


Fig 858. Breast Timbering, Hidden Treasure Mine

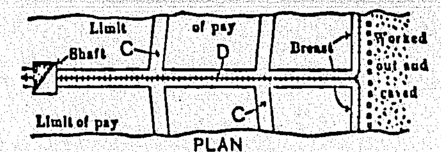


Fig 859. Layout of a Drift Mine in a Narrow Paystreak

of these mines covered large areas, making the maintenance of haulage openings a serious item. Crosscuts *C* and auxiliary drifts *D* are 5 by 6 ft or 6 by 6 ft, timbered and lagged in soft ground, but not in as permanent a manner as the main haulageway. Crosscuts *C* may be driven at an angle to the bedrock slope to secure the desired haulage gradient. Breasting begins at the ends of drifts *D*, and retreats towards the crosscut from which they were driven. Successive positions of the working faces are indicated by dotted lines *S*. Short breasts (Fig 857) allow partial control of roof press by regulating speed of advance and distance apart of working faces. In compact gravel requiring blasting, little care was taken to keep breasts "faced-up" evenly; it was cheaper to break from the corners of blocks. Fig 858 shows breast timbering at the Hidden Treasure (457); it is the usual form for soft gravel.

Fig 859 shows a layout for paystreaks 75 to 100 ft wide, typifying early work in Alaska; also that in NARROW paystreaks in Calif. Central drift *D* may connect with a shaft or an adit; it usually requires timbering even in frozen ground. Prospecting crosscuts *C* are driven at intervals; in frozen ground they are generally untimbered. Breasting is carried the full width of the pay, retreating towards the point of entry. Breasts are timbered with sets in heavy ground, with posts and caps in moderately firm ground, or left untimbered in solidly frozen ground.

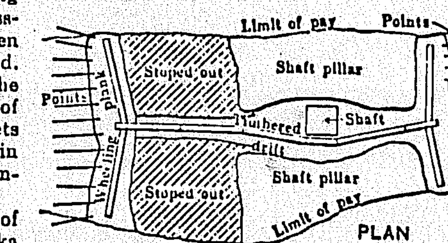


Fig 860. Advancing System (after Ellis)

Fig 860 shows an advancing method of breasting. It has been applied in Alaska and Calif to narrow, irregular deposits where straight haulage drifts, driven ahead of stoping, are not feasible. A gangway is kept open through the worked-out area by timbering with light 3-piece sets and tight lagging (450).

Washing gravel. At mines opened by a drift or tunnel, cars are dumped at the portal into a bin feeding a sluice. Sluicing is rarely continuous; bin is flushed out periodically by a small giant working under low head. At shaft mines, gravel is usually hoisted high enough above surface to give headroom for sluices and tailings disposal. Gravel may be dumped directly into a box (Fig 828) at head of an elevated sluice, or into a bin for intermittent sluicing. Latter plan is usual at small mines and where water is scanty or costly. Bins hold a day's output; upper sluice boxes are cleaned up after each run; frequent clean-ups are advisable due to relative richness of gravel. In the far North,

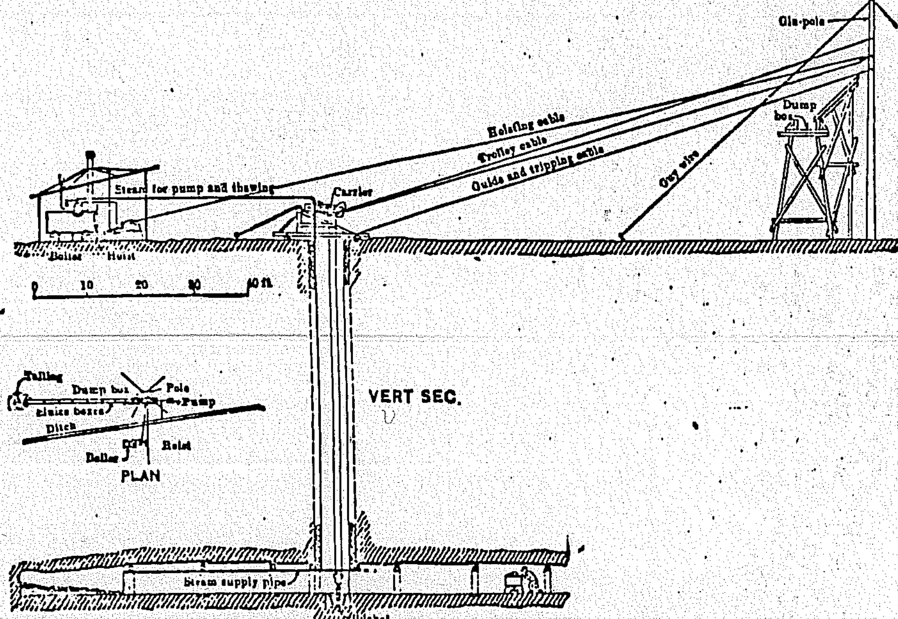
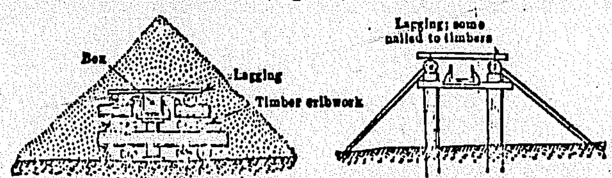


Fig 861. Arrangement of Self Dumper (after Katz)

sluicing is impossible in winter; gravel is stacked on surface and sluiced in spring and summer. In Calif, tough cemented gravel is crushed in stamp mills fitted with coarse screens, and then sluiced. Gravel containing much sticky clay may be passed through trommels or puddled, before sluicing.

Surface plant at Alaskan drift mines is marked by wide use of inclined cableways, the bucket of which descends into the shaft (Fig 861). For winter work, the structure shown



Supporting dump over sluice by cribbing, so that settling will not affect sluice

Supporting dump by posts set in holes thawed in muck

Fig 862. Methods of Protecting Sluice under Winter Dumps (after Ellis)

for supporting the dumpbox is replaced by a sluice, built near the ground, and supported as in Fig 862. The carrier dumps in a conical pile over the sluice; hence, much of the winter dump can be fed to the sluice by gravity assisted by nozzle water in the spring.

Examples of drift mining.

California, EARLY WORK (to 1890). Cost of 6 by 7-ft main haulageways in hard gravel, requiring blasting, \$4–\$7 per ft; smaller crosscuts and drifts, \$3–\$5. In ground less difficult to drill, and in picking ground requiring timbering, main tunnels cost \$3–\$4 per ft; auxiliary openings, \$1.75–\$3. Table 144 shows effect of local conditions on costs at 4 typical mines (456, 460).

Table 144. California Drift Mines Operating about 1888 to 1890 (Brown)

		Hidden Treasure	May Flower	Paragon	Red Point
	Character of pay gravel	*Lo*	*Hc*	*Hc*	*Mc*
	Aver width breasted, ft	250	75	50	120
	Depth of gravel breasted, ft	4–7	2–14	2–7	2–12
	Broken gravel left in mine, % (*h*)	25	35	25	30
	Length of channel worked, ft	7 700	3 900	5 400	2 300
	Length yielding pay, %	100	66	66	66
	Aver grade of channel, ft per mile	70	60	....	75
	Method of breaking ground	*Pc*	*Db*	*Db*	*Db*
	Method of treating gravel	*Sl*	*Mi*	*Mi*	*Sl*
	Aver output per 24 hr, ton	275	130	30	100
Labor	Timbermen and rock-pilers	12	......	......	......
	Miners in tunnels and gangways	12	12	4	7
	Miners in breasts	86	44	16	28
	Millmen	......	6	2	......
	Total men, surface and underground (*b*)	120	130	27	50
	Aver wages per man-day	\$2.15	\$2.75	\$2.70	\$2.40
	Duty in breasting, tons per man-day (*c*)	3.20	2.95	1.87	3.57
Milling and sluicing	Number of stamps	......	20	10	......
	Tons milled per stamp per 24 hr	......	6.5	6.0	......
	Water per ton gravel, cu ft	......	325	325	175
	Cost of milling: water power (*d*)	......	\$0.25	......	......
	steam power (*d*)	......	\$0.35	\$0.50	......
	Aver total cost, mining and milling (*e*)	\$1.10(*f*)	\$3.25	\$3.25	\$2.00
	Aver gross yield per ton gravel (*g*)	\$1.75	\$7.00	\$10.00	\$2.50

Lo = loose. *Hc* = hard cemented. *Mc* = medium cemented. *Pc* = picking and caving. *Db* = drilling and blasting. *Sl* = sluicing. *Mi* = milling. (*b*) Includes surface and underground labor, but not management. (*c*) Tons of pay-gravel per man-day computed from table. (*d*) Per ton. (*e*) Aver cost of labor and supplies for mining and milling (or sluicing) per ton gravel delivered during active operations on aver gravel breast, not including management, improvements, additions to plant, nor dead-work during periods of non-production. See (*f*). (*f*) Includes management. (*g*) Pay-gravel delivered at surface. (*h*) Large stones thrown back from face.

Vallecito-Western mine, Angels Camp, Cal. Data from C. E. Julihn and F. W. Horton (57) in 1938. A segment of Central Hill channel, 40–150 ft wide, aver 6 ft (max, 14 ft) deep, is opened by a 153-ft vert shaft and bedrock tunnel extending 4 300 ft upstream. An abrupt rise of 5 ft occurs in bedrock 300 ft from shaft, beyond which the tunnel, after following bedrock grade of 1.25% for about 2 300 ft, gradually works into and under the bedrock, which thereafter rises at a slightly steeper grade. The downstream portion, within about 1 700 ft of shaft, and while tunnel was still on bedrock grade, was mined from 2 parallel drifts, one on each rim of channel, connected by crosscuts 100–150-ft apart. Breasting method (Fig 863) was applied to one 240-ft block in 1932; for details, see Bib (461, 18).

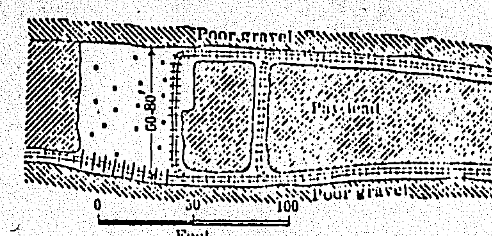


Fig 863. Development for Breasting, Vallecito Western Mine (18)

Following notes from Bib (57) relate to subsequent work (1933–36) upstream. Where gravel lay above tunnel, it was attacked through raises spaced according to the vol of gravel accessible to them; where channel was 100–150 ft wide, spacing might be 50 ft, increasing to 125 ft in narrow parts. Gravel, not cemented but requiring blasting, was well rounded and heavy, with many boulders, some 6–10 ft diam; of ground mined, about 30% consisted of boulders left underground. Gold was coarse (90% on 20-mesh, with frequent nuggets up to 0.5 oz) and 75% of it was within a foot of bedrock, of which 1 or 2 ft was usually taken up. Gravel was mined by breasting across full width of channel. Two rows of 6-ft holes, spaced 4 ft horiz, one row 1.5 ft, other 3.5–4 ft, above bedrock, each hole loaded with 3–4 sticks of 40% dynamite, broke to height of 5 ft; another row gave added height, if wanted. Posts 10–12 ft apart, with headboards, were all the roof support usually required. Broken gravel loaded into wheelbarrows, dumped down nearest raise, discharged into 1-ton cars, hauled in 4-car trains by storage-battery loco to transfer dump 300 ft from shaft, loaded into other cars, and trammed by hand to 1.5-ton skip in shaft. Waste, of deep bedrock cuttings and boulders for which storage space was temporarily lacking, amounted to 31% of all material hoisted. Headframe bin discharged directly into 2-ft sluice 12 ft long, with only enough water to move 4 to 5-in stones; larger ones were picked out by hand; this sluice recovered 50–60% of the gold. Discharge from sluice passed into a disintegrator-trommel yielding plus 1.5-in (to dump), 1.5–0.5 in, and minus 0.5-in sizes; 2 latter were washed separately on sluices 12 in wide, at 4% grade, riffled with flat iron cross-bars, 2 in wide, sloping 45° upstream. In Aug, 1936, 25 men on 3 shifts mined and washed 80 tons per day. During 45 mos, ending Aug 31, 1936, hoisting 40 967 tons of gravel and 18 102 tons of waste; direct mining and washing cost was $4.58 per ton of gravel; indirect and marketing, $0.51; total $5.09. Recovered value, $5.68 per ton of gravel.

Calaveras Central mine, Angels Camp, Calif. Data from Julihn and Horton (57) in 1938. Company said to control 3.5 miles along the Tertiary Central Hill channel, and has developed 3 roughly parallel paystreaks of different ages (others known in reserve), lying on slate or schist bedrock and buried to depth of 250–350 ft by alternating beds of gravel and tuffs. Pay gravel is normally limited to 3–4 ft above bedrock (21 ft in one case) and 1–3 ft of the latter is usually taken up. Gravel is coarse, well rounded, and tightly cemented; boulders numerous; gold mainly coarse (over 10-mesh), associated with considerable pyrite and a little black sand. One paystreak (mainly worked in 1932–33) was 50–70 wide; other 2, 150–200 ft wide, of which only one was actively worked in 1934–36. Aver recovery from 138 750 tons of gravel and bedrock washed in 4.5 yr, $4.94 per ton, incl some low-grade gravel moved in exploration; 1935 aver, $5.17 per ton washed. Development is through 3-compt vert shaft 350 ft deep, and a cross-cut tunnel in bedrock passing underneath the 2 channels now mainly developed; another 240-ft shaft affords ventilation.

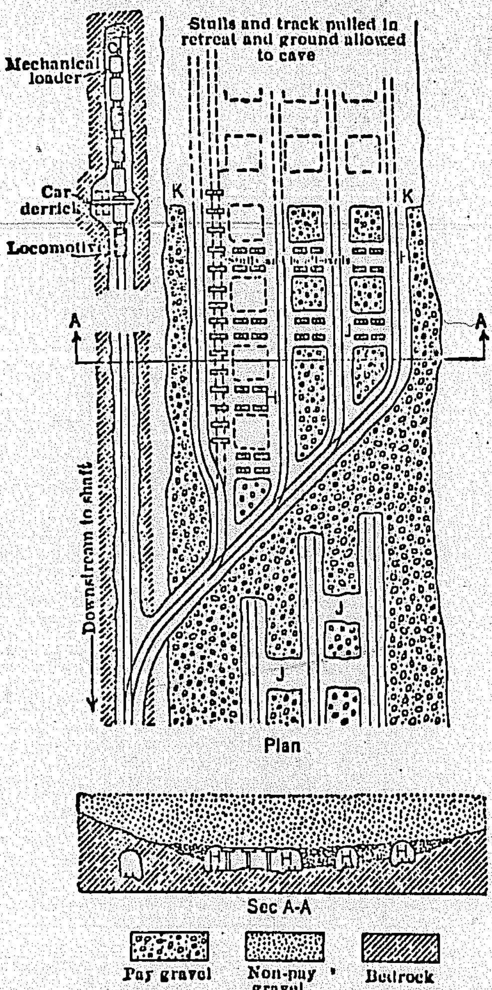


Fig 864. Room-and-pillar Drift Mining, Calaveras Central Mine.

Drifts up and down stream from tunnel follow the 2 principal channels, developed (1936) for a total length of 4 000 ft, with about 30 000 ft of workings. Haulage drifts, 7 by 7 ft, on 1% grade, are advanced about 6 ft per shift by 2 men, drilling with light drifters, shooting 8–10 holes with light charges of 40% dynamite, and loading 2-ton cars with Eimco-Finlay loaders. Use of a "car derrick" facilitates movement of cars at face without switches or side tracks. Fig 864 shows one method of mining. Here the haulageway is beneath the rim of the channel. Parallel headings *H*, 7 by 7 ft, are advanced like bedrock drifts; breakthroughs *J* divide the long pillars into square blocks; nearly all material from these operations is loaded by Eimco-Finlay loader. Most pillars are recovered on retreat. For longwall work, as at *K*, the same type of loader is employed by shifting the track close to the wall before blasting, so that most gravel will be thrown onto the track in better position for the loader. Caterpillar-mounted Nordberg-Butler shovel has also been used with advantage where a train of cars can be placed near the gravel pile. All gravel is loaded, including boulders (except a few of the largest, and these are not piled) since the cost of piling by hand exceeds that of loading, tramming, and hoisting them. Boulders too large for the loaders are sledged or bulldozed. Enough bedrock is taken up and treated as gravel to insure recovery of gold in its crevices. Drag scrapers

have been used experimentally, loading into cars through a hole in a raised platform. Under favorable conditions (a large area of well drained and previously broken or caved gravel) scrapers were expected to be advantageous for handling low-grade gravel, provided haulage, hoisting, and washing facilities were adequate for the enlarged output. Trains of 4–6 2-ton cars are hauled by storage-battery locos to shaft pocket, loading into balanced 2.5-ton skips which dump into mill bin. Waste from bedrock drifts, 25–30% of all material hoisted, is handled similarly, but discarded at surface by a 200-ft stacker belt. Mine water, 150 000 gal per day, pumped by 50-hp turbine from shaft to a tank above the mill, supplies an ample quantity for washing. Costs. During 1933–34, gross output (gravel 75%, waste 25%) was 83 419 tons (aver, 114 tons per day) at cost of $1.80 per ton for mining and washing, excl deprec, depletion, and general overhead. Costs per ton varied inversely with monthly output, from $1.40 on 6 507 tons (209 tons per day) to $3.04 on 1 271 tons (41 tons per day). These costs, largely the result of mechanization, compare favorably with those of earlier years when abundant cheap labor was available.

Dakota mine, Rivulet, Mont. Data from E. D. Gardner and C. H. Johnson in 1935 (18). Deposit was only 6–20 ft wide, under 80-ft cover; 7 ft of gravel was mined, of which much was boulders. An adit was started in the face of old hydraulic workings and driven 150 ft through previously drifted ground to reach virgin gravel. Thereafter face was advanced full width of deposit, with round-timber sets, 4 ft c-c. Caps, 12–15-in diam, were usually 10–14 ft long, depending on width of channel; min width of 10 ft was required to stack boulders; posts, 9–12 in; girts, 6 in. Top lagging, 4.5 ft long, of split poles, was driven ahead as ground was picked out. All rock over size of man's fist was stacked on sides of opening, except large boulders for which there was no room; boulders too large to handle were blockholed. Dry walls, built on each side of 18-in gage track, left only enough room for passage of an 8-cu ft car, 3 ft wide. Two men worked on each of 2 shifts, mining and washing 30 cu ft (1.7 tons) per man-shift. Labor cost (@ $4 per shift), $2.35 per ton; total cost, incl supplies, about $2.60 per ton of material trammed.

Alaska. Wimmler (188), in 1927, stated that drift mining had then become practically obsolete at Nome and elsewhere in Alaska, except in the Yukon-Tenana valley and a few other interior districts. Formerly, a large drift mine would employ 30–50 shovelers and clean 100 000–200 000 sq ft of bedrock in a season; by 1927 there were less than a dozen mines employing as many as 15–20 men and cleaning 50 000 sq ft; but at numerous places 2–6 men, with old and inefficient equipment and working 1 shift, were cleaning 10 000–30 000 sq ft of bedrock per season. Most drift mining in Alaska has been in permanently frozen gravel, at depths of 25–200 ft. They are developed through shafts, usually 7 by 7 ft, which can be sunk by 2 men at 5–8 ft per shift, after thawing; thawed muck can be bailed out. Cost, if little or no timber, $6–$12 per ft; if close cribbed with round timber, with a framed set at bottom, $10–$20 per ft; some deep shafts in bad ground, $25 or more per ft. (For thawing, see Art 131). Aver duty per man picking, shoveling, and wheeling 200–300 ft from working places to shaft, 75–125 barrow loads in 8 hr; equivalent to 20–40 sq ft of bedrock underlying 5–6 ft of gravel; aver, 25 sq ft (5 cu yd). Cost is often stated on basis of bedrock area cleaned. During chief activity at Fairbanks, some costs were 40¢ per sq ft; a few at Nome, only 25¢; usual costs at Fairbanks in 1927 were 60¢–$1 per sq ft; aver about 75¢. In Tolovana dist, 50¢–75¢; 32¢ at one specially favored mine. In Ruby distr (1922), where channels are narrow (about 75 ft) and other conditions adverse, 60¢–$1.25, aver 85¢ per sq ft or $5 per cu yd, of which 45¢ per cu yd was for thawing and 35¢ for sluicing. Central Alaska and the Yukon are essentially high-cost regions due to high wages, scanty supply and high prices of many supplies (incl large transp costs), and short working season of 3–5 mos. Most mines pay wages plus board; general labor in 1926 ranged from $6.50 in larger and more accessible districts to $12 at more remote; board cost $1–$4 per day. Some mines paid a bonus of 50¢ per shift to men who stayed during a whole season. Old system of lower wages in winter was not in effect in 1926. Underground mines usually worked 2 8-hr shifts.

Nome, Alaska; data by A. Gibson, 1914 (454, 462). Table 145 shows data for 5 successful drift mines in frozen gravel. All thawing was done during night shift; mining, in day shift only. Water for sluicing was pumped by independent distillate engines; mines No 2 and 3 were under same management with a common pumping plant; head on pumps about twice that at mines No 4 and 5. Other conditions affecting costs were as follows. Mine No 1: All mining done in winter; 1.5 ft of bedrock mined. As much as possible of the winter dump (6 520 cu yd) was hydraulicked into sluices, the rest shoveled in; sluice tailing was removed with horse scrapers. Water was pumped day and night for 18 days in larger amounts than necessary. Mines No 2 and 3: All summer work; 1.25 ft of bedrock was mined. Gravel was dumped into bins and sluiced intermittently (about once a day). Mine No 4: Preparatory work was done in early spring; all mining and sluicing in the summer; 1.5 ft of bedrock was mined. Gravel was handled on the surface as at No 3. Mine No 5: Spring and summer work as in No 4. Pay-gravel averaged 2 in above, and 2 ft in, bedrock. Gravel was dumped into a mud-box; sluicing was continuous, hence pumping was continuous on day shift. The bedrock in No 1, 2, 3, and 4 was mica schist; at No 5, black slate. The waste or overburden at No 1, 2, and 3 was coarse sand; at No 4, sand and clay; at No 5, light gravel or sand.

Wild Goose mine, Nome, Alaska. E. E. Fleming (681) describes a system of caving in blocks employed in 1905, after typical Calif method (as at Hidden Treasure) had proved dangerous from caving, and costly, from loss of all timber (@ $60 per M, plus frt from Nome). Channel was 80–110 ft wide and nearly straight; mining took out 1.5–2 ft of mica-schist bedrock and 2 ft of gravel, unfrozen and loose. From shafts 69–140 ft deep, usually 40 ft and never less than 25 ft outside of deeper edge of channel, crosscuts were driven to about center line of channel, and turned both ways

Table 145. Data on Drift Mining, Nome, Alaska, in 1914 (Gibson)

	Mine No.	1	2	3	4	5
Gen operating data	Depth of shaft, ft	53	81	81	45	50
	Thickness of pay-gravel, ft	2.5	2.5	2.5	3.5	2.166
	Thickness of waste, ft	1.5	2	2	1.5	2.333
	Total height mined, ft	4	4.5	4.5	5	4.5
	Total boiler hp	45	70	70	35	50
	Thawed per day, cu yd	128	205	257	128.6	327.1
	Pay-gravel hoisted per day, cu yd *	80	114	143	90	157.5
	Capac of bucket, cu ft (a)	18	16	24	13.5	13.5
	Aver number of buckets hoisted per day	120	192.4	161	180	315
Thawing data	Length of steam points, ft	7	7	7	6	7
	Number of steam points	40	90	90	25	46
	Steaming time, hr	9	12	12	8	11
	Hp per steam point	1.12	0.78	0.78	1.4	1.08
	Depth thawed, ft	8	7	9	7.5	7.5
	Sweating time, days	1	2	2	......	2.5
	Duty, cu yd * per point per day	3.2	2.28	2.85	5.14	7.11
Fuel, crude oil	For thawing, gal per day	168	168	168	84	210
	For hoisting, gal per day	52.5	42	42	31.5	52.5
	Per cu yd * thawed, gal	1.3125	0.8195	0.6537	0.6533	0.6419
	Per cu yd * hoisted, gal	0.656	0.368	0.294	0.35	0.333
	Total gal per cu yd * of pay gravel	2.756	1.842	1.469	1.283	1.667
	Distillate per day, pumping sluicing water, gal	132.8	30	30	14	18
	Distillate per cu yd * sluiced, gal	2.73	3.80	4.77	6.43	8.75
	Crude oil per bbl at mine	$2.97	$3.30	$3.30	$2.90	$2.71
	Distillate per gal at mine, ¢	24.25	25.17	25.17	25.5	25.83
Number of men	Thawing: pointmen	3	3	4	2	2
	fireman	1	1	1	1	1
	Mining: manager	1	1/2	1/2	1	1
	foreman	1	1	1	1	1
	engineer	1	1	1	1	1
	laborers	16	17	17	9	20
	Sluicing: engineer	(f)	1/2	1/2	......	1
	laborer	(f)	1	1	1	......
	Total per day	......	25	26	16	27
	Duty of labor (cu yd * per man-day)					
	Thawing waste and pay-gravel (b)	32.0	51.25	51.40	42.85	109.04
	Mining waste and pay-gravel (c)	7.11	10.79	13.53	11.69	14.87
	Mining pay-gravel only (d)	4.44	6.0	7.53	8.18	7.16
	Sluicing pay-gravel (sluicing labor)	18.11	76.0	95.33	90.0	157.5
	Thawing, mining and sluicing (e)	......	4.65	5.61	6.0	6.06

* Loose gravel, not place measure. (a) Bucket of self-dumping cableway (Fig 861). (b) Pointmen and fireman. (c) Foreman, engineer and laborers. Duty, laborers only, 8, 12.06, 15.12, 14.28 and 16.36, respectively, for the 5 mines. (d) Foreman, engineer and laborers. Duty, laborers only, 5, 6.7, 8.41, 10, and 7.87 cu yd, respectively. (e) All labor but manager included. (f) 10 men employed per day while upper part of winter dump was being sluiced; 21 men per day during time it was necessary to shovel-in.

into drifts 300 ft long; a crosscut both ways from end of each drift then divided the channel into sections 600 ft long. Beginning at outer ends of most remote crosscuts, blocks never more than 10 ft square were extracted as in Fig 865, using 8 by 8-in posts at 3 ft c–c, with 3 by 12-in headboards; no headboard was permitted to rest on 2 posts. Runs of gravel from sides were stopped by temporary lagging. When No 1 block was finished and floor cleaned, its 2 gravel faces were close lagged behind posts with 2 by 6-in plank, and all other posts were pulled out; roof usually caved at once, filling block solidly. Block No 2 was then worked back towards No 1, the intervening posts and lagging being drawn before pulling posts in No 2. Successive blocks were mined in the order indicated. A second crosscut had meanwhile been driven 20 ft back, and its 10-ft blocks were removed in same way. This system provided 4 working places at a time, besides crosscut headings, tributary to shaft, keeping hoist busy. Loss of timber in one 600-ft section, full width of channel, was only 5 000 bd ft; shaft timbers were recovered when walls froze in winter.

Fairbanks, Alaska; data from J. F. Newsom; see also Bib (400). 80% of productive deposits are at depths of 40–260 ft; all lie in valley bottoms with flat gradients; most of them solidly frozen. Transport difficult and water supply meager. Work covered by Table 146 was done prior to 1909.

Idaho Mining Co, on Little Eldorado Cr, Fairbanks, Alaska, made successful use of wet jackhammers for working solidly frozen gravel at 165-ft depth (188); mining took 3.5 ft of gravel and 1.5 ft of bedrock. Gravel was tight, containing numerous large and hard boulders, but only about 5% of ice. Drilling was applied first to holes for "sweater" pipes (Art 131); 1 man could drill 209-ft holes and put in their sweaters in 8 hr, at cost of 65¢ per hole, whereas (under previous method of point thawing) 2 men could set only 4–6 points in 8 hr, due to difficult driving. Thawing for 40–45 hr under steam and 24 hr standing usually reached 18 in beyond end of pipe, or 40 sq ft per sweater. The Co next used drills for blasting unthawed gravel, following typical Calif system of breasting from crosscuts, which (as also the drifts) required no timbering. A man could drill and shoot 150 ft of holes per shift, breaking 100 sq ft or 17 cu yd; cost for explosives (0.4 lb per sq ft) was 60¢ per cu yd. Broken gravel was dragged from faces by 12-cu ft bottomless scraper and loaded into cars. Exceptionally small proportion of ice in this gravel made thawing before sluicing unnecessary.

Table 146. Drift Mining, Fairbanks, Alaska (J. F. Newsom)

(a) For 17 claims (b) For 14 claims	Fairbanks Creek			Cleary Creek		
	Max	Min	Aver (a)	Max	Min	Aver (b)
Total depth gravel, ft	55	14	26.7	90	12	45
Width of pay, ft	450	70	193	350	80	192
Height gravel mined, ft	16	2.5	4.9	9	2.5	5.2
Depth bedrock mined, ft	3	1	1.3	2.5	0.5	1.9
Total boiler hp	50	15	......	50	9	......
Hp of hoists	48	6	......	38	6	......
Operating cost per sq ft	$1.30	$0.75	$1.00	$1.30	$0.65	$0.85
Total cost per sq. ft.	$1.40	$0.87	$1.13	$1.51	$0.80	$1.02
Total cost per cu yd.	$7.85	$2.44	$5.40	$9.70	$2.58	$4.50

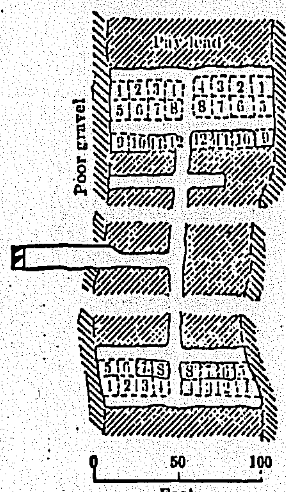


Fig 865. Block System, Wild Goose Mine

Victoria "deep leads," Australia, are old river channels under 250–400 ft of alluvium, frequently capped with basalt flows, and sometimes as much as 2 000 ft above level of present streams. Workable gravel, not always in deepest part of channel, is up to 15 ft (aver 3 ft) thick; gold mainly confined to lower 1–1.5 ft of gravel and upper 0.5–1 ft of bedrock, usually kaolinized; bedrock gradient, 20–40 ft per mile. DRAINAGE of channel is first requisite and development is planned accordingly. Shafts are usually in bedrock at side of lead, to avoid costly sinking through loose, wet sand (Fig 866). From shaft bottom, 80–100 ft below channel, a "main reef" crosscut C is driven under the lead. From a point under the middle or deepest part of the lead, drifts D, called "main reef drives," are driven in both directions under center line of channel; they are on an up grade, for drainage and haulage. Main reef drive D is usually timbered with 12-in

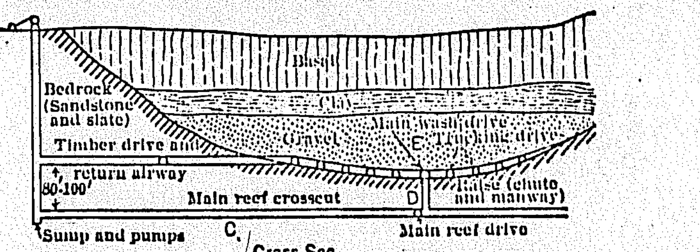


Fig 866. General Scheme of Development, Victoria Deep Leads

round timber; caps 5.5 ft long; posts, 8.5 ft. At 50-ft intervals along drift D, holes are drilled upward into the water-laden gravel. Later, usually at 300-ft intervals, raises are put up to finish drainage and to serve as orepasses and manways; complete drainage may require 3–5 years, pumping 2–6 million gal per day. Fig 867 shows usual DEVELOPMENT in "wash" (gravel), cutting area into rectangular blocks, drifts and crosscuts being advanced by spiling. Posts in "main wash drive" *E* are 7 ft long; caps, 4–5 ft. In "trucking drives" *F*, posts are 5.5 ft long; caps, 3–4 ft. - MINING in 1935. Two methods used: (*a*) "blocking," (*b*) "paneling." BLOCKING METHOD is adopted where wash is very loose, with large boulders, or where thickness of pay gravel is over 4 ft. Development divides wash into strips 40 ft wide (Fig 867); distance between crosscuts, usually 300 ft. Midway between crosscuts, "blocking drive" *G* is driven 20 ft at right-angles to length of strip. At same time, a similar drive is put in from trucking drive on other side of strip, the two holing at the center. Drives *G* are timbered with 8 to 9-ft caps on 3.5 to 4-ft posts (6 in round). Spiling "laths," 8 by 2 in, are driven ahead, gravel is dug out, and next set erected; sets are at 4 to 5-ft intervals. Floor of *G* is at about same elev as that of *F*. Gravel is shoveled into cars and dumped into nearest raise. On completing one blocking drive, another is started alongside, working successively toward the wash crosscuts at both ends of strips, as indicated by numbers in Fig 867. No timber is salvaged from the workings, which soon cave. PANELING is employed where gravel is finer or where gold is confined to bottom 2 or 3 ft of wash. Principle is same as in blocking, but trucking drives are 32 ft apart (instead of 40) and "panel drives" are 4.5 ft wide (instead of 9 ft). Panels are closely timbered with 8 by 2-in caps, 4.5 ft long, supported by props of 2.5 to 3.5-in split timber (Fig 868). Gravel is shoveled back to mouth of panel drive and into car in trucking drive. On "main reef" level, elec locos are customary. Ventilation is important in deep-lead mining, as foul gases tend to exude from the gravels (628, 682, 683).

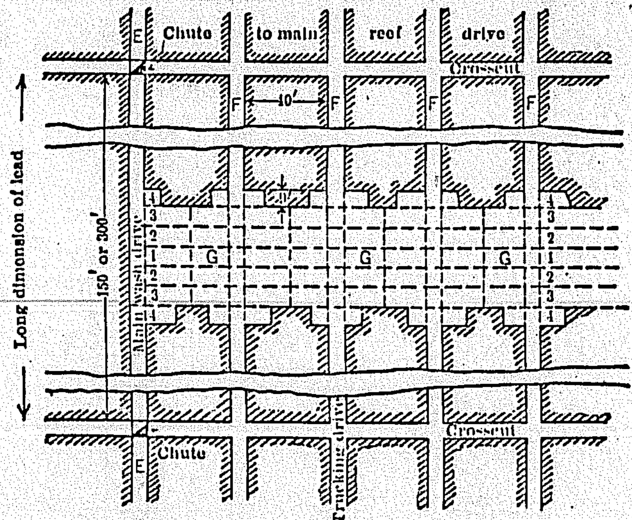


Fig 867. Development and Mining of Victoria Deep Leads by Block System

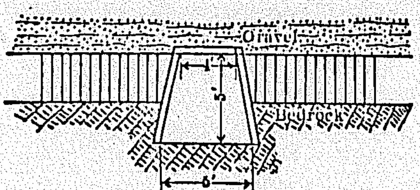


Fig 868. Paneling, Victoria Deep Leads

131. THAWING FROZEN GRAVEL

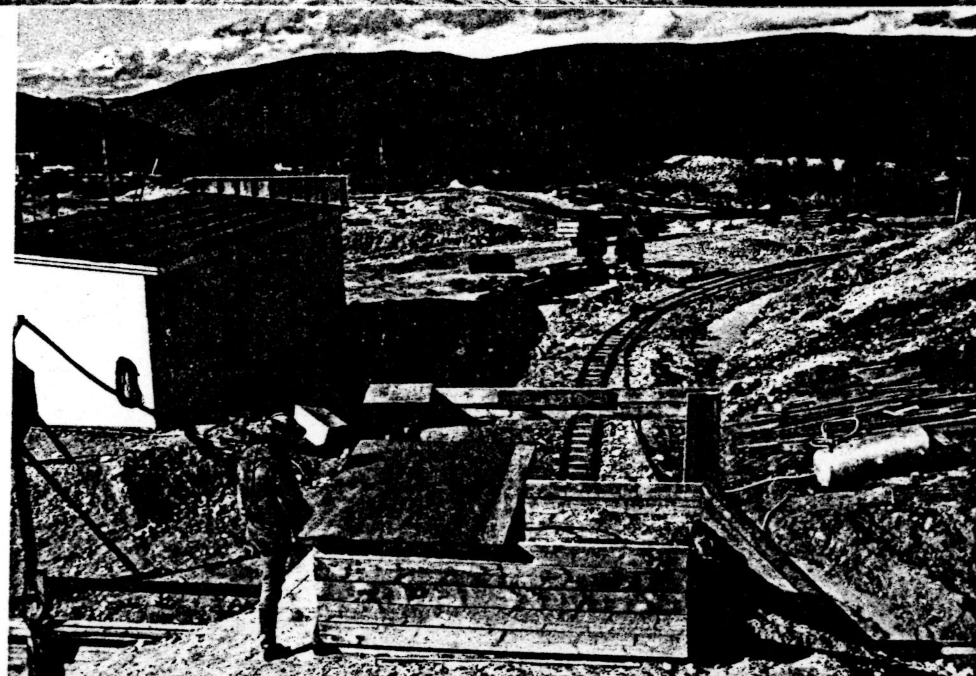
General. In Alaska, Yukon, and Siberia, the earth or muck overlying most placer deposits, and usually the gravel itself and underlying bedrock, are permanently frozen. Such ground gives little trouble in deposits that can be hydraulicked; the muck is thawed by allowing water to run over the surface; frozen ridges left between channels thus formed thaw naturally, or may be thawed and stripped more quickly with giants. When a pit

25

Underground

Looking S.E

← access road

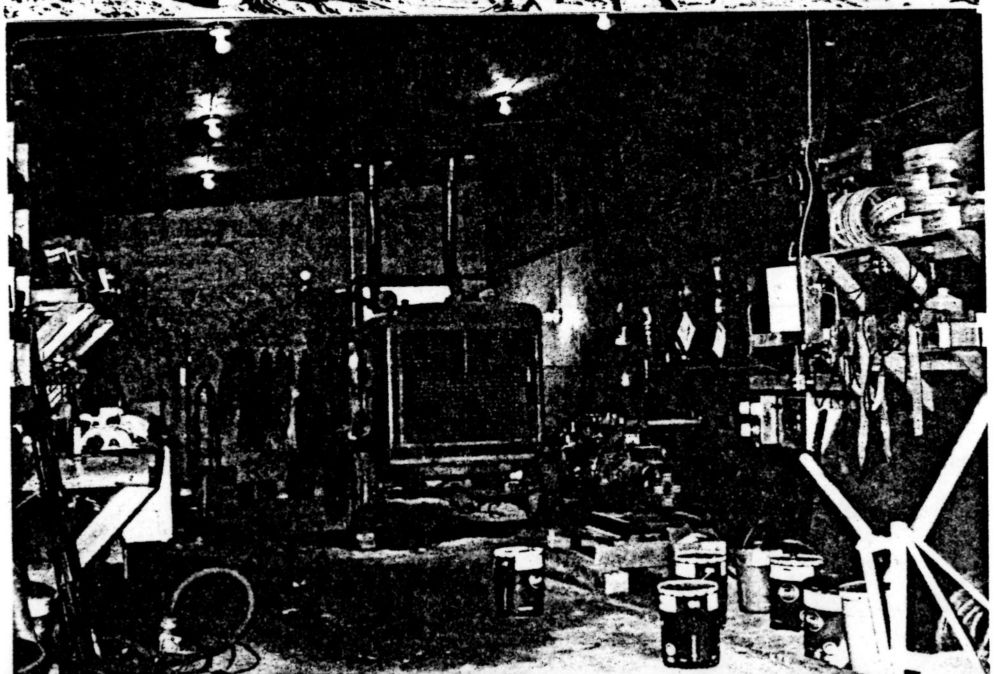


Top of Portal looking downstream

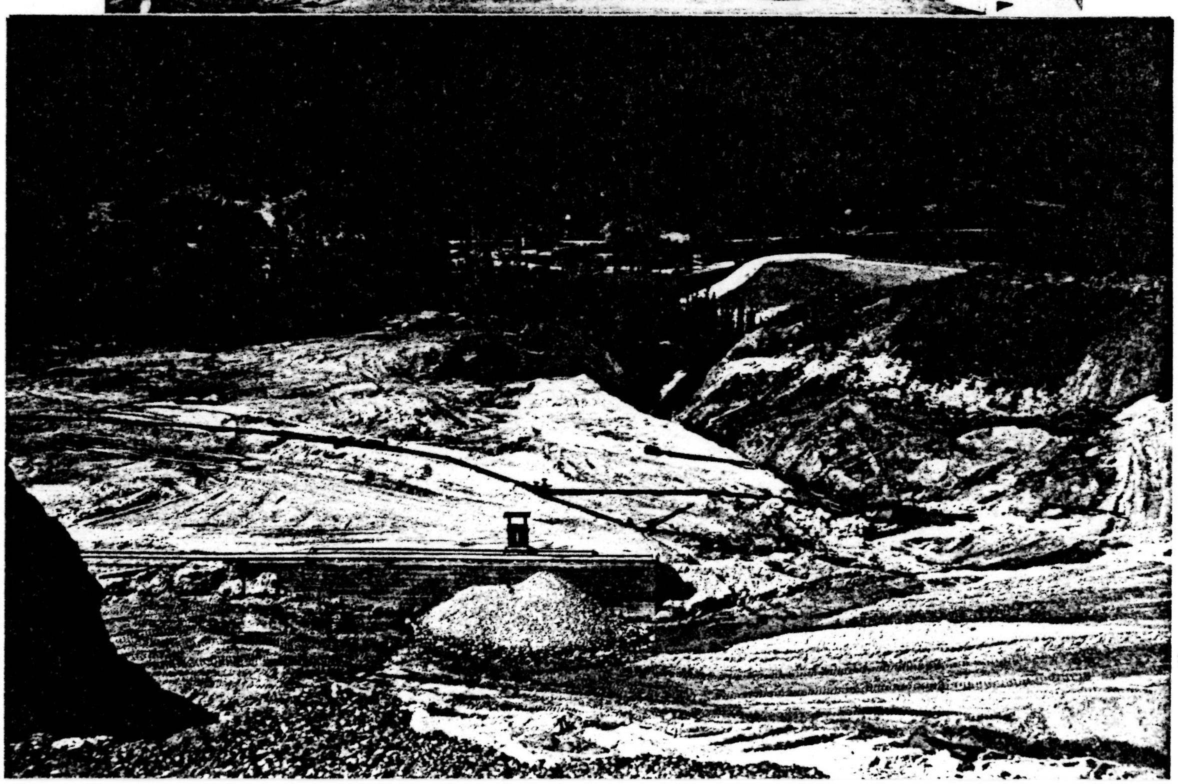
Looking South (approx)

Foreground Dump Station & Sluicing area

Portal



Compressor Bldg



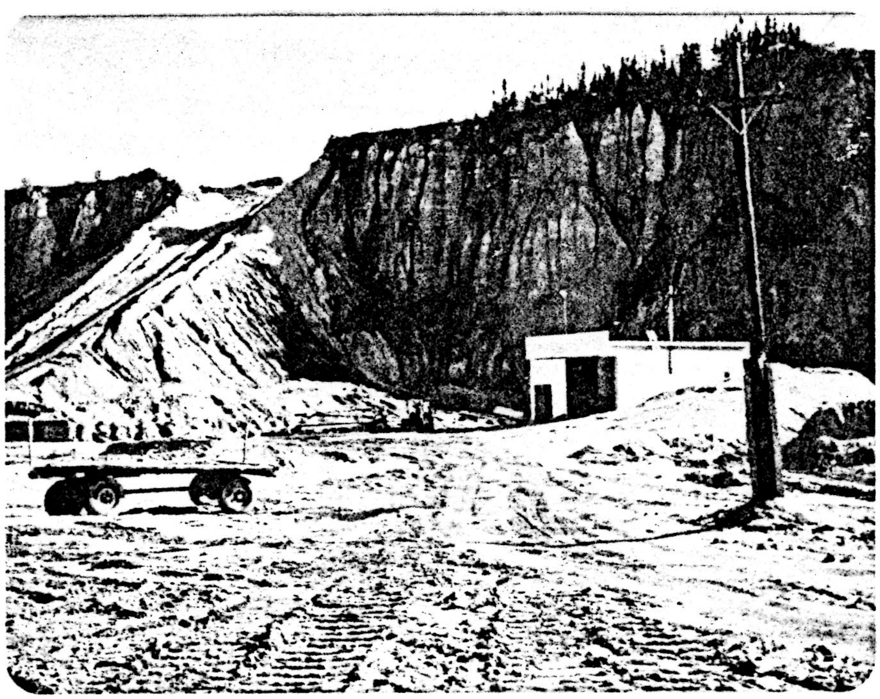
Dump station

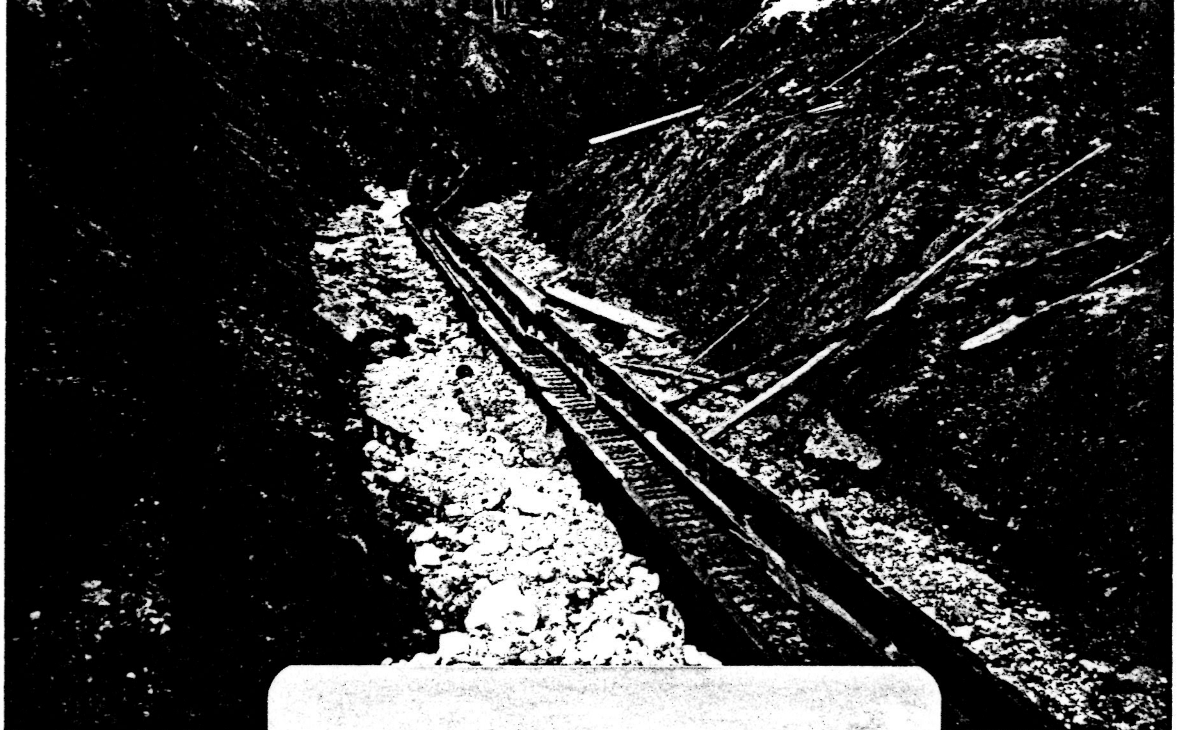
sluice in cut

water pipline hooked to hydraulic nozzle

← Stockpiling area

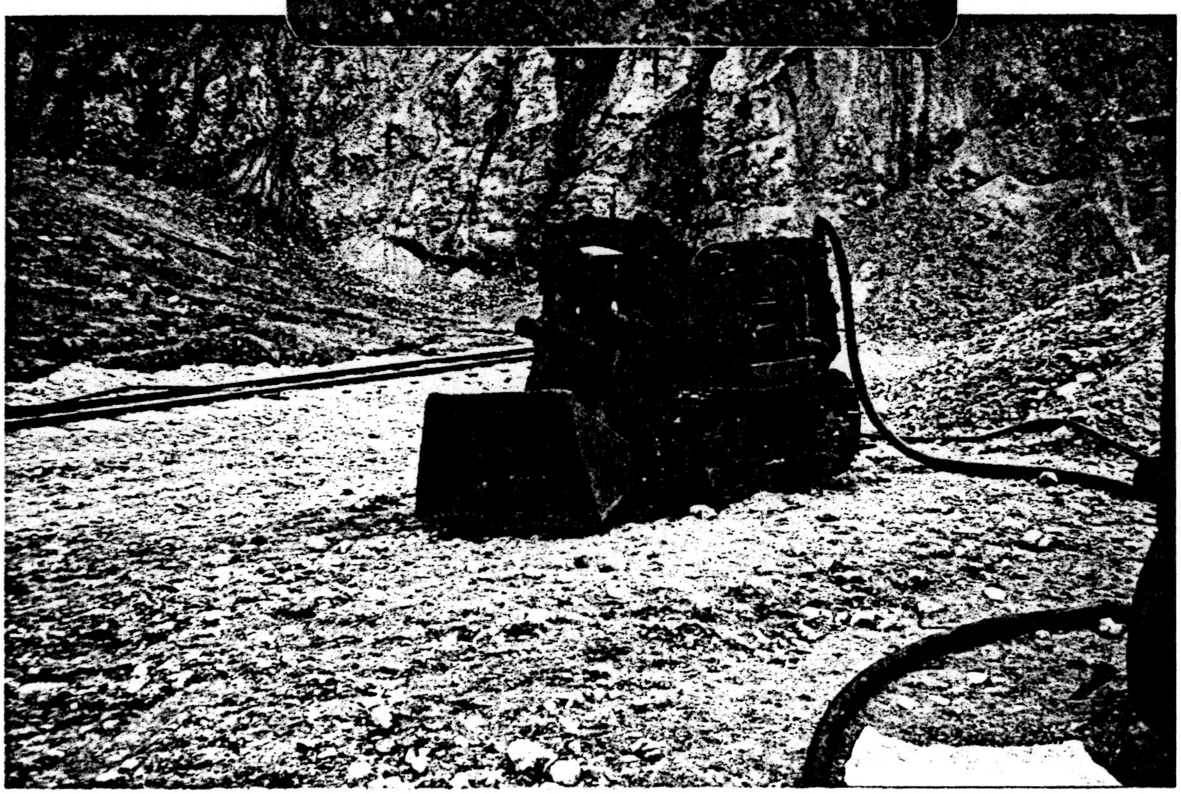
Portal



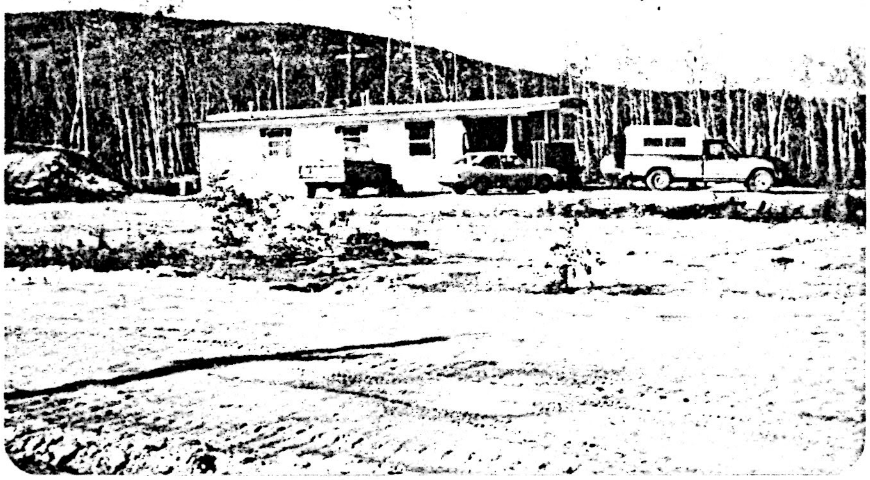


Sluice Box

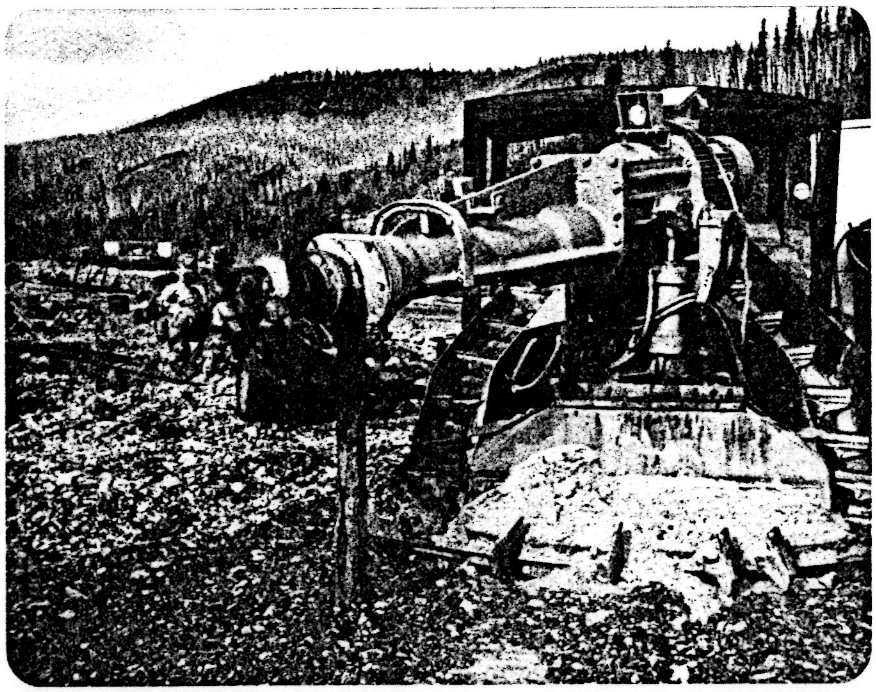
Dump Station
Building Trestle



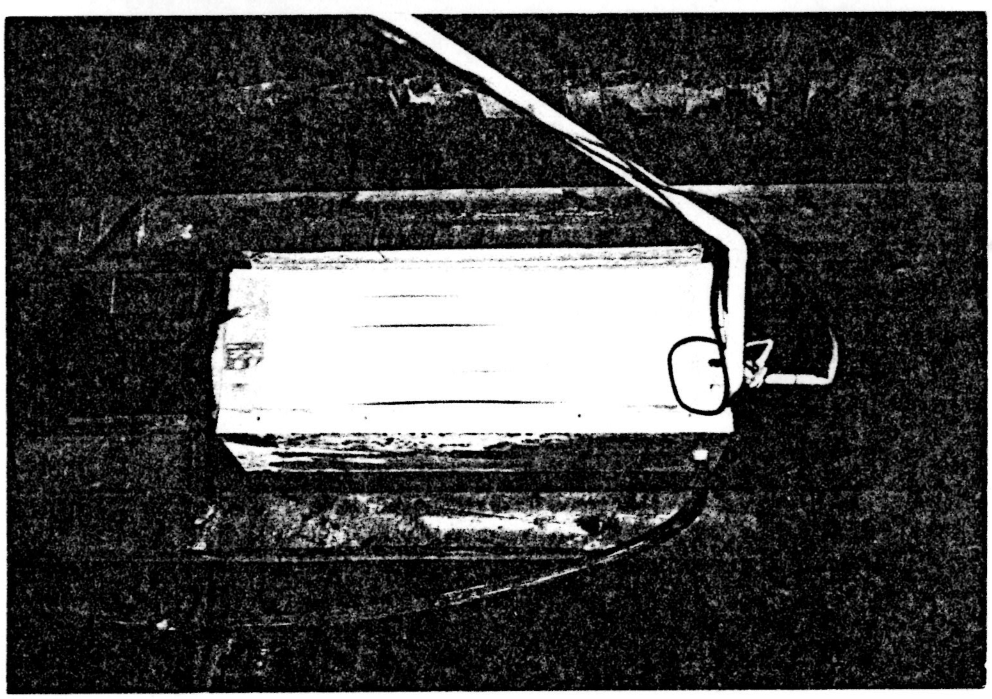
Eimco 630
Mucking Machine



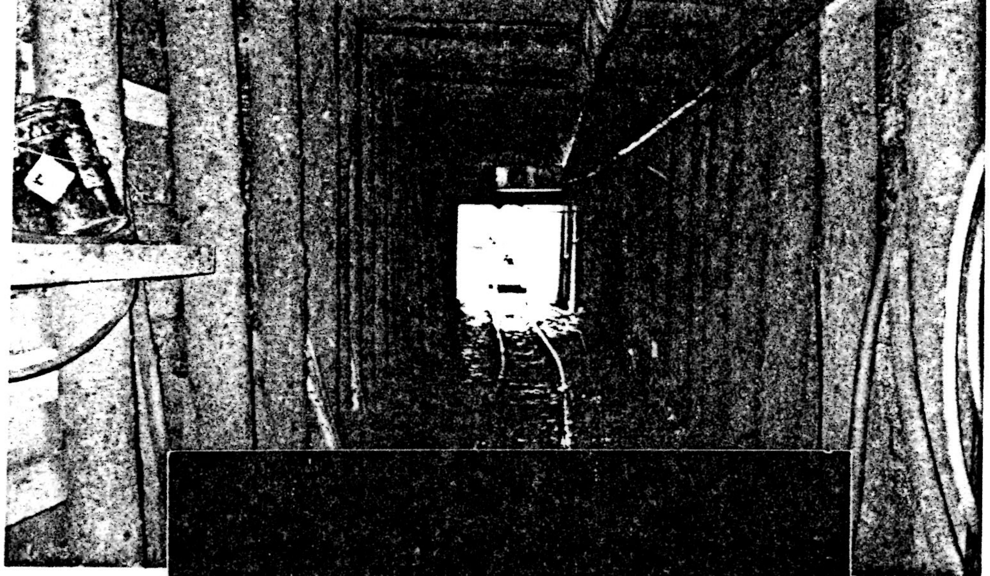
Camp
12x50' Mobile Home
+ 3 room addition



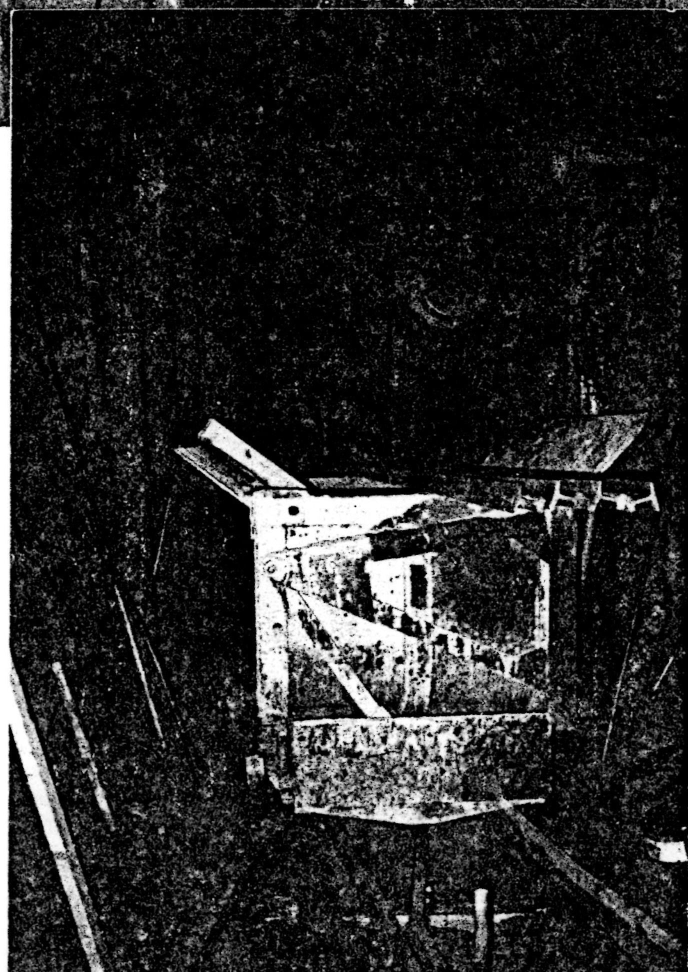
Boring Machine



Refrigeration Unit
(evaporator)
installed undergrd
(frosted-up)



Inside Portal

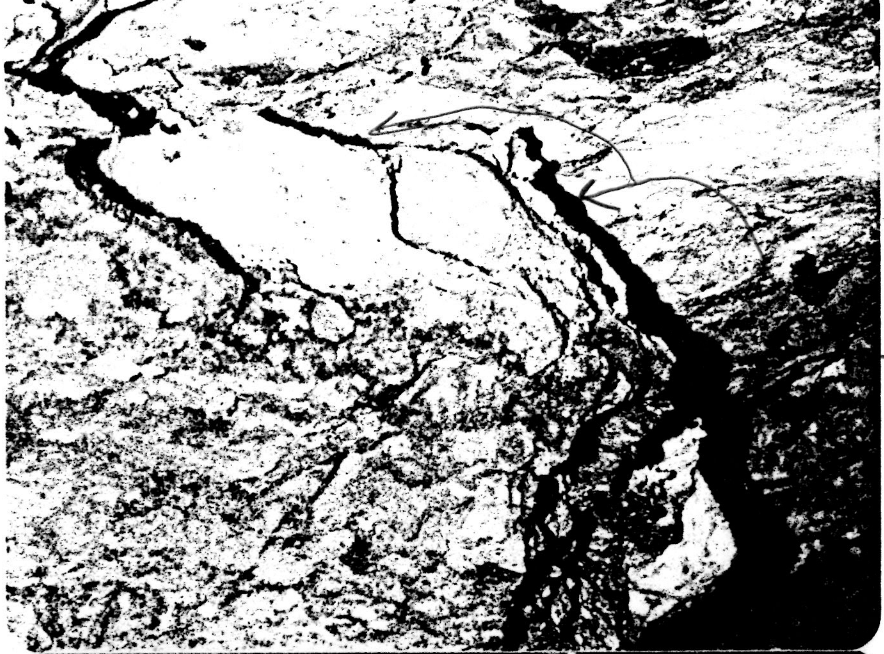


Switching area

← California switch

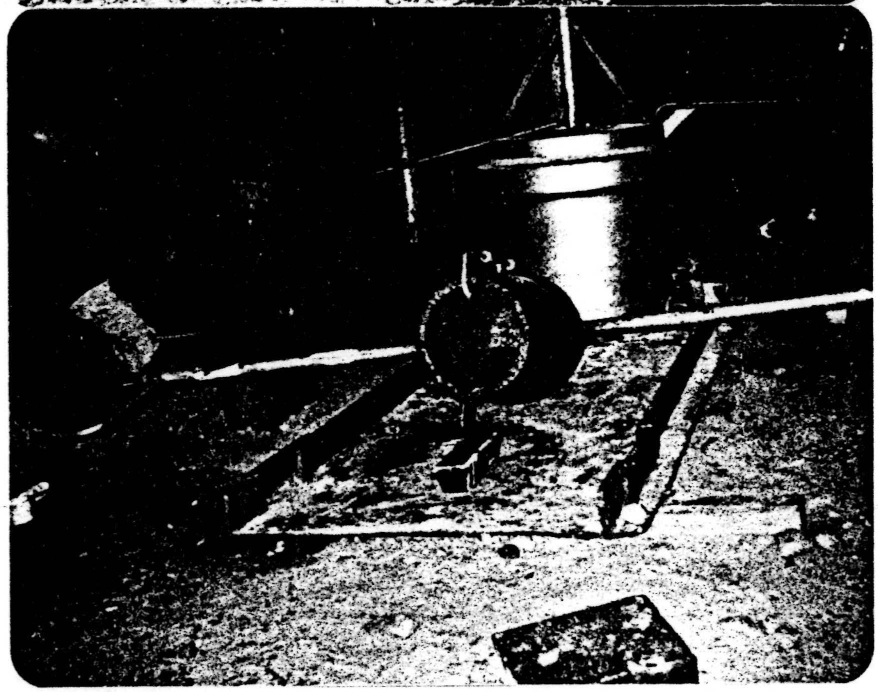
← usupported back

← Eimco 630 Mucking Machine

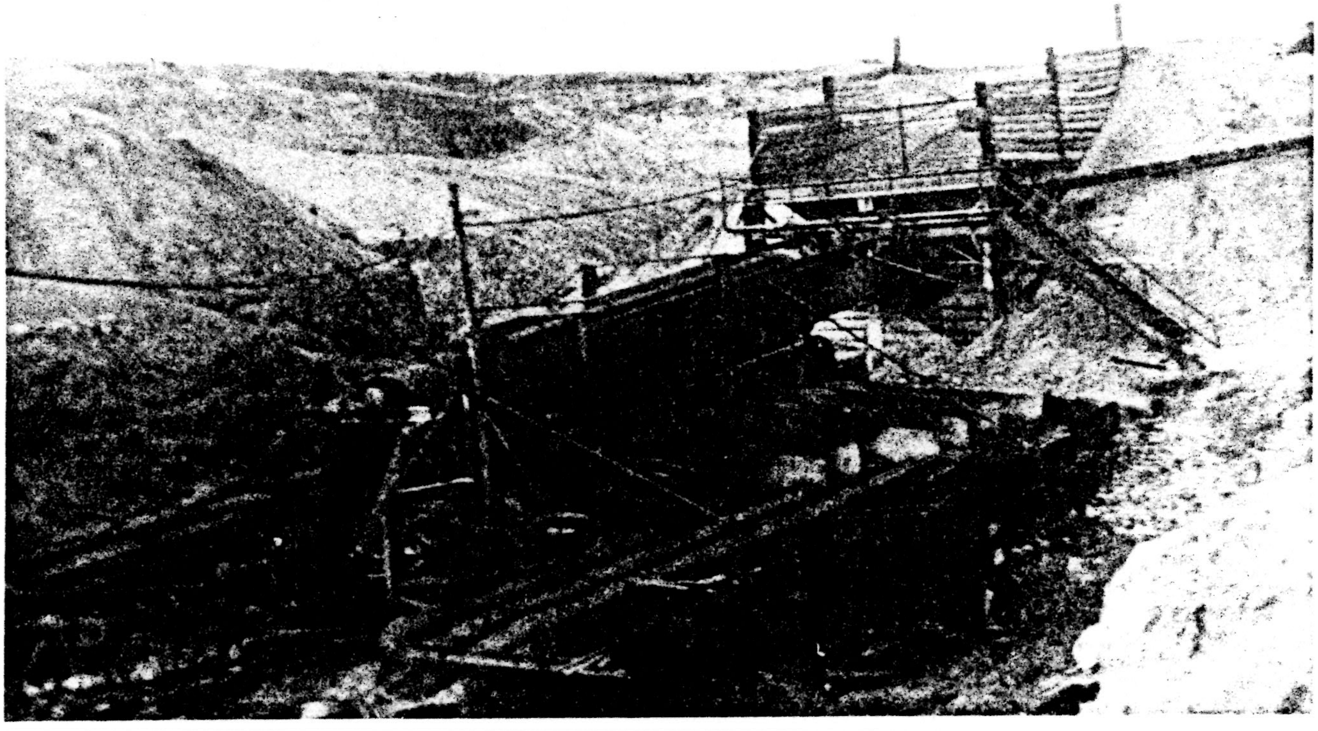


Thawing back

plastic deformation as chunk thaws and parts from back



pouring gold



Maker's Trommel

By Anne Tempelman-Kluit

Dawson cleans up

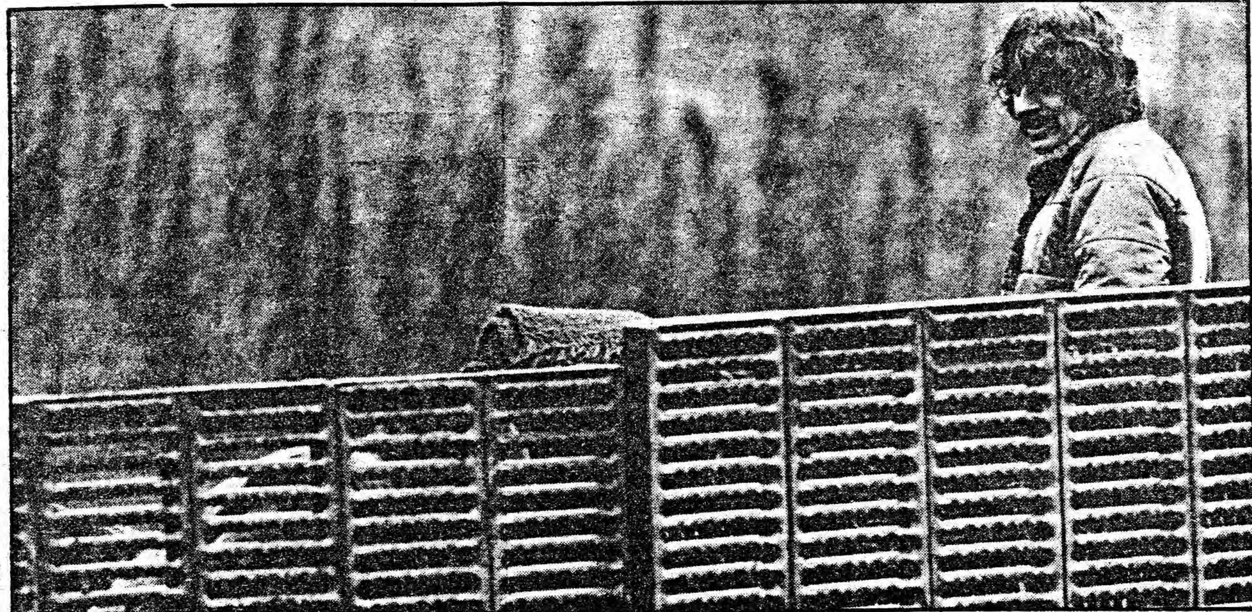


Photo by Ken Faught/Studio 2

GOLD! Territorial Gold Placers president Larry Barr at sluice box clean-out; season's net will be 15,000-20,000 ounces.

Yukon caught up in gold fervor

DAWSON CITY — Mining is the backbone of the economy of the Yukon. Total mineral production in 1980 was $360 million, and the placer (gold) mining industry's contribution was 12 per cent of this figure, $43.2 million. Placer production now rivals the gross value of concentrate produced by United Keno Hill Mines.

The boom in placer mining has mostly taken place in the Dawson area. Spiralling gold prices in the late Seventies made many operations that had been uneconomical at $35 an ounce worth a second look. Between 1978 and 1980, placer claims in the territory jumped from 1,097 to 3,592, and placer leases increased from 222 to 941.

The increase in mining activity has not been without problems. Placer miners have been unhappy about lack of clear guidelines, which they feel are open to individual interpretation, and some feel they are caught between government departments in conflict with each other. At last week's closed Klondike Placer Miners Association annual meeting in Dawson City, the association handed out draft copies of proposed guidelines for written membership comment.

Neil Faulkner, assistant deputy minister for Northern Affairs, said this week that he has been told the the Yukon Placer Mining Act is antiquated and will have to be replaced. Parts of the act are 40 years old. The problem, as Faulkner pointed out, is that re-drafting an act takes time. But he hopes, with the co-operation of the miners, to have interim guidelines in place before next season.

Increased placer activity around Dawson has spawned an increase in secondary industries. Finning Tractor is reluctant to discuss figures, "because of the competition," but its enormous work shops, recently enlarged, and shelves and shelves of parts speak for themselves. Yukon manager Dave Horner explains, "When something break, miners want it replaced immediately. They have a limited working season and can't afford to be down for even a few days." Finning also has a new shop in the industrial area outside Dawson. Many miners say wryly that they are working for the bank or Finning.

Most gold in the Klondike, apart from a small amount of jewelry gold, is sold to Delta Smelting, a gold-refining company in Richmond, B.C. Delta has an office in Whitehorse and Yukon manager Alex Seely works out of Dawson each summer.

Also this summer, the Technational Research Corporation, another B.C. company, opened the Yukon's first gold refinery, in Porter Creek. Technational is doing assays and concentrating and will start final refining this week. Next year, says a company spokesman, they will be ready to do all the refining from the beginning of the season.

Expediting services in Dawson, which arrange everything from food supplies to theatre tickets for bush camps, are also profiting from the new boom. Some established companies are complaining that people without business licenses are offering to do favors for mining companies without a set fee scale and are undercutting licensed businesses. Expediters run a regular daily radio schedule with isolated camps, arrange food orders, equipment, helicopter flights, fuel deliveries and will co-ordinate camp moves; some even can give medical advice if an emergency arises.

Grocery stores in Whitehorse also enjoy the spoils of the mining boom. Few mining companies stint their employees on food, which even with steak on the menu every day is still one of the lowest items in their budget. Propane fridges, freezers and stoves make bush cooking relatively simple, a far cry from the early miners who dug a pit in the permafrost, lined it with moss, put in their meat and ate the fresh stuff fast, before it became too green. The vocational school now runs a special course for bush cooks.

A few Yukoners even specialize in setting up bush camps; a mining crew can go into the bush and find everything ready and waiting for them, even to sheets on the beds.

Some Yukon placer operations are multi-million dollar operations using a dozen or more pieces of heavy duty equipment costing millions of dollars. Most are run by organizations; few are private operations, although there are some family endeavors run on shoestring budgets. A few are even one-man operations, often worked in the evenings or on weekends after a "job that buys the beans and bacon," as one Dawson old-timer put it.

Most miners, whatever size operation they work on, admit there is still that intangible something about mining for gold that Robert Services describes as "It's not wanting the gold that I'm after, as much as just finding the gold."

Veterans go underground

HUNKER CREEK — Placer mining has come a long way since the days of the bearded prospector crouching beside a stream patiently swilling water around in his gold pan. Now the gold pan is strictly for the tourist, and most miners work with half a dozen or more huge yellow machines costing from $50,000 to $500,000 each. An ironic comment often heard around Dawson is that more gold, disguised as yellow Caterpillar machinery sold by Finning Tractor, comes into Dawson than ever goes out.

Mike Stutter and Benny Warnsby placer mine on Hunker Creek, sluicing the rich white channel gravels through the reassembled innards of two abandoned dredges, a unique operation in the Klondike and one of the few independent mines in the area. "There's a lot of Alberta oil money here," comments Stutter, "and the Hunt Brothers have turned their attention to gold here also."

The partners are also involved with an underground mining operation, a joint venture with

Cont'd on p. 5

Star Photo by Jim Beebe

OLD DREDGE TROMMEL is now part of Mike Stutter's operation.

(34)

NEWSPAPER ARTICLE SEPT. 10, 1981

Veterans

Cont'd from p. 4

Jim Simcox, who has been experimenting with underground mining in the Sixtymile area near Dawson for several years.

This underground mining is nothing like the shafts the miners of old used to painstakingly carve through the permafrost with steam points and hoses. In the middle of the 25-metre cliff face where the Stutter and Warnsby have stopped their hydraulic mining, are large double wooden doors. A narrow railway line leads from the doors to a dump pit outside.

When Simcox opens the doors the temperature inside the high, dark tunnel is close to freezing, compared to the summer heat. "It stays more or less at this temperature year-round, and so we can work year round," Simcox explains, shining his flashlight on the pile of rubble on the floor and glistening walls. The tunnel sides are shored up with thick wooden beams which Simcox says were made from trees on the property. The roof is not supported. "As long as we don't let it get warm in here, there's no need."

He and his partners, Gerry Lee and Tom Gilchrist, started blasting the tunnel at the beginning of July. They estimate each blasting "round" gets them three metres farther into the cliff face, and in three years they plan to go in 2,000 metres. [feet]

To keep the cold air in and the warm out, Simcox has installed a 1½-metre-wide "invisible air" door, through which people, equipment and light can penetrate, but not warmth. The curtain is claimed to be 90 per cent effective. A rail car sits inside the entrance, filled with rocks from a recent blast. A compressor provides air to drive the 11-tonne car, which is taken from the tunnel to the dump pit across a 25-metre-long trestle riding four metres above bedrock. There, its contents are dumped sideways into the pit by a forklift devise called an air ram. "The blasted rock is moved from the dump by a loader and sluiced just like the regular gravel scraped off the surface," Simcox says.

abandoned

"The pay (gold) is not distributed evenly through the gravel," he explains. "Gold can be trapped in a layer just above bedrock. It's not economical to dig these cliffs down that far, but with the tunnel we can get at what we think is the richest vein."

"It's lean ground from the top down," Stutter explains, "hardly worth working from our point of view, but the ten feet above bedrock is the richest ground."

Apparently undisturbed by the blasting and the activity below them, the cliff face above the tunnel doors is thickly pocked with cliff swallows' nests.

At the Warnsby and Stutter claims "next door" on the other side of a ridge, the cold and dark of the tunnel seem far away as the sun sparkles on 20,000 litres of water a minute gushing through the nine-metre-long, two-metre wide trommel, salvaged from the Yukon Consolidated Gold Company's No. 8 Dredge. The water is recycled every four hours, there is a primary settling pond on the hill for Stutter's operation and down below a huge pond for all miners operating on Hunker. Stutter checks the group pond and mutters about the miners who don't have a primary pond on their property. He and Warnsby have 65 claims on Hunker, but work only five. "We don't have enough time or machinery to work more," Stutter explains, "so we lease them out to a number of other miners."

The operation moves about a 250,000 cubic metres of gravel through the sluice box each season. The gold is trapped in the first metre or two of the sluice boxes, lined with Astroturf or cocoa matting. Every 12 hours the water is shut off, and the partners do a mini-clean up.

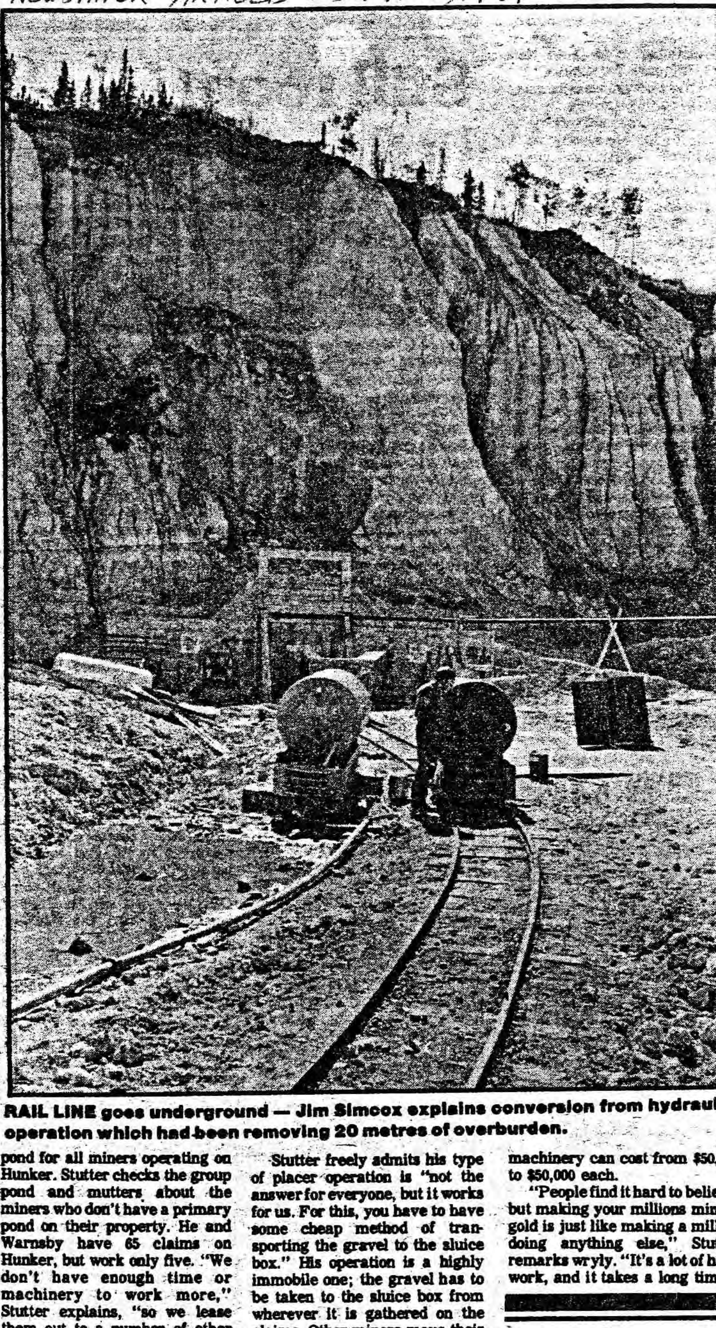
The discarded rocks, or tailings, too large for the sluice box, are taken along a conveyor belt, moving at 100 metres a minute, and dumped in a pile. Stutter watches the rocks dropping onto the pile critically. "When we get down to the bedrock we walk around the tailings piles once in a while." Any nugget over two ounces falls through the trommel and is dumped onto the pile of wet, glistening rocks and quickly covered.

Stutter freely admits his type of placer operation is "not the answer for everyone, but it works for us. For this, you have to have some cheap method of transporting the gravel to the sluice box." His operation is a highly immobile one; the gravel has to be taken to the sluice box from wherever it is gathered on the claims. Other miners move their smaller, more mobile sluice boxes to wherever on their claims the bulldozers are working.

Stutter estimates he needs a recovery rate of at least $5 a cubic metre overall to make the operation viable. He points out the machinery burns 6,000 litres of diesel fuel every day. They lease two D-9 bulldozers, the largest Caterpillar model, and own or are buying a D-9, a D-7 and a D-6. His operation uses a 12-yard loader, a bulldozer and has a 600-horsepower engine to operate his water pipe which snakes up two kilometres, over an elevation of 150 metres, to the recovery site.

While reluctant to talk about profits, Stutter points out there are 10 people on the payroll, "including Benny and myself," and the huge pieces of heavy duty machinery can cost from $50,000 to $50,000 each.

"People find it hard to believe, but making your millions mining gold is just like making a million doing anything else," Stutter remarks wryly. "It's a lot of hard work, and it takes a long time."



Star Photo by Jim Beebe

RAIL LINE goes underground — Jim Simcox explains conversion from hydraulic operation which had been removing 20 metres of overburden.

'We believe in the Yukon'

DAWSON CITY — "Like Topsy, it grew by itself," remarked Larry Barr, of the company he founded. Territorial Gold Placers has been one of the Yukon's leading gold producers during the six seasons it has operated here.

Unlike Topsy, Territorial Gold has made a lot of money. Over six seasons, the company has recovered 34,800 ounces of gold.

It has two established camps in the Dawson area, the main camp at Black Hills Creek and a second at Henderson Creek. This season, for the first time, they are mining on Upper Dominion, Miller and Scroggie creeks as well.

The opening of the new camps has led Territorial Gold into another of its philanthropic ventures: protecting old buildings and artifacts on the creeks that are in danger of destruction.

"It's a shame that the bulldozers can come along and wipe out irreplaceable stuff," says vice-president Fred Dorward. "We have an archeologist from Parks Canada and an amateur photographer helping him. We are looking at buildings which will be destroyed by mining operations and seeing if there is any justifaction in retrieving or preserving them."

As well as investigating the possibility of rescuing old buildings, Territorial Gold has initiated a project of preserving them in paint. Yukon artist Jim Robb and photographer Ken Faught have spent weeks this summer helicoptering into remote areas to document and make preliminary sketches of old buildings, artifacts and abandoned sites of old mines in the Dawson area. Robb will produce 12 watercolor paintings for Territorial Gold this year.

The company's largess has also extended to dog sled racing. Territorial Gold and Murdoch's

Cont'd on p. 6

Wearing his wealth

DAWSON CITY — Jean-Pierre Monfette has 200 claims in the Klondike, but he and his hat are more familiar in the streets of Dawson than out on the creeks. Monfette has a black stetson lavishly decorated with $27,000 worth of gold nuggets, all from his claims.

Monfette, an ex-NBC cameraman from Houston, Texas, has spent five years in the Klondike, mining on Ready Bullion Creek, a tributary of the Klondike River.

"I got the gold fever soon as I hit the first pan," he muses, producing a spice bottle of gold nuggets from his briefcase. "I love it. I'm stuck with it."

$27,000 IN GOLD nuggets makes for heavy headgear.

Plaza

Cont'd from p. 5

Gem shops sponsored Dawson musher Larry Smith when he raced in the Iditarod dog sle' race across Alaska last February — and came agonizingly close to winning.

The only major setback the company appears to have suffered recently is the postponement of its major real estate venture: the $12-million hotel-office Gold Plaza complex which was to have begun construction this summer on the block of land bordered by Wood and Jarvis streets and Second and Third avenues.

"(The P.aza) is still delayed," Dorward says. "We're in a holding pattern. If it does go ahead, it will be on a revised basis. There will be some changes." The eight-storey complex was to include a hotel, dinner-theatre, retail space, four interconnected meeting rooms, roof-top dining room, office space, underground parking and an atrium. Initial problems began with the delay in passing the city's development agreement bylaw, along with spiralling interest rates, a drop in gold prices and rising construction costs which a company official said "would make it uneconomical to build in New York, let alone Whitehorse."

"We are not enthusiastic about short-term investments," Dorward says. "We are trying to invest in the community on a long-term basis, so we're building something for the future. Take the pipeline in perspective — it doesn't create long-term jobs." "We felt there was a need to provide a more luxurious facility so people here could enjoy themselves in a more southern atmosphere. It would be good for Whitehorse, good for the Yukon and create employment for local people."

The hotel is still expected to go ahead, but possibly with a separate office building.

All Territorial Gold's Ventures are not multi-million dollar. The company has donated over two ounces of gold nuggets as prizes for the Midnight Dome Race in Dawson, and its team won the first Outhouse Race in 1977.

The company also has the reputation of running the most luxurious mining camps in the territory, including a satellite TV dish and limousines to take employees into town.

Dorward explains simply, "We earn our money in the Yukon, and we like to spend it here; that's our philosophy.... We believe in the Yukon."

Still room for the little guy on the creek

BONANZA CREEK — "If you win a million dollars, you just keep farming until it's all gone — same as mining," says Dr. Ivan Daunt cheerfully. Daunt hasn't won a million dollars, and in nine years of working his claim, 3-Above Bonanza at the mouth of Skookum Gulch, he hasn't come close to meeting his expenses, but he wouldn't quit now for anything.

Daunt, a Yorkton, Sask., doctor who says he "works like mad for nine months of the year so that I can come up here and do what I want to do the other three," runs a family operation. His wife Frances cooks, two of his three sons, Kieran and Michael, mine with him and his third son Mark works in Dawson for the summer. This year for the first time he has hired two extra helpers. "It's getting pretty exciting now," Daunt exclaims, proudly producing a half ounce gold nugget he found this summer, his biggest find to date.

It's pouring with rain, and has been for hours, and the Daunts have just stopped work for lunch, but despite the wet, cold and mud he's keen to show us his operation, and his gold. "I became interested in the history of paper money, and how worthless its become," he explains. "I bought some of the first gold futures on the Winnipeg market, and we made about $110,000 on them. Most of it went on income tax, but I was hooked on gold."

"We were really interested in coming to the Yukon, so we went to the mining recorder in Saskatchewan in 1973 and found out about this claim. Gold wasn't worth much then, there was still ground to be had. Most of the old-timers knew the best places and had them staked, and we had to learn everything the hard way. We bought mini-equipment which wasn't adequate, we've done all the wrong things, but now we're getting the first signs of life, of gold...." Daunt smiles the wide smile of a happy man.

3-Above, sitting on the very edge of the rich white channel gravel, yielded three ounces last year, the first gold the Daunts have seen. "But I have a very small interest in the Cripple Hill placer operation, the money from that has kept us going," Ivan explains, completely unperturbed by the vast sums he has sunk into the little operation.

He has recently bought a new D-7 Cat, a D-2 and an English machine, a JCB D-3 backhoe loader.

"$53,000 that cost," adds Kieran. "Expenses are heavy. We haven't had much in the way of returns yet. We'll be happy if we clear our expenses. We also have heavy installments on the Cat; they cost about $30,000."

The Daunts' sluice box is 60 centimetres wide, has a 13-metre run and a five-metre dump box. Daunt spends $100 a day on diesel fuel to run his equipment, including pumps, which he estimates operates for four hours a day. "We're trying for better production now we're more organized," Kieran volunteers.

By mid-July the mine had worked about 60 hours, moving 23 cubic metres of dirt an hour. "We're getting roughly one ounce of gold every four hours," Kieran says. "We put everything through the box; you don't know what you'll get. This area has been hand mined, and dredge mined; now we're doing our thing." He produces a 1874 quarter he found recently, with the young Queen Victoria's head still clearly visible. "Apparently 1873 and '75 were good years for quarters. This isn't worth much, but I like it."

Frances Daunt hustles everyone around the round dining table, loaded with filling, warming food, including bannock and rib-sticking soup. "This is just new," she says of the cook trailer. "We used to live in the little trailer and cook and everything. It was a bit of a squash. This is really comfortable." Two Daunts, drying out in front of the wood stove, agree. Three tiny Husky puppies add to the general coziness of the trailer, and a fat phial of gold dust is passed proudly around the table.

"We clean up quite often," Kieran says. "We don't want to get robbed."

Ivan laughs, "We clean up too often. We're so keen to see what we're getting."

FAMILY MINING OPERATIONS have always had a place in the Klondike, though most won't get rich.

Dredging up the past

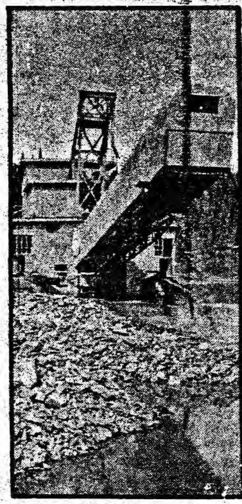
CLEAR CREEK — The last dredge ceased working in the Klondike in 1966. Rising production costs and the fixed price of gold, $35 an ounce, made dredge mining an uneconomical operation.

Most of the large wooden dredges gradually disintegrated ov.r the next decade, but three steel dredges were bought in 1979 by a group of 20 Vancouverites headed by mining contractor Jeff Lerner. "Purely speculation" Lerner explains, who felt the 320-tonne steel machines should be good for something.

That something turned out to be gold mining. Queenstake Resources Ltd. of Vancouver, 45 per cent owned by Canada Tungsten, bought the dredge on Clear Creek, between Dawson and Mayo, in 1980 for an undisclosed sum, and Lerner became the company's Yukon project ma.iager. With his brother Wayne, a master mechanic, he spent the summer of 1980 putting the pieces back together.

The dredge, built by the Walter W. Johnson company of California in 1939, worked on Wildcat Creek in northern California for a year and was shipped to the Yukon in 1940. It was operated by Clear Creek Placers until 1955, when it was abandoned.

The dredge was filled with garbage, vandalized and stripped of many parts; putting it back together was "like a jigsaw puzzle," Jeff Lerner says. No complete plans existed for the machine, although drawings for some parts were found in California. One hundred and thirty five tonnes of steel were used to put the dredge in working order. Queenstake has a huge, well-equipped machine shop at the dredge site with workers who can cope with anything that might occur.



Star Photo by Jim Beebe

CANADA'S ONLY operating gold dredge started up again after 25 years.

The refurbishing was completed in the fall of 1980, and the dredge triumphantly floated from the left fork of Clear Creek to the right fork, where Queenstake owns the first 11 kilometres and has optioned the next five further up.

The dredge began operation on June 27 this year. In it annual report, Queenstake says dryly, "Environmental planning did not have to be considered by the early placer miners," but that is not the situation now. Start-up was delayed for more than a month by wrangles with various federal departments, including the Yukon Water Board and the fisheries department. The Lerner brothers feel that, as the first working dredge in Canada, their operation is so high profile that federal officials were determined to use the dredge to set an example for other miners in the area.

Environmental problems aside, the dredge has proved its worth. The first clean-up, after three weeks, produced 200 ounces of gold (almost $90,000 at today's prices), and weekly clean-ups since then have netted similar amounts. "About what we'd expected," Jeff Lerner says.

Results aside, the real value in the dredge, explain the brothers, is the economy of operation. The dredge works for 24 hours a day, with three shifts of three men each, plus the dredgemaster. It burns only 30-40 litres of diesel fuel hourly, about three times that of the average car, and in one continuous operation, on board, sorts, separates, stacks and dumps.

"Labor and fuel are the two biggest expenses any placer miner has," Jeff Lerner says proudly. "The dredge is economical on both counts."

Queenstake president Gordon Gutrath says he expects to recoup the $1.5 million spent putting the dredge into production within two years. The Lerners estimate it took over $1 million to rebuild the dredge, but as Gutrath says, "A new one would have to be custom designed, and would cost at least $4.5 million."

The dredge is working well, Jeff Lerner said last week, better than he dared expect. All the bugs have been worked out, and the operation is proceeding smoothly. So smoothly that a second dredge, on Thistle Creek, is being eyed thoughtfully by the Lerners and Queenstake.

As Wayne Lerner put it, "We did a lot of learning on this dredge. It would be a shame to waste it."

:XCHANGE (416) 596-5006 (416) 596-5008

...iness Opportunities

:ETAIL OPPORTUNITY!

BECOME A
Royal City Antiques
RETAILER

...ada's largest importer of antique fur...ngs and fine art is offering you the oppor...y to enter the rewarding antiques business ...regional basis. If you are interested in star... a successful business or are an established ...ler whose expansion into antiques is a ...ral extension of your existing business— ... this opportunity is for you. Capitalize on ...experience and buying abilities of Canada's ...est importer, currently operating 65,000 ...re feet of retail display area in British ...umbia. Royal City Antiques also supplies ...y retail and auction outlets on wholesale ...s. Take advantage of our expertise in pro...ion, advertising and selling techniques. An ...usive line of reproduction furnishings and ...rator accessories is also available. ... further information contact:

Ken A. Chalmers
Royal City Antiques Ltd.
275 EAST 8TH AVENUE
VANCOUVER, B.C.
V5T 1R9
(604) 873-4269

DISTRIBUTORS WANTED

...ve importer seeks sales reps. ...ute, sell exciting new lines of electronic security ...s. ... debugging devices — telephone wiretap detectors — ...s phones — remote control telephone answering ...nes.

IMMEDIATE DELIVERY
CALL MR. WILSON
...S COMMUNICATION CONTROL INC.
94 CUMBERLAND
...ORONTO M5R 1A3 (416) 968-9014

131 Business Opportunities

UNDERGROUND PLACER (GOLD MINE)

On drilled coarse gold pay channel. Drill and blast mining method in frozen gravels. Development work complete in the form of portal plus 100 ft. of tunnels, tram line, dump station, compressor building and permanent camp. Existing mining equipment includes compressor, 630 mucking machine, 5 yard side dump ore car, mini 2 boom drill jumbo and power plant. Project needs party with access to underground management ability to bring this property into full production, with estimated minimum financing before return of $275,-000.

For details and/or report on project phone or write:

White Channel Underground Mining Ltd.
708 Cook Street,
Whitehorse, Yukon Y1A 2R9
(403) 668-6479 668-4116 668-4698

BUSINESS & FARM OPPORTUNITIES

For $415,000 — a welded products manufacturing business.
In Medicine Hat — a long established welding business with building lease.
Three Sand and Gravel businesses in Alberta — prices range from $400,000 to $3,600,000.00.
A successful ready mix concrete business for $470,-000.
We have several irrigated farms available starting at $260,000.00.
A & W Restaurant & Takeout in Southern Alberta.
Hotels in Southern Alberta.
Manufacturing Business — Farm Implements for 2.5 Million.
Coin-op Car & Truck Wash.
Tire Shop in Southern Alberta — Gross Sales $513,-000.00.
Development land for 32 Unit Condo in Horseshoe Bay, Texas.

CENTURY 21 Gold Door Realty Ltd.
1704 Mayor Magrath Drive
Lethbridge, Alberta T1K 2R5
PHONE (403) 329-1800
Herb Tindall — 329-4689
Ron Lyon — 328-9386
Stu Scott — 320-0232

MY OWN BUSINESS

If this is your goal then you should talk to us. Canadian Training & Development Group has helped over 90 associates in starting their own business in the training field. You can take control of your future and prosper in the fastest growing marketplace in Canada. Your future success depends on your planning and action today. Don't delay this important decision. Now is the time to write or call collect for information.

Ted Kemper
Canadian Training & Development Group Inc.
1295 Matheson Boulevard,
Mississauga, Ontario
L4W 1R1
Telephone: (416) 624-2000

FOR SALE

South central Pennsylvania lumber manufacturing and building materials business for sale. Completely equipped saw-mill, grading and sorting building, dry kilns, all logging and hauling equipment. A four storey 100 ft. by 200 ft. concrete building for building material business. Sales over $1¾ million per year and a $900,000 inventory on hand. 80 acres of land with saw-mill and buildings. 1,535 acres of timber-land available.

Reply to Box 915
The Financial Post,
481 University Ave.,
Toronto, Ont. M5W 1A7.

EXCELLENT BUSINESS OPPORTUNITY
WHOLESALE/RETAIL HARDWARE

- Southwestern Ontario
- Superior profits
- Management may stay

Contact
V.C. Bassman
(519) 253-2600

A very interesting prestigious retail business is for sale. Located in central Toronto. It is available to an ambitious, intelligent, well read person or couple. This person should have a pleasant personality and be willing to give parties, newspaper, radio and T.V. interviews. Minimum of $70,000 in cash is required.

Box 914
The Financial Post, 481 University Ave.
Toronto, Ont. M5W 1A7

SASKATCHEWAN

Fast growing motel, hotel supply company requires General Manager/Administrator as a capital participating partner or 100% of company available. For information apply to:

P.O. Box 408
Regina, Saskatchewan
S4P 3A2

FISHING LODGE

(416
596-50

134 Investment Oppor...

INVEST...

Limited Partners... Huston, Texas. D... with projected 33... (U.S.) investment... Guaranteed Value... Substantial tax be... over 3 year progra... to qualify. **For m... Dent.**

(713)...

FOREIGN INVES...

HEDGE AGAINST WEAK...

149 room full service hote... Excellent location, close to Car... limited partnership. Asking $1... interest mortgage to good e... inquiries only please. Minimum... 000 U.S.

Write to: R.J., Box 1042, Corn...

152 Seminars

SEMINAR:

HOW TO BUI...
YOUR OWN PA...

CONS...

PRA...

You too can earn subs... or full-time consultant ... the professions. Attend ... learn how to turn weeke... into increased income.

WHO SHOULD ATTEND...
Any man or woman wi... through education or ex... professors, psychologists, ... executive recruiters, pers... students, editors, autho... investors, accountants, de... ists, architects, lawyers, tr...

YOUR SEMINAR LEADE...
Your Seminar conducted ... successful Training Cons... with significant industrial ... an authority in the marketi...

WHAT WILL YOU LEAR...
How to price (value) your s... ... How to set up your con... client dependency ... H... consulting ... How to ident... How to create your own den... ... Low ... /no cost way... ... Contracts ... Billings ... to turn down a consulting ... Opportunities in governme... market a professional pract...

Give this to Dale

for

Gary Lee

To Dale Hendrick
from Ron Granger

Dale -

This Gary Lee is a friend of mine and I suggested to him that G drop you this copy of his report.

Your office keeps sending me letters meant for Bob.

Best Wishes,

Ron

DEC 22 1991